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THE AUTOMOBILE TRADE DIRECTORY

TRADE MARK REG. U. S. PAT. OFF.

PUBLISHED
QUARTERLY

APRIL, 1913

243-249 W. 39TH ST.
NEW YORK

C.A. MEZGER'S

"SOOT-PROOF"

CLEANS



ITSELF

SPARK PLUG

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13 Canal Place

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(MADE IN GERMANY)

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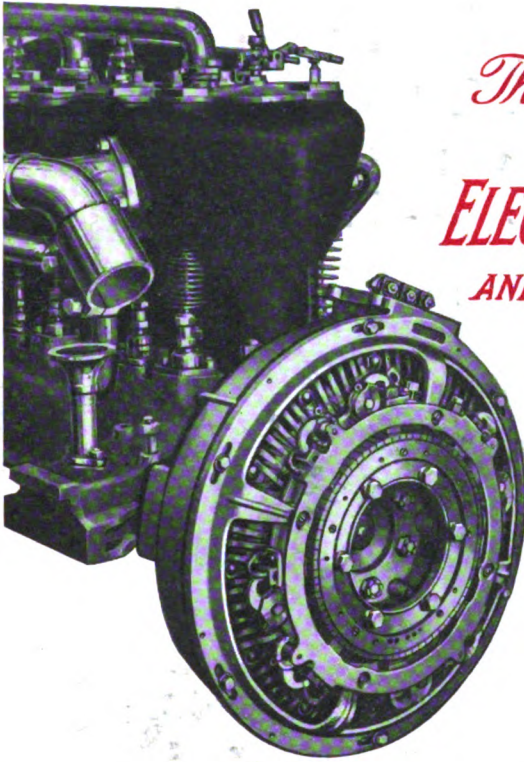
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**Sizes are interchangeable with
other makes**

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The **USL**
THE UNITED STATES LIGHT AND HEATING CO.

ELECTRIC STARTER AND LIGHTER

TAKES THE PLACE OF THE FLYWHEEL

The armature mounted directly on the engine crankshaft in place of the flywheel applies the starting power at the ideal

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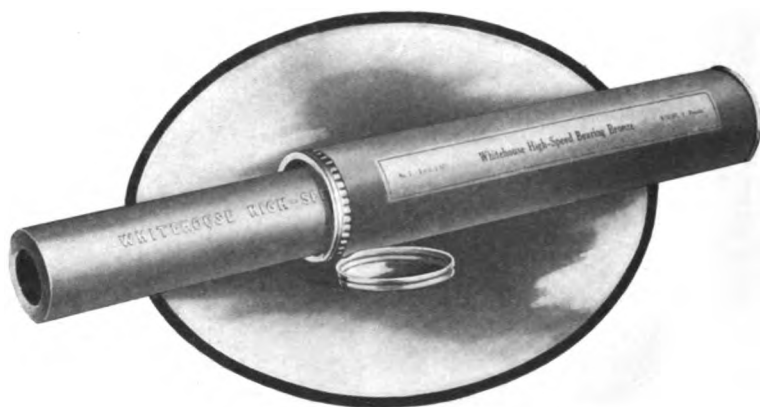
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WHITEHOUSE

High-Speed Bearing Bronze



Will not flake under frictional stress.

List of Sizes Carried in Stock.

No.	O.D.	I.D.	L.	Wt.	List	No.	O.D.	I.D.	L.	Wt.	List
A	$\frac{5}{8}$	Solid	12	1 lb. 3 oz.	.71	5B	$1\frac{1}{2}$	$1\frac{1}{8}$	12	$7\frac{1}{2}$	4.50
0	$\frac{3}{4}$	"	12	$1\frac{1}{4}$	1.05	5C	$1\frac{1}{2}$	$1\frac{1}{4}$	12	$6\frac{3}{4}$	4.05
0X	$\frac{3}{8}$	"	12	$2\frac{1}{2}$	1.50	5D	$1\frac{1}{2}$	$1\frac{1}{4}$	12	$5\frac{3}{4}$	3.45
00	1	"	12	3	1.80	6	2	1	12	9	5.40
1	1	$\frac{1}{2}$	12	$2\frac{1}{4}$	1.35	6A	2	$1\frac{1}{8}$	12	$8\frac{1}{4}$	5.00
1A	$1\frac{1}{8}$	$\frac{1}{2}$	12	3	1.80	7	2	$1\frac{1}{4}$	12	$7\frac{1}{4}$	4.35
1X	$1\frac{1}{8}$	$\frac{3}{4}$	12	$2\frac{3}{4}$	1.65	8	$2\frac{1}{4}$	1	12	12	7.20
2	$1\frac{1}{4}$	$\frac{1}{2}$	12	$3\frac{3}{4}$	2.25	9	$2\frac{1}{4}$	$1\frac{1}{4}$	12	$10\frac{1}{2}$	6.30
2A	$1\frac{1}{4}$	$\frac{5}{8}$	12	$3\frac{1}{2}$	2.10	9A	$2\frac{1}{4}$	$1\frac{1}{8}$	12	10	6.00
AB	$1\frac{1}{4}$	$\frac{3}{4}$	12	3	1.80	9B	$2\frac{1}{4}$	$1\frac{1}{2}$	12	$8\frac{1}{2}$	5.10
2C	$1\frac{3}{8}$	$\frac{5}{8}$	12	$4\frac{1}{2}$	2.70	10	$2\frac{1}{2}$	$1\frac{1}{4}$	12	$13\frac{1}{2}$	8.10
2D	$1\frac{3}{8}$	$\frac{3}{4}$	12	4	2.40	10A	$2\frac{1}{2}$	$1\frac{1}{8}$	12	13	7.80
2E	$1\frac{3}{8}$	$\frac{7}{8}$	12	$3\frac{1}{2}$	2.10	11	$2\frac{1}{2}$	$1\frac{1}{2}$	12	12	7.20
3	$1\frac{1}{2}$	$\frac{3}{4}$	12	5	3.00	11A	$2\frac{1}{2}$	$1\frac{5}{8}$	12	11	6.60
3A	$1\frac{1}{2}$	$\frac{7}{8}$	12	$4\frac{1}{2}$	2.70	12	$2\frac{3}{4}$	$1\frac{1}{2}$	12	16	9.60
3B	$1\frac{1}{2}$	1	12	4	2.40	12A	$2\frac{3}{4}$	$1\frac{5}{8}$	12	15	9.00
3C	$1\frac{3}{8}$	$\frac{7}{8}$	12	$5\frac{1}{2}$	3.30	13	$2\frac{3}{4}$	$1\frac{3}{4}$	12	$13\frac{1}{2}$	8.10
3D	$1\frac{3}{8}$	1	12	5	3.00	13A	$2\frac{3}{4}$	$1\frac{7}{8}$	12	12	7.20
3E	$1\frac{3}{8}$	$1\frac{1}{8}$	12	$4\frac{1}{2}$	2.55	13B	3	$1\frac{7}{8}$	12	$16\frac{1}{4}$	9.75
4	$1\frac{3}{4}$	$\frac{3}{4}$	12	$7\frac{1}{2}$	4.50	14	3	2	12	$15\frac{1}{4}$	9.15
4A	$1\frac{3}{4}$	$\frac{7}{8}$	12	7	4.20	15	3	$2\frac{1}{8}$	12	14	8.40
5	$1\frac{3}{4}$	1	12	$6\frac{1}{4}$	3.75	15A	$3\frac{1}{4}$	$1\frac{7}{8}$	12	20	12.00
5A	$1\frac{3}{4}$	$1\frac{1}{8}$	12	$5\frac{3}{4}$	3.45	16	$3\frac{1}{4}$	$2\frac{1}{8}$	12	18	10.80
						16A	$3\frac{1}{4}$	$2\frac{3}{8}$	12	15	9.00

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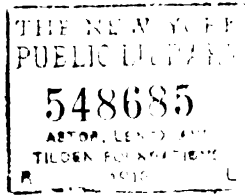
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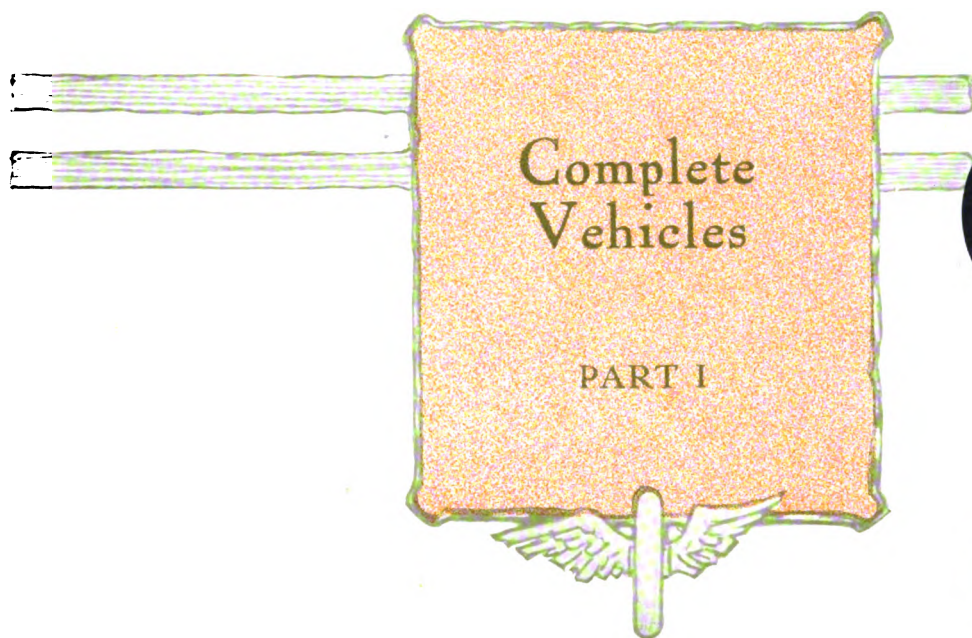
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Classified Lists of the Manufacturers of Automobiles and Commercial Vehicles

Index to classifications in this section appears on page 8



Studebaker

Read the Specifications of These Cars and be Convinced

Five-passenger, four cylinders, long stroke, 33½ in. bore x 5 in. stroke, 102 inch wheelbase.

"25"

Demountable rims.
Stewart & Clark Speedometer.
Acetylene gas primer.
Studebaker Jiffy curtains.
Electric horn.
Prest-O-lite tank.
Silk mohair top.
Full elliptic springs.
Rich upholstery, ample cushions.
Ventilating windshield.
30 x 3½ inch GOODRICH TIRES.
Tire holders.
Robe Rail.
Full set of tools.
Tire repair kit.
Tool box.
Extra rim.

\$885

Four cylinders, 4½ in. bore x 5 in. stroke, 116 in. wheelbase.

"35"

Six-passenger body.
34x4 inch GOODRICH TIRES.
Luxurious upholstery.
Full floating rear axle.
Clear vision, ventilating windshield, rain vision type.
Electric self-starter.
Electric lights.
Electric horn.
Deep cushions.
Silk mohair top.
Studebaker Jiffy curtains.
Detachable, demountable rims.
Stewart & Clark Speedometer.
Three-quarter elliptic springs.
Crowned fenders.
Extra rim.
Tire holders.
Full set of tools.
Wide tool box.

\$1290

Six cylinders, 33½ in. bore x 5 in. stroke, 124 in. wheelbase.

"SIX"

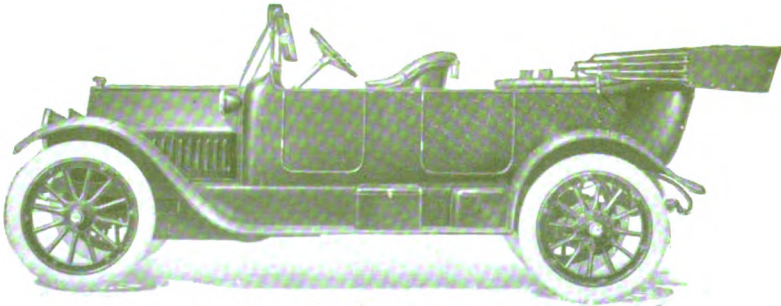
Electric self-starter.
Electric lights.
Electric horn.
Full floating rear axle.
Clear vision, ventilating windshield, rain vision type.
Six-passenger body.
Studebaker Jiffy curtains.
34x4 inch GOODRICH TIRES.
Detachable, demountable rims.
Luxurious upholstery.
Three-quarter elliptic springs.
Deep cushions.
Crowned fenders.
Stewart & Clark Speedometer.
Silk Mohair top.
Extra rim.
Tire holders.
Special tool box.
Full set of tools.

\$1550

When you buy a Studebaker it is like buying U. S. Bonds, you are buying from a concern that has sixty years of success and reputation behind it.

See our dealer or write us.

THE STUDEBAKER CORPORATION
DETROIT, MICHIGAN



The Studebaker "35"

Part I

COMPLETE VEHICLES

PLEASURE VEHICLES

GASOLINE VEHICLES

ABBOTT-DETROIT—See Abbott Motor Co.

ABBOTT Motor Co., 650 Waterloo St., Detroit, Mich. "Abbott-Detroit."
(See page 453.)

ADAMS Co., Dubuque, Iowa. "Adams-Farwell."

ADAMS-FARWELL—See Adams Co.

ALCO—See American Locomotive Co.

ALPENA Motor Car Co., Alpena, Mich.

AMALGAMATED Motors Corp., 400 S. Raymond Ave., Alhambra, Cal.

AMERICAN Locomotive Co., Providence, R. I. "Alco."

AMERICAN Motors Co., Indianapolis, Ind.
(See page 541.)

AMES Motor Car Co., Owensboro, Ky.

AMPLEX Motor Car Co., Byrkit Ave., Mishawaka, Ind.

ANGUS Automobile Co., Nelson, Neb.

APPERSON Bros., Automobile Co., Kokomo, Ind. "Jack Rabbit."
(See page 520.)

ATLAS Motor Car Co., 88 Birnie Ave., Springfield, Mass.

AUBURN Automobile Co., Main St. & Vandalla R. R., Auburn, Ind.

AUSTIN Automobile Co., 82-104 S. Division St., Grand Rapids, Mich.

BABCOCK Co., H. H., Watertown, N. Y.

BAKER-BELL Motor Co., 665-69 N. Broad St., Philadelphia, Pa.

BARTHOLOMEW Co. (Prospect Heights), Peoria, Ill. "Glide."

BELMONT Motor-Vehicle Co., Green St., Castleton, N. Y.

BERTOLET Motor Car Co., 1333 Perkiomen Ave., Reading, Pa.

BRIGGS-DETROITER Co., 465-75 Holbrook Ave., Detroit, Mich.

BRIGHTWOOD Motor Mfg. Co., Birnie Ave. & Portland St., Springfield, Mass.

BROOKS Motor Car Co., Ellicott Sq. Bldg., Buffalo, N. Y.

BUCKEYE Mfg. Co., 154 Columbus Ave., Anderson, Ind. "Lambert."
(See page 557.)

BUICK Motor Co., Hamilton Ave., Flint, Mich.

BURG Carriage Co., L., Dallas City, Ill.

BURNS Bros., Havre de Grace, Md.

CADILLAC Motor Car Co., 1343 Cass Ave., Detroit, Mich.

CALIFORNIA Motor Car Co., 900 High St., Oakland, Cal.

CARROLL Motor Car Co., Main St., Strasburg, Pa.

CARTERCAR Co., 467-69 Woodward Ave., Pontiac, Mich.

CASE, T. M., Co., J. I., State St., Racine, Wis.

CENTRAL Car Co., 18th St. & Columbia Ave., Connerville, Ind.

CHADWICK Engineering Works, Kelm St., Pottstown, Pa.

CHALMERS Motor Co., E. Jefferson Ave. & New Belt Line, Detroit, Mich.

CHANDLER Motor Car Co., 982 Woodward Ave., Detroit, Mich.

CHEVROLET Motor Co., W. Grand Blvd. & Vliager St., Detroit, Mich.

CINCINNATI Motors Mfg. Co., 1743-45 Central Ave., Cincinnati, O.

CINO—See Haberer & Co.

PLEASURE VEHICLES

(Continued)

GASOLINE VEHICLES (Continued)

- CLEBURNE Motor Car Mfg. Co., Cleburne, Tex.
- COLBY Motor Co., Mason City, Ia.
- COLE Motor Car Co., Indianapolis, Ind. (See page 537.)
- COLUMBIA Motor Car Co., 1 Laurel St., Hartford, Conn.
- COLUMBUS Buggy Co., Dublin Ave., Columbus, O. "Firestone."
- CONTINENTAL Motors Corp., Ellicott Sq. Bldg., Buffalo, N. Y.
- CORREJA—See Vandewater & Co.
- CRANE Motor Car Co., 94-104 W. Seventh St., Bayonne, N. J.
- CRAWFORD Automobile Co., Surrey & Summit Aves., Hagerstown, Md.
- CROW Motor Car Co., Main & Simonton Sts., Elkhart, Ind.
- CROXTON Motor Car Co., Washington, Pa. (See page 537.)
- CUNNINGHAM, Son & Co., James, 18 Canal St., Rochester, N. Y.
- CUTTING Motor Car Co., N. Mechanic St., Jackson, Mich.
- DANIELS Motor Car Co., East St. Louis, Ill.
- DAVIS Carriage Co., Geo. W., 11th & E. Sts., Richmond, Ind.
- DAY Automobile Co., 25 Milwaukee Ave., E., Detroit, Mich.
- DISPATCH Motor Car Co., 511 Fourth Ave. S., Minneapolis, Minn.
- DIXIE Motor Car Co., Frederick, Okla.
- DORRIS Motor Car Co., 4100 Laclede Ave., St. Louis, Mo.
- DUQUESNE Motor Car Co., 30th St. & Liberty Ave., Pittsburg, Pa.
- DUSSEAU Fore & Rear Drive Auto Co., 310 Erie St., Toledo, O.
- EASTON Machine Co., Central St., South Easton, Mass. "Morse."
- EDWARDS Motor Car Co., 1790 Broadway, New York, N. Y. (See page 537.)
- ELKHART Carriage & Harness Mfg. Co., Elkhart, Ind. "Pratt." (See page 537.)
- EMPIRE Automobile Co., Indianapolis, Ind. (See page 459.)
- ENGER Motor Car Co., 2100 Gest St., Cincinnati, O.
- F-S Motors Co., 2500 First Ave., Milwaukee, Wis.
- F-A-L Auto Co., 4052-58 Princeton Ave., Chicago, Ill.
- FAWICK Motor Car Co., 811 W. 13th St., Sioux Falls, S. Dak.
- F-I-A-T Co., Poughkeepsie, N. Y.
- FIRESTONE—See Columbus Buggy Co.
- FORD Motor Co., Woodward Ave., Detroit, Mich.
- FOUR Wheel Drive Auto Co., Clintonville, Wis.
- FRANKLIN Machine Co., 770 Franklin Ave., Brooklyn, N. Y.
- FRANKLIN Mfg. Co., H. H., 101 W. Marcellus St., Syracuse, N. Y.
- G. J. G. Motor Car Co., White Plains, N. Y. "Scout," "Pirate."
- GABRIEL Auto Co., 315 Prospect Ave., Cleveland, O.
- GARFORD Co., Elyria, O.
- GAYLORD Motor Car Co., Gaylord, Mich.
- GLIDE—See Bartholomew Co.
- GRANITE Falls Machine Shop, Granite Falls, Minn.
- GRANT Motor Car Co., E. 152d St., Cleveland, O.
- GREAT Southern Automobile Co., Third Ave. & Eighth St., Birmingham, Ala.
- GREAT Western Automobile Co., Peru, Ind. (See page 535.)
- GROUT Automobile Co., 275 E. Main St., Orange, Mass.
- HABERER & Co., Gest & Summer Sts., Cincinnati, O. "Cino."
- HAVERS Motor Car Co., 2803 28th St., Port Huron, Mich.
- HAYNES Automobile Co., 104 Main St., Kokomo, Ind. (See page 33.)
- HEINE-VELOX Agency, 1466 Brush St., San Francisco, Cal.
- HENDERSON Motor Car Co., Indianapolis, Ind. (See page 541.)
- HERRESHOFF Motor Co., 2300 Woodward Ave., Detroit, Mich.
- HUDSON Motor Car Co., Jefferson Ave. & Connors Creek, Detroit, Mich.
- HUPMOBILE—See Hupp Motor Car Co.
- HUPP Motor Car Co., Mt. Elliott & Milwaukee Aves., Detroit, Mich. "Hupmobile."
- IDEAL Motor Car Co., Indianapolis, Ind. "Stutz." (See page 535.)
- IMPERIAL Automobile Co., Jackson, Mich. (See page 541.)
- INDEPENDENCE Motors Co., 929-81 D St., N. W., Washington, D. C.
- INTER-STATE Automobile Co., Muncie, Ind.
- INTERNATIONAL Harvester Corp., Akron, O.
- JACK RABBIT—See Apperson Bros., Automobile Co.
- JACKSON Automobile Co., E. Main & Horton Sts., Jackson, Mich.
- JEFFERY Co., Thos. B., Kenosha, Wis. "Rambler."
- JOHNSON Service Co., 149-53 Michigan St., Milwaukee, Wis.
- KEARNS Motor Car Co., Beavertown, Pa.
- KEETON Motor Co., Lawton Ave. & M. C. R.R., Detroit, Mich.
- KELSEY Motor Co., Market & Morgan Sts., Hartford, Conn.
- KING Motor Car Co., 1300-04 Jefferson Ave., Detroit, Mich. (See page 531.)
- KISSEL KAR—See Kissel Motor Car Co.
- KISSEL Motor Car Co., 121 Kissel Ave., Hartford, Wis. "Kissel Kar."
- KLINE Motor Car Corp., York, Pa. (See page 35.)

NORWALK

UNDERSLUNG SIX

The only six cylinder underslung

Dealers

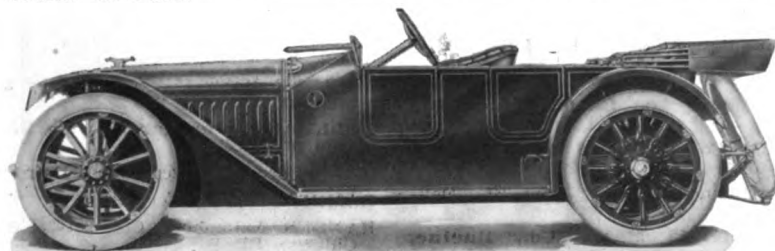
You have heard before of the distinctive cars and unusual agency propositions. Here is a car with two indisputable claims that cannot be denied. The Norwalk Underslung Six, aside from being the only Underslung ever incorporating theoretically perfect and accepted principles of Underslung Construction is the *only Six Cylinder, Underslung now being made*. These, in themselves, are selling arguments powerful enough to enlist the interest of any motorist. In addition, the Norwalk Six offers the maximum of speed and the greatest possible comfort to the motorist because of the Low Center of Gravity, the High Wheels, the Oversize Tires, the Scientific Spring Suspension, and the Luxuriously Deep Upholstery. With its straight line drive (delivering the maximum of power to the rear wheels) and perfect three-point suspension, there is a dependability of performance and an immediate, continuous application of power unsurpassed in any automobile on the market.

When you offer the Norwalk Six, you are not only offering a car that is head and shoulders over the competitors, because of its distinctive and exclusive features, but one that is completely equipped at a price ranging from \$2,750.00 to \$3,750.00 as any \$5,000.00 car on the market.

Its equipment includes complete electric lighting system, electric self starter, a perfect shock absorber—in a word, everything that will make an automobile a joy to the owner, a source of tremendous profit to the dealer, is combined in the Norwalk Underslung Six—"The Car of Absolute Exclusiveness."

You should have our booklet—"The Norwalk Principle of Underslung Construction."

Don't hesitate about writing concerning the Norwalk Agency. Tomorrow may be too late. Do it now.



Model A 2-Passenger.....\$2750.00
Model A 5-Passenger.....\$2750.00
Model A Special 4-Pass.....\$3000.00

Model A Special 6-Pass.....\$3100.00
Model B 4-Passenger.....\$3650.00
Model B 6-Passenger.....\$3750.00

Norwalk Motor Car Company

Martinsburg, W. Va., U. S. A.

CABLE ADDRESS:

"Norwalk, Martinsburgwestvirginia."

EXPORT DEP'T

17 Battery Place, New York, N. Y.

PLEASURE VEHICLES

(Continued)

GASOLINE VEHICLES (Continued)

- KNOX Automobile Co., 53 Wilbraham Rd., Springfield, Mass.
- K-R-I-T Motor Car Co., Mt. Elliott Ave. & E. Grand Blvd., Detroit, Mich.
- LAMBERT—See Buckeye Mfg. Co.
- LEHR Agricultural Co., Fremont, O.
- LENOX Motor Car Co., Hyde Park, Mass.
- LITTLE Motor Car Co., W. Kearsley St., Flint, Mich.
- LOCOMOBILE Co. of America, 2 Main St., Bridgeport, Conn.
- LOZIER Motor Co., Mack Ave., Detroit, Mich.
- LUVERNE Automobile Co., Maple & McKenzie Sts., Luverne, Minn.
- McFARLAN Motor Car Co., Connersville, Ind.
- MCINTYRE Co., W. H., Auburn, Ind.
- MARATHON Motor Works, Clinton St. & 12th Ave., Nashville, Tenn.
- MARINETTE Motor Car Co., Stephenson & Dunlop Aves., Marinette, Wis.
- MARION Motor Car Co., W. Tenth & Canal Sts., Indianapolis, Ind.
- MARMON—See Nordyke & Marmon Co.
- MASON Motor Co., 130 Maytag Station, Waterloo, Ia.
- MATHESON Automobile Co., Wilkes-Barre, Pa.
- MAXWELL Motor Co., Woodward & Warren Aves., Detroit, Mich.
- MERCER Automobile Co., 500 Whitehead Rd., Trenton, N. J.
- MERCURY Motor Co., 390 Webster Ave., Long Island City, N. Y.
- METZ Co., Waltham, Mass.
- MICHIGAN Motor Car Co., Kalamazoo, Mich.
(See page 535.)
- MIDLAND Motor Co., East Moline, Ill.
(See page 539.)
- MILLER Car Co., Richmond & Custer Sts., Detroit, Mich.
- MILLER Machine Co., 117 Front St., Defiance, O.
- MITCHELL-LEWIS Motor Co., Racine, Wis.
(See page 33.)
- MOLINE Automobile Co., 44 Keokuk St. (E. Moline), Moline, Ill.
- MOON Motor Car Co., St. Louis, Mo.
(See page 529.)
- MORSE—See Easton Machine Co.
- MOTOR Car Mfg. Co., Indianapolis, Ind. "Pathfinder," "Farry."
- MOTOR Trading Co., 250 W. 54th St., New York, N. Y. (Second-hand Dealers.)
(See page 671.)
- MOYER, H. A., Park & Wolf Sts., Syracuse, N. Y.
- NANCE Motor Car Co., 1209-17 Vine St., Philadelphia, Pa.
- NATIONAL Motor Vehicle Co., 1020 E. 22d St., Indianapolis, Ind.
- NORDYKE & Marmon Co., 1101-31 W. Morris St., Indianapolis, Ind. "Marmon."
- NORWALK Motor Car Co., Martinsburg, W. Va.
(See page 31.)
- NYBERG Automobile Works, Anderson, Ind.
- OAKLAND Motor Car Co., Pontiac, Mich.
- OLDS Motor Works, Lansing, Mich. "Oldsmobile."
- OLDSMOBILE—See Olds Motor Works.
- OMAHA Motor Car Co., Omaha, Neb.
- ONLY Motor Car Co., Port Jefferson, N. Y.
- ORSON Auto Co., 55 Wall St., New York, N. Y.
- OVERHOLT Co., S. Henderson & Fourth Sts., Galesburg, Ill.
- OVERLAND—See Willys-Overland Co.
- PACKARD Motor Car Co., N. Grand Blvd. & Belt Line, Detroit, Mich.
- PAIGE Detroit Motor Car Co., 301 21st St., Detroit, Mich.
(See page 541.)
- PALMER Motor Car Co., Whitney Bldg., Detroit, Mich.
- PALMER & Singer Mfg. Co., Second & Webster Aves., Long Island City, N. Y.
- PARRY—See Motor Car Mfg. Co.
- PATERSON Co., W. A., Flint, Mich.
(See page 535.)
- PATHFINDER—See Motor Car Mfg. Co.
- PEERLESS Motor Car Co., Quincy Ave. & S. E. 93d St., Cleveland, O.
- PETREL Motor Car Co., First & Oklahoma Aves., Milwaukee, Wis.
- PIERCE Arrow Motor Car Co., 1695 Elmwood Ave., Buffalo, N. Y.
- PILOT Motor Car Co., Richmond, Ind.
- PIRATE—See G. J. G. Motor Car Co.
- PITTSBURG Motor Car Co., First Nat'l Bank Bldg., Pittsburg, Pa.
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- PRATT—See Elkhart Carriage & Harness Mfg. Co.
- PREMIER Motor Mfg. Co., Shelby & Georgia Sts., Indianapolis, Ind.
- PULLMAN Motor Car Co., York, Pa.
(See page 529.)
- R-C-H Corp., 138 Lycaste St., Detroit, Mich.
- RAMBLER—See Jeffery Co.
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- RAYFIELD Motor Co., Chrisman, Ill.
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(See page 531.)

Complete Index to Classification appears on Pages 8 to 22.

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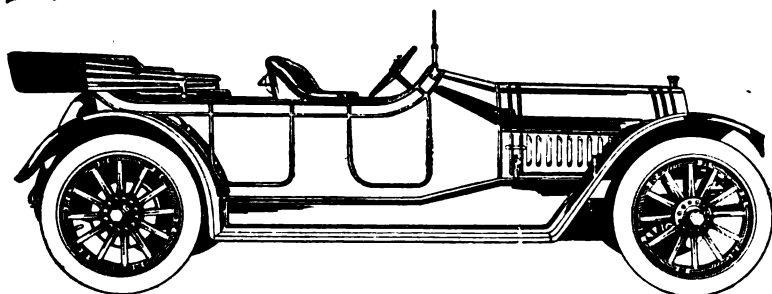
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 (See page 520.)
 STEARNS Co., F. B., Cleveland, O.
 (See page 539.)
 STEVENS-DURYE¹ Co., Chicopee Falls, Mass.
 (See page 531.)
 STUDEBAKER Corp., Detroit, Mich.
 (See page 28.)
 STUTZ—See Ideal Motor Car Co.
 TRIUMPH Motor Car Co., 3308 Sheffield Ave., Chicago, Ill.
 UNITED States Carriage Co., 309-19 S. Fourth St., Columbus, O.
 VANDEWATER & Co., 71 Prince St., Elizabeth, N. J. "Correja."
 (See page 531.)
 VAUGHN Car Co., Kingston, N. Y.
 VELIE Motor Vehicle Co., Moline, Ill.
 (See page 539.)
 VICTORY Motor Car Co., 866-96 S. First St., San Jose, Cal.
 W. F. S. Motor Car Co., 4224 Ludlow St., Philadelphia, Pa.
 WARREN Motor Car Co., Holden Ave., Detroit, Mich.
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 WHITE Co., 805 E. 79th St., Cleveland, Ohio.
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 (See page 678.)
 WINTON Motor Carriage Co., Berea Rd., Cleveland, O.
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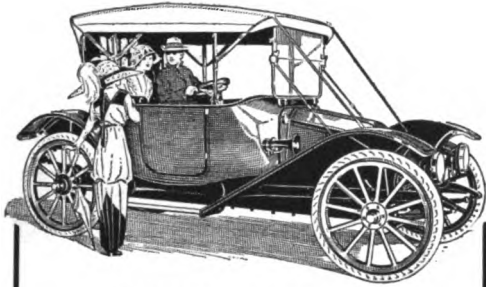
ELECTRIC VEHICLES

ANDERSON Electric Car Co., Riopelle St. & Clay Ave., Detroit, Mich. "Detroit."
 ARGO Electric Vehicle Co., Saginaw, Mich.
 (See page 35.)
 BAILEY & Co., S. R., 895 Boylston St., Boston, Mass.
 (See page 35.)
 BAKER Motor Vehicle Co., Edgewater Park & L. S. & M. S. Ry., Cleveland, O.
 BORLAND-GRANNIS Co., 310 E. Huron St., Chicago, Ill.
 BROC Electric Vehicle Co., 1665-69 E. 40th St., Cleveland, O.
 BRUNN'S Carriage Mfg. Co., 1140-48 Main St., Buffalo, N. Y.
 BUFFALO Electric Vehicle Co., 1237 Main St., Buffalo, N. Y.
 (See page 35.)
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 (See page 85.)
 MAC INNES Bros., 118-22 22d St., Toledo, O.
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 R-C-H Corp., 138 Lycaste St., Detroit, Mich.
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 (See page 557.)
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 (See page 28.)
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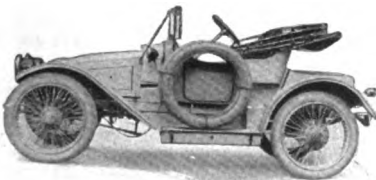
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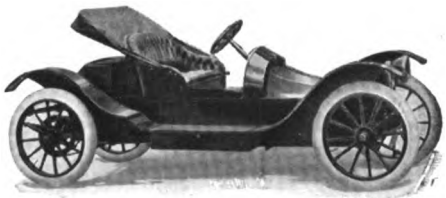
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AMERICAN Locomotive Co., Providence, R. I. "Alco."

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(See page 557.)

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(See page 39.)

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CINO—See Haberer & Co.

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CROWN Commercial Car Co., North Milwaukee, Wis.

CROXTON Motor Car Co., Washington, Pa.
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DART Mfg. Co., Dept. T. D., Waterloo, Ia.
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ECLIPSE Truck Co., Franklin, Pa.

EDWARDS Motor Car Co., 1790 Broadway, New York, N. Y.
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EPPELSON Commercial Truck Co., E. L., 3200 Locust St., St. Louis, Mo.

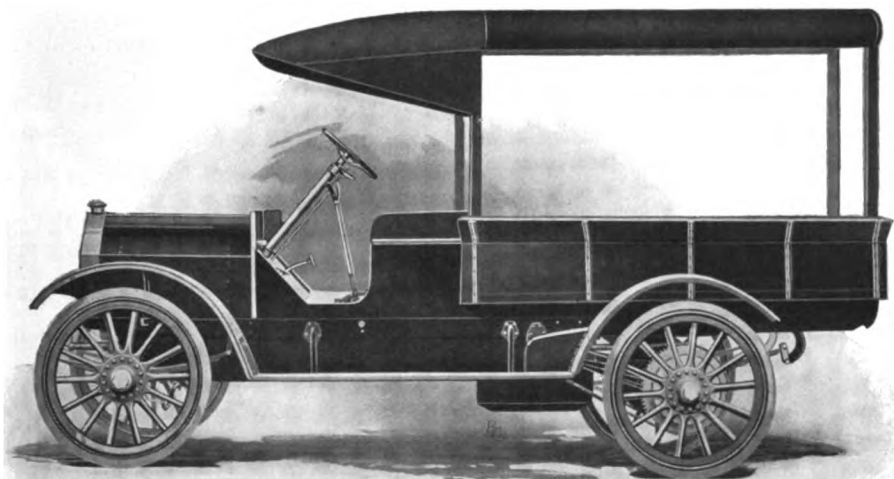
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HORSE POWER	30—35 H. P.	SPRINGS	Semi-Elliptic, front and rear.
IGNITION	Dual System, Batteries and Magneto.	RADIATOR	40 in. front, 46 in. rear.
CARBURETOR	Stromberg, Type B No. 4, with Hot Air Tube.	FRAME	Celleor Type.
TRANSMISSION	Double Disc Friction Patented. Bearings—4 sets Hyatt Roller Bearings. 2 sets Bower Roller Bearings. 2 sets U. S. Ball Bearings.	BODY	Pressed Steel Channel, 38 in. wide thru Body Section, inswept at front for short turning. Designed to take any style Body, back of Motor.
AXLES	Front and Rear. Weston-Mott Extra Heavy Section "I" Beam.	LOADING SPACE	Optional, Flare-Board, Stake, Panel, or Roll Side Curtain Top.
BRAKES	Internal Expanding, 14 in. diameter.	GASOLINE CAPACITY	Back of Seat, $46\frac{1}{2}$ in. wide x 7 ft. 6 in. long for Flare-Board or Panel Body 66" x 114" for Stake Body.
STEERING-GEAR	Non-Reversible Truck Type, on left side.	SPEED EQUIPMENT	23 Gallons.
WHEELS	36 in. Artillery Type, $9\frac{1}{4}$ in. diameter. Flange Bearings, Two Point, Ball, $\frac{1}{4}$ and $\frac{1}{8}$ diameter.	LIGHTING	3 to 20 miles per hour.
WHEEL BASE	115 in.		Two 10-in. Gas Lamps, two Side Oil Lamps, one Tail Lamp, and one Gas Generator.

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 (See page 41.)
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(See page 475.)
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- SAURER—See International Motor Co.
- SAYERS & Scovill Co., 2247-61 Colerain Ave., Cincinnati, O.
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(See page 531.)
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(See page 37.)
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(See page 355.)
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- STAYER Carriage Co., 76th & Wallace Sts., Chicago, Ill.
(See page 529.)
- STEARNS Co., F. B., Cleveland, O.
(See page 539.)
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- STEPHENSON Motor Truck Co., South Milwaukee, Wis.
- STERNBERG Mfg. Co. (W. Allis), Milwaukee, Wis.
(See page 41.)
- STEWART Motor Corp., Superior & Randall Sts., Buffalo, N. Y.
- STUDEBAKER Corp., Detroit, Mich.
(See page 28.)
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- SWANSON Motor Car Co., 5719 Wentworth Ave., Chicago, Ill.
- TEEL Mfg. Co., Medford, Mass.
- TOEPPNER Bros., Bay City, Mich.
- TRANSIT Motor Car Co., Jackson & Lampton Sts., Louisville, Ky.
- TRIUMPH Motor Car Co., 3308 Sheffield Ave., Chicago, Ill.
- TULSA Automobile & Mfg. Co., 20 W. Third St., Tulsa, Okla.
- UNION Motor Truck Co., 61 Fremont St., San Francisco, Cal.
- UNITED States Carriage Co., 309-19 S. Fourth St., Columbus, O.
- UNITED States Motor Truck Co., 216-20 Webster St., Cincinnati, O.
- UNIVERSAL Machinery Co., 1916 St. Paul Ave., Milwaukee, Wis.
- UNIVERSAL Motor Co., Ideal Bldg., Denver, Colo.
- UNIVERSAL Motor Truck Co., 500 Theodore St., Detroit, Mich.
- VAN WINKLE Motor Truck Co., Atlanta, Ga.
- VAUGHN Car Co., Kingston, N. Y. "Commer."
- VEERAC Motor Co., Anoka, Minn.

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**BUILT FOR
ETERNITY**



2, 3, 4 & 5 TON CAPACITIES

The Sternberg truck now enters its 7th year of successful service. Its makers are among the pioneer truck builders in America. Satisfied users in more than a hundred different industries testify that the Sternberg ideal, to build the best truck made, has been realized.

No trouble to sell the Sternberg in competition with any other truck and then, after you have sold the truck, it does not eat up your profit, trying to keep your customer satisfied.

Good territory open to high class agents

STERNBERG MFG. CO.,

West Allis,

Milwaukee, Wis



International Motor Trucks

Proved by Years of Successful Service

Mack Saurer Hewitt

12 years
in use

18 years
in use

10 years
in use

Trucks you know about by years of continuous proof:

Nine sizes: capacities, 1, 1½, 2, 3, 4, 5, 6½, 7½ and 10 tons.

Bodies for every kind of load.

Duplicate parts permanently in stock.

Service stations with factory facilities in all large cities.

International Motor Company

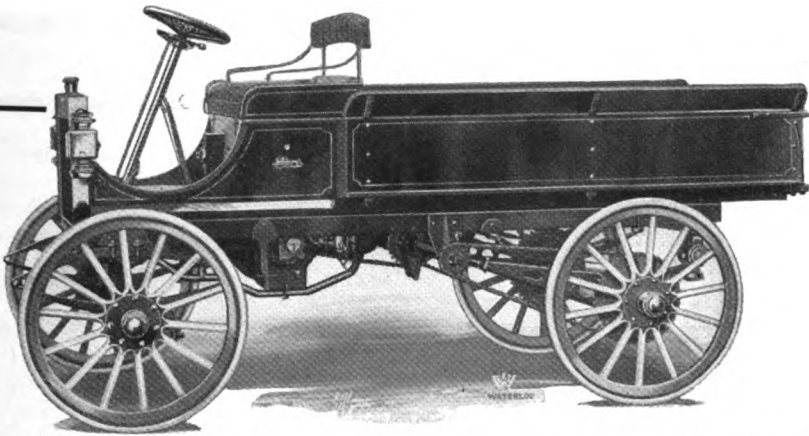
General Offices:

Broadway & 57th St., New York

Works:

Allentown, Pa., Plainfield, N. J.

*Sales and Service Stations
in all large cities.*



Bought by those who know what's best

Bought by those who desire maximum value for minimum cost. By those who want service and stability at low upkeep expense. By those who want delivery refinement coupled with practical work—*The Dart is first choice—second choice—ultimate choice!*

One chassis for the three different bodies—open express (illustrated), \$750.00; canvas top, \$790.00; full oak panel top, \$850.00. F.O.B. Waterloo. Motor, 20 H.P. Capacity, 1500 lbs. Speed, 3-20 miles per hour. Fuel consumption, 15-20 miles per gallon of gasoline.

A new catalog—just off the press—is yours for the asking. Write for it and our agency proposition today.

THE DART MFG. CO., Dept. T.D. Waterloo, Ia.

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COMMERCIAL VEHICLES (Continued)

GASOLINE VEHICLES (Continued)

- VELIE Motor Vehicle Co., Moline, Ill.**
(See page 539.)
- VICTOR Motor Truck Co., Buffalo, N. Y.**
(See page 557.)
- VULCAN**—See Driggs-Seabury Ordnance Corp.
- WAGENHALS Motor Car Co., 668-70 Grand River Ave., Detroit, Mich.**
- WALTER Motor Truck Co., 49-51 W. 66th St., New York, N. Y.**
- WARE Motor Vehicle Co., 771 Raymond Ave., St. Paul, Minn.**
- WARREN Motor Car Co., Holden Ave., Detroit, Mich.**
- WASHINGTON Motor Car Corp., Hyattsville, Md.**
- WESTFIELD Motor Truck Co., Westfield, Mass.**
- WESTMAN Motor Truck Co., 11008 Sturtevant Ave., Cleveland, O.**
- WHITE Co., 805 E. 79th St., Cleveland, O.**
- WHITE Star Motor & Engineering Co., 16-20 Henry St., Brooklyn, N. Y.**
- WHITESIDES Commercial Car Co., New Castle, Ind.**
- WICHITA Falls Motor Co., Wichita Falls, Tex.**
- WILCOX Motor Car Co., H. E., 1030 Marshall St., N. E., Minneapolis, Minn.**
- WILLYS-OVERLAND Co., Dept. 137, Toledo, O. "Overland."**
(See page 678.)

GASOLINE TAXICABS

- ALCO**—See American Locomotive Co.
- AMERICAN Locomotive Co., Providence, R. I. "Alco."**
- ATLAS Motor Car Co., 88 Birnie Ave., Springfield, Mass.**
- CROXTON Motor Car Co., Washington, Pa.**
(See page 537.)
- FORD Motor Co., Woodward Ave., Detroit, Mich.**
- FRANKLIN Mfg. Co., H. H., 101 W. Marcus St., Syracuse, N. Y.**
- PULLMAN Motor Car Co., York, Pa.**
(See page 520.)
- THOMAS Motor Cab Co., 184-88 W. Mohawk St., Buffalo, N. Y.**
- WHITE Co., 805 E. 79th St., Cleveland, O.**

ELECTRIC VEHICLES

- ANDERSON Electric Car Co., Riopelle St. & Clay Ave., Detroit, Mich. "Detroit."**

- ARGO Electric Vehicle Co., Saginaw, Mich.**
(See page 35.)
- ATLANTIC Vehicle Co., 357 Oraton St., Newark, N. J.**
- ATTERBURY Motor Car Co., Hertel & Elmwood Aves., Buffalo, N. Y.**
- BAKER Motor Vehicle Co., Edgewater Park & L. S. & M. S. Ry., Cleveland, O.**
- BUFFALO Electric Vehicle Co., 1227 Main St., Buffalo, N. Y.**
(See page 35.)
- CHICAGO Electric Motor Car Co., 3612-18 S. Morgan St., Chicago, Ill.**
- COLUMBIA Vehicle Co., 213-17 L. St., S. W., Washington, D. C.**
- COMMERCIAL Truck Co. of America, 27th & Brown Sts., Philadelphia, Pa.**
- COUPLE-GEAR Freight-Wheel Co., 1450 Buchanan St., Grand Rapids, Mich.**
- DAYTON Electric Car Co., Fourth & St. Clair Sts., Dayton, O.**
- DETROIT**—See Anderson Electric Car Co.
- FRITCHLE Automobile & Battery Co., 1510-30 Clarkson St., Denver, Colo.**
- G. V.**—See General Vehicle Co.
- GENERAL Motors Truck Co., Pontiac, Mich.**
- GENERAL Vehicle Co., Borden & Review Aves., Long Island City, N. Y. "G. V."**
- IMPERIAL Electric Motor Co., Land Title Bldg., Philadelphia, Pa.**
- KENTUCKY Wagon Mfg. Co., Louisville, Ky. "Urban."**
- LANSDEN Co., 394 Freylinghuysen Ave., Newark, N. J.**
- M. & P. Electric Vehicle Co., Franklin & Dubois Sts., Detroit, Mich.**
- OHIO Electric Car Co., 1501-07 W. Bancroft St., Toledo, O.**
- PARSONS Co., G. W., Newton, Ia.**
- STUDEBAKER Corp., Detroit, Mich.**
(See page 28.)
- UNIVERSAL Motor Co., Ideal Bldg., Denver, Colo.**
- URBAN**—See Kentucky Wagon Mfg. Co.
- WALKER Vehicle Co., 112 W. Adams St., Chicago, Ill.**
- WARD Motor Vehicle Co., E. 143d St. & Concord Ave., New York, N. Y.**
- WAVERLEY Co., 139 S. East St., Indianapolis, Ind.**

STEAM VEHICLES

- CHAUTAUQUA Motor Co., Dunkirk, N. Y.**
- MICHIGAN Steam Motor Co., 448 Lincoln Ave., Detroit, Mich.**

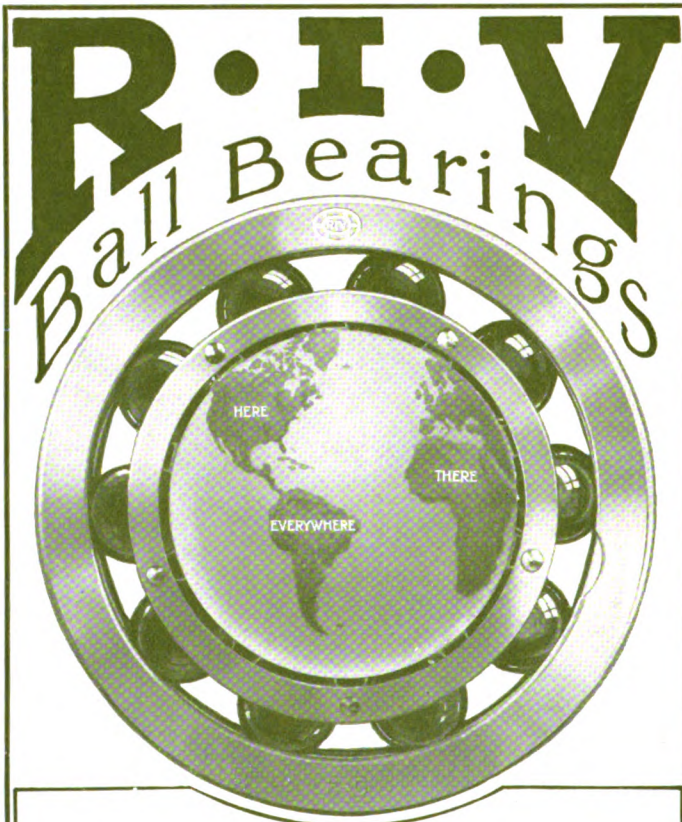


**Classified lists of the Manufacturers of
Component Parts, Accessories, Materials
and Supplies**

A complete index to classifications appears on pages 8 to 22



The "Quality" of R. I. V. Ball Bearings
Has Put Them Where They Are—
NOT TALK.



Imported
Since 1904

Quality

1771 B'way
NEW YORK

The manufacturers in whose cars they
are used are those you have come to regard as
buyers ON QUALITY NOT ON PRICE.

It Shows In Their Cars.

Part II

PARTS AND ACCESSORIES

ACID

BATTERY ACID

(See Electrolyte, Battery)

SOLDERING ACID

(See Flux, Soldering)

ADAPTERS

ELECTRIC LAMP ADAPTERS

(For converting gas or oil lamps into electric lamps)

APLCO—See Apple Electric Co.

APPLE Electric Co., 14 N. Canal St., Dayton, O. "Apico."
(See page 535.)

ARSENIO Electric Co., 819A Boylston St., Boston, Mass.

BECKLEY-RALSTON Co., Michigan Ave. & Randolph St., Chicago, Ill. "Fitz-All."

C-S—See Culver-Stearns Mfg. Co.

CHICAGO Electric Mfg. Co., 2817 S. Halsted St., Chicago, Ill. "Handy."

CULVER-STEARNS Mfg. Co., 34 Southbridge St., Worcester, Mass. "C S."

DIETZ Co., R. E., 60 Laight St., New York, N. Y.

FITZ-ALL—See Beckley-Ralston Co.

FOWLER Lamp & Mfg. Co., 61 E. 24th St., Chicago, Ill.
(See page 400.)

GENERAL Electric Co., Schenectady, N. Y.

GIL-BO—See Metal Specialties Mfg. Co.

GRAY & Davis, 55 Lansdowne St., Boston, Mass.
(See page 150.)

HAMMER Co., E. H., 1839 Euclid Ave., Cleveland, O.

HANDY—See Chicago Electric Mfg. Co.

HOWARD Miniature Lamp Co., 327 Academy St., Newark, N. J.

MANHATTAN Electrical Supply Co., 17 Park Pl., New York, N. Y.

METAL Specialties Mfg. Co., 736 W. Monroe St., Chicago, Ill. "Gil-Bo."

MORSE, Frank W., 516 Atlantic Ave., Boston, Mass.

S-H.—See Stuart-Howland Co.

STUART-HOWLAND Co., 1-3 Winthrop Sq., Boston, Mass. "S-H."

ALARMS

BOILER ALARMS

(See Columns, Water)

TIRE ALARMS

(For sounding an alarm when tires are under or over inflated)

TERPENING, E. A., Mokena, Ill.

ALCOHOL

DENATURED ALCOHOL

PYRO—See United States Industrial Alcohol Co.

UNITED States Industrial Alcohol Co., 100 William St., New York, N. Y. "Pyro."

WOOLNER Distilling Co., ft. Spillman St., Peoria, Ill.

ALUMINUM

SHEET AND ROD ALUMINUM

(For Aluminum Castings—See Castings, Aluminum)
(For Aluminum Tubing—See Tubing, Aluminum)

ALUMINUM Co. of America, Pittsburg, Pa.

FRASSE & Co., Peter A., New York, N. Y. (Importers.)
(See page 453.)

Complete Index to Classification appears on Pages 8 to 22.

AMMETERS

STANDARD AMMETERS AND VOLT-METERS

For switchboard and electric vehicle use. For Pocket Meters—See Gauges, Battery)

CLARK Electric Meter Co., 219 S. Clinton St., Chicago, Ill.

ECLIPSE—See Eldredge Electric Mfg. Co.

ELCO—See Eldredge Electric Mfg. Co.

ELDREDGE Electric Mfg. Co., 7 Post Office Sq., Springfield, Mass. "Eclipse," "Elco."

FORT Wayne Electric Works, Fort Wayne, Ind. "Wood."

GENERAL Electric Co., Schenectady, N. Y.

HOSKINS Mfg. Co., 453 Lawton Ave., Detroit, Mich. "International."

HOYT Electrical Instrument Works, Penacook, N. H. (See page 543.)

INTERNATIONAL—See Hoskins Mfg. Co.

JEWELL Electrical Instrument Co., 810 W. Lake St., Chicago, Ill.

KEYSTONE Electrical Instrument Co., Ninth St. & Montgomery Ave., Philadelphia, Pa.

NORTON Electrical Instrument Co., Manchester, Conn.

PIGNOLET, Louis M., 78 Cortlandt St., New York, N. Y.

QUEEN Co., 1211-17 Eighth St., Philadelphia, Pa.

RELIANCE Instrument Co., 1135 Van Buren St., Chicago, Ill.

ROLLER-SMITH Co., 203-05 Broadway, New York, N. Y.

TROY Electrical Co., River & State Sts., Troy, N. Y.

WAGNER Electric Mfg. Co., 6400 Plymouth Ave., St. Louis, Mo.

WESTERN Electric Co., 463 West St., New York, N. Y.

WESTON Electrical Instrument Co. (Waverly Park), Newark, N. J.

WOOD—See Fort Wayne Electric Works.

ANNUNCIATORS

AUTOMOBILE ANNUNCIATORS

(For signaling from passenger to driver. For Speaking Tubes—See Tubes, Speaking)

COWLES & Co., C., New Haven, Conn. (See page 91.)

HOLT & Beebe Co., 51 Chardon St., Boston, Mass.

O'BRIEN Mfg. Co., Joseph F., 63 Park Pl., New York, N. Y. (See page 229.)

ASBESTOS

SHEET ASBESTOS

(For Asbestos Packing—See Packing, Asbestos)

AMERICAN Asbestos Co., Norristown, Pa. (See page 51.)

CAREY Co., Phillip (Lockland), Cincinnati, O. J-M—See Johns-Manville Co.

JOHNS-MANVILLE Co., H. W., Madison Ave. & 41st St., New York, N. Y. "J-M."

KEASBEY & Mattison Co., Ambler, Pa. (See page 53.)

NEW York Asbestos Mfg. Co., 81 John St., New York, N. Y.

SALL Mountain Asbestos Mfg. Co., 230 S. LaSalle St., Chicago, Ill.

WATSON Co., H. F., Erie, Pa.

AXLES

FRONT AXLES

AMERICAN Ball-Bearing Co., Cleveland, O. (See page 47.)

AMERICAN Gear & Mfg. Co., Jackson, Mich.

BILLINGS & Spencer Co., Hartford, Conn.

DRIGGS-SEABURY Ordnance Corp., Sharon, Pa. (See page 569.)

DUNLAP Mfg. Co., Columbus, O. (See page 439.)

E.-C. Sales Co., 630 Postal Telegraph Bldg., Chicago, Ill. (See page 375.)

GILL & SONS Forge & Machine Works, P. H., Lorraine & Otsego Sts., Brooklyn, N. Y. (See page 507.)

GREENVILLE Metal Products Co., Greenville, Pa.

HESS Spring & Axle Co., Carthage, O. (See pages 46A and 46B.)

HIGGINS Spring & Axle Co., 1314 16th St., Racine, Wis. (See page 621.)

JACOBSON Machine Mfg. Co., Warren, Pa. (See page 493.)

KRUPP—See Prosser & Son.

LEE & Porter Mfg. Co., Buchanan, Mich.

LEWIS Spring & Axle Co., Jackson, Mich. (See page 547.)

LIGGETT Spring & Axle Co., Park Bldg., Pittsburg, Pa. (See page 299.)

McCUE Co., Buffalo, N. Y. (See page 293.)

METAL Products Co., Detroit, Mich. ?? (See page 91.)

MOTT Wheel Works, Utica, N. Y. (See page 437.)

MUNCIE Gear Works, Muncie, Ind. (See page 603.)

PATHFINDER—See Weaver Co.

PROSSER & Son, Thomas, 15 Gold St., New York, N. Y. (Importers.) "Krupp." (See page 361.)

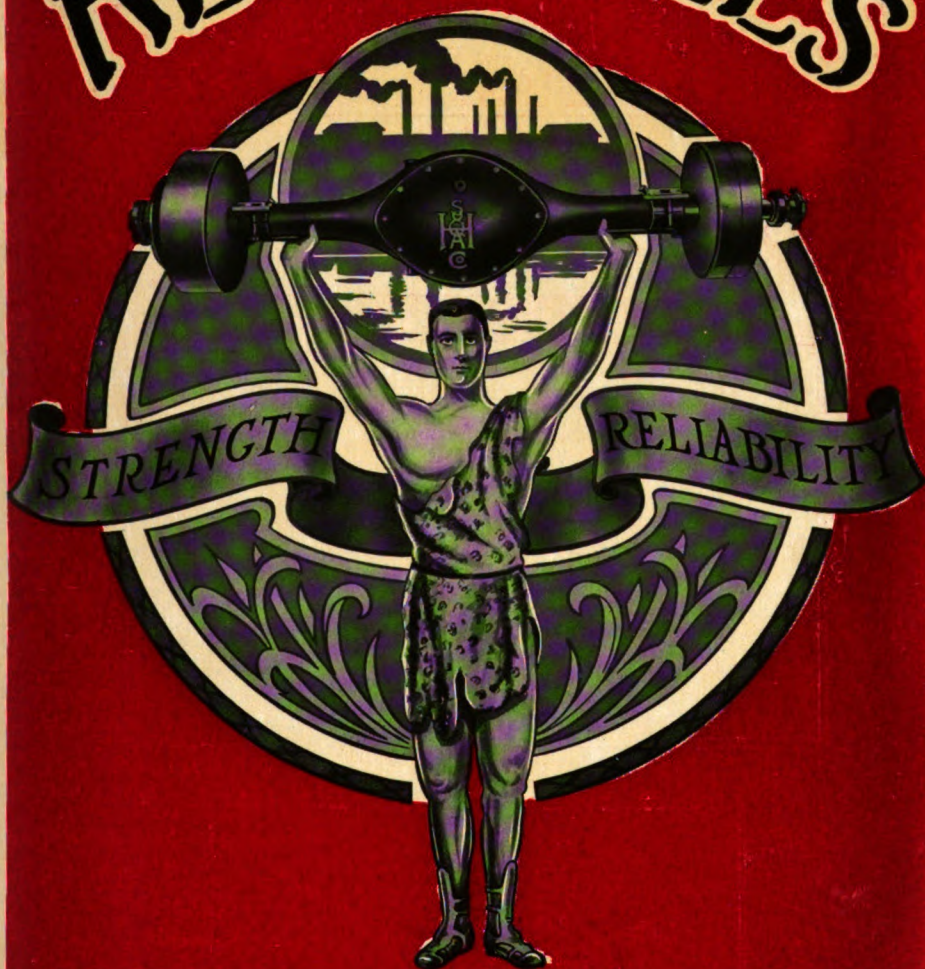
RUSSEL Motor Axle Co., North Detroit, Mich. (See page 49.)

SALISBURY Wheel & Mfg. Co., Jamestown, N. Y. (See page 549.)

SHELDON Axle Co., Wilkes-Barre, Pa. (See pages 50 and 51.)



HESS AXLES



The prestige and reputation attained by the Hess Spring and Axle Company as manufacturers of high grade motor car axles is as unique as the motor car industry itself.

Although the first axles were produced more than four years ago, two years were devoted to testing and experimenting before the first axles were placed on the market. Since then fourteen manufacturers have exclusively adopted Hess axles.

A further gratifying fact of the success of Hess axles is the increasing demand from new manufacturers and renewals of contracts from present users.

Hess axles equipment on your cars means assistance of successful service and the elimination of axle trouble.

THE HESS SPRING & AXLE CO.

CARTHAGE, OHIO, U. S. A.





HESS SPRINGS



The scientific treatment of high-grade spring steels by our Engineering Department, is particularly interesting, and is showing results in physical tests with which every Automobile Engineer should be familiar.

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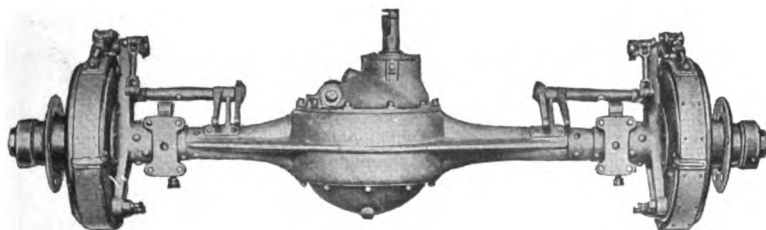


THE HESS SPRING & AXLE CO.

CARTHAGE, OHIO, U. S. A.



American Axles



Bevel Drive

TO SUPPLY correctly proportioned axles for high grade motor cars of various weights, "American" floating bevel drive rear axles are made in three sizes, known respectively as Type 46, 43 and 50.

ALL THREE types possess the same general principles of design and perfection of workmanship which characterize our axles, yet each is constructed to meet the peculiar requirements of the car for which it is intended.

"**AMERICAN AXLES**" cannot be excelled whether for gasoline or electric cars, they assure high efficiency and the smooth and quiet running which is so desirable and even necessary in axles for cars of the better class.

American Ball-Bearing Co.
Cleveland, Ohio

AXLES (Continued)**FRONT AXLES (Continued)**

- SMITH Co., A. O., Milwaukee, Wis.**
(See page 355.)
- STANDARD Roller Bearing Co., 50th St. & Lancaster Ave., Philadelphia, Pa.**
(See page 613.)
- TIMKEN-DETROIT Axle Co., Detroit, Mich.**
- TIPPETT Mfg. Co., 172-82 W. Locust St., Columbus, O.**
(See page 321.)
- WALKER-WEISS Axle Co., Flint, Mich.**
- WEAVER Co., Geo. A., Newport, R. I. "Pathfinder."**
- WESTON-MOTT Co., Flint, Mich.**
(See page 319.)

REAR AXLES

- AMERICAN Ball-Bearing Co., Cleveland, O.**
(See page 47.)
- AMERICAN Gear & Mfg. Co., Jackson, Mich.**
- COLLINS Gear & Motor Co., Frick Bldg., Pittsburg, Pa.**
- COVERT Motor Vehicle Co., Lockport, N. Y.**
(See page 577.)
- DODGE Bros., 1678-1724 Jos. Campau Ave., Detroit, Mich.**
- DRIGGS-SEABURY Ordnance Corp., Sharon, Pa.**
(See page 569.)
- DUNLAP Mfg. Co., Columbus, O.**
(See page 439.)
- E.-C. Sales Co., 630 Postal Telegraph Bldg., Chicago, Ill.**
(See page 375.)
- HESS Spring & Axle Co., Carthage, O.**
(See pages 46A and 46B.)
- HINDLEY Gear Co., 1105 Frankfort St., Philadelphia, Pa.**
- JACOBSON Machine Mfg. Co., Warren, Pa.**
(See page 493.)
- LEE & Porter Mfg. Co., Buchanan, Mich.**
- LIGGETT Spring & Axle Co., Park Bldg., Pittsburg, Pa.**
(See page 299.)
- McCUE Co., Buffalo, N. Y.**
(See page 293.)
- METAL Products Co., Detroit, Mich.**
(See page 91.)
- MOTT Wheel Works, Utica, N. Y.**
(See page 437.)
- RUSSEL Motor Axle Co., North Detroit, Mich.**
(See page 49.)
- SALISBURY Wheel & Mfg. Co., Jamestown, N. Y.**
(See page 549.)
- SHELDON Axle Co., Wilkes-Barre, Pa.**
(See pages 50 and 51.)
- SMITH Co., A. O., Milwaukee, Wis.**
(See page 355.)
- STANDARD Roller Bearing Co., 50th St. & Lancaster Ave., Philadelphia, Pa.**
(See page 613.)
- TIMKEN-DETROIT Axle Co., Detroit, Mich.**

TIPPETT Mfg. Co., 172-82 W. Locust St., Columbus, O.
(See page 321.)

TORBENSON Gear & Axle Co., 220 High St., Newark, N. J.
(See page 569.)

WARNER Mfg. Co., Toledo, O.
(See page 231.)

WAYNE Auto Axle Co., Fort Wayne, Ind.
(See page 603.)

WESTON-MOTT Co., Flint, Mich.
(See page 319.)

REAR AXLES WITH TRANSMISSION

- AMERICAN Gear & Mfg. Co., Jackson, Mich.**
- COVERT Motor Vehicle Co., Lockport, N. Y.**
(See page 577.)
- EVANS—See Merchant & Evans Co.**
- LINDSAY, T. J., Meridian Life Bldg., Indianapolis, Ind.**
(See page 433.)
- MERCHANT & Evans Co., 517 Arch St., Philadelphia, Pa. "Evans."**
- MUNCIE Gear Works, Muncie, Ind.**
(See page 603.)
- PERU Auto Parts Mfg. Co., Peru, Ind.**
- RUSSEL Motor Axle Co., North Detroit, Mich.**
(See page 49.)
- SALISBURY Wheel & Mfg. Co., Jamestown, N. Y.**
(See page 549.)

BACKS**METAL SEAT BACKS**

- A-Z Co., 530 W. 56th St., New York, N. Y.**
(See page 307.)
- BRISCOE Mfg. Co., Detroit, Mich.**
(See pages 239 and 240.)
- BUNN-HUTCHINSON Co., 330 Prospect Ave., N. W., Cleveland, O.**
- MULLINS Co., W. H., 182 Franklin St., Salem, O.**
- RELIABLE Radiator Co., 451-53 E. 173d St., New York, N. Y.**

BAGS**COAT RAIL BAGS**

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- B. E. Mfg. Co., 38 White St., New York, N. Y.**
- GILBERT Mfg. Co., New Haven, Conn.**
- GORDON—See Vehicle Apron & Hood Co.**
- NATHAN Novelty Mfg. Co., 90 G. Reade St., New York, N. Y.**
(See page 143.)
- NIAGRA Auto-Cover Co., 524 W. 50th St., New York, N. Y.**
- PREMIER Novelty Mfg. Co., 83 White St., New York, N. Y.**



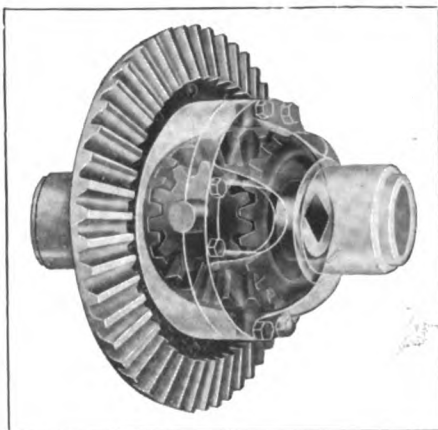
RUSSEL AXLES



Front Axles
Rear Axles and
Jack Shafts
of Bevel Gear Type

*We Make
Our Own Gears*

and therefore do
not divide our
responsibility for
failure to make
quiet-running
axles.



RUSSEL MOTOR AXLE CO.
NORTH DETROIT, MICH.

SHEL

ONE TRUCK EQ

Investigate this equipment if you want something that has been thoroughly tried out. We offer you material as follows:—

Front Axle—I beam style with solid spring pads.

Rectangular Rear Axle—with spring pads forged integral.

Brake and Radius rod equipment.

Jack shaft—with transmission.

Springs

If you wish we can furnish a frame with brackets or spring bracket that you might find very suitable for your own frame. There is some satisfaction besides a saving in getting all this material from one source. You can begin building a one ton truck at once with our axles, springs, etc.



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WILKES-BARRE, PA.
LARGEST AXLE AND SPRING FACTORY IN THE WORLD

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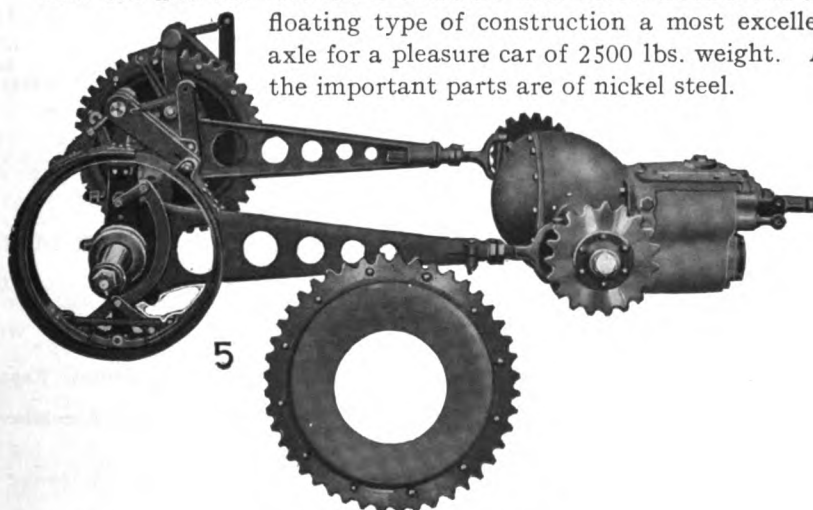
DOWN TON EQUIPMENT

We make I Beam front axles in seven different sizes suitable for trucks from 500 to 20,000 lbs. capacity.

We have truck equipments from two and three ton trucks similar to the one ton outfit shown here. We save you experimenting.

This material you can put into service at once and it **will deliver the goods.**

You will find our No. 201-D Pleasure axle which we make in 3/4 floating type of construction a most excellent axle for a pleasure car of 2500 lbs. weight. All the important parts are of nickel steel.



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WINSHIP, W. W., 71 Summer St., Boston,
Mass.

RUBBER GAS BAGS

- DAVOL Rubber Co., Providence, R. I.
DIAMOND Rubber Co., Akron, O.
GOODRICH Co., B. F., Akron, O.
INDIANA Rubber & Insulated Wire Co.,
Jonesboro, Ind.
MECHANICAL Rubber Co., C. & P. & Nickel
Plate R. R., Cleveland, O.
SEAMLESS Rubber Co. of N. Y., 250 W.
54th St., New York, N. Y.
(See page 387.)
TYER Rubber Co., Andover, Mass. "Tyrian."
TYRIAN—See Tyer Rubber Co.

TOOL BAGS OR ROLLS

(For Tool Boxes—See Boxes, Tool)

- AJAX Trunk & Sample Case Co., 91-93 Mercer
St., New York, N. Y.
B. E. Mfg. Co., 38 White St., New York, N. Y.
BOYLE & Co., John, New York, N. Y.
(See page 81.)
BROWN Co., H. S., 270 Kossuth St., Bridge-
port, Conn.
CAMPBELL—See Perkins Campbell Co.
COOK & Bro., E. C., 1301-45 Carroll Ave.,
Chicago, Ill.
DAFOE-EUSTICE Co., 54 Lafayette Blvd.,
Detroit, Mich.
ECONOMY Stay Co., Jefferson City, Mo.
EXCELSIOR Bag & Mfg. Co., Troy, N. Y.
FEESER Co., Frank S., 1102 Prospect St.,
Indianapolis, Ind. "Superior."
GILBERT Mfg. Co., New Haven, Conn.
GORDON—See Vehicle Apron & Hood Co.
HOLLIDAY & Wyon Co., West & Ohio Sts.,
Indianapolis, Ind.
HOPEWELL Bros., Newton, Mass.
(See page 145.)
M. & E. Mfg. Co., Ashland, O.
MAU-SHERWOOD Supply Co., 1616 W. Third
St., Cleveland, O.
NATHAN Novelty Mfg. Co., 90 G. Reade
St., New York, N. Y.
(See page 145.)
NIAGRA Auto-Cover Co., 524 W. 50th St.,
New York, N. Y.
PERKINS Campbell Co., Cincinnati, O.
"Campbell."
(See page 371.)
PLANET Co., Westfield, Mass.
PREMIER Novelty Mfg. Co., 83 White St.,
New York, N. Y.
SPRINGFIELD Harness Co., 55-61 Dwight
St., Springfield, Mass.

SUPERIOR—See Feeser Co.

VEHICLE Apron & Hood Co., 272 N. Fourth
St., Columbus, O. "Gordon."**BALLS****STEEL BALLS**

- AMERICAN Ball Co., 115 Clifford St., Provi-
dence, R. I.
ATLAS Ball Co., Glenwood Ave. & Second
St., Philadelphia, Pa.
AUBURN Ball Bearing Co., 27 Elizabeth
St., Rochester, N. Y.
(See page 485.)
BANTAM Anti-Friction Co., Bantam,
Conn. (Importers.) "H. & H."
(See page 613.)
BRETZ Co., J. S., 250 W. 54th St., New
York, N. Y. (Importers.)
(See page 661.)
FLANDERS Mfg. Co., Pontiac, Mich.
FRASSE & Co., Peter A., New York, N. Y.
(Importers.)
(See page 453.)
H. & H.—See Bantam Anti-Friction Co.
HOFFMAN—See R. I. V. Co.
NEW Departure Mfg. Co., Bristol, Conn.
(See page 75.)
PRESSED Steel Mfg. Co., Land Title Bldg.,
Philadelphia, Pa.
R. I. V. Co., 1771 Broadway, New York,
N. Y. (Importers.) "Hoffman."
(See page 44.)
STANDARD Roller Bearing Co., 50th St.
& Lancaster Ave., Philadelphia, Pa.
(See page 613.)

BANDING**BRAKE BANDING OR LINING**(For lining brakes or clutches—See also Leather,
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America.
AMBLER AUTOBESTOS—See Keasbey &
Mattison Co.
AMERICAN Asbestos Co., Norristown, Pa.
"Motorbestos."
(See page 81.)
ARABIAN—See Rossendale-Reddaway Belting
& Hose Co.
ASBESTOS & Rubber Works of America,
New York, N. Y. "Ajax," "Motobestos."
(See page 55.)
ATKINS & Co., E. C., South & Illinois Sts.,
Indianapolis, Ind. "F.O.E."
AUTOBESTINE—See Woven Steel Hose &
Rubber Co.
CAMEL HAIR—See Rossendale-Reddaway
Belting & Hose Co.
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Complete Index to Classification appears on Pages 8 to 22.

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(See page 53.)**J-M NON-BURN**—See Johns-Manville Co.**JOHNS-MANVILLE** Co., H. W., Madison Ave. & 41st St., New York, N. Y. "J-M Non-Burn."**KEASBEY & Mattison** Co., Ambler, Pa. "Ambler Autobelastos."
(See page 53.)**KNOWLES** Co., 44-48 Union Sq., Bridgeport, Conn. "Sa Best So."**MAU-SHERWOOD** Supply Co., 1616 W. Third St., Cleveland, O.**MOTOBESTOS**—See Asbestos & Rubber Works of America.**MOTORBESTOS**—See American Asbestos Co.**MULTIBESTOS**—See Standard Woven Fabric Co.**NEW YORK** Leather Belting Co., 51 Beekman St., New York, N. Y. "Grip-on."**RAYBESTOS**—See Royal Equipment Co.**ROSSENDALE-REDDAWAY** Belting & Hose Co., Newark, N. J. "Camel Hair," "Arabian."**ROYAL** Equipment Co., 440 Housatonic Ave., Bridgeport, Conn. "Raybestos," "Stability."
(See page 53.)**S-M-C**—See Staybestos Mfg. Co.**SA BEST SO**—See Knowles Co.**SALL** Mountain Asbestos Mfg. Co., 230 S. LaSalle St., Chicago, Ill.**SCANDINAVIA** Belting Co., 127-29 White St., New York, N. Y.
(See page 605.)**STABILITY**—See Royal Equipment Co.**STANDARD Woven Fabric** Co., Worcester, Mass. "Multibestos."
(See page 583.)**STAYBESTOS** Mfg. Co., Brighthurst St., (Germantown) Philadelphia, Pa. "S-M-C."**THERMOID** Rubber Co., Trenton, N. J.
(See page 393.)**WOVEN** Steel Hose & Rubber Co., Trenton, N. J. "Autobelastine."
(See page 583.)**BANDS****NON-SKID BANDS**

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(See page 203.)**HERCULES**—See Republic Rubber Tire & Shoe Co.**LEATHER** Tire Goods Co., Niagara Falls, N. Y. "Woodworth."
(See page 55.)**M-ER-GEN-C**—See Commonwealth Mfg. Co.**MESINGER** Mfg. Co., H. & F., 1801-07 First Ave., New York, N. Y.
(See page 523.)**PERFECTION** Non-Skid Climber Co., Edon, O.**REPUBLIC** Rubber Tire & Shoe Co., 152 W. 55th St., New York, N. Y. "Hercules."**WOODWORTH**—See Leather Tire Goods Co.**BARS****ARCH BARS**

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JOVE—See Bunnell & Co.

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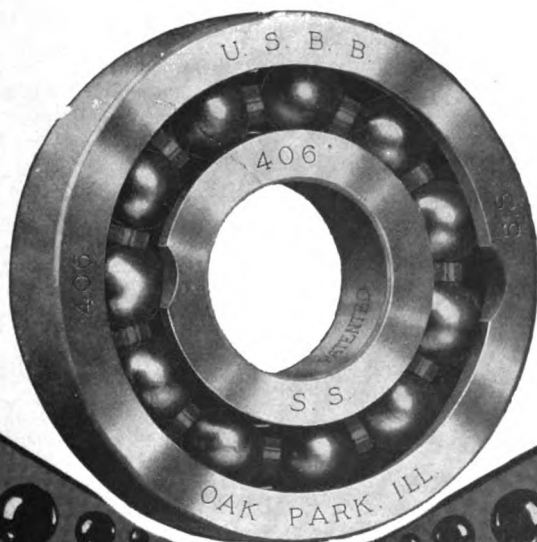
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(See page 61.)

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(See page 597.)

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(See page 613.)

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(See page 59.)

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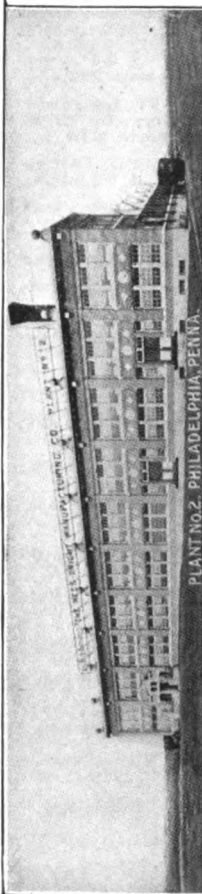
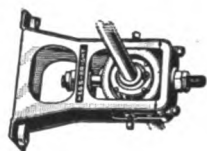
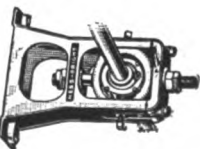
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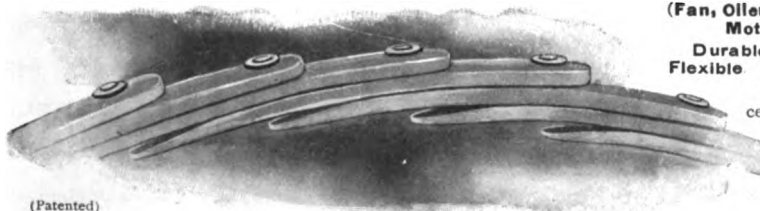
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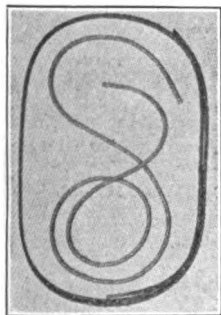
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(See page 73.)
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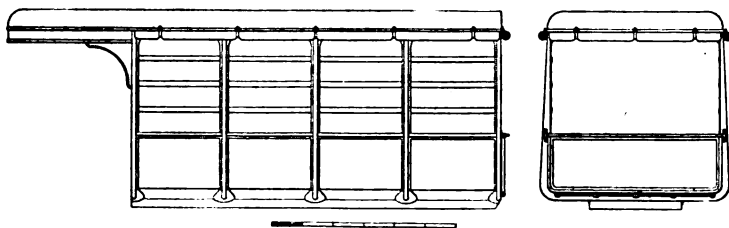
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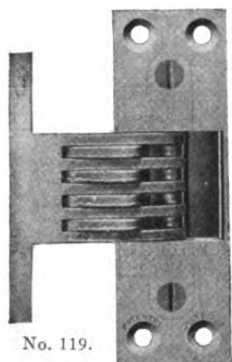
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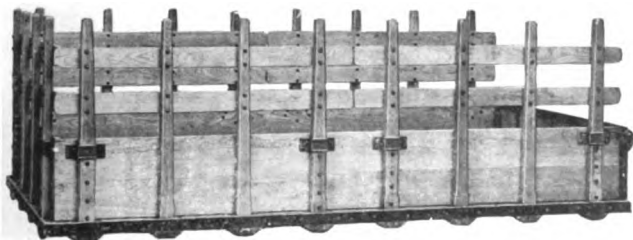
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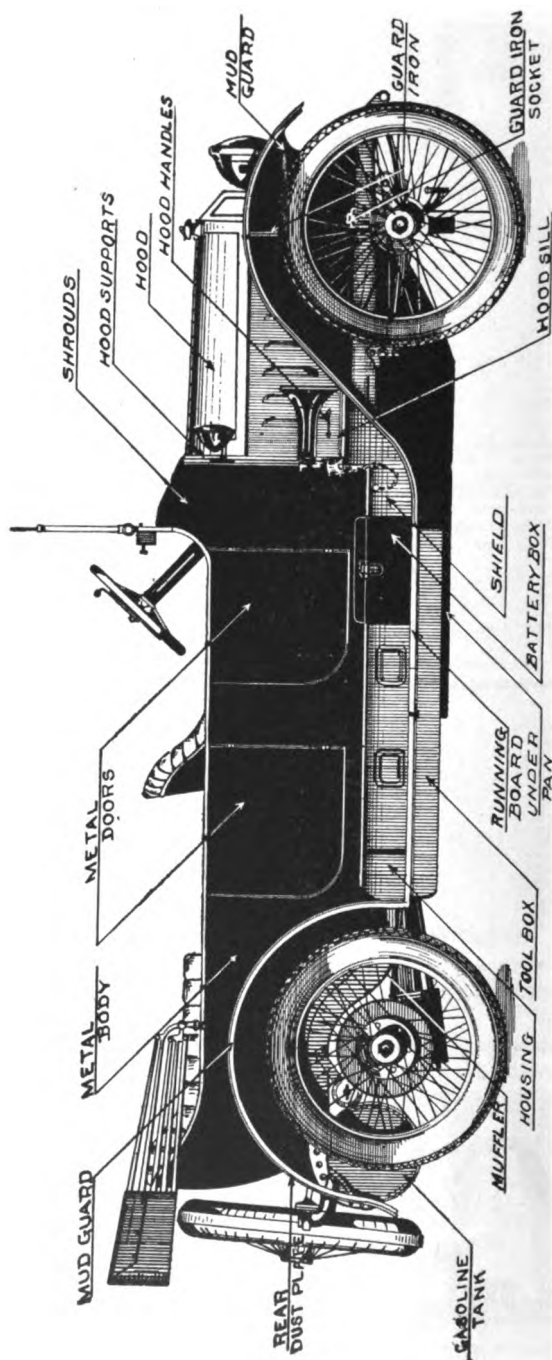
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 (See page 73.)
 SEBASTIAN Wagon Co., 425 E. 53d St., New York, N. Y.
 SHADBOLT Mfg. Co., Flushing Ave. & Cumberland St., Brooklyn, N. Y.
 SHOWALTER Mfg. Co., 330 Hanson Ave., Indianapolis, Ind.
 SJOBERG & Co., J. P., 533-59 W. 32d St., New York, N. Y.
 STEWART Co., W. F., Harriet St., Flint, Mich.
 TEGETMEIER & Rlepe Co., 771-73 First Ave., New York, N. Y.
 TROY Mfg. Co., Troy, O.
 VALENTINE, J. S., 432-38 Princeton Ave., Trenton, N. J.
 WALKER & Werner, 207-13 Fayette St., Peoria, Ill.
 WAVERLEY Co., 139 S. East St., Indianapolis, Ind.
 WELCH & Sutherland, 80 Lunenburg St., Fitchburg, Mass.
 WESTERN Auto-Body Mfg. Co., 416-18 E. Ninth St., Los Angeles, Cal.
 WILLOUGHBY Co., Dwyer Ave. & Turner St., Utica, N. Y.
 WRIGHT Carriage Body Co., 24th Ave. & 24th St., Melrose, Ill.
 WRIGHT Co., Thos., 71-78 Golden St., Jersey City, N. J.
 YORK Wagon Gear Co., York, Pa.
 ZIMMERMAN & Sons, F. F. Main St., Waukegan, Wis.

WOOD PLEASURE CAR BODIES

ABRESCH Co., Chas., Fourth & Poplar Sts., Milwaukee, Wis.
 ACME Body Co., Rahway, N. J.
 AMERICAN Body Co., 1255-63 Niagara St., Buffalo, N. Y.
 ANTHONY Auto Body Co., 83d St. & East River, New York, N. Y.
 ARMSTRONG Co., M., 433 Chapel St., New Haven, Conn.
 AUTO Body Co., Lansing, Mich.
 (See page 73.)
 AUTO Metal Co., 520 Worthington St., Springfield, Mass.
 AUTO Specialty Mfg. Co., 326-30 E. Market St., Indianapolis, Ind.
 AUTO Top & Body Co., 257-59 N. Broad St., Philadelphia, Pa.
 BAILY & Co., S. E., 430 N. Queen St., Lancaster, Pa.
 BARNES-CURTISS Co., 147-49 W. 99th St., New York, N. Y.
 BEAUDETTE Co., O. J., Pontiac, Mich.
 BELLAMORE Armored Car & Equipment Co., 286 Fifth Ave., New York, N. Y.
 BIEHLS Carriage Works, 31 S. Fifth St., Reading, Pa.
 BLUE Ribbon Auto & Carriage Co., 154 Canton St., Bridgeport, Conn.

THE AUTO BODY COMPANY

MANUFACTURERS OF

FINE AUTOMOBILE BODIES

LANSING, MICH.

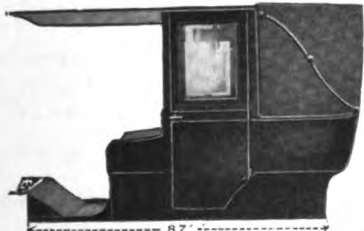
THE WISCONSIN SEATING CO.

Veneer Division

NEW LONDON, WIS.

AUTO DASHES

A SPECIALTY



STOCK TAXICAB BODIES AT RIGHT PRICES

This cut shows a new style of taxicab body, which we offer to the trade as a reliable and serviceable body. The construction is substantial, the framework being built of extra heavy ash lumber, joints being mortised, glued and screwed together. Panels are of 22 gauge automobile steel, windows designed to allow them to drop into frame of body, sills extra heavy to permit of their being fitted to most any style of chassis frame at little expense. Trimmings are of a good grade of leather; silk curtains mounted on spring rollers are provided for each of the windows and doors. Inside are two extra folding seats giving a seating capacity for five people inside and two outside. The exterior finish of these bodies is of a superior quality. We carry in stock a quantity of these bodies, and can make prompt shipments after receiving order.

Dimensions—Size on bottom, 34" x 87".
Height of underbody, 14½".
Back of dash to front seat, 23¼".
Back of dash to center hinge, 64¼".

Capacity, seven adult passengers.

We shall be pleased to receive your inquiries; prices are right, and we guarantee them. We build taxicab bodies to order; also all kinds of open and closed work, tops and trimmings.

SCHUBERT BROS. GEAR CO., 43 Cedar St., Oneida, N. Y.

NEW HAVEN CARRIAGE CO.

NEW HAVEN CONN.

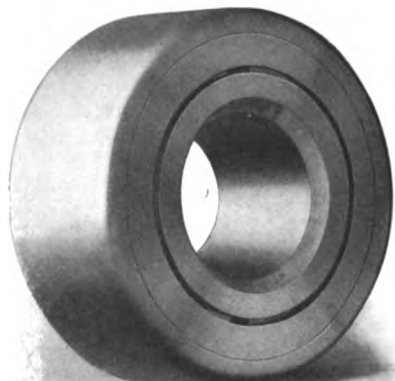


Designers and Builders
of High Grade
Automobile Bodies
Auto Wheels

BODIES (Continued)**WOOD PLEASURE CAR BODIES
(Continued)**

- BORBEIN Auto Co., 2109-11 N. Ninth St., St. Louis, Mo.
- BOWE Carriage Co., 711 Orange St., Wilmington, Del.
- BREWSTER & Co., Queensboro Bridge Plaza, Long Island City, N. Y.
- BRIIGS Carriage Co., Cedar St., Amesbury, Mass.
- BRILL Co., J. G., 62d St. & Woodland Ave., Philadelphia, Pa.
- BROWNELL & Burt, 12 Washington St., Taunton, Mass.
- BRUNN'S Carriage Mfg. Co., 1140-48 Main St., Buffalo, N. Y.
- BURR & Co., 205 W. 75th St., New York, N. Y.
- CAPITOL Body Co., Ray St. & Madison Ave., Indianapolis, Ind.
- CARRIAGE Woodstock Co., Owensboro, Ky.
- CHICAGO Carriage & Trimming Co., 1908 Indiana Ave., Chicago, Ill.
- CHICAGO Coach & Carriage Co., 1223-31 S. Michigan Ave., Chicago, Ill.
- COLLINGS Carriage Co., 108-14 N. Front St., Camden, N. J.
- COLLINS Vehicle Woodwork Co., R. N., 3900 Chouteau Ave., St. Louis, Mo.
- COLYER & Co., J., Central Ave., Newark, N. J.
- COOLING Carriage Co., 402 French St., Wilmington, Del.
- CUNNINGHAM Son & Co., James, 18 Canal St., Rochester, N. Y.
- CURRIER-CAMERON Co., 35 Elm St., Amesbury, Mass.
- DANN Bros. & Co., 80-88 Franklin St., New Haven, Conn.
- DAYTON Body Co., 620 Geyer St., N., Dayton, O.
- DEMAREST & Co., A. T., New Haven, Conn.
- DES MOINES Cabinet Co., 403-09 W. S. Ninth St., Des Moines, Ia.
- DETROIT Body Co., Kercheval & Beaufault Aves., Detroit, Mich.
- EARL Automobile Works, 1320 S. Main St., Los Angeles, Cal.
- FARNHAM & Nelson Co., 47 Union Ave., Boston, Mass.
- FEHRING Carriage Co., 601-09 Third St., Columbus, Ind.
- FISHER, A., 300-10 Fort St., W., Detroit, Mich.
- FISHER Body Co., St. Antoine St. & M. C. R. R., Detroit, Mich.
- FLANDRAU & Co., 406-12 Broome St., New York, N. Y.
- GLESENKAMP Sons & Co., L., 320 Penn Ave., Pittsburg, Pa.
- GOOLD Co., James, Broadway & Schuyler St., Albany, N. Y.
- GRAVES & Co., G. O., Rahway, N. J.
- GREGG-WM. D. ROGERS Co., 1926 Arch St., Philadelphia, Pa.
- GRISWOLD Motor & Body Co., 660 Commonwealth Ave., Detroit, Mich.
- HASSETT & Rogers, Oak St., Amesbury, Mass.
- HEALEY & Co., 1652 Broadway, New York, N. Y.
- HERBERT Mfg. Co., 570 Kirby Ave., W., Detroit, Mich.
- HOLCKER-ELBERG Mfg. Co., Kansas City, Mo.
- HUGHEY & Son, Wm. J., 2518-20 Michigan Ave., Chicago, Ill.
- HUTCHCROFT & Sons Co., D. G., Cleveland, O.
- JOHNSON Service Co., 149-53 Michigan St., Milwaukee, Wis.
- KETTERER Co., C. P., 211-15 W. 19th St., New York, N. Y.
- KIMBALL & Co., C. P., Chicago, Ill.
(See page 85.)
- KINGSBURY-LEAHY Co., 131-33 Hudson Ave., Albany, N. Y.
- KLINGER, Louis, 745 E. 11th St., New York, N. Y.
- LAWRENCE & Co., L., 292 Halsey St., Newark, N. J.
- LIMOUSINE-CARRIAGE Mfg. Co., 3515 Michigan Ave., Chicago, Ill.
- LOCKE & Co., 218-20 W. 84th St., New York, N. Y.
- LOWELL Auto Body Co., Lowell, Mich.
- MACINNIS Bros., 118-22 22d St., Toledo, O.
- MANHATTAN Top & Body Co., 221-23 W. 64th St., New York, N. Y.
- MECKEL, Fred L., 9-13 E. 13th St., Chicago, Ill.
- MEDIA Carriage Mfg. Co., Media, Pa.
- MICHIGAN Auto Body Co., Milford, Mich.
- MIFFLINBURG Body & Gear Co., Mifflinburg, Pa.
- MILBURN Wagon Co., Toledo, O.
- MILLER Bros., Chestnut St., Amesbury, Mass.
- MONROE Body Co., Osmun St., Pontiac, Mich.
- MOORE & Munger Co., 602 W. 52d St., New York, N. Y.
- MOUNT Co., J. W., Maple Ave. & White St., Red Bank, N. J.
- NEW Haven Carriage Co., New Haven, Conn.
(See page 73.)
- PAGE, Samuel K., 60 Franklin St., New Haven, Conn.
- RACINE Mfg. Co., Sixth & Main Sts., Racine, Wis.
- RECH-MARBAKER Co., Eighth St. & Girard Ave., Philadelphia, Pa.
- RICKARDS & McLaughlin Wagon Co., Trenton, N. J.
- ROBBINS & Co., Irvin, 11th & Canal Sts., Indianapolis, Ind.
(See page 77.)
- ROGERS Son & Co., Wm. D., 13th & Cherry Sts., Philadelphia, Pa.
- SARGENT & Ham Co., 26-30 Bowker St., Boston, Mass.
- SCHILDWACHTER Carriage Co., Park Ave. & 128th St., New York, N. Y.
- SCHNABEL & Sons, G. A., Penn Ave. & 31st St., Pittsburg, Pa.
- SCHUBERT Bros. Gear Co., 43 Cedar St., Oneida, N. Y.
(See page 73.)
- SHIELDS Carriage Co., 11 Carriage Ave., Amesbury, Mass.

"American Made for American Trade"



NEW DEPARTURE BALL BEARINGS

DOUBLE ROW

SINGLE ROW

"RADAX"

Nothing Succeeds Like Success—

One of the largest manufacturers of automobiles said to our chief engineer the other day:

"You are giving us more all around ball bearing value for the dollar than anybody in the business."

This manufacturer and his engineers thus honestly expressed the result of their extensive test of New Departure ball bearings for all of the essential factors of efficiency—that is, quality, durability, service, reliability, uniform strength, accuracy of manufacture and finish, etc.

Our factory is operating twenty-two hours a day on orders. More than eight acres of floor space are devoted to the manufacture of this bearing. Seventy-five thousand square feet of floor space are being added for increasing production capacity to care for actual contracts for 1913 delivery.

This American-made ball bearing has proved its right to your consideration. There are solid reasons why you should talk to our representatives and see our catalog.

May we send either or both to you?

The New Departure Mfg. Co., Bristol, Conn.
Detroit Branch, 1016-17 Ford Bldg.

Please mention The Automobile Trade Directory when writing to advertisers.

BODIES (Continued)**WOOD PLEASURE CAR BODIES
(Continued)**

- SHOWALTER Mfg. Co., 330 Hanson Ave., Indianapolis, Ind.
- SIEVERS & Erdman, 294-98 Jefferson Ave., Detroit, Mich.
- STEWART Co., W. F., Harriet St., Flint, Mich.
- STONE & Sons, C., 1658-74 Ogden Ave., Chicago, Ill.
- THOMPSON Co., E. J. (Forbes Field), Pittsburgh, Pa.
- TIERNEY, P. J., Boston Post Rd., New Rochelle, N. Y.
- TROY Mfg. Co., Troy, O.
- UNION City Body Co., Union City, Ind.
- UNION Wheel Works, 51-55 Stanton St., Newark, N. J.
- VALENTINE, J. S., 432-38 Princeton Ave., Trenton, N. J.
- WALKER Carriage Co., Merrimac, Mass.**
(See page 69.)
- WALKER & Co., Alfred J., 218-20 W. 65th St., New York, N. Y.
- WALKER & Werner, 207-13 Fayette St., Peoria, Ill.
- WAVERLEY Co., 139 S. East St., Indianapolis, Ind.
- WERNER & Sons, Geo., 1133-37 Main St., Buffalo, N. Y.
- WERTSCH Co., Wm., 24 Page St., San Francisco, Cal.
- WESTERN Auto-Body Mfg. Co., 416-18 E. Ninth St., Los Angeles, Cal.
- WILLOUGHBY Co., Dwyer Ave. & Turner St., Utica, N. Y.
- WRIGHT Carriage Body Co., Third Ave. & 24th St., Moline, Ill.
- YORK Wagon Gear Co., York, Pa.
- YOUNG Carriage Co., Wm., 4524 Delmar Ave., St. Louis, Mo.
- ZIMMERMAN & Sons, F. F., Main St., Wau-pun, Wis.

BOILERS**AUTOMOBILE STEAM BOILERS**

- OFELDT & Sons, August, Valley Stream, N. Y.
- OFELDT & Sons, F. W., Nyack, N. Y.
- STEAM Carriage Boiler Co., 130 W. First St., Oswego, N. Y.

BOLTS**CAP BOLTS**

(See Screws, Cap and Set)

CARRIAGE BOLTS

(See Bolts, Machine and Carriage)

MACHINE AND CARRIAGE BOLTS

- AMERICAN Iron & Steel Mfg. Co., Front & Cumberland Sts., Lebanon, Pa.
- ANCHOR Bolt & Nut Co., Poughkeepsie, N. Y.
- CLARK Bros. Bolt Co., Milldale, Conn.**
(See page 77.)
- COLUMBUS Bolt Works, 162 W. Randolph St., Columbus, O.
- DETROIT Screw Works, Detroit, Mich.**
(See page 653.)
- FALLS Rivet & Machine Co., Kent, O.
- GRAHAM Nut Co., Pittsburgh, Pa.
- HASKELL Mfg. Co., Wm. H., 451 Main St., Pawtucket, R. I.
- HAYDON, A. & M., 304 N. 22d St., Philadelphia, Pa.
- KANSAS City Bolt & Nut Co. (Sheffield Station), Kansas City, Mo.
- KIRK-LATTY Mfg. Co., Madison Ave., Cleveland, O.
- LAMSON & Sessions Co., 2188 Scranton Rd., Cleveland, O.
- LANZ & Sons, Mathew, 2907 Carson St., Pittsburgh, Pa.
- NEW Castle Forge & Bolt Co., New Castle, Pa.
- OLIVER Iron & Steel Co., Pittsburgh, Pa.
- PITTSBURG Screw & Bolt Co., Liberty Ave. & 25th St., Pittsburgh, Pa.
- REPUBLIC Iron & Steel Co., Republic Bldg., Youngstown, O.
- RHODE Island Tool Co., Providence, R. I.
- RUSSELL, Burdsall & Ward Bolt & Nut Co., Port Chester, N. Y.
- ST. LOUIS Screw Co., Clarence & Bulwer Aves., St. Louis, Mo.
- SHELTON Co., Shelton, Conn.
- SKELLY'S Philadelphia Bolt Works, T., 24th & Callowhill Sts., Philadelphia, Pa.

SPRING AND SHACKLE BOLTS

- BOWEN Mfg. Co., Mechanic St., Auburn, N. Y.**
(See page 151.)
- ELECTRIC Welding Products Co., Cleveland, O.**
(See page 573.)
- PENBERTHY Injector Co., Detroit, Mich.**
(See page 77.)
- WINKLEY Co., Detroit, Mich.**
(See page 255.)
- ZERK Mfg. Co., Cleveland, O.

STOVE AND TIRE BOLTS

- AMERICAN Screw Co., Providence, R. I.
- ATLAS Bolt & Screw Co., 1289 Marquette Rd., N. E., Cleveland, O.
- CLARK Bros. Bolt Co., Milldale, Conn.**
(See page 77.)
- COLUMBUS Bolt Works, 162 W. Randolph St., Columbus, O.
- FALLS Rivet & Machine Co., Kent, O.
- IRELAND & Matthews Mfg. Co., 51-79 Iron St., Detroit, Mich.
- KIRK-LATTY Mfg. Co., Madison Ave., Cleveland, O.

Complete Index to Classification appears on Pages 8 to 22.

AUTOMOBILE BODIES*Metal, Wood or Agasote*

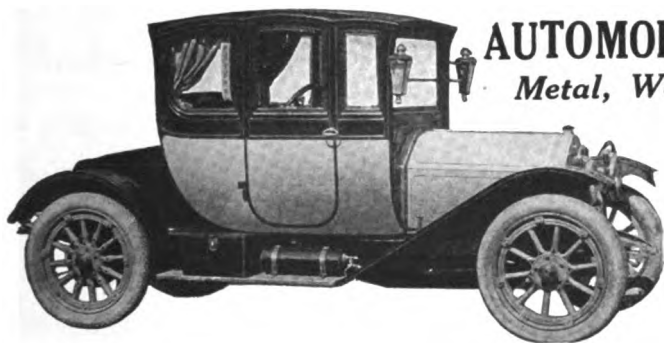
TORPEDO LIMOUSINE
LANDAULET TOURING
COUPE ROADSTER
TAXICAB RUNABOUT

The most distinctive styles are manufactured by us and supplied the largest manufacturers and dealers in the country.

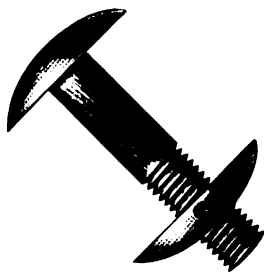
Immediate delivery on coupe top

Irvin Robbins & Co.

11th and Canal Sts.
Indianapolis, Indiana



Automobile Bolts
Machine Bolts
Carriage Bolts
Body Bolts
Wheel Bolts
Nuts, Rivets,
Washers, Screws,
Made of Special
Steels.



Established 1854

Factory:
Milledale, Conn.



CLARK BROS. BOLT CO.

**MILDALE,
CONN.**



CUP ATTACHED SPRING SHACKLE

BOLTS

AND GREASE CUPS OF HIGHEST QUALITY

Cap is securely locked and has a large capacity.
Bolts are scientifically heat treated and ground
to exact size.

We supply some of the most prominent automobile manufacturers.

PROMPT DELIVERY

PAT. ALL'D.

Penberthy Injector Company

DETROIT, MICH.

BOLTS (Continued)**STOVE AND TIRE BOLTS
(Continued)**

- LAMSON & Sessions Co., 2188 Scranton Rd.,
Cleveland, O.
 REED & Prince Mfg. Co., Duncan Ave.,
Worcester, Mass.
 REPUBLIC Iron & Steel Co., Republic Bldg.,
Youngstown, O.
 RUSSELL & Erwin Mfg. Co., 94-98 Lafayette
St., New York, N. Y.
 RUSSELL, Burdall & Ward Bolt & Nut Co.,
Port Chester, N. Y.

TIRE BOLTS

(See Bolts, Stove and Tire)

BONNETS**MOTOR BONNETS**

(See Hoods, Motor)

UNDER BONNETS

(See Pans, Dust)

BOOTS**MOTORISTS OVER BOOTS**

- AUTOMOBILE Apparel Co., 14 W. 22d St.,
New York, N. Y.
 COHEN, Frank & Co., 763-71 Stone Ave.,
Brooklyn, N. Y.
 DEMMERLE & Co., 248 W. 23d St., New York,
N. Y.
 GROSVENOR—See Worcester Slipper Co.
 PUTNAM & Co., A. H., 154 Maple St., Dan-
vers, Mass.
 WORCESTER Slipper Co., 369 Park Ave.,
Worcester, Mass. "Grosvenor."

STEERING KNUCKLE BOOTS

(For enclosing Steering Connections and Universal Joints)

- B. E. Mfg. Co., 38 White St., New York, N. Y.
 CAMPBELL—See Perkins Campbell Co.
 DETROIT Leather Works, 31-35 Mullett
St., Detroit, Mich.
(See page 65.)
 ECONOMY Stay Co., Jefferson City, Mo.
 FEESER Co., Frank S., 1102 Prospect St.,
Indianapolis, Ind. "Superior."
 GILBERT Mfg. Co., New Haven, Conn.
 GORDON—See Vehicle Apron & Hood Co.
 HAGER & Son, Chas., 244-46 E. 52d St., New
York, N. Y.
 LEATHER Products Co., 2268 Spring Grove
Ave., Cincinnati, O.

NATHAN Novelty Mfg. Co., 90 G. Reade
St., New York, N. Y.
(See page 145.)

PERKINS Campbell Co., Cincinnati, O.
"Campbell."
(See page 371.)

PREMIER Novelty Mfg. Co., 83 White St.,
New York, N. Y.

REINHOLD Belting & Supply Co., 174 W. 65th
St., New York, N. Y.

SMITH & Son, James, 40-42 Franklin Ave.,
Brooklyn, N. Y.

STEVENS & Bro., A. A., 1234 Wabash Ave.,
Chicago, Ill.

SUPERIOR—See Feeser Co.

SUTHERLAND Co., F. L., 139 Beaubien
St., Detroit, Mich.
(See page 611.)

VEHICLE Apron & Hood Co., 272 N. Fourth
St., Columbus, O. "Gordon."

VOORHEES Rubber Mfg. Co., 18-46 Bost-
wick Ave., Jersey City, N. J.
(See page 131.)

BOWS**TOP BOWS**

BROWN & Co., S. N., Dayton, O.
(See page 81.)

CAMPBELL & Dann Mfg. Co., Tullahoma,
Tenn.

CONESTOGA Bending Works, 545 N. Market
St., Lancaster, Pa.

DANN Bros. & Co., 80-88 Franklin St., New
Haven, Conn.

DELPHOS Bending Co., Delphos, O.

DETROIT Wood Pulley Co., 1331-37 Bellevue
Ave., Detroit, Mich.

EMPIRE Bending Works, 110 S. Christian St.,
Lancaster, Pa.

LEBZETTER & Son Co., Philip, 241 N. Queen
St., Lancaster, Pa.

MILLIKEN, Geo. W., Muncie, Ind.

MOSSMAN, Yarnelle & Co., Fort Wayne, Ind.

RASTETTER & Son, Louis, Nelson & Wall
Sts., Fort Wayne, Ind.

SCHERER & Co., H., Detroit, Mich.

SHEPARD & Sons, H. G., James & River Sts.,
New Haven, Conn.

STARR, D. H., Highland, N. Y.

TOLEDO Bending Co., Toledo, O.

UNION Bow Co., 725-35 Superior Ave., N. W.,
Cleveland, O.

WAYNE Spoke & Bending Works, Fort
Wayne, Ind.

WHEEL & Wood Bending Co., 141 John St.,
Bridgeport, Conn.

BOXES**METAL BATTERY BOXES**

A-Z Co., 530 W. 56th St., New York, N. Y.
(See page 307.)

BRISCOE Mfg. Co., Detroit, Mich.
(See pages 239 and 240.)

Complete Index to Classification appears on Pages 8 to 22.

GLOBE STEEL TOOL & BATTERY BOXES FOR 1912 THE LARGEST AND MOST VARIED LINE IN AMERICA



B-Style Box
with Aluminum Mat



B 229
Combination



C 208 and Other
C Boxes

Globe Boxes Described

STYLES B and C differ in the radius of the corners, Style B having corners of 1 inch, Style C corners of $\frac{3}{4}$ inch radius. In both styles covers are pressed to shape and sides are one piece with seam at the back. The bottoms rest on lugs forming part of the body. All boxes have grommets for battery wires. Measurements in the list below are all **INSIDE** measurements and depths given do not include depth of cover. Wood Linings, Aluminum Mats, Movable Partitions and Brass Corners are extra and may be had only on boxes with which they are listed as extras. The regular list prices are for boxes with fine Black Enamel

Finish and with the Globe patented Brass Lock and Lift combined, except Box B 116 which has a hinged hasp unless Lock is specified at extra cost.

The Globe line of Tool Steel and Battery boxes is the best and most comprehensive line on the market.

Styles and Prices of Globe Boxes EXTRAS FOR

Number	Size Inside	Inside Wood Lining	Price Regular	Wood Lining	Alumi- num Mat	Brass Cor- ners
B- 116	10 $\frac{3}{4}$ x 6 x 8 $\frac{1}{4}$	9 x 5 $\frac{1}{4}$ x 7 $\frac{5}{8}$	\$2.50	\$0.80	.....	.....
B- 127	12 x 6 $\frac{3}{4}$ x 9	11 $\frac{1}{4}$ x 6 x 8 $\frac{1}{2}$	3.00	.80	.....	.....
B- 148	13 $\frac{1}{2}$ x 8 x 8	12 $\frac{1}{2}$ x 7 x 7 $\frac{5}{8}$	4.00	1.00	\$1.50	\$1.50
B- 178	16 $\frac{5}{8}$ x 7 $\frac{1}{2}$ x 9	15 $\frac{1}{2}$ x 7 x 8 $\frac{1}{4}$	4.50	1.25	2.00	1.50
B- 179	16 $\frac{5}{8}$ x 9 x 9 $\frac{1}{2}$	15 $\frac{3}{4}$ x 8 $\frac{1}{4}$ x 8 $\frac{5}{8}$	4.50	1.25	2.00	1.50
B- 188	18 x 8 x 9	17 x 7 x 8 $\frac{1}{4}$	4.50	1.25	2.00	1.50
B- 229	22 x 9 x 9 $\frac{1}{2}$	21 x 8 $\frac{1}{4}$ x 9	7.00*	1.50	2.50	1.50
B- 229 Combination	(see Cut above)		11.00	.....	2.50	1.50
B-2410	24 x 10 x 9 $\frac{1}{2}$	23 $\frac{1}{4}$ x 9 x 9	8.00*	1.50	3.00	1.50
C- 117	10 $\frac{3}{4}$ x 7 $\frac{1}{8}$ x 9	10 $\frac{1}{4}$ x 6 $\frac{1}{4}$ x 8 $\frac{3}{4}$	3.50	1.00	.....	.....
C- 119	11 $\frac{1}{2}$ x 8 $\frac{3}{4}$ x 9 $\frac{1}{2}$	10 $\frac{3}{4}$ x 8 x 9	3.70	1.00	.....	.....
C- 166	15 $\frac{3}{4}$ x 6 $\frac{1}{2}$ x 9	15 x 5 $\frac{3}{4}$ x 8 $\frac{1}{2}$	4.00	1.00	.....	.....
C- 168	16 $\frac{1}{4}$ x 8 $\frac{1}{2}$ x 9	15 $\frac{1}{2}$ x 7 $\frac{3}{4}$ x 8 $\frac{1}{2}$	4.20	1.00	.....	.....
C- 208	20 x 8 $\frac{1}{2}$ x 9	19 $\frac{1}{4}$ x 7 $\frac{3}{4}$ x 8 $\frac{1}{2}$	5.00	1.50	2.50	.....
C- 217 Gas Tank			4.50	.....	.....	.....
C- 217 $\frac{1}{2}$	21 x 6 $\frac{1}{2}$ x 8	20 $\frac{1}{4}$ x 5 $\frac{3}{4}$ x 7 $\frac{1}{4}$	5.00	1.50	.....	.....
C- 226	22 x 6 x 8 $\frac{1}{2}$	21 $\frac{1}{4}$ x 5 $\frac{1}{2}$ x 8	5.00	1.50	2.50	.....

NOTE—Boxes B 116 and B 127 have hinged hasp as a regular fitting, but brass lock may be had as an extra, in which case the list price of either box is 50 cents higher than the regular list.

*Boxes B 229 and B 2410 may be fitted with wood linings which are slotted to hold variable partitions, thus permitting various sizes of compartments.

THE GLOBE MACHINE & STAMPING COMPANY, CLEVELAND, OHIO

BOXES (Continued)**METAL BATTERY BOXES (Continued)**

- BUNN-HUTCHINSON Co., 330 Prospect Ave., N. W., Cleveland, O.
- DETROIT Auto Specialty Co., 909-11 Greenwood Ave., Detroit, Mich.
- GLOBE Machine & Stamping Co., Cleveland, O.
(See page 79.)
- HAYES Mfg. Co., Detroit, Mich.
(See pages 70 and 71.)
- HUNT & Dorman Mfg. Co., 2102-10 Superior Ave., N. E., Cleveland, O.
- KINSEY Mfg. Co., Toledo, O. "Kinwood."
(See page 395.)
- KINWOOD—See Kinsey Mfg. Co.
- MITCHELL & Son, G. F., 6501 Cedar Ave., Cleveland, O.
- MULLINS Co., W. H., 182 Franklin St., Salem, O.
- SLY Mfg. Co., W. W., Cleveland, O.
- STANDARD Steel Box Co., Pittsburg, Pa.

WOOD BATTERY BOXES

(See also Holders, Battery)

- AMERICAN Body Co., 1255-63 Niagara St., Buffalo, N. Y.
- CHURCHILL Cabinet Co., 2119 Churchill St., Chicago, Ill.
- DELTA Mfg. Co., Bloomfield, N. J.
- KARREMAN Co., Grand Rapids, Mich.
- STANDARD Cabinet Mfg. Co., Peru, Ind.
- WEST Box Co., F. M., 225 Liberty St., Springfield, Mass.

SPARK COIL BOXES

- AUTO Body Co., Lansing, Mich.
(See page 73.)
- BUBECK & Guerin, 161-63 W. 18th St., New York, N. Y.
(See page 345.)
- CHURCHILL Cabinet Co., 2119 Churchill St., Chicago, Ill.
- KARREMAN Co., Grand Rapids, Mich.
- MARON Co., Frank A., Bush Terminal, Brooklyn, N. Y.
- PLYMOUTH Novelty Mfg. Co., Plymouth, Ind.
- STANDARD Cabinet Mfg. Co., Peru, Ind.
- UNION Hardware Co., Torrington, Conn.
- WABASH Cabinet Co., Wabash, Ind.
- WEST Box Co., F. M., 225 Liberty St., Springfield, Mass.

METAL TOOL BOXES

(For Tool Bags—See Bags, Tool)

- A-Z Co., 530 W. 56th St., New York, N. Y.
(See page 307.)
- BRISCOE Mfg. Co., Detroit, Mich.
(See pages 239 and 240.)

- BUNN-HUTCHINSON Co., 330 Prospect Ave., N. W., Cleveland, O.
- DETROIT Auto Specialty Co., 909-11 Greenwood Ave., Detroit, Mich.
- GLOBE Machine & Stamping Co., Cleveland, O.
(See page 79.)
- GRAY Specialty Co., 148 Avon Ave., Newark, N. J.
- HAYES Mfg. Co., Detroit, Mich.
(See pages 70 and 71.)
- KINSEY Mfg. Co., Toledo, O. "Kinwood."
(See page 395.)
- KINWOOD—See Kinsey Mfg. Co.
- LAWSON Co., F. H., Cincinnati, O.
- MITCHELL & Son, G. F., 6501 Cedar Ave., Cleveland, O.
- MOLINE Pressed Steel Co. (E. Moline), Moline, Ill.
- STANDARD Steel Box Co., Pittsburg, Pa.

WOOD TOOL BOXES

(For Tool Bags—See Bags, Tool)

- AMERICAN Body Co., 1255-63 Niagara St., Buffalo, N. Y.
- DETROIT Auto Dash Co., 519-21 Beaubien St., Detroit, Mich.
(See page 153.)
- MARON Co., Frank A., Bush Terminal, Brooklyn, N. Y.
- STANDARD Cabinet Mfg. Co., Peru, Ind.
- TOLLNER'S Sons Co., Chas., Pulaski, N. Y.
- WEST Box Co., F. M., 225 Liberty St., Springfield, Mass.

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- AUTOMATIC Lamp Control Co., Dayton, O.
- BIGSBY Mfg. Co., 7501 Quincy Ave., Cleveland, O.
(See page 291.)
- COX Brass Mfg. Co., Pearl & Van Woert Sts., Albany, N. Y.
- HARPER, Thomas, 139 Lafayette St., New York, N. Y.
- NORTHWAY, Thomas J., Rochester, N. Y. "Rochester."
- RHOADS Automobile Headlight Adjuster Co., 516th St. & Minnesota Ave., Kansas City, Kans.
- ROCHESTER—See Northway, Thomas J.
- SEEROAD Lamp Swivel Co., Vanadium Bldg., Pittsburg, Pa.

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BILLINGS & Spencer Co., Hartford, Conn.

CENTRAL Brass & Fixture Co., N. Fountain Ave., Springfield, O.

COX Brass Mfg. Co., Pearl & Van Woert Sts., Albany, N. Y.

DOUGLAS & Lomason Co., Detroit, Mich.

DRIGGS-SEABURY Ordnance Corp., Sharon, Pa.
(See page 500.)

FINDEISEN & Kropf Mfg. Co., 21st & Rockwell Sts., Chicago, Ill.

GARAGE Equipment Mfg. Co., Milwaukee, Wis. "Gemco."
(See page 203.)

GEMCO—See Garage Equipment Mfg. Co.

HARPER, Thomas, 139 Lafayette St., New York, N. Y.

IMPERIAL Brass Mfg. Co., 440-52 S. Jefferson St., Chicago, Ill.
(See page 165.)

KEELER Brass Co., 261-71 Godfrey Ave., Grand Rapids, Mich.

SMITH & Co., Jos. N., Detroit, Mich.
(See page 201.)

STANHOPE Forge & Machine Works, 49 Lansdowne St., Cambridge, Mass.

TOFFLER Co., S., 841 E. 136th St., New York, N. Y.

WESTERN Brass Mfg. Works, Marshall Blvd., 21st St. & C. B. & Q. R. R., Chicago, Ill.
(See page 85.)

BRAKES**EXPANDING AND CONTRACTING BRAKES**

DUPLEX—See Royal Equipment Co.

GLOBE Machine & Stamping Co., Cleveland, O.
(See page 79.)

LIGGETT Spring & Axle Co., Park Bldg., Pittsburg, Pa.
(See page 299.)

RAYMOND—See Royal Equipment Co.

ROYAL Equipment Co., 440 Housatonic Ave., Bridgeport, Conn. "Raymond," "Duplex."
(See page 83.)

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YOUSE Co., E. S., 46 N. Fifth St., Reading, Pa. "Perfect."

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AMERICAN Brass Co. (Coe Brass Branch), Torrington, Conn.

AMERICAN Brass Co. (Benedict & Burnham Branch), Waterbury, Conn.

AMERICAN Brass Co. (Waterbury Brass Branch), 26 Crane St., Waterbury, Conn.

AMERICAN Brass Co. (Kenosha Branch), Kenosha, Wis.

BRIDGEPORT Brass Co., P. O. Station L., Bridgeport, Conn.
(See page 305.)

BUFFALO Copper & Brass Rolling Mill, Military Rd. & Hertel Ave., Buffalo, N. Y.

CHASE Rolling Mill Co., Waterbury, Conn.

DETROIT Copper & Brass Rolling Mills, Clark Ave. & Wabash R. R., Detroit, Mich.

MANHATTAN Brass Co., 328 E. 28th St., New York, N. Y.

MICHIGAN Copper & Brass Co., 1611 Jefferson Ave., W., Detroit, Mich.

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(See page 81.)

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NATIONAL Carbon Co., Cleveland, O.
(See page 609.)

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SPARK PLUG BRUSHES

AMERICAN Wire Brush Co., 202-04 Centre St., New York, N. Y.

OSBORN Mfg. Co., 5401 Hamilton Ave., N. E., Cleveland, O.

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GOODYEAR Rubber Co., 787 Broadway, New York, N. Y.

PLANET Co., Westfield, Mass. "Duplex."

BUCKLES

STRAP BUCKLES

COWLES & Co., C., New Haven, Conn.
(See page 91.)

EBERHARD Mfg. Co., Cleveland, O.
(See page 215.)

LYNCH Mfg. Co., Madison, Wis. (Lock.)

METAL Stamping Co., 13th St. & Boulevard, Long Island City, N. Y.

NORTH & Judd Mfg. Co., New Britain, Conn.

O'BRIEN Mfg. Co., Joseph F., 63 Park Pl., New York, N. Y.
(See page 229.)

WHITEHOUSE Mfg. Co., E. A., 42-54 Elm St., Newark, N. J.
(See page opposite Title Page.)

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PENNSYLVANIA Rubber Co., Jeannette, Pa.

SEAMLESS Rubber Co. of N. Y., 250 W. 54th St., New York, N. Y.
(See page 387.)

TYER Rubber Co., Andover, Mass. "Tyrian."

TYRIAN—See Tyer Rubber Co.

WALPOLE Tire & Rubber Co., Walpole, Mass.

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AUTOMOBILE BUMPERS

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ALEXANDER Mfg. Co., J., 1931 Broadway, New York, N. Y.
(See page 209.)

ATLAS—See Toffler Co.

AUTO Cushion Fender Co., Clinton Bldg., Columbus, O.

AUTO Parts Mfg. Co., 171 Michigan St., Milwaukee, Wis. "Badger."

BADGER—See Auto Parts Mfg. Co.

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CHICAGO-RACINE Aluminum, Brass & Iron Works, 224-30 W. Huron St., Chicago, Ill. "Ross."
(See page 607.)

COMMON SENSE—See Pratt Mfg. Co.

CONOVER—See New Jersey Tube Co.

COX Brass Mfg. Co., Pearl & Van Woert Sts., Albany, N. Y.

DIAMOND—See Sager Co.

GARAGE Equipment Mfg. Co., Milwaukee, Wis. "Hercules," "Universal," "Gemco," "Simplex."
(See page 203.)

GEMCO—See Garage Equipment Mfg. Co.

GROSSMAN Co., Emil, 248-50 W. 54th St., New York, N. Y. "Swivelaction."

HALLADAY Co., L. P., Streator, Ill. "Imperial," "Universal."

HANDY—See Chicago Electric Mfg. Co.

HARROUN—See Turner Brass Works.

HARTFORD Suspension Co., Jersey City, N. J.
(See pages 337 and 338.)

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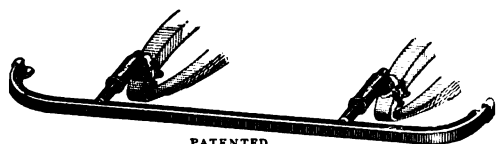
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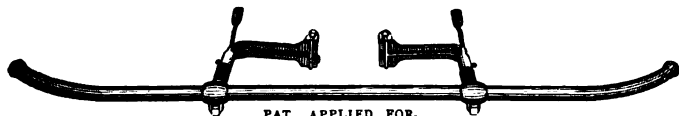
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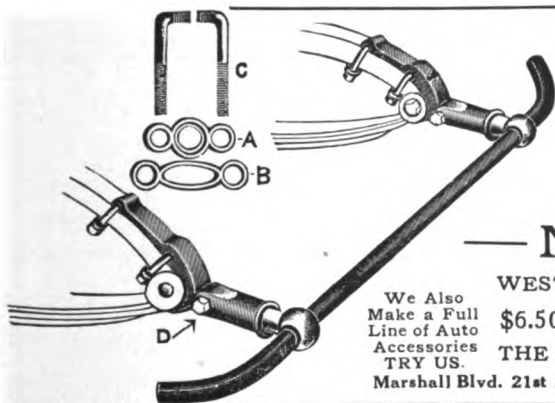


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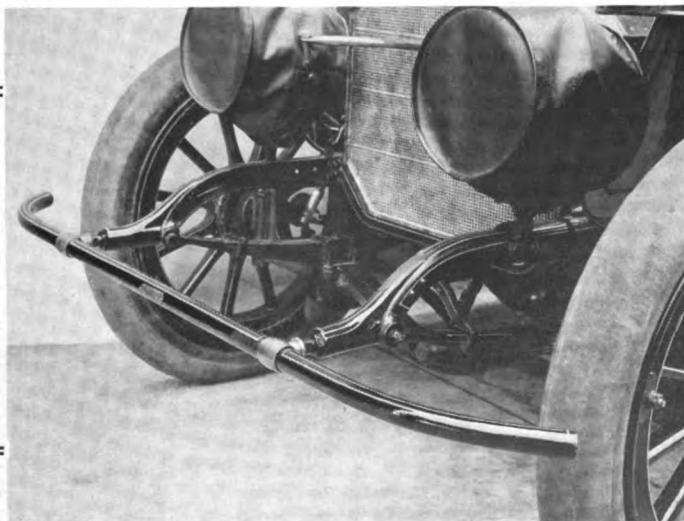
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(See page 551.)

NEW JERSEY Tube Co., Newark, N. J. "Conover."

POLSON Mfg. Co., 27 Chenango St., Buffalo, N. Y.

PRATT Mfg. Co., Wm. E., 35 W. Lake St., Chicago, Ill. "Common Sense."

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TURNER Brass Works, Sycamore, Ill. "Harroun."

U. S. Auto Bumper Co., 20 E. 20th St., Chicago, Ill. "McGregor."
(See page 85.)

UNIVERSAL—See Garage Equipment Mfg. Co.

UNIVERSAL—See Halladay Co.

WESTERN Brass Mfg. Works, Marshall Blvd., 21st St. & C. B. & Q. R. R., Chicago, Ill. "Chicago."
(See page 85.)

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AMERICAN Tire & Rubber Co., 70-78 Beach St., Akron, O.
(See page 343.)

BOSTON Belting Co., 256-60 Devonshire St., Boston, Mass.

CANFIELD Co., H. O., Bridgeport, Conn.

CINCINNATI Rubber Mfg. Co., Cincinnati, O.
(See page 341.)

COMBINATION Rubber Mfg. Co., Bloomfield, N. J.

CONTINENTAL Rubber Works, Erie, Pa.
(See page 341.)

DIAMOND Rubber Co., Akron, O.

EMPIRE Rubber Mfg. Co., Trenton, N. J.

ESSEX Rubber Co., Trenton, N. J.

FEDERAL Rubber Mfg. Co., Milwaukee, Wis.

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(See page 607.)

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(See page 387.)

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(See page 131.)

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ACETYLENE LAMP BURNERS

(See also Automatic and Electric Lighting Burners)

ALCO—See American Lava Co.

AMBO—See American Lava Co.

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AMERICAN Lava Co., Chattanooga, Tenn. "Hela," "Alco," "De Luxe," "No-Name," "Ambo," "Hilo," "Duro," "Hexo."
(See pages 87 and 88.)

AURORA—See Steward Mfg. Co.

BRAY—See Crane Co.

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CRANE Co., William M., 16-20 W. 32d St., New York, N. Y. "Bray," "Roni."

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DURO—See American Lava Co.

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Ambo

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A very popular style of slotted burner. The most efficient of all non-turn down burners. Yielding highest possible candle power. Especially adapted to withstand variations in gas pressure.

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Alco No. 12



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Alco 8



Alco-Cyco



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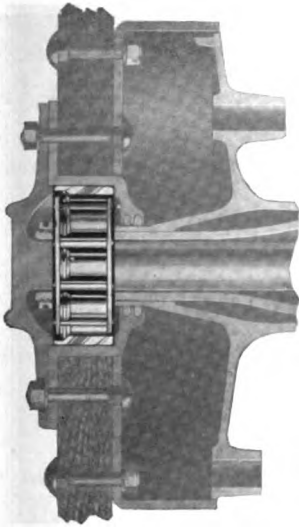


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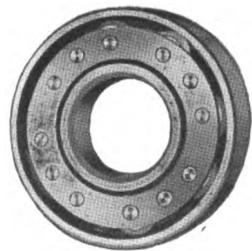
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 TENNESSEE Burner Mfg. Co., Chattanooga, Tenn. "X. L."
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 INST Lighter Co., 59 E. Main St., Columbus, O.
 (See page 235.)
 MATCHLESS—See Advance Motor Specialties Co.
 PREST-O-LITE Co., 1400 E. South St., Indianapolis, Ind.
 (See page 377.)
 START-LITE Co., 1502 Michigan Ave., Chicago, Ill.

GASOLINE AND KEROSENE BURNERS

(For Steam Boilers)

FORG, Peter, 50 Park St., Somerville, Mass.
 NATIONAL—See Thomson Mfg. Co.
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 OFELDT & Sons, F. W., Nyack, N. Y.
 SIMMONS, H. C., North Burlington, Vt.
 THOMSON Mfg. Co., Judson L., Waltham, Mass. "National"

BUTTONS

UPHOLSTERY BUTTONS

ATLAS Tack Co., Fairhaven, Mass.
 COWLES & Co., C., New Haven, Conn.
 (See page 91.)
 CRANDAL, Stone & Co., Binghamton, N. Y.
 HIGGIN Mfg. Co., Newport, Ky.
 JACKSON Cushion Spring Co., Jackson, Mich.
 (See page 551.)
 LOUNSBERRY & Sons, G. H., 107-09 W. Third St., Cincinnati, O.
 METAL Stamping Co., 13th St. & Boulevard, Long Island City, N. Y.
 MILONITE—See Morley Mfg. Co.

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NEW Haven Button Co., 161 Brewery St., New Haven, Conn.

READE, Chas. W., 103 Court St., New Haven, Conn.

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 (See page 509.)
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 (See page 151.)
 KRUPP—See Prosser & Son.
 MUSKEGON Motor Specialties Co., Water St., Muskegon, Mich.
 (See page 91.)
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 (See page 361.)
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 (See page 181.)

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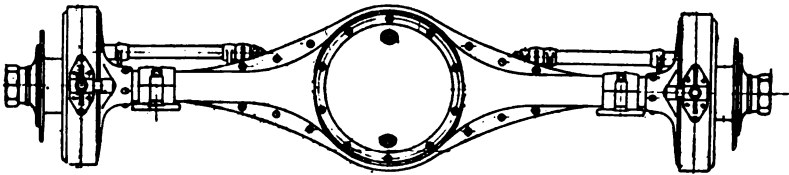
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(See page 157.)**GIER & Dall Mfg. Co.**, Lansing, Mich.**GLOBE Machine & Stamping Co.**, Cleveland, O.
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(See page 157.)**MOTORISTS CAPS****ADIRONDACK**—See Spear-Martin Fur Co.**AMERICAN-BUFFALO Robe Co.**, 1-7 Howell St., Buffalo, N. Y.**BRADLEY Knitting Co.**, Delevan, Wis.**DEMMELE & Co.**, 248 W. 23d St., New York, N. Y.**DINNER Co.**, Isaac H., 694 Washington St., Boston, Mass.**FORMAN & Co.**, Elie, 28 Hayward Pl., Boston, Mass.**FREEMAN-HIRSCHSTICK Co.**, 227 W. Madison St., Chicago, Ill.**GILBERT Mfg. Co.**, New Haven, Conn.**HENDRICKSON Hat Co.**, A. P., 127-29 S. Meridian St., Indianapolis, Ind.**KAPLAN, Frank & Dunn**, 113-15 University Pl., New York, N. Y.**KLING Bros. & Co.**, 291 Fifth Ave., Chicago, Ill.**LASKY & Levy**, 756-60 Broadway, New York, N. Y.**MARSHALL, P. V. & E. L.**, 49 W. Larned St., Detroit, Mich. "Shapkes."**MORAWETZ Co.**, 217-25 E. Water St., Milwaukee, Wis.**PONTIAC Knitting Co.**, Pontiac, Mich.**REVILLON Freres**, 19 W. 34th St., New York, N. Y.**SHAPKES**—See Marshall, P. V. & E. L.**SPEAR-MARTIN Fur Co.**, 41 Church St., Burlington, Vt. "Adirondack."**SPEAR & CO.**, Woodhaven, N. Y.**RUBBER RADIATOR CAPS****AMERICAN Hard Rubber Co.**, 9 Mercer St., New York, N. Y.**CONDENSITE Co. of America**, Glen Ridge, N. J.**LUZERNE Rubber Co.**, Trenton, N. J.**MECHANICAL Rubber Co.**, C. & P. & Nickel Plate R. R., Cleveland, O.**STOKES Rubber Co.**, Jos., Trenton, N. J.**CARBIDE****CALCIUM CARBIDE****AMERICAN Carbolite Co.**, 301 S. 55th Ave., W., Duluth, Minn.**UNION Carbide Sales Co.**, 150 Michigan Blvd., Chicago, Ill.**CARBURETERS****GASOLINE CARBURETERS**

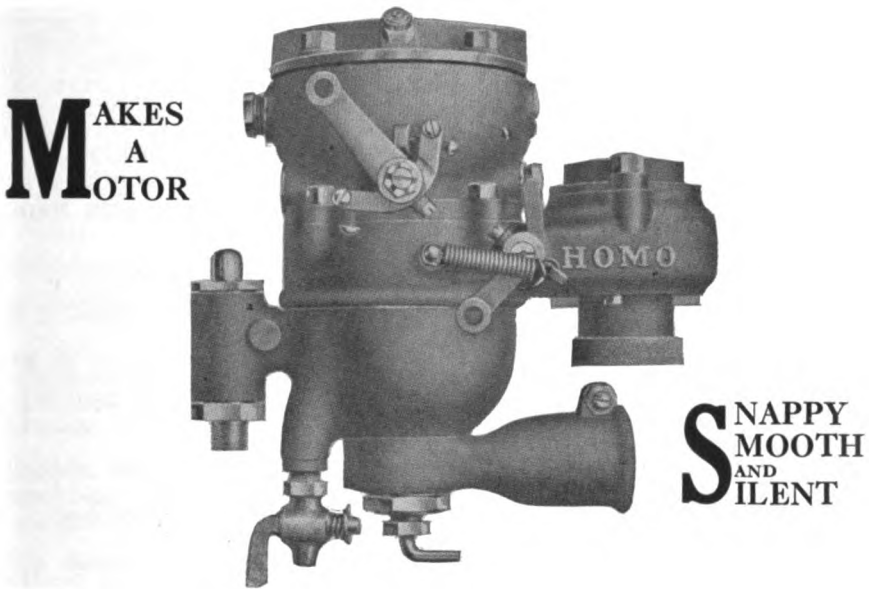
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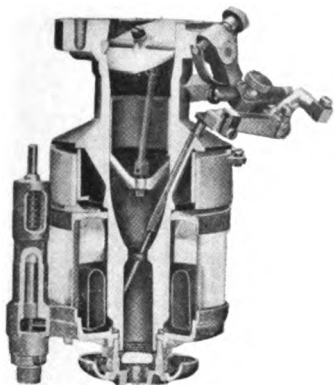
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- MOSLER & Co., A. R., New York, N. Y.
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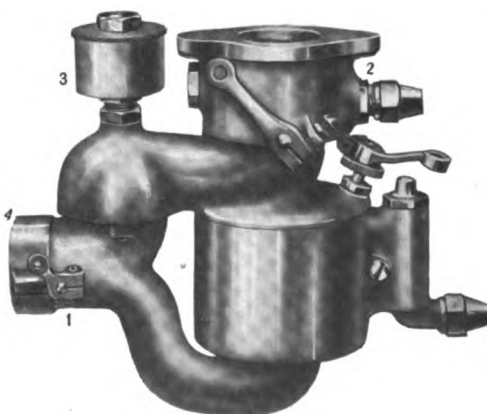
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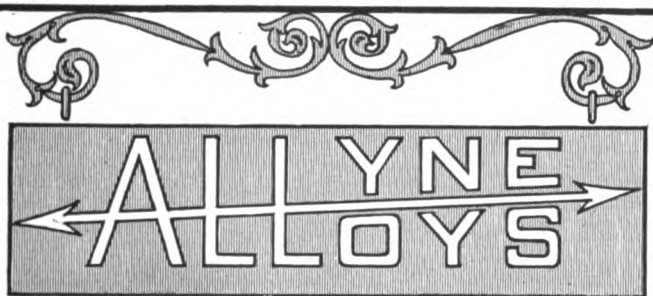
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(See page 105.)

IMPERIAL Brass Mfg. Co., 440-52 S. Jefferson St., Chicago, Ill.
(See page 165.)

INDIANA Brass Co., Frankfort, Ind.
(See page 617.)

JEFFERSON Brass Foundry, 209 King St., Brooklyn, N. Y.

KEELER Brass Co., 261-71 Godfrey Ave., Grand Rapids, Mich.

KEYLESS Lock Co., 1401 Newman St., Indianapolis, Ind.

LEE Co., Wm. O., Port Huron, Mich.

LIGHT Mfg. & Foundry Co., Pottstown, Pa.
(See page 281.)

LIVERMORE, Homer F., 81 Pearl St., Boston, Mass.

LUMEN Bearing Co., Buffalo, N. Y.
(See pages 273 and 274.)

McADAMITE—See United States McAdamite Metal Co.

MILWAUKEE Aluminum & Brass Foundry Co., 295-97 Reed St., Milwaukee, Wis.

MURPHY-POTTER Co., Detroit, Mich.

NABRALCO—See National Bronze & Aluminum Foundry Co.

NATIONAL Aluminum & Bronze Mfg. Co., 529-35 Willard St., Indianapolis, Ind.

NATIONAL Brass Mfg. Co., 191-93 Mill St., Rochester, N. Y.

NATIONAL Bronze & Aluminum Foundry Co., 2539 E. 79th St., Cleveland, O. "Nabralco."

NORTH & Judd Mfg. Co., New Britain, Conn.

NOYES Mfg. Co., Dayton, O.

OVERDORFER Brass Co., M. L., 804 E. Water St., Syracuse, N. Y.

ONONDAGA Brass Co., 1117-19 E. Water St., Syracuse, N. Y.

PARKER White Metal & Machine Co., 2217-23 Rail Road St., Erie, Pa.
(See page 105.)

PAULSON & Son, Thomas, 97-99 Second Ave., Brooklyn, N. Y.
(See page 247.)

PIONEER Brass Works, 424 S. Penna. St., Indianapolis, Ind.

PROVIDENCE Brass & Aluminum Foundry, 460 Eddy St., Providence, R. I.

RACINE Aluminum & Brass Foundry Co., 1329 12th St., Racine, Wis.

RACINE Brass & Iron Co., 1327 Racine St., Racine, Wis.

REEVES & Son, Paul S., 1415-25 Catherine St., Philadelphia, Pa.

RINCON Foundry Co., 349-65 Seventh St., San Francisco, Cal.

ROSTAND Mfg. Co., Milford, Conn.

RUTENBER Motor Co., Marion, Ind.
(See page 447.)

SAYRE Stamping Co., Sayre, Pa.

SHARP Brass Works, J. C., Boyce & 20th Sts., Chattanooga, Tenn.

SHERWOOD Brass Works, 1167 Jefferson Ave., Detroit, Mich.

SILVER Aluminum Metal Co., 294-96 Taaffe Pl., Brooklyn, N. Y.

STANDARD Brass Foundry Co., 6522-32 Central Ave., S. E., Cleveland, O.

STANDARD Brass & Iron Works, 1820 St. Paul Ave., Milwaukee, Wis.

STANDARD Foundry Co., Hartford, Conn.

TRENTON Malleable Iron Co., New York Ave., Trenton, N. J.

TRIUMPH Electric Co. (Oakley), Cincinnati, O.

TURNER Brass Works, Sycamore, Ill.

UNITED Foundry & Machine Co., Bridgeport, Conn.
(See page 617.)

UNITED States Aluminum Castings Co., 1623 Bluerock St., Cincinnati, O.

UNITED States McAdamite Metal Co., Isabella Ave. & E. St., Detroit, Mich. "McAdamite."

WAMBOLD Mfg. Co., 3011 Lisbon Ave., Milwaukee, Wis.
(See page 585.)

WESTERN Brass Mfg. Works, Marshall Blvd., 21st St. & C. B. & Q. R. R., Chicago, Ill.
(See page 85.)

WILLIAMS & Son, E. A., Jersey City, N. J.

WISCONSIN Aluminum Castings Co., Manitowoc, Wis.

WOLVERINE Castings Co., 611-19 Fort St., W., Detroit, Mich.
(See page 619.)

BRONZE AND BRASS CASTINGS

A. B. C. Castings Co., Cleveland, O.

ADAMS & Westlake Co., Chicago, Ill.
"Adlake."
(See page 221.)

ADLAKE—See Adams & Westlake Co.

AETNA Brass Mfg. Co., 4800-10 Hamilton Ave., Cleveland, O.

ALLYNE—See Aluminum Castings Co.

ALUMINUM Castings Co., Cleveland, O.
"Allyne."
(See page 99.)

AMERICAN Air Compressor Co., 1523-31 W. Fort St., Detroit, Mich.

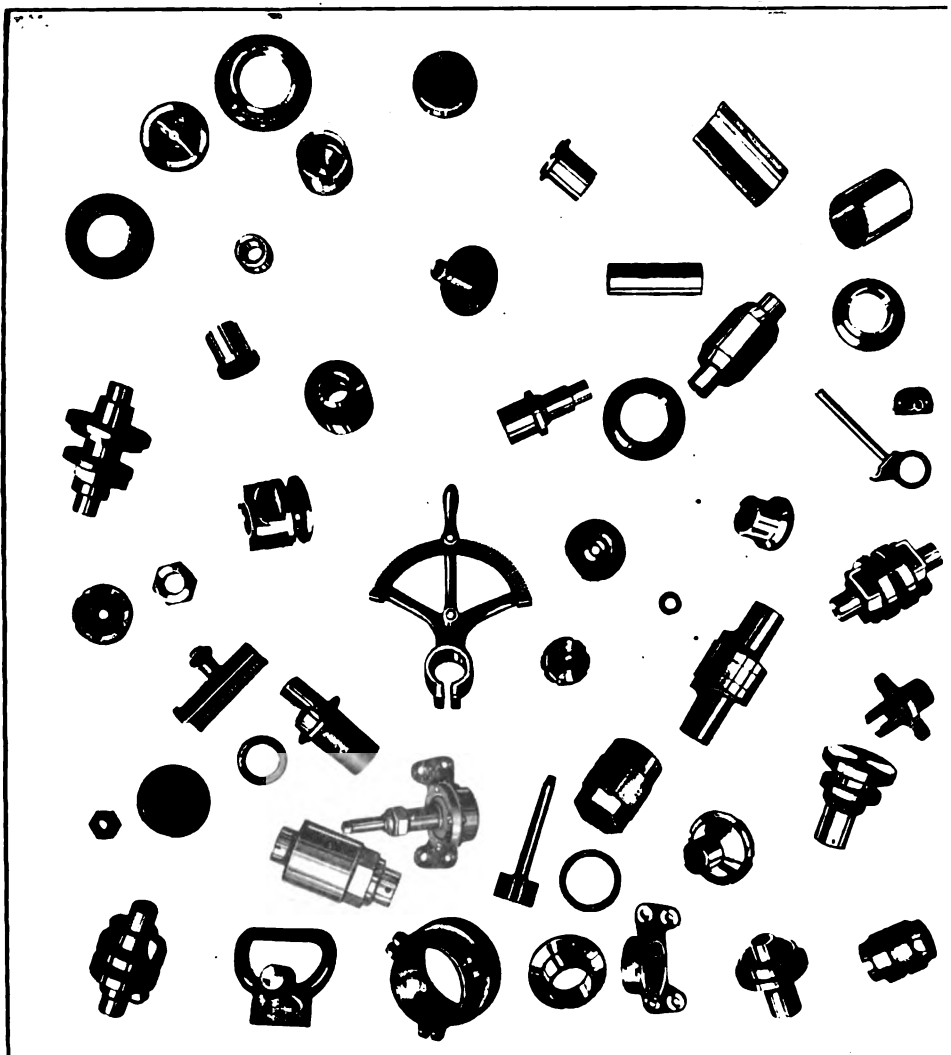
AMERICAN Brass & Iron Co., Crystal & Trombley Sts., Detroit, Mich.

AMERICAN Bronze Co., 82-176 Non-Gran Ave., Berwyn, Pa.
(See pages 248 and 249.)

AMERICAN Bronze Co., 1415 Niagara St., Buffalo, N. Y.

AMERICAN Car & Ship Hardware Mfg. Co., New Castle, Pa.

AMERICAN Castings Co., Byrket St. & L. S. & M. S. Ry., Mishawaka, Ind.



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- ATKIN-WHEELER Co., Huntington, N. Y.
- ATKINSON Co., Rochester, N. Y. "Samson."
(See page 153.)
- ATLAS Brass Foundry, 155 A St., Boston, Mass.
- ATLAS Brass Foundry Co., 991 S. Front St., Columbus, O.
- ATTWOOD Brass Works, 318-20 Bowery St., Grand Rapids, Mich.
(See page 595.)
- BAY View Foundry Co., McDonough, Water & Shelby Sts., Sandusky, O.
- BLAKE, Edwin J., 565 Windsor St., Hartford, Conn.
- BOSTON Casting Co., 12 Pearl St., Boston, Mass.
- BRAINERD Mfg. Co., Fairport, N. Y.
- BRASS Foundry Co., 711-17 S. Adams St., Peoria, Ill.
- BRIDGEPORT Deoxidized Bronze & Metal Co., Bridgeport, Conn.
- BRIDGEPORT Foundry & Machine Co., Washburn & Carbon Sts., Bridgeport, Conn.
- BUCKEYE Brass & Pattern Co., 1807 Columbus Rd., Cleveland, O.
- BUCKEYE Iron & Brass Works, 324 E. Third St., Dayton, O.
- BUFFALO Aluminum & Bronze Co., 41-45 Letchworth St., Buffalo, N. Y.
- BUNTING Brass & Bronze Co., Toledo, O.
(See page 101.)
- CANTON Brass & Machine Co., Canton, O.
- CARTER, E. T., Plainville, Conn.
- CENTRAL Brass Foundry, 105-07 S. Clinton St., Chicago, Ill.
- CENTRAL Brass & Fixture Co., N. Fountain Ave., Springfield, O.
- CHAMPION Brass Works, Coldwater, Mich.
- CHICAGO-RACINE Aluminum, Brass & Iron Works, 224-30 W. Huron St., Chicago, Ill.
(See page 607.)
- CITY Brass Foundry Co., 5310 St. Clair Ave., N. E., Cleveland, O.
- CONESTOGA Job & Brass Foundry, 246 N. Christian St., Lancaster, Pa.
- CONSOLIDATED Casting Co., Mechanicsville, N. Y.
- CRAMP & Sons Ship & Engine Bldg. Co., William, Philadelphia, Pa.
(See page 251.)
- DAMASCUS Bronze Co., Pittsburg, Pa.
- DELTA—See Phosphor Bronze Smelting Co.
- D'ESTE Co., Julian, 24 Canal St., Boston, Mass.
- DETROIT Motor Casting Co., 299-303 Beaufait Ave., Detroit, Mich.
- DIAMOND Brass Foundry & Machine Co., 1115 Washington Blvd., Chicago, Ill.
- DORCHESTER Brass & Aluminum Foundry, Old Sturtevant Bldg. (Jamaica Plain), Boston, Mass.
- EAGLE—See Stillman White Foundry Co.
- EDNA Brass Mfg. Co., 525-33 Reading Rd., Cincinnati, O.
- ELEPHANT—See Phosphor Bronze Smelting Co.
- ELLSWORTH Brass Foundry Co., 249 R. R. Ave., Bridgeport, Conn.
- ERIE Specialty Co., 505 W. 12th St., Erie, Pa.
- ESSEX Brass Foundry Co., Sixth & Harvard Sts., Cambridge, Mass.
- EUREKA Brass Co., 2210-18 Scott Ave., St. Louis, Mo.
- EUREKA Co., North East, Pa.
- EXETER Brass Works, Exeter, N. H.
- EXETER Machine Works, Pittston, Pa.
- FAIRVIEW Foundry Co., Detroit, Mich.
- FARIES Mfg. Co., Decatur, Ill.
- FIDELITY Brass Mfg. Co., 730-34 W. Monroe St., Chicago, Ill.
- FLANDERS Mfg. Co., Pontiac, Mich.
- FORT Hill Bronze Mfg. Co., 48-56 Waters Ave., West Everett, Mass.
- FRANKFORT Brass Foundry, Jackson, Mich.
- FRIES & Co., Buffalo, N. Y.
(See page 251.)
- FRONTIER Engineering Co., 816-36 Fort St., W., Detroit, Mich.
- GAYLORD Co., F. L., Ansonia, Conn.
- GENERAL Aluminum & Brass Castings Co., E. Grand Blvd. & St. Aubin Ave., Detroit, Mich.
(See page 113.)
- GENERAL Castings Co., 327-28 Ford Bldg., Detroit, Mich. (Dealers.)
(See page 113.)
- GERMANN Bronze Co., Erie, Pa.
- GERSON-CAREY Co., Kalamazoo St. & L. S. Ry., Lansing, Mich.
- GRAHAM & Co., James, 293 Wooster St., New Haven, Conn.
(See page 203.)
- HARDY & Sons Co., Wm. A., 113 Water St., Fitchburg, Mass.
- HARLEY Co., Springfield, Mass.
(See page 105.)
- HARPER, Thomas, 139 Lafayette St., New York, N. Y.
- HERCULES Float Works, 200-10 Franklin St., Springfield, Mass.
- HOMER Brass Works, 231 Race St., Philadelphia, Pa.
- IDEAL Bronze Co., 1265 E. 55th St., Cleveland, O.
- IDEAL Mfg. Co., 570 Franklin St., Detroit, Mich.
- IMPERIAL Brass Mfg. Co., 440-52 S. Jefferson St., Chicago, Ill.
(See page 165.)
- INDIANA Brass Co., Frankfort, Ind.
(See page 617.)
- INDIANAPOLIS Brass Co., 1012 E. Michigan St., Indianapolis, Ind.
- JEFFERSON Brass Foundry, 209 King St., Brooklyn, N. Y.
- KEELER Brass Co., 261-71 Godfrey Ave., Grand Rapids, Mich.



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- LEE Co.**, Wm. O., Port Huron, Mich.
- LEVETT Co.**, W. M., 464 Tenth Ave., New York, N. Y.
- LIGHT Mfg. & Foundry Co.**, Pottstown, Pa.
(See page 281.)
- LIVERMORE**, Homer F., 81 Pearl St., Boston, Mass.
- LUMEN Bearing Co.**, Buffalo, N. Y.
(See pages 273 and 274.)
- LUSK Bros.**, Foundry Co., 209-15 Van Buren St., Jackson, Mich.
- METROPOLITAN Mfg. Co.**, Detroit, Mich.
(See page 593.)
- MILWAUKEE Aluminum & Brass Foundry Co.**, 295-97 Reed St., Milwaukee, Wis.
- MILWAUKEE Valve Co.**, 139 Burrell St., Milwaukee, Wis.
(See page 463.)
- MONUMENTAL Bronze Co.**, Bridgeport, Conn.
- MORRIS Mfg. Co.**, A. W., Erie Ave. & Richmond St., Philadelphia, Pa.
(See page 507.)
- MUELLER Metal Co.**, 283 Dyer St., Providence, R. I.
- MURPHY-POTTER Co.**, Detroit, Mich.
- NABRALCO**—See National Bronze & Aluminum Foundry Co.
- NATIONAL Aluminum & Bronze Mfg. Co.**, 529-35 Willard St., Indianapolis, Ind.
- NATIONAL Brass Mfg. Co.**, 191-93 Mill St., Rochester, N. Y.
- NATIONAL Bronze & Aluminum Foundry Co.**, 2539 E. 79th St., Cleveland, O. "Nabralco."
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- NORTH & Judd Mfg. Co.**, New Britain, Conn.
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- OBERDORFER Brass Co.**, M. L., 804 E. Water St., Syracuse, N. Y.
- ONONDAGA Brass Co.**, 1117-19 E. Water St., Syracuse, N. Y.
- PARKER White Metal & Machine Co.**, 2217-23 Rail Road St., Erie, Pa.
(See page 105.)
- PAULSON & Son**, Thomas, 97-00 Second Ave., Brooklyn, N. Y.
(See page 247.)
- PHOSPHOR Bronze Smelting Co.**, 2200 Washington Ave., Philadelphia, Pa. "Elephant," "Delta."
(See page 563.)
- PIONEER Brass Works**, 424 S. Penna. St., Indianapolis, Ind.
- PITTSBURG Brass Mfg. Co.**, 32d St. & Penn Ave., Pittsburgh, Pa.
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- PROVIDENCE Brass & Aluminum Foundry**, 460 Eddy St., Providence, R. I.
- RACINE Aluminum & Brass Foundry Co.**, 1329 12th St., Racine, Wis.
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- RUTENBER Motor Co.**, Marion, Ind.
(See page 447.)
- SAMSON**—See Atkinson Co.
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- SHERWOOD Brass Works**, 1167 Jefferson Ave., Detroit, Mich.
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- STANDARD Brass Foundry Co.**, 6522-32 Central Ave., S. E., Cleveland, O.
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- UNITED Foundry & Machine Co.**, Bridgeport, Conn.
(See page 617.)
- VANADIUM Metals Co.**, Vanadium Bldg., Pittsburgh, Pa. "Victor."
(See page 545.)
- VICTOR**—See Vanadium Metals Co.
- WAMHOLD Mfg. Co.**, 3011 Lisbon Ave., Milwaukee, Wis.
(See page 585.)
- WATERBURY Mfg. Co.**, Waterbury, Conn.
- WELLMAN Bronze Co.**, 6017 Superior Ave., Cleveland, O.
- WELLS Chemical Bronze Works**, 219 Summer St., Worcester, Mass.
- WESTERN Brass Mfg. Works**, Marshall Blvd., 21st St. & C. B. & Q. R. R., Chicago, Ill.
(See page 85.)
- WILLIAMS Valve Co.**, D. T., Spring Grove Ave. & Township St., Cincinnati, O.
- WILLIAMS & Son**, E. A., Jersey City, N. J.
- WOLVERINE Castings Co.**, 611-19 Fort St. W., Detroit, Mich.
(See page 610.)
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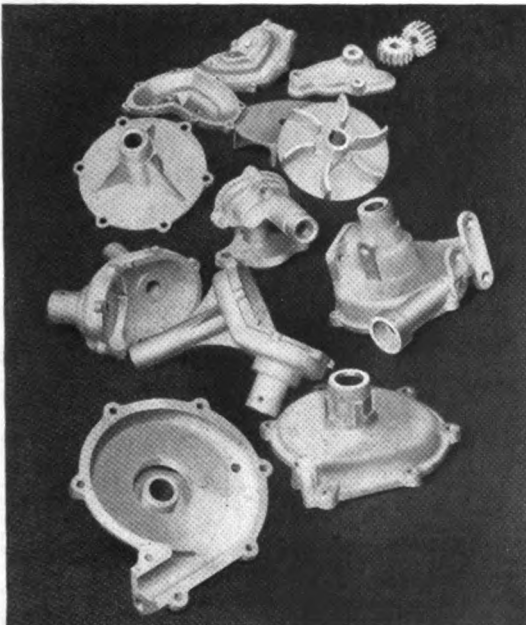


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- BLISS Co., E. W., Brooklyn, N. Y.**
- DOEHLER Die-Casting Co., Brooklyn, N. Y.**
(See pages 195 and 277.)
- FINISHED Parts Mfg. Co., Newark, N. J.**
- FRANKLIN Mfg. Co., 401 S. Geddes St., Syracuse, N. Y.**
(See page 105.)
- GENERAL Castings Co., 327-28 Ford Bldg., Detroit, Mich. (Dealers.)**
(See page 113.)
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- LEGLER-EILERMAN Co., Bacon St., Dayton, O.**
- LIGHT Mfg. & Foundry Co., Pottstown, Pa.**
(See page 281.)
- LUMEN Bearing Co., Buffalo, N. Y.**
(See pages 273 and 274.)
- MOBERG, C. J., 118 Pearl St., Mt. Vernon, N. Y.**
- MODEL Die & Tool Co., 202-04 S. Penn St., Indianapolis, Ind.**
- MOGUL Metal Co., Detroit, Mich.**
(See page 111.)
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(See page 567.)
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(See page 111.)
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(See page 103.)
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(See page 105.)
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(See page 241.)
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(See page 526.)
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(See page 617.)
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(See page 295.)
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(See page 251.)
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(See page 471.)
- FAIRVIEW Foundry Co., Detroit, Mich.**
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(See pages 574 and 575.)
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(See page 113.)

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MANUFACTURERS Foundry Co., Waterbury, Conn.
(See page 109.)

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MOHN & Kershner, Green St., Reading, Pa.

MOTOR Foundry Co., Detroit, Mich.

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(See page 111.)

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(See page 447.)

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SOWERS Mfg. Co., 1300-10 Niagara St., Buffalo, N. Y.

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ARCADE Malleable Iron Co., Worcester, Mass.

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BOSTON Casting Co., 12 Pearl St., Boston, Mass.

BRIDGEPORT Malleable Iron Co., 719 South Ave., Bridgeport, Conn.

BUHL Malleable Iron Co., Detroit, Mich.

CHISHOLM & Moore Mfg. Co., Lakeside Ave. & E. 49th St., Cleveland, O.

COLUMBUS Malleable Casting Co., Curtis Ave., Columbus, O.

DAYTON Malleable Iron Co., Dayton, O.

ERIE Malleable Iron Co., Cherry St. & E. P. R. R., Erie, Pa.

FANNER Mfg. Co., Brookside Pk., Cleveland, O.

FLAGG & Co., Stanley G., 1421 Chestnut St., Philadelphia, Pa.

FRAZER & Jones Co., Syracuse, N. Y.

GENERAL Castings Co., 327-28 Ford Bldg., Detroit, Mich. (Dealers.)
(See page 113.)

GLOBE Malleable Iron & Steel Co., Syracuse, N. Y.
(See page 111.)

ILLINOIS Malleable Iron Co., 1801-25 Diversey Blvd., Chicago, Ill.

JEWEL Steel & Malleable Co., 273 Hertel Ave., Buffalo, N. Y.

JOHNSON & Co., Isaac G., Spuyten Duyvil, New York, N. Y.

MALLEABLE Iron Fittings Co., Branford, Conn.
(See page 327.)

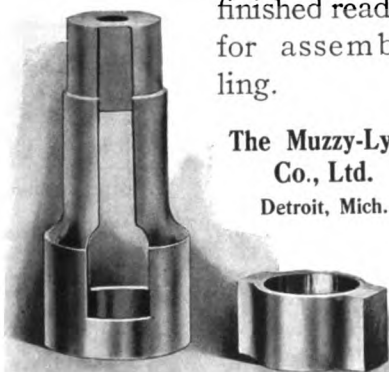
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PRATT & Letchworth Co., 189 Tonawanda St., Buffalo, N. Y.
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SPRINGFIELD Malleable Iron Co., George St., Springfield, O.
STOWELL Mfg. & Foundry Co., South Milwaukee, Wis.
STRAIGHT Line Engine Co., Syracuse, N. Y.
SUPERIOR Iron & Mfg. Co., Toledo, O.
SYRACUSE Malleable Iron Works, Syracuse, N. Y.
 (See page 549.)
TERRE Haute Malleable & Mfg. Co., N. 19th St., Terre Haute, Ind.
TRENTON Malleable Iron Co., New York Ave., Trenton, N. J.
UNITED States Malleable Iron Co., Woodville St., Toledo, O.
VULCAN Iron Works, 63 John St., New Britain, Conn.
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BALDWIN Steel Co., Charleston, W. Va.
 (See page 363.)
BESCO—See Buchanan Electric Steel Co.
BETHLEHEM Steel Co., Third & Poplar Sts., South Bethlehem, Pa.
BOSTON Casting Co., 12 Pearl St., Boston, Mass.
BUCHANAN Electric Steel Co., Buchanan, Mich. "Besco."
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FARRELL-CHEEK Steel Foundry Co., Sandusky, O.
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 (See page 113.)
FLAGG & Co., Stanley G., 1421 Chestnut St., Philadelphia, Pa.
FORT Pitt Steel Casting Co., McKeesport, Pa.
GERLINGER Steel Casting Co., 59th St. & National Ave., West Allis, Wis.
HESS Steel Castings Co., Bridgeton Ave. & C. R. R. of N. J., Bridgeton, N. J.
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KRUPP—See Prosser & Son.
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 (See page 327.)
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PROSSER & Son, Thomas, 15 Gold St., New York, N. Y. (Importers.) "Krupp."
 (See page 361.)
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SWEDISH Crucible Steel Co. (Hamtramck), Detroit, Mich.
 (See page 617.)
TAYLOR Iron Steel Co., High Bridge, N. J.
TOLEDO Steel Casting Co., Toledo, O.
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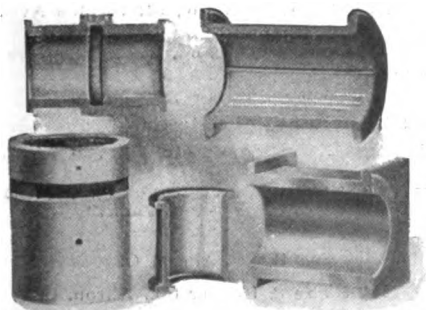
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 (See page 85.)
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 CLEVELAND Steel Cement Co., O'Brien Bldg., Cleveland, O. "Noxal."
 EUREKA—See Taylor & Bro.
 NOXALL—See Cleveland Steel Cement Co.
 PAXSON Co., J. W., 1019 N. Delaware Ave., Philadelphia, Pa.
 (See page 483.)
 SMOOTH-ON Mfg. Co., 572-74 Communipaw Ave., Jersey City, N. J.
 STEAMTITE—See Clark Cast Steel Cement Co.
 TAYLOR & Bro., John H., Montclair, N. J. "Eureka."

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 (See page 120.)
 DURKEE-ATWOOD Co., 919 First Ave., S., Minneapolis, Minn.
 (See page 155.)
 HALL-THOMPSON Co., Hartford, Conn. "Wonder Worker."
 INTERNATIONAL Metal Polish Co., Quill St. & Belt R. R., Indianapolis, Ind. "Blue Ribbon."
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 JONES Auto Supply Co., 20th St. & Telegraph Ave., Oakland, Cal. "Stop-A-Leak."
 MILWAUKEE Auto Specialty Co., 705-15 Chestnut St., Milwaukee, Wis.
 (See page 551.)
 NORTHWESTERN Chemical Co., Marietta, O. "Se-Ment-OL."
 (See page 115.)
 SACKETT Supply Co., Des Moines, Ia.
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 Z & A Mfg. Co., Hazelton, N. Dak.
- ### TIRE REPAIR CEMENT
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 (See page 343.)
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 ATLAS Auto Supply Co., 95 E. Adams St., Chicago, Ill. "Tire-Doh."
 (See page 115.)
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 BROOKLYN Rubber Co., 397 Sumner Ave., Brooklyn, N. Y.
 BUFFALO Rubber Mfg. Co., Sussex Ave. & Erie R. R., Buffalo, N. Y.
 COX, David H., Roselle, N. J.
 DIAMOND Rubber Co., Akron, O. "Titan," "Seal-Tite."
 DUTCH—See Van Cleef Bros.
 DYKES Co., John L. G., 222 N. State St., Chicago, Ill.
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 FRY, Keyser, 616-22 N. Eighth St., Reading, Pa. "Ever Right."
 GEN City Liquid Vulcanizer Co., 1021 E. Third St., Dayton, O. "U-Vulk."
 (See page 115.)
 GOODRICH Co., B. F., Akron, O.
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(See page 607.)
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- NAM-TAY—See Yatman Rubber Co.
- NARCO—See National Rubber Co.
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- NATIONAL Rubber Co., 4409 Narco Bldg., St. Louis, Mo. "Narco."
(See page 155.)
- P. P. & B.—See St. Louis Rubber Cement Co.
- PAGE-LESTER Co., 125 W. Van Buren St., Chicago, Ill.
- PARKS Co., F. B., 171 Prescott St., Grand Rapids, Mich.
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- REPUBLIC Rubber Co., Youngstown, O.
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- S-V—See Williams Mfg. Co.
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- SEAL-TITE—See Diamond Rubber Co.
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(See page 387.)
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(See page 611.)
- STICKFAST—See American Tire & Rubber Co.
- TINGLEY & Co., Chas. O., Rahway, N. J.
- TIRE-DOH—See Atlas Auto Supply Co.
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- YATMAN Rubber Co., 267-69 Mt. Pleasant Ave., Newark, N. J. "Nam-tay."
- YOUNG, Orlando W., 180 Frelinghuysen Ave., Newark, N. J.

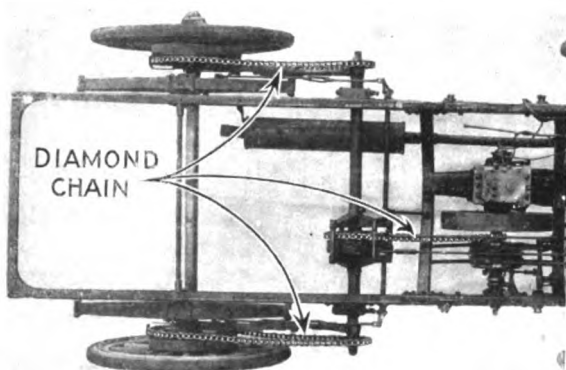
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(See page 117.)
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(See page 453.)
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(See page 567.)
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(See page 647.)

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- GARAGE Equipment Mfg. Co., Milwaukee, Wis. "Emergency."
(See page 203.)
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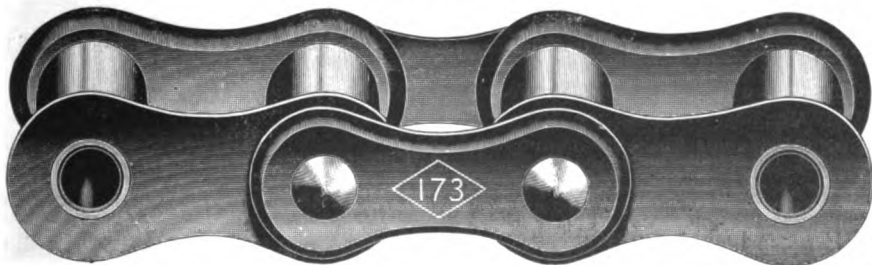
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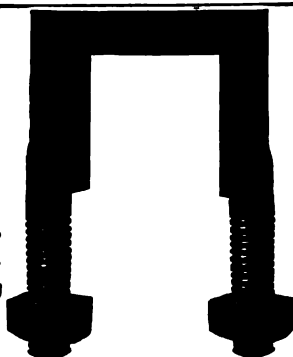
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UNION Forging Co., Union, N. Y.
(See page 119.)

WILCOX Mfg. Co., D., Mechanicsburg, Pa.

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MEYER & Co., John C., Lowell, Mass.

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LEVY & Co., Manasseh, 182 Broadway, New York, N. Y. "Briarcliff," "Safety."

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(See page 671.)

MINEOLA—See New Haven Clock Co.

NEW Haven Clock Co., New Haven, Conn.
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TARPON—See Waterbury Clock Co.

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(See pages 140 and 141.)

WATERBURY Clock Co., Waterbury, Conn.
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(See page 501.)

AMERICAN Rubberfelt Co., 2215 Elston Ave., Chicago, Ill.

BOYLE & Co., John, New York, N. Y.
"Bayonne."
(See page 81.)

BAYONNE—See Boyle & Co.

BULL DOG—See Muttly Co.

CHANDLER Oil Cloth & Buckram Co., East Taunton, Mass.

COOK'S Linoleum Co., Trenton, N. J.

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MERITAS—See Standard Oil Cloth Co.

MONARCH Rubber & Oil Cloth Co., 41 N. Seventh St., Philadelphia, Pa.

MUTTY Co., L. J., Boston, Mass. "Bull Dog."
(See page 121.)

PANTASOTE Co., 11 Broadway, New York, N. Y. "Drikar."

POTTER Sons & Co., Thomas, Lafayette Bldg., Philadelphia, Pa.

STANDARD Oil Cloth Co., 320 Broadway, New York, N. Y. "Meritas."

MOHAIR CLOTH

BULL DOG—See Muttly Co.

CARR Co., F. S., Boston, Mass.
(See page 123.)

CHASE & Co., L. C., Boston, Mass.
(See page 225.)

FABRIKOID Works, Wilmington, Del.

HAARTZ, W. A. & J. C., 130-32 Lincoln St., Boston, Mass.

MUTTY Co., L. J., Boston, Mass. "Bull Dog."
(See page 121.)

SCHERER & Co., H., Detroit, Mich.

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(See page 501.)

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(See page 123.)

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 (See page 607.)
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 (See page 121.)
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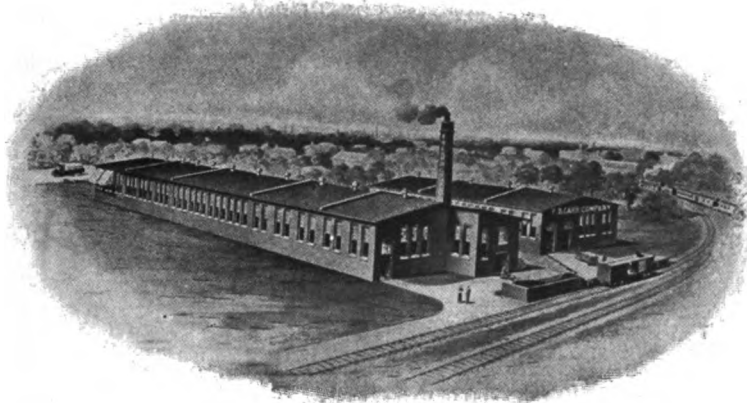
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"Wells."
(See page 507.)

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PNEUMATIC Clutch-Motor Co., 812 E. Third St., Los Angeles, Cal.

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(See page 510.)

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(See page 355.)

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(See page 125.)

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(See page 231.)

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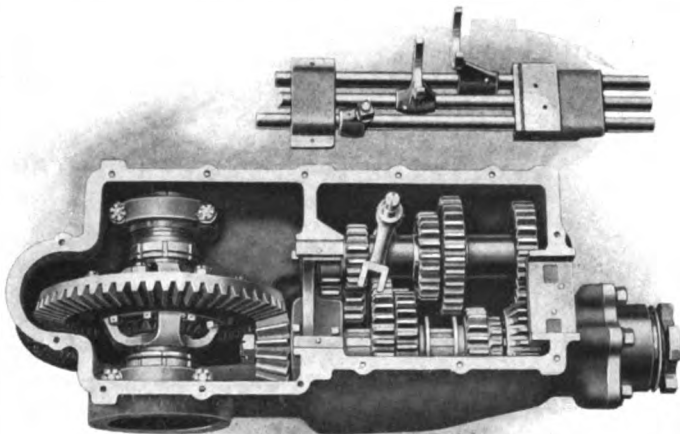
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 (See page 289.)

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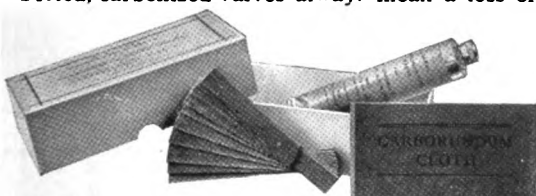
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(See page 377.)

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RADIUM-DECARBONIZER—See Milwaukee Auto Specialty Co.

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PLUGIT—See Gauer, Blaylock & Co.

PUNCTURE Cure Sales Co., 12 Bridge St., Newark, N. J.

PUNCTURE Proof Co., 207-11 E. Broadway, Louisville, Ky.
(See page 131.)

SEALO Tire Co., 1409 Michigan Ave., Chicago, Ill.

RADIATOR CLEANING COMPOUNDS

APEX—See U. S. Compound Co.

BANNER—See Cortland Specialty Co.

BLACK Diamond Chemical Co., 330 E. Drinker St., Dunmore, Pa.

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FIELD Auto Compound Mfg. Co., Auburn, Me.

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GARRATT CALLAHAN Co., 37 S. Clinton St., Chicago, Ill. "Fluff-Foe."

GILMER, Jr., G. Walker, 52 Seventh St., Philadelphia, Pa. "Skalout."
(See page 131 and Back Cover.)

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HAZEN-BROWN Co., 101 South St., Boston, Mass. "R. R. R."

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(See page 551.)

NONKORODA Co., 225 Water St., New York, N. Y.

R. R. R.—See Hazen-Brown Co.

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(See page 673.)

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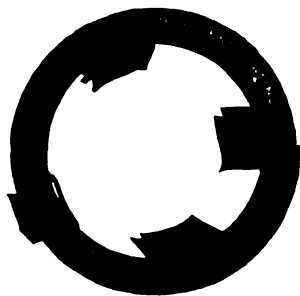
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 ZILIO Sales Co., 3261 S. Park Ave., Chicago, Ill.
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 (See page 557.)

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 NORTHWESTERN Chemical Co., Marietta,
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 TIRE-LAC—See Northwestern Chemical Co.

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 (See page 343.)
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 (See page 115.)
 BESTYET—See St. Louis Rubber Cement Co.
 C. O. T. GUM GUM—See Tingley & Co.
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 EMPIRE Tire Co., Mulberry St. & Clinton
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 tic."
 MOLD-IT—See Van Cleef Bros.
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 St. Louis, Mo. "Narco."
 (See page 155.)
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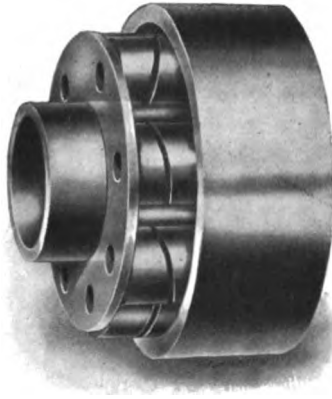
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 (See page 120.)
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 York, N. Y.
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 (See page 155.)
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 ark, N. J.
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 etta, O. "Pioneer."
 (See page 115.)
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(See pages 239 and 240.)

DETROIT Tube Products Co., 187-89 Junction Ave., Detroit, Mich.
(See page 245.)

IMPERIAL Brass Mfg. Co., 440-52 S. Jefferson St., Chicago, Ill.
(See page 105.)

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(See page 500.)

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(See page 85.)

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(See page 85.)

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(See page 135.)

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HASCO—See Hall Automobile Specialties Co.

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(See page 572.)

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(See page 511.)

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(See page 135.)

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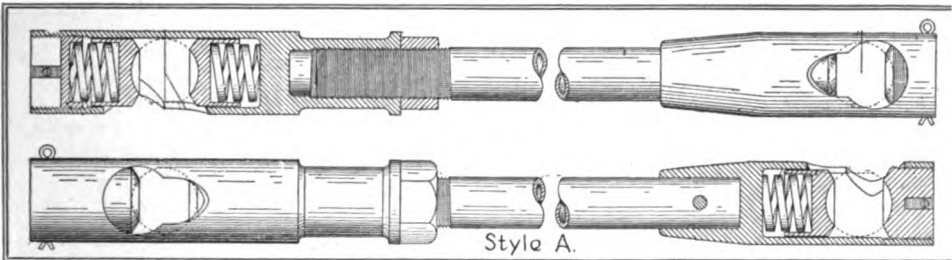
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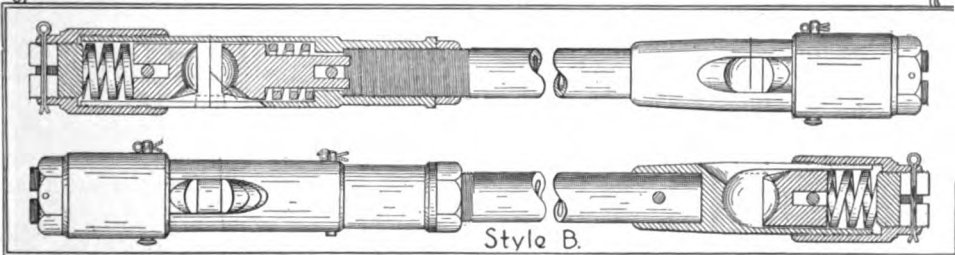


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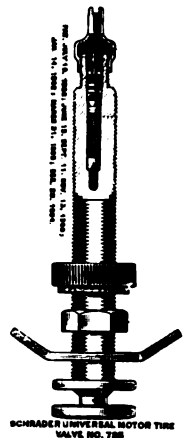
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The car equipped with it is positively protected from rear end collisions no matter where it is driven.

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4. When the driver is about to stop his car, a fourth section becomes brightly illuminated and shows the word "STOP."

Combinations of sections two or three with section four can be made, indicating an intended stop on the left.

The "LASSCO" also provides for reliable and distinct lighting of the license number.

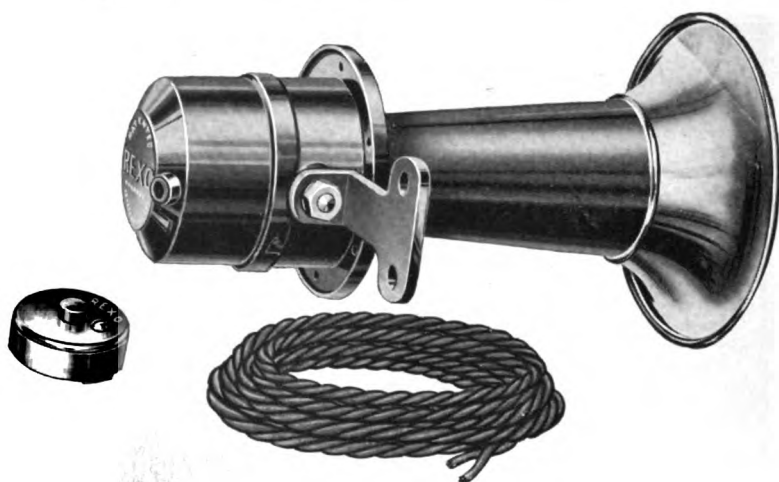
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On account of the reliability and low price of the Rexo electric warning signal, it is destined to be "standard equipment" upon most good cars of medium price for 1914. We have already sold over 65,000 Rexo horns for 1913 cars. 45,000 Rexo horns of special design are specified by one car maker—the largest electric horn order ever placed.

The Rexo horn comes complete with

push button and cord. It is designed to operate from any 6-volt battery. The Rexo does not contain any moving parts to require tri-weekly lubrication, monthly overhaul, washing in gasoline, greasing, etc. There is no danger from dust or moisture.

The operation is positive, winter or summer, as there is no oil to congeal.

The sound of the Rexo is loud, abrupt, clear and instantly responsive—unlike the motor-driven horn.

The standard Rexo for outside mounting is finished in black enamel with polished nickel bell, or black enamel with polished brass bell. We also make a special "under the hood" horn.

For those who desire a complete warning system on their cars, the Tuto two-tone horn offers the highest grade and finest electric warning signal ever devised.

Elyria-Dean Products Manufactured Only By

THE DEAN ELECTRIC COMPANY

515 Olive Street, Elyria, Ohio, U. S. A.

Kansas City, Mo.

San Francisco, Cal.

"Look for Elyria-Dean where quality's seen"

Elyria - Dean Speedometer

Simple and Always Accurate



It always adds mileage whether the car is driven from right or left hand wheel.

The Elyria-Dean Speedometer operates on the unvarying principle of direct centrifugal force. No compensating gears, springs or other parts to hamper or reduce accuracy.

The accuracy is unaffected by weather conditions. It registers the same in winter and summer, in rain or in shine. No regulation or compensation required.

This elegant instrument is the proper equipment for the highest-priced and most luxurious motor cars.

The Elyria-Dean Speedometer has the most modern features of any speed measuring device on the market.

It has real speedometer value, easy reading, steady hand, permanent accuracy, lasting strength, neat design and handsome finish.

The dial is black with white markings; the case is beautifully finished in baked black enamel with nickel trimmings.

The hand is steady and shows the speed at a glance by its position. No need of laboriously deciphering the figures or markings as in other speedometers.

The cup is shaped so that a long scale of uniform division is obtained direct. No need to guess at the reading or doctor the scale.

The Odometer—Geneva type—is exceptionally reliable. Trip scale reset to the tenth-mile, which facilitates following guide book markings.

car goes forward or backward, or whether shaft

Elyria - Dean Ignition System



This is the new system which has created such favorable results on modern power plants. It gives a new breath of life and extra "ginger," which is so much sought for by the car purchaser.

The high frequency spark differs from all other ignition sparks, as it is oscillatory in character, 5,000,000 to 1,000,000 cycles per second.

It ignites the gas in a different manner, by ionizing, embracing a larger volume and giving more rapid and complete combustion, even of poor mixture.

Wide spark plug gaps are permissible, 1-16 to 3-32 inch and the disruptive action of the spark prevents fouling of the plugs. Under average conditions, plugs never have to be removed, unless for mechanical breakage.

High cylinder pressures have less effect on this spark than on the other ignition sparks.

It allows the lowest of motor speeds without missing—running on the magneto current.

"Self-starters" are made successful on magneto ignition, as effective sparks are obtained at very low speeds, below 50 R. P. M.

All wiring carries low voltage currents, as the little resonator coils at the plugs step-up the pressure just where it is used. This obviates leakages and the maintaining of high insulation in the magneto, switch and connecting wiring.

It is a perfect product, the outgrowth of the many thousands of successful High Frequency Systems which have been marketed by the High Frequency Ignition Coil Co., of Los Angeles. Many of these systems have been in use for five or six years, and are still giving satisfactory service.

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THE DEAN ELECTRIC COMPANY

515 Olive Street, Elyria, Ohio, U. S. A.

San Francisco, Cal.

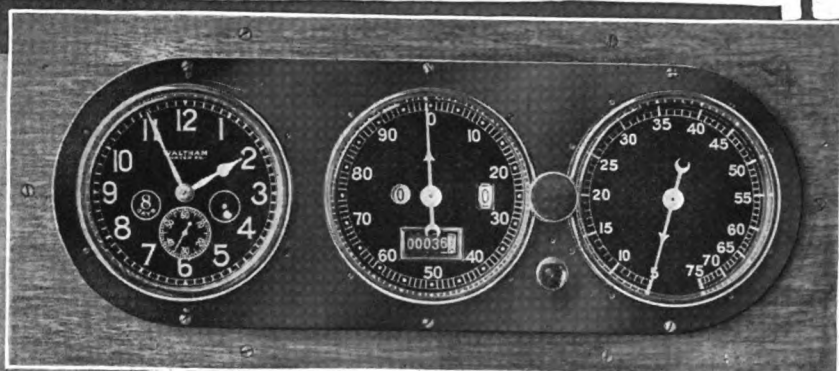
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HOFFMEYER WALT



ELECTRIC-VEHICLE
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FLUSH TYPE DESIGN
LIST PRICE-\$200

HAM
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"COLUMBUS FRICTION" WIND SHIELDS

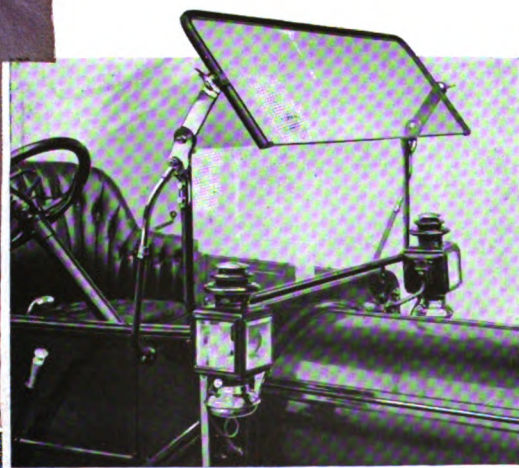
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"Stays where the hand leaves it"

Rain Visions,—Clear Visions,—Ventilators,—
Zig Zags, and Straight Shields,—Each fitted
with the Friction Hinge which gives as many
positions as there are degrees in a circle.

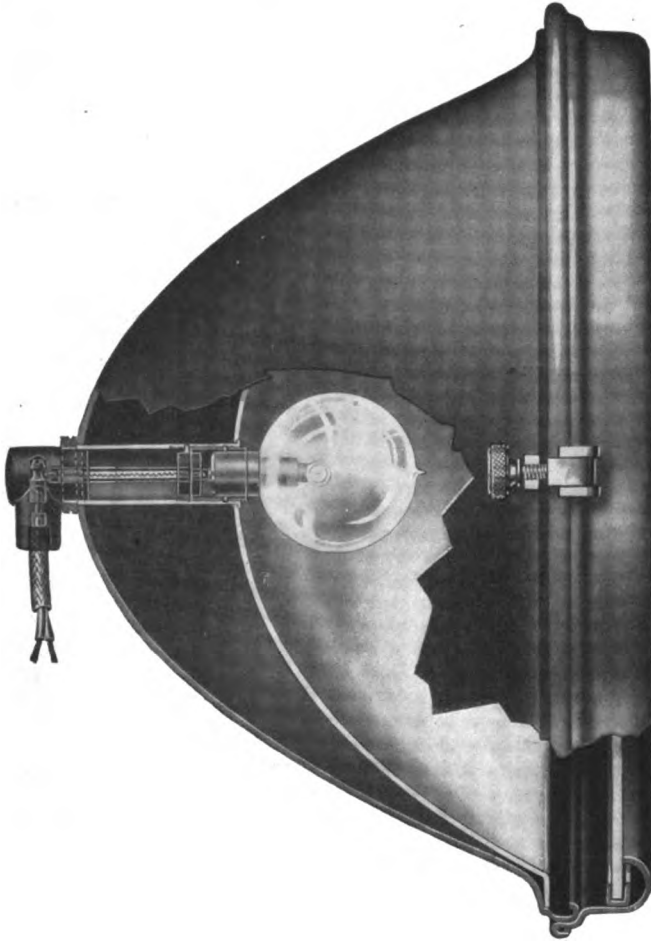
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AND ALL AROUND
A CIRCLE**

**Your Blue Prints
will receive our
prompt and care-
ful attention**



**The Columbus Auto Parts Co Columbus
Ohio, U.S.A.**

Note:—Simplicity of Assembling Reflector.



Electric Sockets, Connectors, Etc., Our Specialty

THE above illustration shows our direct type of FOCUSING SOCKET and CONNECTOR having no intermediate wires, is water and dirt proof and the positive snap connector eliminates possibility of breaking lamp or wires, which may happen in removing lamp when Edi-swan type is not disconnected.

To FOCUS LAMP place bulb in position and push in to stop, then turn to right to FOCUS IN and left to FOCUS OUT.

Let us figure with you on your requirements and tell you of other interesting and advanced ideas in sockets and connections for Automobile Electric Lighting Systems.

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Bronson, Michigan

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- GREENVILLE Metal Products Co., Greenville, Pa.
- LEFEVER Arms Co., 1 Maltbie St., Syracuse, N. Y.
- MERCHANT & Evans Co., 517 Arch St., Philadelphia, Pa. "Evans."
- MUNCIE Gear Works, Muncie, Ind.
(See page 603.)
- NEW YORK Gear Works, Greenpoint Ave. & West St., Brooklyn, N. Y. "Ball."
(See page 603.)
- RUSSEL Motor Axle Co., North Detroit, Mich.
(See page 49.)
- SALISBURY Wheel & Mfg. Co., Jamestown, N. Y.
(See page 549.)
- SHELDON Axle Co., Wilkes-Barre, Pa.
(See pages 50 and 51.)
- TIMKEN-DETROIT Axle Co., Detroit, Mich.
- WARNER Mfg. Co., Toledo, O.
(See page 231.)

COUPLINGS

HOSE COUPLINGS

(See Clamps, Hose)

PIPE COUPLINGS

(See Fittings, Pipe)

TUBE COUPLINGS

(See Unions, Tubing)

COVERS

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- GORDON—See Vehicle Apron & Hood Co.
- HOLCOMB Co., 105 Goffe St., New Haven, Conn.
- SHUREDRY—See Fulton Bag & Cotton Mills.
- VEHICLE Apron & Hood Co., 272 N. Fourth St., Columbus, O. "Gordon."

LAMP COVERS

- ALLEN Auto Specialty Co., 1926 Broadway, New York, N. Y.
(See page 145.)
- B. E. Mfg. Co., 38 White St., New York, N. Y.
- BOHNET & Co., John, Grand Ave. & Wash-tenaw St., Lansing, Mich.
- ECONOMY Stay Co., Jefferson City, Mo.
- FALLS City Buggy Top Co., 128-30 S. Floyd St., Louisville, Ky.
- FEESER Co., Frank S., 1102 Prospect St., Indianapolis, Ind. "Superior."
- GATES-OSBORNE Mfg. Co., Marshalltown, Ia.
- GIFFORD & Son, John A., 25 Park Pl., New York, N. Y. "Tompkins."
- GILBERT Mfg. Co., New Haven, Conn.
- GORDON—See Vehicle Apron & Hood Co.
- HOPEWELL Bros., Newton, Mass.
(See page 145.)
- NATHAN Novelty Mfg. Co., 90G. Reade St., New York, N. Y.
(See page 145.)
- NORRIS Co., R. Milton, 516-18 W. Baltimore St., Baltimore, Md.
- PREMIER Novelty Mfg. Co., 83 White St., New York, N. Y.
- RACINE Buggy Top Co., Racine, Wis.
- SUPERIOR—See Feeser Co.
- TOMPKINS—See Gifford & Son.
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- CAMPBELL—See Perkins Campbell Co.
- DAFOE-EUSTACE Co., 54 Lafayette Blvd., Detroit, Mich.
- DETROIT Leather Works, 31-35 Mullett St., Detroit, Mich.
(See page 65.)
- ECONOMY Stay Co., Jefferson City, Mo.
- GILBERT Mfg. Co., New Haven, Conn.
- HAGER & Son, Chas., 244-46 E. 52d St., New York, N. Y.
- LEATHER Products Co., 2268 Spring Grove Ave., Cincinnati, O.
- MESINGER Mfg. Co., H. & F., 1801-07 First Ave., New York, N. Y.
(See page 523.)
- NORRIS Co., R. Milton, 516-18 W. Baltimore St., Baltimore, Md.
- PERKINS Campbell Co., Cincinnati, O. "Campbell."
(See page 371.)
- PREMIER Novelty Mfg. Co., 83 White St., New York, N. Y.
- REINHOLD Belting & Supply Co., 174 W. 65th St., New York, N. Y.
- SMITH & Son, James, 40-42 Franklin Ave., Brooklyn, N. Y.
- SPRINGFIELD Harness Co., 55-61 Dwight St., Springfield, Mass.
- STEVENS & Bro., A. A., 1224 Wabash Ave., Chicago, Ill.



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Top Slip Covers a Specialty

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Price in Enamel Duck \$2.50
Very liberal discount to trade

HOPEWELL BROTHERS

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ALLEN TIRE CASE

PRICES \$3.00 UP

ALLEN TYROMETER

TIRE PRESSURE GAUGE

HIGHEST IN EFFICIENCY
ABSOLUTELY ACCURATE



PRICE
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(See page 297.)

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BAY State Stamping Co., 380 Chandler St., Worcester, Mass. "Bennett," "Handy."

BENNETT—See Bay State Stamping Co.

BOWEN Mfg. Co., Mechanic St., Auburn, N. Y.
(See page 151.)

ELLIOTT Chemical Works, Newton, Mass.

GITS Bros. Mfg. Co., Chicago, Ill.
(See page 151.)

HANDY—See Bay State Stamping Co.

LONG Bros., Broadway & Buckeye St., Kokomo, Ind.

TUCKER, W. H. & C. F., Hartford, Conn.
(See page 147.)

WINKLEY Co., Detroit, Mich.
(See page 255.)

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SEINSHEIMER Paper Co., 1118-22 Bank St., Cincinnati, O.

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BOYER-SCHLISKE Co., 1171 Van Dyke Ave., Detroit, Mich.

GILLIAM Mfg. Co., Canton, O.

GLOVER Equipment Co., Indianapolis, Ind. "Antidam."
(See page 335.)

GORDON—See Vehicle Apron & Hood Co.

J-M Keystone—See Johns-Manville Co.

JOHNS-MANVILLE Co., H. W., Madison Ave. & 41st St., New York, N. Y. "J-M Keystone."

VEHICLE Apron & Hood Co., 272 N. Fourth St., Columbus, O. "Gordon."

RUBBER STEERING WHEEL COVERS OR GRIPS

B. E. Mfg. Co., 38 White St., New York, N. Y.

EMPIRE Tire Co., Mulberry St. & Clinton Ave., Trenton, N. J.

EZE-GRIP—See Hayne-SurrIDGE Auto Goods Co.

GOODYEAR Rubber Hose & Packing Mfg. Co., 231 Chestnut St., Philadelphia, Pa. "Steerease."

GORDON—See Vehicle Apron & Hood Co.

HAYNE-SURRIDGE Auto Goods Co., 1017 Lucas Ave., St. Louis, Mo. "Eze-Grip."

PARKER-STEARNES & Co., 286 Sheffield Ave., Brooklyn, N. Y.

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(See Holders, Starting Crank)

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(See also Tops, Automobile)

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GATES-OSBORNE Mfg. Co., Marshalltown, Ia.

GILLIAM Mfg. Co., Canton, O.

GLOVER Equipment Co., Indianapolis, Ind.
(See page 335.)

GORDON—See Vehicle Apron & Hood Co.

LONDON Auto Supply Co., 2540-48 Wabash Ave., Chicago, Ill.

MICHIGAN Top Co., 313 Riopelle St., Detroit, Mich.
(See page 599.)

MILWAUKEE Trimming Co., 549 E. Water St., Milwaukee, Wis.

NIAGRA Auto-Cover Co., 524 W. 50th St., New York, N. Y.

SPRINGFIELD Auto Top & Upholstering Co., 102-06 Dwight St., Springfield, Mass.

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VESCO—See Vehicle Top & Supply Co.

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No. 000—1"



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This is not a ratchet cup—has a barrel lock. Heads cannot jar off from vibration; always locked; (no ratchet or springs exposed to grease and dirt); all locking parts enclosed.

Locks automatically. Cup member has internally milled threads to gauge limit, insuring interchangeability. Made in three sizes— $\frac{3}{4}$ ", 1" and $1\frac{1}{4}$ ". Send us your specifications for

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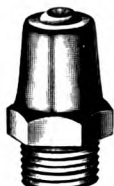
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NOTICE THE INDENT IN THE BALL VALVE ON STYLE B. AND C.

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OIL-CAN SNOOT WON'T SLIDE OFF



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2



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3 Special

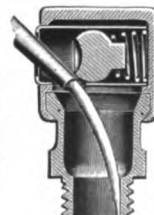
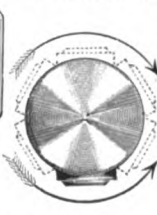


5



7

THE KIND THAT STANDS VIBRATION

Style A—
No. 2Style A—
No. 4Style B—
No. 3Style B—
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Showing exterior and interior

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(For Crankshafts in the rough —See Forgings, Drop)

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(See page 169.)

AUTO Crankshaft Co., 192-96 Piquette Ave., Detroit, Mich.
(See page 315.)

DRIGGS - SEABURY Ordnance Corp., Sharon, Pa.
(See page 569.)

FORE River Shipbuilding Co., Quincy, Mass.

GILL & Sons Forge & Machine Works, P. H., Lorraine & Otsego Sts., Brooklyn, N. Y.
(See page 507.)

JACKSON Motor Shaft Co., Jackson, Mich.
(See page 151.)

JOLIET Forge Co., Joliet, Ill. ♪

KRUPP—See Prosser & Son.

LELAND & Co., W. H., 1025 Southbridge St., Worcester, Mass.

MICHIGAN Crank Shaft Co., Lansing, Mich.
(See page 553.)

MUSKEGON Motor Specialties Co., Water St., Muskegon, Mich.
(See page 91.)

NATIONAL Engineering Co., Saginaw, Mich.

NORTON Grinding Co., Worcester, Mass.

OBERBERGER Drop Forge Co., 220 Lake St., Milwaukee, Wis.

PARK Drop Forge Co., Cleveland, O.
(See page 169.)

PENINSULA Auto Parts Co., 46 Champlain St., Detroit, Mich.

PROSSER & Son, Thomas, 15 Gold St., New York, N. Y. (Importers.) "Krupp."
(See page 361.)

REDMOND Engineering Co., Drexel Bldg., Philadelphia, Pa.
(See page 545.)

STANDARD Gauge Steel Co., Beaver Falls, Pa.
(See page 323.)

TINDELL-MORRIS Co., Eddystone, Pa.

WILCOX-McKIM Co., Saginaw, Mich.
(See page 181.)

WITTEMAN Co., A. P., 112-16 N. Broad St., Philadelphia, Pa.

WYMAN & Gordon Co., Worcester, Mass.
(See page 149.)

CUPS

BALL CUPS AND CONES

ASHLEY Machine Works, 724 University Ave., Rochester, N. Y.
(See page 237.)

BOSSERT Co., Utica, N. Y.
(See page 161.)

CORBIN Screw Corp., 219 High St., New Britain, Conn.

DETROIT Screw Works, Detroit, Mich.
(See page 653.)

GIER & Dall Mfg. Co., Lansing, Mich.

GLOBE Machine & Stamping Co., Cleveland, O.
(See page 79.)

HARTFORD Machine Screw Co., Hartford, Conn.
(See page 285.)

IRELAND & Matthews Mfg. Co., 51-79 Iron St., Detroit, Mich.

KONIGSLOW Mfg. Co., Otto, Cleveland, O.

REESE Machine & Tool Works, S., 224-30 W. Main St., Plymouth, Pa.

U. S. Automatic Co., Amherst, O.

WESTERN Automatic Machine Screw Co., Elyria, O.

WORCESTER Pressed Steel Co., Worcester, Mass.
(See page 157.)

OIL AND GREASE CUPS

(See also Lubricators; also Covers, Oil Hole)

ACTIVE—See Sherman Mfg. Co.

AGNER Co., Raymond C., Burlington, Wis.
"Simplex."

ALBANY Lubricating Co., 708-10 Washington St., New York, N. Y. (Grease Cups only.)

ALLEN Mfg. Co., W. D., 135 W. Lake St., Chicago, Ill. "Czar," "Columbia," "Peerless," "Gibbs."

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AMERICAN Lubricator Co., Summit Ave. & Wabash Ry., Detroit, Mich.

AMERICAN Stamping Co., Battle Creek, Mich.

ARROW—See Long Bros.

BAY State Stamping Co., 380 Chandler St., Worcester, Mass.

BESLY & Co., Charles H., Chicago, Ill.
"Helmet."
(See page 465.)

BOWEN Mfg. Co., Mechanic St., Auburn, N. Y. "Empress."
(See page 151.)

BUFFALO—See Sherwood Mfg. Co.

CAMDEN—See Lindholm Metal Stamping Co.

CHICAGO—See Ohio Injector Co.

COLONIAL—See Powell Co.

COLUMBIA—See Allen Mfg. Co.

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CZAR—See Allen Mfg. Co.

DETROIT Lubricating Co., Lincoln Ave. & G. T. R. R., Detroit, Mich.

EDELMANN & Co., E., 225 W. Illinois St., Chicago, Ill.
(See page 175.)

EMPRESS—See Bowen Mfg. Co.

ERIE Stamping & Mfg. Co., 644-48 W. 12th St., Erie, Pa.

ESSEX Brass Co., G. B., 480-86 Franklin St., Detroit, Mich.

GENERAL Pressed Metals Co., Philadelphia, Pa.

GIBBS—See Allen Mfg. Co.

GITS Bros. Mfg. Co., Chicago, Ill.
(See page 151.)

The WYMAN & GORDON CO.

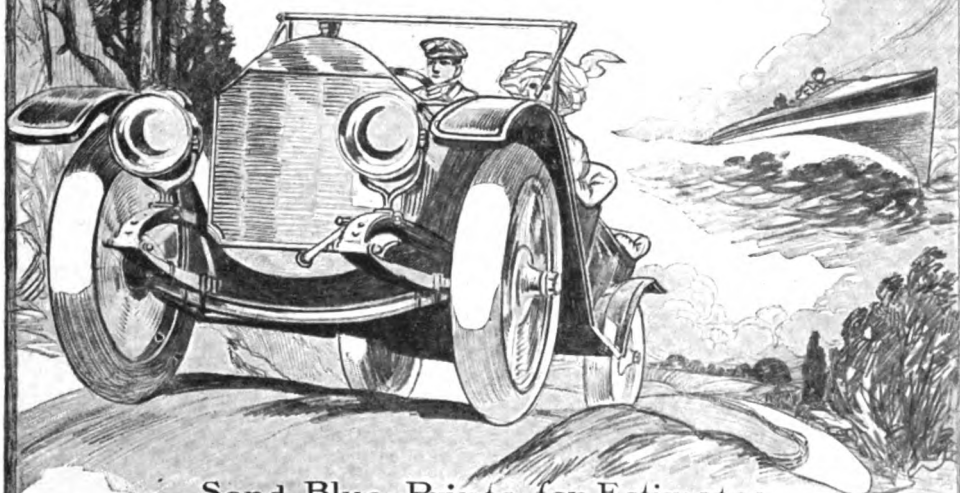
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Long years of experience in the making of crank shafts has developed our products to the point where they are recognized as unequalled, to-day our forgings are acknowledged as the standard for

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 (See page 459.)
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HENRY Mfg. & Grease Cup Co., Terre Haute, Ind.
 (See page 597.)
 IDEAL—See Crum-Wiley Mfg. Co.
 IDEAL—See Lunkenheimer Co.
IMPERIAL Brass Mfg. Co., 440-52 S. Jefferson St., Chicago, Ill.
 (See page 165.)
JOSEPH—See Lindholm Metal Stamping Co.
KELLY & Jones Co., Greensburg, Pa.
LINDHOLM Metal Stamping Co., 111 Erie St., Camden, N. J. "Joseph," "Vale," "Camden," "Madeira," "McKee."
 (See page 591.)
 LION—See Lunkenheimer Co.
LONG Bros., Broadway & Buckeye St., Kokomo, Ind. "Arrow," "Cutter."
LUNKENHEIMER Co., 223 E. Eighth Ave., Cincinnati, O. "Ideal," "Lion," "Pioneer," "Royal," "Sentinel," "Tiger."
McKEE—See Lindholm Metal Stamping Co.
McRAE & Roberts Co., 227-35 Campbell Ave., Detroit, Mich.
MADEIRA—See Lindholm Metal Stamping Co.
 MASCOT—See Powell Co.
 MECCA—See Powell Co.
MECHANICAL & Electrical Mfg. Co., 2227 Prairie Ave., Chicago, Ill.
 (See page 217.)
MERCHANT & Evans Co., 517 Arch St., Philadelphia, Pa.
MICHIGAN Lubricator Co., 661-73 Beaubien St., Detroit, Mich.
 MIKADO—See Powell Co.
MILWAUKEE Valve Co., 139 Burrell St., Milwaukee, Wis.
 (See page 463.)
 MOGUL—See Powell Co.
 NIAGARA—See Sherwood Mfg. Co.
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 PEERLESS—See Allen Mfg. Co.
PENBERTHY Injector Co., Detroit, Mich. "Sterling."
 (See page 77.)
 PERFECT—See Sherman Mfg. Co.
 PERFECTION—See Crum-Wiley Mfg. Co.
PHILLIPS Co., 35-37 Skilton Ave., Somerville, Mass.
 PIONEER—See Lunkenheimer Co.
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 STERLING—See Penberthy Injector Co.
 SWIFT Lubricator Co., Elmira, N. Y.
 TIGER—See Lunkenheimer Co.
TUCKER, W. H. & C. F., Hartford, Conn.
 (See page 147.)
 UNIVERSAL Lubricator Co., 41-43 S. Third St., Philadelphia, Pa.
 VALE—See Lindholm Metal Stamping Co.
 VANGUARD—See Powell Co.
WALWORTH Mfg. Co., Boston, Mass.
 (See page 495.)
 WILKINSON Co., Wm. H., West Medway, Mass.
 WILLIAMS Valve Co., D. T., Spring Grove Ave. & Township St., Cincinnati, O.
WINKLEY Co., Detroit, Mich.
 (See page 255.)
 ZERK Mfg. Co., Cleveland, O.

SPRING KEY PRIMING CUPS

(For ordinary priming cups—See Cocks, Standard Pet)

AMERICAN Injector Co., 173 14th Ave., Detroit, Mich.
 DETROIT Brass Works, 1304 Brooklyn Ave., Detroit, Mich.
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 (See page 175.)
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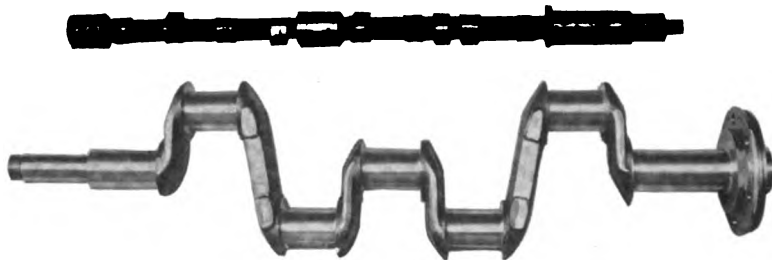
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(See page 111.)

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(See pages 239 and 240.)

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 NELSON'S—See Jewell Mfg. Co.
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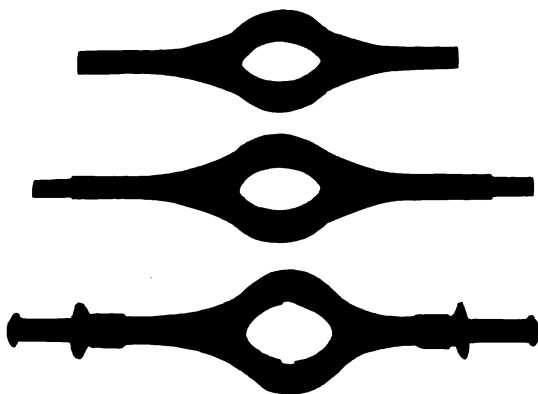
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(See page 307.)

BUSH Mfg. Co., Hartford, Conn.
(See page 345.)

CURRY Co., Joseph F., 475 Washington St.,
Newark, N. J.

DAYTON Malleable Iron Co., Dayton, O.

EBERHARD Mfg. Co., Cleveland, O.
(See page 215.)

ENGLISH & Mersick Co., New Haven, Conn.

GARAGE Equipment Mfg. Co., Milwaukee,
Wis. "Gemco."
(See page 203.)

GEMCO—See Garage Equipment Mfg. Co.

IMPERIAL Brass Mfg. Co., 440-52 S. Jefferson
St., Chicago, Ill.
(See page 165.)

KEELER Brass Co., 261-71 Godfrey Ave.,
Grand Rapids, Mich.

KINSEY Mfg. Co., Toledo, O.
(See page 395.)

SERGEANT Mfg. Co., New & Summit Sts.,
Newark, N. J.

WESTERN Brass Mfg. Works, Marshall
Blvd., 21st St. & C. B. & Q. R. R., Chi-
cago, Ill.
(See page 85.)

WIENER-BARNET Co., 312-28 Adams St.,
Newark, N. J.

WOODRUFF & Sons Co., Walter W., Mount
Carmel, Conn.

FENDERS

MUD FENDERS

(See Guards, Mud)

FIBRE

HARD FIBRE

(Sheet, Rod and Tube)

AMERICAN Vulcanised Fibre Co., Equi-
table Bldg., Wilmington, Del.
(See page 163.)

BRANDYWINE Fibre Products Co., Wilming-
ton, Del.

CONCRETE Fibre Co., Ford & Lafayette Sts.,
Norristown, Pa.

CONTINENTAL Fibre Co., Newark, Del.
(See page 163.)

DELAWARE Hard Fibre Co., Wilmington,
Del.

DIAMOND State Fibre Co., Elsmere, Del.

EASTERN Hard Fibre Co., 50 Church St.,
New York, N. Y.
(See page 163.)

EMPIRE Mfg. Co., 26th & Tatnall Sts., Wil-
mington, Del.

NATIONAL Fibre & Insulation Co., Yorklyn,
Del.

SPAULDING & Sons Co., J., Tonawanda,
N. Y.

STANDARD Fibre Co., Miller St., Somer-
ville, Mass.

WILMINGTON Fibre Specialty Co., Wilming-
ton, Del.

FILLERS

PAINT FILLERS

ACME White Lead & Color Works, 1740-1800
St. Aubin Ave., Detroit, Mich.

BERRY Bros., Detroit, Mich.

BRADLEY & Vrooman Co., Chicago, Ill. "C.
Q. P."

BRIDGEPORT Wood Finishing Co., New
Milford, Conn.

C. Q. P.—See Bradley & Vrooman Co.

CAWN Mining & Mfg. Co., Canton, O. "Econ-
omy."

CELOX—See Valentine & Co.

CHASE, Roberts & Co., West Ave., Fifth &
Sixth Sts., Long Island City, N. Y.

CINCINNATI Color Co., Eighth & Evans Sts.,
Cincinnati, O.

DITZLER Color Co., 18 W. Baltimore Ave., De-
troit, Mich.

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FILLERS (Continued)**PAINT FILLERS (Continued)**

ECONOMY—See Cawn Mining & Mfg. Co.
FLINT Varnish Works, Flint, Mich.
FLOOD & Conklin Co., 136 Chestnut St., Newark, N. J.
FOREST City Paint & Varnish Co., 3334 Lakeside Ave., Cleveland, O.
GRAVES Co., N. Z., 22-26 S. Third St., Philadelphia, Pa.
HARDY Paint & Varnish Co., Toledo, O. (See page 593.)
HEATH & Milligan Mfg. Co., 1833-37 Seward St., Chicago, Ill.
HILDRETH Varnish Co., 90 West St., New York, N. Y.
JOHNSTON Paint Co., 226 Main St., Cincinnati, O. "Krakno."
KEYSTONE Paint & Filler Co., Muncy, Pa.
KRAKNO—See Johnston Paint Co.
MASURY & Son, John W., New York, N. Y.
MITCHELL Varnish Works, River Ave. & State St., Camden, N. J.
MOLLER & Schumann Co., Marcy & Flushing Aves., Brooklyn, N. Y.
MOSER Co., Chas., Cincinnati, O.
MOUND City Paint & Color Co., 11th & Mulanphy Sts., St. Louis, Mo.
NELSON Color Co., Amesbury, Mass.
NICE, Eugene E., 272 S. Second St., Philadelphia, Pa.
PHOENIX Paint & Varnish Co., 124 Market St., Philadelphia, Pa.
RENO Bros. Paint Co., Pulaski, Pa.
ST. LOUIS Surfacers & Paint Co., 26 S. Commercial St., St. Louis, Mo.
SCHRACK & Co., 152 N. Fourth St., Philadelphia, Pa.
SMITH & Co., Edward, Sixth St. & West Ave., Long Island City, N. Y.
VALENTINE & Co., 456 Fourth Ave., New York, N. Y. "Celox."
VESTAL Paint Co., Vestal, N. Y.
WILHELM Co., A., Third & Bern Sts., Reading, Pa.

BUCKEYE Iron & Brass Works, 324 E. Third St., Dayton, O.
CRANE Co., 519 S. Canal St., Chicago, Ill.
DALTON-INGERSOLL Mfg. Co., 171-75 High St., Boston, Mass.
GRIP Coupling Co., Ware, Mass.
HAMLIN & Emery Brass Co., 49 Island St., Boston, Mass.
IDEAL Mfg. Co., 570 Franklin St., Detroit, Mich.
IMPERIAL Brass Mfg. Co., 440-52 S. Jefferson St., Chicago, Ill. (See page 165.)
JARECKI Mfg. Co., Erie, Pa.
KELLY & Jones Co., Greensburg, Pa.
KINSEY & Mahler Co., 400 S. Adams St., Peoria, Ill.
LUNKENHEIMER Co., 223 E. Eighth Ave., Cincinnati, O.
MCDONALD Mfg. Co., A. Y., Dubuque, Ia.
McNAB & Harlin Mfg. Co., 56 John St., New York, N. Y.
McRAE & Roberts Co., 227-35 Campbell Ave., Detroit, Mich.
MICHIGAN Lubricator Co., 661-73 Beaubien St., Detroit, Mich.
PITTSBURG Valve & Fittings Co., Barber-ton, O.
POWELL Co., Wm., 2521-31 Spring Grove Ave., Cincinnati, O.
POWHATAN Brass & Iron Works, Charlestown, W. Va.
QUEEN City Brass & Iron Works, Spring Grove Ave., Cincinnati, O.
RICHARDSON-PHENIX Co., 122-28 Reservoir Ave., Milwaukee, Wis. "Union Cinch."
RUNDLE-SPENCE Mfg. Co., 67 Second St., Milwaukee, Wis.
SHERMAN Mfg. Co., H. B., 12 Barney St., Battle Creek, Mich.
STODDARD Union Co., 60 Arch St., Boston, Mass.
UNION CINCH—See Richardson-Phenix Co.
WALWORTH Mfg. Co., Boston, Mass. (See page 495.)
WESTERN Brass Mfg. Works, Marshall Blvd., 21st St. & C. B. & Q. R. R., Chicago, Ill. (See page 85.)
WILLIAMS Valve Co., D. T., Spring Grove Ave. & Township St., Cincinnati, O.

FINS**RADIATOR FINS**

(See Discs, Radiator)

FITTINGS**PIPE FITTINGS**

(For Tubing or Brazing Fittings—See Tubing Unions)

BARD Union Co., Norwich, Conn.
BARRETT Mfg. Co., James, 50 Pearl St., Boston, Mass.
BELFIELD Co., H., 435 N. Broad St., Philadelphia, Pa.

TOP FITTINGS AND FIXTURES

(See also Bows, Top; also Fasteners, Curtain; also Irons, Slat; also Irons, Top; also Rests, Bow; also Separators, Bow; also Sockets, Bow; also Straps, Top)

AMESBURY Brass & Foundry Co., Amesbury, Mass.
BLAKESLEE Forging Co., Plantsville, Conn.
COLUMBUS Bolt Works, 162 W. Randolph St., Columbus, O.
CORTLAND Carriage Goods Co., Cortland, N. Y.
CORTLAND Forging Co., Cortland, N. Y.
CRANDAL, Stone & Co., Binghamton, N. Y.
CURRY Co., Joseph F., 475 Washington St., Newark, N. J.
DOUGLAS & Lomason Co., Detroit, Mich.

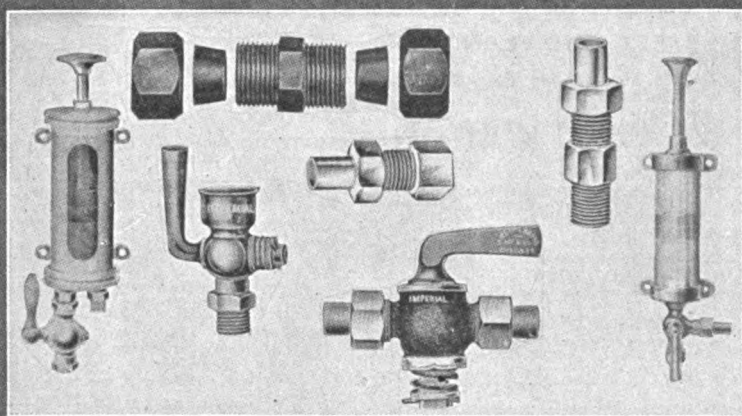
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FITTINGS (Continued)

TOP FITTINGS AND FIXTURES (Continued)

ENGLISH & Mersick Co., New Haven, Conn.
GARAGE Equipment Mfg. Co., Milwaukee, Wis.
(See page 203.)

HIGGIN Mfg. Co., Newport, Ky.

IMPERIAL Brass Mfg. Co., 440-52 S. Jefferson St., Chicago, Ill.
(See page 165.)

KEELER Brass Co., 261-71 Godfrey Ave., Grand Rapids, Mich.

METAL Stamping Co., 13th St. & Boulevard, Long Island City, N. Y.

MONARCH Carriage Goods Co., 2338-44 Spring Grove Ave., Cincinnati, O.

NEWTON & Son, W. H., 125 Elm St., Cortland, N. Y.

SCHERER & Co., H., Detroit, Mich.

SMITH & Co., Jos. N., Detroit, Mich.
(See page 201.)

WESTERN Brass Mfg. Works, Marshall Blvd., 21st St. & C. B. & Q. R. R., Chicago, Ill.
(See page 85.)

FLAGS, PENNANTS AND EMBLEMS

ENGEL Co., W. A., Gloversville, N. Y.
(See page 499.)

KOSMOS-ART Co., Cincinnati, O.

ORCUTT & Co., J. C., 134 S. 13th St., Lincoln, Neb.

SPIEGEL Art Co., 111 Broadway, Brooklyn, N. Y.

FLANGES

PRESSED STEEL HUB FLANGES

(For Forged or Cast Flanges—See Forgings; also Castings)

AVERY Stamping Co., 5209 Lakeside Ave., Cleveland, O.

BOSSERT Co., Utica, N. Y.
(See page 161.)

CROSBY Co., Buffalo, N. Y.
(See page 157.)

DETROIT Pressed Steel Co., 1800 Mt. Elliott Ave., Detroit, Mich.
(See page 213.)

DRIGGS - SEABURY Ordnance Corp., Sharon, Pa.
(See page 569.)

GIER & Dall Mfg. Co., Lansing, Mich.

GLOBE Machine & Stamping Co., Cleveland, O.
(See page 79.)

IRELAND & Matthews Mfg. Co., 51-79 Iron St., Detroit, Mich.

KELSEY Wheel Co., Detroit, Mich.

KONIGSLOW Mfg. Co., Otto., Cleveland, O.

SPARKS-WITHINGTON Co., Jackson, Mich.
(See page 211.)

WORCESTER Pressed Steel Co., Worcester, Mass.
(See page 157.)

FLOATS

CORK CARBURETER FLOATS

ARMSTRONG Cork Co., 23d St. & Railroad Ave., Pittsburg, Pa.

MUNDET & Son, L., King, Ferris & Sullivan Sts., Brooklyn, N. Y.

PADDOCK Cork Co., 1209-17 DeKalb Ave., Brooklyn, N. Y.

METAL CARBURETER FLOATS

FITZGERALD Mfg. Co., Torrington, Conn.
(See page 551.)

GOODNOW & Blake Mfg. Co., Fourth & Porter Sts., Detroit, Mich.

GOODWIN & Kintz Co., Winsted, Conn.

HERCULES Float Works, 200-10 Franklin St., Springfield, Mass.

IMPERIAL Brass Mfg. Co., 440-52 S. Jefferson St., Chicago, Ill.
(See page 165.)

NAUGATUCK Mfg. Co., Naugatuck, Conn.

WORCESTER Pressed Steel Co., Worcester, Mass.
(See page 157.)

FORGINGS

DROP FORGINGS

AMERICAN & British Mfg. Co., 718 Crescent Ave., Bridgeport, Conn.

ANDERSON Forge & Machine Co., Detroit, Mich.
(See page 315.)

ATLAS Drop Forge Co., Lansing, Mich.
(See page 515.)

ATWATER Mfg. Co., Southington, Conn.
(See page 587.)

BAKER Drop Forge Co., Jackson, Mich.
(See page 193.)

BALDWIN Steel Co., Charleston, W. Va.
(See page 363.)

BARNETT Drop Forging Co., East Hampton, Mass.
(See page 167.)

BATES Forge Co., 229 W. Merrill St., Indianapolis, Ind.

BELDEN Machine Co., Whalley Ave. & Tryon St., New Haven, Conn.

BETHLEHEM Steel Co., Third & Poplar Sts., South Bethlehem, Pa.

BILLINGS & Spencer Co., Hartford, Conn.

BLAKESLEE Forging Co., Plantsville, Conn.

BUFFALO Drop Forge Co., 55 Carroll St., Buffalo, N. Y.

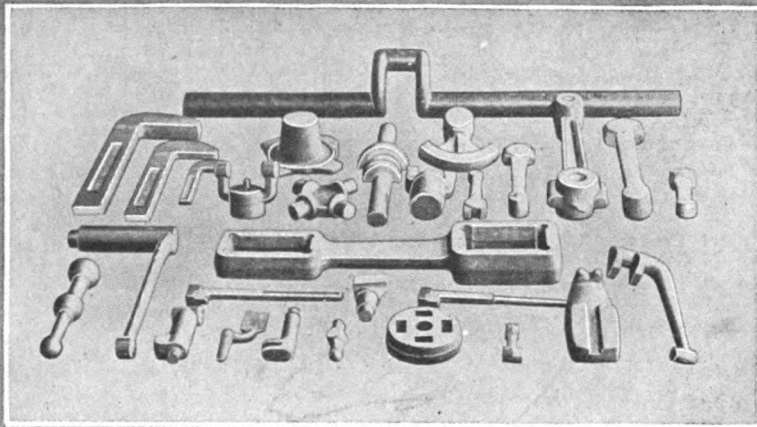
CAMBRIA Forge Co., Johnstown, Pa.

CANTON Drop Forging & Mfg. Co., Canton, O.
(See page 91.)

CAPE Ann Tool Co., Granite St., Pigeon Cove, Mass.

BARNETT DROP FORGING CO.

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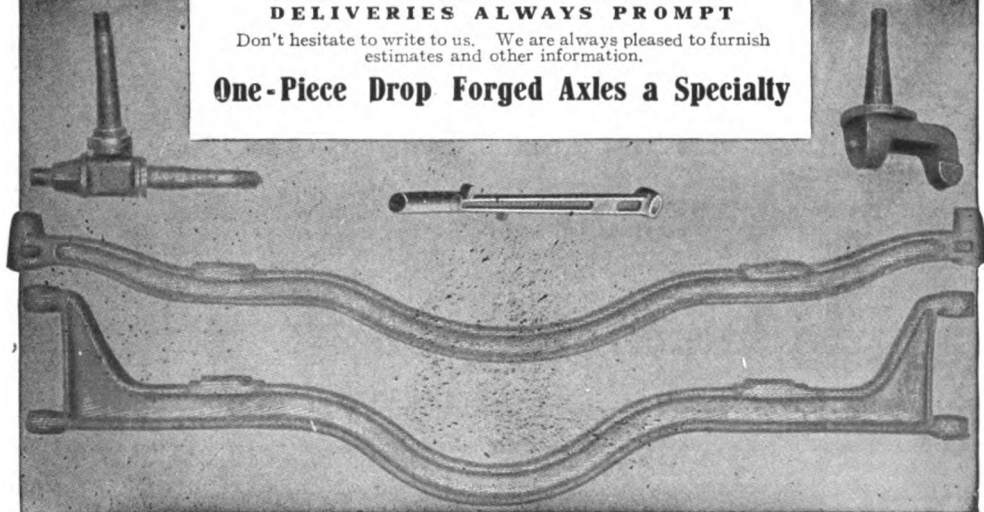
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FORGINGS (Continued)

DROP FORGINGS (Continued)

- CHAMPION Machine & Forging Co., 3725 E. 78th St., Cleveland, O.**
(See page 197.)
- CHICAGO Drop Forge & Foundry Co., 447-517 Kensington Ave., Chicago, Ill.**
- CHRISTE-KLINE Forge Co., Detroit, Mich.**
- CLAPP Mfg. Co., E. D., Auburn, N. Y.**
- CLEVELAND Hardware Co., Cleveland, O.**
- COLUMBIAN Hardware Co., 1296 E. 53d St., Cleveland, O.**
- COLUMBUS Bolt Works, 162 W. Randolph St., Columbus, O.**
- COLUMBUS Forge & Iron Co., Columbus, O.**
- CONSOLIDATED Mfg. Co., Toledo, O.**
(See page 255.)
- CORTLAND Forging Co., Cortland, N. Y.**
- CRESCENT Forgings Co., Oakmont, Pa.**
- DEAN Forging Co., 1825 E. Jackson St., Muncie, Ind.**
- DETROIT Steel Products Co., Boulevard & Griffin St., Detroit, Mich.**
- DETROIT Steel Products Co., Boulevard & Griffin St., Detroit, Mich.**
- DIAMOND Forging & Mfg. Co., Pittsburg, Pa.**
- DODGE Bros., 1678-1724 Jos. Campau Ave., Detroit, Mich.**
- DRIGGS - SEABURY Ordnance Corp., Sharon, Pa.**
(See page 569.)
- DROP Forging Co. of New York, West Side Ave. & Flisk St., Jersey City, N. J.**
- ECCLES Co., Richard, Auburn, N. Y.**
(See page 119.)
- ELLIOTT, H. A., Majestic Bldg., Detroit, Mich. (Importer.)**
- ELMORE Tool Mfg. Co., Hartford, Conn.**
- EMERGENCY Forge Co., Lansing, Mich.**
- ERIE Forge Co., 15th & Cascade Sts., Erie, Pa.**
- EUREKA Co., North East, Pa.**
- FLANDERS Mfg. Co., Pontiac, Mich.**
- FOREST City Electric Co., 5003 Windsor Ave., Cleveland, O.**
- FRUIN Drop Forge Co., 345 Root St., Chicago, Ill.**
- FULTON Machine & Forging Co., Canal Fulton, O.**
- GENERAL Drop Forge Co., 1740 Elmwood Ave., Buffalo, N. Y.**
(See page 565.)
- GLOBE Malleable Iron & Steel Co., Syracuse, N. Y.**
(See page 111.)
- HERBRAND Co., Fremont, O.**
- HIGGINS Spring & Axle Co., 1314 16th St., Racine, Wis.**
(See page 621.)
- INDIANAPOLIS Drop Forging Co., Madison Ave. & Dowling St., Indianapolis, Ind.**
- INGALLS-SHEPARD Forging Co., Michigan Ave. & Van Buren St., Chicago, Ill.**
(See page 487.)
- JACKSON Drop Forging Co., Jackson, Mich.**
- KILBORN & Bishop Co., Chapel & Lloyd Sts., New Haven, Conn.**
- KROPP Forge Co., 2510 W. 21st St., Chicago, Ill.**
- KRUPP—See Prosser & Son.**
- LAKESIDE Forge Co., Erie, Pa.**
- LEWIS Spring & Axle Co., Jackson, Mich.**
(See page 547.)
- MACHINERY Forging Co., Hamilton & Marquette Sts., Cleveland, O.**
- MARTIN Forging Co., H. J., 510 Harding St., Indianapolis, Ind.**
- MERRILL Bros., Maspeth, N. Y.**
- MICHIGAN Bolt & Nut Works, ft. Meldrum Ave., Detroit, Mich.**
- MOORE Drop Forging Co., Birnie Ave., Springfield, Mass.**
- NEW England Forge Co., 9 Plymouth St., Worcester, Mass.**
- OBENBERGER Drop Forge Co., 320 Lake St., Milwaukee, Wis.**
- OHIO Forge Co., 2186-2210 E. 65th St., Cleveland, O.**
(See page 587.)
- O. K. Tool Holder Co., Shelton, Conn.**
- OLIVER Iron & Steel Co., Pittsburg, Pa.**
- PAGE-STORMS Drop Forge Co., Chicopee, Mass.**
- PARK Drop Forge Co., Cleveland, O.**
(See page 169.)
- PORTLAND Foundry & Machine Co., Portland, Ind.**
- PROSSER & Son, Thomas, 15 Gold St., New York, N. Y. (Importers.) "Krupp."**
(See page 361.)
- QUEEN City Forging Co., Cincinnati, O.**
- REDMOND Engineering Co., Drexel Bldg Philadelphia, Pa.**
(See page 545.)
- REVERE Drop Forge Co., Revere, Mass.**
- RICHMOND Forging Corp. (Acca Station), Richmond, Va.**
- RIVETLESS Chain & Engineering Co. (Avon) Lebanon, Pa.**
- SCRANTON Forging Co., Green Ridge & Albright Sts., Scranton, Pa.**
- SEWARD & Son Co., M., Grant St., New Haven, Conn.**
- SMITH Co., A. O., Milwaukee, Wis.**
(See page 355.)
- SMITH & Co., H. D., Plantville, Conn.**
- STRIEBY & Foote Co., 301 Ogden St., Newark, N. J.**
- TRANSUE & Williams Co., Alliance, O.**
- UNION Drop Forge Co., 358 W. Indiana St., Chicago, Ill.**
- UNION Forging Co., Union, N. Y.**
(See page 119.)
- VAN Doren Mfg. Co., 17th & Arnold Sts., Chicago Heights, Ill.**
- WAVERLY Co., 139 S. East St., Indianapolis, Ind.**
- WESTERN Drop Forge Co., Marion, Ind.**
(See page 107.)
- WESTERN Malleable Steel Co., 1250 Jefferson Ave., W., Detroit, Mich.**
- WESTERN Tool & Forge Co., Brackenridge, Pa.**
- WHITMAN & Barnes Mfg. Co., Akron, O.**
- WILCOX, Critterden & Co., 83 Main St., Middletown, Conn.**

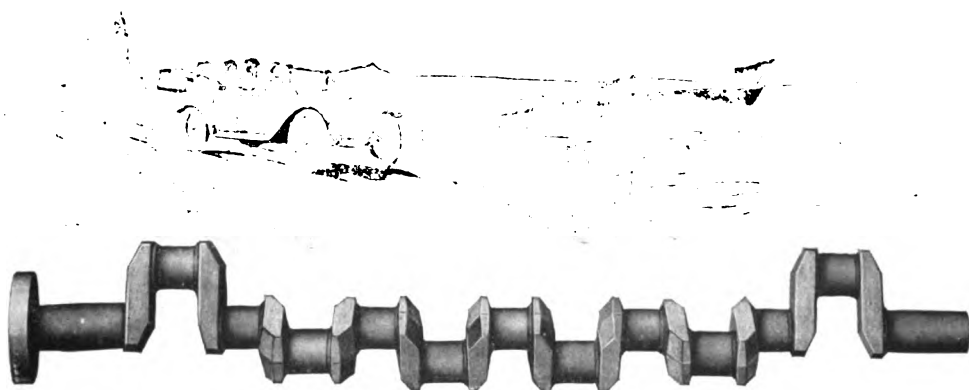
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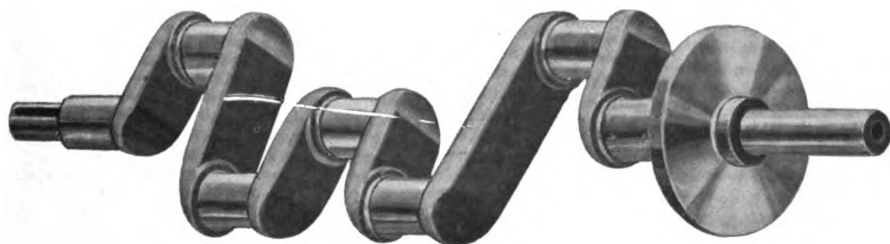
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 WILLIAMS & Co., J. H., 150 Hamilton Ave.,
 Brooklyn, N. Y.
 WRIGHT Wrench & Forging Co., 1424 Barth
 St., Canton, O.
 WYMAN & Gordon Co., Worcester, Mass.
 (See page 149.)

FRAMES

PRESSED STEEL FRAMES

- DETROIT Pressed Steel Co., 1800 Mt. El-
 liott Ave., Detroit, Mich. "Presteel."
 (See page 213.)
 DRIGGS - SEABURY Ordnance Corp.,
 Sharon, Pa.
 (See page 569.)
 HYDRAULIC Pressed Steel Co., Cleveland,
 O.
 (See inside back cover.)
 KINSEY Mfg. Co., Toledo, O.
 (See page 395.)
 KRUPP—See Prosser & Son.
 PARISH Mfg. Co., Reading, Pa.
 (See page 595.)
 PARISH & Bingham Co., Cleveland, O.
 (See page 171.)
 PRESTEEL—See Detroit Pressed Steel Co.
 PROSSER & Son, Thomas, 15 Gold St.,
 New York, N. Y. (Importers.) "Krupp."
 (See page 361.)
 SMITH Co., A. O., Milwaukee, Wis.
 (See page 355.)

FRICTIONS

FIBRE FRICTIONS

(For use in Friction Transmission)

- ROCKWOOD Mfg. Co., 1800 English Ave.,
 Indianapolis, Ind.

GALVANIZING

- AMERICAN Tube & Stamping Co., Bridge-
 port, Conn.
 BRIDGEPORT Electro Plate Co., 270 Kossuth
 St., Bridgeport, Conn.
 BUFFALO Galvanizing & Tinning Works, 49-
 53 Jackson St., Buffalo, N. Y.
 CLEVELAND Galvanizing Works Co., Cooper
 Ave. & P. R. R., Cleveland, O.
 CRAMP & Sons Ship & Engine Bldg. Co.,
 William, Philadelphia, Pa.
 (See page 251.)
 DANA Mfg. Co., Cincinnati, O.
 DOVER Stamping & Mfg. Co., 385 Putnam
 Ave., Cambridge, Mass.
 (See page 435.)
 GEUDER, Paeschke & Frey Co., 100 15th St.,
 Milwaukee, Wis.

GLOBE Machine & Stamping Co., Cleve-
 land, O.
 (See page 79.)

GRABLER Mfg. Co., Cleveland, O.

MALLEABLE Iron Fittings Co., Bran-
 ford, Conn.
 (See page 327.)

MEAKER Co., Fulton & Elizabeth Sts., Chi-
 cago, Ill.

NEW England Sherardizing Co., Hartford,
 Conn.

NEW Haven Sherardizing Co., State & Law-
 rence Sts., New Haven, Conn.

OHIO Sherardizing Co., Whitney Power Bldg.,
 Cleveland, O.

PROVIDENCE Autogenous Welding & Mfg
 Co., 291 Promenade St., Providence, R. I.

SCHUTZ Mfg. Co., 17 Fairview Ave., Pough-
 keepsie, N. Y.

SHERARDIZING Co. of Illinois, 567 W. Van
 Buren St., Chicago, Ill.

TOWER Mfg. Co., Madison, Ind.

UNION Elevator & Machine Co., 215-17 W
 Ontario St., Chicago, Ill.

U. S. Electro-Galvanizing Co., 1-9 Park Ave.,
 Brooklyn, N. Y.

VAIL Galvanizing Plant, 211 Commercial St.,
 Boston, Mass.

GAPS

SPARK GAPS

ACME—See Sheer Co.

CHAMPION Spark Plug Co., Dept. H., To-
 ledo, O. "Misskip."
 (See page 289.)

HERZ & Co., 295 Lafayette St., New York,
 N. Y. "Oscillum."
 (See page 269.)

MANVILLE, Geo. W., Towanda, Pa.

MEANS, Eugene D., Towanda, Pa.

MISSKIP—See Champion Spark Plug Co.

MOSLER & Co., A. R., New York, N. Y.
 (See page 287.)

OSCILLUM—See Herz & Co.

SHEER Co., H. M., Dept. 109, Quincy, Ill.
 "Acme."
 (See page 611.)

GARAGES

PORTABLE GARAGE BUILDINGS

ALADDIN—See North American Construction
 Co.

AMERICAN Portable House Co., Arcade
 Bldg., Seattle, Wash.

AMERICAN Sectional Garage Co., Detroit,
 Mich.

ANCHOR Corrugating Construction Co.,
 62 Cortlandt St., New York, N. Y.
 (See page 173.)

BERGER Mfg. Co., Canton, O.

BURNHAM-STANDEFORD Co., Washington
 & First Sts., Oakland, Cal.

CHESBRO-WHITMAN Co., 1167 First Ave.,
 New York, N. Y.

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DUCKER Co., 277 Broadway, New York, N. Y.
DULUTH Corrugating & Roofing Co., Duluth, Minn.
EDWARDS Mfg. Co., 724-74 Eggleston Ave., Cincinnati, O.
(See page 583.)
FARGO Cornice & Ornament Co., 1002-04 Front St. Fargo, N. Dak. "Rusk."
GORDON Mfg. Co., Middletown, O.
HARRY Steel Co., O. K., 2333-35 Papin St., St. Louis, Mo.
HODGSON Co., E. F., 116 Washington St., Boston, Mass.
IDEAL Sectional Building Co., St. Johns, Mich.
ILLINOIS Portable House Co., 6331-33 Evanston Ave., Chicago, Ill.
KARR Portable House Co., 2554 W. Irving Park Blvd., Chicago, Ill.
KENYON Co., R. L., Waukesha, Wis.
KNAPP Portable-Permanent Building Co., 111 Broadway, New York, N. Y.
MERSHON & Morley Co., Saginaw, Mich.
METAL Shelter Co., 3-23 W. Water St., St. Paul, Minn. "Pruden."
NILES Iron & Steel Roofing Co., Niles, O.
NORTH American Construction Co., Bay City, Mich. "Aladdin."
PINYOUN & Son, F. C., 2526 Carnegie Ave., Cleveland, O.
PORTABLE Construction Co., 50 Church St., New York, N. Y.
PRUDEN—See Metal Shelter Co.
RIVERSIDE Mfg. Co., 162-66 Riverside Ave., Newark, N. J.
ROGERS Co., J. S., Moorestown, N. J.
RUBY Mfg. Co., Jackson, Mich.
RUSK—See Fargo Cornice & Ornament Co.
ST. JOHNS Portable Building Co., 30 Church St., New York, N. Y.
SPRINGFIELD Mfg. Co., 801 Allen St., Springfield, Mass.
(See page 253.)
WYCKOFF Lumber & Mfg. Co., Ithaca, N. Y. "Cornell."

GASKETS

METALLIC GASKETS

(For Asbestos, Composition or Rubber Gaskets—
See Packing)

AKRON Metallic Gasket Co., 274 Park St., Akron, O.
BETTCHEE Mfg. Co., Cleveland, O.
DETROIT Radiator Co., Detroit, Mich.
FITZGERALD Mfg. Co., Torrington, Conn.
(See page 551.)

GASKET Supply Co., 1729 Ludlow St., Philadelphia, Pa. "Right."
GOODWIN & Kintz Co., Winsted, Conn.
HERZ & Co., 295 Lafayette St., New York, N. Y. (Importers.)
(See page 269.)
KINSEY Mfg. Co., Toledo, O. "Kinwood."
(See page 395.)
KINWOOD—See Kinsey Mfg. Co.
McCORD Mfg. Co., Detroit, Mich. "McKim."
(See pages 310 and 311.)
McKIM—See McCord Mfg. Co.
MICHIGAN Stamping Co., 759-71 Bellevue Ave., Detroit, Mich.
RIGHT—See Gasket Supply Co.
UNITED States Indestructible Gasket Co., 50 Church St., New York, N. Y.
VICTOR Mfg. & Gasket Co., Troy & 21st Sts., Chicago, Ill.

GASOLINE

AUTOMOBILE GASOLINE

BUCK & Co., E. A., Worcester, Mass. "Powers."
CREW Levick Co., Land Title Bldg., Philadelphia, Pa.
(See page 187.)
ENERGINE Refining & Mfg. Co., Cleveland, O.
(See page 191.)
GULF Refining Co., Frick Bldg. Annex, Pittsburgh, Pa.
PETROLEUM Products Co., 3600-10 Grant Blvd., Pittsburgh, Pa. "Vigorite."
(See page 191.)
POWERS—See Buck & Co.
STANDARD Oil Co. of N. Y., New York, N. Y.
TEXACO—See Texas Co.
TEXAS Co., New York, N. Y. "Texaco."
(See page 461.)
VIGORITE—See Petroleum Products Co.
WAVERLY Oil Works Co., 54th St. & A. V. R. R., Pittsburgh, Pa.

GATES

AUTOMATIC DRIVEWAY GATES

BYERLY—See Cargill Mfg. Co.
CARGILL Mfg. Co., West End of Buttles Ave., Columbus, O. "Byerly."
MANLOVE Gate Co., 17 W. Huron St., Chicago, Ill.

GAUGES

BATTERY GAUGES

(Pocket Battery Testers. For Standard Instruments—
See Ammeters)
ADVANCE—See Eldredge Electric Mfg. Co.
AMERICAN Coll Co., Foxboro, Mass.
AMERICAN Ever Ready Co., 316 Hudson St., New York, N. Y. "Ever Ready."

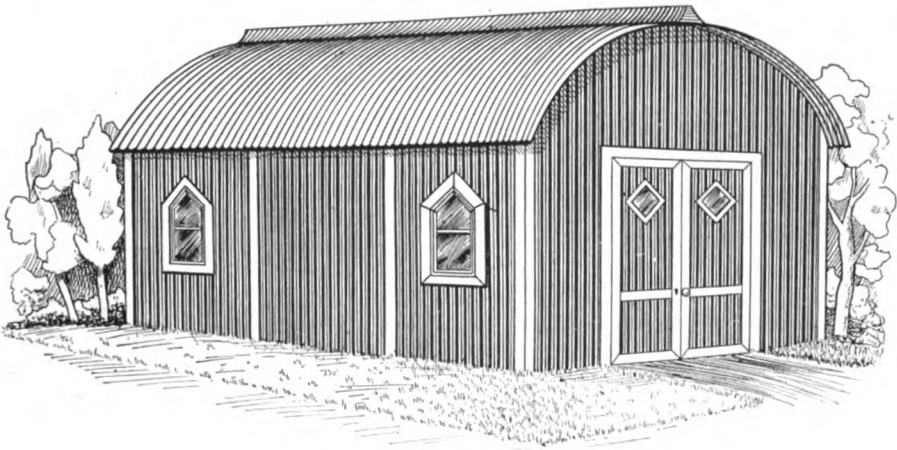
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BATTERY GAUGES (Continued)

ATWATER Kent Mfg. Works, 4937 Sten-ton Ave., Philadelphia, Pa.
(See page 495.)

B. & R.—See Beckley-Ralston Co.

BECKLEY-RALSTON Co., Michigan Ave. & Randolph St., Chicago, Ill. "B. & R."

CONNECTICUT Telephone & Electric Co., 34 Britannia St., Meriden, Conn.

DOW Mfg. Co., 131 Adams St., Braintree, Mass.

ECLIPSE—See Eldredge Electric Mfg. Co.

ELDRIDGE Electric Mfg. Co., 7 Post Office Sq., Springfield, Mass. "Advance," "Eclipse," "Express."

ELITE—See Manhattan Electrical Supply Co.

EVER READY—See American Ever Ready Co.

EXCEL Instrument Co., 1555 E. 65th St., Cleveland, O.

EXPRESS—See Eldredge Electric Mfg. Co.

HANDY—See Roller-Smith Co.

HOYT Electrical Instrument Works, Penacook, N. H. "Triune," "Ultimate."
(See page 543.)

MANHATTAN Electrical Supply Co., 17 Park Pl., New York, N. Y. "Elite."

PENNSYLVANIA Rubber & Supply Co., 1845-47 Euclid Ave., Cleveland, O. "Prsco."

PIGNOLET, Louis M., 78 Cortlandt St., New York, N. Y.

PRSCO—See Pennsylvania Rubber & Supply Co.

READRITE Meter Works, 22 Main St., Bluffton, O.

RELIANCE Instrument Co., 1135 Van Buren St., Chicago, Ill.

ROBERT Instrument Co., 56 Shelby St., Detroit, Mich.

ROLLER-SMITH Co., 203-05 Broadway, New York, N. Y. "Handy."

STACKPOLE Carbon Co., St. Marys, Pa.
(See page 593.)

STERLING Mfg. Co., American Trust Bldg., Cleveland, O.

TRIUNE—See Hoyt Electrical Instrument Works.

TROY Electrical Co., River & State Sts., Troy, N. Y.

ULTIMATE—See Hoyt Electrical Instrument Works.

WAGNER Electric Mfg. Co., 6400 Plymouth Ave., St. Louis, Mo.

BOILER WATER-LINE GAUGES

(For indicating height of water in steam boilers)

ASHTON Valve Co., 271 Franklin St., Boston, Mass.

JERGUSON Mfg. Co., 10 Post Office Sq., Boston, Mass.

RELIABLE Water Gauge Co., 1616 Pine St., St. Louis, Mo.

SCHAEFFER & Budenberg Mfg. Co., 481 De Kalb Ave., Brooklyn, N. Y.

STANDARD Gauge Mfg. Co., Foxboro, Mass.

CYLINDER COMPRESSION GAUGES

(For testing compression in gas engine cylinders)

AZADIAN Gauge Mfg. Co., Syracuse, N. Y.
(See page 175.)

BROWN Co., Bellevue & Chester Sts., Syracuse, N. Y.

EDELMANN & Co., E., 225 W. Illinois St., Chicago, Ill.
(See page 175.)

STANDARD Gauge Mfg. Co., Foxboro, Mass.

GASOLINE TANK GAUGES

(For indicating amount of gasoline in fuel tanks)

ALERT—See Bob-Smith Co.

BOB-SMITH Co., Detroit, Mich. "Alert."

BOSTON Auto Gage Co., 10 Waltham St., Boston, Mass. "Triumph," "Tankoscope."

BUSH Mfg. Co., Hartford, Conn.
(See page 345.)

DEPENDO—See Roper & Co.

E-Z-2-C—See National Motor Supply Co.

EUREKA Gauge Co., Majestic Bldg., Detroit, Mich.

FREER—See Tanner Gauge Co.

GASIG Mfg. Co., 335 Columbia St., Utica, N. Y.

GOODNOW Mfg. Co., Old South Bldg., Boston, Mass.

HANCOCK Mfg. Co., 770 Henry St., Charlotte, Mich.

HANS Motor Equipment Co., La Crosse, Wis.

IMPERIAL Fluid Gauge Co., Canton, O.

JOHNSTON, J. E., Ardmore, Pa.

JONES Speedometer Co., New Rochelle, N. Y.

KANT-STIK—See National Motor Supply Co.

LIPMAN Mfg. Co., 211 Pleasant St., Beloit, Wis.

NATIONAL Motor Supply Co., 1911 Euclid Ave., Cleveland, O. "Kant-Stik," "E-Z-2-C."

PFAHL Gauge & Mfg. Co., 26-28 Peterson Pl., Akron, O.

RANDALL-FAICHNEY Co., Boston, Mass.
"Webster."
(See page 463.)

ROPER & Co., C. F., Hopedale, Mass.
"Dependo."
(See page 347.)

TANKOSCOPE—See Boston Auto Gage Co.

TANNER Gauge Co., Akron, O. "Freer."

TRIUMPH—See Boston Auto Gage Co.

WEBSTER—See Randall-Faichney Co.

STEAM AND AIR GAUGES

(Standard Pressure Gauges)

AMERICAN Steam Gauge & Valve Mfg. Co., 203 Camden St., Boston, Mass.

AZADIAN Gauge Mfg. Co., Syracuse, N. Y.
(See page 175.)

BELFIELD Co., H., 435 N. Broad St., Philadelphia, Pa.

CLEVELAND Steam Gauge Co., 418 W. Prospect Ave., Cleveland, O.

Everyone Knows and Buys High Grade
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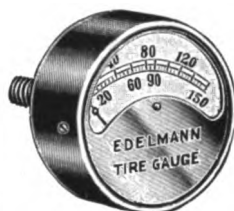
No. 1. Tire Tester



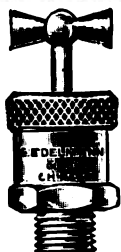
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No. 3. Tire Pump Gauge

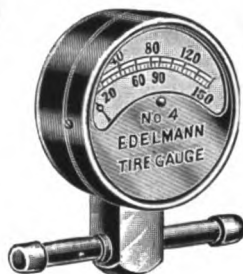


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- IMPROVED Gage Mfg. Co., 302 W. Water St., Syracuse, N. Y.
 MARSH & Co., Jas. P., 321-23 W. Washington St., Chicago, Ill.
 SCHAEFFER & Budenberg Mfg. Co., 481 De Kalb Ave., Brooklyn, N. Y.
 STANDARD Gauge Mfg. Co., Foxboro, Mass.
 STAR Brass Mfg. Co., 108-14 E. Dedham St., Boston, Mass.
 UNITED States Gauge Co., 67 Wall St., New York, N. Y.

TIRE PRESSURE GAUGES

(For indicating pressure in tires—See also Valves, Tire Safety)

- ADVANCE Specialty Co., I Shinola Bldg., Rochester, N. Y. "Staon."
 (See page 343.)
 ALLEN Auto Specialty Co., 1926 Broadway, New York, N. Y. "Tyrometer."
 (See page 145.)
 APT Tire Gauge Co., 110 E. Seventh St., Kansas City, Mo.
 AZADIAN Gauge Mfg. Co., Syracuse, N. Y.
 (See page 175.)
 BROWN Co., Bellevue & Chester Sts., Syracuse, N. Y.
 CODMAN & Shurtleff, 120 Boylston St., Boston, Mass.
 ECONOMY—See Edelmänn & Co.
 EDELMANN & Co., E., 225 W. Illinois St., Chicago, Ill. "Economy."
 (See page 175.)
 HONEST—See National Motor Supply Co.
 IMPROVED Gage Mfg. Co., 302 W. Water St., Syracuse, N. Y.
 INVINCIBLE—See United States Gauge Co.
 JUDD & Leland Mfg. Co., Clifton Springs, N. Y. "Washburn."
 (See pages 197 and 543.)
 KELLOGG Mfg. Co., 104 Circle St., Rochester, N. Y. "National."
 (See page 325.)
 LITTLE GEM—See Mayo Mfg. Co.
 MAYO Mfg. Co., 54 E. 18th St., Chicago, Ill. "Little Gem."
 NATIONAL—See Kellogg Mfg. Co.
 NATIONAL Motor Supply Co., 1911 Euclid Ave., Cleveland, O. "Honest."
 SCHRAEDER'S Son, A., 28 Rose St., New York, N. Y.
 (See page 135.)
 STANDARD Gauge Mfg. Co., Foxboro, Mass.
 STAON—See Advance Specialty Co.
 STEVENS & Co., 375 Broadway, New York, N. Y.
 (See page 599.)
 STEVENS Mfg. & Supply Co., 1223-27 Wabash Ave., Chicago, Ill.
 TWITCHELL Gauge Co., 1208 Michigan Ave., Chicago, Ill.
 (See page 177.)
 TYROMETER—See Allen Auto Specialty Co.

UNITED States Gauge Co., 67 Wall St., New York, N. Y. "Invincible."

WASHBURN—See Judd & Leland Mfg. Co.

WATER CIRCULATION GAUGES

(For indicating pressure in water cooling systems)

- AZADIAN Gauge Mfg. Co., Syracuse, N. Y.
 (See page 175.)
 BROWN Co., Bellevue & Chester Sts., Syracuse, N. Y.
 IMPROVED Gage Mfg. Co., 302 W. Water St., Syracuse, N. Y.
 SCHAEFFER & Budenberg Mfg. Co., 481 De Kalb Ave., Brooklyn, N. Y.
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(See Gloves, Motorists)

GEARS

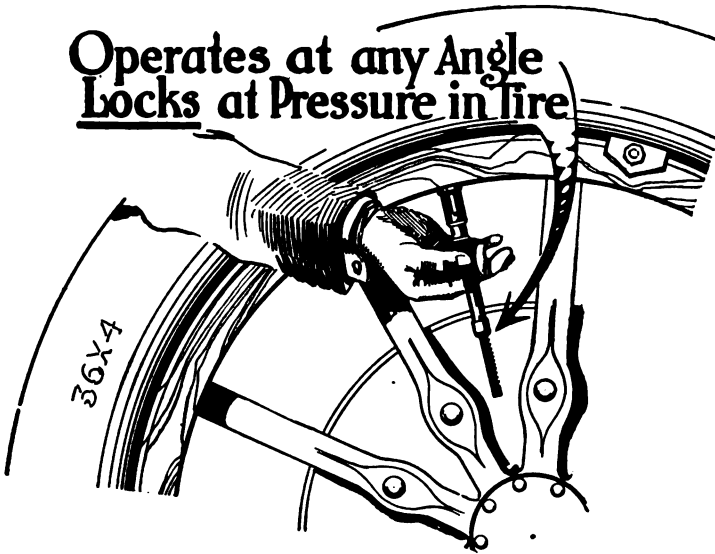
DIFFERENTIAL GEARS

- BARNES Gear Co., Oswego, N. Y.
 BOSTON Gear Works, Norfolk Downs, Mass.
 (See page 369.)
 BROWN-LIPE-CHAPIN Gear Co., Syracuse, N. Y.
 (See page 569.)
 BROWN & Sharpe Mfg. Co., Promenade St., Providence, R. I.
 CROSS Gear & Engine Co., Detroit, Mich.
 (See page 199.)
 CULLMAN Wheel Co., 1352 Greenwood
 (See page 283.)
 FLANDERS Mfg. Co., Pontiac, Mich. "Vulcan."
 FROST Gear & Machine Co., Jackson, Mich.
 (See page 193.)
 GRANT-LEES Machine Co., 2368 69th St., Cleveland, O.
 (See page 183.)
 METAL Products Co., Detroit, Mich.
 (See page 91.)
 MUNCIE Gear Works, Muncie, Ind.
 (See page 603.)
 NEW Process Gear Corp., Syracuse, N. Y.
 (See page 185.)
 PROVIDENCE Engineering Works, Providence, R. I.
 ROSS Gear & Tool Co., 949 Main St., Lafayette, Ind.
 (See page 179.)
 RUSSEL Motor Axle Co., North Detroit, Mich.
 (See page 49.)
 RUSSEL Wheel & Foundry Co., Detroit, Mich.
 VULCAN—See Flanders Mfg. Co.
 WARNER Gear Co., Muncie, Ind.
 (See page 125.)
 WARNER Mfg. Co., Toledo, O.
 (See page 231.)
 WAYNE Auto Axle Co., Fort Wayne, Ind.
 (See page 603.)

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Operates at any Angle
Locks at Pressure in Tire



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 DART Mfg. Co., Dept. T. D., Waterloo, Ia. (See page 41.)
 DETROIT Motor Chassis Co., 960 Champlain St., Detroit, Mich.
 DODGE Bros., 1678-1724 Jos. Campau Ave., Detroit, Mich.
 FRANKLIN Machine Co., 770 Franklin Ave., Brooklyn, N. Y.
 GARFORD Co., Elyria, O.
 GREENVILLE Metal Products Co., Greenville, Pa.

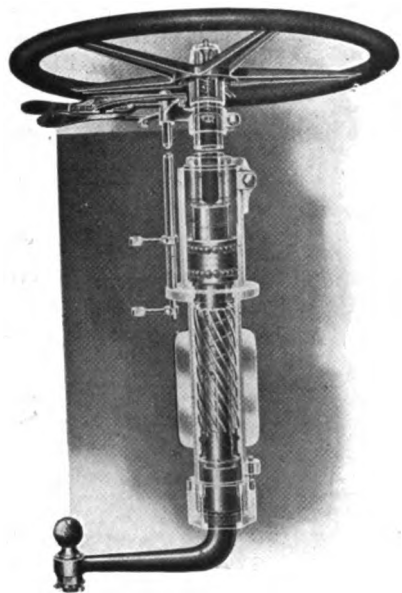
STEERING GEARS

- ADVANCE Power Co., 517 Aldine Pl., Chicago, Ill.
 AMERICAN Gear & Mfg. Co., Jackson, Mich.
 BARNES Gear Co., Oswego, N. Y.
 BAYARD & Co., M. L., Woodbine, N. J. "Hindley."
 BOSTON Gear Works, Norfolk Downs, Mass. (See page 369.)
 BOYER-MILLER Co., Boyer Bldg., Detroit, Mich.
 BROWN & Sharpe Mfg. Co., Promenade St., Providence, R. I.
 CONTINENTAL Engine Co., 1146 Michigan Ave., Chicago, Ill.
 CROSS Gear & Engine Co., Detroit, Mich. (See page 199.)
 FLANDERS Mfg. Co., Pontiac, Mich.
 FOSTER Gear Co., Columbus, O.
 GEMMER Mfg. Co., Detroit, Mich. (See page 571.)
 GRAEF-ARTHUR Engineering Co., Mt. Elliott & Gratiot Aves., Detroit, Mich.
 GRANT-LEES Machine Co., 2368 69th St., Cleveland, O. (See page 183.)
 HINDLEY—See Bayard & Co.
 JACKSON-CHURCH-WILCOX Co., Saginaw, W. S., Mich. "Jacox." (See page 603.)
 JACOX—See Jackson-Church-Wilcox Co.
 JOHNSON Service Co., 149-53 Michigan St., Milwaukee, Wis.
 LAVIGNE Gear Co., Station A., Racine, Wis. (See page 181.)
 ROSS Gear & Tool Co., 940 Main St., Lafayette, Ind. (See page 179.)
 S. & W.—See Schweppe & Wilt Mfg. Co.
 SCHWEPPE & Wilt Mfg. Co., Champlain St. & Meldrum Ave., Detroit, Mich. "S. & W."
 SUPERIOR Machine & Engineering Co., 51-53 Fort St., E., Detroit, Mich.
 TRIO Mfg. Co., 1206 Bellevue Ave., Detroit, Mich.

- UNIVERSAL Mfg. Co., Racine, Wis.
 WARNER Co., T. W., Kilgore & Perkins Aves., Muncie, Ind.
 WARNER Gear Co., Muncie, Ind. (See page 125.)
 WARNER Mfg. Co., Toledo, O. (See page 231.)
 WILCOX-McKIM Co., Saginaw, Mich. (See page 181.)

TRANSMISSION GEARS

- ADVANCE Power Co., 517 Aldine Pl., Chicago, Ill.
 ALLXANDER & Cox Co., Ogden & Western Aves., Chicago, Ill.
 ANDERSON Motor Co., 50 W. 16th St., Anderson, Ind.
 AUTO Parts Mfg. Co., Dept. 11, Detroit, Mich. (See page 609.)
 AUTO Parts Mfg. Co., 620-30 S. Elliot St., Muncie, Ind. "B. T. K." (See page 371.)
 B.T.K.—See Auto Parts Mfg. Co.
 BALL—See New York Gear Works.
 BARNES Gear Co., Oswego, N. Y.
 BOSTON Gear Works, Norfolk Downs, Mass. (See page 369.)
 BRENNAN Motor Co., 105 Grape St., Syracuse, N. Y. (See page 485.)
 BROWN-LIPE-CHAPIN Gear Co., Syracuse, N. Y. (See page 569.)
 BROWN & Sharpe Mfg. Co., Promenade St., Providence, R. I.
 BROWNELL Motor Co., F. A., Driving Park Ave. & Wren St., Rochester, N. Y.
 BUDA Co., Harvey, Ill. (See page 263.)
 CAMPBELL—See Economy Equipping Co.
 CLIMAX Electric Works, New Salem, Mass.
 CONTINENTAL Engine Co., 1146 Michigan Ave., Chicago, Ill.
 COTTA Gear Co., Ninth St. & 19th Ave., Rockford, Ill.
 COTTA Transmission Co., 814 S. Main St., Rockford, Ill. (See page 183.)
 COVERT Motor Vehicle Co., Lockport, N. Y. (See page 577.)
 CROSS Gear & Engine Co., Detroit, Mich. (See page 199.)
 DART Mfg. Co., Dept. T. D., Waterloo, Ia. (See page 41.)
 DETROIT Gear & Machine Co., 127-51 Franklin St., Detroit, Mich.
 DODGE Bros., 1678-1724 Jos. Campau Ave., Detroit, Mich.
 DRIGGS - SEABURY Ordnance Corp., Sharon, Pa. (See page 569.)
 ECONOMY Equipping Co., Unity Bldg., Chicago, Ill. "Campbell."
 FLANDERS Mfg. Co., Pontiac, Mich.
 FRANKLIN Machine Co., 770 Franklin Ave., Brooklyn, N. Y.



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(See page 193.)
- FULLER & Sons Mfg. Co., Kalamazoo, Mich.**
- GRANT-LEES Machine Co., 2368 69th St., Cleveland, O.**
(See page 183.)
- JAMESVILLE Mfg. Co., Jamesville, N. Y.**
- JOHNSON Service Co., 149-53 Michigan St., Milwaukee, Wis.**
- LEFEVER Arms Co., 1 Maltbie St., Syracuse, N. Y.**
- LIGGETT Spring & Axle Co., Park Bldg., Pittsburgh, Pa.**
(See page 200.)
- MECHANICS Machine Co., Ninth St. & 19th Ave., Rockford, Ill.**
- MILWAUKEE Motor Co., 32d & Burleigh Sts., Milwaukee, Wis.**
- MODEL Gas Engine Works, Peru, Ind.**
(See page 507.)
- MUNCIE Gear Works, Muncie, Ind.**
(See page 603.)
- NEW York Gear Works, Greenpoint Ave. & West St., Brooklyn, N. Y. "Ball."**
(See page 603.)
- NORTHWAY Motor & Mfg. Co., 510-14 Maybury Grand Ave., Detroit, Mich.**
- PARKER Transmission & Appliance Co., Fulton, N. Y.**
- PROVIDENCE Engineering Works, Providence, R. I.**
- SEITZ Automobile & Transmission Co., 225-27 Beecher Ave., Detroit, Mich.**
- SMITH Co., A. O., Milwaukee, Wis.**
(See page 355.)
- SUPERIOR Machine Tool Co., Kokomo, Ind.**
- SUPERIOR Machine & Engineering Co., 51-53 Fort St., E., Detroit, Mich.**
- SYRACUSE Gear Co., 103 Grape St., Syracuse, N. Y.**
- TURLEY Gear & Machine Co., 1505-11 N. Tenth St., St. Louis, Mo.**
- WABASH Gear Works, Tenth & Farrington Sts., Terre Haute, Ind.**
- WARNER Co., T. W., Kilgore & Perkins Aves., Muncie, Ind.**
- WARNER Gear Co., Muncie, Ind.**
(See page 125.)
- WARNER Mfg. Co., Toledo, O.**
(See page 231.)
- WAUKESHA Motor Co., Waukesha, Wis.**
(See page 257.)
- YUSTER Axle & Transmission Co. of America, South Bend, Ind.**

BLANK GEARS

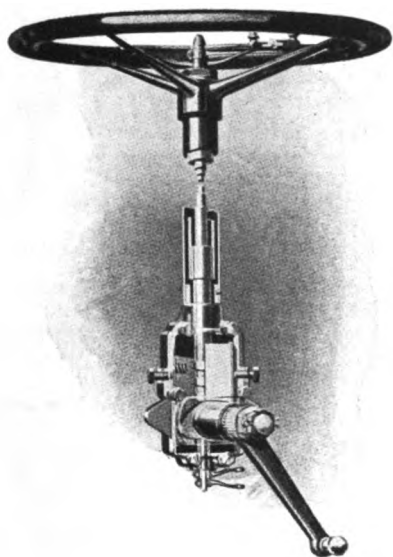
(See also Forgings; also Castings)

- AMERICAN & British Mfg. Co., 718 Crescent Ave., Bridgeport, Conn.**
- ANDERSON Forge & Machine Co., Detroit, Mich.**
(See page 315.)
- ASHLEY Machine Works, 724 University Ave., Rochester, N. Y.**
(See page 237.)

- BILLINGS & Spencer Co., Hartford, Conn.**
- BLAKESLEE Forging Co., Plantsville, Conn.**
- BULTMAN Co., F. H., 2103 Superior Viaduct, Cleveland, O.**
- CLEVELAND Hardware Co., Cleveland, O.**
- COLUMBUS Forge & Iron Co., Columbus, O.**
- DETROIT Screw Works, Detroit, Mich.**
(See page 653.)
- DRIGGS - SEABURY Ordnance Corp., Sharon, Pa.**
(See page 569.)
- ELLIOTT, H. A., Majestic Bldg., Detroit, Mich. (Importer.)**
- GANSCHOW Co., Wm., 1001-05 Washington Blvd., Chicago, Ill.**
(See page 589.)
- GENERAL Drop Forge Co., 1740 Elmwood Ave., Buffalo, N. Y.**
(See page 565.)
- GILL & Sons Forge & Machine Works, P. H., Lorraine & Otsego Sts., Brooklyn, N. Y.**
(See page 507.)
- GRANT-LEES Machine Co., 2368 69th St., Cleveland, O.**
(See page 183.)
- HARTFORD Machine Screw Co., Hartford, Conn.**
(See page 285.)
- JOLIET Forge Co., Joliet, Ill.**
- KROPP Forge Co., 2510 W. 21st St., Chicago, Ill.**
- KRUPP—See Prosser & Son.**
- McINNES Steel Co., Corry, Pa.**
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- OEBENBERGER Drop Forge Co., 220 Lake St., Milwaukee, Wis.**
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(See page 361.)
- REESE Machine & Tool Works, S., 224-30 W. Main St., Plymouth, Pa.**
- U. S. Automatic Co., Amherst, O.**
- WESTERN Automatic Machine Screw Co., 750 Lake Ave., Elyria, O.**
(See page 331.)

METAL GEARS AND PINIONS

- ADAMS Co., Dubuque, Ia.**
- ALBAUGH-DOVER Co., 2100 Marshall Blvd., Chicago, Ill.**
(See page 659.)
- ALEXANDER & Cox Co., Ogden & Western Aves., Chicago, Ill.**
- ANDERSON Rolled Gear Co., Berea Rd. & L. S. & M. S. R. R., Cleveland, O.**
- ARTHUR Co., 188 Front St., New York, N. Y.**
- BEHRENDT, H. F., 22 Green St., Newark, N. J.**
- BILGRAM Machine Works, 1235 Spring Garden St., Philadelphia, Pa.**
- BOSTON Gear Works, Norfolk Downs, Mass.**
(See page 369.)
- BULTMAN Co., F. H., 2103 Superior Viaduct, Cleveland, O.**
- CINCINNATI Gear Co., Ninth St. & Broadway, Cincinnati, O.**
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(See page 199.)

CURRIE & Son, J. B., 72 Adams St., Brooklyn, N. Y.

DETROIT Gear & Machine Co., 127-51 Franklin St., Detroit, Mich.

DRIGGS - SEABURY Ordnance Corp., Sharon, Pa.
(See page 569.)

EARLE Gear & Machine Co. (Germantown), Philadelphia, Pa.

FLANDERS Mfg. Co., Pontiac, Mich. "Vulcan."

FOOTE Bros. Gear & Machine Co., Chicago, Ill.
(See page 663.)

FROST Gear & Machine Co., Jackson, Mich.
(See page 193.)

GANSCHOW Co., Wm., 1001-05 Washington Blvd., Chicago, Ill.
(See page 589.)

GEAR Grinding Machine Co., Chene St. & Boulevard, Detroit, Mich.

GLEASON Works, 1100 University Ave., Rochester, N. Y.

GOULD & Eberhardt, N. J. R. R. Ave. & Green St., Newark, N. J.

GRANT Gear Works, 6 Portland St., Boston, Mass.

GRANT-LEES Machine Co., 2368 69th St., Cleveland, O.
(See page 183.)

HAWTHORNE Mfg. Co., 38 Spruce St., Bridgeport, Conn.
(See page 459.)

HOUPERT Machine Co., 351-55 W. 52d St., New York, N. Y.

KRUPP—See Prosser & Son.

MEISEL Press Mfg. Co., 944-48 Dorchester Ave., Boston, Mass.

MUNCIE Gear Works, Muncie, Ind.
(See page 603.)

NEW England Gear Works, 100 Purchase St., Boston, Mass.

NEW Process Gear Corp., Syracuse, N. Y.
(See page 185.)

NEWARK Gear Cutting Machine Co., 69 Prospect St., Newark, N. J.

NILSON-MILLER Co., 13th & Hudson Sts., Hoboken, N. J.

NORTHERN Engineering Works, 2 Chene St., Detroit, Mich.

NUTTALL Co., R. D., McCandless St. & Harrison Ave., Pittsburg, Pa.

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PHILADELPHIA Gear Works, 1120 Vine St., Philadelphia, Pa.

PROSSER & Son, Thomas, 15 Gold St., New York, N. Y. (Importers.) "Krupp."
(See page 361.)

ROSS Gear & Tool Co., 949 Main St., Lafayette, Ind.
(See page 179.)

ROSS Machine Co., 208 S. Fourth St., La Fayette, Ind.

RUSSEL Wheel & Foundry Co., Detroit, Mich.

SAWYER Gear Works, 227 St. Clair St., Cleveland, O.

SIER-BATH Co., 143 W. 54th St., New York, N. Y.
(See page 183.)

SOUTH Park Mfg. Co., Port Huron, Mich.

SPACKE Machine Co., F. W., Indianapolis, Ind.
(See page 241.)

SYRACUSE Rawhide Mfg. Co., Niagara & Shonnard Sts., Syracuse, N. Y.

T. C. M. Mfg. Co., Hunterdon & First Sts., Harrison, N. J.

THROOP Perforating Co., 80 Terrace, Buffalo, N. Y.

TURLEY Gear & Machine Co., 1505-11 N. Tenth St., St. Louis, Mo.

VAN Dora & Dutton Co., Cleveland, O.
(See page 471.)

VULCAN—See Flanders Mfg. Co.

WABASH Gear Works, Tenth & Farrington Sts., Terre Haute, Ind.

WARNER Gear Co., Muncie, Ind.
(See page 125.)

WOBURN Gear Works, 32 Nashua St., Woburn, Mass.

WORCESTER Gear Works, 31 N. Foster St., Worcester, Mass.

RAWHIDE GEARS AND PINIONS

BOSTON Gear Works, Norfolk Downs, Mass.
(See page 369.)

CHICAGO Rawhide Mfg. Co., 1301 Elston Ave., Chicago, Ill.

FLANDERS Mfg. Co., Pontiac, Mich.

FROST Gear & Machine Co., Jackson, Mich.
(See page 193.)

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(See page 589.)

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NEW England Gear Works, 100 Purchase St., Boston, Mass.

NEW Process Gear Corp., Syracuse, N. Y.
(See page 185.)

NUTTALL Co., R. D., McCandless St. & Harrison Ave., Pittsburg, Pa.

PHILADELPHIA Gear Works, 1120 Vine St., Philadelphia, Pa.

SIER-BATH Co., 143 W. 54th St., New York, N. Y.
(See page 183.)

SYRACUSE Rawhide Mfg. Co., Niagara & Shonnard Sts., Syracuse, N. Y.

WOBURN Gear Works, 32 Nashua St., Woburn, Mass.

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(See page 221.)



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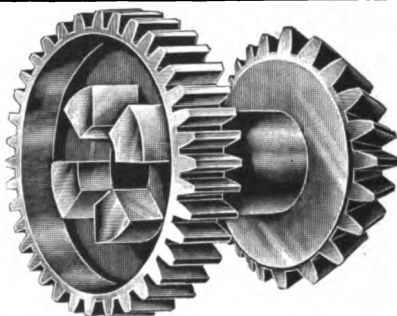
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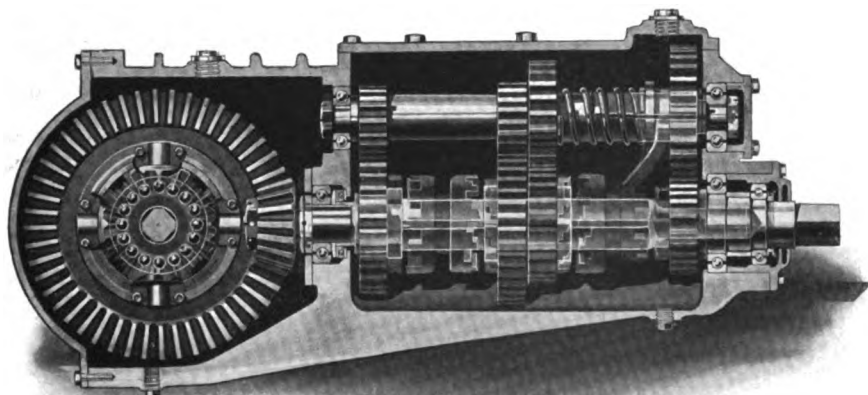
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(See page 223.)

GRAY & Davis, 55 Lansdowne St., Boston, Mass.
(See page 159.)

HANDY—See Dietz Co.

HAUCK-SEEBACH Co., 291-95 Essex St., Brooklyn, N. Y.

HAWTHORNE Mfg. Co., 38 Spruce St., Bridgeport, Conn. "Old Sol."
(See page 459.)

HINE-WATT Mfg. Co., 180 N. Market St., Chicago, Ill. "Columbia."

HOFACKER Mfg. Co., 553-55 W. 42d St., New York, N. Y.

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PRESSURE Light Co., Wichita, Kans.

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RUSHMORE Dynamo Works, Plainfield, N. J.
(See page 221.)

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STERLING Machine & Stamping Co., Welling-ton, O.

SUPERIOR Lamp Mfg. Co., 2422 First Ave., New York, N. Y.

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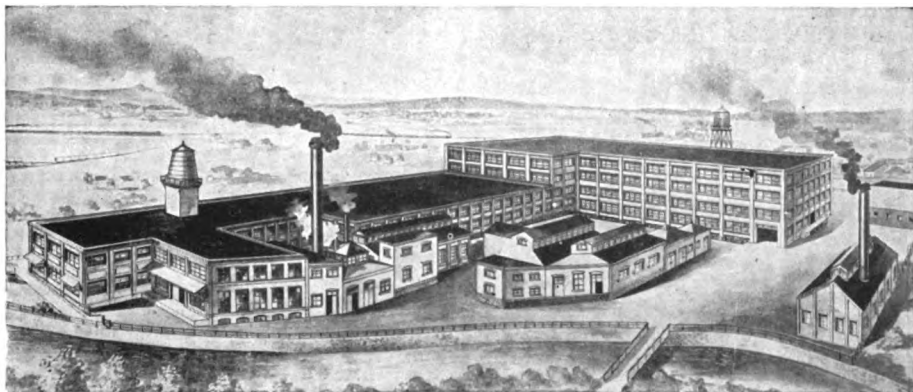
MORAWETZ Co., 217-25 E. Water St., Milwaukee, Wis.

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(See page 187.)

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 (See page 187.)

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(See page 465.)
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- BORNE, Scrymser Co., 80 South St., New York, N. Y. "Colo," "Sillex."
(See page 265.)
- BUCK & Co., E. A., Worcester, Mass.
- BULLY—See New York Oil & Grease Co.
- CAROLINE—See Valley Oil Co.
- CATARACT Refining & Mfg. Co., Mutual Life Bldg., Buffalo, N. Y.
- CENTURY—See Zartman Oil Co.
- CLARKSON & Ford Co., 55 Water St., New York, N. Y. "Banner."
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- CLINTON Oil Co., Cleveland, O. "Red Star."
- COLO—See Borne, Scrymser Co.
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- CONNECTICUT Oil Co., 549 S. Leonard St., Waterbury, Conn.
- CONSOLIDATED Lubricants Co., 551 W. 42d St., New York, N. Y. "Right."
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- CROWN—See Kellogg & Co.
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- DETROIT—See Zurn Co.
- DIAMOND CROSS—See Auto Oil Co.
- DIXON Crucible Co., Joseph, Jersey City, N. J.
(See page 187.)
- DRAKE Oil Co., 99 Spring St., Titusville, Pa.
- E-Z-WAY—See Bliven & Carrington.
- EAGLE Oil & Supply Co., Boston, Mass.
"Eagleline."
(See page 503.)
- EAGLEINE—See Eagle Oil & Supply Co.
- EMCO—See Emery Mfg. Co.
- EMERY Mfg. Co., Bradford, Pa. "Emco."
- EMERY Pneumatic Lubricator Co., 1932 N. Broadway, St. Louis, Mo.
- EMPIRE—See Richardson Lubricating Co.
- ENERGINE Refining & Mfg. Co., Cleveland, O.
(See page 191.)
- ENSIGN Refining Co., 10605 Quebec Ave., Cleveland, O.
- ENTERPRISE Oil Co., Buffalo, N. Y.
- EUREKA—See Crane & Co.
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- FRANKLIN Refining Co., 3027 Locust St., St. Louis, Mo.
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- GRETAG—See Acheson Oildag Co.
- GREOIL—See Robinson & Son Co.
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(See page 180.)
- HARRIS & Co., Elmer E., 2 Maurice St., Buffalo, N. Y.
- HARRISON Agalite Lubricating Co. Syracuse, N. Y.
(See page 191.)
- HAVOLINE Oil Co., 17 Battery Pl., New York, N. Y.
- HAVOLINE—See Indian Refining Co.
- HAWKEYE Oil Co., Waterloo, Ia. "Faultless."
- HAWS, George A., 62 Pine St., New York, N. Y. "Panhard."
(See page 267.)
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- KILNOYS—See Miller Co.
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- MICAFLAKE—See U. S. Mica Mfg. Co.
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Complete Index to Classification appears on Pages 8 to 23.

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- MILLS Oil Co., C. E., 263 Walton St., Syracuse, N. Y.
- MONARCH Mfg. Co., Council Bluffs, Iowa. "Gold Medal."
- MONOGRAM—See Columbia Lubricants Co.
- MOORE Oil Co., York St. & McLean Ave., Cincinnati, O. "Lion."
- MORRIS & Co., Richard S., Chicago, Ill.
- MOTOLINE—See Houghton & Co.
- MOTORLIGHT—See Petroleum Coke Co.
- MOTORLUBE—See Tygert Co.
- NATIONAL Refining Co., Rose Bldg., Cleveland, O.
- NARRAGANSETT Chemical Co., Providence, R. I. "Meteor."
- NATIONAL Lubricating Co., Prospect Bldg., Cleveland, O.
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- NEW York Oil & Grease Co., 128 Maiden Lane, New York. "Bully."
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- NOBETR—See Sawyer Oil Co.
- NOBLE Refining Co., 706 Canal Rd., Cleveland, O.
- NON-FLUID—See New York & New Jersey Lubricant Co.
- NORTHWESTERN Chemical Co., Marietta, O. (See page 115.)
- OIL City Oil & Grease Co., Oil City Trust Bldg., Oil City, Pa. "Imperial."
- OILZUM—See White & Bagley Co.
- OTTOMO—See Pioneer Mfg. Co.
- OWL—See Western Chemical Mfg. Co.
- PANAMA Oil & Grease Co., 159-61 W. 51st St., New York, N. Y.
- PANHARD—See Haws, Geo. A.
- PARAGON—See Loos & Dilworth.
- PARAGON Refining Co., Front St., Toledo, O. "Polar."
- PATTERSON Lubricating Co., 114 Broad St., Boston, Mass.
- PENN Oil & Supply Co., Chicago, Ill.
- PENNSYLVANIA Lubricating Co., 34th St. & A. V. Ry., Pittsburg, Pa.
- PENNSYLVANIA Oil Works Co., 72 Front St., New York, N. Y. "Flat," "Zenith."
- PERFECTION—See Millers Sons Co.
- PERFECTION—See Wood Co.
- PERFECTO—See Young & Kimball.
- PERRY Oil Co., 372 Central Ave., Pawtucket, R. I.
- PETROLEUM Coke Co., Edgemont & Venango Sts., Philadelphia, Pa. "Motorlight."
- PETROLEUM Products Co., 3600-10 Grant Blvd., Pittsburg, Pa. "Soundproof." (See page 191.)
- PHILADELPHIA Grease Mfg. Co., 848-50 S. Swanson St., Philadelphia, Pa.
- PIGOT-SAYRE Co., 135 William St., New York, N. Y. "Aurora."
- PIONEER Mfg. Co., 5220 Sweeney Ave., S. E., Cleveland, O. "Ottomo."
- PIONEER Oil Co., Old South Bldg., Boston, Mass.
- POLAR—See Paragon Refining Co.
- POLARINE—See Standard Oil Co. of N. Y.
- PURITAN Oil Co., 1218 W. 70th St., Cleveland, O.
- RED STAR—See Clinton Oil Co.
- RICHARDSON Lubricating Co., Quincy, Ill. "Empire."
- RIGHT—See Consolidated Lubricants Co.
- ROBINSON & Son Co., Wm. C., Baltimore, Md. "Greoil." (See page 269.)
- ROYAL—See Kendall Refining Co.
- SAFEGUARD—See Baker, Wm. T.
- SAWYER Oil Co., Howard B., 65 Long Wharf, Boston, Mass. "Nobetr."
- SHEPPARD, W. S., 22 Lawrence St., Newark, N. J. "Fibroviscos."
- SILEX—See Borne, Scrymser Co.
- SONNEBORN Sons, L., Fulton & Pearl Sts., New York, N. Y. "Amalie."
- SOUND-PROOF—See Petroleum Products Co.
- SPEARE'S Sons Co., Alden, 140 Sixth St., Boston, Mass.
- STANDARD Oil Co. of N. Y., New York, N. Y. "Polarine."
- SULLIVAN Oil Co., 413 Wells St., Chicago, Ill.
- SUPERIOR Oil Co., Wade Bldg., Cleveland, O.
- SUTHERLAND & Co., P., 232 Milk St., Boston, Mass. "Velvet."
- SWAN & Finch Co., 151 Maiden Lane, New York, N. Y. "Atlas."
- SWASTIKA—See McLean-Jones Oil & Supply Co.
- SWEET, Charles F., 247 State St., Hartford, Conn. "Climax."
- TOCO—See Tropical Oil Co.
- TROPICAL Oil Co., W. 70th St. & L. S. & M. S. Ry., Cleveland, O. "Toco."
- TYGERT Co., E. A., 126 N. Front St., Philadelphia, Pa. "Motorlube."
- U. S. Mica Mfg. Co., 234 S. LaSalle St., Chicago, Ill. "Micaflake."
- UNITED States Graphite Co., Saginaw, Mich.
- UNIVERSAL—See Young & Kimball.
- VACUUM Oil Co., Rochester, N. Y.
- VALLEY Oil Co., Century Bldg., Cleveland, O. "Carolene."
- VALVOLINE Oil Co., 11 Broadway, New York, N. Y.
- VAN NOSTRAND Mfg. Co., 136 Liberty St., New York, N. Y. "White Circle."
- VERACITY—See Warren Refining Co.
- VELVET—See Sutherland & Co.
- VISCO Motor Oil Co., 2104 Superior Viaduct, Cleveland, O.
- VISCOS—See National Oil & Supply Co.
- WARREN Refining Co., Cleveland, O. "Veracity."
- WESTERN Chemical Mfg. Co., 151 Sixth St., Milwaukee, Wis. "Owl."
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 WHITMORE Mfg. Co., Iron Court & Erie R. R., Cleveland, O.
 WHIZ—See Hollingshead Co.
 WOOD Co., W. A., 373 Atlantic Ave., Boston, Mass. "Perfection," "Germanic."
 YOUNG, Orlando W., 180 Freylinghuysen Ave., Newark, N. J.
 YOUNG & Kimball, Frank L., 111 Purchase St., Boston, Mass. "Universal," "Perfecto."
 ZARTMAN Oil Co., J. V., 120 S. Meridian St., Indianapolis, Ind. "Century."
 ZENITH—See Pennsylvania Oil Works Co.
 ZURN Co., O. F., Broad St. & Lehigh Ave., Philadelphia, Pa. "Detroit."

GRIPS

LEVER HANDLE GRIPS

- GOODYEAR Tire & Rubber Co., Akron, O.

PEDAL GRIPS

- CORK Products Co., 1926 Broadway, New York, N. Y. "Kork-Tred."
 (See page 659.)
 KORK-TRED—See Cork Products Co.
 SIDWELL Pedal Mat Co., 245 Columbus Ave., Boston, Mass.

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 CONDENSITE Co. of America, Glen Ridge, N. J.
 LUZERNE Rubber Co., Trenton, N. J.
 STOKES Rubber Co., Jos., Trenton, N. J.

GUARDS

HORN BULB GUARDS

- ASCO—See New York Wire & Spring Co.
 N. Y. Wire & Spring Co., 586-88 Washington St., New York, N. Y. "Asco."
 (See page 621.)
 WHITEHOUSE Mfg. Co., E. A., 42-54 Elm St., Newark, N. J.
 (See page opposite Title Page.)

LEATHER MUD GUARDS AND FENDERS

- McKINNON Dash Co., 252 Amherst St., Buffalo, N. Y.
 PETERS-HERRON Dash Co., Gift & Culbertson Sts., Columbus, O.

METAL MUD GUARDS AND FENDERS

- A-Z Co., 530 W. 56th St., New York, N. Y.
 (See page 307.)
 AUTO Metal Co., 520 Worthington St., Springfield, Mass.
 AUTO Radiator & Fender Co., 229 Dolphin St., Baltimore, Md.
 AUTO Sheet Metal Works, 2228 Michigan Ave., Chicago, Ill.
 BRISCOE Mfg. Co., Detroit, Mich.
 (See pages 239 and 240.)
 BUNN-HUTCHINSON Co., 330 Prospect Ave., N. W., Cleveland, O.
 BUSH Mfg. Co., Hartford, Conn.
 (See page 345.)
 COLUMBUS Auto Brass Co., Columbus, O.
 DETROIT Auto Specialty Co., 909-11 Greenwood Ave., Detroit, Mich.
 DETROIT Radiator Co., Detroit, Mich.
 FRANKLIN Machine Co., 770 Franklin Ave., Brooklyn, N. Y.
 HAYES-IONIA Co., Ionia, Mich.
 HAYES Mfg. Co., Detroit, Mich.
 (See pages 70 and 71.)
 IDEAL Sheet Metal Works, 2807 Michigan Ave., Chicago, Ill.
 KELLS Mfg. Co., W. J., 521-25 W. 45th St., New York, N. Y.
 (See page 205.)
 KEYSTONE Sheet Metal Co., Ambridge, Pa.
 KINSEY Mfg. Co., Toledo, O.
 (See page 395.)
 LAWSON Co., F. H., Cincinnati, O.
 METAL Stamping Co., Jackson, Mich.
 MICHIGAN Stamping Co., 759-71 Bellevue Ave., Detroit, Mich.
 MOLINE Pressed Steel Co. (E. Moline), Moline, Ill.
 MULLINS Co., W. H., 182 Franklin St., Salem, O.
 NOVELTY Mfg. Co., Jackson, Mich.
 PARAGON Auto Parts Mfg. Co., 506 W. 53d St., New York, N. Y.
 PERFEX Radiator Co., Racine, Wis.
 REID Co., 1603 Second Ave., Moline, Ill.
 RELIABLE Radiator Co., 451-53 E. 173d St., New York, N. Y.
 SAGINAW Sheet Metal Works, Saginaw, Mich.
 SCHIEDEL-THOMPSON Mfg. Co., Industrial Bldg., Indianapolis, Ind.
 (See page 379.)
 SPRINGFIELD Metal Body Co., Springfield, Mass.
 (See page 67.)
 SUSSMAN & Rosenberg Mfg. Co., M., Tarrytown, N. Y.
 TODD Mfg. Co., 820 Mary Pl., Minneapolis, Minn.
 WERNER Radiator Co., 2642 Michigan Ave., Chicago, Ill.
 WILLIS & Sons Co., 204-06 18th St., Moline, Ill.
 WISCONSIN Automobile Radiator Co., North Milwaukee, Wis.
 (See page 583.)

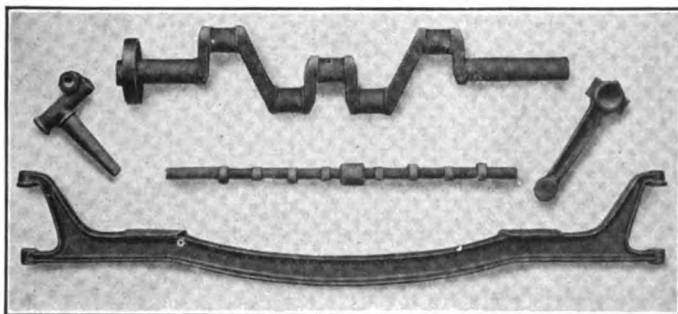


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(See page 153.)
- DANN Bros. & Co.**, 80-88 Franklin St., New Haven, Conn.

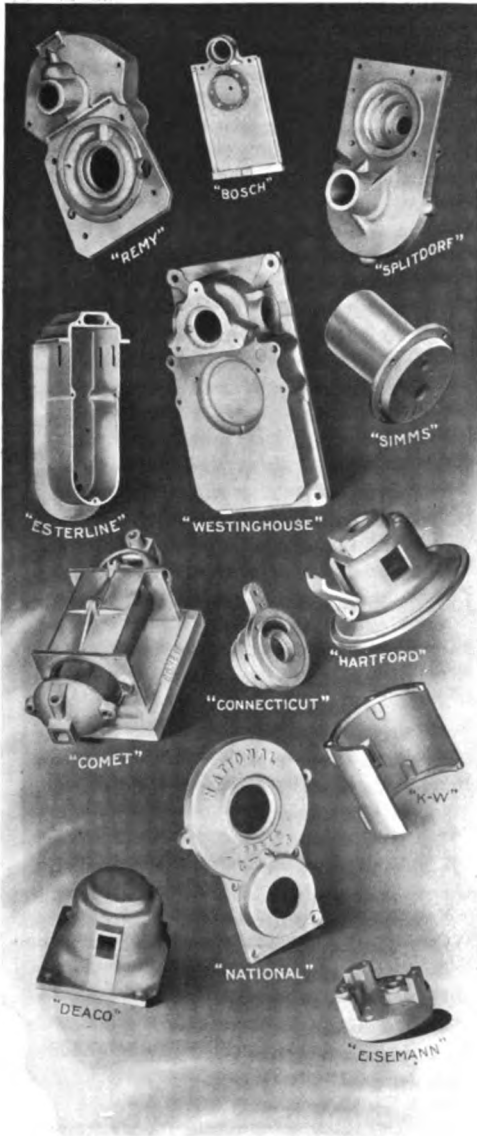
GUNS**GREASE GUNS**

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"Simplex."
- AUTO Pump Co.**, 59 Terrace, Buffalo, N. Y.
"Spencer."
- B-LINE**—See Randall-Faichney Co.
- B & R**—See Beckley-Ralston Co.
- BECKLEY-RALSTON Co.**, Michigan Ave. & Randolph St., Chicago, Ill. "B & R," "Maximus."
- BIG DANE**—See Miller & Starr.
- HIGSBY Mfg. Co.**, 7501 Quincy Ave., Cleveland, O.
(See page 291.)
- BROWN Co.**, Bellevue & Chester Sts., Syracuse, N. Y.
- COX Brass Mfg. Co.**, Pearl & Van Woert Sts., Albany, N. Y.
- DELTA Mfg. Co.**, Bloomfield, N. J.
- ESSEX Brass Co.**, G. B., 480-86 Franklin St., Detroit, Mich.
- FOWLER Lamp & Mfg. Co.**, 61 E. 24th St., Chicago, Ill. "Yankee."
(See page 409.)
- GARAGE Equipment Mfg. Co.**, Milwaukee, Wis. "Gemco."
(See page 203.)
- GEMCO**—See Garage Equipment Mfg. Co.
- GLEASON-PETERS Air Pump Co.**, 255-61 Classon Ave., Brooklyn, N. Y.
- HANCOCK Mfg. Co.**, 770 Henry St., Charlotte, Mich.
- HAUCK-SEEBACH Co.**, 291-95 Essex St., Brooklyn, N. Y.
- HIPWELL Mfg. Co.**, 831-35 North Ave., W., Pittsburg, Pa.
(See page 543.)
- INTERNATIONAL Automobile Supply Co.**, 117 W. South Water St., Chicago, Ill.
(See page 329.)
- KELLOGG Mfg. Co.**, 104 Circle St., Rochester, N. Y.
(See page 325.)
- LEE**, Henry B., New London, Conn.
- LITTLE GIANT**—See Nelman Machine Wks.
- MAXIMUS**—See Beckley-Ralston Co.
- MILLER & Starr**, 1784 Broadway, New York, N. Y. "Big Dane."
- NEIMAN Machine Works**, Freeport, Ill. "Little Giant."
- NOERA Mfg. Co.**, Waterbury, Conn.
(See page 511.)
- PIONEER**—See Standard Sheet Metal Co.
- RANDALL-FAICHNEY Co.**, Boston, Mass. "B-Line."
(See page 463.)
- SIMPLEX**—See Agner Co.
- SPENCER**—See Auto Pump Co.

- STANDARD Sheet Metal Co.** (N. Paterson), Paterson, N. J. "Pioneer."
- TOWNSEND & Co.**, S. P., Orange, N. J.
(See page 589.)
- WILSON Instrument & Spec. Co.**, 223 Passaic St., Passaic, N. J. "Wisco."
- WISCO**—See Wilson Instrument & Spec. Co.
- YANKEE**—See Fowler Lamp & Mfg. Co.

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- BECKLEY-RALSTON Co.**, Michigan Ave. & Randolph St., Chicago, Ill. "B. & R."
- BROWN Co.**, Bellevue & Chester Sts., Syracuse, N. Y.
- CODMAN & Shurtleff**, 120 Boylston St., Boston, Mass.
- COPLEY**—See Randall-Faichney Co.
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- DELTA Mfg. Co.**, Bloomfield, N. J.
- ESSEX Brass Co.**, G. B., 480-86 Franklin St., Detroit, Mich.
- FOWLER Lamp & Mfg. Co.**, 61 E. 24th St., Chicago, Ill. "Yankee."
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- HANCOCK Mfg. Co.**, 770 Henry St., Charlotte, Mich.
- HAUCK-SEEBACH Co.**, 291-95 Essex St., Brooklyn, N. Y.
- JUDD & Leland Mfg. Co.**, Clifton Springs, N. Y.
(See pages 197 and 543.)
- KELLOGG Mfg. Co.**, 104 Circle St., Rochester, N. Y.
(See page 325.)
- NEW York Coach & Auto Lamp Co.**, 302-06 W. 53d St., New York, N. Y. "Universal."
- NOERA Mfg. Co.**, Waterbury, Conn.
(See page 511.)
- OSBORNE & Stephenson Mfg. Co.**, W. Main St., Plainville, Conn.
(See page 569.)
- RANDALL-FAICHNEY Co.**, Boston, Mass. "B-Line," "Copley."
(See page 463.)
- SIMPLEX**—See Agner Co.
- SPENCER**—See Auto Pump Co.
- UNIVERSAL**—See New York Coach & Auto Lamp Co.
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- WISCO**—See Wilson Instrument & Spec. Co.
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- BURLINGTON Basket Works**, Burlington, Ia. "Hawkeye." (See page 107.)
- EASYPACK**—See Bubeck & Guerin.
- HAWKEYE**—See Burlington Basket Works.
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- AMERICAN Brass & Iron Co.**, Crystal & Trombley Sts., Detroit, Mich.
- ATTWOOD Brass Works**, 318-20 Bowery St., Grand Rapids, Mich. (See page 595.)
- BRAINERD Mfg. Co.**, Fairport, N. Y.
- CHICAGO-RACINE Aluminum, Brass & Iron Works**, 224-30 W. Huron St., Chicago, Ill. (See page 607.)
- COWLES & Co., C.**, New Haven, Conn. (See page 91.)

- CURRY Co.**, Joseph F., 475 Washington St., Newark, N. J.
- DOUGLAS & Lomason Co.**, Detroit, Mich.
- ELECTRIC City Specialty Co.**, 103 Adams St., Buffalo, N. Y. (See page 401.)
- ENGLISH & Mersick Co.**, New Haven, Conn.
- ENTERPRISE Brass & Plating Co.**, 2838-44 Spring Grove Ave., Cincinnati, O.
- IMPERIAL Brass Mfg. Co.**, 440-52 S. Jefferson St., Chicago, Ill. (See page 165.)
- JONAH & George**, Merrimac, Mass. (See page 163.)
- KEELER Brass Co.**, 261-71 Godfrey Ave., Grand Rapids, Mich.
- MERRIMAC Specialty Mfg. Co.**, Merrimac, Mass.
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- NORTH & Judd Mfg. Co.**, New Britain, Conn.
- O'BRIEN Mfg. Co.**, Joseph F., 63 Park Pl., New York, N. Y. (See page 229.)
- OCHSNER & Sons Co.**, A., 1060 State St., New Haven, Conn.
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- REGAN & Kirwin Mfg. Co.**, 37 Shattuck St., Lowell, Mass.
- SERGEANT Mfg. Co.**, New & Summit Sts., Newark, N. J.
- SMITH & Co.**, Jos. N., Detroit, Mich. (See page 201.)
- STRONG, M. H.**, 168 South Ave., Rochester, N. Y.
- WESTERN Brass Mfg. Works**, Marshall Blvd., 21st St. & C. B. & Q. R. R., Chicago, Ill. (See page 85.)
- WHITE Mfg. Co.**, Bridgeport, Conn. (See page 619.)
- WIENER-BARNET Co.**, 312-28 Adams St., Newark, N. J.
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(See page 161.)**CROSBY Co.**, Buffalo, N. Y.
(See page 157.)**DETROIT Pressed Steel Co.**, 1800 Mt. Elliott Ave., Detroit, Mich.
(See page 213.)**DRIGGS-SEABURY Ordnance Corp.**, Sharon, Pa.
(See page 569.)**GLOBE Machine & Stamping Co.**, Cleveland, O.
(See page 79.)**ROCHESTER Pressed Steel Co.**, Rochester, N. Y.**HASSOCKS****AUTOMOBILE HASSOCKS**

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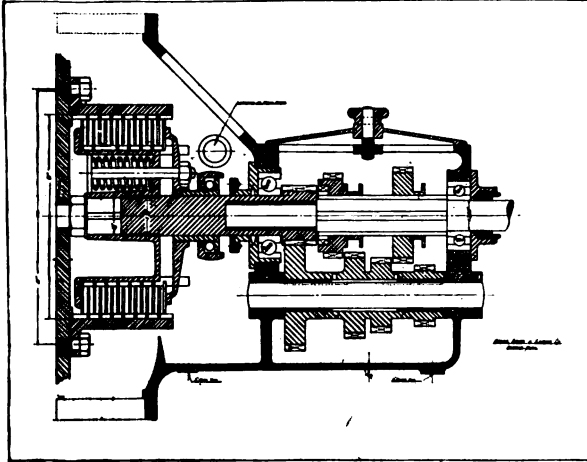
ELECTRIC HEADLIGHTS**A. B. Mfg. Co.**, Poughkeepsie, N. Y.
(See page 497.)**APLCO**—See Apple Electric Co.**APPLE Electric Co.**, 14 N. Canal St., Dayton, O. "Aplico."
(See page 555.)**E & J**—See Edmunds & Jones Mfg. Co.**EDMUNDS & Jones Mfg. Co.**, 432-52 Lawton Ave., Detroit, Mich. "E & J."
(See page 223.)**ELECTROBOLA Lamp Co.** of Milwaukee, Buffalo & Milwaukee Sts., Milwaukee, Wis.**FOWLER Lamp & Mfg. Co.**, 61 E. 24th St., Chicago, Ill.
(See page 409.)**HALL Lamp Co.**, C. M., Rivard & Hancock Sts., Detroit, Mich.**HAMMER Co.**, E. H., 1839 Euclid Ave., Cleveland, O.**HOFACKER Mfg. Co.**, 553-55 W. 42d St., New York, N. Y.**MILWAUKEE Electrical Specialties Co.**, Milwaukee, Wis.**O'BRIEN Electrophone Co.**, Hallowell, Me.**SPRAGUE-WALDO Mfg. Co.**, 19-23 Harper Ave., Detroit, Mich.**HEATERS****AUTOMOBILE HEATERS****AL-TON**—See Atlas Ball Co.**AMERICAN Auto-Heater Co.**, 160 14th St., Buffalo, N. Y.**AMERICAN Electrical Heater Co.**, Detroit, Mich.**ATLAS Ball Co.**, Glenwood Ave. & Second St., Philadelphia, Pa. "Al-Ton."**CHICAGO Flexible Shaft Co.**, 608 La Salle Ave., Chicago, Ill. "Duchess." "Clark."**CINCINNATI Pump Co.**, Liberty & Clay Sts., Cincinnati, O.**CLARK**—See Chicago Flexible Shaft Co**DETROIT Auto Heater Co.**, Detroit, Mich.**DUCHESS**—See Chicago Flexible Shaft Co.**GARRISON Gasoline Engine Specialties Co.**, 251-55 E. Richmond St., Philadelphia, Pa.**LEHMAN Bros.**, 10 Bond St., New York, N. Y. "Queen." "Star."**MILWAUKEE Auto Specialty Co.**, 705-15 Chestnut St., Milwaukee, Wis. "Radio."
(See page 551.)**MOTOR & Mfg. Works Co.**, Dunkirk, N. Y. "Reid."
(See page 381.)**QUEEN**—See Lehman Bros.**RADIO**—See Milwaukee Auto Specialty Co.**REID**—See Motor & Mfg. Works Co.**STAR**—See Lehman Bros.**FEED WATER HEATERS****NATIONAL Pipe Bending Co.**, New Haven, Conn.**OFELDT & Sons**, F. W., Nyack, N. Y.**RADIATOR HEATERS**

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(See page 235.)

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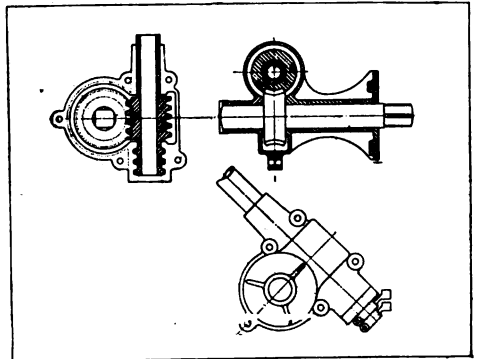
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 (See page 215.)
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 (See page 229.)
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 (See page 201.)
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 (See page 69.)
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 (See page 85.)
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 (See page 307.)
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 (See page 395.)
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 (See page 201.)
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 RONSON Specialty Co., 7-15 Mulberry St., Newark, N. J.
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 (See page 459.)
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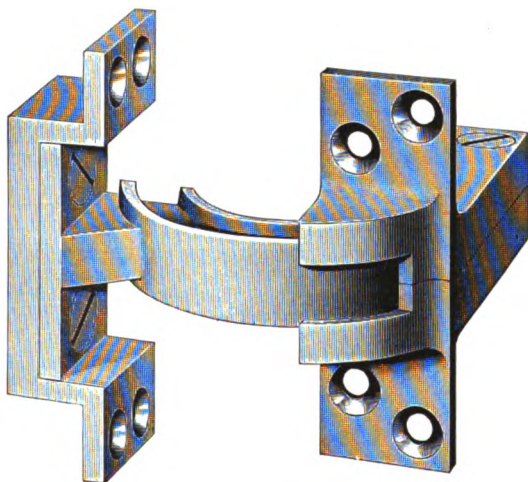
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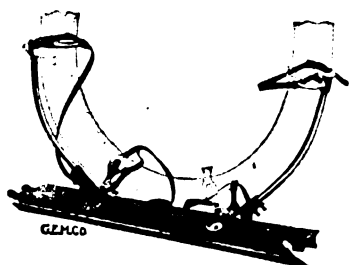
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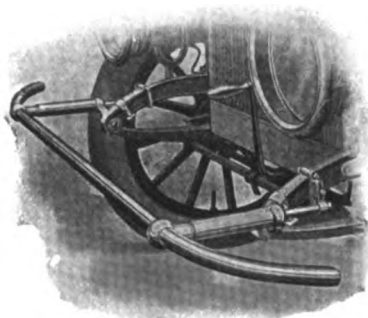
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 (See page 203.)
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 (See page 85.)
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 (See pages 239 and 240.)
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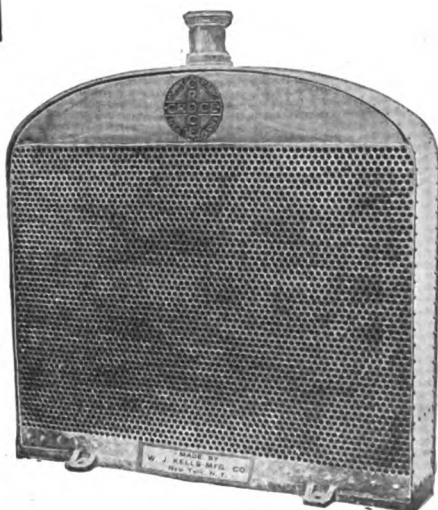
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 (See pages 138 and 139.)
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 (See page 459.)
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 (See page 619.)
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 (See page 217.)
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 (See page 207.)
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 (See page 495.)
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 (See pages 138 and 139.)
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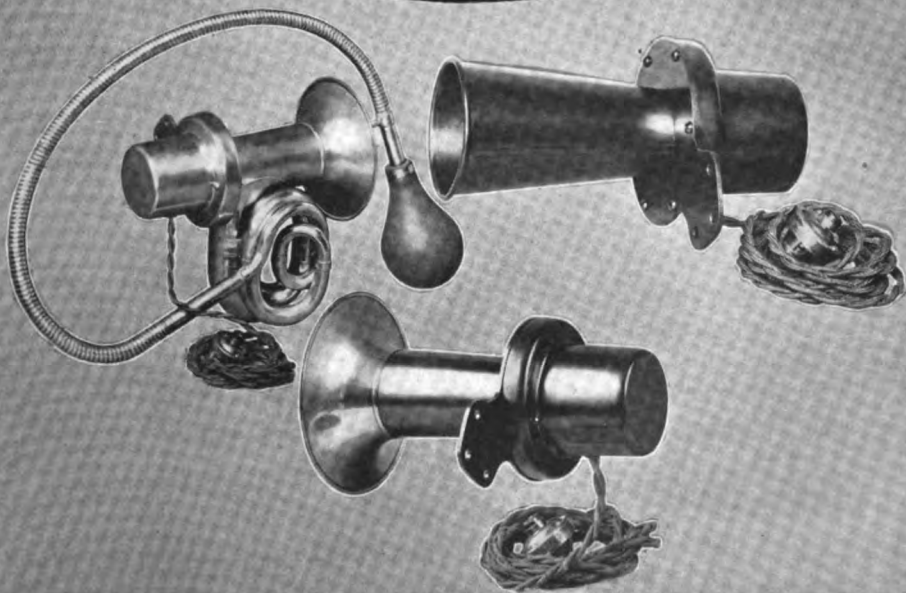
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HORNS (Continued)

ELECTRIC HORNS AND HORN BLOWERS (Continued)

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HOLTZER-CABOT Electric Co., Brookline, Mass. "Autobis," "Reacto." (See page 223.)

JACO—See Alexander Mfg. Co.

KA-HA-CO—See Kales-Haskel Co.

KALES-HASKEL Co., 441-53 Lafayette Blvd., Detroit, Mich. "Ka-Ha-Co."

KLAXET—See Lovell-McConnell Mfg. Co.

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KOSMAK Electrical Co., 2909 Ocean Ave., Jersey City, N. J. "Cubit." (See page 403.)

LOVELL-McCONNELL Mfg. Co., Newark, N. J. "Klaxon," "Klaxonet," "Klaxet." (See page 209.)

MANHATTAN Electrical Supply Co., 17 Park Pl., New York, N. Y.

MAXEFF Electric Horn Co., 814 Woodward Ave., Detroit, Mich.

MONOPLEX—See Atwater Kent Mfg. Works.

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SIRENO Co., 39-41 Cortlandt St., New York, N. Y.

SPARKS - WITHERINGTON Co., Jackson, Mich. "Sparton." (See page 211.)

SPARTON—See Sparks-Withington Co.

STANDARD Metal Mfg. Co., Newark, N. J. (See page 207.)

SUPERIOR Lamp Mfg. Co., 2422 First Ave., New York, N. Y.

TUTO—See Dean Electric Co.

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EXO—See Troy Auto Specialty Co.

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GABRIEL Horn Mfg. Co., 1407 40th St., N. E., Cleveland, O.

GARAGE Equipment Mfg. Co., Milwaukee, Wis. "Melody," "Superior." (See page 203.)

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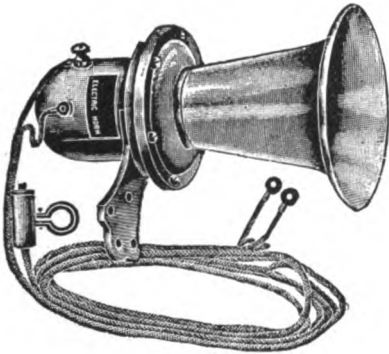
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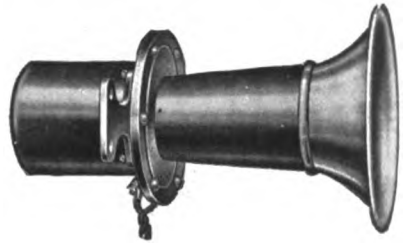


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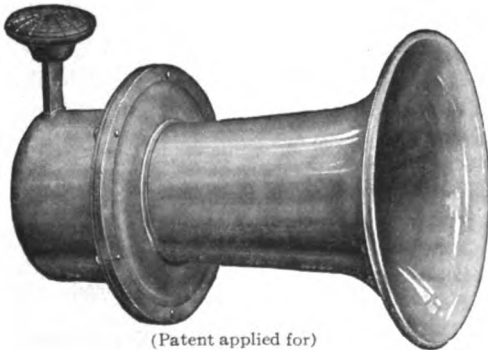
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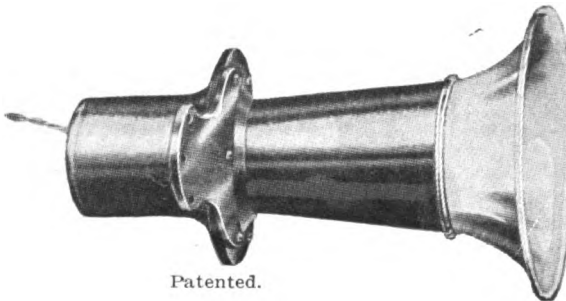
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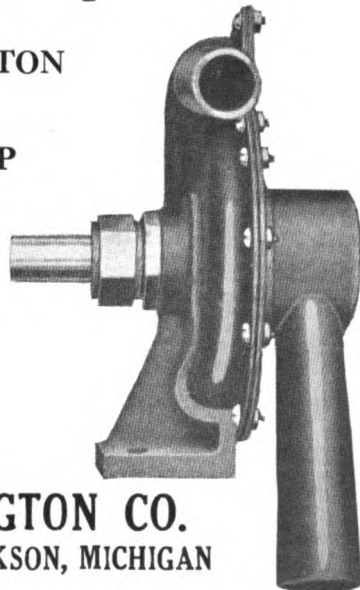
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(See page 213.)

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(See page 560.)

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(See page 355.)

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(See page 355.)

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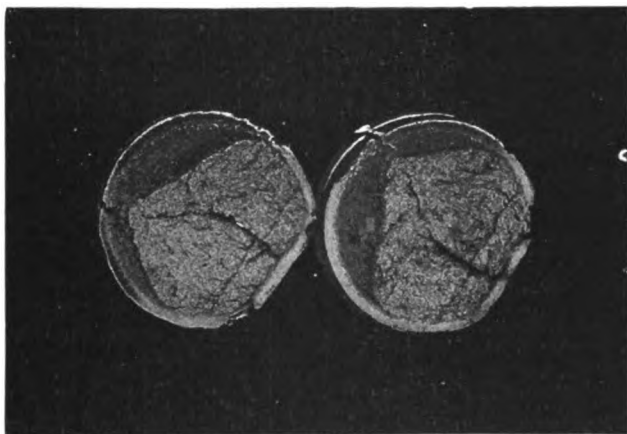
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(See page 91.)

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(See page 565.)

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(See page 91.)

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(See page 335.)

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(See page 215.)

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(See page 263.)

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(See page 209.)

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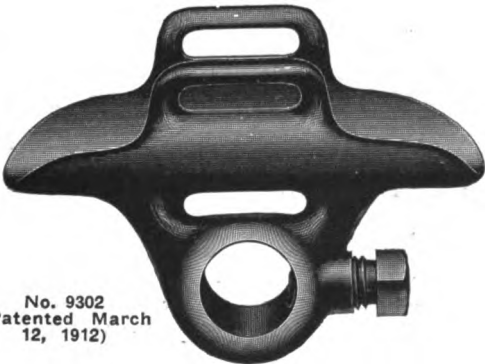
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HOEFT & Co., Chicago, Ill. "Hoco." (See page 253.)

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WALKER-MOORE Mfg. Co., 310 Walker St., Racine, Wis.

WEAVER Mfg. Co., Springfield, Ill. (See page 215.)

WESTERN Brass Mfg. Works, Marshall Blvd., 21st St. & C. B. & Q. R. R., Chicago, Ill. (See page 85.)

JARS**RUBBER BATTERY JARS**

AMERICAN Hard Rubber Co., 9 Mercer St., New York, N. Y. "Volcan," "Mercury."

DIAMOND Rubber Co., Akron, O.

LUZERNE Rubber Co., Trenton, N. J.

MERCURY—See American Hard Rubber Co.

STOKES Rubber Co., Jos., Trenton, N. J.

VOLCAN—See American Hard Rubber Co.

JOBBERS**SUPPLY JOBBERS**

(This is a list of Jobbers and Dealers in Automobile Supplies who advertise in this publication)

BALL-FINTZE Co., 10-20 Canal St., Newark, O. (See page 343.)

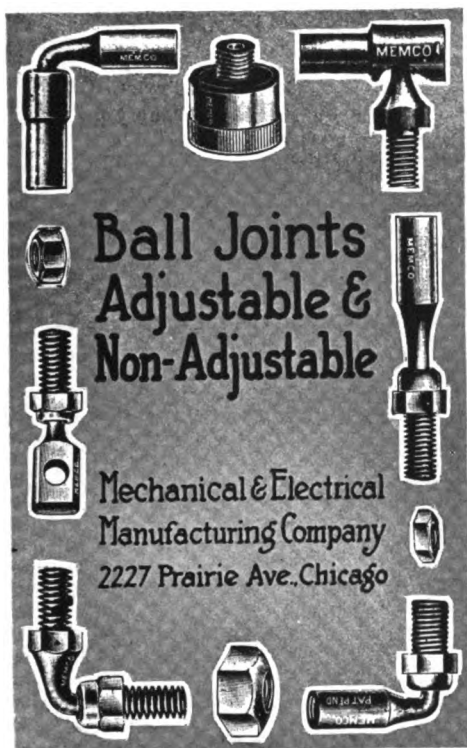
POST & Lester Co., Hartford, Conn. (See page 217.)

PRUDEN Hardware Co., W. E., 804-06 Eighth Ave., New York, N. Y. (See page 473.)

SHAIN, Chas. D., Box 53, Station L., Brooklyn, N. Y. (See page 97.)

WASHINGTON Automobile Supply Co., Washington, Ill. (See page 585.)

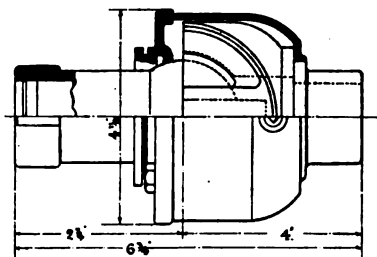
ZINKE Co., 1256 Michigan Ave., Chicago, Ill. (See page 400.)



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CHICAGO Screw Co., Homan Ave. & Fillmore St., Chicago, Ill. "Security."
 (See page 217.)
CINCINNATI Ball Crank Co., Cincinnati, O.
 (See page 185.)
MECHANICAL & Electrical Mfg. Co., 2227 Prairie Ave., Chicago, Ill. "Memco."
 (See page 217.)
MEMCO—See Mechanical & Electrical Mfg. Co.
PENINSULAR Milled Screw Co., Champlain St. & Canton Ave., Detroit, Mich.
PORTER & Co., W. S., 608 S. Dearborn St., Chicago, Ill.
SECURITY—See Chicago Screw Co.

UNIVERSAL JOINTS

- ACME Universal Joint Mfg. Co.**, Stockbridge Ave. & Fulford St., Kalamazoo, Mich.
AUTO Parts Mfg. Co., 620-30 S. Elliot St., Muncie, Ind. "B. T. K."
 (See page 371.)
B.T.K.—See Auto Parts Mfg. Co.
BAUSH Machine Tool Co., 500 Wason Ave., Springfield, Mass.
BLOOD Bros. Machine Co., Ransom St. & S. Haven R. R., Kalamazoo, Mich.
BOSTON Gear Works, Norfolk Downs, Mass.
 (See page 300.)
COOPER Machine Works, Eighth Ave. & 18th St., Brooklyn, N. Y.
FEENEY-HURD Co., Muncie, Ind.
 (See page 217.)
HARTFORD Auto Parts Co., Hartford, Conn.
 (See page 578.)
JOHNSON Service Co., 149-53 Michigan St., Milwaukee, Wis.
K-B—See Kinsler-Bennett Co.
KINSLER-BENNETT Co., 60 Vernon St., Hartford, Conn. "K-B."
 (See page 219.)
KONIGSLOW Mfg. Co., Otto, Cleveland, O.
LEHMAN, I., 2187 E. Second St., Cleveland, O.
LIGGETT Spring & Axle Co., Park Bldg., Pittsburgh, Pa.
 (See page 200.)
MECHANICAL Devices Co., 917 First Ave., Watervliet, N. Y. "Walters."
MICHIGAN Auto-Joint Co., 314 Bowery St., Grand Rapids, Mich.
MICHIGAN Wheel Co., Canal & Newberry Sts., Grand Rapids, Mich.
MUTUAL Machine Co., 25 Wells St., Hartford, Conn. "Warrens."
NEW England Auto Parts Mfg. Co., Kimball Bldg., Boston, Mass.
SPADE Mfg. Co., Kalamazoo, Mich.
SPICER Mfg. Co., Plainfield, N. J.
 (See page 210.)

- VACO**—See Victor Appliance Co.
VICTOR Appliance Co., Troy, N. Y. "Vaco."
 (See page 305.)
WALTERS—See Mechanical Devices Co.
WARRENS—See Mutual Machine Co.
WILCOX-MCKIM Co., Saginaw, Mich.
 (See page 181.)

KEYS

ACETYLENE GAS TANK KEYS

- EDELMANN & Co.**, E., 225 W. Illinois St., Chicago, Ill.
 (See page 175.)
GILBERT Mfg. Co., New Haven, Conn.
NELSON Mfg. Co., A., 564-72 W. Randolph St., Chicago, Ill.
PREST-O-LITE Co., 1400 E. South St., Indianapolis, Ind.
 (See page 377.)
STERLING Machine & Stamping Co., Wellington, O.
UNIQUE Findings & Supply Co., 36 Garnet St., Providence, R. I.
WESTERN Brass Mfg. Works, Marshall Blvd., 21st St. & C. B. & Q. R. R., Chicago, Ill.
 (See page 85.)
WHITEHOUSE Mfg. Co., E. A., 42-54 Elm St., Newark, N. J.
 (See page opposite Title Page.)

KITS

TIRE REPAIR KITS

- (See also Cement, Tire; also Patches, Tire; also * Plugs, Tire; also Sleeves, Tire)
AUTO Time Saver Repair Kit Co., 178 Devonshire St., Boston, Mass.
GOODRICH Co., B. F., Akron, O.
GOODYEAR Tire & Rubber Co., Akron, O.
HAZEN-BROWN Co., 101 South St., Boston, Mass.
M. & M. Mfg. Co., Akron, O.
MICHELIN Tire Co., Milltown, N. J.
PEERLESS Cement Co., 39 Viaduct, Akron, O.
S-V—See Williams Mfg. Co.
TINGLEY & Co., Chas. O., Rahway, N. J.
WILLIAMS Mfg. Co., 18th & Carman Sts., Camden, N. J. "S-V."
YATMAN Rubber Co., 257-69 Mt. Pleasant Ave., Newark, N. J.

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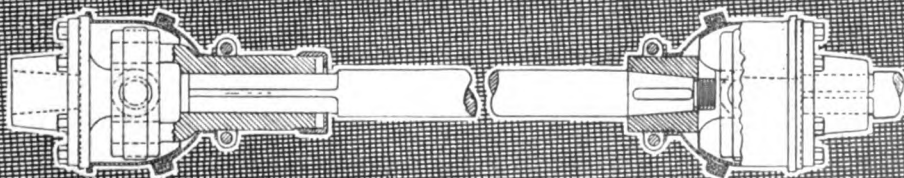
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(See page 81.)

COLUMBIA—See Horstmann Co.

HORSTMANN Co., Wm. H., Fifth & Cherry Sts., Philadelphia, Pa. "Columbia."

SCHLEGEL Mfg. Co., College Ave. & M. Goodman St., Rochester, N. Y.

VOGT Mfg. & Coach Lace Co., 408-10 St. Paul St., Rochester, N. Y.

LAMPS**ACETYLENE LAMPS OR HEAD-LIGHTS**

AMERICAN Lamp Works, 253 W. 47th St., New York, N. Y. "Liberty."

B. & L. Auto Lamp Co., 507-09 W. 35th St., New York, N. Y.
(See page 221.)

BADGER Brass Mfg. Co., Lyman Ave., Kenosha, Wis. "Solar."

BROWN Mfg. Co., John W., Columbus, O.

CASTLE Lamp Co., Battle Creek, Mich.

CHICAGO Auto Lamp Works, 900-04 W. Lake St., Chicago, Ill. "Diamond."

COLUMBIA—See Hine-Watt Mfg. Co.

CORCORAN Lamp Co., Reading Rd., Cincinnati, O.

DIAMOND—See Chicago Auto Lamp Works.

DIETZ Co., R. E., 60 Laight St., New York, N. Y. "Majestic," "Victor."

DRESSSEL Railway Lamp Works, 3860-80 Park Ave., New York, N. Y.

E & J—See Edmunds & Jones Mfg. Co.

EDMUNDS & Jones Mfg. Co., 432-52 Lawton Ave., Detroit, Mich. "E & J,"
(See page 223.)

ENGLISH & Mersick Lamp & Foundry Co., New Haven, Conn.

GRAY & Davis, 55 Lansdowne St., Boston, Mass.
(See page 150.)

HALL Lamp Co., C. M., Rivard & Hancock Sts., Detroit, Mich.

HAWTHORNE Mfg. Co., 38 Spruce St., Bridgeport, Conn. "Old Sol."
(See page 450.)

HINE-WATT Mfg. Co., 180 N. Market St., Chicago, Ill. "Columbia."

HOFACKER Mfg. Co., 552-55 W. 42d St., New York, N. Y.

INDIANA Lamp Co., Connersville, Ind. "Lunar."

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OLD SOL—See Hawthorne Mfg. Co.

ROSE Mfg. Co., 910 Arch St., Philadelphia, Pa. "Neverout."

RUSHMORE Dynamo Works, Plainfield, N. J.
(See page 221.)

SAXON Mfg. Co., 205-19 Cherry St., Toledo, O.
SOLAR—See Badger Brass Mfg. Co.

SPRAGUE-WALDO Mfg. Co., 19-23 Harper Ave., Detroit, Mich.

SUPERIOR Lamp Mfg. Co., 2422 First Ave., New York, N. Y.

UNIVERSAL—See New York Coach & Auto Lamp Co.

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VICTOR Auto Parts Co., Second & Elm Sts., Cincinnati, O.

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WIDMAN & Co., J. C., 14th & 15th Sts. & G. T. Ry., Detroit, Mich.

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(See Lamps, Electric Dash)

ELECTRIC LAMPS OR HEAD-LIGHTS

(See Headlights, Electric)

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ALEXANDER Mfg. Co., J., 1031 Broadway, New York, N. Y.
(See page 200.)

AMERICAN Ever Ready Co., 816 Hudson St., New York, N. Y. "Ever Ready."

APLCO—See Apple Electric Co.

APPLE Electric Co., 14 N. Canal St., Dayton, O. "Aplico."
(See page 555.)

C-S—See Culver-Stearns Mfg. Co.

COWLES & Co., C., New Haven, Conn.
(See page 91.)

CULVER-STEARNS Mfg. Co., 34 Southbridge St., Worcester, Mass. "C-S."

DOLLY Electric Specialty Co., 1461 Michigan Ave., Chicago, Ill.

EDMUNDS & Jones Mfg. Co., 432-52 Lawton Ave., Detroit, Mich.
(See page 223.)

EVER READY—See American Ever Ready Co.

FOWLER Lamp & Mfg. Co., 61 E. 24th St., Chicago, Ill.
(See page 400.)

GUIDE Motor Lamp Mfg. Co., Cleveland, O.

HOLT & Beebe Co., 51 Chardon St., Boston, Mass.

L-C-R Storage Battery Co., 33 S. St. Clair St., Dayton, O.

MANHATTAN Electrical Supply Co., 17 Park Pl., New York, N. Y.

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(See Lamps, Electric Hand)

ELECTRIC SIDE AND TAIL LAMPS**A. B. Mfg. Co.**, Poughkeepsie, N. Y. (See page 407.)**ADAMS & Westlake Co.**, Chicago, Ill. "Adiako." (See page 221.)**ADLAKE**—See Adams & Westlake Co.**ATLAS Stamping Co.**, 557-61 Jackson Blvd., Chicago, Ill. (Tail lamps only.)**B. & L. Auto Lamp Co.**, 507-09 W. 35th St., New York, N. Y. (See page 221.)**BADGER Brass Mfg. Co.**, Lyman Ave., Kenosha, Wis. "Solar."**BROWN Mfg. Co.**, John W., Columbus, O.**BUFFALO Lamp Co.**, 106-10 Broadway, Buffalo, N. Y.**CASTLE Lamp Co.**, Battle Creek, Mich.**CHICAGO Auto Lamp Works**, 900-04 W. Lake St., Chicago, Ill.**COLUMBUS Auto Brass Co.**, Columbus, O.**CORCORAN Lamp Co.**, Reading Rd., Cincinnati, O.**COWLES & Co., C.**, New Haven, Conn. (See page 91.)**DEARBORN Hardware Mfg. Co.**, 2911-19 Carroll Ave., Chicago, Ill.**DIETZ Co.**, R. E., 60 Laight St., New York, N. Y. "Excelsior," "Sentinel."**DRESSSEL Railway Lamp Works**, 3860-80 Park Ave., New York, N. Y.**EDMUNDS & Jones Mfg. Co.**, 432-52 Lawton Ave., Detroit, Mich. (See page 223.)**ELECTROBOLA**—See Garage Equipment Mfg. Co.**ELECTROBOLA Lamp Co.** of Milwaukee, Buffalo & Milwaukee Sts., Milwaukee, Wis.**ENGLISH & Mersick Lamp & Foundry Co.**, New Haven, Conn.**EXCELSIOR**—See Dietz Co.**FOWLER Lamp & Mfg. Co.**, 61 E. 24th St., Chicago, Ill. (See page 409.)**GARAGE Equipment Mfg. Co.**, Milwaukee, Wis. "Electrobola." (See page 203.)**GRAY & Davis**, 53 Lansdowne St., Boston, Mass. (See page 159.)**GUIDE Motor Lamp Mfg. Co.**, Cleveland, O.**HALL Lamp Co.**, C. M., Rivard & Hancock Sts., Detroit, Mich.**HAMMER Co.**, E. H., 1839 Euclid Ave., Cleveland, O.**HOFACKER Mfg. Co.**, 553-55 W. 42d St., New York, N. Y.**HOLT & Beebe Co.**, 51 Chardon St., Boston, Mass.**INDIANA Lamp Co.**, Connersville, Ind. "Lunar."**K. & H. Lamp Co.**, 40-46 Champlain St., Detroit, Mich.**LUNAR**—See Indiana Lamp Co.**SAXON Mfg. Co.**, 205-19 Cherry St., Toledo, O.**SENTINEL**—See Dietz Co.

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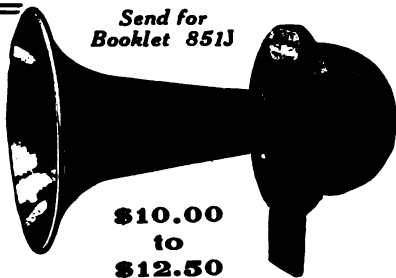
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 WESTINGHOUSE Electric & Mfg. Co. (E. Pittsburgh), Pittsburgh, Pa.
 WHITE Mfg. Co., Bridgeport, Conn. (See page 610.)
 WIDMAN & Co., J. C., 14th & 15th Sts., & G. T. Ry., Detroit, Mich.

ELECTRIC TAIL LAMPS

(See Lamps, Electric Side and Tail)

GAUGE LAMPS

(See Lamps, Electric Dash or Gauge)

HAND LAMPS

(See Lamps, Electric Hand)

INSPECTION LAMPS

(See Lamps, Electric, Hand or Inspection)

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 BRILLIANT Electric Co., Electric Bldg., Cleveland, O.
 BRYAN-MARSH Electric Works, 431 S. Dearborn St., Chicago, Ill.
 BUCKEYE Electric Co., Cuyahoga Bldg., Cleveland, O.
 COLONIAL Electric Works, Warren, O.
 COLUMBIA Incandescent Lamp Co., Equitable Bldg., St. Louis, Mo.
 ELUX Miniature Lamp Works, 324 Lafayette St., New York, N. Y. (See page 221.)
 FEDERAL Miniature Lamp Co., Chicago, Ill.
 FOSTORIA Incandescent Lamp Works, Fostoria, O.
 GENERAL Electric Co., Schenectady, N. Y. "Mazda."
 GENERAL Incandescent Lamp Co., Electric Bldg., Cleveland, O.
 HOWARD Miniature Lamp Co., 327 Academy St., Newark, N. J.
 INDEPENDENT Lamp & Wire Co., 1733 Broadway, New York, N. Y. (See page 579.)
 JAEGER Co., H. J., Terminal Bldg., Hoboken, N. J. (See page 223.)

MAZDA—See General Electric Co.
 PACKARD Lamp Works, Warren, O.
 PEERLESS Lamp Works, Warren, O.
 STERLING Electric Lamp Works, Warren, O.
 U. S. INCANDESCENT Lamp Co., Laclede Bldg., St. Louis, Mo.
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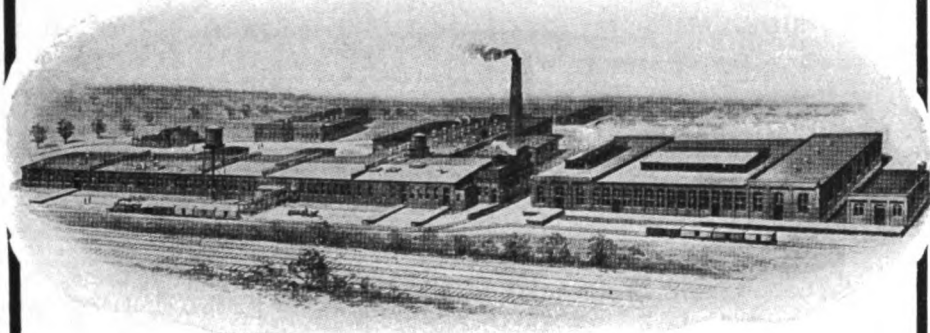
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 ADLAKE—See Adams & Westlake Co.
 B. & L. Auto Lamp Co., 507-09 W. 35th St., New York, N. Y. (See page 221.)
 BADGER Brass Mfg. Co., Lyman Ave., Kenosha, Wis. "Solar."
 BOESCH Lamp Co., 1135 Mission St., San Francisco, Cal.
 BROWN Mfg. Co., John W., Columbus, O. "Perfection."
 CASTLE Lamp Co., Battle Creek, Mich.
 CHAMPION—See Dietz Co.
 COLD BLAST—See Ham Mfg. Co.
 CORCORAN Lamp Co., Reading Rd., Cincinnati, O.
 COWLES & Co., C., New Haven, Conn. (See page 91.)
 DAINTY—See Dietz Co.
 DIETZ Co., R. E., 60 Laight St., New York, N. Y. "Sterling, Jr.," "Queen," "Regal," "Ideal," "Orient," "Dainty," "Royal," "Champion," "Union."
 DRESSEL Railway Lamp Works, 3860-80 Park Ave., New York, N. Y.
 E & J—See Edmunds & Jones Mfg. Co.
 EDMUNDS & Jones Mfg. Co., 432-52 Lawton Ave., Detroit, Mich. "E & J". (See page 223.)
 ENGLISH & Mersick Lamp & Foundry Co., New Haven, Conn.
 GRAY & Davis, 55 Lansdowne St., Boston, Mass. (See page 159.)
 HALL Lamp Co., C. M., Rivard & Hancock Sts., Detroit, Mich.
 HAM Mfg. Co., C. T., 731 Oak St., Rochester, N. Y. "Cold Blast."
 HOFACKER Mfg. Co., 553-55 W. 42d St., New York, N. Y.
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 INDIANA Lamp Co., Connersville, Ind. "Lunar."
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 NEVEROUT—See Rose Mfg. Co.
 NEW YORK Coach & Auto Lamp Co., 302-06 W. 53d St., New York, N. Y. "Universal."
 ORIENT—See Dietz Co.
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 QUEEN—See Dietz Co.
 REGAL—See Dietz Co.
 ROSE Mfg. Co., 910 Arch St., Philadelphia, Pa. "Neverout."
 ROYAL—See Dietz Co.

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 UNION—See Dietz Co.
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 VICTOR Auto Parts Co., Second & Elm Sts., Cincinnati, O.
 VICTOR Lamp Co., Colerain & Sassafras Sts., Cincinnati, O.
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TUNGSTEN LAMPS

(See Lamps, Miniature Tungsten)

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- AMERICAN Lava Co., Chattanooga, Tenn.
 (See pages 87 and 88.)
 STEWARD Mfg. Co., D. M., Chattanooga, Tenn.

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ARTIFICIAL OR IMITATION LEATHER

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 BULL DOG—See Muttly Co.
 CARR Co., F. S., Boston, Mass.
 (See page 123.)
 CHANDLER Oil Cloth & Buckram Co., East Taunton, Mass.
 CHASE & Co., L. C., Boston, Mass.
 (See page 225.)
 COOK'S Linoleum Co., Trenton, N. J.
 FABRIKOID Works, Wilmington, Del.
 KERATOL Co., South & Van Buren Sts., Newark, N. J.
 MAROKENE Co., 6 Fletcher St., New York, N. Y.

MUTTY Co., L. J., Boston, Mass. "Bull Dog."
 (See page 121.)

O'BANNON Corp., 74 Duane St., New York, N. Y.
 (See page 227.)

PANTASOTE Co., 11 Broadway, New York, N. Y.

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CHICAGO Rawhide Mfg. Co., 1301 Elston Ave., Chicago, Ill.

COE & Brown, 202-04 George St., New Haven, Conn.

DETROIT Clutch Cover Co., Detroit, Mich.
 (See page 227.)

DETROIT Leather Specialty Co., 275 Beecher Ave., Detroit, Mich.

DUCKWALL Belting & Hose Co., 121 W. Maryland St., Indianapolis, Ind.

GRATON & Knight Mfg. Co., Worcester, Mass.
 (See page 65.)

HIDE, Leather & Belting Co., Indianapolis, Ind.
 (See page 227.)

HUDSON Belting Co., 1-3 Eaton Pl., Worcester, Mass.

JEWELL Belting Co., 15 Trumbull St., Hartford, Conn.

M.L.B.—See Milwaukee Leather Belting Co.

MAU-SHERWOOD Supply Co., 1616 W. Third St., Cleveland, O.

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NATIONAL Leather Mfg. Co., Niles, Mich.

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RAHMANN & Co., Geo., 31 Spruce St., New York, N. Y.

SCHIEREN, Co., Chas. A., New York, N. Y.

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 BYRON & Sons, W. D., Williamsport, Md. "Tanok."
 CARTER Co., George R., 1600-20 Kentucky Ave., Connersville, Ind. (Dealers.) (See page 220.)
 CHARTER OAK—See Bridgeport Patent Leather Mfg. Co.
 CLARK Leather Co., 723 Gough St., San Francisco, Cal. "Royal."
 CLEVELAND Tanning Co., Jennings & Denison Aves., S. W., Cleveland, O.
 DIEFENTHALER, John V., Hamilton & Bruen Sts., Newark, N. J. "Equator."
 EQUATOR—See Diefenthaler, John V.
 HERTZ, Max, 68 Oliver St., Newark, N. J.
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 HOWELL-HINCHMAN Co., Middletown, N. Y.
 HUDSON Leather Co., 15 Margaretta St., Newark, N. J. (See page 220.)
 LACKAWANNA Leather Co., Hackettstown, N. J.
 LION—See Howell Co.
 OTTAWA Leather Co., Grand Haven, Mich.
 RADEL Leather Mfg. Co., Hamburg Place Rd., Newark, N. J.
 RASER Tanning Co., Ashtabula, O.
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 REILLY & Son Corp., P., Matt St. & Passaic Ave., Newark, N. J. "Stag."
 ROSER & Son, Hermann, Glastonbury, Conn.
 ROYAL—See Clark Leather Co.
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 SMITH & Sons, L. M., 59 Lock St., Newark, N. J.
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 WARD & Co., E. S., 414 Frelinghuysen Ave., Newark, N. J.

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 HIDE, Leather & Belting Co., Indianapolis, Ind. (See page 227.)
 LADEW, Est. of Edw. R., 32-34 Fulton St., New York, N. Y.
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 NATIONAL Leather Belting Co., 29 Ferry St., New York, N. Y.
 NATIONAL Leather Mfg. Co., Niles, Mich.
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 HALCO—See Hagerstown Legging Co.
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 (See page 569.)
 HAZARD Motor Mfg. Co., 23 Scherer St., Rochester, N. Y.
 JAMESVILLE Mfg. Co., Jamesville, N. Y.
 JOHNSON Service Co., 149-53 Michigan St., Milwaukee, Wis.
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 LEWIS Spring & Axle Co., Jackson, Mich.
 (See page 547.)
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 WARNER Co., T. W., Kilgore & Perkins Aves., Muncie, Ind.
 WARNER Gear Co., Muncie, Ind.
 (See page 125.)
 WARNER Mfg. Co., Toledo, O.
 (See page 231.)

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 (See page 357.)
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 (See page 357.)
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 (See page 409.)
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 GRINNELL—See G. C. A. Mfg. Co.
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 (See page 235.)
 HANNA Starter Co., 701 S. Salina St., Syracuse, N. Y.
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 (See page 235.)
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 (See page 377.)
 PRESTO—See Locke Regulator Co.
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 (See page 220.)
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 (See page 400.)

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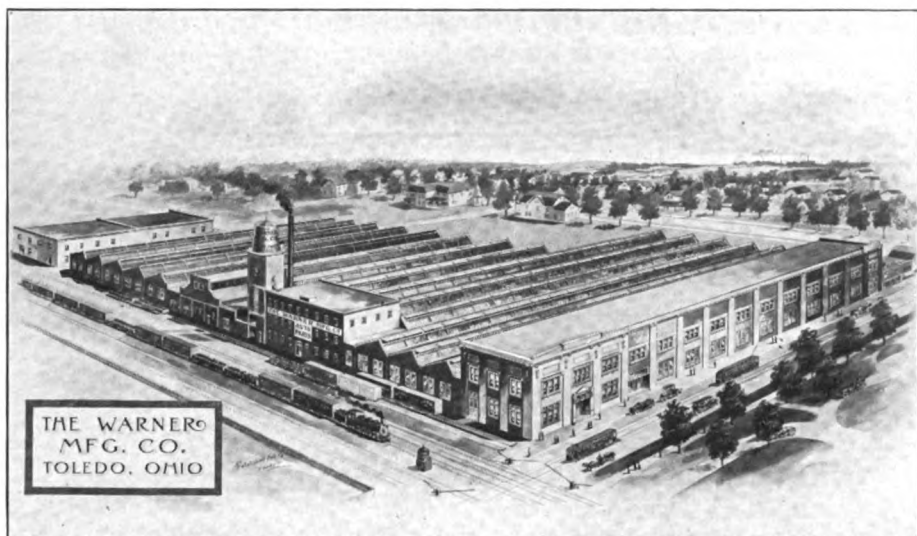
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 (See page 200.)
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(See page 409.)
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(See page 229.)
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(See page 233.)

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(See page 235.)

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(See page 235.)

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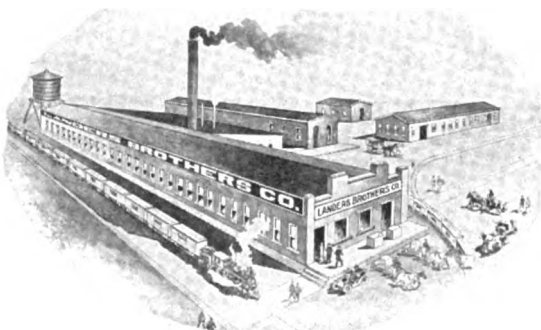
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(See page 201.)
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(See page 595.)
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(See page 91.)
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(See page 103.)
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(See page 229.)
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(See page 201.)
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cago, Ill.
(See page 85.)
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ferson St., Chicago, Ill.
(See page 165.)
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(See page 395.)
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(See page 303.)
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(See page 253.)
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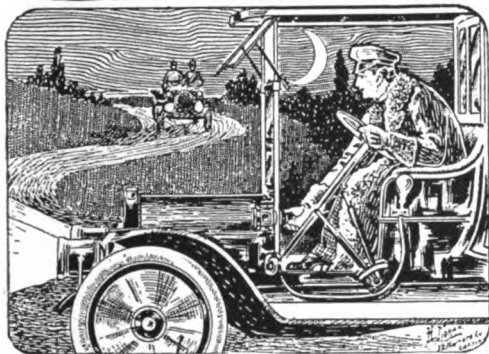
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Ave., New York, N. Y.
(See page 253.)
- SHERWOOD Mfg. Co.**, Elmwood Ave. & Belt
Line, Buffalo, N. Y.
- WILKINSON Co.**, Wm. H., West Medway,
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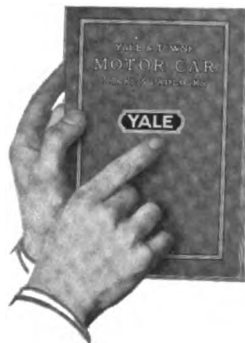
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AMERICAN & British Mfg. Co., 718 Crescent Ave., Bridgeport, Conn.

ASHLEY Machine Works, 724 University Ave., Rochester, N. Y.
(See page 237.)

ATTWOOD Brass Works, 318-20 Bowery St., Grand Rapids, Mich.
(See page 505.)

BETTCHER Mfg. Co., Cleveland, O.

BILLINGS & Spencer Co., Hartford, Conn.

BLACK & Decker Mfg. Co., 113-15 S. Calvert St., Baltimore, Md.

BLAIR Tool & Machine Works, 521 Greenwich St., New York, N. Y.

BLAKE & Johnson Co., Waterbury, Conn.

BLANCHARD Machine Co., 64 State St., Cambridge, Mass.

BUDA Co., Harvey, Ill.
(See page 203.)

BULTMAN Co., F. H., 2108 Superior Viaduct, Cleveland, O.

BUNTING Brass & Bronze Co., Toledo, O.
(See page 101.)

CANFIELD Brake Co., Corning, N. Y.

CASSADY-FAIRBANK Mfg. Co., 6106-30 La Salle St., Chicago, Ill.

CHESTERMAN & Streeter, 125 N. Seventh St., Philadelphia, Pa.

CHICAGO-RACINE Aluminum, Brass & Iron Works, 224-30 W. Huron St., Chicago, Ill.
(See page 007.)

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CONOVER-OVERKAMP Machine & Tool Co., 841 W. Germantown St., Dayton, O.

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CURRIE & Son, J. B., 72 Adams St., Brooklyn, N. Y.

DETLAFF, A. J., 121 Champlain St., Detroit, Mich.

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DETROIT Motor Casting Co., 299-303 Beaufait Ave., Detroit, Mich.

DIAMOND Chain & Mfg. Co., 231 W. Georgia St., Indianapolis, Ind.
(See page 117.)

DIEROLD-PETERS Co., Whitney Power Bldg., Cleveland, O.

DRIGGS - SEABURY Ordnance Corp., Sharon, Pa.
(See page 560.)

DWIGHT Slate Machine Co., 512-16 Asylum St., Hartford, Conn.

EASTERN Machine & Stamping Co., 15 Wickenden St., Providence, R. I.

FERRO Machine & Foundry Co., 47 Hubbard Ave., Cleveland, O.
(See pages 574 and 575.)

FLANDERS Mfg. Co., Pontiac, Mich.

FORE River Shipbuilding Co., Quincy, Mass.

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(See page 251.)



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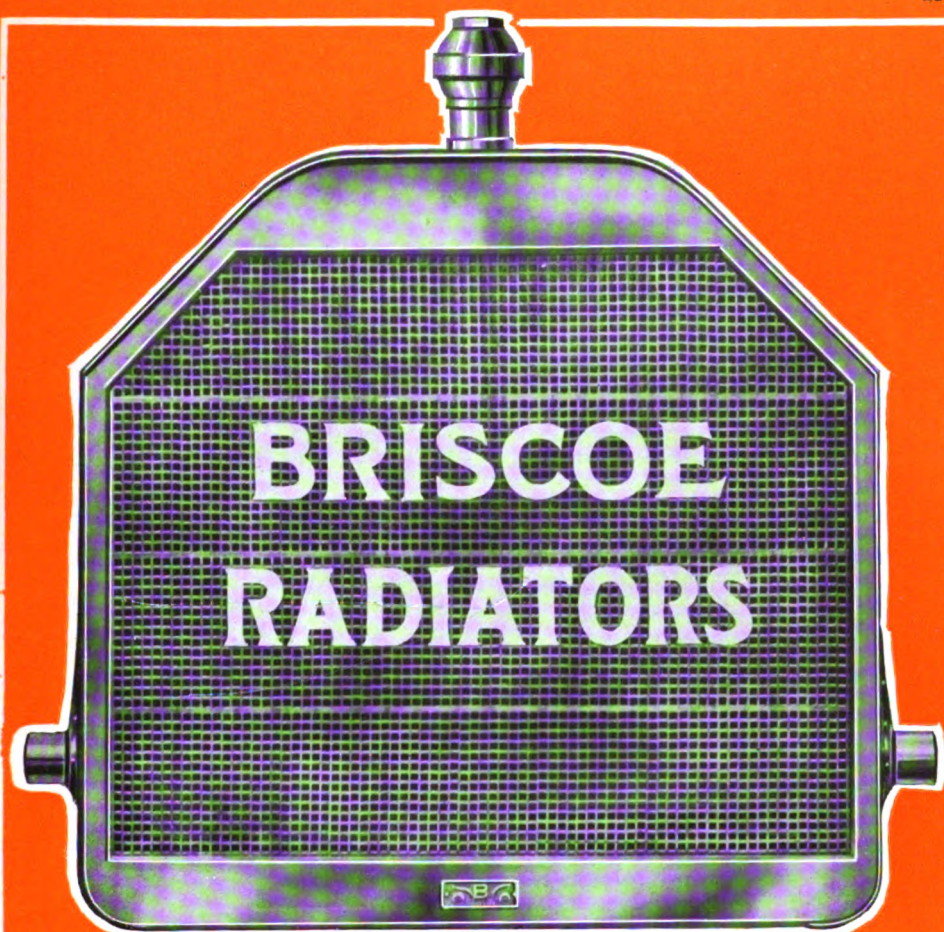
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(See page 193.)
- FULLER & Sons Mfg. Co., Kalamazoo, Mich.
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- GARVIN Machine Co., Spring & Varick Sts., New York, N. Y.
- GEIER Co., P. A., 5114 St. Clair Ave., E., Cleveland, O.
- GILL & Sons Forge & Machine Works, P. H., Lorraine & Otsego Sts., Brooklyn, N. Y.
(See page 507.)
- GLOBE Machine & Stamping Co., Cleveland, O.
(See page 79.)
- GOETZ Co., 1802 Clybourn Ave., Chicago, Ill.
- HARTFORD Machine Screw Co., Hartford, Conn.
(See page 285.)
- HAWTHORNE Mfg. Co., 38 Spruce St., Bridgeport, Conn.
(See page 459.)
- HIBBARD Engineering Co., Majestic Bldg., Detroit, Mich.
- HILES & Co., C. A., 14th St. & Western Ave., Chicago, Ill.
- HOUPERT Machine Co., 351-55 W. 52d St., New York, N. Y.
- HULL Mfg. Co., Lansing, Mich.
- IMPERIAL Brass Mfg. Co., 440-52 S. Jefferson St., Chicago, Ill.
(See page 165.)
- INDIANA Brass Co., Frankfort, Ind.
(See page 617.)
- INDIANAPOLIS Tool & Mfg. Co., Indianapolis, Ind.
- IRELAND & Matthews Mfg. Co., 51-79 Iron St., Detroit, Mich.
- JACOBSON Machine Mfg. Co., Warren, Pa.
(See page 493.)
- JOHNSTON & Jennings Co., 877 Addison Rd., Cleveland, O.
- KEELER Brass Co., 261-71 Godfrey Ave., Grand Rapids, Mich.
- KELLS Foundry & Machine Co., East Gary, Ind.
- KERMATH Mfg. Co., 45 Fort St. E., Detroit, Mich.
- KONIGSLOW Mfg. Co., Otto, Cleveland, O.
- KRAHN Mfg. Co., Milwaukee, Wis.
- LEE Co., Wm. O., Port Huron, Mich.
- LIGGETT Spring & Axle Co., Park Bldg., Pittsburgh, Pa.
(See page 209.)
- LINK-BELT Co., Indianapolis, Ind.
(See page 651.)
- LONG Machine Works, Adam A., Rochester, N. Y.
- LYCOMING Foundry & Machine Co., Williamsport, Pa.
- MANVILLE Bros. Co., 25-33 Benedict St., Waterbury, Conn.
- MASSACHUSETTS Machine Shop Co., 100 Beacon St., Worcester, Mass.
- MECHANICAL Devices Co., 917 First Ave., Watervillet, N. Y.
- METROPOLITAN Mfg. Co., Detroit, Mich.
(See page 593.)
- MILHOLLAND Machine Co., W. K., Tenth & Canal Sts., Indianapolis, Ind.
- MODERN Machinery Co., Monroe & Fifth Sts., Wilmington, Del.
- MOORE & Co., 301 W. Indiana St., Chicago, Ill.
- MORROW Mfg. Co., Elmira, N. Y.
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- MURRAY Machine Works, 1924 Wabansia Ave., Chicago, Ill.
- NATIONAL Cycle & Mfg. Co., Bay City, Mich.
- NATIONAL Engineering Co., Saginaw, Mich.
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- NATIONAL Stamping & Electric Works, 410-26 Clinton St., Chicago, Ill.
- NIAGARA Brass Manufactory, 163-65 Adams St., Buffalo, N. Y.
- NILSON-MILLER Co., 13th & Hudson Sts., Hoboken, N. J.
- OBERDORFER Brass Co., M. L., 804 E. Water St., Syracuse, N. Y.
- OFFENHAEUSER & Dotsch, 41 Beekman Ave. (N. Tarrytown), Tarrytown, N. Y.
- PIPER Machine Co., 560-70 N. Elder Ave., Indianapolis, Ind.
- PROSSER Engineering Co., 2106 W. Superior Ave., Cleveland, O.
- PROVIDENCE Engineering Works, Providence, R. I.
- REDMOND Engineering Co., Drexel Bldg., Philadelphia, Pa.
(See page 545.)
- ROBSON Mfg. Co., Galesburg, Ill.
- ROSS Machine Co., 208 S. Fourth St., La Fayette, Ind.
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(See page 519.)
- SCHATZ Mfg. Co., 17 Fairview Ave., Poughkeepsie, N. Y.
- SHIMER & Sons, Samuel J., Milton, Pa.
- SIER-BATH Co., 143 W. 54th St., New York, N. Y.
(See page 183.)
- SMITH Mfg. Co., Philip, Sidney, O.
- SOUTH Norwalk Engineering Co., 10 R. R. Ave., South Norwalk, Conn.
- SPACKE Machine Co., F. W., Indianapolis, Ind.
(See page 241.)
- STANDARD Mfg. Co., 990 Housatonic Ave., Bridgeport, Conn.
- STERLING Machine Co., Norwich, Conn.
(See page 489.)
- SUPERIOR Machine & Engineering Co., 51-53 Fort St. E., Detroit, Mich.
- SUPERIOR Metal Products Co., Elyria, O.
(See page 617.)
- T. C. M. Mfg. Co., Hunterdon & First Sts., Harrison, N. J.
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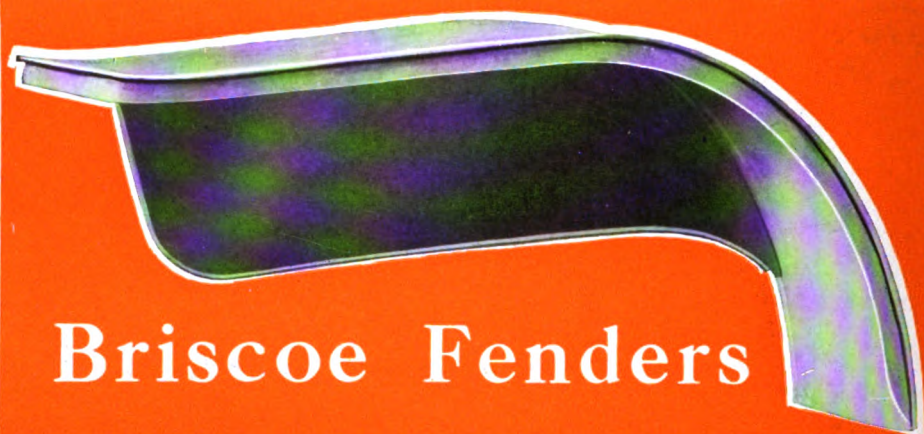
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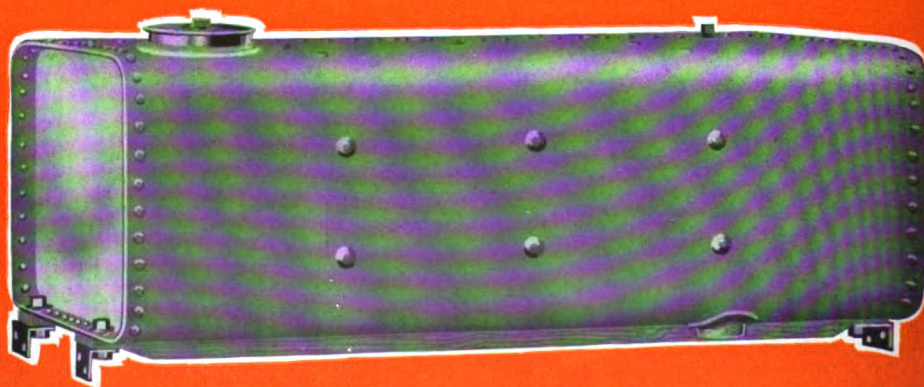
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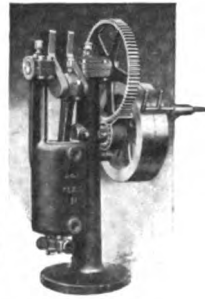
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(See page 321.)
- TURNER** Brass Works, Sycamore, Ill.
- TURNER & Moore Mfg. Co.**, 54 Champlain St., Detroit, Mich.
- UNION Elevator & Machine Co.**, 215-17 W. Ontario St., Chicago, Ill.
- UNIVERSAL Telegraph Co.**, 107 E. Lombard St., Baltimore, Md.
- VOELKNER & Harry Mfg. Co.**, 282-92 Woodbridge St., E., Detroit, Mich.
- WADE Machine Co.**, 817 Albany St., Boston, Mass.
- WAINWRIGHT & Son, W. W.**, 16th St. & Western Ave., Connerville, Ind.
- WALKER Co., H. J.**, 44 Champlain St., Detroit, Mich.
- WARNER Bros. Machine Works**, High & Howard Sts., Muncie, Ind.
- WESTERN Brass Mfg. Works**, Marshall Blvd., 21st St. & C. B. & Q. R. R., Chicago, Ill.
(See page 85.)
- WESTINGHOUSE Machine Co.**, (E. Pittsburg), Pittsburg, Pa.
- WILCOX-McKIM Co.**, Saginaw, Mich.
(See page 181.)
- YORK Electric & Machine Co.**, 30 N. Penn St., York, Pa.

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- BRETZ Co., J. S.**, 250 W. 54th St., New York, N. Y. (Importers.) "U. & H."
(See page 661.)
- BRIGGS Magneto Co.**, Elkhart, Ind.
- CHAMPION Ignition Co.**, Flint, Mich.
(See page 445.)
- COMET**—See Hendricks Novelty Co.
- CONNECTICUT Telephone & Electric Co.**, 34 Britannia St., Meriden, Conn.
- DAYTON-DICK Co.**, Quincy, Ill. "H & H"
- DEAN Electric Co.**, 515 Olive St., Elyria, O. "Elyria-Dean."
(See pages 138 and 139.)
- DOW Mfg. Co.**, 131 Adams St., Braintree, Mass.
- ECONOMY Mfg. Co.**, Economy, Pa. "Perfection."
(See page 435.)
- EISEMANN Magneto Co.**, 225-27 W. 57th St., New York, N. Y.
(See page 243.)
- ELECTRIC Goods Mfg. Co.**, Canton, Mass. "Perfex."

- ELKHART Mfg. Co.**, First St. & Conant Ave., Monroe, Mich. "Monroe."
- ELYRIA-DEAN**—See Dean Electric Co.
- EUREKA**—See Henricks Novelty Co.
- GENERAL Electric Co.**, Schenectady, N. Y.
- H & H**—See Dayton-Dick Co.
- HEINZE Electric Co.**, Lowell, Mass.
- HENRICKS Novelty Co.**, 1237-39 St. Paul St., Indianapolis, Ind. "Eureka," "Comet."
- HERZ & Co.**, 295 Lafayette St., New York, N. Y. (Importers.)
(See page 269.)
- HI-FRE-CO**—See High Frequency Ignition Coll Co.
- HIGH Frequency Ignition Coll Co.**, 126½ E. Ninth St., Los Angeles, Cal. "Hi-Fre-Co."
- HOLTZER-CABOT Electric Co.**, Brookline, Mass.
(See page 223.)
- K-W Ignition Co.**, 2833 Chester Ave., Cleveland, O.
- KINGSTON**—See Kokomo Electric Co.
- NOBLOCK-HEIDEMAN Mfg. Co.**, Sample St. & Vistula Ave., South Bend, Ind. "Quick Action."
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- PHILADELPHIA Timer & Machine Co.**, Philadelphia, Pa. "Velos."
(See page 595.)
- PITTSFIELD Spark Coll Co.**, Dalton, Mass.
(See page 127.)
- QUICK ACTION**—See Knoblock-Heideman Mfg. Co.
- REMY Electric Co.**, Anderson, Ind.
(See page 245.)
- SIMMS Magneto Co.**, 1780 Broadway, New York, N. Y.
- SPLITDORF Electrical Co.**, 98 Warren St., Newark, N. J.
- SWISS Magneto Co.**, 1023 W. Jackson Blvd., Chicago, Ill.
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(See page 607.)
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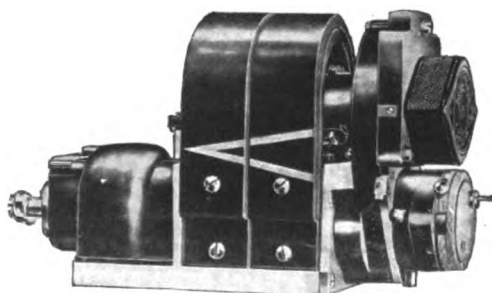
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(See page 307.)

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(See page 403.)

BALTIMORE Tube Co., Baltimore, Md.
(See page 403.)

BRASS & Copper Products Co., 237-43 Chestnut St., Newark, N. J.

BUNN-HUTCHINSON Co., 330 Prospect Ave., N. W., Cleveland, O.

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(See page 245.)

IMPERIAL Brass Mfg. Co., 440-52 S. Jefferson St., Chicago, Ill.
(See page 165.)

MILWAUKEE Valve Co., 139 Burrell St., Milwaukee, Wis.
(See page 403.)

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SANFORD Mfg. Co., F. C., Bridgeport, Conn.

STANDARD Metalwork Co., 22-40 Prospect St., Thompsonville, Conn.
(See page 599.)

WORCESTER Pressed Steel Co., Worcester, Mass.
(See page 157.)

MANUFACTURERS AGENTS

(This is a list of Manufacturers Agents who advertise in this publication.)

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(See page 383.)

GWILLIAM Co., Broadway & 58th St., New York, N. Y.
(See page 413.)

HINCHMAN-BAKER Co., 503 Free Press Bldg., Detroit, Mich.
(See page 673.)

LAKK Sales Co., 1947 Broadway, New York, N. Y.
(See page 659.)

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RANCOCAS Mills, Trenton, N. J.

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(See page 501.)

BOSTON Belting Co., 256-60 Devonshire St., Boston, Mass.

BOSTON Woven Hose & Rubber Co., 110 Portland St., Cambridge, Mass. "Lenox," "Tiger."

BOWERS Rubber Works, 68-70 Sacramento St., San Francisco, Cal.

CINCINNATI Rubber Mfg. Co., Cincinnati, O.
(See page 341.)

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CONSOLIDATED Rubber Co., Trenton, N. J.

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EMPIRE Rubber Mfg. Co., Trenton, N. J.

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HAMILTON Rubber Mfg. Co., Trenton, N. J.

HOME Tire Co., Trenton, N. J.
(See page 401.)

LENOX—See Boston Woven Hose & Rubber Co.

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MANSFIELD Tire & Rubber Co., Mansfield, O.

MATTSON Rubber Co., Lodi, N. J.
(See page 607.)

MECHANICAL Rubber Co., C. & P. & Nickel Plate R. R., Cleveland, O.

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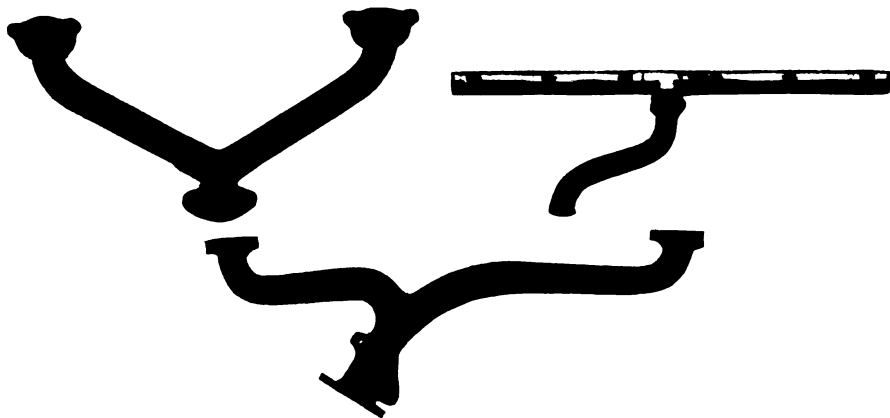
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MATS (Continued)

RUBBER MATS (Continued)

- NEW Jersey Car Spring & Rubber Co., Wayne & Brunswick Sts., Jersey City, N. J.
 NEW York Belting & Packing Co., 91 Chambers St., New York, N. Y.
 PENNSYLVANIA Rubber Co., Jeannette, Pa.
 THERMOID Rubber Co., Trenton, N. J. (See page 393.)
 TIGER—See Boston Woven Hose & Rubber Co.
 VICTOR Rubber Co., Springfield, O.
 VOORHEES Rubber Mfg. Co., 18-46 Bostwick Ave., Jersey City, N. J. (See page 131.)
 WALPOLE Tire & Rubber Co., Walpole, Mass.

STEEL MATS

- CARY Mfg. Co., 19-21 Roosevelt St., New York, N. Y.
 WORTH Wire Works, Kokomo, Ind.

STEP OR RUNNING BOARD MATS

- KAR KLEAN—See Specialty Mat Co.
 MOSLER & Co., A. R., New York, N. Y. (See page 287.)
 SPECIALTY Mat Co., 1 First St., Troy, N. Y. "Kar Klean."

METALS

BEARING METALS

- A. B. C. Castings Co., Cleveland, O. "Meteor."
 ACORN—See Cadman Mfg. Co.
 ALLEN-MURPHY Co., 46th St. & Rock Island Tracks, Chicago, Ill.
 ALUMINUM Castings Co., Cleveland, O. (See page 99.)
 AMERICAN Bronze Co., 82-176 Non-Gran Ave., Berwyn, Pa. "Non-Gran." (See pages 248 and 249.)
 AMERICAN Bronze Co., 1415 Niagara St., Buffalo, N. Y. "Grainless."
 AMERICAN Manganese Bronze Co., 99 John St., New York, N. Y. "Spare's."
 ATKINSON Co., Rochester, N. Y. "Superior," "Plata." (See page 153.)
 AUTO-CRAT—See Syracuse Smelting Works.
 AZALEA—See Vanadium Metals Co.
 BIRKENSTEIN & Sons, S., 387-99 Ontario St., Chicago, Ill. (See page 579.)
 CADMAN Mfg. Co., A. W., 2814-16 Smallman St., Pittsburg, Pa. "Acorn."
 CLIMAX—See Enterprise Metal Co.
 COLORADO Lead Works Co., 1516 Blake St., Denver, Colo.
 COLUMBIA Smelting & Refining Works, 365-67 West St., New York, N. Y.
 COPPERINE—See Erie White Metal Co.

CRAMP & Sons Ship & Engine Building Co., William, Philadelphia, Pa. "Parsons." (See page 251.)

- DAMASCUS Bronze Co., Pittsburg, Pa.
 DAWSON Copper Co., S. R., 42 Broadway, New York, N. Y.
 ELEPHANT—See Phosphor Bronze Smelting Co.
 EMPIRE Metal Co., Syracuse, N. Y. "Premier," "Triumph."
 ENTERPRISE Metal Co., Union Bldg., Syracuse, N. Y. "Climax," "Vanadium."
 ERIE White Metal Co., Erie, Pa. "Copperline."
 EUREKA Brass Co., 2210-18 Scott Ave., St. Louis, Mo. "Solax."
 EUREKA Co., North East, Pa.
 FAHRIG Metal Co., 34 Commerce St., New York, N. Y.
 FORT Hill Bronze Mfg. Co., 48-56 Waters Ave., West Everett, Mass.
 FRICTIONLESS Bushing Co., 312 W. 43d St., New York, N. Y.
 FRICTIONLESS Metal Co., Chattanooga, Tenn.
 GARDINER Metal Co., 1356-64 W. Lake St., Chicago, Ill.
 GRAHAM & Co., James, 293 Wooster St., New Haven, Conn. (See page 203.)
 GRAINLESS—See American Bronze Co.
 GREAT Western Smelting & Refining Co., 41st & Wallace Sts., Chicago, Ill.
 HECLA—See Paulson & Son.
 HOYT Metal Co., Merchants-LeClade Bldg., St. Louis, Mo.
 KAHN Bros., 775-97 Humboldt St., Brooklyn, N. Y.
 LIGHT Mfg. & Foundry Co., Pottstown, Pa. (See page 281.)
 LISSBERGER & Son, Marks, 281 Borden Ave., Long Island City, N. Y.
 LUMEN Bearing Co., Buffalo, N. Y. (See pages 273 and 274.)
 MAGNOLIA Metal Co., 113-15 Bank St., New York, N. Y.
 MERCHANT & Evans Co., Philadelphia, Pa.
 METEOR—See A. B. C. Castings Co.
 MOGUL Metal Co., Detroit, Mich. (See page 111.)
 MORE-JONES Brass & Metal Co., 3132-44 N. Broadway, St. Louis, Mo.
 MURPHY-POTTER Co., Detroit, Mich.
 MUZZY-LYON Co., Detroit, Mich. (See page 111.)
 NATIONAL Lead Co., New York, N. Y. (See page 103.)
 NEW Era Mfg. Co., Kalamazoo, Mich.
 NON-GRAN—See American Bronze Co.
 NORTH American Smelting Co., Ninth & Thompson Sts., Philadelphia, Pa. "Vulcan."
 PALMETTO Metal Co., Old Colony Bldg., Chicago, Ill.
 PARSONS—See Cramp & Sons.
 PAULSON & Son, Thomas, 97-99 Second Ave., Brooklyn, N. Y. "Hecla." (See page 247.)

"Hecla" anti-friction **Bronze**

A BEARING
METAL FUL-
FILLING ALL
OF THE RE-
QUIREMENTS
OF SUCH A
PRODUCT

This bearing metal WILL NOT CUT or otherwise injure the journal or pin under any conditions, and while many metals act well when conditions are favorable, it remains that "HECLA" ANTI-FRICTION BRONZE will successfully withstand the most arduous tests to which it is subjected.

"Hecla" anti-friction bronze is an economy for three reasons:

First—It cannot injure the parts with which it is brought in contact.

Second—It will outwear and outlast any metallic compound of its kind.

Third—The machining cost is low.

In tensile and crushing strengths, it will resist pounding out or breaking.

Delivered in CORED and SOLID bars, 12 inches long and in all sizes up to $3\frac{1}{2}$ inches in diameter, FROM STOCK. We will also make castings for bearings of every description from your patterns, blue prints or sketches.

"Hecla" bronze is the result of an experience covering a long period of years. *There is nothing experimental about it*—nothing in its make-up that we cannot guarantee to absolutely fulfill our every claim.

Write and get full information concerning our facilities, methods of manufacture and the quality of the product. We will save you money and make you money.

Thomas Paulson & Son
BRASS FOUNDERS
97-99 Second Ave. Brooklyn, N. Y.

Why Are the Best Motor Cars

such as the MARMON, the SIMPLEX and others too numerous to mention, the best Motor Trucks such as the KELLY, the SAURER and others, and the best Motor-Cycles such as the EXCELSIOR and others, being equipped with



Simply because NON-GRAN has demonstrated to their manufacturers that it gives many times the service of any other bronze made.

Why Is NON-GRAN Better ?

BECAUSE it more successfully resists the pull of friction.

A bearing wears out because friction is constantly at work pulling away the minute metallic particles constituting the bearing surface. As friction continues to pull away these billions of particles, the bearing keeps getting larger and larger until it is of no further value.

The structure of NON-GRAN is fibrous, the particles are all knit and interlocked together, and friction is thus unable to pull away the particles on the bearing surface as these particles are all locked to, and held down by, the particles beneath the surface.

NON-GRAN, as its name implies, is non-granular in structure.

In the bronzes which are granular in structure, the particles are just like so much sand or sugar massed together, there is no holding bond or cohesion between the particles and they are thus readily pulled away by the friction of a shaft revolving against them.

The granular bearing bronzes can be satisfactory only until you learn, by actual test, how much longer NON-GRAN bronze stands up.

AMERICAN BRONZE COMPANY

82-176 NON-GRAN AVE., BERWYN, PENNSYLVANIA

Sole manufacturers of NON-GRAN and the largest exclusive manufacturers of Bearing Bronze in the world

In Motor Car and Motor Truck Construction

HIGH SPEED **NON-GRAN** BEARING BRONZE

is recommended for:—

Cam shaft bearings
Wrist pin bushings
Magneto and pump shaft bushings
Idler gear bushings
Timer gear bushings
Timer shaft bushings
Valve plunger guides
Oil pump bushings
Timer Gears
Clutch bushings

Reverse idler gear bushings
Sleeve gear bushings
Universal joint bushings
Differential pinion bushings
Steering gear bushings
Steering knuckle bushings
Plain hub bushings
Steering Gears
Worm Gears

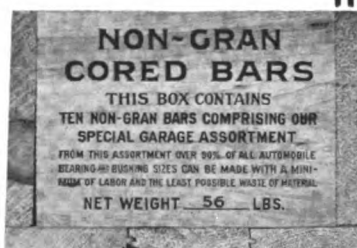
For the above and similar duties, NON-GRAN is the finest material made.

The Special Assortment of NON-GRAN bars listed below is exactly what every Repair Shop needs:



SIZES IN ASSORTMENT

Outside Diam.	Inside Diam.	Length	Approx. Weight ea. bar
$\frac{3}{4}$	Solid	12	$1\frac{1}{4}$ lbs.
1	$\frac{1}{2}$	12	$2\frac{1}{4}$ "
$1\frac{1}{4}$	$\frac{5}{8}$	12	$3\frac{1}{2}$ "
$1\frac{3}{8}$	$\frac{3}{4}$	12	$3\frac{1}{2}$ "
$1\frac{1}{2}$	$\frac{3}{4}$	12	5 "
$1\frac{5}{8}$	$\frac{7}{8}$	12	$5\frac{1}{2}$ "
$1\frac{3}{4}$	1	12	$6\frac{1}{2}$ "
2	$1\frac{1}{4}$	12	$8\frac{1}{4}$ "
$2\frac{1}{4}$	$1\frac{3}{8}$	12	10 "
$2\frac{1}{2}$	$1\frac{5}{8}$	12	11 "



Other sizes for special requirements, up to four inches outside diameter, supplied promptly on order.

To ascertain proper size of bar to use for machining a bushing, add $\frac{1}{8}$ inch to the outside diameter of the latter and subtract $\frac{1}{8}$ inch from its inside diameter.

NON-GRAN Bars are carried in stock by leading Automobile Supply Jobbers and Wholesale Hardware Houses in all principal cities.

AMERICAN BRONZE COMPANY

82-176 NON-GRAN AVENUE

BERWYN, PENNSYLVANIA

Sole manufacturers of NON-GRAN and the largest exclusive manufacturers of Bearing Bronze in the world

METALS (Continued)

BEARING METALS (Continued)

- PHOSPHOR** Bronze Smelting Co., 2200 Washington Ave., Philadelphia, Pa. "Elephant."
(See page 565.)
- PITTSBURGH** White Metal Co., Diamond Bank Bldg., Pittsburgh, Pa.
- PLATA**—See Atkinson Co.
- PREMIER**—See Empire Metal Co.
- REEVES & Son**, Paul S., 1415-25 Catherine St., Philadelphia, Pa.
- SANFORD Co.**, David C., 33-39 Tullip St., Bridgeport, Conn.
- SEMPER IDEM**—See Wildes Son, Thomas.
- SHONBERG, I.**, 122 Flushing Ave., Brooklyn, N. Y.
- SOLAR**—See Eureka Brass Co.
- SPARE'S**—See American Manganese Bronze Co.
- STANLEY**—See Syracuse Smelting Works.
- SUPERIOR**—See Atkinson Co.
- SYRACUSE Smelting Works**, Drawer 48, Station G, Brooklyn, N. Y. "Auto-Crat," "Stanley."
(See page 526.)
- TRIUMPH**—See Empire Metal Co.
- UNITED Foundry & Machine Co.**, Bridgeport, Conn.
(See page 617.)
- U. S. Reduction Co.**, Manhattan Bldg., Chicago, Ill.
- VANADIUM**—See Enterprise Metal Co.
- VANADIUM Metals Co.**, Vanadium Bldg., Pittsburgh, Pa. "Azalea."
(See page 545.)
- VULCAN**—See North American Smelting Co.
- WHITEHOUSE Mfg. Co.**, E. A., 42-54 Elm St., Newark, N. J.)
(See page opposite Title Page.)
- WILDES Son**, Thomas, 14 Dover St., New York, N. Y. "Semper Idem."
- WILLIAMS & Son**, E. A., Jersey City, N. J.
- WING & Co.**, J. T., 15-19 Woodward Ave., Detroit, Mich.
- ZENITE Metal Co.**, 518 N. Capitol Ave., Indianapolis, Ind.

PERFORATED METALS

- ERDLIE Perforating Co.**, 279 Mill St., Rochester, N. Y.
- HARRINGTON & King Perforating Co.**, 612-30 N. Union St., Chicago, Ill.
- HENDRICK Mfg. Co.**, 30 Church St., Carbon-dale Pa.
- MANHATTAN Perforated Metal Co.**, 237-39 Centre St., New York, N. Y.
- MUNDT & Sons**, Chas., 53-57 Fairmount Ave., Jersey City, N. J.
- NORTMANN-DUFFKE Foundry Co.**, 27th Ave. & N. W. R. R., Milwaukee, Wis.
- THROOP Perforating Co.**, 80 Terrace, Buffalo, N. Y.

METERS

COMPRESSION METERS

(See Gauges, Cylinder Compression)

DISTANCE RECORDING METERS OR ODOMETERS

(For combined Odometers and Speedometers—See Speedometers)

- BAUMGAERTNER, F.**, 2344 E. 105th St., Cleveland, O. "Coronet."
- CORONET**—See Baumgaertner, F.
- JONES Speedometer Co.**, New Rochelle, N. Y.
- STAR Speedometer Co.**, Milton, Pa.
- VEEDER Mfg. Co.**, 22 Sargeant St., Hartford, Conn.

GRADE METERS

- ADAMS Co.**, Dubuque, Ia. "Gradometer."
- AMERICAN Thermo Ware Co.**, 16 Warren St., New York, N. Y. (Importers.) "Autocrat."
- AUTOCRAT**—See American Thermo Ware Co.
- GRADOMETER**—See Adams Co.

HEAT INDICATING METERS

(For attachment to radiator to show temperature of cooling water)

- BOYCE MOTOMETER**—See Motometer Co.
- MOTOMETER Co.**, 1790 Broadway, New York, N. Y. "Boyce Motometer."

SPEED METERS

(See Speedometers)

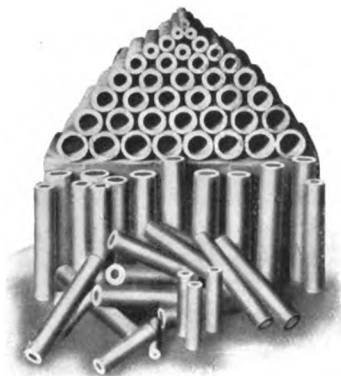
TAXI METERS

(See Taximeters)

MICA

- AMERICAN Mica Co.**, Newton Lower Falls, Mass.
- ASHEVILLE Mica Co.**, Asheville, N. C.
- CHICAGO Mica Co.**, Valparaiso, Ind.
- DIELECTRIC Mfg. Co.**, 224 S. Vandeventer Ave., St. Louis, Mo.
- INTERNATIONAL Mica Tube Co.**, 358 Nosstrand Ave., Brooklyn, N. Y.
- MICA Mfg. Co.**, 150-52 Chambers St., New York, N. Y.
- MUNSELL & Co.**, Eugene, 68 Church St., New York, N. Y.
- NEW YORK Mica & Mfg. Co.**, Auburn, N. Y.
- PRESTON Co.**, Robert K., Monadnock Bldg., Chicago, Ill. "Prestonite."
- PRESTONITE**—See Preston Co.
- SCHOONMAKER, A. O.**, 221 Fulton St., New York, N. Y.
- SNOW FLAKE**—See Western Mica Mining & Milling Co.
- UNITED Mica Co.**, Grafton Center, N. H.
- VANCE, D. T.**, Plumtree, N. C.
- WATSON Bros.**, 170 Purchase St., Boston Mass.
- WESTERN Mica Mining & Milling Co.**, W. 16th Ave. & Bryant St., Denver, Colo. "Snow Flake."

CORED BARS FOR BUSHINGS



PARSONS' WHITE BRASS for Crank pin and main bearings. CRAMP'S SPECIAL BEARING BRONZE for wrist pin, cam shaft, transmission and axle bearings.

List of cored and solid cast bars of our bearing metals in stock:

Number.	Outside Diameter. Inches.	Inside Diameter. Inches.	Length. Inches.
1	1	1/2	6
2	1 1/4	1 1/8	6
3	1 1/2	1 1/4	6
4	1 3/4	1 1/2	12
5	1 3/4	1	12
6	2	1	12
7	2	1 1/4	12
8	2 1/4	1	12
9	2 1/4	1 1/4	12
10	2 1/2	1 1/2	12
11	2 1/2	1 1/2	12
12	2 3/4	1 1/2	12
13	2 3/4	1 3/4	12
14	3	2	12
15	3	2 1/4	12
16	3 1/2	2 1/2	12
17	3 1/2	2 3/4	12

Solid bars up to 2 inches diameter.

Furnished either in PARSONS' WHITE BRASS or CRAMP'S SPECIAL BEARING BRONZE. Sizes of bars not shown in the list and cored whole and half bushings with end collars can be furnished from stock patterns. In ordering refer to the number in first column.

THE WILLIAM CRAMP & SONS SHIP AND ENGINE BUILDING CO.
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**Aluminum
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MIRRORS**

(To enable driver to see to the rear of the car)

- ALEXANDER Mfg. Co., J.**, 1931 Broadway, New York, N. Y. "Mirrorscope."
(See page 209.)
- AMERICAN Lamp Works**, 253 W. 47th St., New York, N. Y. "Liberty."
- AMERICAN Thermo Ware Co.**, 16 Warren St., New York, N. Y. (Importers.) "Autocrat."
- ANSONIA Mfg. Co.**, Ansonia, Conn.
- ARGOS**—See Motor Car Equipment Co.
- ATLAS**—See Toffler Co.
- AUTOCRAT**—See American Thermo Ware Co.
- BALZER Auto Co., Gus.**, 1777 Broadway, New York, N. Y.
- BELLAMY**—See Novelty Mfg. Co.
- C-WELL Mirror Co.**, 3109 Monroe St., Toledo, O.
- COX Brass Mfg. Co.**, Pearl & Van Woert Sts., Albany, N. Y. "Reflectorscope."
- ECLIPSE Specialty Co.**, 250 W. 54th St., New York, N. Y.
- FRANCO Mfg. Co.**, 1332-34 Michigan Ave., Chicago, Ill.
- GOODWIN & Kintz Co.**, Winsted, Conn.
- HOCO**—See Hoeft & Co.
- HOEFT & Co.**, Chicago, Ill. "Hoco."
(See page 253.)
- HOLT & Beebee Co.**, 51 Chardon St., Boston, Mass.
- HUDSON Auto Lamp Works**, 1648-50 Broadway, New York, N. Y.
- KALES-HASKEL Co.**, 441-53 Lafayette Blvd., Detroit, Mich.
- LIBERTY**—See American Lamp Works.
- MIRRORSCOPE**—See Alexander Mfg. Co.
- MOTOR Car Equipment Co.**, 55 Warren St., New York, N. Y. (Importers.) "Argos."
- NOVELTY Mfg. Co.**, Waterbury, Conn. "Bellamy"
See page 619.)
- REFLECTORSCOPE**—See Cox Brass Mfg. Co.
- RILEY-KLOTZ Mfg. Co.**, 17 Mulberry St., Newark, N. J.
- SEARLS Mfg. Co.**, 27 Mulberry St., Newark, N. J.
- SMITH Co., H. Lund**, 201 Paterson Ave., Paterson, N. J.
- TOFFLER Co., S.**, 841 E. 136th St., New York, N. Y. "Atlas."
- WESTERN Brass Mfg. Works**, Marshall Blvd., 21st St. & C. B. & Q. R. R., Chicago, Ill.
(See page 85.)
- WHITEHOUSE Mfg. Co.**, E. A., 42-54 Elm St., Newark, N. J.
(See page opposite Title Page.)

WATER GAUGE MIRRORS**KNOX Co.**, Frank J., Hartford, Conn.**MIXERS****FUEL MIXERS OR AGITATORS**

- AMERICAN Compensating Valve Co.**, 630 18th St., Manitowoc, Wis.
- ARISTOS Co.**, 250 W. 54th St., New York, N. Y. "Mondex-Helix."
- AUTOMIZER Co.**, City Natl. Bank Bldg., Canton, O.
- BATTERSHALL & Co.**, F. W., 51 Maiden Lane, Albany, N. Y.
- BINGHAM Mfg. Co.**, 227 Prospect Ave., N. W., Cleveland, O. "G. L."
- BREMER-WILSON Mfg. Co.**, 1475 Michigan Ave., Chicago, Ill. "Triplex."
- CRONE, F. G.**, 334 Genesee St., Buffalo, N. Y.
- D-F**—See Forbes, Walter J.
- EGYPTIAN**—See Loose Mixing Chamber Co.
- FORBES, Walter J.**, 243 Columbus Ave., Boston, Mass. "D-F."
- G. L.**—See Bingham Mfg. Co.
- GAS Saver Sales Co.**, Broadway & 58th St., New York, N. Y. "Gasosava."
- GASIFTER**—See Toledo Auto Devices Co.
- GASOSAVA**—See Gas Saver Sales Co.
- GYREX**—See Royal Equipment Co.
- INTERNATIONAL Accessories Corp.**, 1146 Michigan Blvd., Chicago, Ill. "Speedo."
- LOOSE Mixing Chamber Co.**, R. D., 110½ N. Fifth St., Springfield, Ill. "Egyptian."
- M & M**—See Moller Bros. Controller & Economizer Co.
- MICHENER, E. S.**, 80 Washington St., New Castle, Pa.
- MOLLER Bros. Controller & Economizer Co.**, Betz Bldg., Philadelphia, Pa. "M & M."
- MONDEX-HELIX**—See Aristos Co.
- PECK, E. C.**, 432 Third St., San Bernardino, Cal.
- RAIMES & Co.**, 50 Ferry St., New York, N. Y. "Spider."
- ROYAL Equipment Co.**, 440 Housatonic Ave., Bridgeport, Conn. "Gyrex."
(See page 83.)
- SAUNDERS Co.**, Leslie R., 927 W. Seventh St., Los Angeles, Cal.
- SPEEDO**—See International Accessories Corp.
- SPIDER**—See Raimes & Co.
- STEWART Machine Works**, Alfred C., 1008 Santee St., Los Angeles, Cal.
- TOLEDO Auto Devices Co.**, Gardner Bldg., Toledo, O. "Gasifter."
- TRIPLEX**—See Bremer-Wilson Mfg. Co.

MONOGRAMS**ORNAMENTAL METAL
MONOGRAMS**

- BALZER Auto Co., Gus.**, 1777 Broadway, New York, N. Y.
- BERNARD Co., J.**, 422-30 E. 53d St., New York, N. Y.



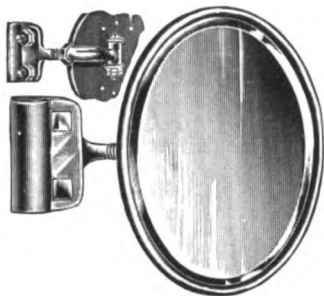
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Let your judgment show in the selection of one. Do not be misled, but compare the **Springfield Portable Garage** with all others and you will find that while our **Garages** have been widely imitated they have never been equalled. You will also find them a great convenience, a large saving, a sure protection for your auto—right in your own yard.

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Positively Prevent Flapping Curtains

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- CHILDS & Co., S. D., 279 E. Monroe St., Chicago, Ill.
- COLGAN Co., J. W., Sudbury Bldg., Boston, Mass.
- CROWE Name Plate & Engraving Co., Chicago, Ill.
(See page 567.)
- ETCHING Company of America, 2526-28 W. Congress St., Chicago, Ill.
- FINE Co., Horace E., 19 E. State St., Trenton, N. J.
- GRAMMES & Sons, L. F., Jordan & Union Sts., Allentown, Pa.
- GREENDUCK Co., 227 Van Buren Pl., Chicago, Ill.
- HANCOCK Mfg. Co., 770 Henry St., Charlotte, Mich.
- HANDEL, Louis, 138 Centre St., New York, N. Y.
- HANSON, C. H., 178 N. Clark St., Chicago, Ill.
- HICKOK Mfg. Co., 38 St. Paul St., Rochester, N. Y.
(See page 255.)
- IMPERIAL Brass Mfg. Co., 440-52 S. Jefferson St., Chicago, Ill.
(See page 165.)
- JOHNSTON Co., J. G., 79 Sudbury St., Boston, Mass.
- MATTHEWS & Co., Jas. H., Pittsburg, Pa.
- MULHAUPT, J. Jos., 227 N. Fifth St., La Fayette, Ind.
- MURDOCK, Jr. Co., James, 116 Opera Pl., Cincinnati, O.
- NEW YORK Stencil Works, 100 Nassau St., New York, N. Y.
- REES, F. H., Granite Bldg., Rochester, N. Y.
- RONSON Specialty Co., 7-15 Mulberry St., Newark, N. J.
- SALMAN, John A., 17-21 Bromfield St., Boston, Mass.
- SCHRIDDE, Wm., 35 S. Clark St., Chicago, Ill.
- SCHWERDTLE Stamp Co., 39-41 Cannon St., Bridgeport, Conn.
- STAFFORD Co., N., 67 Fulton St., New York, N. Y.
- WALTER & Sons, N. C., 194 William St., New York, N. Y.
- WHITEFORD & Co., Jos. G., 165 N. Jefferson St., Chicago, Ill.

MOTORS**ELECTRIC AUTOMOBILE MOTORS**

- DIEHL Mfg. Co., Elisabethport, N. J.
(See page 255.)
- GENERAL Electric Co., Schenectady, N. Y.
- WAGNER Electric Mfg. Co., 6400 Plymouth Ave., St. Louis, Mo.
- WESTINGHOUSE Electric & Mfg. Co., (E. Pittsburg) Pittsburg, Pa.

GASOLINE AUTOMOBILE MOTORS

- ADVANCE Power Co., 517 Aldine Pl., Chicago, Ill.
- ANDERSON Motor Co., 50 W. 16th St., Anderson, Ind. "Dice."
- AUTO Parts Mfg. Co., Dept. 11, Detroit, Mich.
(See page 609.)
- BEAVER Mfg. Co., 789 Chase St., Milwaukee, Wis.
(See pages 258 and 259.)
- BERGDOLL Machine Co., 31st & Dauphin Sts., Philadelphia, Pa.
- BINSSE Machine Co., Harrison, N. J. "Howard."
(See page 485.)
- BRENNAN Motor Co., 105 Grape St., Syracuse, N. Y.
(See page 485.)
- BROWNELL Motor Co., F. A., Driving Park Ave. & Wren St., Rochester, N. Y.
- BUDA Co., Harvey, Ill.
(See page 263.)
- CADY Co., C. N., 307 W. Center St., Canastota, N. Y.
- CHRISTENSEN Engineering Co., 841-47 30th St., Milwaukee, Wis.
- CLARK Motor Co., E. C., E. LeRoy St., Jackson, Mich.
- COLLINS Gear & Motor Co., Frick Bldg., Pittsburg, Pa.
- CONTINENTAL Engine Co., 1146 Michigan Ave., Chicago, Ill.
- CONTINENTAL Motor Mfg. Co., Detroit, Mich.
(See page 271.)
- CRESCENT Motor Co., Second St. & H. D. R. R. (Carthage), Cincinnati, O.
- CROSS Gear & Engine Co., Detroit, Mich.
(See page 199.)
- DART Mfg. Co., Dept. T. D., Waterloo, Ia.
(See page 41.)
- DAVIS Mfg. Co., 15th Ave. & Park St., Milwaukee, Wis.
(See page 491.)
- DESCHLER, August, 18-20 E. Water St., Chillicothe, O.
- DICE—See Anderson Motor Co.
- ERGON—See Hazard Motor Mfg. Co.
- FAIRBURY Motor Car Works, Main & Sixth Sts., Fairbury, Ill.
- FALLS Machine Co., Sheboygan Falls, Wis.
- FRANKLIN Machine Co., 770 Franklin Ave., Brooklyn, N. Y.
- GOBY Engine Co., Central Ave. & E. 65th St., Cleveland, O.
- GOLDEN, Belknap & Swartz Co., 1248 Grand River Ave., Detroit, Mich.
- GRIMM Mfg. Co., 39 Erie St., Buffalo, N. Y.
- HAZARD Motor Mfg. Co., Rochester, N. Y. "Ergon."
(See page 481.)
- HERSCHELL-SPILLMAN Co., North Tonawanda, N. Y.
(See page 563.)
- HOOVEN, Owens, Rentschler Co., Hamilton, O.
- HOWARD—See Binsse Machine Co.
- HYDRAULIC Engineering Works, 220 N. Jefferson St., Chicago, Ill. "Roxey."
- JENCICK Motor Corp., Port Chester, N. Y.
(See page 491.)

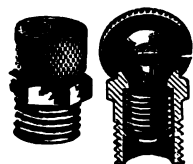
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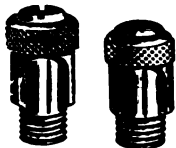
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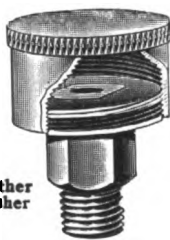
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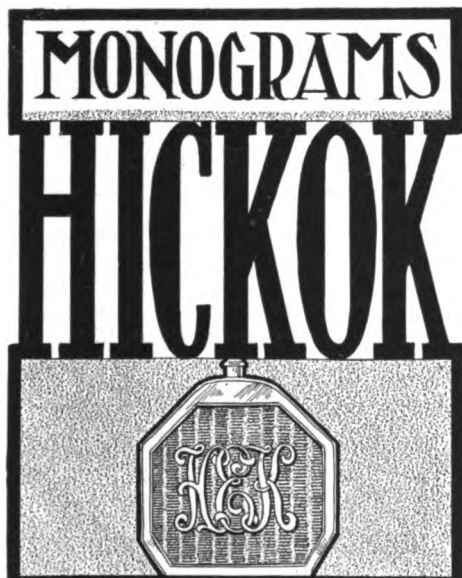


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- JOHNSON Service Co., 149-53 Michigan St., Milwaukee, Wis.
- JULIAN Motor Co., Syracuse, N. Y.
- KERMATH Mfg. Co., Detroit, Mich.
- KIRKHAM Motor Mfg. Co., Bath, N. Y.
- KNIGHT—See Stearns Co.
- LIGHT Inspection Car Co., Hagerstown, Ind. "Teetor."
- LYCOMING Foundry & Machine Co., Williamsport, Pa. "Lycoming-Mead."
- LYCOMING-MEAD—See Lycoming Foundry & Machine Co.
- LYONS-ATLAS Co., Indianapolis, Ind.
- METAL Products Co., Decatur, Ind.
- MILWAUKEE Auto Engine & Supply Co., 706-08 Winnebago St., Milwaukee, Wis.
- MILWAUKEE Motor Co., 32d & Burleigh Sts., Milwaukee, Wis.
- MODEL Gas Engine Works, Peru, Ind. (See page 507.)
- MONARCH Motor Mfg. Co., 3145-53 N. Halsted St., Chicago, Ill.
- N-P Motor Co., 817 Monadnock Bldg., Chicago, Ill. (See page 563.)
- NORTHWAY Motor & Mfg. Co., 510-14 Maybury Grand Ave., Detroit, Mich.
- OSWALD Motor Co., Goshen, Ind. (See page 563.)
- OULTON Motor & Mfg. Co., 311 Atlantic Ave., Boston, Mass.
- PALMER-MOORE Co., 100 N. Geddes St., Syracuse, N. Y.
- PIGGINS Motor Truck Co., Sixth St., Racine, Wis.
- PORT HURON Construction Co., Port Huron, Mich.
- REEVES Pulley Co., Columbus, Ind.
- REGAL Gasoline Engine Co., Coldwater, Mich.
- ROBERTS Motor Co., 1435 Columbus Ave., Sandusky, O.
- ROXEY—See Hydraulic Engineering Works.
- RUTENBER Motor Co., Marion, Ind. (See page 447.)
- SANDUSKY Auto Parts & Motor Truck Co., Sandusky, O. (See page 475.)
- SCHLOSSER Mfg. Co., 151 E. 120th St., New York, N. Y. (See page 585.)
- SCOTT, Semple S., 1653 Marquette Bldg., Chicago, Ill. (See page 559.)
- SOMMER Motor Co., Bucyrus, O.
- STEARNS Co., F. B., Cleveland, O. "Knight." (See page 539.)
- SWAIN Engine Co., 4105 Cottage Grove Ave., Chicago, Ill.
- TEETOR—See Light Inspection Car Co.

- TIPPETT Mfg. Co., 172-82 W. Locust St., Columbus, O. (See page 321.)
- TREBERT Engine Works, H. L. F., 495 St. Paul St., Rochester, N. Y.
- WAMBOLD Mfg. Co., 3011 Lisbon Ave., Milwaukee, Wis. (See page 585.)
- WARNER Mfg. Co., Toledo, O. (See page 231.)
- WAUKESHA Motor Co., Waukesha, Wis. (See page 257.)
- WHITEFORD & Co., Jos. G., 165 N. Jefferson St., Chicago, Ill.
- WILLET Engine & Truck Co., 6-8 Lock St., Buffalo, N. Y.
- WISCONSIN Machinery & Mfg. Co., Canal St. & Muskego Ave., Milwaukee, Wis.
- WISCONSIN Motor Mfg. Co., Dept. 27, Milwaukee, Wis. (See page 563.)

STEAM AUTOMOBILE MOTORS

(See Engines, Steam)

MOULDING

BRASS MOULDING

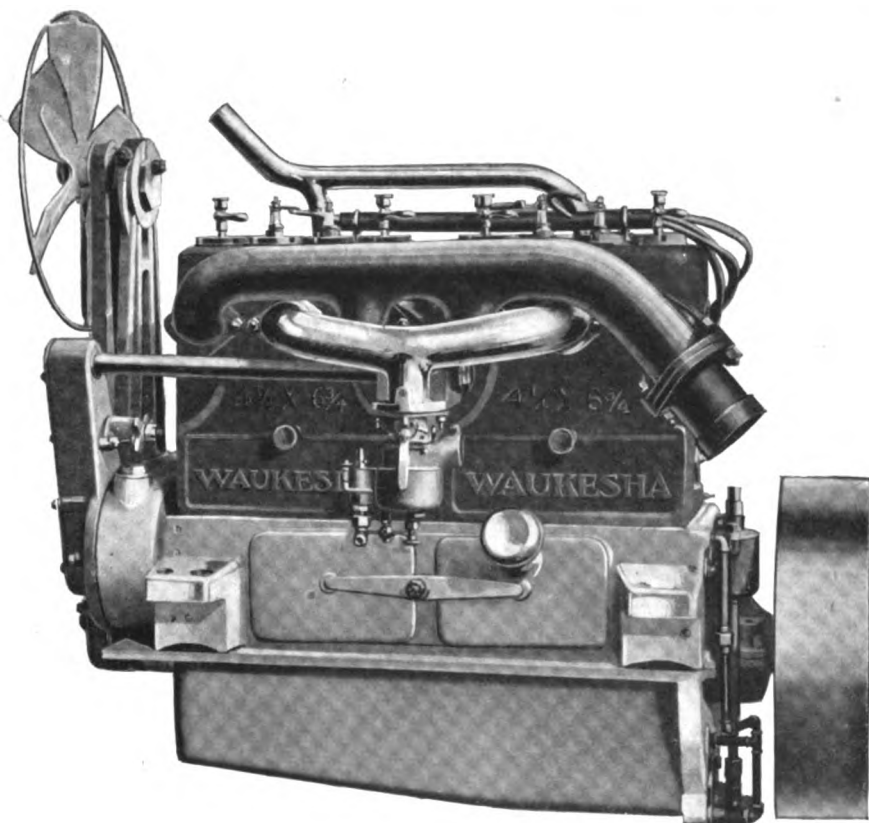
- BRIDGEPORT Brass Co., P. O. Station L., Bridgeport, Conn. (See page 305.)
- COWLES & Co., C., New Haven, Conn. (See page 91.)
- DOUGLAS & Lomason Co., Detroit, Mich.
- ENGLISH & Mersick Co., New Haven, Conn.
- JONAH & George, Merriam, Mass. (See page 163.)
- KINSEY Mfg. Co., Toledo, O. (See page 305.)
- MANHATTAN Brass Co., 328 E. 28th St., New York, N. Y.
- METAL Stamping Co., 13th St. & Boulevard, Long Island City, N. Y.
- MURPHY Co., G. W. J., Merrimac, Mass.
- RANDOLPH-CLOWES Co., Waterbury, Conn.
- ROME Brass & Copper Co., Rome, N. Y.
- SMITH & Co., Jos. N., Detroit, Mich. (See page 201.)
- WHITE Mfg. Co., Bridgeport, Conn. (See page 619.)
- WOODRUFF & Sons Co., Walter W., Mount Carmel, Conn.

RUNNING BOARD MOULDING

(See also Moulding, Brass; also Moulding, Steel)

- BRIDGEPORT Brass Co., P. O. Station L., Bridgeport, Conn. (See page 305.)
- ENGLISH & Mersick Co., New Haven, Conn.
- METALLIC Automobile Matting Co., 281 Mill St., Rochester, N. Y.
- SMITH & Co., Jos. N., Detroit, Mich. (See page 201.)

The ^{AN} EXCEPTIONAL MOTOR WAUKESHA



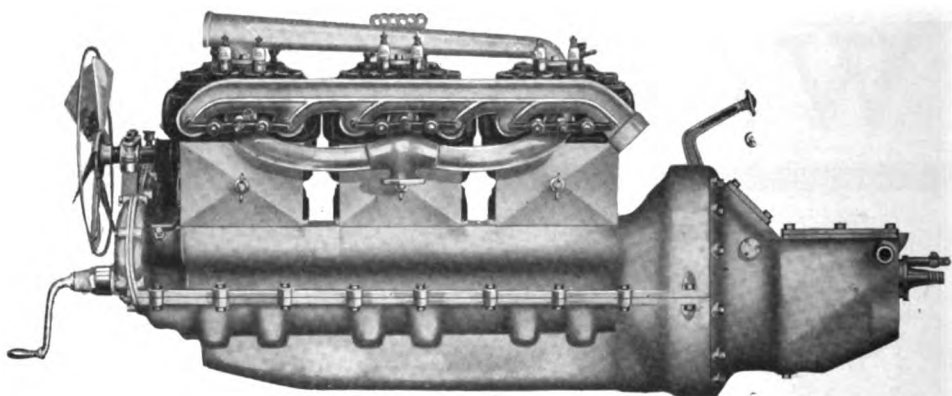
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Strength—Long Wear—Economy of Fuel—the ability to work under all conditions—those are what you get in a WAUKESHA MOTOR. The crankshaft has a tensile strength of 70 tons; the bearings have three times the wearing quality of ordinary bearings. Let us prove the WAUKESHA MOTOR'S supremacy. Write us.

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Enclosed Action*

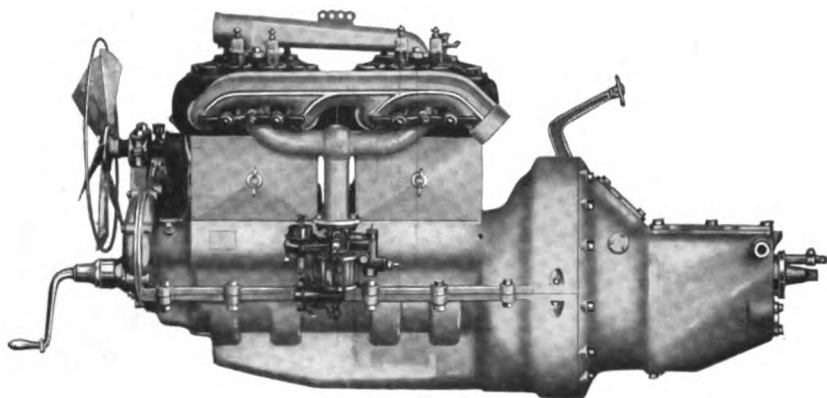
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$3\frac{3}{4} \times 5$ inch
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(See page 307.)

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Chicago, Ill.

BRISCOE Mfg. Co., Detroit, Mich.
(See pages 239 and 240.)

BUNN-HUTCHINSON Co., 330 Prospect Ave.,
N. W., Cleveland, O.

BYRNE, Kingston & Co., 1040 Webster St.,
Kokomo, Ind. "Kingston."

EJECTOR—See Motor & Mfg. Works Co.

GARAGE Equipment Mfg. Co., Milwaukee,
Wis. "Anti-Explo," "Milwaukee."
(See page 203.)

GRAY-HAWLEY Mfg. Co., 937-43 Jefferson
Ave., Detroit, Mich.

HAYES Mfg. Co., Detroit, Mich.
(See pages 70 and 71.)

KELLS Mfg. Co., W. J., 521-25 W. 45th
St., New York, N. Y.
(See page 205.)

KINGSTON—See Byrne, Kingston & Co.

KINSEY Mfg. Co., Toledo, O. "Kinwood."
(See page 395.)

KINWOOD—See Kinsey Mfg. Co.

LAWSON Co., F. H., Cincinnati, O.

MICHIGAN Stamping Co., 759-71 Bellevue
Ave., Detroit, Mich.

MILWAUKEE—See Garage Equipment Mfg.
Co.

MITCHELL & Son, G. F., 6501 Cedar Ave.,
Cleveland, O.

MILWAUKEE Auto Specialty Co., 705-15
Chestnut St., Milwaukee, Wis. "Ra-
dium."
(See page 551.)

MOTOR & Mfg. Works Co., Dunkirk, N. Y.
"Ejector."
(See page 381.)

NOVELTY Mfg. Co., Jackson, Mich.

OLDBERG Mfg. Co., Detroit, Mich.
(See page 201.)

POWELL Muffler & Timer Co., 42 La Fa-
yette St., Utica, N. Y.
(See page 207.)

RADIUM—See Milwaukee Auto Specialty Co.

SANFORD Mfg. Co., F. C., Bridgeport, Conn.
SWAIN Mfg. Co., 3240 Rhodes Ave., Chicago,
Ill.

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XARGIL Mfg. Co., 34 Broadway, Utica, N. Y.

YALE Mfg. & Sales Co., Milwaukee, Wis.

YANKEE Co., Utica, N. Y.
(See page 409.)

THROAT MUFFLERS

BRADLEY Knitting Co., Delavan, Wis.

SCOTT Knitting Co., 1021 Gallia St., Ports-
mouth, O.

WAY Muffler Co., 23d & Arch Sts., Philadel-
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(See Tacks, Upholstery)

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(See Fittings, Pipe)

PUMP NIPPLES

(See Connections, Tire Pump)

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BALTIMORE Enamel & Novelty Co., ft. Allen
St., Baltimore, Md.

BALZER Auto Co., Gus, 1777 Broadway, New
York, N. Y.

BLISS Mfg. Co., E. C., 91 Sabin St., Provi-
dence, R. I.
(See page 595.)

BOYLE & Co., John, New York, N. Y.
(See page 81.)

FINE Co., Horace E., 19 E. State St., Tren-
ton, N. J.

GREACEN & Co., Walter, 12 Mechanic St.,
Newark, N. J.

INGRAM-RICHARDSON Mfg. Co., Beaver
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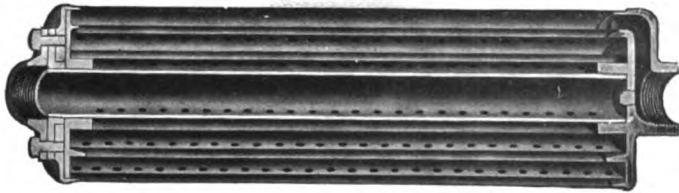
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ROYAL Enameling & Stamping Works, Des-plaines, Ill.
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CLARK Bros. Bolt Co., Milldale, Conn. (See page 77.)
COLUMBIA Nut & Bolt Co., 1550 Railroad Ave., Bridgeport, Conn.
EBERHARD Mfg. Co., Cleveland, O. (See page 215.)
GARLAND Nut & Rivet Co., Bailey-Farrell Bldg., Pittsburg, Pa.
GRAHAM Nut Co., Pittsburg, Pa.
MILTON Mfg. Co., Milton, Pa.
NATIONAL-ACME Mfg. Co., Cleveland, O. (See page 329.)
NATIONAL Bolt & Nut Co., Pittsburg, Pa.
RHODE Island Tool Co., Providence, R. I.
RUSSELL, Burdsall & Ward Bolt & Nut Co., Port Chester, N. Y.
ST. LOUIS Screw Co., Clarence & Bulwer Aves., St. Louis, Mo.
UPSON Nut Co., Unionville, Conn.
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CHICAGO Screw Co., Homan Ave. & Fillmore St., Chicago, Ill. (See page 217.)
CLARK Bros. Bolt Co., Milldale, Conn. (See page 77.)
GARLAND Nut & Rivet Co., Bailey-Farrell Bldg., Pittsburg, Pa.
GRAHAM NUT CO., Pittsburg, Pa.
HARRIS & Reed Mfg. Co., 1500-22 W. 15th St., Chicago, Ill.

HARTFORD Machine Screw Co., Hartford, Conn. (See page 285.)

HASKELL Mfg. Co., Wm. H., 451 Main St., Pawtucket, R. I.

MILTON Mfg. Co., Milton, Pa.

NATIONAL-ACME Mfg. Co., Cleveland, O. (See page 329.)

NATIONAL Bolt & Nut Co., Pittsburg, Pa.

NEW HAVEN Machine Screw Co., New Haven, Conn. (See page 325.)

PAWTUCKET Mfg. Co., 327 Pine St., Pawtucket, R. I.

PITTSBURG Screw & Bolt Co., Liberty Ave. & 25th St., Pittsburg, Pa.

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AMERICAN Nut & Bolt Fastener Co., Pittsburg, Pa. "Bartley."
BARTLEY—See American Nut & Bolt Fastener Co.
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COLUMBIA Nut & Bolt Co., 1550 Railroad Ave., Bridgeport, Conn.
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FLUKE, F. S., 4742 Langley Ave., Chicago, Ill. "F. F."
GRIP Nut Co., Old Colony Bldg., Chicago, Ill.
HOBBS Mfg. Co., Worcester, Mass.
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NATIONAL Lock Washer Co., Newark, N. J.
PIN Hole Locked Nut Co., 1790 Broadway, New York, N. Y. (See page 567.)
POSITIVE Lock Washer Co., Newark, N. J. (See page 591.)
RELIANCE Mfg. Co., Massillon, O. (See page 295.)
STEEL Specialties Co., 6 Beacon St., Boston, Mass. "W. W. W."
UNITED Nut Lock Co., Springfield, Mass. "Hugtite."
U. S. Lock Washer Co., 34-36 Brenner St., Newark, N. J.
UNIVERSAL Lock-Washer Co., Bridgeport, Conn.
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by our new process. The surface of wrought iron or low carbon steel is converted into High Carbon Steel, to any PRACTICAL depth required for case-hardening the exterior uniformly while leaving the core soft.

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(See page 217.)

CLARK Bros. Bolt Co., Milldale, Conn.
(See page 77.)

COLUMBUS Bolt Works, Columbus, O.

CORBIN Screw Corp., 219 High St., New Britain, Conn.

DETROIT Screw Works, Detroit, Mich.
(See page 653.)

EBERHARD Mfg. Co., Cleveland, O.
(See page 215.)

GARLAND Nut & Rivet Co., Bailey-Farrell Bldg., Pittsburg, Pa.

HASKELL Mfg. Co., Wm. H., 451 Main St., Pawtucket, R. I.

KEELER Brass Co., 261-71 Godfrey Ave., Grand Rapids, Mich.

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ST. LOUIS Screw Co., Clarence & Bulwer Aves., St. Louis, Mo.

UPSON Nut Co., Unionville, Conn.

WESTERN Automatic Machine Screw Co., 750 Lake Ave., Elyria, O.
(See page 331.)

WHITMAN & BARNES Mfg. Co., Akron, O.

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ADVANCE Oil Works, 310-12 Flushing Ave., Brooklyn, N. Y.

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"Amoco," "Amolico."

AMOCO—See American Oil Co.

AMOILCO—See American Oil Co.

ARCO—See Atlantic Refining Co.

ATLANTIC Refining Co., Cleveland, O.
"Arco."

ATLAS—See Swan & Finch Co.

AURORA—See Pigot-Sayre Co.

AUTLUBO—See Moore Oil Co.

AUTO Oil Co., 172 S. Water St., Jackson, Mich. "Diamond Cross."

AUTOBY—See Great Western Oil Co.

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AUTOLINE—See Robinson & Son Co.

BAKER, Wm. T., 220-32 Suydam Ave., Jersey City, N. J. "Paramount."

BALKAN—See Jones, C. D.

BANNER—See Clarkson & Ford Co.

BANNER—See Cortland Specialty Co.

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BLUE RIBBON—See Sawyer Oil Co.

BORNE, Scrymser Co., 80 South St., New York, N. Y. "Colonial."
(See page 265.)

BUCK & Co., E. A., Worcester, Mass.

BULLY—See New York Oil & Grease Co.

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COMMODORE—See Miller Co.

CONNECTICUT Oil Co., 549 S. Leonard St., Waterbury, Conn.

CONSOLIDATED Lubricants Co., 551 W. 42d St., New York, N. Y. "Right."

CORTLAND Specialty Co., 176 Railroad St., Cortland, N. Y. "Banner."

CRANE & Co., L. M., 91 Oliver St., Boston, Mass. "Eureka."

CRAWFORD Co., Wm. J., 14 Wood St., Pittsburg, Pa.

CREW Levick Co., Land Title Bldg., Philadelphia, Pa. "Perfection."
(See page 187.)

CROWN—See Great Western Oil Co.

CYLOIL—See Hsley, Doubleday & Co.

DAVEY & Co., 2600 Grand Ave., Chicago, Ill.
"Century."

DEARBORN Drug & Chemical Works, Chicago, Ill. "Fort Putnam," "Fort Auto," "Fort Hudson."

DEFIANCE—See Waverly Oil Works Co.

DIAMOND CROSS—See Auto Oil Co.

DRAKE Oil Co., 99 Spring St., Titusville, Pa.
"Speed-Oil."

DUPLEX—See Enterprise Oil Co.

EAGLE Oil & Supply Co., Boston, Mass.
"No-Karbon," "Eagleline."
(See page 593.)

EAGLEINE—See Eagle Oil & Supply Co.

EARLENE—See Franklin Oil Works.

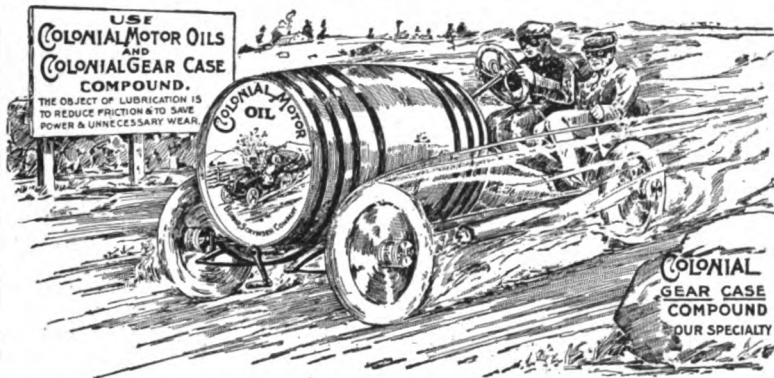
EMCO—See Emery Mfg. Co.

EMERY Mfg. Co., Bradford, Pa. "Emco."

ENERGINE Refining & Mfg. Co., Cleveland, O. "Polar Star."
(See page 191.)

ENSIGN Refining Co., 10605 Quebec Ave., Cleveland, O.

TO OBTAIN THE BEST RESULTS, USE THE BEST LUBRICANTS.
CAN BE HAD AT GARAGES, OR AT ANY OF OUR STORES



COLONIAL MOTOR OIL

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- ENTERPRISE Oil Co., Buffalo, N. Y. "Duplex."
- EUCLID—See Rellance Oil & Grease Co.
- EUREKA—See Crane & Co.
- EXCELSIOR—See Miller's Sons.
- FAULTLESS—See Hawkeye Oil Co.
- FIAT—See Pennsylvania Oil Works Co.
- FIDELITY Oil Co., 306-10 E. 17th St., Kansas City, Mo.
- FISKE Bros. Refining Co., 24 State St., New York, N. Y. "Lubroleine."
- FORT AUTO—See Dearborn Drug & Chemical Works.
- FORT HUDSON—See Dearborn Drug & Chemical Works.
- FORT PUTNAM—See Dearborn Drug & Chemical Works.
- FRANK Oil Co., Titusville, Pa.
- FRANKLIN Oil Works, Franklin, Pa. "Earlene."
- FRANKLIN Refining Co., 3027 Locust St., St. Louis, Mo.
- FRENCH—See Marshall Oil Co.
- FULCRUM Oil Co., Franklin, Pa.
- GENERAL Oil Works Co., Traction Bldg., Indianapolis, Ind. "Reliable."
- GRAND PRIX—See Alexander & Co.
- GREAT Western Oil Co., 2855 E. 37th St., Cleveland, O. "Autoby," "Nokarbo," "Crown."
- GREENSLADE Oil Co., 40 Jefferson Ave., Detroit, Mich. "Packard 24-30."
- GULF Refining Co., Frick Bldg. Annex, Pittsburgh, Pa.
- HARRIS Oil Co., A. W., 326 S. Water St., Providence, R. I. (See page 189.)
- HARRIS & Co., Elmer E., 2 Maurice St., Buffalo, N. Y.
- HAVOLINE—See Indian Refining Co.
- HAVOLINE Oil Co., 17 Battery Pl., New York, N. Y.
- HAWKEYE Oil Co., Waterloo, Ia. "Faultless."
- HAWS, George A., 62 Pine St., New York, N. Y. "Panhard." (See page 267.)
- HINDS & Coon, 124-26 Pearl St., Boston, Mass. "Peach."
- HOLLINGSHEAD Co., R. M., Camden, N. J. "Whizoll."
- HOUGHTON & Co., E. F., 240 W. Somerset St., Philadelphia, Pa. "Motoline."
- IDEAL—See Sheppard, W. S.
- ILSLEY, Doubleday & Co., 229-31 Front St., New York, N. Y. "Cyloll."
- INDIAN Refining Co., 17 Battery Pl., New York, N. Y. "Havoline."
- INTER-LUBE—See Whitney Chemical Co.
- INVADER Oil Co., 80 Broad St., New York, N. Y.
- INVINCIBLE—See Miller's Sons Co.
- JONES, C. D., 429 Locust St., Philadelphia, Pa. "Balkan."
- KELLOGG & Co., E. H., 233-43 South St., New York, N. Y.
- KENDALL Refining Co., Bradford, Pa.
- KEYSTONE Lubricating Co., 21st & Clearfield Sts., Philadelphia, Pa.
- KINCAID Oil Co., 219-21 W. Exchange St., Providence, R. I.
- KOSMOS—See Mulliken Oil Co.
- LIBERTY—See Richardson Lubricating Co.
- LIBERTY BELL—See Bell Oil Co.
- LOOS & Dilworth, 134 S. Front St., Philadelphia, Pa. "Paragon."
- LUBRO Oil Co., 116 Prospect Ave., N. W., Cleveland, O.
- LUBROLEINE—See Fiske Bros. Refining Co.
- McLEAN-JONES Oil & Supply Co., 40 India Wharf, Boston, Mass. "Swastika."
- MAGIE Bros., 110-12 S. Clinton St., Chicago, Ill. "Russian."
- MARSHALL Oil Co., Marshalltown, Ia. "French."
- MARVIN-STRECK Oil & Supply Co., 1318 Olive St., St. Louis, Mo.
- MERIT—See Oil City Oil & Grease Co.
- METEOR—See Narragansett Chemical Co.
- MILLER Co., Wm. P., 244-50 Greene St., Brooklyn, N. Y. "Commodore."
- MILLER'S Sons, Wm. P., 12th St., Long Island City, N. Y. "Excelsior," "Pan-O-Lite."
- MILLER'S Sons Co., A. D., Pittsburg, Pa. "Invincible."
- MILLS Oil Co., 263 Walton St., Syracuse, N. Y.
- MOBILOIL—See Vacuum Oil Co.
- MONAMOBILE—See Monarch Mfg. Co.
- MONARCH Mfg. Co., Council Bluffs, Ia. "Monamobile."
- MONOGRAM—See Columbia Lubricants Co.
- MOORE Oil Co., York St. & McLean Ave., Cincinnati, O. "Autlubo."
- MORRIS & Co., Richard S., Chicago, Ill.
- MOTOLINE—See Houghton & Co.
- MOTORLUBE—See Tygert Co.
- MOTOROL—See New York & New Jersey Lubricant Co.
- MULLIKEN Oil Co., 200 Friend St., Boston, Mass. "Kosmos."
- NARRAGANSETT Chemical Co., Providence, R. I. "Meteor."
- NATIONAL Lubricating Co., Prospect Bldg., Cleveland, O.
- NATIONAL Oil & Supply Co., Essex & First Sts., Harrison, N. J. "Viscos."
- NATIONAL Refining Co., Rose Bldg., Cleveland, O.
- NEW York Oil & Grease Co., 123 Maiden Lane, New York, N. Y. "Bully."
- NEW York & New Jersey Lubricant Co., 165 Broadway, New York, N. Y. "Motorol."
- NOBLE Refining Co., 706 Canal Rd., Cleveland, O.
- NO-KARBON—See Eagle Oil & Supply Co.
- NOKARBO—See Great Western Oil Co.
- NYE, Wm. F., New Bedford, Mass.
- OIL City Oil & Grease Co., Oil City Trust Bldg., Oil City, Pa. "Merit."
- OIL Products Co., 17 Battery Pl., New York, N. Y. "Usoline."

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The dealer who handles Panhard Oil has the satisfaction of winning permanent customers, of seeing his oil sales increase from month to month.

Panhard Oil pleases every user because it combines heavy body with freedom from carbon. It is refined with such care that the free tarry matter is extracted without reducing lubricating properties.

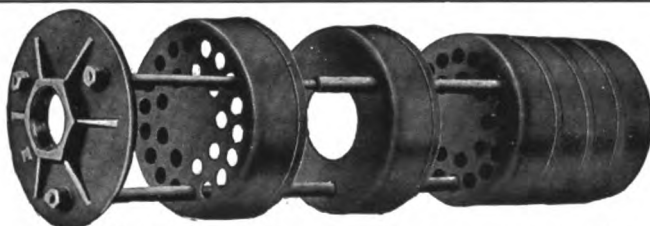
Our latest booklet will give many valuable hints on lubricating. Write for it now, and ask for our special proposition to the trade.

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New York

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WE manufacture Mufflers of the following diameters: 5 inch, 6 inch and 6 $\frac{1}{4}$ inch and we use the number of sections necessary to properly muffle the different size motors that are on the market.

5 inch diameter Mufflers are stamped from 20 gauge steel

6 " " " " " " " 18 " "

6 $\frac{1}{4}$ " " " " " " " 16 or 18 gauge steel.

This muffler is made up of a succession of pressed steel cups drawn from sheet metal. Each cup is shouldered so that it overlaps the bottom of the succeeding one by one-fourth of an inch.

The end plates are malleable iron, with pipe or flange connection.

The perforations are around the outer edge of each baffling plate with an additional one in the center of the first few, the area of these holes varying with the size of the engine to be muffled.

The POWELL MUFFLER is *standard equipment on 36 of the best AMERICAN made automobiles and trucks*, which is ample proof of its efficiency and durability.

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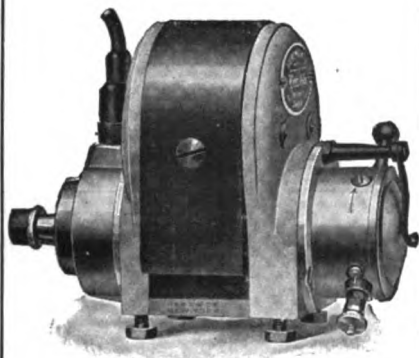
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OILS (Continued)

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- OILDAG—See Acheson Oildag Co.
- OILZUM—See White & Bagley Co.
- OTTOMO—See Pioneer Mfg. Co.
- OZARK—See Tropical Oil Co.
- PACKARD—See Puritan Oil Co.
- PACKARD—See Wolverine Lubricants Co. of New York.
- PACKARD 24-30—See Greenslade Oil Co.
- PANAMA Oil & Grease Co., 159-61 W. 51st St., New York, N. Y.
- PANHARD—See Haws, Geo. A.
- PAN-O-LITE—See Miller's Sons.
- PARAGON—See Loos & Dilworth.
- PARAGON Refining Co., Front St., Toledo, O. "Petrolene."
- PARAMOUNT—See Baker, Wm. T.
- PATHFINDER—See Sweet, Charles F.
- PATTERSON Lubricating Co., 114 Broad St., Boston, Mass.
- PEACH—See Hinds & Coon.
- PENN Oil & Supply Co., Chicago, Ill.
- PENN Petroleum Co., 209 Arch St., Philadelphia, Pa. "Primus."
- PENNSYLVANIA Oil Works Co., 72 Front St., New York, N. Y. "Flat," "Zenith," "Velox."
- PERFECTION—See Crew Levick Co.
- PERFECTION—See Wood Co.
- PERRY Oil Co., 372 Central Ave., Pawtucket, R. I.
- PETROLENE—See Paragon Refining Co.
- PETROLEUM Products Co., 3600-10 Grant Blvd., Pittsburg, Pa. "Sound-Proof." (See page 191.)
- PIERCE & Rice Oil Co., Hammond & Canterbury Sts., Worcester, Mass.
- PIGOT-SAYRE Co., 135 William St., New York, N. Y. "Aurora."
- PIONEER Mfg. Co., 5220 Sweeney Ave., S. E., Cleveland, O. "Ottomo."
- PIONEER Oil Co., Old South Bldg., Boston, Mass.
- POLAR STAR—See Engerine Refining & Mfg. Co.
- POLARINE—See Standard Oil Co. of N. Y.
- PRIMUS—See Penn Petroleum Co.
- PURE Oil Co., Fifth & Chestnut Sts., Philadelphia, Pa.
- PURITAN Oil Co., 1218 W. 70th St., Cleveland, O. "Packard."
- RED STAR—See Clinton Oil Co.
- RELIABLE—See General Oil Works Co.
- RELANCE Oil & Grease Co., Cleveland, O. "Euclid."
- RICHARDSON Lubricating Co., Quincy, Ill. "Liberty."
- RIGHT—See Consolidated Lubricants Co.
- ROBINSON & Son Co., Wm. C., Baltimore, Md. "Autoline." (See page 269.)
- RUNEASY—See Winn, Wm. R.
- RUSSIAN—See Magie Bros.
- SAWYER Oil Co., Howard B., 65 Long Wharf, Boston, Mass. "Blue Ribbon."
- SHEPPARD, W. S., 22 Lawrence St., Newark, N. J. "Ideal."
- SONNEBORN Sons, L., Fulton & Pearl Sts., New York, N. Y. "Amalie."
- SOUND-PROOF—See Petroleum Products Co.
- SPEARE'S Sons Co., Alden, 140 Sixth St., Boston, Mass.
- SPEED-OIL—See Drake Oil Co.
- STANDARD Oil Co. of N. Y., New York, N. Y. "Polarine."
- SULLIVAN Oil Co., 413 Wells St., Chicago, Ill.
- SUPERIOR Oil Co., Wade Bldg., Cleveland, O.
- SUTHERLAND & Co., P., 232 Milk St., Boston, Mass. "Velvet."
- SWAN & Finch Co., 151 Maiden Lane, New York, N. Y. "Atlas."
- SWASTIKA—See McLean-Jones Oil & Supply Co.
- SWEET, Charles F., 247 State St., Hartford, Conn. "Pathfinder."
- TEXACO—See Texas Co.
- TEXAS Co., New York, N. Y. "Texaco." (See page 461.)
- TIONA Refining Co., Indianapolis, Ind.
- TROPICAL Oil Co., W., 70th St. & L. S. & M. S. Ry., Cleveland, O. "Ozark."
- TYGERT Co., E. A., 126 N. Front St., Philadelphia, Pa. "Motorlube."
- UNDERHAY Oil Co., 276 Franklin St., Boston, Mass.
- UNION Petroleum Co., 135 S. Second St., Philadelphia, Pa.
- USOLINE—See Oil Products Co.
- VACUUM Oil Co., Rochester, N. Y. "Mobil-oil."
- VALVOLINE Oil Co., 11 Broadway, New York, N. Y.
- VELOX—See Pennsylvania Oil Works Co.
- VELVET—See Sutherland & Co.
- VISCO Motor Oil Co., 2104 Superior Viaduct, Cleveland, O.
- VISCOLINE—See Zartman Oil Co.
- VISCOS—See National Oil & Supply Co.
- VISCOSITY Oil Co., 1101 W. 37th St., Chicago, Ill.
- WARREN Refining Co., Cleveland, O.
- WAVERLY Oil Works Co., 54th St. & A. V. R. R., Pittsburg, Pa. "Defiance."
- WHALE—See Nye, Wm. F.
- WHITE & Bagley Co., 100 Foster St., Worcester, Mass. "Oilzum."
- WHITNEY Chemical Co., Rockefeller Bldg., Cleveland, O. "Inter-Lube."
- WHIZOIL—See Hollingshead Co.
- WILBURINE Oil Works, 11 Broadway, New York, N. Y.
- WINN, Wm. R., 123 Maiden Lane, New York, N. Y. "Runeasy."
- WOLFS HEAD—See Wolverine Lubricants Co. of N. Y.
- WOLVERINE Lubricants Co. of N. Y., 80 Broad St., New York, N. Y. "Packard," "Wolfs Head."
- WOOD Co., W. A., 373 Atlantic Ave., Boston, Mass. "Perfection."
- YOUKIM—See Young & Kimball.



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Hit or miss methods will not do for the house of Rudge Witworth in Coventry, England, the largest English manufacturers of motor-cycles and cycle-cars. Not satisfied to equip their splendid cycles with a Magneto simply because it *looked* to be best or because people *said* it was best, they determined to make an exhaustive analysis of the various Magnetos on their own account. They wanted to *know* beyond question that their equipment could not be surpassed.

Their chief engineer, Mr. Holroyd, was delegated to examine into the matter. He visited practically every Magneto manufacturer on the Continent, naturally including in his trip Stuttgart, the center of the entire world in Magneto production.

While in Stuttgart, Mr. Holroyd called at the Ruthardt plant, the home of the HERZ MAGNETO. He was shown everything from raw material to finished product, including the elaborate testing plant where a diagram is taken from every Magneto built. Mr. Holroyd stated that no other factory he had visited had such complete facilities for testing, that most of them had none at all and no diagram indicator, and some did not even know what the latter was.

When we say that HERZ MAGNETOS were selected by Rudge Witworth under these conditions, the statement needs no comment.

HERZ MAGNETO gives a strong, hot spark under full compression at 35 R.P.M. as against 45 R.P.M. for the best of the other makes. Its superior efficiency and serviceability are beyond all question.

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Manufacturers of the Herz Plug.



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- ZARTMAN Oil Co., J. V., 120 S. Meridian St., Indianapolis, Ind. "Viscoline."
- ZENITH—See Pennsylvania Oil Works Co.
- ZURN Co., O. F., Broad St. & Lehigh Ave., Philadelphia, Pa. "Zurnoil."
- ZURNOIL—See Zurn Co.

ORNAMENTS

RADIATOR ORNAMENTS

- BALZER Auto Co., Gus, 1777 Broadway, New York, N. Y.
- CRAMP & Sons Ship & Engine Building Co., William, Philadelphia, Pa. (See page 251.)
- GOODWIN & Kintz Co., Winsted, Conn.
- INTERNATIONAL Silver Co., Meriden, Conn.
- RONSON Specialty Co., 7-15 Mulberry St., Newark, N. J.

PACKING

ASBESTOS AND FIBROUS PACKING

- AMERICAN Asbestos Co., Norristown, Pa. "Motorbestos." (See page 81.)
- ASBESTOLITH—See Asbestos & Rubber Works of America.
- ASBESTOS & Rubber Works of America, New York, N. Y. "Asbestolith," "Eternite." (See page 55.)
- BROWN & Co., Charles D., 49 Federal St., Boston, Mass. "Vellumold."
- CAREY Co., Philip (Lockland), Cincinnati, O.
- CRANDALL Packing Co., Palmyra, N. Y.
- DEFENDER—See Woven Steel Hose & Rubber Co.
- EAGLE Oil & Supply Co., Boston, Mass. (See page 593.)
- EMPIRE Tire Co., Mulberry St. & Clinton Ave., Trenton, N. J. "Motobestos."
- ENDURA Mfg. Co., 63d St. & Eastwick Ave., Philadelphia, Pa.
- ESSEX Rubber Co., Trenton, N. J.
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- HART Packing Co., Boston, Mass.
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- JOHNS-MANVILLE Co., H. W., Madison Ave. & 41st St., New York, N. Y. "J. M. Mobilene."

KEASBEY & Mattison Co., Ambler, Pa. (See page 53.)

MOTOBESTOS—See Empire Tire Co.

MOTORBESTOS—See American Asbestos Co.

SALL Mountain Asbestos Mfg. Co., 230 S. La Salle St., Chicago, Ill.

VELLUMOID—See Brown & Co.

WOVEN Steel Hose & Rubber Co., Trenton, N. J. "Defender." (See page 593.)

METALLIC PACKING

(See Gaskets, Metallic)

RUBBER PACKING

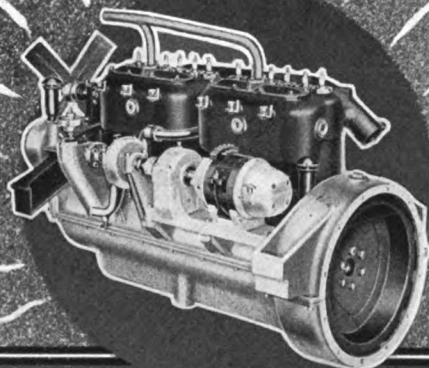
- BOSTON Belting Co., 256-60 Devonshire St., Boston, Mass.
- BOWERS Rubber Works, 68-70 Sacramento St., San Francisco, Cal.
- CANFIELD Mfg. Co., 78 Murray St., New York, N. Y.
- CINCINNATI Rubber Mfg. Co., Cincinnati, O. (See page 341.)
- CONSOLIDATED Rubber Co., Trenton, N. J.
- CRANDALL Packing Co., Palmyra, N. Y.
- EAGLE Oil & Supply Co., Boston, Mass. (See page 593.)
- EMPIRE Rubber Mfg. Co., Trenton, N. J.
- GARLOCK Packing Co., Palmyra, N. Y.
- HAMILTON Rubber Mfg. Co., Trenton, N. J.
- HART Packing Co., Boston, Mass.
- HOME Tire Co., Trenton, N. J. (See page 401.)
- KNOWLTON Rubber Co., Geo. W., 60 Pearl St., Boston, Mass.
- MANHATTAN Rubber Mfg. Co., Passaic, N. J.
- MATTSON Rubber Co., Lodi, N. J. (See page 607.)
- NATIONAL India Rubber Co., Bristol, R. I.
- NEW Jersey Car Spring & Rubber Co., Wayne & Brunswick Sts., Jersey City, N. J.
- NEW York Belting & Packing Co., 91 Chambers St., New York, N. Y.
- QUAKER City Rubber Co., 629 Market St., Philadelphia, Pa.
- REPUBLIC Rubber Co., Youngstown, O.
- STOKES Rubber Co., Jos., Trenton, N. J.
- THERMOID Rubber Co., Trenton, N. J. "Vulcanoid." (See page 393.)
- VOORHEES Rubber Mfg. Co., 18-46 Bostwick Ave., Jersey City, N. J. (See page 131.)
- VULCANOID—See Thermoid Rubber Co.

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(See Numbers, License)

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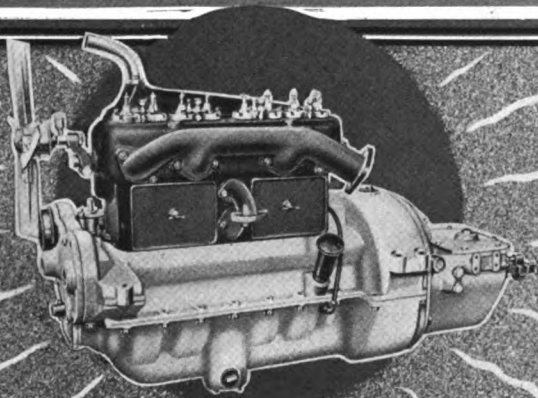
He uses it because he has a product worthy of it; and he has enough pride in both to maintain the Continental standard throughout his own product.

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 BUCKEYE Paint & Varnish Co., 15th & Lucas Sts., Toledo, O.
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 MOUND City Paint & Color Co., 11th & Mulanphy Sts., St. Louis, Mo.
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 WILHELM Co., A., Third & Bern Sts., Reading, Pa.
 WILLEY Co., C. A. (Hunter's Point), New York, N. Y.
 (See page 411.)

ALUMINUM AND BRONZE PAINTS

ALUSTRUM—See Devoe & C. T. Reynolds Co.
 ARNOLD, N. B., 1 Sigourney St., Brooklyn, N. Y. "Silkup."
 (See page 155.)
 BILLINGS-CHAPIN Co., Cleveland, O.
 BINSWANGER & Co., B., Philadelphia, Pa.
 BRONZE Powder Works Co., Elizabeth, N. J. "Ideal," "Vulcan."
 CULLEN & Co., F. C., First National Bank Bldg., Chicago, Ill.
 DEVOE & C. T. Reynolds Co., F. W., 101 Fulton St., New York, N. Y. "Alustrum."
 GERSTENDORFER Bros., 231 E. 42d St., New York, N. Y. "Sapolin."
 IDEAL—See Bronze Powder Works Co.
 KEMP Co., W. H., 165 Spring St., New York, N. Y.
 SAPOLIN—See Gerstendorfer Bros.
 SCHLEGEL Mfg. Co., Oscar, 111 E. 12th St., New York, N. Y.
 SLIKUP—See Arnold, N. B.
 VULCAN—See Bronze Powder Works Co.

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 ESSEX Varnish Co., 92 Vesey St., Newark, N. J.
 FELTON, Sibley & Co., 136-40 N. Fourth St., Philadelphia, Pa.
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31X4 \$6.00	33X4 \$6.50	35X4 \$7.50	37X4 \$8.00	39X4 \$8.50	31X4 1/2 \$6.50	33X4 1/2 \$7.00	35X4 1/2 \$7.50	37X4 1/2 \$8.00	39X4 1/2 \$8.50
40X4 \$10.00	30X4 1/2 \$6.50	32X4 1/2 \$7.00	34X4 1/2 \$7.50	36X4 1/2 \$8.00	40X5 \$12.00	38X5 \$10.50	36X5 1/2 \$12.00	34X5 \$9.00	32X5 \$8.00
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IMPERIAL—See Akron Varnish Co.
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PRATT & Lambert, Buffalo, N. Y.
SHERWIN-WILLIAMS Co., 100 Canal St., Cleveland, O.
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VALENTINE & Co., 456 Fourth Ave., New York, N. Y.

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(See page 155.)
ARNSTEIN, Eugene, 46th St. & Wentworth Ave., Chicago, Ill.
BULGER Varnish Co., William, 105th St. & Quebec Ave., Cleveland, O.
C. O. T.—See Tingley & Co.
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(See page 155.)
HALL-THOMPSON Co., Hartford, Conn. "Wonder Worker."
NORTHWESTERN Chemical Co., Marietta, O. "Pioneer."
(See page 115.)
PIONEER—See Northwestern Chemical Co.
SLIKUP—See Arnold, N. B.
TINGLEY & Co., Chas. O., Rahway, N. J. "C. O. T."
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(See page 155.)
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(See page 115.)
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HALL-THOMPSON Co., Hartford, Conn. "Wonder Worker."
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KARBONEATER Mfg. Co., Vanadium Bldg., Pittsburg, Pa. "K M C."
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NATIONAL Rubber Co., 4409 Narco Bldg., St. Louis, Mo. "Narco Tirenew."
(See page 155.)
NEW Tyr Mfg. Co., 771 Lexington Ave., New York, N. Y.
NORTHWESTERN Chemical Co., Marietta, O. "Tire-Lac."
(See page 115.)
NU-TIRE—See Auto Products Co. of America.
PAGE-LESTER Co., 125 W. Van Buren St., Chicago, Ill. "Tire-Kote."
PETERSON Co., T. J., Lees Bldg., Chicago, Ill. "Arrow."
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(See page 669.)
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(See page 153.)
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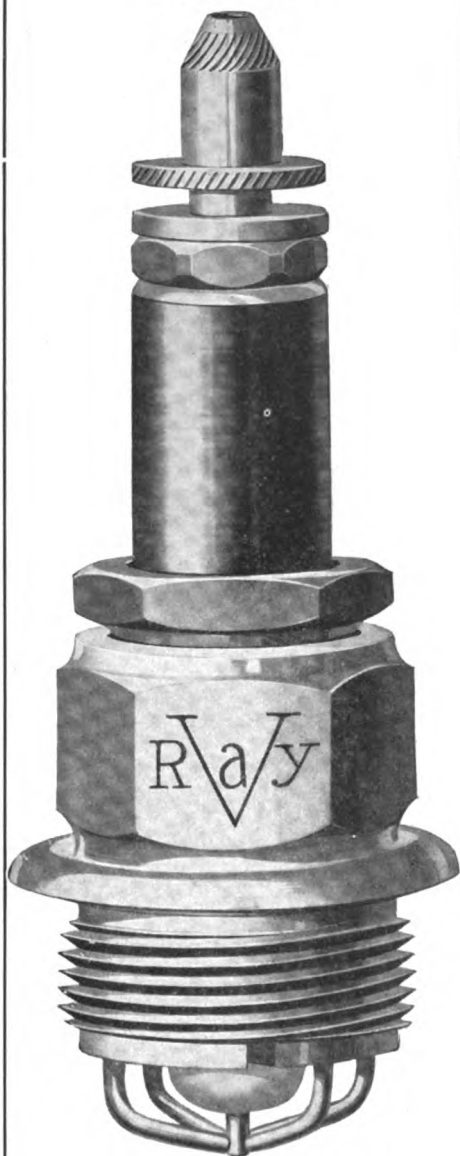
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(See pages 70 and 71.)

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(See page 395.)

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(See page 157.)

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(See page 395.)

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(See page 343.)

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CINCINNATI Rubber Mfg. Co., Cincinnati, O.
(See page 341.)

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(See page 341.)

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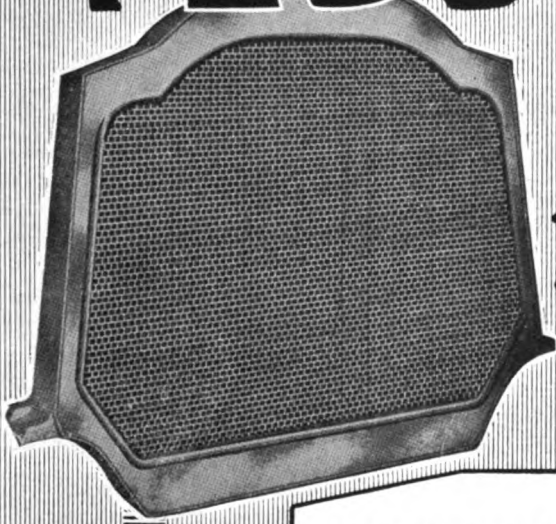
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(See page 621.)
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(See page 321.)
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(See page 653.)

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(See page 285.)

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(See page 579.)

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PERRY-FAY Mfg. Co., Elyria, O.

PORTER & Co., W. S., 608 S. Dearborn St., Chicago, Ill.

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STANDARD Tool Co., 6900-34 Central Ave., Cleveland, O.

U. S. Automatic Co., Amherst, O.

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(See page 331.)

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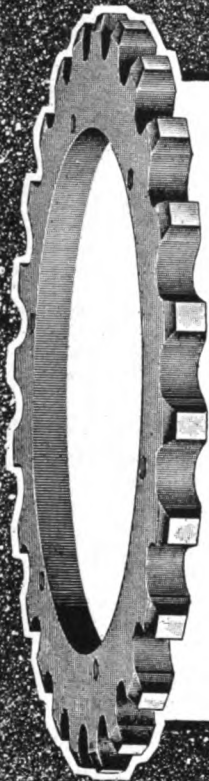
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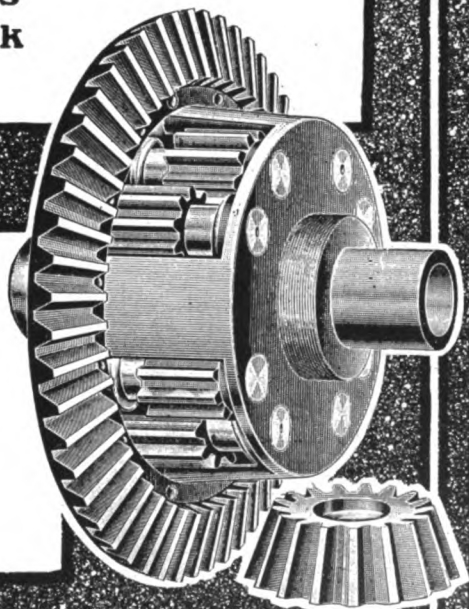


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(See page 595.)
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(See page 593.)
- MULHAUPT, F. Jos., 227 N. Fifth St., Lafayette, Ind.
- MURDOCK, Jr. Co., Jas., 116 Opera Pl., Cincinnati, O.
- NEW York Stencil Works, 100 Nassau St., New York, N. Y.
- PREMIER Metal Etching Co., 617-21 E. 18th St., New York, N. Y.
- QUINT'S Sons Co., S. H., 15 S. Fourth St., Philadelphia, Pa.
- ROBBINS Mfg. Co., John, 58 Kneeland St., Boston, Mass.
- SHEPARD Mfg. Co., Melrose Highlands, Mass.
- SMITH & Co., Jos. N., Detroit, Mich.
(See page 201.)
- STAFFORD Co., N., 67 Fulton St., New York, N. Y.
- TURNER Brass Works, Sycamore, Ill.
- WALTER & Sons, N. C., 194 William St., New York, N. Y.
- WATSON Co., Mechanics St., Attleboro, Mass.
- WHITEFORD & Co., Jos. G., 165 N. Jefferson St., Chicago, Ill.
- WRIGHT & Son, Greg. G., 119-21 Opera Pl., Cincinnati, O.
- YEUELL Co., E. V., Malden, Mass.

PLATING**BRASS AND NICKEL PLATING**

- AMERICAN Car & Ship Hardware Mfg. Co., New Castle, Pa.
- AUTO Parts Mfg. Co., 620-30 S. Elliot St., Muncie, Ind.
(See page 371.)
- BRIDGEPORT Electro Plate Co., 270 Kosuth St., Bridgeport, Conn.
- BRIDGEPORT Metal Goods Mfg. Co., Howard Ave. & Spruce St., Bridgeport, Conn.
- CHICAGO-RACINE Aluminum, Brass & Iron Works, 224-30 W. Huron St., Chicago, Ill.
(See page 607.)
- DETLAFF, A. J., 121 Champlain St., Detroit, Mich.
- FRIES & Co., Buffalo, N. Y.
(See page 251.)
- HILLMAN Auto Supply Mfg. Co., 98 Massachusetts Ave., Boston, Mass.
- HOLT & Beebe Co., 51 Chardon St., Boston, Mass.
- METROPOLITAN Mfg. Co., Detroit, Mich.
(See page 593.)
- NEHLS Plating Works, 248 Brush St., Detroit, Mich.
- NOVELTY Mfg. Co., Jackson, Mich.
- VOELKNER & Harry Mfg. Co., 282-92 Woodbridge St., E., Detroit, Mich.
- WHITEHOUSE Mfg. Co., E. A., 42-54 Elm St., Newark, N. J.
(See page opposite Title Page.)

PLATINUM

(See also Points, Sparking)

- AMERICAN Platinum Works, 225-31 N. J. R. Ave., Newark, N. J.
- BAKER & Co., Newark, N. J.
(See page 589.)
- BISHOP & Co., Platinum Works, J., Malvern, Pa.
- COMMERCIAL Research Co., Tuckahoe, N. Y.
(See page 301.)
- DEE & Co., Thos. J. D., 26 W. Washington St., Chicago, Ill.
- GOLDSMITH Bros. Smelting & Refining Co., Heyworth Bldg., Chicago, Ill.
- PLATT, C. S., 29 Gold St., New York, N. Y.
- ROESSLER & Hasslacher Chemical Co., 100 William St., New York, N. Y.
(See page 301.)

PLIERS**TIRE REPAIR PLIERS**

- GILMER, Jr., G. Walker, 52 Seventh St., Philadelphia, Pa.
(See page 131 and Back Cover.)
- NATIONAL Cutlery Co., Westmoreland & Bond Sts., Philadelphia, Pa.

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Best**

By a new design and process of assembling we have made our plugs positively **Gas Tight** at the same time reducing the strain on the porcelain to a degree never before attained.

They may be taken apart, cleaned and re-assembled many times and still remain gas tight.

The center electrode is so designed that it can not become

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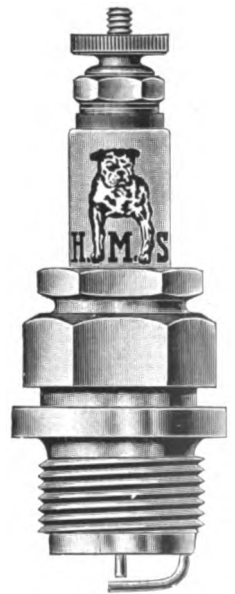
The sparking points are made of a special high heat-resistance wire which is a composition especially designed for the purpose and which has proved in the most exhaustive competitive tests to be far superior to any other on the market.

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 LANG Electric Co., J., 423 N. Lincoln St., Chicago, Ill.
 RUSSELL & Stoll Co., 48 Cliff St., New York, N. Y.
 WESTINGHOUSE Electric & Mfg. Co., (E. Pittsburg), Pittsburg, Pa.

SPARK PLUGS

- A. C.—See Champion Ignition Co.
 ACME Sales Co., 237 Jefferson Ave., Detroit, Mich. "Lore."
 ACME Telephone & Mfg. Co., Albia, Ia. "Flash."
 AJAX—See Auto Specialties Mfg. Co.
 ALBRIGHT Ignition Co., Columbus, Ga.
 ALL-IN-ONE—See Frontier Specialty Co.
 AMERICAN Coil Co., Foxboro, Mass.
 ANCHOR—See Szel Import & Export Co.
 ANDERSON Spark Plug Co., 206 N. Holliday St., Baltimore, Md. (See page 661.)
 ARROW—See Reflex Ignition Co.
 ASCO RED DEVIL—See Automobile Sundries Co.
 AUBURN—See New York Mica & Mfg. Co.
 AUTO-MARINE—See Legnard Bros.
 AUTO Specialties Mfg. Co., 656-58 Third St., Milwaukee, Wis. "Ajax," "Meteor."
 AUTOMOBILE Sundries Co., 18 Broadway, New York, N. Y. "Asco Red Devil."
 BEAT-EM-ALL—See Mosler & Co.
 BECKLEY-RALSTON Co., Michigan Ave. & Randolph St., Chicago, Ill. "Victor," "Copperhead," "Diamond."
 BENFORD Mfg. Co., Mount Vernon, N. Y. "Monarch." (See page 555.)
 BENTON Co., F. L., Vergennes, Vt.
 BEST Ignition Equipment Co., 200 W. 64th St., New York, N. Y. (See page 555.)
 BETHLEHEM—See Silvex Co.
 BIGSBY Mfg. Co., 7501 Quincy Ave., Cleveland, O. "Vital." (See page 291.)
 BINGHAM Mfg. Co., 227 Prospect Ave., N. W., Cleveland, O. "Snappoon."
 BLACK EAGLE—See Standard Co.
 BLAKE Spark Plug Co., 101 Concord Ave., Cambridge, Mass.
 BLICKENS DERFER & Co., G. C., Stamford, Conn. "Bulls Eye."
 BOSCH Magneto Co., 223 W. 46th St., New York, N. Y.
 BOUGIE MERCEDES—See Herz & Co.
 BREECH-BLOCK—See Mosler & Co.
 BROCKETT-GORHAM Co., Marion, O. "Bro-Gor."
 BRO-GOR—See Brockett-Gorham Co.
 BULL Dog—See Hartford Machine Screw Co.
 BULLS EYE—See Blickensderfer & Co.
 BURNHAM Spark Plug Co., East Edgemoor, Me.
 BUSCOBA—See Bush-Scott Co.
 BUSH-SCOTT Co., Detroit, Mich. "Busco ba."
 CENTERFIRE—See Milwaukee Auto Specialty Co.
 CHAMPION Ignition Co., Flint, Mich. "A. C." (See page 445.)
 CHAMPION Spark Plug Co., Dept. H, Toledo, O. (See page 289.)
 CHARTER & Co., Hoopeston, Ill.
 CHICAGO-RACINE Aluminum, Brass & Iron Works, 224-30 W. Huron St., Chicago, Ill. (See page 607.)
 CLEVELAND—See Pennsylvania Rubber & Supply Co.
 COMET—See Oakes & Dow Co.
 COPPERHEAD—See Beckley-Ralston Co.
 COX, David H., Roselle, N. J., "Cox-Edick."
 COX-EDICK—See Cox, David H.
 CZAR Ignition Co., 732 Main St., Buffalo, N. Y.
 DAY, Geo. F., 21 Haverhill St., Boston, Mass.
 DELTA Mfg. Co., Bloomfield, N. J.
 DIAMOND—See Beckley-Ralston Co.
 DOW Mfg. Co., 131 Adams St., Braintree, Mass.
 DOXEY, N. D., 197 E. Washington Ave., Elmira, N. Y. "Lightning."
 DUPLEX Multi-Spark Plug Co., Devils Lake, N. D. "Maher."
 ECHO—See Electrolamp Co.
 ECLIPSE Specialty Co., 250 W. 54th St., New York, N. Y.
 EDISON—See Jeffery-DeWitt Co.
 EISEMANN Magneto Co., 225-27 W. 57th St., New York, N. Y. (See page 243.)
 ELECTRIC Goods Mfg. Co., Canton, Mass. "Perfex."
 ELECTROLAMP Co., 60 Atwater St., E. Detroit, Mich. "Little Gem," "Echo."
 ELGIN Spark Plug & Ignition Co., Elgin, Ill.
 EMPIRE—See Grant Mfg. & Machine Co.
 FIREFLY—See Sharp Spark Plug Co.
 FLASH—See Acme Telephone & Mfg. Co.
 FLASH LIGHT—See Janney, Steinmetz & Co.
 FRANKLIN Machine Co., 770 Franklin Ave., Brooklyn, N. Y.
 FRONTIER Specialty Co., Buffalo, N. Y. "All-In-One." (See page 477.)
 GOTHAM—See Sturdy Mfg. Co.
 GRAHAM Mfg. Co., Providence, R. I.
 GRANT Mfg. & Machine Co., Bridgeport, Conn. "Empire." (See page 439.)
 GROSSMAN Co., Emil, 248-50 W. 54th St., New York, N. Y. "Red Head."
 H. M. S.—See Hartford Machine Screw Co.

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WE GUARANTEE ALL

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If you are having ignition trouble
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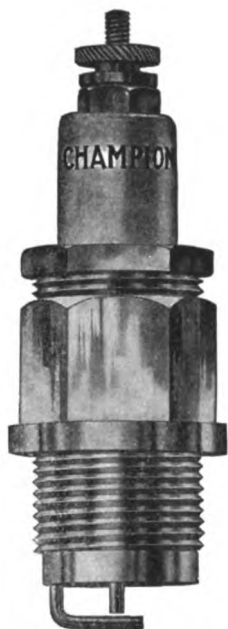
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- HAGSTROM Bros. Mfg. Co., Lindsborg, Kans.
 HAMPSHIRE Mfg. Co., Hatfield, Mass.
 "Wizard," "Rival."
- HARTFORD Machine Screw Co., Hartford, Conn. "H. M. S.," "Bull Dog."
 (See page 285.)
- HARTFORD Suspension Co., Jersey City, N. J.
 (See pages 337 and 338.)
- HATCH, D. F., Denver, Colo.
- HECO—See Heinze Electric Co.
- HEINZE Electric Co., Lowell, Mass. "Heco."
- HEL-FI—See Motor Accessories Mfg. Co.
- HERBERT, W. H., 3312 Wabash Ave., Chicago, Ill. "Little Giant."
- HERZ & Co., 295 Lafayette St., New York, N. Y. "Bougie Mercedes."
 (See page 269.)
- HOT SHOT—See K-W Ignition Co.
- IDEAL Switch Co., Plainville, Conn.
- INTERNATIONAL Mica Tube Co., 358 Nosstrand Ave., Brooklyn, N. Y.
- J-D—See Jeffery-Dewitt Co.
- JANNEY, Steinmets & Co., Philadelphia, Pa. "Flash Light."
 (See page 379.)
- JEFFERY-DEWITT Co., 54 Butler Ave., Detroit, Mich. "Reliance," "J-D," "Edison."
 (See pages 291 and 301.)
- JEWELL—See Pittsfield Spark Coil Co.
- JOHNSON Bros., 803 Downing St., Denver, Colo.
- K-W Ignition Co., 2833 Chester Ave., Cleveland, O. "Vim," "Hot Shot."
- KINGSTON—See Kokomo Electric Co.
- KINSEY Mfg. Co., Toledo, O.
 (See page 395.)
- KNOBLOCK-HEIDEMAN Mfg. Co., Sample St. & Vistula Ave., South Bend, Ind.
- KOKOMO Electric Co., 1415 Webster St., Kokomo, Ind. "Kingston."
- KOSMAK Electrical Co., 299 Ocean Ave., Jersey City, N. J.
 (See page 463.)
- LA FAYETTE Electric & Mfg. Co., La Fayette, Ind.
 (See page 445.)
- LEGNARD Bros., 461 Broadway, Milwaukee, Wis. "Auto-Marine."
- LEHMAN Mfg. Co., J. H., 727 Seventh Ave., New York, N. Y.
 (See page 613.)
- LIGHTNING—See Doxey, N. D.
- LIGHTNING—See Reflex Ignition Co.
- LITTLE GEM—See Electrolamp Co.
- LITTLE GIANT—See Herbert, W. H.
- LOCKE Regulator Co., 76 North St., Salem, Mass. "New Challenge."
- LONG Distance Spark Plug Co., 212 S. Illinois St., Indianapolis, Ind.
- LORE—See Acme Sales Co.
- MCCORMICK Mfg. Co., First & Sears Sts., Dayton, O.
- MACKAE BLITZ—See Randall-Faichney Co.
- MAHER—See Duplex Multi-Spark Plug Co.
- MANHATTAN Electrical Supply Co., 17 Park Pl., New York, N. Y.
- METEOR—See Auto Specialties Mfg. Co.
- MEZGER, C. A., 13 Canal Pl., New York, N. Y. "Soot Proof," "Victor."
 (See Front Cover.)
- MILWAUKEE Auto Specialty Co., 705-15 Chestnut St., Milwaukee, Wis. "Cementfire," "Victor."
 (See page 551.)
- MONARCH—See Benford Mfg. Co.
- MOSLER & Co., A. R., New York, N. Y. "Split Fire," "Triumph," "Beat-em-all," "Breech-Block."
 (See page 287.)
- MOTOR Accessories Mfg. Co., 34 W. Main St., Marshalltown, Ia. "Hel-Fi."
- NATIONAL Coil Co., Lansing, Mich.
- NEW CHALLENGE—See Locke Regulator Co.
- NEW York Mica & Mfg. Co., Auburn, N. Y. "Auburn," "Wright."
- OAKES & Dow Co., 15 Chardon St., Boston, Mass. "Comet," "Sootless."
- ORSWELL Igniter Co., 81 Haverhill St., Boston, Mass.
- PENN—See Pennsylvania Rubber & Supply Co.
- PENNSYLVANIA Rubber & Supply Co., 1845-47 Euclid Ave., Cleveland, O. "Penn," "Cleveland."
- PERFECTION Specialty Mfg. Co., 115-17 W. Second Ave., Cincinnati, O.
 (See page 483.)
- PERFEX—See Electric Goods Mfg. Co.
- PERPETUAL Spark Plug Co., 330 E. Drinker St., Dunmore, Pa.
- PITTSFIELD Spark Coil Co., Dalton, Mass. "Jewell."
 (See page 127.)
- PORTER & Co., W. S., 608 S. Dearborn St., Chicago, Ill.
- RAJAH Auto Supply Co., Bloomfield, N. J.
 (See page 555.)
- RANDALL-FAICHNEY Co., Boston, Mass.
 (See page 463.)
- RAPP Mfg. Co., 609-11 Jefferson Ave., Toledo, O. "Viso."
- RED HEAD—See Grossman Co.
- REFLEX Ignition Co., 6919 Lexington Ave., Cleveland, O. "Arrow," "Lightning."
- RELIANCE—See Jeffery-Dewitt Co.
- REX Ignition Mfg. Co., 1779 Broadway, New York, N. Y.
- RIVAL—See Hampshire Mfg. Co.
- SCHUG Electric Mfg. Co., 326 Jefferson Ave., Detroit, Mich.
- SHAIN, Chas. D., Box 63, Station L., Brooklyn, N. Y.
 (See page 97.)
- SHARP Spark Plug Co., 3343 Broadview Rd., Cleveland, O. "Firefly."
- SILVEX Co., Chicago, Ill. "Bethlehem."
 (See page 313.)
- SIMMS Magneto Co., 1780 Broadway, New York, N. Y.



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Champion Regulator
\$1.00

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- SOOT PROOF**—See Mezger, C. A.
- SPEEDWAY Plug Co.**, 1506 Harrison Ave., Cincinnati, O.
- SPIT FIRE**—See Mosler & Co.
- SPLITDORF Electrical Co.**, 98 Warren St., Newark, N. J.
- STA-RITE**—See Sturdy Mfg. Co.
- STANDARD Co.**, Torrington, Conn. "Black Eagle."
(See page 667.)
- STURDY Mfg. Co.**, 2637 Michigan Ave., Chicago, Ill. "Sta-Rite," "Gotham," "Vulcan," "Venus."
- SURE FIRE**—See U. S. Auto Supply & Mfg. Co.
- SZEL Import & Export Co.**, 359 Broadway, New York, N. Y. "Anchor."
- T. A. D.**—See Toledo Auto Devices Co.
- TOLEDO Auto Devices Co.**, Gardner Bldg., Toledo, O. "T. A. D."
- TRIUMPH**—See Mosler & Co.
- UKO**—See Utility Co.
- U. S. Auto Supply & Mfg. Co.**, 372 Michigan Ave., Detroit, Mich. "Sure Fire."
- UTILITY Co.**, 636 W. 44th St., New York, N. Y. "Uko."
- V-RAY Co.**, Marshalltown, Ia.
(See page 277.)
- VENUS**—See Sturdy Mfg. Co.
- VICTOR**—See Beckley-Ralston Co.
- VICTOR**—See Milwaukee Auto Specialty Co.
- VIM**—See K-W Ignition Co.
- VISO**—See Rapp Mfg. Co.
- VITAL**—See Bigsby Mfg. Co.
- VOLCANO Spark Plug Co.**, Ashland, O.
- VULCAN**—See Sturdy Mfg. Co.
- WASCO**—See Washington Automobile Supply Co.
- WASHINGTON Automobile Supply Co.**, Washington, Ill. "Wasco."
(See page 585.)
- WICO**—See Witherbee Igniter Co.
- WILLIAMS, E. Q.**, 535-39 S. Clinton St., Syracuse, N. Y.
- WITHERBEE Igniter Co.**, Springfield, Mass. "Wico."
(See page 601.)
- WIZARD**—See Hampshire Mfg. Co.
- WRIGHT**—See New York Mica & Mfg. Co.

TIRE REPAIR PLUGS

- BATAVIA Rubber Co.**, Batavia, N. Y.
- DIAMOND Rubber Co.**, Akron, O.
- GOODRICH Co.**, B. F., Akron, O.
- TINGLEY & Co.**, Chas. O., Rahway, N. J.
- YATMAN Rubber Co.**, 267-69 Mt. Pleasant Ave., Newark, N. J.

POINTS**SPARKING POINTS**

(See also Platinum)

- AMERICAN Platinum Works**, 225-31 N. J. R. R. Ave., Newark, N. J.
- BAKER & Co.**, Newark, N. J.
(See page 589.)
- BISHOP & Co. Platinum Works**, J., Malvern, Pa.
- BOKER & Co.**, Herman, 101 Duane St., New York, N. Y. (Importers). "Meteor."
- COMMERCIAL Research Co.**, Tuckahoe, N. Y. "Comreco."
(See page 301.)
- COMRECO**—See Commercial Research Co.
- DRIVER-HARRIS Wire Co.**, Harrison, N. J. "Ignito."
- HEEREN Bros. & Co.**, Penn. Ave. & Eighth St., Pittsburg, Pa.
- IGNITO**—See Driver-Harris Wire Co.
- METEOR**—See Boker & Co.
- NEY Co.**, J. M., 265 Asylum St., Hartford, Conn.
- QUEEN Co.**, 1211-17 Eighth St., Philadelphia, Pa.
- ROESSLER & Hasselacher Chemical Co.**, 100 William St., New York, N. Y.
(See page 301.)

POLISHES**AUTOMOBILE BODY POLISHES**

(See also Soaps, Automobile)

- A1**—See Rath Co.
- A-O-K**—See Ulrich & Co.
- A-S-K**—See Aull-Sides-Klean Co.
- ADAMS Grease & Oil Co.**, 161 W. 51st St., New York, N. Y. "Apollo."
- ADAMS & Elting Co.**, 718-26 Washington Blvd., Chicago, Ill. "Hy-Pol."
- ALDER Chemical Co.**, Mt. Vernon, N. Y. "Star."
- AMERICUS Products Mfg. Co.**, Detroit, Mich.
(See page 297.)
- APOLLO**—See Adams Grease & Oil Co.
- ARNOLD, N. B.**, 1 Sigourney St., Brooklyn, N. Y. "Slakup."
(See page 155.)
- ARROW**—See Peterson Co.
- AULL-SIDES-KLEAN Co.**, 317-30 E. Fifth Ave., Cincinnati, O. "A-S-K."
(See page 295.)
- AUTO-GLOSS**—See Indianapolis Paint & Color Co.
- B-BRITE**—See Polish Products Co.
- BAILEYS**—See Crown Mfg. Co.
- BAUM'S Castorine Co.**, 104 N. George St., Rome, N. Y.
- BEN-HUR Metal Polish Co.**, 108 E. Market St., Crawfordsville, Ind.
- BLUE RIBBON**—See International Metal Polish Co.

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Two Leaders of the Famous J-D Line



Wise motorists by tens of thousands in 1912 demanded this plug with the window in the porcelain. For it locates ignition troubles at a glance—without testing, without unscrewing the plug, without fuss of any sort. Price \$1.00.

This is truly a marvelous invention; and 1913 will bring orders in a countless flood.

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- BORNSCHEIN & Co.**, John F., 6420 Sangamon St., Chicago, Ill. "Schein."
- BRIDGEPORT Wood Finishing Co.**, New Milford, Conn.
- BROOKS & Co.**, Clarence, 249-77 Chestnut St., Newark, N. J.
- BUFFALO Oil, Paint & Varnish Co.**, Buffalo, N. Y.
- BUFFALO Specialty Co.**, 375 Ellicott St., Buffalo, N. Y. "Liquid Veneer."
- CALLERY & Co.**, W. W., 188 36th St., Pittsburgh, Pa.
- CHICAGO White Lead & Oil Co.**, Green & Fulton Sts., Chicago, Ill.
- CLEANOLA Co.**, Fulton Bldg., Pittsburg, Pa.
- COLUMBIA Lubricants Co.** of New York, 116 Broad St., New York, N. Y.
- CO-OPERATIVE Cleaner Products Co.**, 309 N. 19th St., St. Louis, Mo. "Hi-Brite."
- CROWN Mfg. Co.**, Indianapolis, Ind. "Baillys."
- CUNNINGHAM**—See Pitt Specialty Co.
- DAVIS Co.**, W. C., 237 N. Main St., Brockton, Mass. "Superior."
- DIAMOND Specialty Co.**, Indianapolis, Ind. (See page 129.)
- DIAMOND Wood Polish Co.**, Washington Trust Bldg., Washington, Pa.
- DURKEE-ATWOOD Co.**, 919 First Ave., S., Minneapolis, Minn. (See page 155.)
- EVERSHINE**—See Zenith Mfg. Co.
- FINALINE Co.**, 4907 Maple Ave., St. Louis, Mo.
- GLISTENER Mfg. Co.**, 622 Cypress Ave., Kansas City, Mo. "Lee's." "Varnishine."
- GLO Co.**, 38 Hedden Pl., East Orange, N. J.
- GOLDEN STAR**—See Morris Mfg. Co.
- HALL-THOMPSON Co.**, Hartford, Conn. "Wonder Worker."
- HALO**—See Standard Carbon Co.
- HAWKEYE Oil Co.**, Waterloo, Ia.
- HI-BRITE**—See Co-operative Cleaner Products Co.
- HOLLINGSHEAD Co.**, R. M., Camden, N. J. "Nugloss."
- HY-POL**—See Adams & Elting Co.
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- INTERNATIONAL Metal Polish Co.**, Quill St. & Belt R. R., Indianapolis, Ind. "Blue Ribbon."
- JEWEL Mfg. Co.**, 21st St. & Marshall Blvd., Chicago, Ill. "Nelsons."
- K M C**—See Karboneater Mfg. Co.
- KARBONEATER Mfg. Co.**, Vanadium Bldg., Pittsburg, Pa. "K M C."
- KOONSHINE**—See St. Louis Surfacar & Paint Co.
- LE DOYEN, Frank J.**, 1111 W. Cross St., Baltimore, Md. "Varnoll."
- LEE'S**—See Glistener Mfg. Co.
- LEVO**—See Stanley, John T.
- LIQUID VENEER**—See Buffalo Specialty Co.
- LUSTRE Creme Mfg. Co.**, Rock Island, Ill.
- LUSTRE Mfg. Co.**, 5551 Woman's Temple, Chicago, Ill.
- MAGICLEAN**—See Schmoeger, Frederic A.
- MARVIN-STRECK Oil & Supply Co.**, 1318 Olive St., St. Louis, Mo.
- MATCHLESS**—See Standard Oil Co. of N. Y.
- MODOC Co.**, Fernwood, Pa.
- MONARCH**—See Suydam Co.
- MONROE Specialty Co.**, 223 W. 16th St., New York, N. Y. "Sunrise."
- MOORE Oil Co.**, York St. & McLean Ave., Cincinnati, O.
- MORRILL, M. O.**, 173 W. 124th St., New York, N. Y. "Tar-Co-La."
- MORRIS Mfg. Co.**, R. W., Gumbel Bldg., Kansas City, Mo. "Golden Star."
- NAY Chemical Co.**, Tom, Holden, Mo.
- NELSONS**—See Jewel Mfg. Co.
- NEW Method Varnish Co.**, 310 W. Hudson St., Elmira, N. Y. "Uncle Hiram's."
- NORTHWESTERN Chemical Co.**, Marietta, O. "Pioneer." (See page 115.)
- NOXAL**—See Noxall Polish Mfg. Co.
- NOXALL Polish Mfg. Co.**, 1238 Belmont Ave., Philadelphia, Pa. "Noxal."
- NUGLOSS**—See Hollingshead Co.
- O. K.**—See Sheppard, W. S.
- OLD RELIABLE**—See Blue Ribbon Mfg. Co.
- PERUVIAN**—See Sweet, Charles F.
- PETERSON Co.**, T. J., Lees Bldg., Chicago, Ill. "Arrow."
- PIONEER**—See Northwestern Chemical Co.
- PITT Specialty Co.**, 1016 Congress St., N. S., Pittsburg, Pa. "Cunningham."
- POLISH Products Co.**, 606 Broadway, Kansas City, Mo. "B-Brite."
- RAPID**—See Shannon, T. R.
- RATH Co.**, Chas. H., 53d & Broomall Sts., Philadelphia, Pa. "Al."
- ROYAL Lubricating Oil Co.**, 116 Broad St., New York, N. Y.
- RUB-ON Varnish Co.**, 363 Elm St., Buffalo, N. Y.
- ST. LOUIS Surfacar & Paint Co.**, 26 S. Commercial St., St. Louis, Mo. "Koonshine."
- SCHEIN**—See Bornschein & Co.
- SCHMOEGER, Frederic A.**, Sterling, Ill. "Magiclean."
- SHANNON, T. R.**, 19 Lorraine St., Hartford, Conn. "Rapid."
- SHEPPARD, W. S.**, 22 Lawrence St., Newark, N. J. "O. K."
- SILCO**—See Silvex Co.
- SILVEX Co.**, Chicago, Ill. "Silco." (See page 313.)
- SLIKUP**—See Arnold, N. B.

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STANDARD Oil Co. of N. Y., New York, N. Y. "Matchless."
STANLEY, John T., 628-52 W. 30th St., New York, N. Y. "Levo."
STAR—See Alder Chemical Co.
SUNRISE—See Monroe Specialty Co.
SUPERIOR—See Davis Co.
SUPERIOR Specialty Co., 444 E. Jefferson St., Louisville, Ky.
SUYDAM Co., M. B., 61st & Butler Sts., Pittsburg, Pa. "Monarch."
SWEET, Charles F., 247 State St., Hartford, Conn. "Peruvian."
TAR-CO-LA—See Morrill, M. O.
THREE X—See Bobrick Chemical Co.
THUMB, E. W., 872 Orleans St., Chicago, Ill.
U-AUTO-VARNISH Co., 345 The Arcade, Cleveland, O.
ULRICH & Co., 227-33 E. North St., Buffalo, N. Y. "A-O-K."
UNCLE HIRAM'S—See New Method Varnish Co.
VAN TILBURG Oil Co., 2424-28 University Ave., S. E., Minneapolis, Minn. "Waxit."
VARNISHINE—See Gilstener Mfg. Co.
VARNOIL—See Le Doyen, Frank J.
WARREN Refining Co., Cleveland, O.
WAXIT—See Van Tilburg Oil Co.
WERNER-SERVICE Mfg. Co., 263 Fairmount Ave., Jersey City, N. J.
WONDER WORKER—See Hall-Thompson Co.
ZENITH Mfg. Co., Long Acre Bldg., New York, N. Y. "Evershine."

METAL POLISHES

- Al—See Rath Co.
A-S-K—See Aull-Sides-Klean Co.
ADAMS & Elting Co., 718-26 Washington Blvd., Chicago, Ill. "Shinite."
AJAX—See Crowell Chemical Co.
ALCO Mfg. Co., 136 Beekman St., New York, N. Y.
AMALIE—See Sonneborn Sons.
AMERICAN—See Harvey Chemical Co.
AMERICAN Marine Equipment Co., 27 Haverhill St., Boston, Mass. "Dazzleline."
AMERICAN Metal Polish Co., 89 Winslow Ave., W., West Somerville, Mass. "North Star," "Meyers."
AMERICAN Oil & Disinfectant Co., 96 Beekman St., New York, N. Y. "Sparrow."
AMERICUS Products Mfg. Co., Detroit, Mich.
(See page 297.)
ANCHOR—See Hoffman Paint & Varnish Co.
A-O-K—See Ulrich & Co.
APEX POLISHINE—See Millers Sons Co.
ARCO SPOTZOFF—See Atlantic Refining Co.
ARMIGER Chemical Co., 2155-57 Austin Ave., Chicago, Ill. "Rex."
ARNOLD, N. B., 1 Sigourney St., Brooklyn, N. Y. "Slakup."
(See page 155.)
ARNSTEIN, Eugene, 46th St. & Wentworth Ave., Chicago, Ill. "Shine-All."
ARROW—See Peterson Co.
ATLANTIC Refining Co., Cleveland, O. "Arco Spotzoff."
ATLAS Auto Supply Co., 95 E. Adams St., Chicago, Ill. "Sta-Brite."
(See page 115.)
AUBURN Specialties Co., 3 N. Green St., Auburn, N. Y. "Blitz."
AULL-SIDES-KLEAN Co., 317-30 E. Fifth Ave., Cincinnati, O. "A-S-K."
(See page 295.)
AUTO Oil Co., 172 S. Water St., Jackson, Mich.
B-BRITE—See Polish Products Co.
BAILEYS—See Crown Mfg. Co.
BAUM'S Castorine Co., 104 N. George St., Rome, N. Y.
BELL—See Reid Mfg. Co.
BELL Mfg. Co., Maine & Gratiot Sts., St. Louis, Mo. "Star."
BEN Hur Metal Polish Co., 108 E. Market St., Crawfordsville, Ind.
BERTRAM—See New Jersey Paint Works.
BLACK Silk Stove Polish Works, Sterling, Ill.
BLITZ—See Auburn Specialties Co.
BLUE RIBBON—See International Metal Polish Co.
BLUE Ribbon Mfg. Co., 27 Baldwin St., (Charlestown), Boston, Mass. "Peerless."
BOBRICK Chemical Co., 111-17 S. Garey St., Los Angeles, Cal. "Radium," "E. Z. Q."
BONN, J., 19 Mercer Ct., Newark, N. J. "E. Z."
BORSUM Bros., 188 Greenwich St., New York, N. Y.
BOWMAN-EDSON Co., M. K., 64 Dey St., New York, N. Y. "Edsonia."
BRIGGS & Co., John, 45 Purchase St., Boston, Mass. "Hub."
BUFFALO—See Ulrich & Co.
BULLY—See New York Oil & Grease Co.
BURNISHINE—See Paul & Co.
C. P.—See Chicago Polish Co.
CALLERY & Co., W. W., 188 36th St., Pittsburg, Pa. "Winterton."
CHAMBERLAIN Co., Sixth Ave. & Grant St., Pittsburg, Pa. "Desolve."
CHEMI Co., 629 E. Main St., Richmond, Va.
CHEMICAL Products Co., 217 Elm St., St. Louis, Mo. "Tarnish-off."
CHEMICAL Supply Co., 1565 Merwin St., Cleveland, O.
CHICAGO Polish Co., 3715-19 Grand Ave., Chicago, Ill. "C. P."
CHICAGO White Lead & Oil Co., Green & Fulton Sts., Chicago, Ill.
CLEANER Mfg. Co., 2842 Olive St., St. Louis, Mo. "Polishine."
CLEANOLA Co., Fulton Bldg., Pittsburg, Pa. "Spe-De-Shyne."
COLGAN Mfg. & Supply Co., 42 South St., New York, N. Y. "Peerless," "Crescent."
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CRESCENT—See Colgan Mfg. & Supply Co.
 CROSS & Co., W. H., 29 Murray St., New York, N. Y. "Gilt Edge," "Laquerine," "Prestoline," "Putzade."
 CROWELL Chemical Co., 12 Oxford Terrace, Beverly, Mass. "Oxford," "Ajax."
 CROWN Mfg. Co., Indianapolis, Ind. "Baileys."
 DAY Mfg. Co., S. A., 10-12 Pearl St., Buffalo, N. Y. "Zircon."
 DAZZLEINE—See American Marine Equipment Co.
 DESOLVO—See Chamberlain Co.
 DETROIT White Lead Works, 530-60 Milwaukee Ave., E., Detroit, Mich. "Rogers."
 DIAMOND Specialty Co., Indianapolis, Ind. (See page 129.)
 DIAMOND Wood Polish Co., Washington Trust Bldg., Washington, Pa.
 DRAGON—See Paul & Co.
 E Z—See Bonn, J.
 E. Z. Q.—See Bobrick Chemical Co.
 EAGLE Oil & Supply Co., Boston, Mass. "Eagleine." (See page 593.)
 EAGLEINE—See Eagle Oil & Supply Co.
 EAVENSON & Sons, J., Camden, N. J. "Jesco."
 EDSONIA—See Bowman-Edson Co.
 ERICKA Mfg. Co., 832 Liberty St., Springfield, Mass. "Shineaul."
 ESSEX Paint Works, Essex, Conn.
 EVER-BRITE—See Page-Lester Co.
 EVERBRYTE—See Winn, Wm. R.
 EVERGLOSS—See Zenith Mfg. Co.
 FEINER Chemical Mfg. Co., Springfield, Mass. "Rub-Less."
 FIEBING Chemical Co., 238-40 Reed St., Milwaukee, Wis. "Lusterine."
 FLASH Chemical Co., 9 Fulton Pl., Boston, Mass.
 FORD & DEENEN—See Richmond & Co.
 FRANKLIN Refining Co., 3027 Locust St., St. Louis, Mo. "U-Auto-Shine."
 G. W.—See Great Western Oil Co.
 GARRATT-CALLAHAN Co., 37 S. Clinton St., Chicago, Ill.
 GILT EDGE—See Cross & Co.
 GLISTENER Mfg. Co., 622 Cypress Ave., Kansas City, Mo. "Lee's."
 GLITTERSHINE—See Grady Mfg. Co.
 GLO Co., 38 Heddon Pl., East Orange, N. J.
 GLOBE—See Ralmes & Co.
 GOLDENGLITTER—See Mooney Co.
 GOLDEN STAR—See Morris Mfg. Co.
 GOLDSHINE—See Van Tilburg Oil Co.
 GRADY Mfg. Co., 509 W. 30th St., New York, N. Y. "Glittershine," "National," "Putz," "Uno," "Scourer."
 GREAT Western Oil Co., 2855 E. 37th St., Cleveland, O. "G.W."
 GREEN SEAL—See Silver Co.

HALL-THOMPSON Co., Hartford, Conn. "Wonder Worker."
 HALO—See Standard Carbon Co.
 HARRIS Oil Co., A. W., 326 S. Water St., Providence, R. I. "Scourer." (See page 189.)
 HARVEY Chemical Co., N. Fifth St., La Fayette, Ind. "American."
 HAVOLINE—See Indian Refining Co.
 HAWKEYE Oil Co., Waterloo, Ia.
 HEANEY Mfg. Co., 184 State St., Boston, Mass.
 HERCULES Chemical Works, 1904 W. Van Buren St., Chicago, Ill. "Non-Such."
 HI-BRITE—See Co-operative Cleaner Products Co.
 HINDS & Coon, 124-26 Pearl St., Boston, Mass. "Ruby-Rub."
 HOFFMAN, Geo. W., 557 E. Washington St., Indianapolis, Ind. "U. S."
 HOFFMAN Paint & Varnish Co., 8 Medford St., Boston, Mass. "Anchor."
 HOLLINGSHEAD Co., R. M., Camden, N. J. "Whiz."
 HUB—See Briggs & Co.
 HYGLO—See Stanley, John T.
 IDEALO Co., 321 Bourse, Philadelphia, Pa.
 INDIAN Refining Co., 17 Battery Pl., New York, N. Y. "Havoline."
 INDIANAPOLIS Paint & Color Co., 118 W. Chesapeake St., Indianapolis, Ind. "Metal-Brite."
 INTERNATIONAL Metal Polish Co., Quill St. & Belt R. R., Indianapolis, Ind. "Blue Ribbon."
 J-M—See Johns-Manville Co.
 JESCO—See Eavenson & Sons.
 JEWEL—See Wadsworth-Howland Co.
 JEWELL Mfg. Co., 21st St. & Marshall Blvd., Chicago, Ill. "Nelsons."
 JOHNS-MANVILLE Co., H. W., Madison Ave. & 41st St., New York, N. Y. "J-M."
 JUSTICE Co., A. R., Philadelphia, Pa. "U Kan-Plate."
 K M C—See Karboneater Mfg. Co.
 KARBONEATER Mfg. Co., Vanadium Bldg., Pittsburg, Pa. "K M C."
 KETTLER Brass Mfg. Co., 109 Fairview St., Houston, Tex. "Qck Work."
 KLEAN-IT-KLEAN Co., 329-31 Main St., Grinnell, Ia.
 KOONSHINE—See St. Louis Surfacers & Paint Co.
 KOSMOS—See Mulliken Oil Co.
 LAQUERINE—See Cross & Co.
 LE DOYEN, Frank J., 111 W. Cross St., Baltimore, Md.
 LEE'S—See Glistener Mfg. Co.
 LORD Polish Co., F. T., 37 Hovey Ave., Cambridge, Mass. "Lumino."
 LUMINO—See Lord Polish Co.
 LUSTERINE—See Fiebing Chemical Co.
 LUSTRE Creme Mfg. Co., Rock Island, Ill.
 LUSTRE Mfg. Co., 5551 Woman's Temple, Chicago, Ill.
 McLEAN-JONES Oil & Supply Co., 40 Indian Wharf, Boston, Mass. "Nox-All."



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- MAGIC—See Sweet, Charles F.
- MARVIN-STRECK Oil & Supply Co., 131½ Olive St., St. Louis, Mo.
- MATCHLESS Metal Polish Co., 149 Varick St., New York, N. Y. "Mexoline."
- MAXINE—See Rexine Co.
- METAL-BRITE—See Indianapolis Paint & Color Co.
- METALINE—See Victor Mfg. Co.
- MEXOLINE—See Matchless Metal Polish Co.
- MEYERS—See American Metal Polish Co.
- MILLERS Sons Co., A. D., Pittsburg, Pa. "Apex Polishine."
- MODOC Co., Fernwood, Pa.
- MONARCH—See Suydam Co.
- MOONEY Co., A. J., 509 W. 30th St., New York, N. Y. "Golden Gltter."
- MOORE Oil Co., York St. & McLean Ave., Cincinnati, O. "Moreshine."
- MOORESHINE—See Moore Oil Co.
- MORRIS Mfg. Co., R. W., Gumbel Bldg., Kansas City, Mo. "Golden Star."
- MORRIS & Co., Richard S., Chicago, Ill.
- MULLIKEN Oil Co., 200 Friend St., Boston, Mass. "Kosmos."
- NARRAGANSETT Chemical Co., Providence, R. I. "Reflectolite."
- NATIONAL—See Grady Mfg. Co.
- NATIONAL Valgrinok Co., 195 Church St., Newton, Mass. "Valgrinok."
- NAY Chemical Co., Tom, Holden, Mo.
- NELSONS—See Jewell Mfg. Co.
- NEW Jersey Paint Works, Jersey City, N. J. "Bertrams."
- NEW York Oil & Grease Co., 128 Malden Lane, New York, N. Y. "Bully."
- NON-SUCH—See Hercules Chemical Works.
- NORTH STAR—See American Metal Polish Co.
- NORTHWESTERN Chemical Co., Marietta, O. "Pioneer."
(See page 115.)
- NOX-ALL—See McLean-Jones Oil & Supply Co.
- NOXAL—See Noxall Polish Mfg. Co.
- NOXALL Polish Mfg. Co., 1238 Belmont Ave., Philadelphia, Pa. "Noxal."
- OIL Products Co., 17 Battery Pl., New York, N. Y. "Uoline."
- OSMACO—See Schlegel Mfg. Co.
- OXFORD—See Crowell Chemical Co.
- PAGE-LESTER Co., 125 W. Van Buren St., Chicago, Ill. "Ever-Brite."
- PATTERSON Lubricating Co., 114 Broad St., Boston, Mass.
- PAUL & Co., J. C., Chicago, Ill. "Burrishine," "Dragon."
(See page 505.)
- PEERLESS—See Blue Ribbon Mfg. Co.
- PEERLESS—See Colgan Mfg. & Supply Co.
- PENN Petroleum Co., 209 Arch St., Philadelphia, Pa. "Primus."
- PETERSON Co., T. J., Lees Bldg., Chicago, Ill. "Arrow."
- PIONEER—See Northwestern Chemical Co.
- PIONEER Mfg. Co., 5220 Sweeney Ave., S. E., Cleveland, O. "Shino."
- POLESHINE—See Cleaner Mfg. Co.
- POLISH Products Co., 606 Broadway, Kansas City, Mo. "B-Brite."
- PRESTOLINE—See Cross & Co.
- PRESTOSHINE—See Sheppard, W. S.
- PRIMUS—See Penn Petroleum Co.
- PURITAN Oil Co., 1218 W. 70th St., Cleveland, O.
- PURITAN Soap Co., 496 Exchange St., Rochester, N. Y.
- PUTZ—See Grady Mfg. Co.
- PUTZADE—See Cross & Co.
- QCK WORK—See Kettler Brass Mfg. Co.
- RADIUM—See Bobrick Chemical Co.
- RAIMES & Co., 50 Ferry St., New York, N. Y. "Globe."
- RATH Co., Chas H., 53d & Broomall Sts., Philadelphia, Pa. "Al."
- RAYDO—See Ulrich & Co.
- RAYO Co., 5 Nassau St., New York, N. Y.
- RED CROSS—See Robertson & Co.
- REDIO—See MacLaren Imperial Cheese Co.
- REFLECTOLITE—See Narragansett Chemical Co.
- REID Mfg. Co., W. W., 79 Milk St., Boston, Mass. "Bell," "Zip."
- RELIABLE Cement Co. (E. Akron), Akron, O.
- REX—See Armiger Chemical Co.
- REXINE Co., 725 New York Ave., Sheboygan, Wis. "Maxine."
- RICHMOND & Co., C. C., 40 Batterymarch St., Boston, Mass. "Ford & Denneen."
- ROBERTSON & Co., 1141 W. Madison St., Chicago, Ill. "Red Cross."
- ROGERS—See Detroit White Lead Works.
- ROME Soap Mfg. Co., E. Dominick St., Rome, N. Y.
- ROSTAND Mfg. Co., Milford, Conn.
- ROYAL Lubricating Oil Co., 116 Broad St., New York, N. Y.
- RUB-LESS—See Feiner Chemical Mfg. Co.
- RUBY-RUB—See Hinds & Coon.
- ST. LOUIS Surfacer & Paint Co., 26 S. Commercial St., St. Louis, Mo. "Koonshine."
- SCHLEGEL Mfg. Co., Oscar, 111 E. 12th St., New York, N. Y. "Osmaco."
- SCHMOEGER, Frederic A., Sterling, Ill.
- SCOUREE—See Grady Mfg. Co.
- SCOUREE—See Harris Oil Co.
- SHEPPARD, W. S., 22 Lawrence St., Newark, N. J. "Prestoshine."
- SHINAL—See Adams & Elting Co.
- SHINE-ALL—See Arnstein, Geo. W.
- SHINEAUL—See Ericka Mfg. Co.
- SHINITE—See Adams & Elting Co.
- SHINO—See Pioneer Mfg. Co.

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POLISHES (Continued)**METAL POLISHES (Continued)**

SILCO—See Silvex Co.

SILVEX Co., Chicago, Ill. "Green Seal," "Silco."
(See page 313.)

SIMPLEX Auto Specialty Co., Detroit, Mich.

SLIKUP—See Arnold, N. B.

SOLARINE Co., 153-55 N. Carpenter St., Chicago, Ill.

SOLSHINE Mfg. Co., 204 Milk St., Boston, Mass.

SONNEBORN Sons, L., Fulton & Pearl Sts., New York, N. Y. "Amalie."

SPARROW—See American Oil & Disinfectant Co.

SPE-DE-SHYNE—See Cleanola Co.

SPEARE'S Sons Co., Alden, 140 Sixth St., Boston, Mass.

STA-BRITE—See Atlas Auto Supply Co.

STANDARD Carbon Co., 1151-57 Stanford Ave., Los Angeles, Cal. "Halo."

STANLEY, John T., 628-52 W. 30th St., New York, N. Y. "Hygio."

STAR—See Bell Mfg. Co.

STEVENS, Frederic B., Larned & Third Sts., Detroit, Mich.
(See pages 503 and 504.)

SUYDAM Co., M. B., 61st & Butler Sts., Pittsburg, Pa. "Monarch."

SWEET, Charles F., 247 State St., Hartford, Conn. "Magic."

TARNISH-OFF—See Chemical Products Co.

TRAFTON Co., F. M., 176 Federal St., Boston, Mass.

U-AUTO-SHINE—See Franklin Refining Co.

U-KAN-PLATE—See Justice Co.

ULRICH & Co., 227-33 E. North St., Buffalo, N. Y. "A-O-K," "Buffalo," "Raydo."

U. S.—See Hoffman, Geo. W.

U. O.—See Grady Mfg. Co.

USOLINE—See Oil Products Co.

UTILITY Co., 636 W. 44th St., New York, N. Y.

VALGRINOK—See National Valgrinok Co.

VAN Tilburg Oil Co., 2424-28 University Ave., S. E., Minneapolis, Minn. "Goldshine."

VICTOR Mfg. Co., 72 Chestnut St., Newark, N. J. "Metalline."

WADSWORTH-HOWLAND Co., 225 Carpenter St., Chicago, Ill. "Jewell."

WARREN Refining Co., Cleveland, O.

WHIZ—See Hollingshead Co.

WINN, Wm. R., 143 Maiden Lane, New York, N. Y. "Everbryte."

WINTERTON—See Callery & Co.

WONDER WORKER—See Hall-Thompson Co.

YALE—See Rostand Mfg. Co.

YOUNG, Orlando W., 180 Frelinghuysen Ave., Newark, N. J.

ZENITH Mfg. Co., Long Acre Bldg., New York, N. Y. "Evergloss."

ZIP—See Reid Mfg. Co.

ZIRCON—See Day Mfg. Co.

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EMPIRE China Works, 142-56 Greene St., Brooklyn, N. Y.

GENERAL Porcelain Co., East Liverpool, O.

HARTFORD Faience Co., Hartford, Conn.

IMPERIAL Porcelain Works, Mulberry St. & New York Ave., Trenton, N. J.

JEFFERY-DEWITT Co., 54 Butler Ave., Detroit, Mich.
(See pages 291 and 301.)

NATIONAL Porcelain Co., Trenton, N. J.

PERU Electric Mfg. Co., Peru, Ind.

STAR Porcelain Co., Trenton, N. J.
(See page 599.)

PRIMERS**GASOLINE ENGINE PRIMERS**

CENTRAL Brass & Fixture Co., N. Fountain Ave., Springfield, O.

COLONIAL Auto & Supply Co., 101 W. 66th St., New York, N. Y.

CRONE, F. G., 334 Genesee St., Buffalo, N. Y.

FOWLER Lamp & Mfg. Co., 61 E. 24th St., Chicago, Ill. "Webb-Jay."
(See page 409.)

FRANCO Mfg. Co., 1332-34 Michigan Ave., Chicago, Ill.

GILSON Motor Starting Co., 1407-09 N. Illinois St., Indianapolis, Ind.

HAGSTROM Bros. Mfg. Co., Lindsborg, Kans.

HULL Electric Co., R. C., 1822 Euclid Ave., Cleveland, O.

IDEAL—See Interstate Auto Accessory Co.

INTERSTATE Auto Accessory Co., 2122 E. Washington St., Indianapolis, Ind. "Ideal."

NATIONAL Mfg. Co., Kalamazoo, Mich.

NELSON Mfg. Co., 4529 State St., Chicago, Ill.

TATE—See United Motor Equipment Co.

UNITED Motor Equipment Co., 19 S. La Salle St., Chicago, Ill. "Tate."

WEBB-JAY—See Fowler Lamp & Mfg. Co.

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ENGEL Co., W. A., Gloversville, N. Y.
(See page 499.)

GORDON—See Vehicle Apron & Hood Co.

VEHICLE Apron & Hood Co., 272 N. Fourth St., Columbus, O. "Gordon."



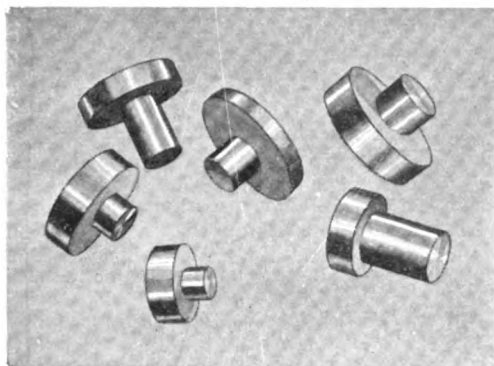
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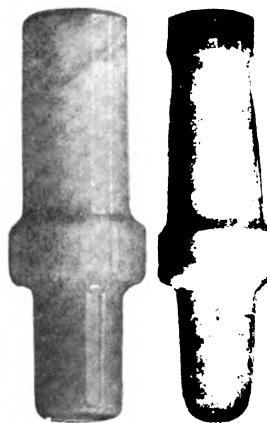
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Made to any specifications and of any degree of hardness to meet all requirements

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ENGINE DRIVEN TIRE PUMPS

A.B.C.—See Artizan Brass Co.
 ABELL—See Standard Thermometer Co.
 ARISTO—See Eagle Mfg. Co.
 ARTIZAN Brass Co., 218 N. Jefferson St., Chicago, Ill. "A.B.C."
 AUBURN Auto Pump Co., 541 Tremont St., Boston, Mass. "Ten Eyck."
 (See page 335.)
 AUTO Pump Co., 59 Terrace, Buffalo, N. Y. "Spencer."
 AUTOARO Pump Co., 1354 West Ave., Buffalo, N. Y.
 AUTOMATIC—See Woodward & Son.
 B. B.—See Herz & Co.
 BARRINGTON Automatic Automobile Pump Co., Short & South Sts., Harrisburg, Pa.
 BASTIAN—See General Utility Co.
 BIRD & Smith, 4275 S. Vermont Ave., Los Angeles, Cal. "Smiths."
 BROWN Co., Bellevue & Chester Sts., Syracuse, N. Y.
 CHRISTIAN Pump & Specialty Co., The Bourse, Philadelphia, Pa.
 DEWEY-ANDERSON Co., 456 Woodruff Ave., Toledo, O.
 (See page 325.)
 EAGLE Mfg. Co., 651-67 Blue Rock St., Cincinnati, O. "Aristo."
 E-Z—See Wheaton & Co.
 FOLBERTH Auto Specialty Co., 2929 Lorain Ave., Cleveland, O.
 GENERAL Utility Co., 1326-30 Ogden St., Philadelphia, Pa. "Bastian."
 H. M. S.—See Hartford Machine Screw Co.
 HANNA—See Troy Auto Specialty Co.
 HART & Widder Co., 511 W. 21st St., New York, N. Y.
 HARTFORD—See Wootton & Conant.
 HARTFORD Machine Screw Co., Hartford, Conn. "H. M. S."
 (See page 285.)
 HERZ & Co., 295 Lafayette St., New York, N. Y. "B. B.," "Tandem."
 (See page 269.)
 KELLOGG Mfg. Co., 104 Circle St., Rochester, N. Y.
 (See page 325.)
 KENMORE Mfg. Co., 1337-45 Carroll Ave., Chicago, Ill.
 LIPMAN Mfg. Co., 211 Pleasant St., Beloit, Wis.
 M. & L.—See McCarrell & Hawley.
 M. & L.—See Migeot Machine Co.
 MANZEL, Charles W., 89-93 Main St., Buffalo, N. Y.
 MANZEL Bros. Co., 320 Babcock St., Buffalo, N. Y.
 (See page 303.)

MAYO Mfg. Co., 54 E. 18th St., Chicago, Ill.
 MIGEOT Machine Co., 333 N. Fourth St., Philadelphia, Pa. "M. & L."
 NATIONAL Motor Supply Co., 1911 Euclid Ave., Cleveland, O.
 NOIL—See Taylor Mfg. Co.
 O. B.—See Universal Mfg. Co.
 P. T. C.—See Pacific Tucking & Mfg. Co.
 PACIFIC Tucking & Mfg. Co., 471-73 18th St., Brooklyn, N. Y. "P.T.C."
 PEERLESS Accessories Manufacturers, 1926 S. Wabash Ave., Chicago, Ill.
 PERFECTION Auto Pump Co., Auburn, N. Y.
 RACINE Engine & Machinery Co., Racine, Wis. "Two Minute."
 ROHRBACHER Automatic Air Pump Co., 173 E. Water St., Portland, Ore.
 SMITHS—See Bird & Smith.
 SPENCER—See Auto Pump Co.
 STANDARD Thermometer Co., 65 Shirley St., Boston, Mass. "Abell."
 (See page 357.)
 TANDEM—See Herz & Co.
 TAYLOR Mfg. Co., W. 14th St. & 48th Ave., Chicago, Ill. "Noil."
 TEN EYCK—See Auburn Auto Pump Co.
 TROY Auto Specialty Co., Troy, N. Y. "Hanna."
 TWO MINUTE—See Racine Engine & Machinery Co.
 UNIVERSAL Mfg. Co., 308-12 Ninth St., S., Minneapolis, Minn. "O. B."
 WHEATON & Co., C. M. Sunbury, Ohio. "E-Z."
 WOODWARD & Son, Nicholas Bldg., Toledo, O. "Automatic."
 WOOTTON & Conant, 161 Summer St., Boston, Mass. "Hartford."

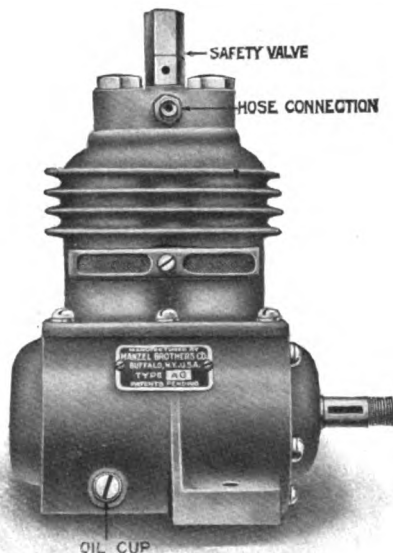
HAND TIRE PUMPS

AEOLUS—See Bridgeport Brass Co.
 AERTITE—See Keystone Novelty Co.
 AIR-JAMER—See Payne Mfg. Co.
 ATLAS—See Bridgeport Brass Co.
 BINKS—See Star Brass Works.
 BISHOP-BABCOCK-BECKER Co., Garfield Bldg., Cleveland, O.
 BLIZZARD—See Bridgeport Brass Co.
 BOSS—See Cox Brass Mfg. Co.
 BRIDGEPORT Brass Co., P. O. Station L., Bridgeport, Conn. "Stapley," "Aeolus," "Atlas," "Windjammer," "Crown."
 (See page 305.)
 BUSTER—See Payne Mfg. Co.
 CARVER—See Osborne & Stephenson Mfg. Co.
 CENTRAL Brass & Fixture Co., N. Fountain Ave., Springfield, O. "Springfield."
 CLEVELAND Faucet Co., 708 Frankfort Ave., N. W., Cleveland, O.
 CODMAN & Shurtleff, 120 Boylston St., Boston, Mass.
 COE-STAPLEY Mfg. Co., 1565 Railroad Ave., Bridgeport, Conn. "Rex," "Little Giant."
 COLUMBIA—See Judd & Leland Mfg. Co.
 COX Brass Mfg. Co., Pearl & Van Woert Sts., Albany, N. Y. "Boss," "Handy," "Reliable."

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**Stops that
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Breaking
Tire
Pumping**

**The Engine
Does
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**Best for
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**Made
in Three
Sizes**

Designed according to correct mechanical and scientific principles and in the most compact form, special attention being given to the small details so generally overlooked. Light in weight, but durable in construction. Takes up but a small amount of space on any car. Supplies absolutely pure air to the tires. All working parts are enclosed and cannot be affected by dust or dirt.

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The Manzel Tire Pump is built like an engine, with heavy drop forged steel crank shaft—Grey Iron Piston and Piston Rings, accurately ground to size—Bronze Connecting Rods and Bearings—Aluminum Crank Case. There are no cams to cause trouble, nor are there any rubber, fibre or leather rings to wear out.

OILING SYSTEM

Lubricated by means of splash system similar to the oiling system of Automobile Engines—positive always—and no possibility of oil getting into the tire.

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**WE ARE ALSO PREPARED TO FURNISH PUMPS FOR USE WITH
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 CYCLONE—See Judd & Leland Mfg. Co.
 EUREKA—See Judd & Leland Mfg. Co.
 GLEASON-PETERS Air Pump Co., 255-61 Classon Ave., Brooklyn, N. Y.
 GLOBE Mfg. Co., Battle Creek, Mich.
 GOULDS Mfg. Co., Seneca Falls, N. Y.
 HANCOCK Mfg. Co., 770 Henry St., Charlotte, Mich.
 HANDY—See Cox Brass Mfg. Co.
 HAWTHORNE Mfg. Co., 38 Spruce St., Bridgeport, Conn.
 (See page 459.)
 HILL—See Judd & Leland Mfg. Co.
 IDEAL—See Noera Mfg. Co.
 IMPERIAL Brass Mfg. Co., 440-52 S. Jefferson St., Chicago, Ill. "Wixon."
 (See page 165.)
 JUDD & Leland Mfg. Co., Clifton Springs, N. Y., "Eureka," "Columbia," "Tornado," "Cyclone," "Hill," "Victor."
 (See pages 197 and 543.)
 KELLOGG Mfg. Co., 104 Circle St., Rochester, N. Y.
 (See page 325.)
 KEYSTONE Novelty Co., Columbia, Pa. "Myers Aertite."
 LITTLE GIANT—See Coe-Stapley Mfg. Co.
 MASCOT Pump Co., Stewart Ave., Grove City, Pa.
 MAYO Mfg. Co., 54 E. 18th St., Chicago, Ill. "Skinner."
 MYERS AERTITE—See Keystone Novelty Co.
 NOERA Mfg. Co., Waterbury, Conn. "Red Devil," "Ideal."
 (See page 511.)
 OSBORNE & Stephenson Mfg. Co., W. Main St., Plainville, Conn. "Carver."
 (See page 569.)
 PAYNE Mfg. Co., 78 Portland St., Boston, Mass. "Air-Jamer," "Buster."
 PEERLESS Accessories Manufacturers, 1926 S. Wabash Ave., Chicago, Ill.
 PITNER Pump Co., 1220 S. Michigan Ave., Chicago, Ill.
 RED DEVIL—See Noera Mfg. Co.
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 SHAWVER Co., rear 31 W. Pleasant St., Springfield, O. "Springfield."
 SKINNER—See Mayo Mfg. Co.
 SPRINGFIELD—See Central Brass & Fixture Co.
 SPRINGFIELD—See Shawver Co.
 STANDARD Sheet Metal Co., (N. Paterson) Paterson, N. J.
 STAPLEY—See Bridgeport Brass Co.
 STAR Brass Works, 1909-11 Fulton St., Chicago, Ill. "Binks."
 STEVENS Mfg. & Supply Co., 1223-27 Wabash Ave., Chicago, Ill.
 TORNADO—See Judd & Leland Mfg. Co.
 TURNER Brass Works, Sycamore, Ill.

VICTOR—See Judd & Leland Mfg. Co.
 VOELKNER & Harry Mfg. Co., 282-92 Woodbridge St., E., Detroit, Mich.
 WERNER-SERVICE Mfg. Co., 263 Fairmount Ave., Jersey City, N. J.
 WINDJAMMER—See Bridgeport Brass Co.
 WIXON—See Imperial Brass Mfg. Co.

OIL PUMPS

(See Lubricators)

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 MARSH—See American Steam Pump Co.
 UNION Steam Pump Co., Battle Creek, Mich.

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AMERICAN Steam Pump Co., Battle Creek, Mich. "Marsh."
 MARSH—See American Steam Pump Co.
 OFELDT & Sons, August. Valley Stream, N. Y.
 UNION Steam Pump Co., Battle Creek, Mich.

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ATLAS Brass Foundry Co., 991 S. Front St., Columbus, O.
 BLACKMER Rotary Pump, Power & Mfg. Co., Petoskey, Mich.
 BROWN & Sharpe Mfg. Co., Promenade St., Providence, R. I.
 DIXON Cascade Pump Co., Runyon St. & Badger Ave., Newark, N. J.
 DOEHLER Die-Casting Co., Brooklyn, N. Y.
 (See pages 195 and 277.)
 H. M. S.—See Hartford Machine Screw Co.
 HARTFORD Machine Screw Co., Hartford, Conn. "H. M. S."
 (See page 285.)
 IMPERIAL Brass Mfg. Co., 440-52 S. Jefferson St., Chicago, Ill.
 (See page 165.)
 KINNEY Mfg. Co., 100 Boylston St., Boston, Mass.
 LEE Co., Wm. O., Port Huron, Mich.
 LIPMAN Mfg. Co., 211 Pleasant St., Beloit, Wis.
 LOBEE Pump & Machinery Co., 111-19 Dearborn St., Buffalo, N. Y.
 OBERDORFER Brass Co., M. L., 804 E. Water St., Syracuse, N. Y.
 SPARKS - WITHINGTON Co., Jackson, Mich.
 (See page 211.)
 WILLIAMS Valve Co., D. T., Spring Grove Ave. & Township St., Cincinnati, O.

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EDMUNDS & Jones Mfg. Co., 432-52 Lawton Ave., Detroit, Mich.
 (See page 223.)
 TINKMAN Mfg. Co., Peirce City, Mo.
 WESTERN Brass Mfg. Works, Marshall Blvd., 21st St. & C. B. & Q. R. R., Chicago, Ill.
 (See page 85.)

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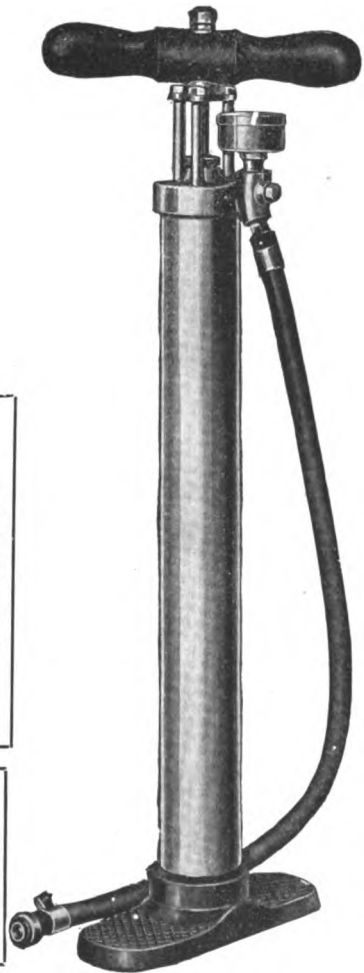


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FRENCH & Co., Samuel H., York Ave., Fourth & Callowhill Sts., Philadelphia, Pa.

LUCAS & Co., John, 322-33 Race St., Philadelphia, Pa.

ORDAMOR—See Baker, Wm. T.

WILHELM Co., A., Third & Bern Sts., Reading, Pa.

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BALL RACES

(See Cups, Ball)

RACKS

HAT RACKS

(See also Hangers, Hat)

BRIDGEPORT Coach Lace Co., 17th St. & Fourth Ave., New York, N. Y.
(See page 81.)

COLUMBIA—See Horstmann Co.

HORSTMANN Co., Wm. H., Fifth & Cherry Sts., Philadelphia, Pa. "Columbia."

SCHLEGEL Mfg. Co., College Ave. & N. Goodman St., Rochester, N. Y.

VOGT Mfg. & Coach Lace Co., 408-10 St. Paul St., Rochester, N. Y.

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HIGHTON & Sons Co., Wm., Nashua, N. H.

MASCO—See Milwaukee Auto Specialty Co.

MILWAUKEE Auto Specialty Co., 705-15 Chestnut St., Milwaukee, Wis. "Masco."
(See page 551.)

NOONAN Tool & Machine Works, 130-36 St. James St., Rome, N. Y.

SARGENT & Ham Co., 26-30 Bowker St., Boston, Mass.

SMITH Co., H. Lund, 201 Paterson Ave., Paterson, N. J.

STANDARD—See Connecticut Steel & Wire Co.

TOFFLER Co., S., 341 E. 136th St., New York, N. Y.

RADIATORS

WATER COOLERS OR RADIATORS

A-Z Co., 530 W. 56th St., New York, N. Y.
(See page 307.)

AUTO Sheet Metal Works, 2228 Michigan Ave., Chicago, Ill.

BEHRINGER Radiator Works, Ticonderoga, N. Y.

BRISCOE Mfg. Co., Detroit, Mich.
(See pages 239 and 240.)

BUSH Mfg. Co., Hartford, Conn.
(See page 345.)

CANDLER Radiator Co., 1086-90 Jefferson Ave., E., Detroit, Mich.
(See page 565.)

DETROIT Radiator Co., Detroit, Mich.

EL ARCO Radiator Co., 6-10 E. 31st St., New York, N. Y.

EMPIRE Radiator Co., Buffalo, N. Y.

ENGLISH & Mersick Mfg. Co., New Haven, Conn.

EUREKA Auto Parts Mfg. Co., 3031 Olive St., St. Louis, Mo.

FA-VOSE—See Farlinger Mfg. Co.

FARLINGER Mfg. Co., 1506-12 Fort St., W., Detroit, Mich. "Fa-Vose."
(See page 309.)

FEDDERS Mfg. Works, 55 Tonawanda St., Buffalo, N. Y.
(See page 279.)

GOETZ Co., 1802 Clybourn Ave., Chicago, Ill.

HARRISON Mfg. Co., Lockport, N. Y.

(See page 559.)

KELLS Mfg. Co., W. J., 521-25 W. 45th St., New York, N. Y.
(See page 205.)

KINSEY Mfg. Co., Toledo, O. "Kinwood."
(See page 395.)

KINWOOD—See Kinsey Mfg. Co.

KURTZNER Radiator Co., 416 Prospect Ave., N. W., Cleveland, O.

LIVINGSTON Radiator & Mfg. Co., 136-46 W. 52d St., New York, N. Y.

LONG Mfg. Co., Detroit, Mich.
(See page 517.)

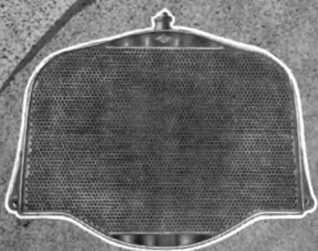
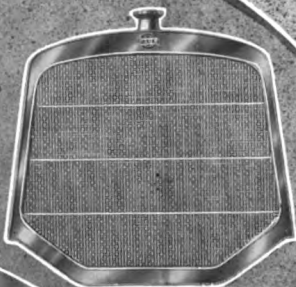
MCCORD Mfg. Co., Detroit, Mich.
(See pages 310 and 311.)

MAYO Radiator Co., New Haven, Conn.

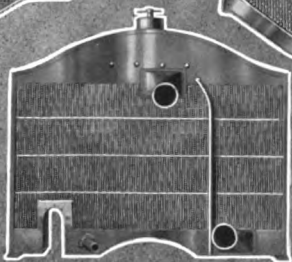
METAL Stamping Co., 13th St. & Boulevard Long Island City, N. Y.

NATIONAL Can Co., Detroit, Mich.

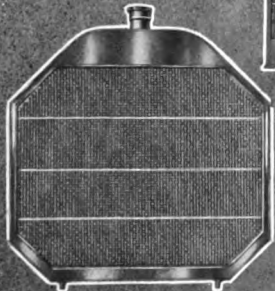
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THE A-Z CO
 NEW YORK

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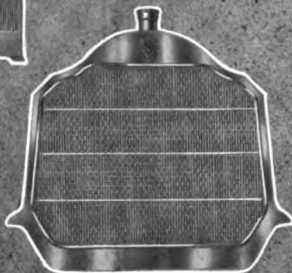
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 ROME-TURNEY Radiator Co., Rome, N. Y.
 TAKE-APART-RADIATOR Co., 804 E. Washington St., Greensburg, Ind. "T-A-R-Co."
 T-A-R-CO—See Take-Apart-Radiator Co.
 TODD Mfg. Co., 820 Mary Pl., Minneapolis, Minn.
 WERNER Radiator Co., 2642 Michigan Ave., Chicago, Ill.
 WISCONSIN Automobile Radiator Co., North Milwaukee, Wis. (See page 583.)
 WRIGHT Cooler & Hood Mfg. Co., Muskegon, Mich.

RAILS

ROBE OR COAT RAILS

ALEXANDER Mfg. Co., J., 1931 Broadway, New York, N. Y. (See page 209.)
 ALLEN Fire Department Supply Co., Providence, R. I.
 ATTWOOD Brass Works, 318-20 Bowery St., Grand Rapids, Mich. (See page 595.)
 AUTO Parts Mfg. Co., 171 Michigan St., Milwaukee, Wis.
 AUTO Specialty Co., 89 Pearl St., Boston, Mass.
 B. & B. Mfg. Co., 6526 Carnegie Ave., Cleveland, O.
 CENTRAL Brass & Fixture Co., N. Fountain Ave., Springfield, O.
 CHICAGO Electric Mfg. Co., 2817 S. Halsted St., Chicago, Ill. "Handy."
 CHICAGO-RACINE Aluminum, Brass & Iron Works, 224-30 W. Huron St., Chicago, Ill. (See page 607.)
 COLUMBUS Auto Brass Co., Columbus, O.
 COWLES & Co., C., New Haven, Conn. (See page 91.)
 COX Brass Mfg. Co., Pearl & Van Woert Sts., Albany, N. Y.
 CURRY Co., Joseph F., 475 Washington St., Newark, N. J.
 DETLAFF, A. J., 121 Champlain St., Detroit, Mich.
 DOUGLAS & LOMASON Co., Detroit, Mich.
 ENGLISH & Mersick Co., New Haven, Conn.
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 FINDEISEN & Kropf Mfg. Co., 21st & Rockwell Sts., Chicago, Ill.
 GARAGE Equipment Mfg. Co., Milwaukee, Wis. "Milwaukee." (See page 203.)

HANDY—See Chicago Electric Mfg. Co.
 HARPER, Thomas, 139 Lafayette St., New York, N. Y.
 HIGHTON & Sons Co., Wm., Nashua, N. H.
 IMPERIAL Brass Mfg. Co., 440-52 S. Jefferson St., Chicago, Ill. (See page 165.)
 JONAH & George, Merrimac, Mass. (See page 163.)
 KEELER Brass Co., 261-71 Godfrey Ave., Grand Rapids, Mich.
 KINSEY Mfg. Co., Toledo, O. (See page 395.)
 MEDINA Machine & Stamping Co., Medina, N. Y.
 MILWAUKEE—See Garage Equipment Mfg. Co.
 MILWAUKEE Auto Specialty Co., 705-15 Chestnut St., Milwaukee, Wis. "Rad-dium." (See page 551.)
 MURDOCK, Jr. Co., Jas., 116 Opera Pl., Cincinnati, O.
 NEW YORK Coach & Auto Lamp Co., 302-06 W. 53d St., New York, N. Y.
 NORTH & Judd Mfg. Co., New Britain, Conn.
 NOVELTY Mfg. Co., Waterbury, Conn. (See page 619.)
 O'BRIEN Mfg. Co., Joseph F., 63 Park Pl., New York, N. Y. (See page 229.)
 RADIUM—See Milwaukee Auto Specialty Co.
 REGAN & Kirwin Mfg. Co., 37 Shattuck St., Lowell, Mass.
 SEARLS Mfg. Co., 27 Mulberry St., Newark, N. J.
 SMITH & Co., Jos. N., Detroit, Mich. (See page 201.)
 SMITH Co., H. Lund, 201 Paterson Ave., Paterson, N. J.
 STAR Brass Works, 1721-23 Baltimore Ave., Kansas City, Mo.
 STERLING—See Auto Accessories Mfg. Co.
 TOFFLER Co., S., 841 E. 136th St., New York, N. Y.
 TURNER Brass Works, Sycamore, Ill.
 WESTERN Brass Mfg. Works, Marshall Blvd., 21st St. & C. B. & Q. R. R., Chicago, Ill. (See page 85.)
 WHITE Mfg. Co., Bridgeport, Conn. (See page 619.)
 WHITEHOUSE Mfg. Co., E. A., 42-54 Elm St., Newark, N. J. (See page opposite Title Page.)
 WIENER-BARNET Co., 312-28 Adams St., Newark, N. J.
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AUTOMOBILE RADIATION REVOLUTIONIZED



Our Radiators are Composed of Not to Exceed 30 Pieces of Metal.

Simplicity

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**That's Where
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Equipped to Build All Styles.**

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Built and designed as a strictly high grade fan.

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Deliver oil positively and against pressure, close adjustment and accurate sight feed; resulting in efficient and economical Lubrication.

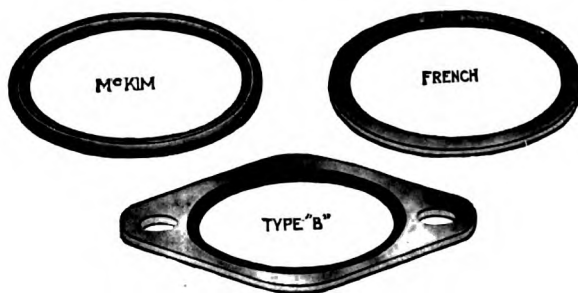
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VEHICLE MOVEMENT RECORDERS (Continued)

RECORDING Speedometer Sales Co., 54 Clinton St., Newark, N. J. "Speedograph."

SEARS-CROSS Co., 685-89 11th Ave., New York, N. Y.
(See page 349.)

SERVICE Recorder Co., 2344 E. 105th St., Cleveland, O. "Servis."

SERVIS—See Service Recorder Co.

SPEEDOGRAPH—See Recording Speedometer Sales Co.

TRAVELOG—See Brown, W. H.

UNIQUE Recorder Co., Glover Bldg., Hazleton, Pa.

RECTIFIERS

ALTERNATING CURRENT RECTIFIERS

AMERICAN Battery Co., 1132-34 Fulton St., Chicago, Ill.

ASHBROOK, J. F., 2639 Emmet St., Chicago, Ill. "Johns."

COMO Electrical Co., Spring Lake, N. J. "Hickley."

ECONOMY—See Electric Economy Co.

EDISON, Thomas A., 114 Lakeside Ave., Orange, N. J.

ELECTRIC Economy Co., 64 Warren St. (Roxbury), Boston, Mass. "Economy."

ELECTRIC Products Co., Cleveland, O. "Wotton."

ELECTRIC Storage Battery & Mfg. Co., Cincinnati, O.

GENERAL Electric Co., Schenectady, N. Y.

HICKLEY—See Como Electrical Co.

JOHNS—See Ashbrook, J. F.

MOHAWK Electric Co., 65-67 Shipman St., Newark, N. J. "Rollinson."

MURPHY Electricity Rectifier Co., 187 N. Water St., Rochester, N. Y.

ROLLINSON—See Mohawk Electric Co.

SIMPLICITY—See Wilson Supply Co.

SIRCH Electrical & Testing Laboratories, Los Angeles, Cal.

WAGNER Electric Mfg. Co., 6400 Plymouth Ave., St. Louis, Mo.

WESTINGHOUSE Electric & Mfg. Co., (E. Pittsburg), Pittsburg, Pa.

WILSON Supply Co., 2366 Woodhill Rd., Cleveland, O. "Simplicity."

WOTTON—See Electric Products Co.

REFLECTORS

MIRROR LAMP REFLECTORS

BACHE & Co., Semon, West & Hubert Sts., New York, N. Y.

BAUSCH & Lomb Optical Co., Rochester, N. Y.

FRY Glass Co., H. C., Rochester, Pa.

LANCASTER Lens Co., Lancaster, O.
(See page 543.)

MACBETH-EVANS Glass Co., Wabash Terminal Bldg., Pittsburg, Pa.

MATISSE, C. & A., 543-49 E. 116th St., New York, N. Y.
(See page 313.)

UNITED States Optical Glass Co., Follansbee, W. Va.

REGULATORS

FUEL FEED REGULATORS

OFELDT & Sons, F. W., Nyack, N. Y.

TANK PRESSURE REGULATORS

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IMPERIAL Brass Mfg. Co., 440-52 S. Jefferson St., Chicago, Ill.
(See page 165.)

LOCKE Regular Co., 76 North St., Salem, Mass.

LUNKENHEIMER Co., 223 E. Eighth Ave., Cincinnati, O.

WILLIAMS Valve Co., D. T., Spring Grove Ave. & Township St., Cincinnati, O.

WATER LEVEL REGULATORS

LANE Motor Vehicle Co., Poughkeepsie, N. Y.

OFELDT & Sons, F. W., Nyack, N. Y.

WINDOW REGULATORS

PERFECT Window Regulator Co., 43 Exchange Pl., New York, N. Y.
(See page 313.)

REMOVERS

CARBON REMOVERS

(See also Compounds, Carbon Removing; also Scrapers Carbon)

MICHENER, E. S., 80 Washington St., New Castle, Pa.

PAINT AND VARNISH REMOVERS

ACME White Lead & Color Works, 1740-1800 St. Aubin Ave., Detroit, Mich.

AD-EL-ITE—See Adams & Elting Co.

ADAMS & Elting Co., 718-26 Washington Blvd., Chicago, Ill. "Ad-el-ite."

ALBANY Chemical Co., 22 Broadway, Albany, N. Y.

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(Continued)**

- CALLERY & Co., W. W., 188 36th St., Pittsburg, Pa.
- CHADELOID Chemical Co., 100 William St., New York, N. Y.
- CHALMERS Chemical Co., 218 McWhorter St., Newark, N. J. "Phenoid."
- CROWN—See Bradley & Vrooman Co.
- DETROIT White Lead Works, 530-60 Milwaukee Ave., E., Detroit, Mich. "Rogers Abluent."
- EBERSON Paint Co., 18th & Pine Sts., St. Louis, Mo.
- ECLIPSE—See Gould & Cutler.
- ENTERPRISE Paint Mfg. Co., Peoria & Van Buren Sts., Chicago, Ill. "Noxall."
- FOREST City Paint & Varnish Co., 3334 Lakeside Ave., Cleveland, O.
- GILLESPIE & Son, Chas. H., 19 Dey St., Jersey City, N. J. "Monarch Bull Dog."
- GLIDDEN Varnish Co., W. Madison Ave. & L. S. & M. S. Ry., Cleveland, O.
- GOULD & Cutler, 45 Sudbury St., Boston, Mass. "Eclipse."
- HEATH & Milligan Mfg. Co., 1833-37 Seward St., Chicago, Ill.
- IDOL-YUSSO—See Schlegel Mfg. Co.
- JEWEL—See Wadsworth-Howland Co.
- KLEAN-ITT—See Lawrence & Co.
- LAWRENCE & Co., W. W., Pittsburg, Pa. "Klean-itt."
- LUCAS & Co., John, 322-30 Race St., Philadelphia, Pa. "Mirac."
- MIRAC—See Lucas & Co.
- MONARCH Bull Dog—See Gillespie & Son.
- NOXALL—See Enterprise Paint Mfg. Co.
- PARROTT Varnish Co., 453 N. Washington Ave., Bridgeport, Conn.
- PENINSULAR Paint & Varnish Co., Detroit, Mich.
- PHENOID—See Chalmers Chemical Co.
- PRINCE Paint Co., Jas. H., 5-7 Lancaster St., Boston, Mass.
- ROGERS ABLUENT—See Detroit White Lead Works.
- SCHLEGEL Mfg. Co., Oscar, 111 E. 12th St., New York, N. Y. "Idol-Yusso."
- WADSWORTH-HOWLAND Co., 225 Carpenter St., Chicago, Ill. "Jewel."
- WILSON Remover Co., Hudson Terminal Bldg., New York, N. Y.

REPAIRERS**SPRING REPAIRERS**

(See Clamps, Spring Repair)

RESTS**BOW RESTS**

- BARBEE Mfg. Co., 1401-05 W. Ninth St., Cleveland, O.
- CAMPBELL—See Perkins Campbell Co.
- CANTON Top Rest Co., 1432 E. Eighth St., Canton, O.
- CLEVELAND Hardware Co., Cleveland, O.
- CRANDALL, Stone & Co., Binghamton, N. Y.
- CURRY Co., Joseph F., 475 Washington St., Newark, N. J.
- DAYTON Malleable Iron Co., Dayton, O.
- DETROIT Socket Co., 814 Jefferson Ave., W., Detroit, Mich.
- EBERHARD Mfg. Co., Cleveland, O. (See page 215.)
- ELECTRIC City Specialty Co., 165 Adams St., Buffalo, N. Y. (See page 401.)
- JONAH & George, Merrimac, Mass. (See page 163.)
- KEELER Brass Co., 261-71 Godfrey Ave., Grand Rapids, Mich.
- METAL Stamping Co., 13th St. & Boulevard, Long Island City, N. Y.
- O'BRIEN Mfg. Co., Joseph F., 63 Park Pl., New York, N. Y. (See page 229.)
- PERKINS Campbell Co., Cincinnati, O. "Campbell." (See page 371.)
- SCHERER & Co., H., Detroit, Mich.
- SMITH & Co., Jos. N., Detroit, Mich. (See page 201.)
- WESTERN Brass Mfg. Works, Marshall Blvd., 21st St. & C. B. & Q. R. R., Chicago, Ill. (See page 85.)
- WHITEHOUSE Mfg. Co., E. A., 42-54 Elm St., Newark, N. J. (See page opposite Title Page.)
- WIENER-BARNET Co., 312-28 Adams St., Newark, N. J.
- WOODRUFF & Sons Co., Walter W., Mount Carmel, Conn.

FOOT RESTS

(See also Hassoeks)

- A-Z Co., 530 W. 56th St., New York, N. Y. (See page 307.)
- ALEXANDER Mfg. Co., J., 1931 Broadway, New York, N. Y. (See page 209.)
- ALLEN Fire Department Supply Co., Providence, R. I.
- ATTWOOD Brass Works, 318-20 Bowery St., Grand Rapids, Mich. (See page 595.)
- AUTO Parts Mfg. Co., 171 Michigan St., Milwaukee, Wis.
- AUTO Specialty Co., 39 Pearl St., Boston, Mass.
- B. & B. Mfg. Co., 6526 Carnegie Ave., Cleveland, O.
- CENTRAL Brass & Fixture Co., N. Fountain Ave., Springfield, O.
- CHICAGO Electric Mfg. Co., 2817 S. Halsted St., Chicago, Ill. "Handy."

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(See page 607.)

COLUMBUS Auto Brass Co., Columbus, O.

COWLES & Co., C., New Haven, Conn.
(See page 91.)

COX Brass Mfg. Co., Pearl & Van Woert Sts., Albany, N. Y.

CURRY Co., Joseph F., 475 Washington St., Newark, N. J.

DETLAFF, A. J., 121 Champlain St., Detroit, Mich. "Rest E-Z."

DOUGLAS & Lomason Co., Detroit, Mich.

ENTERPRISE Brass & Plating Co., 2838-44 Spring Grove Ave., Cincinnati, O.

FINDEISEN & Kropf Mfg. Co., 21st & Rockwell Sts., Chicago, Ill.

GARAGE Equipment Mfg. Co., Milwaukee, Wis. "Milwaukee."
(See page 203.)

GLOBE Machine & Stamping Co., Cleveland, O.
(See page 79.)

HANDY—See Chicago Electric Mfg. Co.

HARPER, Thomas, 139 Lafayette St., New York, N. Y.

HIGHTON & Sons Co., Wm., Nashua, N. H.

IMPERIAL Brass Mfg. Co., 440-52 S. Jefferson St., Chicago, Ill.
(See page 165.)

JONAH & George, Merrimac, Mass.
(See page 163.)

KEELER Brass Co., 261-71 Godfrey Ave., Grand Rapids, Mich.

KINSEY Mfg. Co., Toledo, O.
(See page 395.)

MEDINA Machine & Stamping Co., Medina, N. Y.

MILWAUKEE—See Garage Equipment Mfg. Co.

NEW York Coach & Auto Lamp Co., 302-06 W. 53d St., New York, N. Y.

NORTH & Judd Mfg. Co., New Britain, Conn.

NOVELTY Mfg. Co., Waterbury, Conn.
(See page 619.)

REGAN & Kirwin Mfg. Co., 37 Shattuck St., Lowell, Mass.

REST E-Z—See Detlaff, A. J.

SARGENT Mfg. Co., New & Summit Sts., Newark, N. J.

SEARLS Mfg. Co., 27 Mulberry St., Newark, N. J.

SMITH & Co., Jos. N., Detroit, Mich.
(See page 201.)

SMITH Co., H. Lund, 201 Paterson Ave., Paterson, N. J.

STAR Brass Works, 1721-23 Baltimore Ave., Kansas City, Mo.

TOFFLER Co., S., 841 E. 136th St., New York, N. Y.

TURNER Brass Works, Sycamore, Ill.

WESTERN Brass Mfg. Works, Marshall Blvd., 21st St. & C. B. & Q. R. R., Chicago, Ill.
(See page 85.)

WHITE Mfg. Co., Bridgeport, Conn.
(See page 619.)

WHITEHOUSE Mfg. Co., E. A., 42-54 Elm St., Newark, N. J.
(See page opposite Title Page.)

WIENER-BARNET Co., 312-28 Adams St., Newark, N. J.

WOODRUFF & Sons Co., Walter W., Mount Carmel, Conn.

HEEL RESTS

LUCAS & Son, J. L., 3 Fox St., Bridgeport, Conn.
(See page 591.)

RETAINERS

BALL RETAINERS

BOSSERT Co., Utica, N. Y.
(See page 161.)

GLOBE Machine & Stamping Co., Cleveland, O.
(See page 79.)

KONIGSLOW Mfg. Co., Otto, Cleveland, O.

STAR Ball Retainer Co., Lancaster, Pa.
(See page 317.)

WORCESTER Pressed Steel Co., Worcester, Mass.
(See page 157.)

RHEOSTATS

BATTERY CHARGING RHEOSTATS

ALLEN-BRADLEY Co., Milwaukee, Wis.

CUTLER-HAMMER Mfg. Co., Milwaukee, Wis.

ELECTRIC Products Co., Cleveland, O.

GENERAL Electric Co., Schenectady, N. Y.

LEONARD Electric Co., Ward, Bronxville, N. Y.
(See page 669.)

WESTINGHOUSE Electric & Mfg. Co., (E. Pittsburg), Pittsburg, Pa.

RIMS

QUICK DETACHABLE RIMS

AMERICAN Rim Co., Sun Bldg., Detroit, Mich. "Lambert."

CLEVELAND Welding & Mfg. Co., 3205 Franklin Ave., N. W., Cleveland, O.

IMPERIAL-MOTT Department, Flint, Mich.
(See page 417.)

JACKSON Rim Co., Jackson, Mich.

KELSEY Wheel Co., Detroit, Mich.

LAMBERT—See American Rim Co.

MOTT Wheel Works, Utica, N. Y.
(See page 437.)

NATIONAL Rim Co., Tarrytown, N. Y.

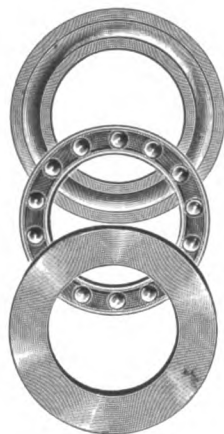
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(See Book Mark.)**UNITED Rim Co., Akron, O.**
(See page 479.)**UNIVERSAL Rim Co., 1303 Michigan Ave., Chicago, Ill.****WESTON-MOTT Co., Flint, Mich.**
(See page 319.)**REMOVABLE OR DEMOUNTABLE RIMS****AMERICAN Rim Co., Sun Bldg., Detroit, Mich. "Lambert."****ANGLADA Co., 650 Woodward Ave., Detroit, Mich.****ASHLEY—See General Rim Co.****BAKER—See Universal Rim Co.****BOOTH Demountable Rim Co., University Bldg., Detroit, Mich.****DETROIT—See Kelsey Wheel Co.****DETROIT Demountable Rim Co., 247 Jefferson Ave., Detroit, Mich.**
(See page 561.)**EMPIRE Tire Co., Mulberry St. & Clinton Ave., Trenton, N. J.****FIRESTONE Tire & Rubber Co., Akron, O.**
(See page 451.)**FISSK Rubber Co., Chicopee Falls, Mass.****FUNK, R. W., 1876 Broadway, New York, N. Y.****GENERAL Rim Co., 1916 Broadway, New York, N. Y. "Ashley."****HOWARD Demountable Rim Co., Trenton, N. J.****IMPERIAL-MOTT Department, Flint, Mich.**
(See page 417.)**J-M—See Johns-Manville Co.****JACKSON Rim Co., Jackson, Mich.****JOHNS-MANVILLE Co., H. W., Madison Ave. & 41st St., New York, N. Y. "J-M."****KELSEY Wheel Co., Detroit, Mich. "Detroit."****LAMBERT—See American Rim Co.****MICHELIN Tire Co., Milltown, N. J.****MOTE Demountable & Detachable Rim Co., Wayne County Bank Bldg., Detroit, Mich.****MOTT Wheel Works, Utica, N. Y.**
(See page 437.)**NEWMATIC Tire Co., 151 W. 68th St., New York, N. Y.****PRESTO Inner-Rim Co., 53 State St., Boston, Mass.****SCOTTS—See Sinclair-Scott Co.****SINCLAIR-SCOTT Co., 6 E. German St., Baltimore, Md. "Scotts."****STANDARD Welding Co., Cleveland, O. "Stanweld."**
(See Book Mark.)**STANWELD—See Standard Welding Co.****UNITED Rim Co., Akron, O.**
(See page 479.)**UNITED States Tire Co. Broadway & 58th St., New York, N. Y.****UNIVERSAL Rim Co., 1303 Michigan Ave., Chicago, Ill. "Baker."****WESTON-MOTT Co., Flint, Mich.**
(See page 319.)**RUBBER STEERING WHEEL RIMS****AUTO Specialty Co., Toledo, O.****DIAMOND RUBBER CO., Akron, O.****LUZERNE Rubber Co., Trenton, N. J.****STOKES Rubber Co., Jos., Trenton, N. J.****STANDARD RIMS****AMERICAN Tube & Stamping Co., Bridgeport, Conn.****CLEVELAND Welding & Mfg. Co., 8205 Franklin Ave., N. W., Cleveland, O.****IMPERIAL-MOTT Department, Flint, Mich.**
(See page 417.)**KELSEY Wheel Co., Detroit, Mich.****MOTT Wheel Works, Utica, N. Y.**
(See page 437.)**STANDARD Welding Co., Cleveland, O. "Stanweld."**
(See Book Mark.)**STANWELD—See Standard Welding Co.****UNIVERSAL Welding Co., St. Anne, Ill.****WESTON-MOTT Co., Flint, Mich.**
(See page 319.)**WOOD RIMS OR FELLOES****AMERICAN Wood Rim Co., Onaway, Mich.****BREECE Mfg. Co., Portsmouth, O.****CAMPBELL & Dann Mfg. Co., Tullahoma, Tenn.****CRANE & MacMahon, 8-10 Bridge St., New York, N. Y. "Nut." "Star."****EBERLY & Orris Mfg. Co., Mechanicsburg, Pa.**
(See page 615.)**HARTWELL & Co., C. L., Chicago Heights, Ill.****JONES & Co., Phineas, Newark, N. J.**
(See page 615.)**LEBZELTER & Son Co., Phillip, 241 N. Queen St., Lancaster, Pa.****NUT—See Crane & MacMahon.****RASTETTER & Son, Louis, Nelson & Wall Sts., Fort Wayne, Ind.****SKINNER Bending Co., J. M., Toledo, O.****STAR—See Crane & MacMahon.****TOLEDO Bending Co., Toledo, O.****TUCKER Woodwork Co., Sidney, O.****YORK Bending Works, York, Pa.****WOOD STEERING WHEEL RIMS****AMERICAN Wood Rim Co., Onaway, Mich.****DETROIT Auto Dash Co., 519-21 Beaubien St., Detroit, Mich.**
(See page 153.)**RASTETTER & Son, Louis, Nelson & Wall Sts., Fort Wayne, Ind.****TUCKER Woodwork Co., Sidney, O.**

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(See Washers, Felt)

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- EVARTS Machine Co., 18 Hicks St., Hartford, Conn.
- LEAK-PROOF—See McQuay-Norris Mfg. Co.
- McQUAY-NORRIS Mfg. Co., 1311 Chestnut St., St. Louis, Mo. "Leak-Proof."
- MERRITT Co., S. Whyte, 407-09 E. 31st St., New York, N. Y. (See page 321.)
- PISTON Ring Co., Muskegon, Mich.
- SPACKE Machine Co., F. W., Indianapolis, Ind. (See page 241.)
- TIPPETT Mfg. Co., 172-82 W. Locust St., Columbus, O. (See page 321.)
- VACO—See Victor Appliance Co.
- VICTOR Appliance Co., Troy, N. Y. "Vaco." (See page 395.)
- WAINWRIGHT & Son, W. W., 16th St. & Western Ave., Connersville, Ind.
- WASSON Piston Ring Co., 1121-23 Clinton St., Hoboken, N. J.
- WILCOX-McKIM Co., Saginaw, Mich. (See page 181.)

RIVETS**BRASS AND COPPER RIVETS**

- BLAKE & Johnson Co., Waterbury, Conn.
- BRIDGEPORT Brass Co., P. O. Station L., Bridgeport, Conn. (See page 305.)
- COBB & Drew, Plymouth, Mass.
- FALLS Rivet & Machine Co., Kent, O.
- HASSALL, John, Clay & Oakland Sts., Brooklyn, N. Y. (See page 321.)
- PLUME & Atwood Mfg. Co., 470 Bank St., Waterbury, Conn.
- PROGRESSIVE Mfg. Co., Torrington, Conn.
- ROME Brass & Copper Co., Rome, N. Y.
- STEELE & Johnson Mfg. Co., 779 S. Main St., Waterbury, Conn.
- WATERBURY Brass Goods Corp., 160 Washington Ave., Waterbury, Conn.
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(See Rivets, Brass)

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- COLUMBUS Bolt Works, 162 W. Randolph St., Columbus, O.
- FALLS Rivet and Machine Co., Kent, O.
- GARLAND Nut & Rivet Co., Bailey-Farrell Bldg., Pittsburg, Pa.
- GRAND Crossing Tack Co. (Grand Crossing), Chicago, Ill.
- HASSALL, John, Clay & Oakland Sts., Brooklyn, N. Y. (See page 321.)
- HOOPES & Townsend Co., 1330 Buttonwood St., Philadelphia, Pa.
- KANSAS City Bolt & Nut Co. (Sheffield Station), Kansas City, Mo.
- LAMSON & Sessions Co., 2188 Scranton Rd., Cleveland, O.
- MICHIGAN Bolt & Nut Works, ft. Meldrum Ave., Detroit, Mich.
- NATIONAL Screw & Tack Co., Stanton Ave., S. E., & C. & P. Ry., Cleveland, O.
- NEWARK Rivet Works, 262 Lafayette St., Newark, N. J.
- PITTSBURG Rivet Co., 38th St. & Junction Ry., Pittsburg, Pa.
- PITTSBURG Screw & Bolt Co., Liberty Ave. & 25th St., Pittsburg, Pa.
- PLYMOUTH Mills, Plymouth, Mass.
- REED & Prince Mfg. Co., Duncan Ave., Worcester, Mass.
- UPSON Nut Co., Unionville, Conn.

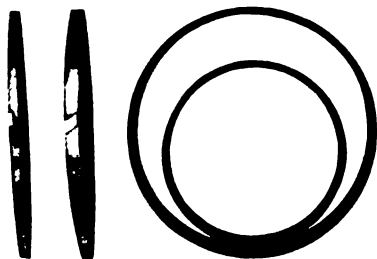
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(See Platinum)

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- BALLARD & Co., J. O., Malone, N. Y.
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- BISHOP Co., J. H., Wyandotte, Mich.
- BURLINGTON Blanket Co., Burlington, Wis. "Sho-Fur."
- CHASE & Co., L. C., Boston, Mass. (See page 225.)
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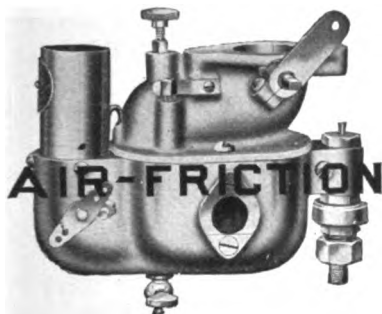
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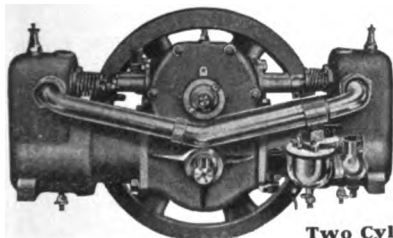
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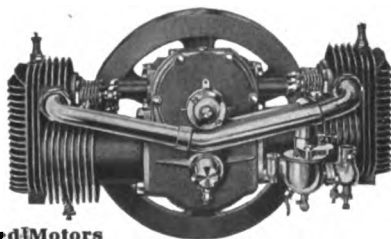


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(See page 619.)

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 CURTIS Screw Co., Buffalo, N. Y.
 DETROIT Screw Works, Detroit, Mich. (See page 653.)
 EASTERN Machine Screw Corp., Barclay & Truman Sts., New Haven, Conn.
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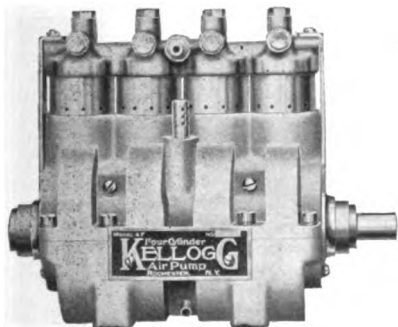
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 LAMSON & Sessions Co., 2188 Scranton Rd., Cleveland, O.
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 CORBIN Screw Corp., 219 High St., New Britain, Conn.
 DETROIT Screw Works, Detroit, Mich.
 (See page 653.)
 HARTFORD Machine Screw Co., Hartford, Conn.
 (See page 285.)
 HILL, Co., Geo. Q., 32-34 Dorchester Ave. (E. Boston), Boston, Mass.
 INTERNATIONAL Machine & Screw Co., 172 Lyman St., Springfield, Mass.
 MICHIGAN Screw Co., Lansing, Mich.

NATIONAL-ACME Mfg. Co., Cleveland, O.
 (See page 329.)

NATIONAL Screw & Tack Co., Stanton Ave., S. E., & C. & P. Ry., Cleveland, O.

NEW Haven Machine Screw Co., New Haven, Conn.
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(See Screws, Cap and Set)

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(See page 595.)

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(See page 459.)

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(See page 217.)

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(See page 135.)

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(See page 653.)

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(See page 569.)

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(See page 445.)

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(See page 299.)

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(See page 651.)

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(See page 593.)

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(See page 329.)

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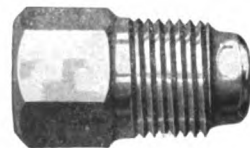


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(See page 587.)
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(See page 183.)
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(See page 480.)
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(See page 331.)
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(See page 85.)
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(See page 331.)
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(See page 85.)
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- McKINNON Dash Co., 252 Amherst St., Buffalo, N. Y.
- METAL Stamping Co., 13th St. & Boulevard, Long Island City, N. Y.
- FOLSON Mfg. Co., 27 Chenango St., Buffalo, N. Y.

SEPARATORS

BOW SEPARATORS

- AMERICAN—See Weiss & Son.
- AMESBURY Brass & Foundry Co., Amesbury, Mass.
- ATTWOOD Brass Works, 318-20 Bowery St., Grand Rapids, Mich.
(See page 595.)
- AUTO Specialties Mfg. Co., Fisher Bldg., Chicago, Ill. "Bair."
(See page 331.)
- BAIR—See Auto Specialties Mfg. Co.
- CLEVELAND Hardware Co., Cleveland, O.
- COWLES & Co., C., New Haven, Conn.
(See page 91.)
- COX, David H., Roselle, N. J.
- CRANDAL, Stone & Co., Binghamton, N. Y.
- CURRY Co., Joseph F., 475 Washington St., Newark, N. J.
- DAYTON Malleable Iron Co., Dayton, O.
- DETROIT Socket Co., 814 Jefferson Ave., W., Detroit, Mich.
- EBERHARD Mfg. Co., Cleveland, O.
(See page 215.)
- ELECTRIC City Specialty Co., 165 Adams St., Buffalo, N. Y.
(See page 401.)

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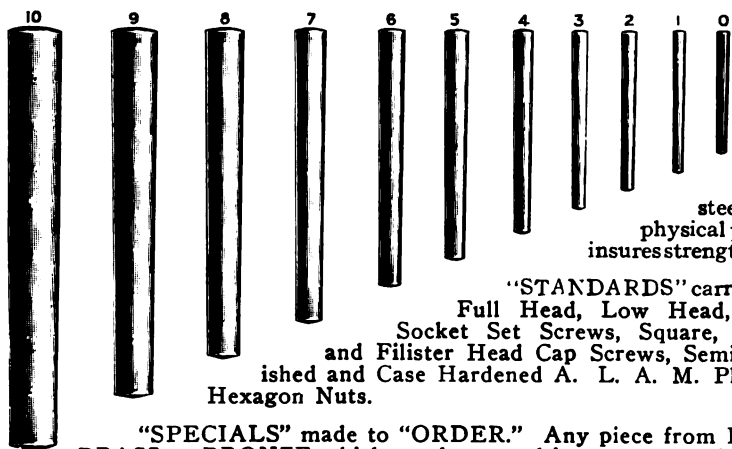
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- FINDEISEN & Kropf Mfg. Co.**, 21st & Rockwell Sts., Chicago, Ill.
- IROQUOIS Auto Top Co.**, Utica, N. Y. "Stick Title."
- JONAH & George**, Merrimac, Mass.
(See page 163.)
- KEELER Brass Co.**, 261-71 Godfrey Ave., Grand Rapids, Mich.
- MURPHY Co.**, G. W. J., Merrimac, Mass.
- NEVER-RUB**—See Springfield Auto Top & Upholstering Co.
- NOVELTY Mfg. Co.**, Waterbury, Conn.
(See page 619.)
- O'BRIEN Mfg. Co.**, Joseph F., 63 Park Pl., New York, N. Y.
(See page 229.)
- PENNSYLVANIA Rubber Co.**, Jeannette, Pa.
- SCHERER & Co.**, H., Detroit, Mich.
- SMITH & Co.**, Jos. N., Detroit, Mich.
(See page 201.)
- SPRINGFIELD Auto Top & Upholstering Co.**, 102-06 Dwight St., Springfield, Mass.
"Never-Rub."
- STICK TITE**—See Iroquois Auto Top Co.
- THOMPSON Mfg. Co.**, Watertown, Mass.
- WEISS & Son, Chas.**, 4801 Cottage Grove Ave., Chicago, Ill. "American."
- WESTERN Brass Mfg. Works**, Marshall Blvd., 21st St. & C. B. & Q. R. R., Chicago, Ill.
(See page 85.)
- WHITEHOUSE Mfg. Co.**, E. A., 42-54 Elm St., Newark, N. J.
(See page opposite Title Page.)
- WIENER-BARNET Co.**, 312-28 Adams St., Newark, N. J.
- WOODRUFF & Sons Co.**, Walter W., Mount Carmel, Conn.

GASOLINE SEPARATORS

(See Strainers, Gasoline)

SHAFTING**FLEXIBLE SHAFTING**

- COATES Clipper Mfg. Co.**, 237 Chandler St., Worcester, Mass.
- GEM Mfg. Co.**, 3251 Spruce St., Pittsburg, Pa.
- STOW Flexible Shaft Co.**, 26th & Callowhill Sts., Philadelphia, Pa.
- WEBB Mfg. Co.**, 156-58 Front St., Newark, N. J.
(See page 65.)
- WHITE Dental Mfg. Co.**, S. S., 5-9 Union Sq., W., New York, N. Y.

SHAFTS**CAMSHAFTS**

(See Camshafts, Finished)

COUNTERSHAFTS

(See Countershafts, Finished)

CRANKSHAFTS

(See Crankshafts; also Forgings, Drop)

FLEXIBLE SHAFTS

(See Shafting, Flexible)

PROPELLER SHAFTS

- HARTFORD Auto Parts Co.**, Hartford, Conn.
(See page 578.)
- KINSLER-BENNETT Co.**, 69 Vernon St., Hartford, Conn.
(See page 219.)
- SALISBURY Wheel & Mfg. Co.**, Jamestown, N. Y.
(See page 549.)
- SPICER Mfg. Co.**, Plainfield, N. J.
(See page 219.)

SHELLS**COPPER BOILER SHELLS**

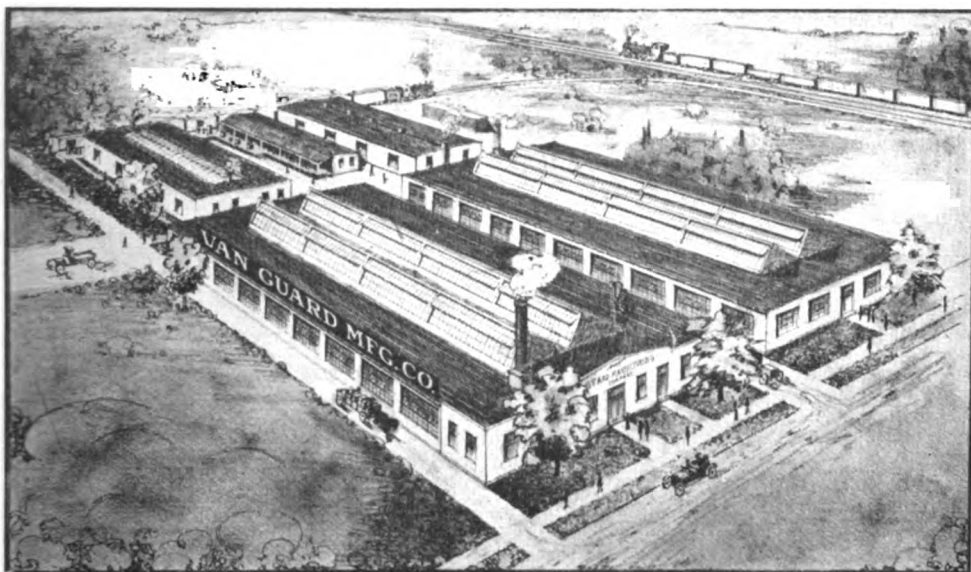
- RANDOLPH-CLOWES Co.**, Waterbury, Conn.

STEEL BOILER SHELLS

- AVERY Stamping Co.**, 5209 Lakeside Ave., Cleveland, O.
- JANNEY, Steinmets & Co.**, Philadelphia, Pa.
(See page 379.)
- PRESSED Steel Tank Co.**, West Allis, Wis.

SHIELDS**WIND SHIELDS**

- A. B. C. O.**—See Auto Brass Mfg. Co.
- ACKERMAN**—See Smith & Co.
- AJAX**—See Novelty Mfg. Co.
- ALEXANDER Mfg. Co., J.**, 1931 Broadway, New York, N. Y.
(See page 209.)
- AMERICAN Auto Top Mfg. Co.**, 244-50 W. 49th St., New York, N. Y.
- AMERICAN Brass Products Co.**, Hartford, Conn. "Premier," "Majestic," "Marvel," "Whirlwind."
- ANSONIA Mfg. Co.**, Ansonia, Conn.
- AUTO Brass Mfg. Co.**, 56 Friendship St., Providence, R. I. "A. B. C. O."
- AUTO Parts Mfg. Co.**, 171 Michigan St., Milwaukee, Wis. "Badger."
- AUTO Wind Shield Co.**, University Rd., Cambridge, Mass.
- B. & B. Mfg. Co.**, 6526 Carnegie Ave., Cleveland, O.



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- BADGER—See Auto Parts Mfg. Co.
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BANKER Wind Shield Co., Ellsworth & Negley Aves., Pittsburg, Pa.
 (See page 335.)
 BEAN Windshield Co., 466 Main St., Malden, Mass.
 BOREAS—See Page Woven Wire Fence Co.
 CHICAGO Coach & Carriage Co., 1223-31 S. Michigan Ave., Chicago, Ill.
 COLLINS & Son, G. A., Main & Church Sts., Akron, O.
 COLUMBIA Tire & Top Co., 1014 Commonwealth Ave., Boston, Mass.
COLUMBUS Auto Parts Co., Columbus, O.
 (See page 142.)
 COX Brass Mfg. Co., Pearl & Van Woert Sts., Albany, N. Y.
 CRANMER, Harry C., 223 S. 24th St., Philadelphia, Pa. "Philadelphia."
 DETROIT Steering Wheel & Wind Shield Co., Leib & Wight Sts., Detroit, Mich.
 DOUGLAS & Lomason Co., Detroit, Mich.
 DUQUESNE Auto Parts Co., 5715-17 Kirkwood St., Pittsburg, Pa.
 EMPIRE Gear & Top Co., 207 N. 22d St., Philadelphia, Pa.
 ENGLISH & Mersick Co., New Haven, Conn.
 FLANDERS Mfg. Co., Titusville, Pa.
GARAGE Equipment Mfg. Co., Milwaukee, Wis. "Milwaukee," "Gemco."
 (See page 203.)
 GATES-OSBORNE Mfg. Co., Marshalltown, Ia.
 GEMCO—See Garage Equipment Mfg. Co.
GLOVER Equipment Co., Indianapolis, Ind.
 (See page 335.)
 HOLCOMB Co., 105 Goffe St., New Haven, Conn. "New Haven."
 IDEAL Wind Shield Co., 1926 Broadway, New York, N. Y.
 IRELAND & Matthews Mfg. Co., 51-79 Iron St., Detroit, Mich.
 J. H. Tonneau Shield Co., 225 W. 49th St., New York, N. Y.
 JOHNSON Service Co., 149-53 Michigan St., Milwaukee, Wis.
KIMBALL & Co., C. P., Chicago, Ill.
 (See page 85.)
 KINGSLEY—See Novelty Mfg. Co.
KINSEY Mfg. Co., Toledo, O. "Kinwood."
 (See page 395.)
 KINWOOD—See Kinsey Mfg. Co.
 KRAHN Mfg. Co., Milwaukee, Wis.
 LONDON Auto Supply Co., 2540-48 Wabash Ave., Chicago, Ill.
 MAJESTIC—See American Brass Products Co.
 MANHATTAN Top & Body Co., 221-23 W. 64th St., New York, N. Y.
 MARVEL—See American Brass Products Co.
 MEDINA Machine & Stamping Co., Medina, N. Y. "Whirlwind."
 METAL Stamping Co., 13th St. & Boulevard, Long Island City, N. Y.
 MILWAUKEE—See Garage Equipment Mfg. Co.
 MOORE Co., W. J., Montague Ave. & Joy St., Caro, Mich.
 MURRAY & Co., P. A., Newton, Mass.
 NEW HAVEN—See Holcomb Co.
 NEWARK Rivet Works, 262 Lafayette St., Newark, N. J.
NOVELTY Mfg. Co., Waterbury, Conn. "Ajax," "Kingsley."
 (See page 619.)
 PAGE Woven Wire Fence Co., Adrian, Mich. "Boreas."
 PEERLESS—See Sisson Mfg. Co.
 PERFECTO Wind Deflector Co., 67 Church St., Boston, Mass.
 PHILADELPHIA—See Cranmer, Harry C.
 POLSON Mfg. Co., 27 Chenango St., Buffalo, N. Y.
 PREMIER—See American Brass Products Co.
 RACINE Buggy Top Co., Racine, Wis.
 RANDS Mfg. Co., 67-89 Fort St., E., Detroit, Mich.
 ROSTAND Mfg. Co., Milford, Conn.
 SARGENT & Ham Co., 26-30 Bowker St., Boston, Mass.
 SISSON Mfg. Co., 76 Main St., Buffalo, N. Y. "Peerless."
SMITH & Co., J. N., Detroit, Mich. "Ackerman."
 (See page 201.)
 SMITH C., H. Lund, 201 Paterson Ave., Paterson, N. J.
 SPRAGUE Umbrella & Mfg. Co., Norwalk, O.
 SPRINGFIELD Harness Co., 55-61 Dwight St., Springfield, Mass.
 STAR Brass Works, 1721-23 Baltimore Ave., Kansas City, Mo.
 SUPERIOR Mfg. Co., Ann Arbor, Mich.
 TROY Carriage Sun Shade Co., Troy, O.
 20TH Century Motor Car Supply Co., South Bend, Ind.
 UNION Auto Specialties Co., Brookville, Pa.
 UNIVERSAL Wind Shield Co., 1614 Prairie Ave., Chicago, Ill.
VANGUARD Mfg. Co., Detroit, Mich.
 (See page 333.)
 WALL Mfg. Co., R. C., 228-30 N. 15th St., Philadelphia, Pa.
 WESTERN Auto-Body & Mfg. Co., 416-18 E. Ninth St., Los Angeles, Cal.
 WESTERN Wind Shield Works, 1513 Hennepin Ave., Minneapolis, Minn.
 WHIRLWIND—See American Brass Products Co.
 WHIRLWIND—See Medina Machine & Stamping Co.
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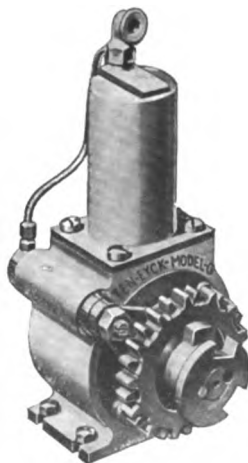
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 FITZGERALD Mfg. Co., Torrington, Conn.
 (See page 551.)
 GASKET Supply Co., 1729 Ludlow St., Philadelphia, Pa.
 GOODWIN & Kintz Co., Winsted, Conn.
 KALES-HASKEL Co., 441-53 Lafayette Blvd., Detroit, Mich.
 LINDHE Shim Co., 210-12 Canal St., New York, N. Y.
 (See page 335.)
 McCORD Mfg. Co., Detroit, Mich.
 (See pages 310 and 311.)
 VICTOR Mfg. & Gasket Co., Troy & 21st Sts., Chicago, Ill.
 VOELKNER & Harry Mfg. Co., 282-92 Woodbridge St., E., Detroit, Mich.

SHOCK ABSORBERS

SHOCK ABSORBERS AND SUPPLEMENTARY SPRINGS

- ACME Torsion Spring Co., 998-1000 Boylston St., Boston, Mass.
 AIR Shock Absorber Co., 883 Boylston St., Boston, Mass.
 AMES—See Peacock & Co.
 APPROVED Auto Specialties Co., 1737 Broadway, New York, N. Y. "Cahill's."
 ARISTOS Co., 250 W. 54th St., New York, N. Y. "Mondex."
 AUTO-CUSHION—See Mellen-Edwards Co.
 BALL Bearing Shock Absorber Co., 5-7 Beekman St., New York, N. Y.
 BLACKLEDGE Mfg. Co., John W., 2210 Michigan Ave., Chicago, Ill. "Velvet."
 CAHILL'S—See Approved Auto Specialties Co.
 CONNECTICUT Shock Absorber Co., Meriden, Conn.
 (See page 339.)
 FLENTJE, Ernst, 1643 Cambridge St., Cambridge, Mass.
 (See page 383.)
 FORBES, Walter J., 243 Columbus Ave., Boston, Mass. "Knojah."
 FRANCO Mfg. Co., 1332-34 Michigan Ave., Chicago, Ill.
 GABRIEL Horn Mfg. Co., 1407 40th St., N. E., Cleveland, O.
 GURNEY, C. S., Portsmouth, N. H.
 HARTFORD Suspension Co., Jersey City, N. J. "Truffault-Hartford."
 (See pages 337 and 338.)
 HERZ & Co., 295 Lafayette St., New York, N. Y. "Pater Noster."
 (See page 269.)
 HOOVER Co., W. H., New Berlin, O.
 HOOVER Spring Co., 617-37 Turk St., San Francisco, Cal.

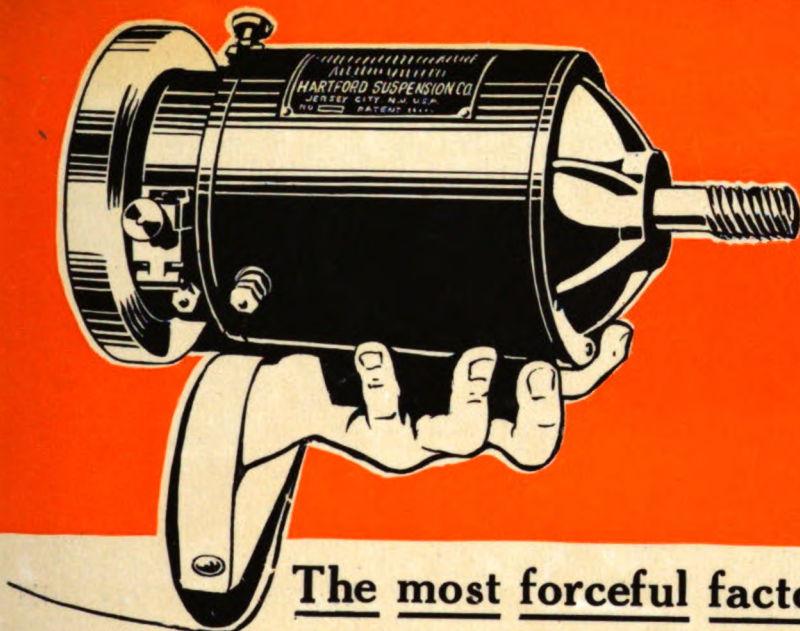
- IDEAL—See American Sales Co.
 J. M. Shock Absorber Co., 210 S. 17th St., Philadelphia, Pa.
 (See page 515.)
 KILGORE Mfg. Co., 585 Boylston St., Boston, Mass.
 KNOJAH—See Forbes, Walter J.
 MCGREGOR—See U. S. Auto Bumper Co.
 MARTIN Shock Absorber Co., 1169 E. Tenth St., Los Angeles, Cal.
 MAYO Mfg. Co., 54 E. 18th St., Chicago, Ill. "Skinner."
 MELLEN-EDWARDS Co., Beloit, Wis. "Auto-Cushion."
 MESINGER Mfg. Co., H. & F., 1801-07 First Ave., New York, N. Y.
 (See page 523.)
 MITCHELL Shock Absorber Co., 11 Holton St., Lawrence, Mass.
 MONDEX—See Aristos Co.
 PACIFIC Leather Works, 239 12th St., Oakland, Cal. "Sierra."
 PATER NOSTER—See Herz & Co.
 PEACOCK & Co., Clarence N., 1784 Broadway, New York, N. Y. "Ames."
 (See page 523.)
 PEERLESS—See Sager Co.
 PENFIELD Shock Absorber Mfg. Co., 49 Randolph Ave., Meriden, Conn.
 S. & S. Shock Absorber Co., Washington, D. C.
 SAGER Co., J. H., 265 South Ave., Rochester, N. Y. "Peerless."
 ST. LOUIS Supplementary Spiral Spring Co., 4523 Delmar Ave., St. Louis, Mo.
 SHIPPLEY Co., Geo. E., Pittsfield, Mass.
 SIERRA—See Pacific Leather Works.
 SKINNER—See Mayo Mfg. Co.
 SPRING Equalizer Co., 247 Jefferson Ave., Detroit, Mich.
 TEMCO Electric Motor Co., Leipsic, O.
 TRIPLE Action Spring Co., 215-17 E. 21st St., Chicago, Ill.
 TRUFFAULT - HARTFORD—See Hartford Suspension Co.
 U. S. Auto Bumper Co., 20 E. 20th St., Chicago, Ill. "McGregor."
 (See page 85.)
 U. S. Rapid-Fire Gun & Powder Co., Derby, Conn. "Westinghouse."
 VELVET—See Blackledge Mfg. Co.
 WEEBER Mfg. Works, C. F., Albany, N. Y.
 WESTINGHOUSE—See U. S. Rapid-Fire Gun & Powder Co.

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- AMERICAN Rubber Products Co., 24-30 S. Clinton St., Chicago, Ill.
 AMERICAN Tire & Rubber Co., 70-78 Beach St., Akron, O.
 (See page 343.)



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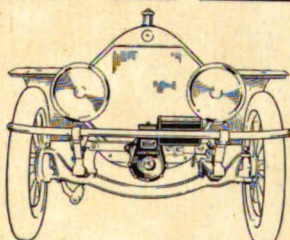
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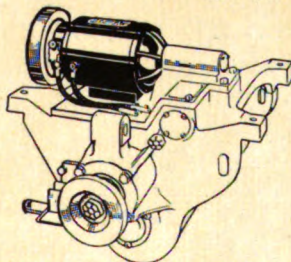
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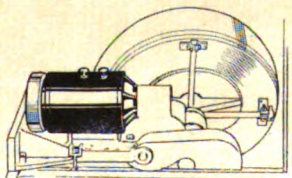
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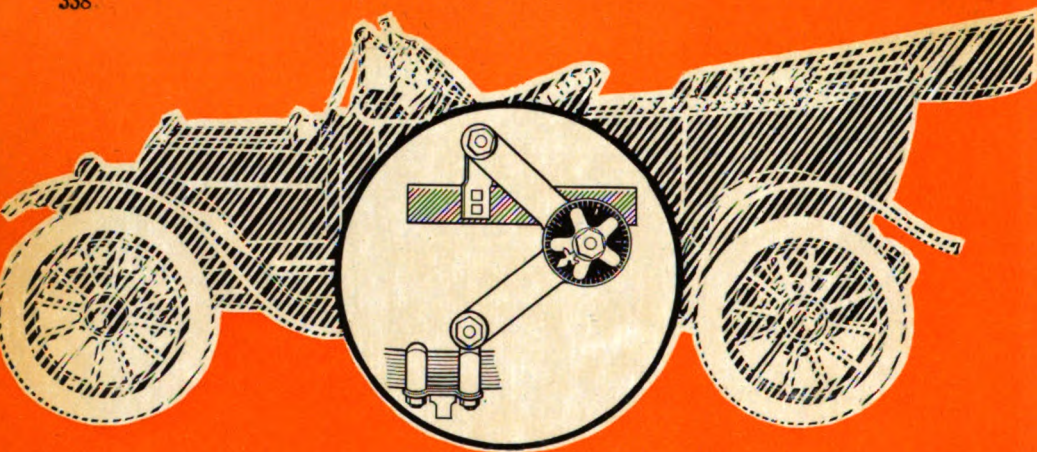
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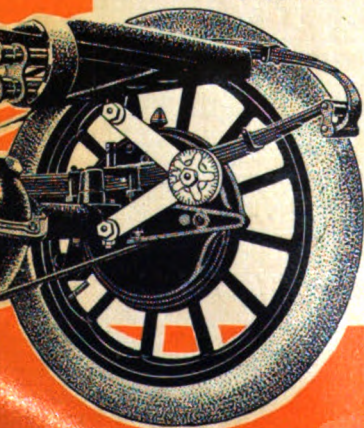
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On a good road they do not make the car ride hard.

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This check will be more or less as the road is bad or fair.

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(See page 341.)

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BROCKETT-GORHAM Co., Marion, O.
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BROWNIE—See States Mfg. Co.

BULL DOG—See Pennsylvania Rubber Co.

BULL DOG—See Polson Bros. Mfg. Co.

CINCINNATI Rubber Mfg. Co., Cincinnati, O.
(See page 341.)

CONTINENTAL Rubber Works, Erie, Pa.
(See page 341.)

COX, David H., Roselle, N. J.

DAYTON Inner-Tire & Mfg. Co., 17 N. Madison St., Dayton, O.

DIAMOND Rubber Co., Akron, O.

DOUBLE Fabric Tire Co., 60 W. Ninth St., Auburn, Ind. "Murray," "Interlock."
(See page 341.)

DYKES Co., John L. G., 222 N. State St., Chicago, Ill.

EGYPTIAN—See Polson Bros. Mfg. Co.

ESSEX Rubber Co., Trenton, N. J.

FALLS Rubber Co., Cuyahoga Falls, O.

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GORDON—See Vehicle Apron & Hood Co.

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HOOD Rubber Co., Watertown, Mass.
"Meteor."

INDIA Rubber Tire Co., 1461-63 Michigan Ave., Chicago, Ill.

INDIANA Rubber & Insulated Wire Co., Jonesboro, Ind.

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INNERSHU—See Inner Shoe Tire Co.

INTERLOCK—See Double Fabric Tire Co.

K. & W. Mfg. Co., Ashland, O.
(See page 607.)

KANT-BLO—See Hampton Mfg. Co.

KEYSTONE Rubber Mfg. Co., Erie, Pa.

KLINCHER—See Inner Shoe Tire Co.

LIBERTY Rubber Co., Orange, N. J.

M. & M. Mfg. Co., Akron, O.

MARION—See Brockett-Gorham Co.

MARTEL Blow-Out Protector Co., 336-38 W. 63d St., Chicago, Ill.

METEOR—See Hood Rubber Co.

MILLER, Chas. E., 1400 S. Meridian St., Anderson, Ind.

MURRAY—See Double Fabric Tire Co.

O'NEILL Tire & Protector Co., Buchtel Ave., Akron, O.

PACIFIC Leather Works, 239 12th St., Oakland, Cal. "Sierra."

PEERLESS—See Polson Bros. Mfg. Co.

PEERLESS Cement Co., 39 Viaduct, Akron, O.

PENNSYLVANIA Rubber Co., Jeannette, Pa. "Bull Dog."

POLSON Bros. Mfg. Co., 331 Southwest Blvd., Kansas City, Mo. "Bull Dog," "Egyptian," "Peerless."

RUBBER Goods Supply & Mfg. Co., Akron, O.

SECURITY Reliner Co., 33 Meade St., Montgomery, N. Y.

SHUR-HOLD—See Inner Shoe Tire Co.

SIERRA—See Pacific Leather Works.

STAR—See States Mfg. Co.

STATES Mfg. Co., 1029-37 W. Adams St., Chicago, Ill. "Brownie," "Star."

THERMOID Rubber Co., Trenton, N. J.
(See page 393.)

TIRE Interlining Co., 2642 Stanton Ave., Cincinnati, O.

TRAVER Blowout Patch Co., Thoroughfare Bldg., New York, N. Y.

UNITED States Tire Co., Broadway & 58th St., New York, N. Y.

VEHICLE Apron & Hood Co., 272 N. Fourth St., Columbus, O. "Gordon."

VOORHEES Rubber Mfg. Co., 18-46 Bostwick Ave., Jersey City, N. J. "Ideal."
(See page 131.)

VULCAN Rubber Co., W. Lake Rd., Erie, Pa.

WABAN Webbing Co., 207 Essex St., Boston, Mass.

WEARWELL Rubber Co., Kokomo, Ind.

WESTERN Automobile Supply Co., Chicago, Ill.

ZEE ZEE Tire & Rubber Co., 33d & Walnut Sts., Philadelphia, Pa.

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KRAHN Mfg. Co., Milwaukee, Wis.

LEE Co., Wm. O., Port Huron, Mich.

LUNKENHEIMER Co., 223 E. Eighth Ave., Cincinnati, O.

McCord Mfg. Co., Detroit, Mich.
(See pages 310 and 311.)

MICHIGAN Lubricator Co., 661-73 Beaubien St., Detroit, Mich.

PEDERSEN Lubricator Co., 636-44 First Ave., New York, N. Y.
(See page 253.)

WILKINSON Co., Wm. H., West Medway, Mass.

WILLIAMS Valve Co., D. T., Spring Grove Ave. & Township St., Cincinnati, O.

SIGNALS**REAR TRAFFIC SIGNALS**

AUTO Safety Signal Lamp Co., 246-48 N. Fifth St., Philadelphia, Pa. "Lassco."
(See page 137.)

COWLES & Co., C., New Haven, Conn.
(See page 91.)

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 LASSCO—See Auto Safety Signal Lamp Co.
 MARTIN E. Z.—See Hudson Auto Lamp Works.
 MOSLER & Co., A. R., New York, N. Y. (See page 287.)
 NEIL—See Ham Mfg. Co.
 ROSE Mfg. Co., 910 Arch St., Philadelphia, Pa.
 SCHINDLER, Chas. A., 287 Pallsade Ave., West Hoboken, N. J.
 TOBIN Whichway Signal Co., 48 Walker St., New York, N. Y.

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 SAUQUOIT Silk Mfg. Co., Philadelphia, Pa.

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- CHENEY Bros., South Manchester, Conn.
 SAUQUOIT Silk Mfg. Co., Philadelphia, Pa.

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 AMERICAN Rubber Products Co., 24-30 S. Clinton St., Chicago, Ill.
 ATLAS Rubber Co., 226-30 N. Jefferson St., Chicago, Ill. (See page 341.)
 BATAVIA Rubber Co., Batavia, N. Y.
 BOSS Rubber Co., 1614 Broadway, Denver, Colo.
 BRICSTON Mfg. Co., Brookings, S. Dak.
 CHICAGO Leather Specialty Co., 208 N. Fifth Ave., Chicago, Ill.
 CHICAGO Rawhide Mfg. Co., 1301 Elston Ave., Chicago, Ill. "Krome."
 CONTINENTAL Rubber Works, Erie, Pa. (See page 341.)
 COOK & Bro., E. C., 1301-45 Carroll Ave., Chicago, Ill.
 COX, David H., Roselle, N. J.
 DAVIS Co., W. C., 237 N. Main St., Brockton, Mass. "Star."
 DAYTON Inner-Tire & Mfg. Co., 17 N. Madison St., Dayton, O.
 DOUBLE Fabric Tire Co., 60 W. Ninth St., Auburn, Ind. (See page 341.)
 DYKES Co., John L. G., 222 N. State St., Chicago, Ill.
 ECLIPSE—See Vulcan Rubber Co.
 ECONOMY Tread Co., 113 Lenox Ave., New York, N. Y.
 EMPIRE Tire Co., Mulberry St. & Clinton Ave., Trenton, N. J.
 ESSEX Rubber Co., Trenton, N. J.
 FEDERAL Rubber Mfg. Co., Milwaukee, Wis.
 G & K—See Graton & Knight Mfg. Co.
 GILBERT Mfg. Co., New Haven, Conn.
 GOODRICH Co., B. F., Akron, O.
 GOODYEAR Tire & Rubber Co., Akron, O.
 GRATON & Knight Mfg. Co., Worcester, Mass. "G & K." (See page 65.)
 GRAY Specialty Co., 148 Avon Ave., Newark, N. J.
 HAGER & Son, Chas., 244-46 E. 52d St., New York, N. Y.
 HOOD Rubber Co., Watertown, Mass.
 HOOK-ON—See Vulcan Rubber Co.
 INDIANA Rubber & Insulated Wire Co., Jonesboro, Ind.
 INNER Shoe Tire Co., Front & Allen Sts., Grand Rapids, Mich.
 K. & W. Mfg. Co., Ashland, O. (See page 607.)
 KEYSTONE Rubber Mfg. Co., Erie, Pa.
 KIMBALL Tire Case Co., 168 Broadway, Council Bluffs, Ia.
 KROME—See Chicago Rawhide Mfg. Co.
 LACE-ON—See Vulcan Rubber Co.
 LEATHER Tire Goods Co., Niagara Falls, N. Y. (See page 55.)
 MESINGER Mfg. Co., H. & F., 1801-07 First Ave., New York, N. Y. (See page 523.)
 MICHELIN Tire Co., Milltown, N. J.
 MILLER, Chas. E., 1400 S. Meridian St., Anderson, Ind.
 MODEL—See Voorhees Rubber Mfg. Co.
 NATIONAL Leather Belting Co., 29 Ferry St., New York, N. Y.
 NEW York Leather Belting Co., 51 Beekman St., New York, N. Y.
 O'NEILL Tire & Protector Co., Buchtel Ave., Akron, O.
 PACIFIC Leather Works, 239 12th St., Oakland, Cal.
 PEERLESS Cement Co., 39 Viaduct, Akron, O.
 PENNSYLVANIA Rubber Co., Jeannette, Pa.
 POLSON Bros., Mfg. Co., 331 Southwest Blvd., Kansas City, Mo.
 RUBBER Goods Supply & Mfg. Co., Akron, O.
 STAR—See Davis Co.
 TWENTIETH Century Tire Protector Co., Midlothian, Tex.
 UNITED States Tire Co., Broadway & 58th St., New York, N. Y.
 UNIVERSAL Tire Protector Co., Angola, Ind.
 VOORHEES Rubber Mfg. Co., 18-46 Bostwick Ave., Jersey City, N. J. "Model." (See page 131.)
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- AMERICAN Oil & Disinfectant Co., 96 Beekman St., New York, N. Y.
- AMOCO—See American Oil Co.
- ARCOLINE—See Atlantic Refining Co.
- ARNOLD, N. B., 1 Sigourney St., Brooklyn, N. Y. "Slukup."
(See page 155.)
- ARROW—See Peterson Co.
- ATLANTIC Refining Co., Cleveland, O. "Arcoline."
- AUTO Oil Co., 172 S. Water St., Jackson, Mich.
- BALKAN—See Jones, C. D.
- BAUM'S Castorine Co., 104 N. George St., Rome, N. Y.
- BELL Oil Co., 51 Ferry St., St. Louis, Mo. "Liberty Bell."
- BLUE RIBBON—See International Metal Polish Co.
- BUCKEYE—See Davies Co.
- BULLY—See New York Oil & Grease Co.
- CHAMBERLAIN Co., Sixth Ave. & Grant St., Pittsburg, Pa.
- CHARIOT—See Fiske Bros. Refining Co.
- CHEMICAL Supply Co., 1565 Merwin St., Cleveland, O.
- CLENZO—See Puritan Oil Co.
- COLUMBIA Lubricants Co. of New York, 116 Broad St., New York, N. Y.
- CONSOLIDATED Lubricants Co., 551 W. 42d St., New York, N. Y. "Right."
- DAVIES Co., J. P., Dayton, O. "Buckeye."
- DETROIT Soap Co., Detroit, Mich.
- DETROIT White Lead Works, 530-60 Milwaukee Ave., E., Detroit, Mich.
- DIAMOND Specialty Co., Indianapolis, Ind.
(See page 129.)
- EAGLE Oil & Supply Co., Boston, Mass. "Eoco."
(See page 593.)
- EAVENSON & Sons, J., Camden, N. J. "Jesco."
- ENERGINE Refining & Mfg. Co., Cleveland, O.
(See page 191.)
- EOCO—See Eagle Oil & Supply Co.
- ERICKA Mfg. Co., 882 Liberty St., Springfield, Mass.
- FAIRCHILD & Bro., M. H., 20 W. Michigan St., Chicago, Ill.
- FISK Mfg. Co., Springfield, Mass.
(See page 345.)
- FISKE Bros. Refining Co., 24 State St., New York, N. Y. "Charlot."
- FORD & DENNEN—See Richmond & Co.
- G. W.—See Great Western Oil Co.
- FRANKLIN Refining Co., 3037 Locust St., St. Louis, Mo.
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- MAGIC—See Zurn Co.
- MARVIN-STRECK Oil & Supply Co., 1318 Olive St., St. Louis, Mo.
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- NATIONAL Refining Co., Rose Bldg., Cleveland, O.
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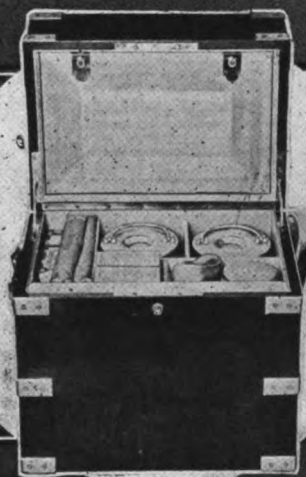
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 (See page 155.)
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 (See page 145.)
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 JESCO—See Eavenson & Sons.
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 (See page 115.)
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 PAOS—See Hopewell Bros.
 PEERLESS—See Blue Ribbon Mfg. Co.
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 STANLEY, John T., 628-52 W. 30th St., New York, N. Y. "Shofo."
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 TATLOCK Bros., Rochester, N. Y. "Tat's."
 TAT'S—See Tatlock Bros.
 UNEEDIT—See Cross, W. H.
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 ZIP—See Frost, F. M.

SOCKETS

BOW SOCKETS

(See also Irons, Slat)

- AJAX—See Cortland Forging Co.
 ASHTABULA Bow Socket Co., Ashtabula, O.
 CLEVELAND Hardware Co., Cleveland, O.
 CORTLAND Carriage Goods Co., Cortland, N. Y.
 CORTLAND Forging Co., Cortland, N. Y. "Ajax."
 CRANDALL, Stone & Co., Binghamton, N. Y. "Pioneer."
 DETROIT Forging Co., 120 Mt. Elliott St., Detroit, Mich.
 DETROIT Socket Co., 314 Jefferson Ave., W., Detroit, Mich.
 GENERAL Drop Forge Co., 1740 Elmwood Ave., Buffalo, N. Y. (See page 565.)
 METAL Stamping Co., 13th St. & Boulevard, Long Island City, N. Y.
 MICHIGAN Bow Socket Co., 607-09 Fort St., W., Detroit, Mich.
 PIONEER—See Crandal, Stone & Co.
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 HOWARD Miniature Lamp Co., 327 Academy St., Newark, N. J.
 McCANDLESS & Co., H. W., 67 Park Pl., New York, N. Y. "Empire."
 MORSE, Frank W., 516 Atlantic Ave., Boston, Mass.
 WARNE-DOUGLAS Co., Bronson, Mich. (See page 143.)

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CORBIN Screw Corp., 219 High St., New Britain, Conn. "Corbin Brown."

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 (See pages 138 and 139.)

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 (See pages 140 and 141.)

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SEARS-CROSS Co., 685-89 11th Ave., New York, N. Y.
 (See page 349.)

STANDARD Thermometer Co., 65 Shirley St., Boston, Mass.
 (See page 357.)

STAR Speedometer Co., Milton, Pa.

STEWART-WARNER Speedometer Corp., Beloit, Wis. "Auto-Meter."

STEWART Speedometer Factory, 1904 Diversey Blvd., Chicago, Ill.
 (See page 349.)

STOVER-LANG Co., 219-23 Columbus Ave., Boston, Mass.

TROY Carriage Sun Shade Co., Troy, O.

VEEDER Mfg. Co., 23 Sargeant St., Hartford, Conn.

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STANDARD Co., Torrington, Conn.
 (See page 667.)

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 CINCINNATI & Hammond Spring Co., 909-23 Summer St., Cincinnati, O.
 CLEVELAND-CANTON Spring Co., Canton, O.
 (See page 397.)
 COOPER Spring Co., Main Ave. & Center St., Cleveland, O.
 DELANY & Son, D., Liberty & Hamilton Sts., Newark, N. J.
 DETROIT Steel Products Co., Boulevard & Griffin St., Detroit, Mich.
 DRAGON—See Sheldon Axle Co.
 FORT Pitt Spring & Mfg. Co., McKees Rocks, Pa.
 FOWLER—See National Spring Co.
 GARDEN City Spring Works, E. 20th St. & Santa Fe R. R., Chicago, Ill.
 HARVEY Spring Co., Box 34, Racine, Wis.
 (See page 351.)
 HESS-PONTIAC Spring & Axle Co., Pontiac, Mich.
 HESS Spring & Axle Co., Carthage, O.
 (See pages 46A and 46B.)
 HIGGINS Spring & Axle Co., 1314 10th St., Racine, Wis.
 (See page 621.)
 HUSTON Multiple C Spring Co., Parkway Bldg., Philadelphia, Pa.
 IRON City Spring Co., 2916-26 Smallman St., Pittsburgh, Pa.
 JENKINS Mfg. Co., Sumter, S. C. "Vulcan."
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 KEYSTONE Spring Works, 1301 Buttonwood St., Philadelphia, Pa.
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 (See page 547.)

LIGGETT Spring & Axle Co., 1111 Park Bldg., Pittsburg, Pa.
 (See page 299.)

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 (See Back Bone.)

MARBURG-HAGEN—See Marburg Bros.

MATHER Spring Co., Toledo, O.
 (See page 351.)

MERRILL Spring Co., E. R., 530 West 28th St., New York, N. Y.

MILLER & Van Winkle, 18 Bridge St., Brooklyn, N. Y.

NATIONAL Spring Co., New Castle, Ind. "Fowler."
 (See page 605.)

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PERFECTION Spring Co., Cleveland, O.
 (See page 576.)

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 (See page 361.)

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TROY Spring Works, 394-96 Congress St., Troy, N. Y.

TUTHILL Spring Co., 766 Polk St., Chicago, Ill.
 (See page 621.)

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WATERTOWN Spring Works, Watertown, N. Y.

WESTERN Spring & Axle Co., Cincinnati, O.

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CUYAHOGA Spring Works, 429-35 Prospect Ave., N. W., Cleveland, O.

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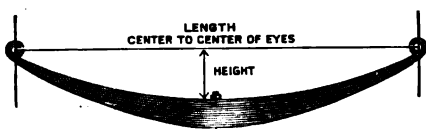
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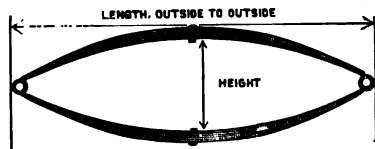
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 GARDNER Wire Co., 5646-48 Ohio St. (Austin Station), Chicago, Ill.
 GIBSON Co., Wm. D., Huron & Kingsbury Sts., Chicago, Ill.
 (See page 353.)
 HARROW Springs Co., 745 E. Vine St., Kalamazoo, Mich.
 HEBB, George A., 70 William St., Newark, N. J.
 HUBBARD Spring Co., M. D., Pontiac, Mich.
 (See page 621.)
 MILLER Wire Spring Co., Bridgeport, Conn.
 MILLER & Van Winkle, 18 Bridge St., Brooklyn, N. Y. "Eagle."
 MORGAN Spring Co., Worcester, Mass.
 N. Y. Wire & Spring Co., 586-88 Washington St., New York, N. Y.
 (See page 621.)
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 SABIN Machine Co., Montpelier, Vt.
 TUCK Mfg. Co., 74 Ames St., Brockton, Mass.
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 (See page 353.)
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 DEAN & Co., Henry E., 180 Austin Ave., Worcester, Mass.
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 (See page 353.)
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 (See page 353.)
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 (See page 551.)

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 (See page 117.)

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 (See page 569.)

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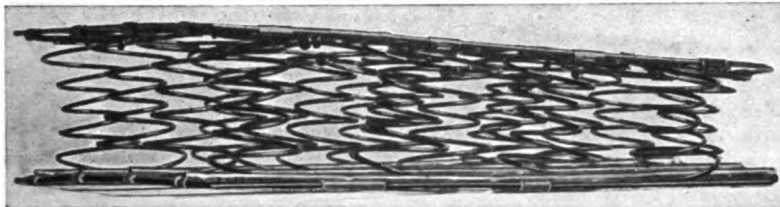
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 (See page 171.)

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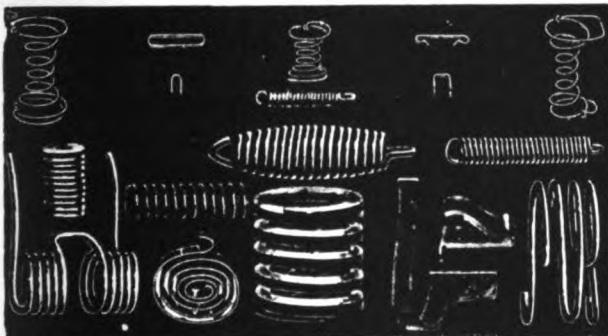
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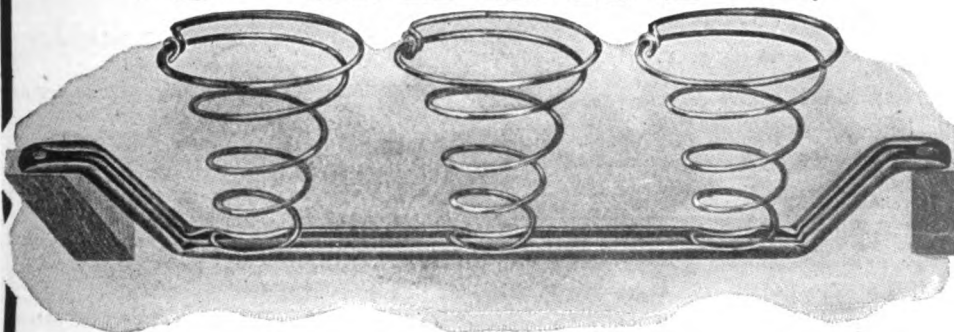
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(See page 595.)
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(See page 161.)
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(See page 591.)
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(See page 105.)
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(See page 381.)
- QUINSIGAMOND Pressed Steel Co.**, 62 Jackson St., Worcester, Mass.
- R. P. K. Pressed Metal Co.**, 331 Madison Ave., New York, N. Y.
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(See page 587.)
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(See page 509.)
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(See page 379.)
- SESSIONS & Son, J. H.**, Bristol, Conn.
- SMITH Co., A. O.**, Milwaukee, Wis.
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- SPARKS - WITHINGTON Co.**, Jackson, Mich.
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- SPECIAL Machine Co.**, 184 John St., Bridgeport, Conn.
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(See page 617.)
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- UNIQUE Findings & Supply Co.**, 36 Garnet St., Providence, R. I.
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- WALTER & Sons, N. C.**, 194 William St., New York, N. Y.
- WORCESTER Pressed Steel Co.**, Worcester, Mass.
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(See Lights, Wash Stand)

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(See page 357.)
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(See page 377.)
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- SHEER Co., H. M.**, Dept. 109, Quincy, Ill. "Acme."
(See page 611.)
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(See page 663.)
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- H & M**—See Ham-Meix Mfg. Co.
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(See page 379.)



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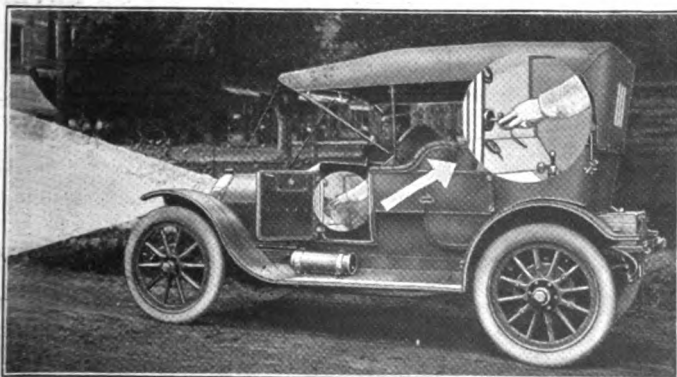
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 LOMBARD Mfg. Co., 30-40 S. Water St., Rochester, N. Y.
 MANZEL Bros. Co., 320 Babcock St., Buffalo, N. Y.
 (See page 303.)
 MERRALLS Starter Co., 1777 Broadway, New York, N. Y.
 NEVER MISS—See Wilson Motor Starter Co.
 ROTH-MURPHY Engine Starter Co., Lemcke Bldg., Indianapolis, Ind.
 START-LITE Co., 1502 Michigan Ave., Chicago, Ill.
 STEVENS Mfg. & Supply Co., 1223-27 Wabash Ave., Chicago, Ill.
 THURBER Rotary Starter Co., Detroit, Mich.
 (See page 665.)
 WILSON Motor Starter Co., Franklin, Pa.
 "Never Miss."

ELECTRIC ENGINE STARTERS

- ADAMS-BAGNALL Electric Co., 7214 Platt Ave., Cleveland, O.
 APLCO—See Apple Electric Co.
 APPLE Electric Co., 14 N. Canal St., Dayton, O. "Aplco."
 (See page 555.)
 BAILEY Electric Co., 503 Grandville Ave., Grand Rapids, Mich.
 BIJOU Motor Lighting Co., 250 W. 54th St., New York, N. Y.
 DAYTON Engineering Laboratories Co., Dayton, O. "Delco."
 (See page 359.)
 DEACO—See Detroit Electric Appliance Co.
 DEAN Electric Co., 515 Olive St., Elyria, O.
 (See pages 138 and 139.)
 DELCO—See Dayton Engineering Laboratories Co.
 DETROIT Electric Appliance Co., 264-68 Jefferson Ave., Detroit, Mich. "Deaco."
 DISCO Co., 302 Dodge Bldg., Detroit, Mich.
 (See page 357.)
 DYNETO Electric Co., Elbridge, N. Y. "Entz."
 ELECTRIC Auto Lite Co., 135-37 Michigan St., Toledo, O.
 ELECTRO Light & Starter Co., Tenth & Canal Sts., Indianapolis, Ind.
 (See page 561.)
 EMERSON Electric Mfg. Co., 2024-32 Washington Ave., St. Louis, Mo.
 ENTZ—See Dyneto Electric Co.
 ESTERLINE Co., 128 Main St., La Fayette, Ind.
 FISHER Electric Co., Larned St., Detroit, Mich.
 (See page opposite inside Back Cover.)
 GRAY & Davis, 55 Lansdowne St., Boston, Mass.
 (See page 159.)

HARTFORD Suspension Co., Jersey City, N. J.
 (See pages 337 and 338.)

JENNEY Electric Starter Co., 401-03 S. Illinois St., Indianapolis, Ind.

JESCO—See Jones Electric Starter Co.

JONES Electric Starter Co., Jackson & Loomis Sts., Chicago, Ill. "Jesco."
 (See page 675.)

LEECE-NEVILLE Co., 2069 E. Fourth St., Cleveland, O.

LEONARD Electric Co., Ward, Bronxville, N. Y.
 (See page 669.)

NORTH East Electric Co., Rochester, N. Y.
 (See page 587.)

OTHO Motor Co., 45 Milk St., Boston, Mass.

PARIS Electric Starter Co., Paris, Ill.

REMY Electric Co., Anderson, Ind.
 (See page 245.)

RUSHMORE Dynamo Works, Plainfield, N. J.
 (See page 221.)

SPLITDORF, John, 136-46 W. 52d St., New York, N. Y.

STRONG Electric Co., 917-19 W. Grand Ave., Des Moines, Ia.

U. S. Light & Heating Co., 30 Church St., New York, N. Y.
 (See page opposite inside front cover.)

WAGNER Electric Mfg. Co., 6400 Plymouth Ave., St. Louis, Mo.

WARNER Mfg. Co., Toledo, O.
 (See page 231.)

WESTINGHOUSE Electric & Mfg. Co. (East Pittsburg), Pittsburg, Pa.

GASOLINE OR VAPOR ENGINE STARTERS

(For Priming Devices—See Primers; Gasoline Engines)

AUTOMATIC Starter Co., 418 N. Third St., St. Louis, Mo.

MARKHAM Co., W. D., Clarksdale, Miss.

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COLUMBIA—See MacFarland, Merle.

DETROIT Mechanical Starter Co., 1195 Woodward Ave., Detroit, Mich.
 (See page 561.)

GLENARD—See National Motor Device Co.

HERCULES Auto Starter Co., Mills Bldg., San Francisco, Cal.

KNAPP Bros. Starter & Equipment Co., 24th & Central Aves., Minneapolis, Minn.

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MODERN Sales Bureau, 4105 Cottage Grove Ave., Chicago, Ill. "Mesnards."

TUDOR, J. W., 35 Congress St., Boston, Mass.

UNIVERSAL Mfg. Co., Racine, Wis.

VOLKNAR Auto Starter Co., 203 Broadway, New York, N. Y.

STEEL**DEALERS IN STEEL**

(This is a List of Dealers in Iron, Steel and other metals who advertise in this publication)

FRASSE & Co., Peter A., New York, N. Y. (See page 453.)

HARVEY Co., Arthur C., 374 Congress St., Boston, Mass. (See page 553.)

MORRIS & Co., E. K., 311-17 W. Second St., Cincinnati, O. (See page 553.)

RICHARDS & Co., 200-06 Causeway St., Boston, Mass. (See page 340.)

**ANGLE, CHANNEL AND TEE IRON
OR STEEL**

CAMBRIA Steel Co., Morris Bldg., Philadelphia, Pa.

CARNEGIE Steel Co., Carnegie Bldg., Pittsburgh, Pa.

HARROW Spring Co., 745 E. Vine St., Kalamazoo, Mich.

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JONES & Laughlin Steel Co., Pittsburg, Pa.

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LOGAN Iron & Steel Co., 1421 Chestnut St., Philadelphia, Pa.

LONGMEAD Iron Co., Conshohocken, Pa.

PENNSYLVANIA Steel Co., Morris Bldg., Philadelphia, Pa. (See page 365.)

REPUBLIC Iron & Steel Co., Republic Bldg., Youngstown, O.

BAR IRON OR STEEL

AMERICAN Iron & Steel Mfg. Co., Front & Cumberland Sts., Lebanon, Pa.

BALDWIN Steel Co., Charleston, W. Va. (See page 303.)

BETHLEHEM Steel Co., Third & Poplar Sts., South Bethlehem, Pa.

CAMBRIA Steel Co., Morris Bldg., Philadelphia, Pa.

FARIST Steel Co., 137 E. Main St., Bridgeport, Conn.

HARROW Spring Co., 745 E. Vine St., Kalamazoo, Mich.

ILLINGSWORTH Steel Co., John (Frankford), Philadelphia, Pa.

ILLINOIS Steel Co., 72 W. Adams St., Chicago, Ill.

INLAND Steel Co., First National Bank Bldg., Chicago, Ill.

JONES & Laughlins Steel Co., Pittsburg, Pa.

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LACKAWANNA Steel Co., Buffalo, N. Y.

LOCKHART Iron & Steel Co., McKees Rocks, Pa.

LOGAN Iron & Steel Co., 1421 Chestnut St., Philadelphia, Pa.

PARDEE Works, C., Perth Amboy, N. J.

PENNSYLVANIA Steel Co., Morris Bldg., Philadelphia, Pa. (See page 365.)

PHILADELPHIA Steel & Forge Co., 50 Church St., New York, N. Y.

PROSSER & Son, Thomas, 15 Gold St., New York, N. Y. (Importers.) "Krupp." (See page 361.)

RAILWAY Steel-Spring Co., 30 Church St., New York, N. Y.

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SWEET'S Steel Co., Williamsport, Pa.

SHEET STEEL

ALLEGHENY Steel Co., Brackenridge, Pa.

AMERICAN Rolling Mill Co., Middletown, O. "Middletown." (See page 369.)

AMERICAN Sheet & Tin Plate Co., Frick Bldg., Pittsburg, Pa.

CANTON Sheet Steel Co., Canton, O.

CARNAHAN Tin Plate & Sheet Co., Canton, O.

FOLLANSBEE Bros. Co., Third & Liberty Aves., Pittsburg, Pa.

INLAND Steel Co., First National Bank Bldg., Chicago, Ill.

KRUPP—See Prosser & Son.

LA BELLE Iron Works, Steubenville, O.

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PARKERSBURG Iron & Steel Co., Parkersburg, W. Va.

PROSSER & Son, Thomas, 15 Gold St., New York, N. Y. (Importers.) "Krupp." (See page 361.)

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 PITTSBURG Shafting Co., of Detroit, Detroit, Mich.
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 UNION Drawn Steel Co., Beaver Falls, Pa. (See page 363.)

COLD ROLLED STRIP STEEL

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 AMERICAN Tube & Stamping Co., Bridgeport, Conn.
 CARPENTER Steel Co., Reading, Pa.
 COLUMBIA Steel Co., Elyria, O.
 CRUCIBLE Steel Co. of America, Oliver Bldg., Pittsburg, Pa.
 ELLIOTT-BLAIR Steel Co., Taylor & Mercer Sts., Newcastle, Pa.
 KRUPP—See Prosser & Son.
 MORRIS & Bailey Steel Co., Pittsburg, Pa.
 PROSSER & Son, Thomas, 15 Gold St., New York, N. Y. (Importers.) "Krupp." (See page 361.)
 STANLEY Works, Lake St., New Britain, Conn.
 SUPERIOR Steel Co., Carnegie, Pa.
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 ATLAS Steel Co., Dunkirk, N. Y.
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 BECKER Steel Co. of America, 90 West St., New York, N. Y. (Importers.)
 BETHLEHEM Steel Co., Third & Poplar Sts., South Bethlehem, Pa.
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 COLUMBIA Tool Steel Co., Chicago Heights, Ill.
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 CROWLEY Co., John A., 120-22 Liberty St., New York, N. Y. (Importers.) (See page 607.)
 CRUCIBLE Steel Co. of America, Oliver Bldg., Pittsburg, Pa.
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 HELLER Bros. Co., Newark, N. J.
 ILLINGSWORTH Steel Co., John (Frankford), Philadelphia, Pa.
 JESSOP & Sons, Wm., 91 John St., New York, N. Y. (Importers.) (See page 363.)
 KREFELD Steel Co., 50 Church St., New York, N. Y. (Importers.)
 KRUPP—See Prosser & Son.
 LINDENBERG Steel Co., 90 West St., New York, N. Y. (Importers.)
 LUDLUM Steel & Spring Co., Watervliet, N. Y. "Pompton."
 McINNES Steel Co., Corry, Pa.
 MIDVALE Steel Co. (Nictown), Philadelphia, Pa.
 MUIR-DAVIDSON Steel Co., 44 Cliff St., New York, N. Y. (Importers.) (See page 426.)
 PHILADELPHIA Steel & Forge Co., 50 Church St., New York, N. Y.
 PITTSBURGH Tool Steel Wire Co., Monaca, Pa.

POLDI—See Frasse & Co.
 POMPTON—See Ludlum Steel & Spring Co.
 PROSSER & Son, Thomas, 15 Gold St., New York, N. Y. (Importers.) "Krupp." (See page 361.)
 SCHUCHARDT & Schutte, 90 West St., New York, N. Y. (Importers.)
 TOLEDO—See Andrew & Co.
 VANADIUM-ALLOYS Steel Co., Latrobe, Pa.
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 WARD & Sons, Edgar T., 23-25 Purchase St., Boston, Mass. (Importers.) "Dannemora."

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 BALDWIN Steel Co., Charleston, W. Va. (See page 363.)

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ALLOY CASTINGS A SPECIALTY
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For DIES and High-Grade TOOLS****Annealed and Unannealed****Has an unexcelled record for
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 (See page 607.)
 FARIST Steel Co., 137 E. Main St., Bridgeport, Conn.
 HALCOMB Steel Co., Geddes St., Syracuse, N. Y.
 HARROW Spring Co., 745 E. Vine St., Kalamazoo, Mich.
 HELMUTH Co., L., 22 State St., New York, N. Y. (Importers.)
 ILLINOIS Steel Co., 72 W. Adams St., Chicago, Ill.
 KREFELD Steel Co., 50 Church St., New York, N. Y. (Importers.)
 KRUPP—See Prosser & Son.
 MIDVALE Steel Co. (Nictown), Philadelphia, Pa.
 MUIR-DAVIDSON Steel Co., 44 Cliff St., New York, N. Y. (Importers.)
 (See page 426.)
 PENNSYLVANIA Steel Co., Morris Bldg., Philadelphia, Pa.
 (See page 365.)
 PROSSER & Son, Thomas, 15 Gold St., New York, N. Y. (Importers.) "Krupp."
 (See page 361.)
 PHILADELPHIA Steel & Forge Co., 50 Church St., New York, N. Y.
 SWEETS Steel Co., Williamsport, Pa.
 VULCAN Crucible Steel Co., First St., Allquippa, Pa.

MANGANESE STEEL

KRUPP—See Prosser & Son.
 PROSSER & Son, Thomas, 15 Gold St., New York, N. Y. (Importers.) "Krupp."
 (See page 361.)
 UNITED Steel Co., Canton, O.
 (See page 367.)

NICKEL STEEL

ALLEN & Co., Edgar, 718 W. Lake St., Chicago, Ill. (Importers.)
 AMERICAN Import & Export Co., 150 Nassau St., New York, N. Y. (Importers.)
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 (See page 363.)
 BECKER Steel Co. of America, 90 West St., New York, N. Y. (Importers.)
 BETHLEHEM Steel Co., Third & Poplar Sts., South Bethlehem, Pa.
 BOKER & Co., Herman, 101 Duane St., New York, N. Y. (Importers.)
 CARBON Steel Co., ft. 32d St., Pittsburgh, Pa.
 CARPENTER Steel Co., Reading, Pa.

CROWLEY Co., John A., 120-22 Liberty St., New York, N. Y. (Importers.)
 (See page 607.)

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FARIST Steel Co., 137 E. Main St., Bridgeport, Conn.

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 (See page 453.)

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KIDD Bros. & Burgher Steel Wire Co., Allquippa, Pa.

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KRUPP—See Prosser & Son.

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MIDVALE Steel Co. (Nictown), Philadelphia, Pa.

MUIR-DAVIDSON Steel Co., 44 Cliff St., New York, N. Y. (Importers.)
 (See page 426.)

PHILADELPHIA Steel & Forge Co., 50 Church St., New York, N. Y.

POLDI—See Frasse & Co.

PROSSER & Son, Thomas, 15 Gold St., New York, N. Y. (Importers.) "Krupp."
 (See page 361.)

UNION Drawn Steel Co., Beaver Falls, Pa.
 (See page 363.)

VULCAN Crucible Steel Co., First St., Allquippa, Pa.

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 (See page 363.)

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CARBON Steel Co., ft. 32d St., Pittsburgh, Pa.

CARPENTER Steel Co., Reading, Pa.

CROWLEY Co., John A., 120-22 Liberty St., New York, N. Y. (Importers.) "Arrow."
 (See page 607.)

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ELLIOTT, H. A., Majestic Bldg., Detroit, Mich. (Importer.)

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FRASSE & Co., Peter A., New York, N. Y. (Importers.) "Poldi."
 (See page 453.)

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HELLER Bros. Co., Newark, N. J.

ILLINGSWORTH Steel Co., John (Frankford), Philadelphia, Pa.

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NATURAL ALLOY. NICKEL-CHROME.

Manufactured From Cuban Ore

Crank-Shafts; Transmission, Drive and Jack Shafts; I-Beam, Tubular and Driving Axles; Connecting Rods; Transmission and Differential Gears, Case Hardened, Water or Oil Hardened; Frames; High Tension Bolts; Steering Knuckles; Springs; Miscellaneous Forgings to be Heat-Treated

In the untreated condition this steel may be forged, rolled or machined the same as carbon steel; experience in special steels is not essential. After heat-treatment will show from 50,000 to over 200,000 pounds per square inch Elastic Limit, according to grade and treatment. An excellent base for VANADIUM additions, superior to chrome-vanadium steel.

Supplied in round or square bars, flats; billets; forging blooms, concave spring flats. Rolled, smooth forged, cold drawn or turned bars.

Silico-Manganese Spring Steel

Concave Flats and Standard Rounds.

Tensile Strength 210,000, Elastic Limit 190,000, Elongation in 2" 10.0%, Reduction of Area 30.0%, Tough, Resilient, Fibrous.

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Works
Steelton, Pa.

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(See page 363.)

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KREFELD Steel Co., 50 Church St., New York, N. Y. (Importers.)

KRUPP—See Prosser & Son.

LINDENBERG Steel Co., 90 West St., New York, N. Y. (Importers.)

McINNES Steel Co., Corey, Pa.

MAYARI—See Pennsylvania Steel Co.

MIDVALE Steel Co. (Nictown), Philadelphia, Pa.

MUIR-DAVIDSON Steel Co., 44 Cliff St., New York, N. Y. (Importers.)
(See page 426.)

PENNSYLVANIA Steel Co., Morris Bldg., Philadelphia, Pa. "Mayari."
(See page 365.)

PHILADELPHIA Steel & Forge Co., 50 Church St., New York, N. Y.

POLDI—See Frasse & Co.

PROSSER & Son, Thomas, 15 Gold St., New York, N. Y. (Importers.) "Krupp."
(See page 361.)

SCHUCHARDT & Schutte, 90 West St., New York, N. Y. (Importers.)

UNION Drawn Steel Co., Beaver Falls, Pa.
(See page 363.)

VULCAN Crucible Steel Co., First St., All-quippa, Pa.

VANADIUM STEEL

ALLEN & Co., Edgar, 718 W. Lake St., Chicago, Ill. (Importers.)

BALDWIN Steel Co., Charleston, W. Va.
(See page 363.)

BETHLEHEM Steel Co., Third & Poplar Sts., South Bethlehem, Pa.

CARBON Steel Co., ft. 32d St., Pittsburg, Pa.

CARNEGIE Steel Co., Carnegie Bldg., Pittsburg, Pa.

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KRUPP—See Prosser & Son.

MIDVALE Steel Co. (Nictown), Philadelphia, Pa.

PROSSER & Son, Thomas, 15 Gold St., New York, N. Y. (Importers.) "Krupp."
(See page 361.)

UNION Drawn Steel Co., Beaver Falls, Pa.
(See page 363.)

UNITED Steel Co., Canton, O.
(See page 367.)

VANADIUM-ALLOYS Steel Co., Latrobe, Pa. "Vasco."

VASCO—See Vanadium-Alloys Steel Co.

VULCAN Crucible Steel Co., First St., All-quippa, Pa.

ALUMINUM COATED SHEET STEEL

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ALBION—See Hobson, Houghton & Co.

ALLEN & Co., Edgar, 718 W. Lake St., Chicago, Ill. (Importers.)

AMERICAN Import & Export Co., 150 Nassau St., New York, N. Y. (Importers.)

ANDREW & Co., J. H., 107 West St., New York, N. Y. (Importers.) "Toledo."

ARK—See Jessop & Sons.

ATLAS Steel Co., Dunkirk, N. Y. "Loco."

BALDWIN Steel Co., Charleston, W. Va. "Hudson."
(See page 363.)

BETHLEHEM Steel Co., Third & Poplar Sts., South Bethlehem, Pa.

BOKER & Co., Hermann, 101 Duane St., New York, N. Y. (Importers.) "Novo."

BRAEBURN Steel Co., Braeburn, Pa.

BURGESS—See Cyclops Steel Works.

CAPITAL—See Nash & Co.

CARDINAL—See Elliott, H. A.

CARPENTER Steel Co., Reading, Pa. "Zenith."

COLUMBIA Tool Steel Co., Chicago Heights, Ill.

CROWLEY Co., John A., 120-22 Liberty St., New York, N. Y. (Importers.)
(See page 607.)

CRUCIBLE Steel Co. of America, Oliver Bldg., Pittsburg, Pa.

CYCLOPS Steel Works, Titusville, Pa. "Burgess."

ELLIOTT, H. A., Majestic Bldg., Detroit, Mich. (Importer.) "Cardinal."

FRASSE & Co., Peter A., New York, N. Y. (Importers.) "Poldi."
(See page 453.)

HALCOMB Steel Co., Geddes St., Syracuse, N. Y.

HELLER Bros. Co., Newark, N. J.

HOBSON, Houghton & Co., 83 Beekman St., New York, N. Y. (Importers.) "Albion."

HUDSON—See Baldwin Steel Co.

IMPROVED CAPITAL—See Ward & Sons.

INTERNATIONAL High Speed Steel Co., 475 Pearl St., New York, N. Y.

JESSOP & Sons, Wm., 91 John St., New York, N. Y. (Importers.) "Ark."
(See page 363.)

JONES & Co., B. M., 141 Milk St., Boston, Mass. (Importers.) "Mushet."

KIDD Bros. & Burgher Steel Wire Co., All-quippa, Pa.

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- McINNES Steel Co., Corry, Pa.
- MIDVALE Steel Co. (Nicetown), Philadelphia, Pa.
- MUIR-DAVIDSON Steel Co., 44 Cliff St., New York, N. Y. (Importers.) (See page 426.)
- MUSHET—See Jones & Co.
- NASH & Co., Geo., 217 Pearl St., New York, N. Y. (Importers.) "Capital."
- NOVO—See Boker & Co.
- POLDI—See Frasse & Co.
- RED CUT SUPERIOR—See Vanadium-Alloys Steel Co.
- SCHUCHARDT & Schutte, 90 West St., New York, N. Y. (Importers.)
- TOLEDO—See Andrew & Co.
- VANADIUM-ALLOYS Steel Co., Latrobe, Pa. "Red Cut Superior."
- VULCAN Crucible Steel Co., First St., Allquippa, Pa.
- WARD & Sons, Edgar T., 23-25 Purchase St., Boston, Mass. (Importers.) "Improved Capital."
- ZENITH—See Carpenter Steel Co.

SELF-HARDENING CUTTING STEEL

- AJAX—See Baldwin Steel Co.
- ALLEN & Co., Edgar, 718 W. Lake St., Chicago, Ill. (Importers.)
- AMERICAN Import & Export Co., 150 Nassau St., New York, N. Y. (Importers.)
- BAIRDWIN Steel Co., Charleston, W. Va. "Ajax." (See page 363.)
- BLUE CHIP—See Firth-Sterling Steel Co.
- BOHLERS—See Houghton & Richards.
- FIRTH-STERLING Steel Co., McKeesport, Pa. "Blue Chip."
- HALCOMB Steel Co., Geddes St., Syracuse, N. Y.
- HOBSON, Houghton & Co., 83 Beekman St., New York, N. Y. (Importers.) "Soho."
- HOUGHTON & Richards, 150 Oliver St., Boston, Mass. "Bohlers."
- ILLINGSWORTH Steel Co., John (Frankford), Philadelphia, Pa.
- JESSOP & Sons, Wm., 91 John St., New York, N. Y. (Importers.) (See page 363.)
- JONES & Co., B. M., 141 Milk St., Boston, Mass. (Importers.) "Mushet."
- MUSHET—See Jones & Co.
- SOHO—See Hobson, Houghton & Co.
- VULCAN Crucible Steel Co., First St., Allquippa, Pa.

STEPS**FORGED STEPS**

(See Forgings, Drop)

SPECIAL STEPS AND RUNNING BOARDS

- BOSSERT Co., Utica, N. Y. (See page 161.)
- DETROIT Pressed Steel Co., 1800 Mt. Elliott Ave., Detroit, Mich. (See page 213.)
- ENGLISH & Mersick Co., New Haven, Conn.
- HAYES Mfg. Co., Detroit, Mich. "Hayes-Stanwood." (See pages 70 and 71.)
- HAYES-STANWOOD—See Hayes Mfg. Co.
- HYDRAULIC Pressed Steel Co., Cleveland, O. (See inside Back Cover.)
- KINSEY Mfg. Co., Toledo, O. (See page 395.)
- METALLIC Automobile Matting Co., 281 Mill St., Rochester, N. Y.
- MICHIGAN Stamping Co., 759-71 Bellevue Ave., Detroit, Mich.
- MOTOR Parts Co., Plainfield, N. J. "Stanwood."
- PARISH & Bingham Co., Cleveland, O. (See page 171.)
- STANWOOD—See Motor Parts Co.

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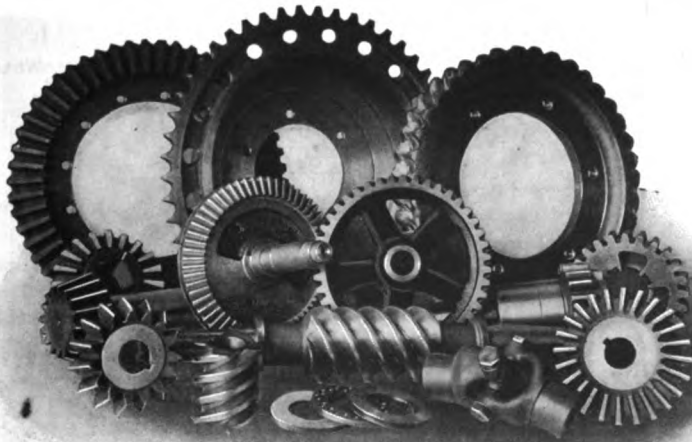
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 (See page 395.)
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 (See page 290.)
LUNKENHEIMER Co., 223 E. Elgth Ave., Cincinnati, O.
MARVEL Carbureter Co., Flint, Mich.
MICHIGAN Lubricator Co., 661-73 Beaubien St., Detroit, Mich.
MOSLER & Co., A. R., New York, N. Y.
 (See page 287.)
MOTOR Shop, Barnegat, N. J.
NATIONAL Sales Co., 45 Milk St., Boston, Mass. "Ellis."
PLANHARD Mfg. Co., Main St. & Broadway, Kokomo, Ind.
REYNOLDS, George T., 341-49 Eddy St., Providence, R. I.
SHURECLEEN—See Bingham Mfg. Co.
STERLING Machine Co., Norwich, Conn. "Uncas."
 (See page 489.)
STOTT-CROWLEY Mfg. Co., 1042 Grand River Ave., Detroit, Mich.
UNCAS—See Sterling Machine Co.
WALLACE Supply Co., 108-28 N. Jefferson St., Chicago, Ill. "Davidson."
WESTERN Brass Mfg. Works, Marshall Bldg., 21st St. & C. B. & Q. R. R., Chicago, Ill.
 (See page 85.)
WHEELER & Schebler, Indianapolis, Ind.
 (See page 97.)
ZERK Mfg. Co. Cleveland, O.

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 (See page 371.)

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 (See page 229.)
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DETROIT Leather Works, 31-35 Mullett St., Detroit, Mich.
 (See page 65.)

- ECONOMY Stay Co., Jefferson City, Mo.**
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GARAGE Equipment Mfg. Co., Milwaukee, Wis. "Superior."
 (See page 203.)
GRATON & Knight Mfg. Co., Worcester, Mass.
 (See page 65.)
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PERKINS Campbell Co., Cincinnati, O. "Campbell."
 (See page 371.)
REINHOLD Belting & Supply Co., 174 W. 56th St., New York, N. Y.
RHOADS & Sons, J. E., 12 N. Third St., Philadelphia, Pa.
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 (See page 611.)
WING Co., Charles, Amesbury, Mass.
 (See page 371.)

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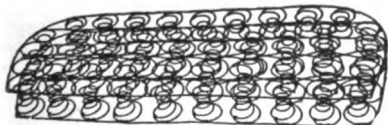
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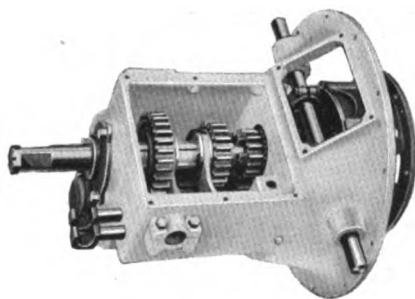
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(See page 523.)

PERKINS CAMPBELL Co., Cincinnati, O.
(See page 371.)

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ark, O.
(See page 343.)

POST & Lester Co., Hartford, Conn.
(See page 217.)

PRUDEN Hardware Co., W. E., 864-66
Eighth Ave., New York, N. Y.
(See page 473.)

SHAIN, Chas. D., Box 53, Station L., Brook-
lyn, N. Y.
(See page 97.)

WASHINGTON Automobile Supply Co.,
Washington, Ill.
(See page 585.)

ZINKE Co., 1256 Michigan Ave., Chicago,
Ill.
(See page 469.)

SUPPORTS

HOOD SUPPORTS OR ARCH BARS

CROSBY Co., Buffalo, N. Y.
(See page 157.)

KINSEY Mfg. Co., Toledo, O.
(See page 395.)

KONIGSLOW Mfg. Co., Otto, Cleveland, O.

METAL Specialty Co., Cincinnati, O.

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SORENSEN, P., 18 Dunham Pl., Brooklyn,
N. Y.

WESTINGHOUSE Electric & Mfg. Co., (E.
Pittsburg), Pittsburg, Pa.

FOOT SWITCHES

(Ignition Switch or Cut-out—to be operated by foot
For Kick Switches—See Switches, Ignition.)

HERZ & Co., 295 Lafayette St., New York,
N. Y.
(See page 269.)

IGNITION SWITCHES

AMERICAN Ever Ready Co., 316 Hudson St.,
New York, N. Y. "Ever Ready."

AMERICAN Coil Co., Foxboro, Mass.

ATWATER Kent Mfg. Works, 4937 Sten-
ton Ave., Philadelphia, Pa.
(See page 495.)

BRIGGS & Stratton Co., 275 Milwaukee St.,
Milwaukee, Wis.

CHICAGO Electric Mfg. Co., 2817 S. Halsted
St., Chicago, Ill. "Handy."

CLUM Mfg. Co., Mitchell Bldg., Milwaukee,
Wis.

CONNECTICUT Telephone & Electric Co., 34
Britannia St., Meriden, Conn.

COUCH CO., S. H., 170 Purchase St., Boston,
Mass. "Puritan."

DAYTON Engineering Laboratories Co.,
Dayton, O. "Delco."
(See page 359.)

DELCO—See Dayton Engineering Labora-
tories Co.

DOW Mfg. Co., 131 Adams St., Braintree,
Mass.

ELECTRIC Goods Mfg. Co., Canton, Mass.
"Perfex."

EVER READY—See American Ever Ready
Co.

FAULTLESS—See Motsinger Device Mfg. Co.

GRAHAM Mfg. Co., Providence, R. I.

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Pl., New York, N. Y.

MORSE, Frank W., 516 Atlantic Ave., Bos-
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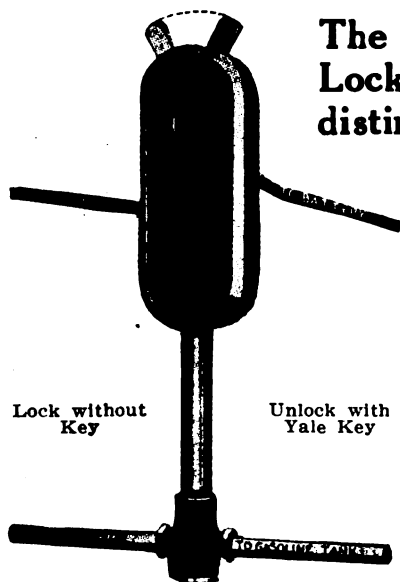
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York, N. Y.

PERFEX—See Electric Goods Mfg. Co.

PITTSFIELD Spark Coil Co., Dalton, Mass.
(See page 127.)

PURITAN—See Couch Co.



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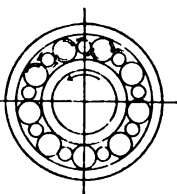
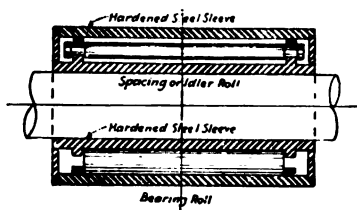
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- WELLS Mfg. Co., R. C., Station A., Fond du Lac, Wis.**
(See page 127.)
- WICO**—See Witherbee Igniter Co.
- WILLIAMS, E. Q., 535-39 S. Clinton St., Syracuse, N. Y.**
- WITHERBEE Igniter Co., Springfield, Mass., "Wico."**
(See page 601.)

KICK SWITCHES

(See Switches, Ignition)

LIGHT SWITCHES

(For turning on and off Electric Lights on Car)

- A. B. Mfg. Co., Poughkeepsie, N. Y.**
(See page 407.)
- BRIGGS & Stratton Co., 275 Milwaukee St., Milwaukee, Wis.**
- CHICAGO Electric Mfg. Co., 2817 S. Halsted St., Chicago, Ill. "Handy."**
- CLUM Mfg. Co., Mitchell Bldg., Milwaukee, Wis.**
- COWLES & Co., C., New Haven, Conn.**
(See page 91.)
- CUTLER-HAMMER Mfg. Co., Milwaukee, Wis.**
- DIAMOND H**—See Hart Mfg. Co.
- GENERAL Electric Co., Schenectady, N. Y.**
- HANDY**—See Chicago Electric Mfg. Co.
- HART Mfg. Co., Hartford, Conn. "Diamond H."**
- HARTMAN Electrical Mfg. Co., Mansfield, O.**
- HOWARD Miniature Lamp Co., 327 Academy St., Newark, N. J.**
- IDEAL Switch Co., Plainville, Conn.**
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- NORTH East Electric Co., Rochester, N. Y.**
(See page 587.)
- O'BRIEN Mfg. Co., Joseph F., 63 Park Pl., New York, N. Y.**
(See page 229.)
- WESTINGHOUSE Electric & Mfg. Co., (E. Pittsburg), Pittsburg, Pa.**
- WICO**—See Witherbee Igniter Co.
- WITHERBEE Igniter Co., Springfield, Mass., "Wico."**
(See page 601.)

LOCK SWITCHES

(Ignition Switches equipped with lock to prevent unauthorized use of car)

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- CLUM Mfg. Co., Mitchell Bldg., Milwaukee, Wis.**

CONNECTICUT Telephone & Electric Co., 3, Britannia St., Meriden, Conn.

DAYTON Engineering Laboratories Co., Dayton, O. "Delco."
(See page 359.)

DELCO—See Dayton Engineering Laboratories Co.

ESCO Mfg. Co., 1000 Woodward Ave., Detroit, Mich.
(See page 373.)

JOHNSTONE Auto Lock Co., Rockefeller Bldg., Cleveland, O.

SAFETY Device Co., 372 S. Illinois St., Indianapolis, Ind.

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ADAMS & Westlake Co., Chicago, Ill. "Adlake."
(See page 221.)

ADLAKE—See Adams & Westlake Co.

APPLE Electric Co., 14 N. Canal St., Dayton, O.
(See page 555.)

BERDON—See Esterline Co.

DEAN Electric Co., 515 Olive St., Elyria, O. "Dynalux."
(See page 138 and 139.)

DYNALUX—See Dean Electric Co.

DYNETO Electric Co., Elbridge, N. Y.

ECONOMY Mfg. Co., Economy, Pa.
(See page 435.)

ELECTRIC Auto Lite Co., 135-37 Michigan St., Toledo, O. "Fisher."

ELECTRO Light & Starter Co., Tenth & Canal Sts., Indianapolis, Ind.
(See page 561.)

ESTERLINE Co., 128 Main St., La Fayette, Ind. "Berdon."

FISHER—See Electric Auto Lite Co.

FISHER Electrical Works, 2000 Larned St., Detroit, Mich.

(See page opposite Inside Back Cover.)

HARTMAN Electrical Mfg. Co., Mansfield, O.

HOLTZER-CABOT Electric Co., Brookline, Mass.
(See page 223.)

JESCO—See Jones Electric Starter Co.

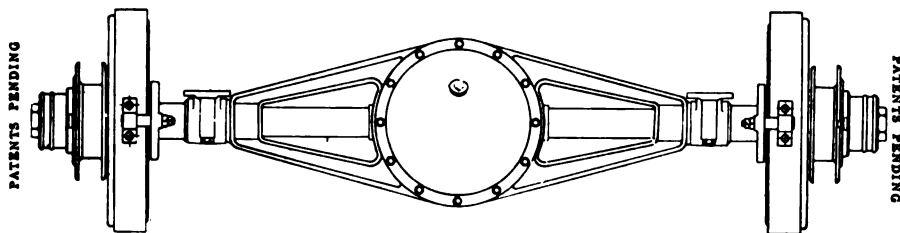
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(See page 675.)

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LEECE-NEVILLE Co., 2069 E. Fourth St., Cleveland, O. "L-N."

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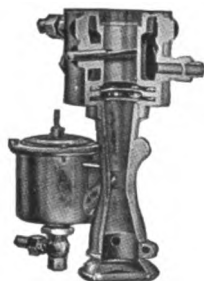
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They are 1st: The ball cage (shown in the accompanying illustration) which automatically regulates the air-intake and always insures the right amount of mixture; and

2nd: The predetermined position of the spray nozzle, which insures uniformity in the supply of gasoline.

The G & A Carburettor never has to be touched after it is once properly adjusted on the car. It is always ready—always right; can be throttled down to 3 or 4 miles per hour and provides considerable saving in fuel consumption.

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(See page 669.)
- NORTH East Electric Co.**, Rochester, N. Y.
(See page 587.)
- STRONG Electric Co.**, 917-19 W. Grand Ave., Des Moines, Ia.
- U. S. Light & Heating Co.**, 30 Church St., New York, N. Y.
(See page opposite Inside Front Cover.)
- VESTA Accumulator Co.**, 1332 Michigan Ave., Chicago, Ill.
- WAGNER Electric Mfg. Co.**, 6400 Plymouth Ave., St. Louis, Mo.
- WESTINGHOUSE Electric & Mfg. Co.**, (E. Pittsburg), Pittsburg, Pa.

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- ROBERTS, G. G.**, South Ave., Whitman, Mass.
- SALMOND & Son**, Sam, Hanover, Mass.
- SHELTON Co.**, Shelton, Conn.
- TURNER & Seymour Mfg. Co.**, Torrington, Conn. "Eagle."
- TOCKWOTTON Co.**, 79 S. Main St., Providence, R. I.
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- WATERMAN Co.**, R. C., South Hanover, Mass.

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TIRE TALC

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(See pages 87 and 88.)
- ATLAS Auto Supply Co.**, 95 E. Adams St., Chicago, Ill. "Prevento."
(See page 115.)

- BESTYET**—See St. Louis Rubber Cement Co.
- COHUTTA Talc Co.**, Dalton, Ga.
- DOGGETT**, Stanley, 101 Beekman St., New York, N. Y.
- NEVINS Co.**, Samuel, 109 E. Second St., Philadelphia, Pa.
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- NORTH Carolina Talc & Mining Co.**, Hewitts, N. C.
- NORTHWESTERN Chemical Co.**, Marietta, O. "Slip-Easy."
(See page 115.)
- PREVENTO**—See Atlas Auto Supply Co.
- ST. LOUIS Rubber Cement Co.**, 3046 Lambdin Ave., St. Louis, Mo. "Bestyet."
- SLIP-EASY**—See Northwestern Chemical Co.
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- METEOR Auto Tank Co.**, 1666 Broadway, New York, N. Y.
- PREST-O-LITE Co.**, 1400 E. South St., Indianapolis, Ind.
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(See page 435.)

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(See page 307.)
- AMERICAN Steel Package Co.**, Defiance, O.
- AUTO Metal Co.**, 520 Worthington St., Springfield, Mass.
- AUTO Sheet Metal Works**, 2228 Michigan Ave., Chicago, Ill.
- EVERY Stamping Co.**, 5209 Lakeside Ave., Cleveland, O.
- BADGER & Sons Co.**, E. B., 63-69 Pitts St., Boston, Mass.
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(See pages 239 and 240.)
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Prest-O-Torch

Mighty handy in your workshop and a good profit in the sale of it

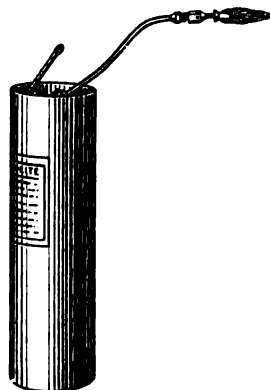
This neat little device makes the soldering pot and the gasoline torch look clumsy and out of date.

To use it, simply connect Prest-O-Torch to any size Prest-O-Lite.

Turn on the gas and touch a match. Instantly you have an intense flame that does the work easier, quicker and better than any other device made for the same purpose.

Prest-O-Torch heats a soldering iron in one minute and has sufficient volume to braze steel rods up to and including $\frac{3}{8}$ inch. Larger work can be done by using two or more flames on the same point. Operating expense is only a few cents per hour of actual use.

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So be prepared when he comes in.

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Our nearest branch will supply you.

The Prest-O-Lite Co.

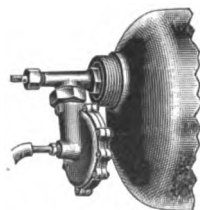
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The Prest-O-Lite Automatic gives the correct pressure at all times, whether the Prest-O-Lite is full, half full, or nearly empty. No matter how far the tank valve is opened, a uniform pressure of two ounces is maintained in the pipe lines.

We have spent years in perfecting this valve. It is now perfected, and is a wonderful, sturdy bit of mechanism. If not tampered with, it will give years of faithful service.

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(See page 345.)

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(See page 553.)

FREELAND Sons Co., B. F., Sturgis, Mich.

GOETZ Co., 1802 Clybourn Ave., Chicago, Ill.

HAYES Mfg. Co., Detroit, Mich.
(See pages 70 and 71.)

HUNT & Dorman Mfg. Co., 2102-10 Superior Ave., N. E., Cleveland, O.

IDEAL Sheet Metal Works, 2807 Michigan Ave., Chicago, Ill.

JANNEY, Steinmets & Co., Philadelphia, Pa.
(See page 379.)

KELLS Mfg. Co., W. J., 521-25 W. 45th St., New York, N. Y.
(See page 205.)

KEYSTONE Sheet Metal Co., Ambridge, Pa.

KINSEY Mfg. Co., Toledo, O.
(See page 395.)

KOVEN & Bro., L. O., 50 Cliff St., New York, N. Y.
(See page 379.)

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MANUFACTURERS Can Co., 434 Mulberry St., Newark, N. J.

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(See page 379.)

TRAGESER Steam Copper Works, John, 447-57 W. 26th St., New York, N. Y.

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(See page 107.)

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(See page 583.)

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(See page 309.)

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(See page 379.)

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- SAVO—See Anchor Brass Works.
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(See page 379.)
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- SNELLS—See Hydraulic Oil Storage Co.
- SOO—See Trahern Pump Co.
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- UNITED States Pump & Tank Co., 3312 Pestalozzi St., St. Louis, Mo.
- VAC Liquid Equipment Co., Cedar Rapids, Ia.
- WALLMAN Mfg. Co., 283-87 Fifth Ave., Milwaukee, Wis.
- WAYNE Oil Tank & Pump Co., Fort Wayne, Ind.
(See page 381.)
- WELDED Steel Barrel Corp., Leib & Wight Sts., Detroit, Mich.
- WESTERN Oil Pump & Tank Co., 2437 Kosciuszko St., St. Louis, Mo.
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(See page 377.)
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(See page 435.)

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(See page 459.)
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(See page 607.)
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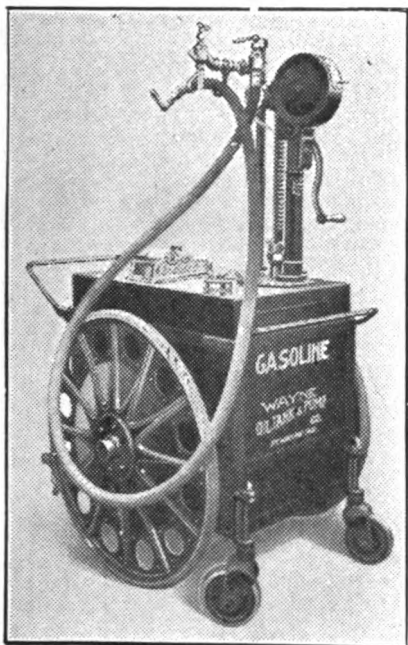
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No outfit is quite so complete as the **WAYNE PORTABLE** for safety and ease in handling gasoline around the garage. It reduces to a minimum the fire hazard on portable storage of gasoline.

Note the strong steel frame construction which supports the tank. The solid steel wheels are attached to this frame, which prevents the necessity of an opening through the tank for axle equipment.

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Pump measures pints, quarts, half gallons and gallons accurately and locks automatically when tank is empty.

This outfit is complete in every detail.

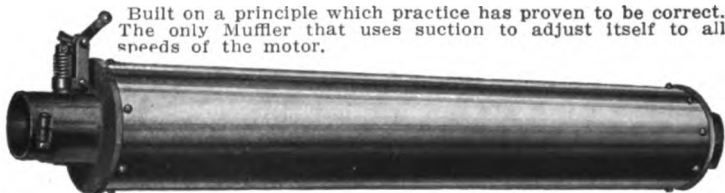
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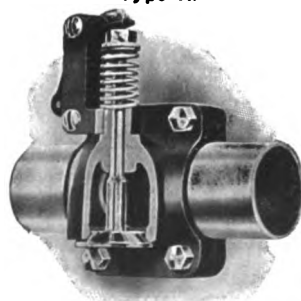


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 KINSEY Mfg. Co., Toledo, O. (See page 395.)
 LOMBARDI Motor Co., Derby, Conn.
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 MOSLER & Co., A. R., New York, N. Y. (See page 287.)
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 PITTSFIELD Spark Coil Co., Dalton, Mass. (See page 127.)
 RAJAH Auto Supply Co., Bloomfield, N. J. (See page 555.)
 SHAIN, Chas. D., Box 53, Station L., Brooklyn, N. Y. (See page 97.)
 SIMPLEX Auto Specialty Co., Detroit, Mich.
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 SUPERIOR Metal Products Co., Elyria, O. (See page 617.)
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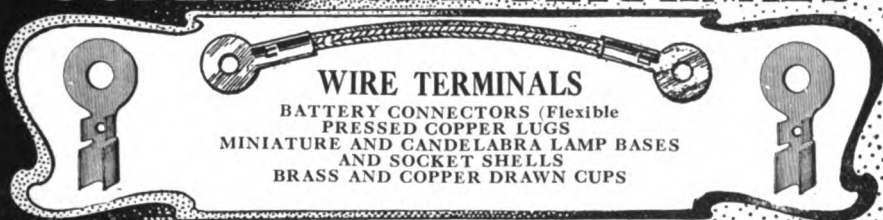
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 HERZ & Co., 295 Lafayette St., New York, N. Y. (See page 269.)
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 MONITOR—See Motor Specialties Co.
 MOSLER & Co., A. R., New York, N. Y. "Klahn," "Umph." (See page 287.)

DUPLEX WIRE TERMINALS



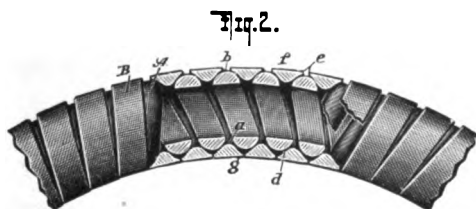
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PRESSED COPPER LUGS
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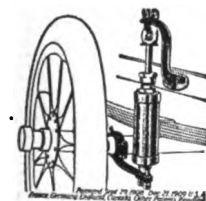
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- PHILADELPHIA Novelty Supply Co., 2031-33 N. 29th St., Philadelphia, Pa.
- PHILADELPHIA Timer & Machine Co., Philadelphia, Pa. "Velos."
(See page 595.)
- PITTSFIELD Spark Coil Co., Dalton, Mass.
(See page 127.)
- RHOADES—See New York Coll Co.
- SAMSON—See American Electric Co.
- SCHUG Electric Mfg. Co., 326 Jefferson Ave., Detroit, Mich.
- SINTZ—See Wilmarth & Morman Co.
- SPLITDORF Electrical Co., 98 Warren St., Newark, N. J.
- STERLING Machine Co., Norwich, Conn. "Uncas."
(See page 489.)
- STEVENS Co., E. W., Hurlock, Md.
- TRIO Mfg. Co., 1206 Bellevue Ave., Detroit, Mich.
- UMPH—See Mosler & Co.
- UNCAS—See Sterling Machine Co.
- VELOS—See Philadelphia Timer & Machine Co.
- WELLS Mfg. Co., R. C., Station A, Fond du Lac, Wis.
(See page 127.)
- WERNER Ignition Co., 112 N. Sixth St., Philadelphia, Pa.
- WICO—See Witherbee Igniter Co.
- WILMARTH & Morman Co., 1179 Monroe Ave., N. W., Grand Rapids, Mich. "Sintz."
- WITHERBEE Igniter Co., Springfield, Mass. "Wico."
(See page 601.)
- ZIMMERMAN-SMITH Co., 72-74 Main St., North Tonawanda, N. Y.

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BURNER TIPS

(See Burners, Acetylene)

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RACINE Auto Tire Co., 200 Clark St., Racine, Wis. "Horseshoe."

PNEUMATIC TIRES

(See also Tubes, Inner)

- ACME Rubber Mfg. Co., Trenton, N. J.
(See page 501.)
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- BATAVIA Rubber Co., Batavia, N. Y.
- BRAENDER Rubber & Tire Co., 1987 Broadway, New York, N. Y.
(See page 391.)
- CARSPRING—See New Jersey Car Spring & Rubber Co.
- CATARACT Rubber Co., 320-21 White Bldg., Buffalo, N. Y.
(See page 387.)
- CENTURY Rubber Co., 123 W. 68th St., New York, N. Y.
- COMBINATION Rubber Mfg. Co., Bloomfield, N. J.
- CORD—See Goodyear Tire & Rubber Co.
- COURTNEY Tire & Rubber Co., Buick Bldg., New York, N. Y.
- DIAMOND Rubber Co., Akron, O.
- EMPIRE Tire Co., Mulberry St. & Clinton Ave., Trenton, N. J.
- ENGLERT Tire Co., 1916 Broadway, New York, N. Y. (Importers.)
- FALLS Rubber Co., Cuyahoga Falls, O.
- FEDERAL Rubber Mfg. Co., Milwaukee, Wis.
- FIRESTONE Tire & Rubber Co., Akron, O.
(See page 451.)
- FISK Rubber Co., Chicopee Falls, Mass.
- FRONTIER Tire & Rubber Co., 1054 Main St., Buffalo, N. Y.
- GAULOIS Tire Corp., 49 W. 64th St., New York, N. Y. (Importers.)
(See page 385.)
- GOODRICH Co., B. F., Akron, O.
- GOODYEAR Tire & Rubber Co., Akron, O. "Cord."
- GREAT American Rubber Co., Conshohocken, Pa.
- HARDMAN Tire & Rubber Co., Mill & Main Sts., Belleville, N. J.
- HOME Tire Co., Trenton, N. J.
(See page 401.)
- HOOD Rubber Co., Watertown, Mass.
- HYDRO—See St. Louis Tire & Rubber Co.
- IMPERIAL—See McGraw Tire & Rubber Co.
- INDIANA Rubber & Insulated Wire Co., Jonesboro, Ind.
- KELLY-SPRINGFIELD Tire Co., 20 Vesey St., New York, N. Y.
(See page 387.)
- KNIGHT Tire & Rubber Co., Canton, O.
- LEE Tire & Rubber Co., Conshohocken, Pa.
- MCGRAW Tire & Rubber Co., East Palestine, O. "Imperial."
- MANHATTAN Rubber Mfg. Co., Passaic, N. J.
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(See page 607.)
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- MILLER Rubber Co., Akron, O.**
- MOHAWK Rubber Co., Akron, O.**
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- RUTHERFORD Rubber Co., Rutherford, N. J. "Sterling," "Spurtread."**
- ST. LOUIS Tire & Rubber Co., St. Louis, Mo. "Hydro."**
- SEAMLESS Rubber Co. of N. Y., 250 W. 54th St., New York, N. Y.**
(See page 387.)
- SPURTREAD—See Rutherford Rubber Co.**
- STERLING—See Rutherford Rubber Co.**
- SWINEHART Tire & Rubber Co., Akron, O.**
(See page 581.)
- THERMOID Rubber Co., Trenton, N. J.**
(See page 393.)
- TYER Rubber Co., Andover, Mass. "Tyrian."**
- TYRIAN—See Tyer Rubber Co.**
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- WALPOLE Tire & Rubber Co., Walpole, Mass.**
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- DIAMOND Rubber Co., Akron, O.**
- FIRESTONE Tire & Rubber Co., Akron, O.**
(See page 451.)
- GAULOIS Tire Corp., 49 W. 64th St., New York, N. Y. (Importers.)**
(See page 385.)
- GIBNEY Rubber Co., James L., Philadelphia, Pa.**
(See page 393.)
- GOODRICH Co., B. F., Akron, O.**
- GOODYEAR Tire & Rubber Co., Akron, O.**
- HYDRO—See St. Louis Tire & Rubber Co.**
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(See page 387.)
- MILFORD Rubber Works, Milford, Ill.**
- MOTZ Tire & Rubber Co., Akron, O.**
(See page 391.)

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- POLACK Tyre & Rubber Co., 246 W. 59th St., New York, N. Y.**
(See page 605.)
- PORTAGE Rubber Co., Akron, O.**
- REPUBLIC Rubber Co., Youngstown, O.**
- ST. LOUIS Tire & Rubber Co., St. Louis, Mo. "Hydro."**
- SWINEHART Tire & Rubber Co., Akron, O.**
(See page 581.)
- UNITED States Tire Co., Broadway & 58th St., New York, N. Y.**
- VICTOR Rubber Co., Springfield, O.**

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(See page 391.)
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- OVERMAN Tire Co., 250 W. 54th St., New York, N. Y.**
- PERFECT Tire Sales Co., 118 S. 16th St., Philadelphia, Pa.**
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(See page 581.)

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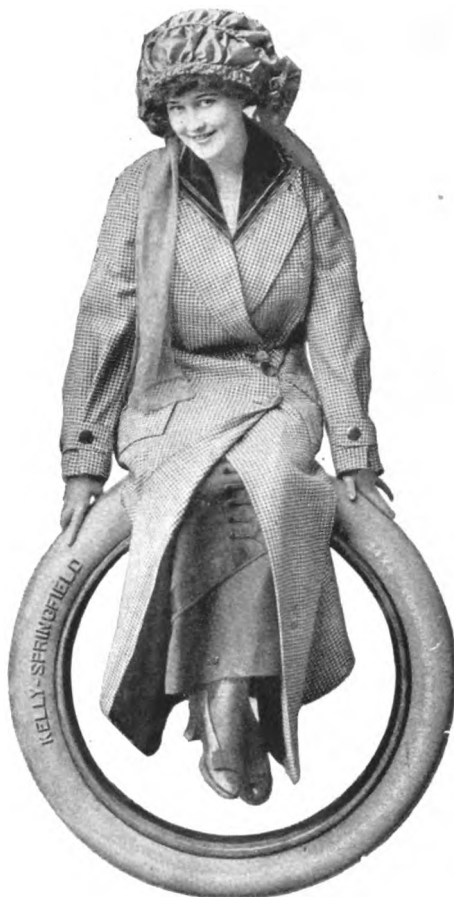
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 (See page 597.)

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 (See page 407.)
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 (See page 203.)

GEMCO—See Garage Equipment Mfg. Co.

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O-TAK-A Tire Remover, Le Roy, N. Y.
 (See page 389.)

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 (See page 605.)

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SMITH & Co., H. D., Plantsville, Conn. "Perfect Handle."

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STAR—See Carlson & Co.

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 (See page 551.)

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TIRE REMOVER



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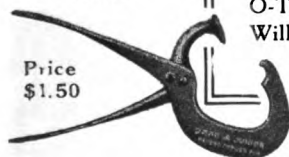
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(See page 325.)

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MOTCH & Merryweather Machinery Co., 707 Lakeside Ave., N. W., Cleveland, O.
"Misch."

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DAYTON Malleable Iron Co., Dayton, O.

FLEXIBLE Valve Remover Co., 110 W. Exchange St., Providence, R. I.
(See page 551.)

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(See page 203.)

GEMCO—See Garage Equipment Mfg. Co.

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HOADLEY, F. B., 479 Willow St., Waterbury, Conn.

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(See page 217.)

MERTZ Co., H. B., 1408 Rutherford Ave., Pittsburg, Pa.

MILWAUKEE Auto Specialty Co., 705-15 Chestnut St., Milwaukee, Wis. "Radium."
(See page 551.)

MORGAN, B., John St., Newport, R. I.
"Utility."

MOUND Tool & Scraper Co., 1203 S. Seventh St., St. Louis, Mo.
(See page 433.)

NATIONAL Jack & Mfg. Co., 130-32 S. Clinton St., Chicago, Ill. "Yarwood."

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(See page 519.)

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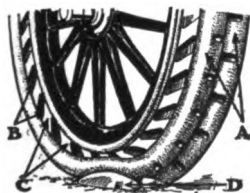
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- CAPITOL Body Co., Ray St. & Madison Ave., Indianapolis, Ind.
- CHANSLOR & Lyon Co., 945-47 S. Main St., Los Angeles, Cal.
- CHICAGO Carriage & Trimming Co., 1908 Indiana Ave., Chicago, Ill.
- CHICAGO Coach & Carriage Co., 1223-31 S. Michigan Ave., Chicago, Ill.
- COLLINGS Carriage Co., 108-14 N. Front St., Camden, N. J.
- COLLINS & Son, G. A., Main & Church Sts., Akron, O.
- COLUMBIA Tire & Top Co., 1014 Commonwealth Ave., Boston, Mass.
- CREAM City Trimming Co., 67-71 Juneau Ave., Milwaukee, Wis.
- DALLAS Buggy Top Co., 562 Main St., Dallas, Tex.
- DETROIT Motor Car Supply Co., 1280 Jefferson Ave., Detroit, Mich.
- ECKLAND Bros., 110½ Sixth St., S., Minneapolis, Minn.
- ELMWOOD Auto Top & Supply Co., 707 Main Ave., Elmwood Place, O.
- EMPIRE Auto Top & Supply Co., 1219-21 Michigan Ave., Chicago, Ill.
- ENNIS, W. G., 18 Cumberland St., Charleston, S. C.
- EUREKA Co., Rock Falls, Ill.
- FALLS City Buggy Top Co., 128-30 S. Floyd St., Louisville, Ky.
- FARNHAM & Nelson Co., 47 Union Ave., Boston, Mass.
- FEHRING Carriage Co., 601-09 Third St., Columbus, Ind.
- FRANK, W. H., 22-24 Harrison St., New Rochelle, N. Y.
- GATES Mfg. Co., Indianapolis, Ind.
- GATES-OSBORNE Mfg. Co., Marshalltown, Ia.
- GLOVER Equipment Co., Indianapolis, Ind.
(See page 335.)
- GOLDE-PATENT Mfg. Co., 509-15 W. 56th St., New York, N. Y. "Ideal."
- HAWES Storm Front Co., 14 N. Monroe St., Coldwater, Mich.
- HOLBROOK Co., 509-15 W. 56th St., New York, N. Y.
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- HOLCOMB Co., 105 Goffe St., New Haven, Conn.
- HUME Carriage Co., 1000 Commonwealth Ave., Boston, Mass.
- IDEAL—See Golde-Patent Mfg. Co.
- INDIANA Top & Vehicle Co., Lawrenceburg, Ind.
- INDIANAPOLIS Auto Top & Rubber Co., 909-17 E. Washington St., Indianapolis, Ind.
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- IRVIN Mfg. Co., R. J., Morris & Division Sts., Indianapolis, Ind.
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- JOHNSON Service Co., 149-53 Michigan St., Milwaukee, Wis.
- KETTERER Co., C. P., 211-15 W. 19th St., New York, N. Y.
- KEYSTONE Vehicle Co., Reading, Pa.
(See page 69.)
- KING Top Mfg. Co., Dayton, O.
- KROH Mfg. Co., C. Z., 1212-14 Jackson Ave., Toledo, O.
- LA DUE Auto Top Co., 1109 Monroe St., Toledo, O.
- LANE, T. W., Amesbury, Mass.
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- LONGDIN & Brugger Co., Fond-du-Lac, Wis.
- LOUD, Fred A., Franklin & Lansdowne Sts., Cambridge, Mass.
- McDONALD Bros., 1009-11 E. Pike St., Seattle, Wash.
- MANHATTAN Top & Body Co., 221-23 W. 64th St., New York, N. Y.
- MATT & Co., F., 491 Washington St., Newark, N. J.
- MEYER & Son, C. G., 18-20 Ann St., Tiffin, O.
- MICHIGAN Top Co., 313 Riopelle St., Detroit, Mich.
(See page 599.)
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- MONAHAN Vehicle Co., Kinsley Ave. & Eagle St., Providence, R. I.
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- REYNOLDS Mfg. Co., E. W., 709-11 S. 15th St., Omaha, Neb.
- ROBBINS & Co., Irvin, 11th & Canal Sts., Indianapolis, Ind.
(See page 77.)
- ROSS & Browne, 6127-29 Cottage Grove Ave., Chicago, Ill.
- RUCH Auto Top Co., Third & Sidney Aves., Mt. Vernon, N. Y.
- ST. LOUIS Top Co., 3025-29 Olive St., St. Louis, Mo.
- SARGENT & Ham Co., 26-30 Bowker St., Boston, Mass.
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- SCHREIBER Carriage Mfg. Co., Charlton, Ia.
- SCHUBERT Bros. Gear Co., 43 Cedar St., Oneida, N. Y.
(See page 73.)
- SEFFENS, Charles, Madison, Wis.
- SHIELDS Carriage Co., 11 Carriage Ave., Amesbury, Mass.
- SIEDER Mfg. Co., 31-33 E. Woodbridge St., Detroit, Mich.
- SIMON Auto Top Mfg. Co., S., 306--10 E. 17th St., Kansas City, Mo.
- SNOW, Newell H., 171 State St., Binghamton, N. Y.
- SNOW-MOSS Co., 127 W. 49th St., New York, N. Y.
- SPRAGUE Umbrella & Mfg. Co., Norwalk, O.
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- SPRINGFIELD Harness Co., 55-61 Dwight St., Springfield, Mass.
- SPRINGFIELD Metal Body Co., Springfield, Mass.
(See page 67.)
- STANDARD Top & Equipment Co., 1212 Huron Rd., Cleveland, O.
- STERLING Auto Top Co., 144 W. Congress St., Detroit, Mich.
- STONE & Sons, C., 1658-74 Ogden Ave., Chicago, Ill.
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- VESCO—See Vehicle Top & Supply Co.
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- WERNER & Sons, Geo., 1133-37 Main St., Buffalo, N. Y.
- WILLIAMS Top Co., 1814 Commerce St., Dallas, Tex.
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- WRIGHT & Co., C. E., Norfolk, Va.

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TRUCK TRAILERS

- DETROIT Trailer Co., 90 E. Woodbridge St., Detroit, Mich.
(See page 401.)
- TOLEDO Trailer Co., Buckeye & Terminal Belt Ry., Toledo, O.

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- COLORADO Tire & Leather Co., 1025 Broadway, Denver, Colo.
- DAVIS Robe & Armor Co., 8 N. State St., Chicago, Ill.
- ECONOMY Tread Co., 113 Lenox Ave., New York, N. Y.
- HERCULES—See Republic Rubber Tire & Shoe Co.
- KIMBALL Tire Case Co., 168 Broadway, Council Bluffs, Ia.
- LEATHER Tire Goods Co., Niagara Falls, N. Y. "Woodworth."
(See page 55.)
- MANSFIELD Tire & Rubber Co., Mansfield, O.
- MAPLEBAY Mfg. Co., Crookston, Minn.
- MILLER, Chas. E., 1400 S. Meridian St., Anderson, Ind.
- PACIFIC Leather Works, 239 12th St., Oakland, Cal.
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(See page 213.)

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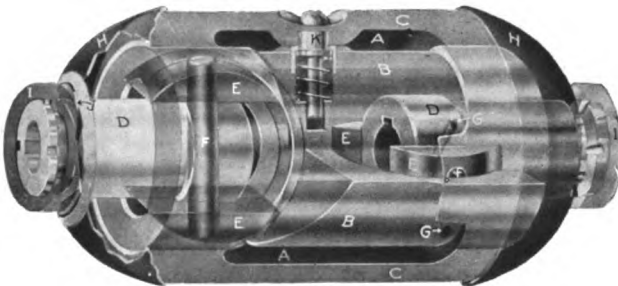
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(See page 81.)
- CARR Co., F. S., Boston, Mass.
(See page 123.)
- CHANDLER Oil Cloth & Buckram Co., East Taunton, Mass.
- CHASE & Co., L. C., Boston, Mass.
(See page 225.)
- CINCINNATI Cushion Co., 118 Opera Pl., Cincinnati, O.
- DUSENBERY & Co., Louis, 224 Fourth Ave., New York, N. Y.
- FINE Woolen Co., 58-60 Worth St., New York, N. Y.
- GALLAND, Wechmar & Co., 456 Fourth Ave., New York, N. Y.
- GERHAB, Jacob, 158-64 N. Third St., Philadelphia, Pa.
- GIFFORD & Son, John A., 25 Park Pl., New York, N. Y.
- HOOF Co., C. M., 317 W. Randolph St., Chicago, Ill.
- HORSTMANN Co., Wm. H., Fifth & Cherry Sts., Philadelphia, Pa.
- KENNEDY, Willing & Co., 524 Arch St., Philadelphia, Pa.
- LAILAW, Jr., Wm. R., 218-20 W. 47th St., New York, N. Y.
(See page 397.)
- LANDERS Bros. Co., Toledo, O.
(See page 233.)
- LOUNSBERY & Sons, G. H., 107-99 W. Third St., Cincinnati, O.
- MOSSMAN, Yarnelle & Co., Fort Wayne, Ind.
- NELSON Co., A. T. A., 2528 Colerain Ave., Cincinnati, O.
- NORRIS & Sons, R. W., 346-48 N. Gay St., Baltimore, Md.
- PARRY & Co., A. N., Amesbury, Mass.
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- ROEHM & Davison, Woodbridge & Wayne Sts., Detroit, Mich.
- ROGERS & Co., E. F., 410 Arch St., Philadelphia, Pa.
- SCHERER & Co., H., Detroit, Mich.
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- SHERWOOD, A. S., 754-56 Seventh Ave., New York, N. Y.
- SLOANE, W. & J., Fifth Ave. & 47th St., New York, N. Y.
- TEN EICK, Cornelius, 253 W. 47th St., New York, N. Y.
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- ATTWOOD Brass Works, 318-20 Bowery St., Grand Rapids, Mich.
(See page 595.)
- CHICAGO-RACINE Aluminum, Brass & Iron Works, 224-30 W. Huron St., Chicago, Ill.
(See page 607.)
- COWLES & Co., C., New Haven, Conn.
(See page 91.)
- CURRY Co., Joseph F., 475 Washington St., Newark, N. J.
- DOUGLAS & Lomason Co., Detroit, Mich.
- ENGLISH & Mersick Co., New Haven, Conn.
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- IMPERIAL Brass Mfg. Co., 440-52 S. Jefferson St., Chicago, Ill.
(See page 165.)
- METAL Stamping Co., 13th St. & Boulevard, Long Island City, N. Y.
- MONARCH Carriage Goods Co., 2838-44 Spring Grove Ave., Cincinnati, O.
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- SMITH & Co., Jow. N., Detroit, Mich.
(See page 201.)
- TAYLOR Co., H. D., 101-05 Oak St., Buffalo, N. Y.
- WESTERN Brass Mfg. Works, Marshall Blvd., 21st St. & C. B. & Q. R. R., Chicago, Ill.
(See page 85.)
- WHITE Mfg. Co., Bridgeport, Conn.
(See page 619.)
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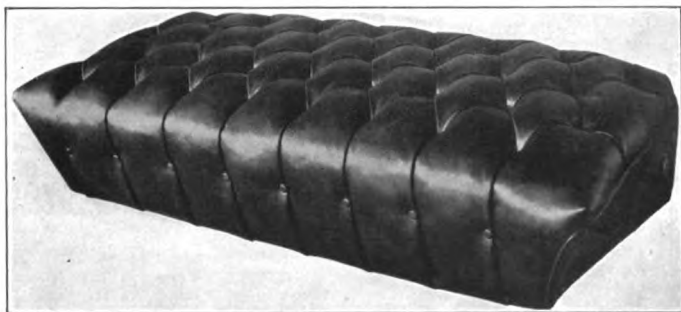
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 BATAVIA Rubber Co., Batavia, N. Y.
 BUFFALO Rubber Mfg. Co., Sussex Ave. & Erie R. R., Buffalo, N. Y.
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 CLOVER LEAF—See Howe Rubber Co.
 CONTINENTAL Rubber Works, Erie, Pa. (See page 341.)
 DIAMOND Rubber Co., Akron, O.
 EMPIRE Tire Co., Mulberry St. & Clinton Ave., Trenton, N. J.
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GOODYEAR Tire & Rubber Co., Akron, O.
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GORDON Rubber Co., Canton, O.

HOME Tire Co., Trenton, N. J.
(See page 401.)

HOOD Rubber Co., Watertown, Mass.

HOWE Rubber Co., New Brunswick, N. J.
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MATTSON Rubber Co., Lodi, N. J.
(See page 607.)

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SEAMLESS Rubber Co. of N. Y., 250 W. 54th St., New York, N. Y.
(See page 387.)

SLADE Mfg. Co., Providence, R. I.

STERLING—See Rutherford Rubber Co.

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(See page 393.)

TRIPLEX Tube Co., 19 Congress St., Boston, Mass.

TYER Rubber Co., Andover, Mass. "Tyrian."

TYRIAN—See Tyer Rubber Co.

UNITED States Tire Co., Broadway & 58th St., New York, N. Y.

VAIL-OSGOOD Rubber Products Co., 2131 Michigan Ave., Chicago, Ill.

VULCAN Rubber Co., W. Lake Rd., Erie, Pa.

ZEE Zee Tire & Rubber Co., 33d & Walnut Sts., Philadelphia, Pa.

SPEAKING TUBES

AUTOPHONE—See Inventors Aid & Mfg. Co.

BRIDGEPORT Coach Lace Co., 17th St. & Fourth Ave., New York, N. Y.
(See page 81.)

CHAU-PHONE—See Western Electric Co.

COLUMBIA—See Horstmann Co.

COWLES & Co., C., New Haven, Conn.
(See page 91.)

ENGLISH & Mersick Co., New Haven, Conn.

HORSTMANN Co., Wm. H., Fifth & Cherry Sts., Philadelphia, Pa. "Columbia."

INVENTORS Aid & Mfg. Co., 109 31st St., West New York, N. J. "Autophone."

PERPENTE Mfg. Co., State & Wall Sts., New Haven, Conn.

SCHLEGEL Mfg. Co., College Ave. & N. Goodman St., Rochester, N. Y.

STRONG, M. H., 168 South Ave., Rochester, N. Y.

WESTERN Electric Co., 463 West St., New York, N. Y. "Chau-Phone."

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ALUMINUM Co. of America, Pittsburg, Pa.

IVINS Tube Works, Elwood, Oak Lane Station, Philadelphia, Pa.

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AMERICAN Brass Co. (Ansonia Brass & Copper Branch), Ansonia, Conn.

AMERICAN Brass Co. (Coe Brass Branch), Torrington, Conn.

AMERICAN Brass Co. (Benedict & Burnham Branch), Waterbury, Conn.

AMERICAN Brass Co. (Waterbury Brass Branch), 26 Crane St., Waterbury, Conn.

AMERICAN Brass Co. (Kenosha Branch), Kenosha, Wis.

AMERICAN Tube Works, 10 Oliver St., Boston, Mass.

BALTIMORE Tube Co., Baltimore, Md.
(See page 403.)

BARCALO Mfg. Co., Buffalo, N. Y.

BRIDGEPORT Brass Co., P. O. Station 1., Bridgeport, Conn.
(See page 305.)

BUFFALO Copper & Brass Rolling Mill, Military Rd. & Hertel Ave., Buffalo, N. Y.

CHASE Rolling Mill Co., Waterbury, Conn.

CORNELIS & Gridley, Wolcott St., Waterbury, Conn.

DETROIT Copper & Brass Rolling Mills, Clark Ave. below Wabash R. R., Detroit, Mich.

ERIE-BUFFALO Tube Co., 17th & Cascade Sts., Erie, Pa.

FRENCH Mfg. Co., 142 Robbins St., Waterbury, Conn.

HORN Co., M. T., 82-86 Park Pl., New York, N. Y.

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 RANDOLPH-CLOWES Co., Waterbury, Conn.
 ROME Brass & Copper Co., Rome, N. Y.
 STANDARD Brass & Copper Tube Co., New London, Conn.
 UNIFORM Seamless Wire Co., 71 Peck St., Providence, R. I.
 UNITED Wire & Supply Co., 109 Summer St., Providence, R. I.
 WATERBURY Mfg. Co., Waterbury, Conn.
 WELLS & Co., A. H., Watertown Rd., Waterbury, Conn.

COPPER TUBING

(See Tubing, Brass and Copper)

DEALERS IN TUBING

(This is a list of Dealers in Tubing who advertise in this publication)

FRASSE & Co., Peter A., New York, N. Y.
 (See page 453.)
 MORRIS & Co., E. K., 311-17 W. Second St., Cincinnati, O.
 (See page 553.)
 RUTTER & Co., Arthur T., 256-57 Broadway, New York, N. Y.
 (See page 587.)

FIBRE TUBING

(See Fibre, Hard)

FLEXIBLE METALLIC TUBING

ALMOND Mfg. Co., T. R., 1 Maple Ave., Ashburnham, Mass.
 (See page 383.)
 AMERICAN Metal Hose Co., Waterbury, Conn.
 AUTOMOBILE Supply Mfg. Co., 220 Taaffe Pl., Brooklyn, N. Y.
 BALTIMORE Tube Co., Baltimore, Md.
 "Riflex."
 (See page 403.)
 BREEZE Carbureter Co., 250-52 South St., Newark, N. J.
 DUOFLEX—See Fischer Spring Co.
 FISCHER Spring Co., Chas., 88-90 Walker St., New York, N. Y. "Duoflex."
 LOMBARDI Motor Co., Derby, Conn.
 OSBORNE & Stephenson Mfg. Co., W. Main St., Plainville, Conn.
 (See page 569.)
 PENNFLEX—See Pennsylvania Flexible Metallic Tubing Co.
 PENNSYLVANIA Flexible Metallic Tubing Co., 17 Battery Pl., New York, N. Y. "Pennflex."

RIFLEX—See Baltimore Tube Co.
 RILEY-KLOTZ Mfg. Co., 17 Mulberry St., Newark, N. J.
 STANDARD Metal Mfg. Co., Newark, N. J.
 (See page 207.)
 U. S. Flexible Metallic Tubing Co., 450 E. Third St., Los Angeles, Cal.

HARD RUBBER TUBING

(See Rubber, Hard)

IRON-LINED BRASS TUBING

PHENIX Tube Co., 182 N. 11th St., Brooklyn, N. Y.
 ROME Mfg. Co., Railroad St., Rome, N. Y.

SOFT RUBBER TUBING

ACME Rubber Mfg. Co., Trenton, N. J.
 (See page 501.)
 BOSTON Woven Hose & Rubber Co., 110 Portland St., Cambridge, Mass.
 BOWERS Rubber Works, 68-70 Sacramento St., San Francisco, Cal.
 CALDWELL Mfg. Co., 1756 Cranston St., Providence, R. I.
 CANFIELD Rubber Co., Bridgeport, Conn.
 CINCINNATI Rubber Mfg. Co., Cincinnati, O.
 (See page 341.)
 COMBINATION Rubber Mfg. Co., Bloomfield, N. J.
 CONSOLIDATED Rubber Co., Trenton, N. J.
 CONTINENTAL Rubber Works, Erie, Pa.
 (See page 341.)
 DIAMOND Rubber Co., Akron, O.
 EMPIRE Rubber Mfg. Co., Trenton, N. J.
 ESSEX Rubber Co., Trenton, N. J.
 FEDERAL Rubber Mfg. Co., Milwaukee, Wis.
 GOODRICH Co., B. F., Akron, O.
 HAMILTON Rubber Mfg. Co., Trenton, N. J.
 HODGMAN Rubber Co., 876 Broadway, New York, N. Y.
 INDIANA Rubber & Insulated Wire Co., Jonesboro, Ind.
 LIBERTY Mfg. Co., East Norwalk, Conn.
 MATTSON Rubber Co., Lodi, N. J.
 (See page 607.)
 MECHANICAL Rubber Co., C. & P. & Nickel Plate R. R., Cleveland, O.
 MILFORD Rubber Works, Milford, Ill.
 MILLER Rubber Co., Akron, O.
 NATIONAL India Rubber Co., Bristol, R. I.
 NEW Jersey Car Spring & Rubber Co., Wayne & Brunswick Sts., Jersey City, N. J.
 NEW York Belting & Packing Co., 91 Chambers St., New York, N. Y.
 PARKER, Stearns & Co., 286 Sheffield Ave., Brooklyn, N. Y.
 PENNSYLVANIA Rubber Co., Jeannette, Pa.
 SEAMLESS Rubber Co. of N. Y., 250 W. 54th St., New York, N. Y.
 (See page 387.)



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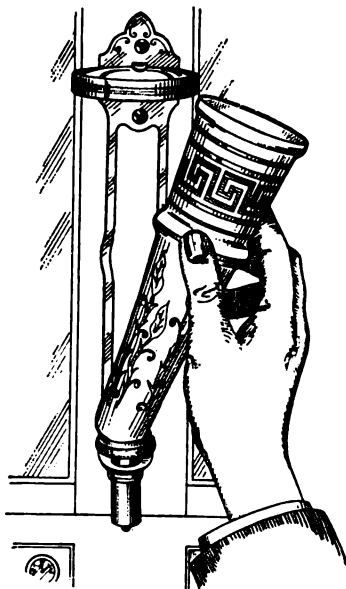
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(See page 611.)
- THERMOID Rubber Co., Trenton, N. J.**
(See page 393.)
- TYER Rubber Co., Andover, Mass.** "Tyrian."
- TYRIAN**—See Tyer Rubber Co.
- UNITED States Tire Co., Broadway & 58th St., New York, N. Y.**
- WALPOLE Tire & Rubber Co., Walpole, Mass.**

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- AMERICAN Tube & Stamping Co., Bridgeport, Conn.**
- BECKER Steel Co. of America, 90 West St., New York, N. Y.** (Importers.)
- DELAWARE Seamless Tube Co., Auburn, Pa.**
- DETROIT Seamless Steel Tubes Co., Detroit, Mich.**
(See page 673.)
- GLOBE Seamless Steel Tubes Co., Milwaukee, Wis.**
- IVINS Tube Works, Elwood, Oak Lane Station, Philadelphia, Pa.**
- KRUPP**—See Prosser & Son.
- NATIONAL Tube Co., Frick Bldg., Pittsburg, Pa.**
- OHIO Seamless Tube Co., Shelby, O.**
(See page 405.)
- PITTSBURG Seamless Tube Co., Beaver Falls, Pa.**
- PITTSBURGH Steel Products Co., Frick Annex, Pittsburg, Pa.**
- PROSSER & Son, Thomas, 15 Gold St., New York, N. Y.** (Importers.) "Krupp."
(See page 361.)
- STANDARD Steel Tube Co., Toledo, O.**
(See page 405.)
- STANDARD Welding Co., Cleveland, O.**
(See Book Mark.)

TURN-BUCKLES**WROUGHT TURN-BUCKLES**

- COLUMBUS Bolt Works, 162 W. Randolph St., Columbus, O.**
- DETROIT Screw Works, Detroit, Mich.**
(See page 653.)
- EBERHARD Mfg. Co., Cleveland, O.**
(See page 215.)
- GARAGE Equipment Mfg. Co., Milwaukee, Wis.** "Gemco."
(See page 203.)
- GEMCO**—See Garage Equipment Mfg. Co.
- HASKELL Mfg. Co., Wm. H., 451 Main St., Pawtucket, R. I.**
- HOOPES & Townsend Co Philadelphia, Pa.**

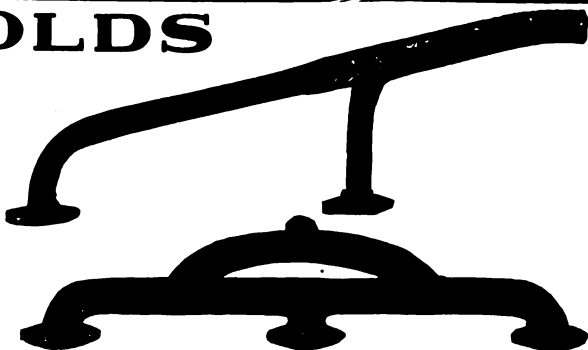
- KANSAS City Bolt & Nut Co. (Sheffield Station), Kansas City, Mo.**
- MERRILL Bros., Maspeth, N. Y.**
- MICHIGAN Bolt & Nut Co., ft. Meldrum Ave., Detroit, Mich.**
- NEW England Bolt & Steel Co., Bowdoin St. (Everett), Boston, Mass.**
- PAWTUCKET Mfg. Co., 327 Pine St., Pawtucket, R. I.**
- PENINSULAR Milled Screw Co., Champlain St. & Canton Ave., Detroit, Mich.**
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- LANSING Co., Lansing, Mich.**
- LINK-BELT Co., Indianapolis, Ind.**
(See page 651.)
- McKELVEY, R. J., 14 Fairview Heights, Rochester, N. Y.**
- NICOLS & Bro., George P., Chicago, Ill.**
- NORTHERN Engineering Works, 2 Chene St., Detroit, Mich.**
- NORWOOD**—See Automobile & Accessories Mfg. Co.
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- SMITH Co., H. Lund, 201 Paterson Ave., Paterson, N. J.**
- SMITH Iron Co., G. W. & F., Boston, Mass.**
- TURNER Machine Co., Danbury, Conn.**
(See page 435.)
- UNITED Casting Co., Wilson & Violet Sts., Los Angeles, Cal.**
- UNIVERSAL**—See Canton Foundry & Machine Co.
- WEAVER Mfg. Co., Springfield, Ill.**
(See page 215.)
- WERER Cycle & Supply Co., 6 E. Klowa St., Colorado Springs, Colo.**
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(See page 291.)

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(See page 165.)

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(See page 463.)

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(See page 407.)

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(See page 91.)

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(See page 373.)

GASOLOCK—See Auto Lock & Specialty Co.

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HILL—See Janney, Steinmetz & Co.

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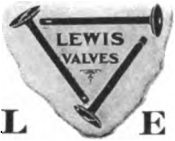
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(See page 379.)

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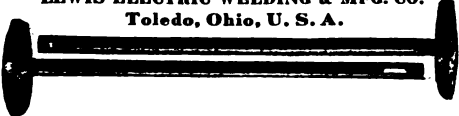
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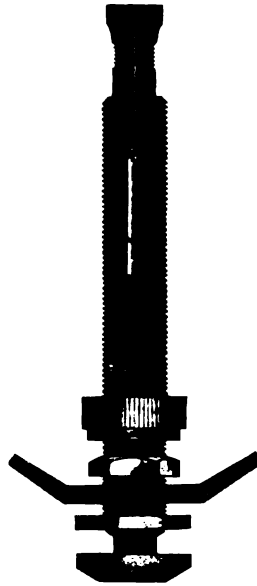
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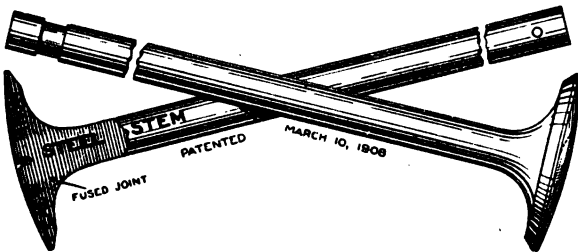
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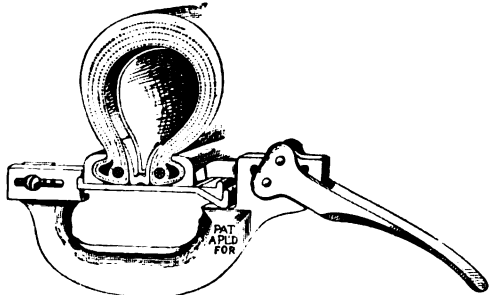
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FOWLER Lamp & Mfg. Co., 61 E. 24th St., Chicago, Ill.
(See page 409.)

G. P.—See Piel Co.

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(See page 203.)

GEMCO—See Garage Equipment Mfg. Co.

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HUSK—See Western Brass Works.

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(See page 329.)

LINCOLN Machine Shops, Lincoln, Ill.

LITTLE GIANT—See Herbert, W. H.

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(See page 551.)

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(See page 381.)

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(See page 209.)

POWELL, Muffler & Timer Co., 42 La Fayette St., Utica, N. Y.
(See page 267.)

RADIUM—See Milwaukee Auto Specialty Co.

RUDIE—See Findelsen & Kropf Mfg. Co.

RUDIE—See Western Brass Mfg. Works.

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(See page 85.)

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YANKEE Co., Utica, N. Y.
(See page 409.)

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(See page 407.)

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(See page 135.)

STANDARD Engineering Works, 59 Social St., Woonsocket, R. I. "Potter."

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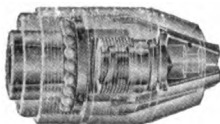
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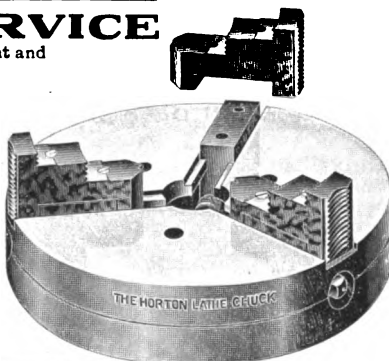


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(See page 393.)

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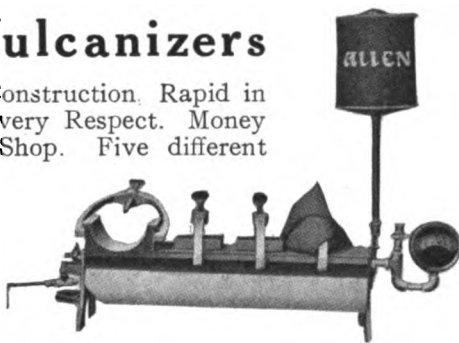
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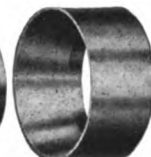
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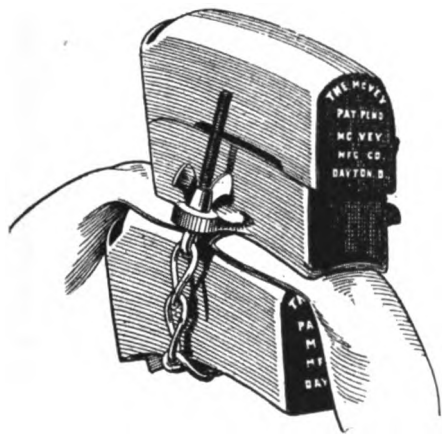
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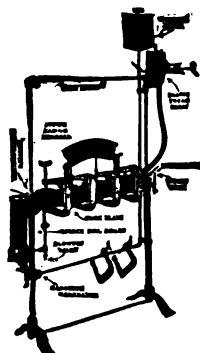
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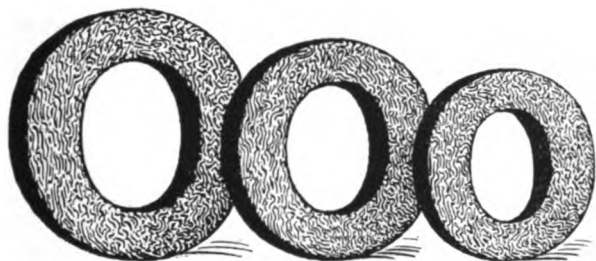
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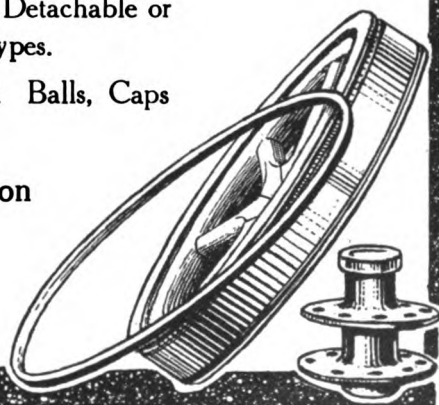
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 ATLAS Welding Works, 2424 Elizabeth Ave., Rahway, N. J.
 AUTOGENOUS Welding Equipment Co., 41 Bay St., Springfield, Mass.
 BIRMINGHAM Welding & Machinery Co., 118 S. 22d St., Birmingham, Ala.
 BOSSERT Co., Utica, N. Y.
 (See page 161.)
 BOURNOVILLE & Sons, Eug., 250-52 W. 64th St., New York, N. Y.
 CAPITOL Welding Co., 45-47 Sabin St., Providence, R. I.
 CROSBY Co., Buffalo, N. Y.
 (See page 157.)
 DELCAMPE Welding Co., 1517 Wood Ave., Bridgeport, Conn.
 DES MOINES Welding Co., 117-19 Grand Ave., Des Moines, Ia.
 ELLINGER Mfg. Co., Walter, 827 Pennsylvania Ave., Sheboygan, Wis.
 FUTTERMAN Welding System Co., 302-06 W. 53d St., New York, N. Y.
 GERLOFF, Chas. W., 300 Water St., Norfolk, Va.
 GREAT Lakes Welding Co., 937-45 West St., Cleveland, O.
 HENDERSON-WILLIS Welding & Cutting Co., 2024 Eugenie St., St. Louis, Mo.
 HUB Machine, Welding & Contracting Co., 22d & Race Sts., Philadelphia, Pa.
 JACOBS, F. L., 442 Guoin St., Detroit, Mich.
 METALS Welding Co., 4400 Perkins Ave., Cleveland, O.
 MICHIGAN Electric Welding Co., 514 Hart Ave., Detroit, Mich.
 (See page 572.)
 NATIONAL Welding & Mfg. Co., 1418-30 Niagara St., Buffalo, N. Y.
 NEW Bedford Welding Co., 177 N. Water St., New Bedford, Mass.
 NORTHERN Welding & Galvanizing Co., 2429 University Ave., S. E., Minneapolis, Minn.
 OHIO Welding & Mfg. Co., 828-30 W. Sixth St., Cincinnati, O.
 OREGON Welding & Mfg. Co., 305 Glisan St., Portland, Ore.
 OXY-ACETYLENE Welding Co., 1921 Grand Ave., Kansas City, Mo.
 OXY-CARBI Co., New Haven, Conn.
 PITTSBURGH Reinforced Brazing & Machine Co., 2525 Liberty Ave., Pittsburg, Pa.
 PREST-O-LITE Co., 1400 E. South St., Indianapolis, Ind.
 (See page 377.)
 PROVIDENCE Autogenous Welding & Mfg. Co., 291 Promenade St., Providence, R. I.

ROOK & Wright Co., 819 Jersey Ave., Jersey City, N. J.
 SANFORD Mfg. Co., F. C., Bridgeport, Conn.
 SCHAAP Automobile Co., 344 Cumberland St., Brooklyn, N. Y.
 SLOAN Engineering Co., 240-42 Hall St., Brooklyn, N. Y.
 SMITH & Co., W. R., 304-06 W. 52d St., New York, N. Y.
 SPARKS-WITHINGTON Co., Jackson, Mich.
 (See page 211.)
 STANDARD Welding & Mfg. Co., 951 Main St., Buffalo, N. Y.
 SUPERIOR Welding & Machine Co., Quintard Pl., Stamford, Conn.
 VULCAN Brazing & Machine Co., 312 N. 16th St., Philadelphia, Pa.
 WATERBURY Welding Co., Waterbury, Conn.
 (See page 581.)
 WATERHOUSE Welding Co., 6 Pelham St., Boston, Mass.
 WESTERN Drop Forge Co., Marion, Ind.
 (See page 197.)
 WESTERN Sheet Metal Mfg. Co., 503 Railroad Ave., Seattle, Wash.
 WESTERN Welding & Mfg. Co., 557 W. Jackson Blvd., Chicago, Ill.
 WORCESTER Pressed Steel Co., Worcester, Mass.
 (See page 157.)

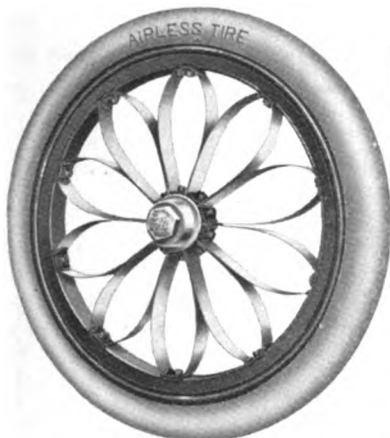
ELECTRIC WELDING

AKRON-SELLE Co., High & Chestnut Sts., Akron, O.
 BILLINGS & Spencer Co., Hartford, Conn.
 ELECTRIC Welding Products Co., Cleveland, O.
 (See page 573.)
 LEWIS Electric Welding & Mfg. Co., Toledo, O.
 (See page 407.)
 MICHIGAN Electric Welding Co., 514 Hart Ave., Detroit, Mich.
 (See page 572.)
 OAKES Co., Indianapolis, Ind.
 SPARKS-WITHINGTON Co., Jackson, Mich.
 (See page 211.)
 STANDARD Welding Co., Cleveland, O.
 (See Book Mark.)
 UNIVERSAL Welding Co., St. Anne, Ill.
 WORCESTER Pressed Steel Co. (Barbers Crossing), Worcester, Mass.

WHEELS

CAST STEEL WHEELS

FRASSE & Co., Peter A., New York, N. Y.
 (Importers.)
 (See page 453.)
 SHELDON Axle Co., Wilkes-Barre, Pa.
 (See pages 50 and 51.)



THE IDEAL RESILIENT STEEL WHEEL

eliminates the necessity for pneumatic tires and shock absorbers and makes any car run easier and smoother. It takes the strain off the suspension, cushions the driving shaft, the differential, the brakes and the entire motive and operative mechanism against sudden and excessive strains and increases their efficiency and life. It absorbs the shocks of traffic **before** they reach the axle (which is the sole medium of connection between periphery of wheels and suspension,) and thereby relieves the car of the most destructive strains of service. The Ideal Resilient Steel Wheel

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(See page 375.)

HOUK Co., Geo. W., 5001 Lancaster Ave., Philadelphia, Pa. "Rudge-Whitworth."

McCUE Co., Buffalo, N. Y.
(See page 293.)

MOTT Wheel Works, Utica, N. Y.
(See page 437.)

RUDGE-WHITWORTH—See Houk Co.

SPECIAL PNEUMATIC, SPRING AND EMERGENCY WHEELS

CONTINENTAL Spring Wheel & Vehicle Co., South Bend, Ind.

DURGIN Auto Wheel Co., Lawrence National Bank Bldg., Lawrence, Kans.

ELASTIC Wheel Co., Union Trust Bldg., Baltimore, Md.

IDEAL Steel Wheel Co., 1070 First National Bank Bldg., Cincinnati, O.
(See page 419.)

INDESTRUCTIBLE Wheel Co., 809 E. Walnut St., Lebanon, Ind. "Lofland."

JENKINS Emergency Wheel Co., Mutual Bldg., Richmond, Va.

JOHNSON Steel Wheel Corp., 30 Kemble St., Boston, Mass.

KELSEY Wheel Co., Detroit, Mich.

LEAP Resilient Wheel Co., 1025 W. Jackson Blvd., Chicago, Ill.

LEIB Yielding Wheel Co., Middletown, O.

LOFLAND—See Indestructible Wheel Co.

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AUTO Specialty Co., Toledo, O. "Campbell."

BENHAM Mfg. Co., 1882 Mt. Elliott Ave., Detroit, Mich.

BRISCOE Mfg. Co., Detroit, Mich.
(See pages 239 and 240.)

CAMPBELL—See Auto Specialty Co.

COLEMAN Mfg. Co., 679-85 Atwater St. E., Detroit, Mich.

DETROIT Steering Wheel & Wind Shield Co., Leib & Wight Sts., Detroit, Mich.

PERFECTION—See Prosser Engineering Co.

PROSSER Engineering Co., 2106 W. Superior Ave., Cleveland, O. "Perfection."

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WAYNE Cabinet Co., Detroit, Mich.

WIRE WHEELS

ASHLEY—See General Rim Co.

E.-C. Sales Co., 630 Postal Telegraph Bldg., Chicago, Ill.
(See page 375.)

GENERAL Rim Co., 1916 Broadway, New York, N. Y., "Ashley."

KELSEY Wheel Co., Detroit, Mich.

McCUE Co., Buffalo, N. Y.
(See page 293.)

MOTT Wheel Works, Utica, N. Y.
(See page 437.)

STE-ELASTIC—See Whiteside Wheel Co.

WHITESIDE Wheel Co., Canal & Tenth Sts., Indianapolis, Ind. "Ste-elastic."

WOOD WHEELS

ARCHIBALD Wheel Co., 150 West St., Lawrence, Mass.

AUTO Wheel Co., Lansing, Mich.
(See page 501.)

BALTIMORE Hub-Wheel & Mfg. Co., 326-32 N. Holliday St., Baltimore, Md.

BIMEL Spoke & Auto Wheel Co., Portland, Ind.
(See page 501.)

BUCKEYE Wheel Co., Gallon, O.

CENTRAL City Wheel Works, Plum & Willkinson Sts., Syracuse, N. Y.

DEFIANCE—See Turnbull Wagon Co.

EAMES & Co., A. M., South Framingham, Mass.

EBERLY & Orris Mfg. Co., Mechanicsburg, Pa.
(See page 615.)

EMPIRE Wheel Works, 174 South St., Utica, N. Y.

HAYES Wheel Co., Jackson, Mich.
(See page 443.)

HOOPES Bros. & Darlington, West Chester, Pa.

IMPERIAL-MOTT Department, Flint, Mich.
(See page 417.)

IMPERIAL Wheel Co., St. John & Hamilton Sts., Flint, Mich.

JAMESTOWN Wheel & Mfg. Co., Jamestown, N. Y.

JONES & Co., Phineas, Newark, N. J.
(See page 615.)

KELSEY Wheel Co., Detroit, Mich.

MEEKER Mfg. Co., Linden & Hoffman Aves., Dayton, O.

MILLAR Wheel Works, 3518-22 N. Clark St., Chicago, Ill.

MUNCIE Wheel Co., Muncie, Ind.
(See page 421.)

NEW Haven Carriage Co., New Haven, Conn.
(See page 73.)

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Wheels made by Bannister are the
BEST in Material and workmanship
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This is all we have to say about them
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Let us prove it to you.

We can.

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- PRUDDEN & Co., W. K., Lansing, Mich.
- SALISBURY Wheel & Mfg. Co., Jamestown, N. Y.**
(See page 549.)
- SCHWARZ Wheel Co., Margaret St. & Trenton Ave., Philadelphia, Pa.
- SHORTSVILLE Wheel Co., Shortsville, N. Y.
- STANDARD Wheel Co., Terre Haute, Ind.**
(See page 615.)
- TURNBULL Wagon Co., Defiance, O. "Defiance."
- WAVERLY Co., 139 S. East St., Indianapolis, Ind.
- WAYNE Wheel Co., Newark, N. Y.**
(See page 615.)
- WHEEL & Wood Bending Co., 141 John St., Bridgeport, Conn.
- ZWICK & Greenwald Wheel Co., Linden & Hoffman Sts., Dayton, O.

WHIPCORD**UPHOLSTERY WHIPCORD**

- AMERICAN Mills Co., 17th St. & Fourth Ave., New York, N. Y.**
(See page 81.)
- ROY Woolen Co., Watervliet, N. Y.
- WATERLOO Woolen Mfg. Co., Waterloo, N. Y.**

WHISTLES**EXHAUST WHISTLES**

(See Horns, Exhaust)

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- ESTES Mills, Fall River, Mass.
- HOFFMAN-CORR Mfg. Co., 150-52 Duane St., New York, N. Y.**
- HOOPER & Sons Co., Wm. E., Maryland Life Bldg., Baltimore, Md.
- LEES Mfg. Co., 320 Broadway, New York, N. Y.
- MASSASOIT Mfg. Co., Fall River, Mass.
- WESTPORT Mfg. Co., Fall River, Mass.

FELT LUBRICATOR WICKING

- BOOTH, N. E., 644 Pacific St., Brooklyn, N. Y.**
(See page 415.)

WICKS**LAMP WICKS**

- ANSONIA O. & C. Co., Ansonia, Conn.
- CONSOLIDATED Duck Co., 86 Worth St., New York, N. Y.
- HOOPER & Sons Co., Wm. E., Maryland Life Bldg., Baltimore, Md.
- LEES Mfg. Co., 320 Broadway, New York, N. Y.

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- CONSUMERS Paper Co., Detroit, Mich.
- DETROIT Sanitary Rag Co., 267 E. Hancock Ave., Detroit, Mich.
- FULTON Bag & Cotton Mills, Atlanta, Ga.
- HAGY Waste Works, J. Milton, 836-42 Swan-son St., Philadelphia, Pa.
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- LYMAN Co., John R., Springfield, Mass.
- MARCUS & Bro. Corp., M. H., 8-10 Woodworth Ave., Yonkers, N. Y.
- MILL Remnants Co., 102-04 Greenwich St., New York, N. Y.
- NORTH & Son, Jos. W., Sixth St., Elizabeth, N. J.
- REACH, A. L., 258 Purchase St., Boston, Mass.
- ROWACO—See Royal Waste Co.
- ROYAL Waste Co., 176 Federal St., Boston, Mass. "Rowaco."

WIRE**BOWDEN WIRE**

- BRETZ Co., J. S., 250 W. 54th St., New York, N. Y. (Importers.)**
(See page 681.)

INSULATED WIRE

- ACME Rubber Mfg. Co., Trenton, N. J.
(See page 501.)
- AMERICAN Electrical Works, Phillipsdale, R. I.
- AMERICAN Steel & Wire Co., 72 W. Adams St., Chicago, Ill.
(See page 487.)
- ATLANTIC Insulated Wire & Cable Co., 120 Liberty St., New York, N. Y.
- B. I. W.—See Boston Insulated Wire & Cable Co.
- BISHOP Gutta-Percha Co., 426 E. 25th St., New York, N. Y.**
(See page 423.)

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It will pay you to specify "BISHOP"***

BISHOP IGNITION CABLE positively will outlast any other make on the market. This is due to the way it is made and the material it is made from—new Para rubber so perfectly compounded and vulcanized that it will stand *double* the voltage ever required in service—impregnated with a special compound which makes it positive proof against heat, oil, grease and water—that's why it lasts. In addition to this impregnation of the rubber itself, we coat the Braided Cable with a superior flexible enamel, thoroughly baked on. Every foot is electrically tested before shipment.



TYPE	Diameter Millimeters	Approx. Weight per 1000 Ft.	List Prices per Ft.
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B	6	32 "	.07
C	7	60 "	.12
D	9	98 "	.16
E	10	110 "	.18
F	12	145 "	.25
G	12	132 "	.20
H	15	280 "	.45

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(See page 601.)

BOURN Rubber Co., 58 Warren St., Providence, R. I. "Star."

CRESCENT Insulated Wire & Cable Co.,
Olden Ave. & Taylor St., Trenton, N. J.

DIAMOND Rubber Co., Akron, O.

EAGLE—See Marion Insulated Wire & Rubber Co.

EMPIRE Tire Co., Mulberry St. & Clinton Ave., Trenton, N. J.

GENERAL Electric Co., Schenectady, N. Y.

GROSSMAN Co., Emil, 248-50 W. 54th St., New York, N. Y. "Red Rib."

HABIRSHAW Wire Co., 1 Madison Ave., New York, N. Y.

HAZARD Mfg. Co., Wilkes-Barre, Pa.

INDIANA Rubber & Insulated Wire Co.,
Jonesboro, Ind.

KERITE Insulated Wire & Cable Co., 30 Church St., New York, N. Y.

MARION Insulated Wire & Rubber Co.,
Eighth St., & Big Four Ry., Marion, Ind.
"Eagle."

NATIONAL India Rubber Co., Bristol, R. I.

NEW York Insulated Wire Co., 114 Liberty St., New York, N. Y.

OKONITE Co., 253 Broadway, New York, N. Y.

PACKARD Electric Co., 309 Dana Ave., Warren, O.
(See page 423.)

RED RIB—See Grossman Co.

ROEBLINGS Sons Co., John A., Trenton, N. J.

SAFETY Insulated Wire & Cable Co., 114 Liberty St., New York, N. Y.

SIMPLEX Wire & Cable Co., 201 Devonshire St., Boston, Mass.

STANDARD Rubber & Cable Co., Bridgeport, Conn.
(See page 611.)

STANDARD Underground Cable Co., Westinghouse Bldg., Pittsburg, Pa.

STAR—See Bourn Rubber Co.

PHOSPHOR BRONZE WIRE

AMERICAN Brass Co. (Benedict & Burnham Branch), Waterbury, Conn.

PHOSPHOR Bronze Smelting Co., 2200 Washington Ave., Philadelphia, Pa.
(See page 565.)

RIVERSIDE Metal Co., Riverside, N. J.

STEEL SPRING WIRE

AMERICAN Steel & Wire Co., 72 W. Adams St., Chicago, Ill.
(See page 487.)

FRASSE & Co., Peter A., New York, N. Y. (Importers.)
(See page 453.)

HELMUTH Co., L., 22 State St., New York, N. Y. (Importers.)

MORGAN Spring Co., Worcester, Mass.

ROEBLINGS Sons Co., John A. Trenton, N. J.

SPENCER Wire Co., Worcester, Mass.

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A complete index to classifications appears on pages 8 to 22



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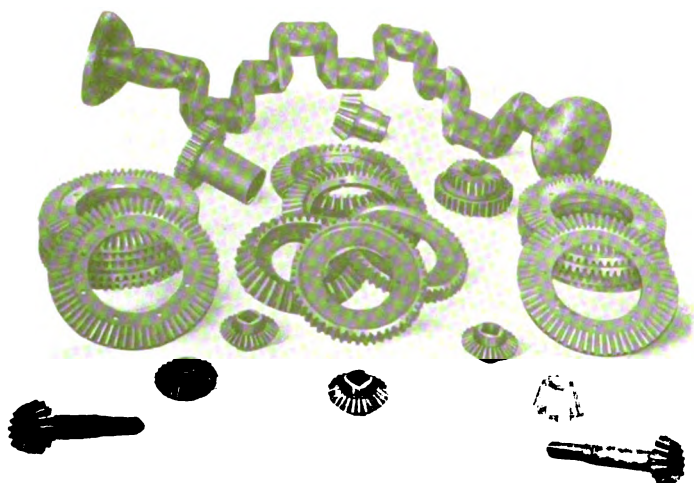
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PETER WRIGHT—See Wiebusch & Hilger.
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GLOBE Machine & Stamping Co., Cleve-
land, O.
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HENDERSON Bros., Waterbury, Conn.
NORTHERN Engineering Works, Detroit,
Mich.

PAXSON Co., J. W., 1019 N. Delaware
Ave., Philadelphia, Pa.
(See page 483.)

PERKINS Co., Henry, Bridgewater, Mass.

ROYERSFORD Foundry & Machine Co., Roy-
ersford, Pa.

STANDARD Machinery Co., Providence, R. I.
WHITING Foundry Equipment Co., Harvey,
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DAVIS Boring Tool Co., St. Louis, Mo.
DETROIT Twist Drill Co., 657-69 Fort
St., Detroit, Mich.
(See page 451.)
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KRIEGER Tool & Mfg. Co., Grand Rapids,
Wis.
MARVIN & Casler Co., Canastota, N. Y.
O. K. Tool Holder Co., Shelton, Conn.
READY Tool Co., Bridgeport, Conn. "Red-E."
RED-E—See Ready Tool Co.
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Haven, Conn.
UNIVERSAL Boring Machine Co., Hudson,
Mass.

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DIPPING BASKETS

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Complete Index to Classification appears on Pages 8 to 22.

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X L C R—See Excelsior Tool & Machine Co.

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CHESTER Mfg. Co., Chester, Conn.

CLARK'S—See Brown & Co.

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DEUSE, J. S., Chester, Conn.

FOREST City Bit & Tool Co., Rockford, Ill.

FORSTNER—See Progressive Mfg. Co.

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IRWIN Auger Bit Co., Wilmington, O.

IVES Mfg. Co., W. A., Wallingford, Conn. "Mephisto."

JENNINGS & Co., C. E., New York, N. Y.

KILBORN & Bishop Co., New Haven, Conn. "Lavigne."

LAVIGNE—See Kilborn & Bishop Co.

MEPHISTO—See Ives Mfg. Co.

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PROGRESSIVE Mfg. Co., Torrington, Conn. "Forstner."

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SNELL Mfg. Co., Fiskdale, Mass.

SWAN Co., Jas., Seymour, Conn.

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(For Hack Saw Frames—See Frames, Hack Saw)

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ARCHER Co., New Haven, Conn.

ARROW HEAD—See Jennings & Co.

ATKINS & Co., E. C., Indianapolis, Ind. "A. A. A."

BOSTON Saw & Tool Co., Boston, Mass. "Knoxall," "Champion."

CHAMPION—See Boston Saw & Tool Co.

CHROMOL—See Disston & Sons.

DIAMOND Saw & Stamping Works, Buffalo, N. Y. "Sterling."

DISSTON & Sons, Henry, Philadelphia, Pa. "Chromol."

ELLIS Co., New Haven, Conn.

EUREKA-YANKEE—See Thompson & Son Co.

GOODELL-PRATT Co., Greenfield, Mass.

GRIFFIN Co., G. W., Franklin, N. H.

JENNINGS & Co., C. E., New York, N. Y. "Arrow Head."

KNOXALL—See Boston Saw & Tool Co.

MASSACHUSETTS Saw Works, Chicopee, Mass. "Victor."

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STAPF & Co., John B., Dunkirk, N. Y.

STAR—See Millers Falls Co.

STERLING—See Diamond Saw & Stamping Works.

TT.—See Thompson & Son Co.

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VICTOR—See Massachusetts Saw Works.

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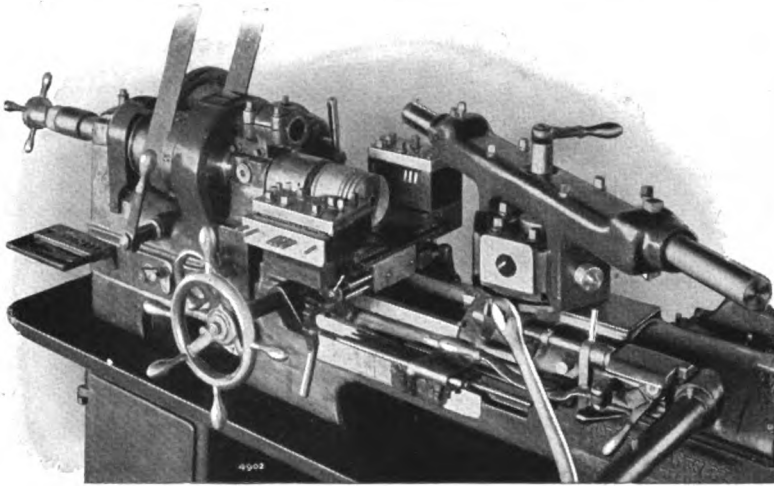
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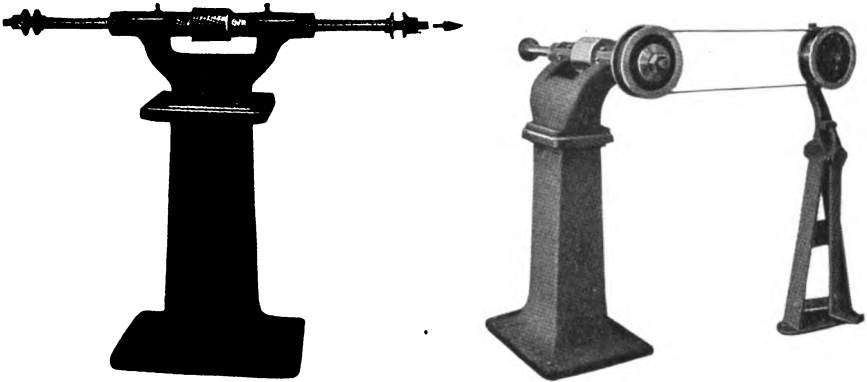
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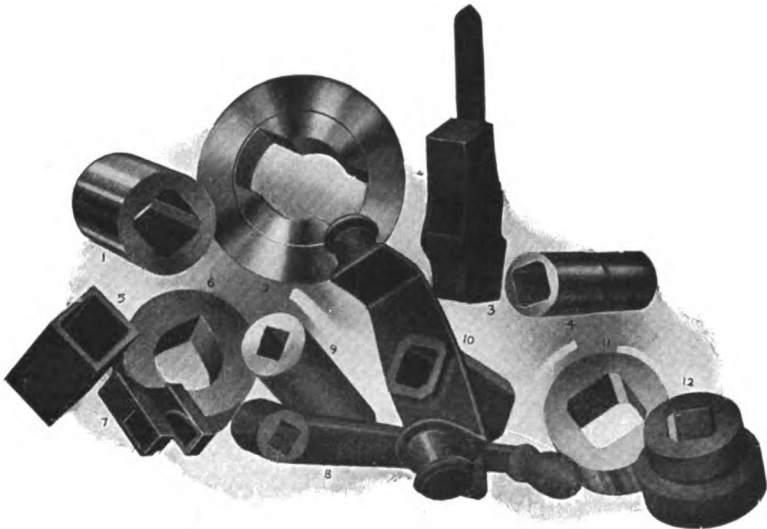
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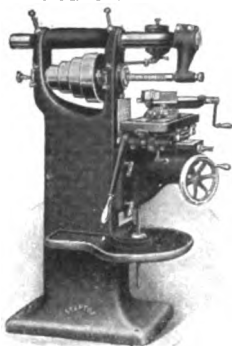
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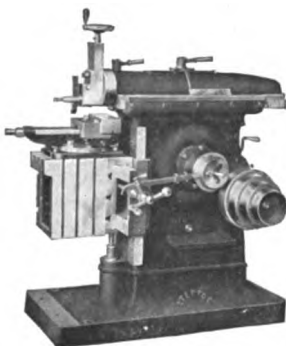


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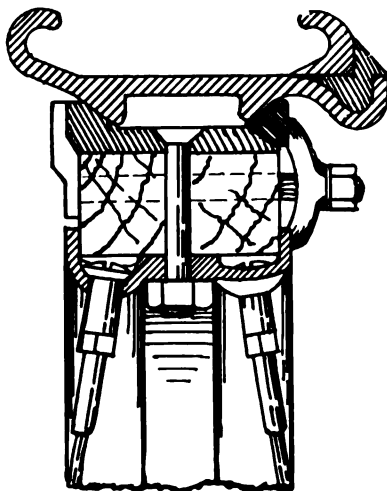
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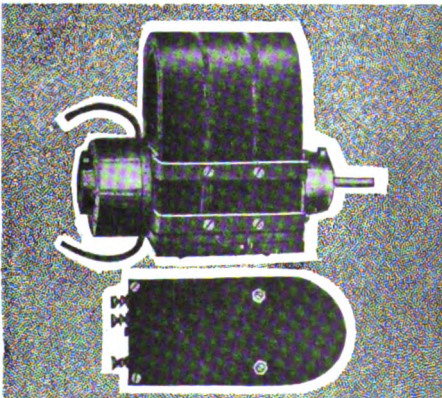
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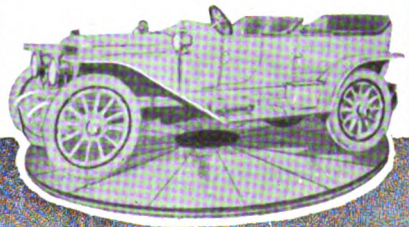
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 (See page 653.)
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 STEVENS Mfg. & Supply Co., Chicago, Ill.
 WAGNER—See C. & W. Specialty Co.

CLIPPERS**BOLT AND RIVET CLIPPERS**

(Hand Power)

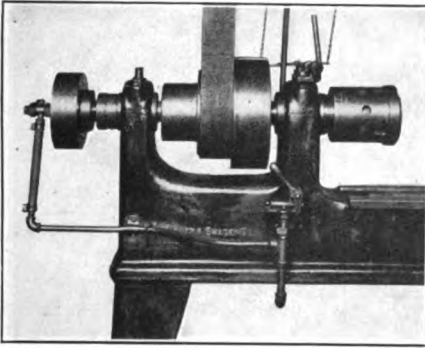
ALLEN-RANDALL—See Porter, H. K.
 CAROLUS Mfg. Co., Sterling, Ill.
 CHAMBERS Bros. Co., Philadelphia, Pa.
 COLUMBUS Bolt Works, Columbus, O.
 EASY—See Porter, H. K.
 ELM CITY—See Schollhorn Co.
 HELWIG Mfg. Co., St. Paul, Minn.
 METAL Stamping Co., Long Island City, N. Y.
 NEW EASY—See Porter, H. K.
 PECK, Stow & Wilcox Co., Southington, Conn.
 PORTER, H. K., Everett, Mass. "Easy,"
 "New Easy," "Allen-Randall."
 (See page 441.)
 ROBERTS Mfg. Co., Somerville, Mass. "Vic-
 tor."
 SCHOLLHORN Co., Wm., New Haven, Conn.
 "Elm City."
 VICTOR—See Roberts Mfg. Co.

RIVET CLIPPERS

(See Clippers, Bolt and Rivet)

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SYSTEMS**

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 BUFFALO Forge Co., Buffalo, N. Y.
 KNICKERBOCKER Co., Jackson, Mich.
 "Morse-Rarefied."
 MORSE-RAREFIED—See Knickerbocker Co.
 PANGBORN Co., Thomas W., P. O. Box 856
 Hagerstown, Md.
 (See page 485.)



THE AERO CHUCKS

are indispensable in the manufacture of Brass and Bronze Automobile parts. Carburetor Bodies and parts, Bronze Bushings, etc., are chucked to the best advantage in our Universal Two Jaw Chuck, the Hinge Collet and Special Air Operated Chucks.

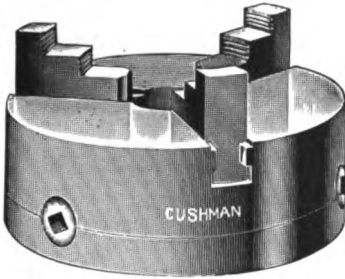
We are also builders of THE COLLAPSIBLE TAP, the only collapsible tap on the market that does not clog up with chips. Made in eleven sizes, with capacities from 15/32" to 3", including 1/4" to 2 1/2" iron pipe sizes.

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Our facilities and our corps of expert engineers are particularly fitted to carry out contracts at long time production.

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The machine will do better work and much more rapidly than can be done by any other machine on the market.

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 ACME—See Universal Fluxine Co.
 BANNER—See Cortland Specialty Co.
 BRAZIRON—See A. & J. Mfg. Co.
 CAST Iron Brazing & Mfg. Co., Manchester, N. H.
 CORTLAND Specialty Co., Cortland, N. Y. "Banner."
 DIXON Crucible Co., Joseph, Jersey City, N. J. (See page 187.)
 FLUXINE—See Krembs & Co.
 FRY, Keyser, Reading, Pa.
 HALL-THOMPSON Co., Hartford, Conn. "Wonder Worker."
 KREMBS & Co., Chicago, Ill. "Fluxine."
 LAFFITTE—See Phillips-Laffitte Co.
 NATIONAL Cement & Rubber Co., Toledo, O.
 PHILLIPS-LAFITTE Co., Philadelphia, Pa. "Laffitte."
 SCHNEIDER, Emil, Newark, N. J.
 STANDARD Brazing Co., Boston, Mass. "Tichon."
 STANDARD Mfg. Co., Chicago, Ill. "Superior."
 SUPERIOR—See Standard Mfg. Co.
 TICHON—See Standard Brazing Co.
 UNIVERSAL Fluxine Co., Urbana, O. "Acme."
 WELDWELL—See Westinghouse Electric & Mfg. Co.
 WESTINGHOUSE Electric & Mfg. Co., Pittsburgh, Pa. "Weldwell."
 WONDER WORKER—See Hall-Thompson Co.

BUFFING AND POLISHING COMPOUNDS

B & L—See Backus & Leaser Co.
 BACKUS & Leaser Co., 410-12 W. 13th St., New York, N. Y. "B. & L." (See page 441.)
 BENNETT-O'CONNELL Co., Chicago, Ill. "Mascot."
 CROWN—See Geneva Buff & Polish Co.
 DETROIT Foundry Supply Co., Detroit, Mich.
 DIXON, Wm., New York, N. Y.
 EBONITE—See Geneva Buff & Polish Co.
 GENEVA Buff & Polish Co., Geneva, N. Y. "Crown," "Ebonite."
 LYMAN Co., John R., Springfield, Mass.
 MASCOT—See Bennett-O'Connell Co.
 MATCHLESS Metal Polish Co., New York, N. Y. "White-Diamond."
 STEVENS, Frederic B., Larned & Third Sts., Detroit, Mich. "White Rose," "White Columbia." (See pages 503 and 504.)
 WHITE COLUMBIA—See Stevens, Frederic B.
 WHITE-DIAMOND—See Matchless Metal Polish Co.
 WHITE ROSE—See Stevens, Frederic B.

CASE HARDENING COMPOUNDS

ACHILLES—See Houghton & Co.
 BLACK DIAMOND—See Rogers & Hubbard Co.
 BLAICH, Alfred O., 1956 Clybourn Ave., Chicago, Ill. (See page 441.)
 CARBO—See Rodman Chemical Co.
 HOUGHTON & Co., E. F., Philadelphia, Pa. "Achilles," "Pearlite."
 IDEAL Case Hardening Compound Co., New York, N. Y.
 KALUX—See Metal Hardening Solution Co.
 METAL Hardening Solution Co., Rochester, N. Y. "Kalux."
 MOSSO, C. A., Chicago, Ill.
 PARK Chemical Co., Detroit, Mich. "Wood-sides."
 PEARLITE—See Houghton & Co.
 PETTINOS Bros., Bethlehem, Pa.
 PORTLAND—See Rogers & Hubbard Co.
 RODMAN Chemical Co., East Pittsburg, Pa. "Carbo."
 ROGERS & Hubbard Co., Middletown, Conn. "Black Diamond," "Standard," "Portland."
 *STANDARD—See Rogers & Hubbard Co.
 STERLINGWORTH Charcoal Co., Boston, Mass.
 V. D.—See Van Doren Mfg. Co.
 VAN Doren Mfg. Co., Chicago Heights, Ill. "V. D."
 VINCENT Steel Products Co., Detroit, Mich.
 WOODSIDES—See Park Chemical Co.

CORE COMPOUNDS

DETROIT Foundry Supply Co., Detroit, Mich. "Eureka."
 EBONY—See Hill & Griffith Co.
 EUREKA—See Detroit Foundry Supply Co.
 GLUTRIN—See Robeson Process Co.
 HILL & Griffith Co., Cincinnati, O. "Ebony," "Linoline."
 HOLLAND Linseed Oil Co., Chicago, Ill.
 KING KORE KOMPOUND—See Stevens, Frederick B.
 LINOLINE—See Hill & Griffith Co.
 MILLS Mfg. Co., H. E., Syracuse, N. Y.
 OBERMAYER Co., S., Cincinnati, O.
 PAXSON Co., J. W., 1019 N. Delaware Ave., Philadelphia, Pa. (See page 483.)
 ROBESON Process Co., Au Sable Forks, N. Y. "Glutrin."
 STEVENS, Frederic B., Larned & Third Sts., Detroit, Mich. "King Kore Kom-pound." (See pages 503 and 504.)

POLISHING COMPOUNDS

(See Compounds, Buffing and Polishing)

Complete Index to Classification appears on Pages 8 to 22.



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THE STANDARD NOW AND ALWAYS

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Three Styles—Five Sizes. Meet Every Need.

H. K. PORTER, Bolt Clipper Specialist
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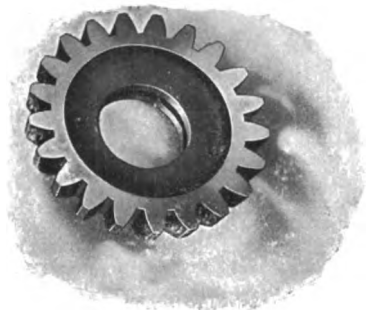
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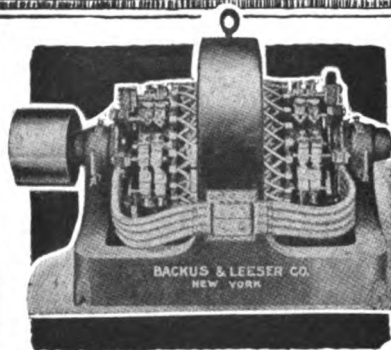


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which uses a ground generating cutter. In addition to cutting faster and turning out smoother gears than any other machine, it planes cluster and internal gears from the solid blank. A very large per cent of all automobile gears are cut on the Gear Shaper.

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CORTLAND Welding Compound Co., Cortland, N. Y.
 DINGEE, Mont. H., Lynchburg, Va. "Spar-ger's."
 KREMBS & Co., Chicago, Ill. "Weldine."
 SPARGER'S—See Dingee, Mont. H.
 WELDINE—See Krembs & Co.

COUNTERBORES

AMERICAN Die & Tool Co., Reading, Pa.
 CLEVELAND Twist Drill Co., Cleveland, O.
 (See pages 451 and 497.)
 CLOUGH, R. M., Tolland, Conn.
 KENDRICK & Davis Co., Lebanon, N. H.
 MORSE Twist Drill & Machine Co., New Bedford, Mass.
 (See page 579.)
 NATIONAL Twist Drill & Tool Co., Detroit, Mich.
 PRATT & Whitney Co., Hartford, Conn.
 (See page 429.)
 WELLS & Son Co., F. E., Greenfield, Mass.

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 BRAUNSDORF-MUELLER Co., Elizabeth, N. J.
 BRUBAKER & Bros., W. L., Millersburg, Pa.
 CINCINNATI Tool Co., Norwood, O. "Har-grave."
 CLEVELAND Twist Drill Co., Cleveland, O.
 (See pages 451 and 497.)
 DETROIT Twist Drill Co., 657-69 Fort St., Detroit, Mich.
 (See page 451.)
 DEUSE, J. S., Chester, Conn.
 DIAMOND—See Whitman & Barnes Mfg. Co.
 HARGRAVE—See Cincinnati Tool Co.
 JOHNSON, Wm., Newark, N. J.
 KENDRICK & Davis Co., Lebanon, N. H.
 KILBORN & Bishop Co., New Haven, Conn.
 LIGHTNING—See Wiley & Russell Mfg. Co.
 LITTLE GIANT—See Wells Bros. Co.
 LOWENTRAUT Mfg. Co., P., Newark, N. J.
 MAYHEW Co., H. H., Shelburne Falls, Mass.
 MORSE Twist Drill & Machine Co., New Bedford, Mass.
 (See page 579.)
 NATIONAL Twist Drill & Tool Co., Detroit, Mich.
 PRATT & Whitney Co., Hartford, Conn.
 (See page 429.)
 SNELL Mfg. Co., Fishdale, Mass.

STANDARD Tool Co., Cleveland, O.
 STARRETT Co., L. S., Athol, Mass.
 SWAN Co., Jas., Seymour, Conn.
 SYRACUSE Twist Drill Co., Syracuse, N. Y.
 TUCK Mfg. Co., Brockton, Mass.
 VAUGHAN & Bushnell Mfg. Co., Chicago, Ill.
 WELLS Bros. Co., Greenfield, Mass.
 "Little Giant."
 (See page 513.)
 WELLS & Son Co., F. E., Greenfield, Mass.
 WHITMAN & Barnes Mfg. Co., Akron, O.
 "Diamond."
 WILEY & Russell Mfg. Co., Greenfield, Mass.
 "Lightning."

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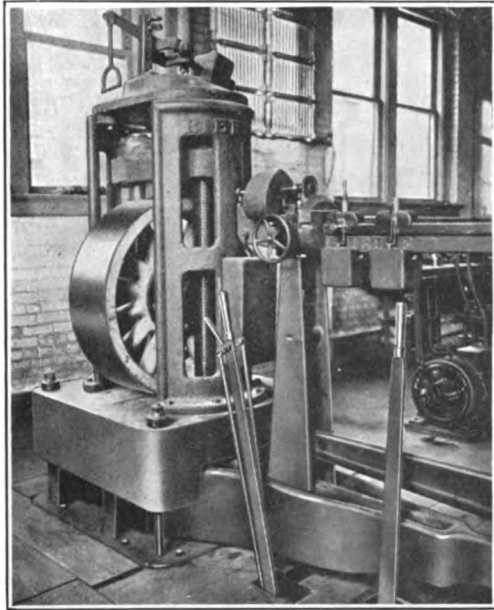
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ACME—See Moore Co.
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 CAMERON Engineering Co., Washington, N. J.
 CANTON Foundry & Machine Co., Canton, O.
 CHISHOLM & Moore Mfg. Co., Cleveland, O.
 "Cyclone."
 CYCLONE—See Chisholm & Moore Mfg. Co.
 FORD Chain Block & Mfg. Co., Philadelphia, Pa. "Tribloc."
 FRANKLIN Portable Crane & Hoist Co., Franklin, Pa.
 HARRINGTON Son & Co., Edwin, Philadelphia, Pa. "Peerless."
 IMPERIAL—See Ingersoll-Rand Co.
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 INGERSOLL-RAND Co., 11 Broadway, New York, N. Y. "Imperial."
 (See page 457.)
 LAFAYETTE Engineering Co., Lafayette, Ind.
 (See page 445.)
 MILTON & Son, S. G., Franklin, Pa.
 (See page 445.)
 MOORE Co., Franklin, Winsted, Conn.
 "Acme," "Imperial."
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 WESTON—See Round & Son.
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 (See page 235.)

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CAN ONLY MEAN

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*Automobile
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“Attention”*

*“They Stood
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S.A.E. Standard 40"x5" Dual. Tested for Direct Loading. Elastic Limit 140,075 lbs.

Test made under personal supervision of Prof. C. J. Tilden, C. E., of University of Michigan. Write us for further data. Our engineers and designers are at your disposal

It is by means of our efficient corps of timber buyers, choosing and contracting the wood before it is cut; a thoroughly equipped and up-to-date factory, superintended by skilled millwrights of 24 years' experience in the manufacture of wheels; accurate, reliable executive and engineering forces, that we are able to quote you intelligently on any style of pleasure or truck wheels.

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- BARTLEY Crucible Co., Jonathan, Trenton, N. J.
 BRIDGEPORT Crucible Co., Bridgeport, Conn.
 DIXON Crucible Co., Joseph, Jersey City, N. J.
 (See page 187.)
 GAUTIER & Co., J. H., Jersey City, N. J.
 McCULLOUGH-DALZELL Crucible Co., Pittsburgh, Pa.
 PAIGE Retort & Crucible Co., Taunton, Mass.
 ROSS-TACONY Crucible Co., Philadelphia, Pa.
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 NEWTEN—See Northern Engineering Works.
 NORTHERN Engineering Works, Detroit, Mich. "Newten."
 PAXSON Co., J. W., 1019 N. Delaware Ave., Philadelphia, Pa.
 (See page 483.)
 WHITING Foundry Equipment Co., Harvey, Ill.

CUTTERS

BAR CUTTERS

(See Cutters, Rod and Bar)

GASKET CUTTERS

(See Cutters, Washers and Gasket)

MILLING CUTTERS

- AMERICAN Die & Tool Co., Reading, Pa.
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 BOKER & Co., Herman, New York, N. Y. (Importers.)
 BROWN & Sharpe Mfg. Co., Providence, R. I.
 CLEVELAND Twist Drill Co., Cleveland, O.
 (See pages 451 and 497.)
 CLOUGH, R. M., Tolland, Conn.
 DETROIT Twist Drill Co., 657-69 Fort St., Detroit, Mich.
 (See page 451.)

- HUTHER Saw Works, Rochester, N. Y.
 INGERSOLL Milling Machine Co., Rockford, Ill.
 LINCOLN-WILLIAMS Twist Drill Co., Taunton, Mass.
 MICHIGAN Twist Drill Co., Detroit, Mich.
 MORSE Twist Drill & Machine Co., New Bedford, Mass.
 (See page 579.)
 NATIONAL Tool Co., Cleveland, O.
 NATIONAL Twist Drill & Tool Co., Detroit, Mich.
 PRATT & Whitney Co., Hartford, Conn.
 (See page 429.)
 ROGERS Works, John M., Gloucester City, N. J.
 STANDARD Tool Co., Cleveland, O.
 UNION Twist Drill Co., Athol, Mass.
 UNIVERSAL Boring Machine Co., Hudson, Mass.
 WHITNEY Mfg. Co., Hartford, Conn.
 (See page 647.)

PIPE CUTTERS

(Hand Power)

- ARMSTRONG Mfg. Co., Bridgeport, Conn.
 AYES & Co., Chicago, Ill. "Barnes," "Saunders."
 BARNES—See Ayes & Co.
 BARNES—See Collmer Bros.
 BARNES Tool Co., New Haven, Conn.
 COLLMER Bros., South Bend, Ind. "Barnes," "Saunders."
 ERIE Tool Works, Erie, Pa.
 HOLLANDS Mfg. Co., Erie, Pa.
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 OSWEGO Tool Co., Oswego, N. Y.
 REED Mfg. Co., Erie, Pa.
 SAUNDERS—See Ayes & Co.
 SAUNDERS—See Collmer Bros.
 SAUNDERS Sons, D., Yonkers, N. Y.
 TRIMO—See Trimont Mfg. Co.
 TRIMONT Mfg. Co., Roxbury, Mass.
 "Trimont."
 (See page 521.)
 WELLS & Son Co., F. E., Greenfield, Mass.

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 "Regent."
 BRAUNSDORF-MUELLER Co., Elizabeth, N. J.
 MARVEL—See Armstrong-Blum Mfg. Co.
 MERWIN Mfg. Co., Erie, Pa. "Vulcan."
 REGENT—See Bennet & Co.
 SCHATZ Mfg. Co., Poughkeepsie, N. Y.
 VULCAN—See Merwin Mfg. Co.

PORTABLE CRANE AND HOIST

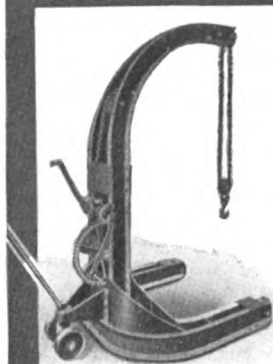
Notice the long easy curve of columns. This gives great strength to our cranes. Pinions supplied are strengthened by a heavy shroud, and never break. Metal in bed-plate is much heavier at the end where columns are joined on. This is the weak place in many cranes resulting in bed-plates being frequently broken. By means of crank handle the bed-plate is allowed to rest on the axle outside of the front wheels, when handle is thrown up, thus locking the crane in position. ALL MACHINES HAVE ROLLER BEARINGS.

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High enough and powerful enough to lift any car, low enough to be conveniently operated in any factory—these are the earmarks of our portable garage crane, and you cannot afford to be without one.

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We are qualified by experience and by the magnitude and equipment of our plant to be specialists of the highest grade in all kinds of automobile accessories

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SPARK PLUGS

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 BUFFALO Forge Co., Buffalo, N. Y.
 SHUSTER Co., F. B., New Haven, Conn.
 STANDARD Machinery Co., Providence, R. I.
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 BRAUNSDORF-MUELLER Co., Elizabeth, N. J.
 CINCINNATI Tool Co., Norwood, O. "Hargrave."
 COOPER—See Bonney Vise & Tool Works.
 GOODELL-PRATT Co., Greenfield, Mass.
 HARGRAVE—See Cincinnati Tool Co.
 HOGGSON & Pettis Mfg. Co., New Haven, Conn.
 JOHNSON, Wm., Newark, N. J.
 KRAEUTER & Co., Newark, N. J.
 LOWENTRAUT Mfg. Co., P., Newark, N. J.
 MOUND Tool & Scraper Co., 1203 S. Seventh St., St. Louis, Mo. (See page 433.)
 ROSE, J. A., Hastings, Neb.
 SMITH, Otis A., Rockfall, Conn.
 STORTZ & Son, John, Philadelphia, Pa.

WOOD FORMING CUTTERS

SHIMER & Sons, Samuel J., Milton, Pa.

DIES

SCREW CUTTING DIES

(See Taps and Dies)

DIVIDERS

DIVIDERS AND CALIPERS

(See Calipers and Dividers)

DOGS

LATHE DOGS

ARMSTRONG Bros. Tool Co., Chicago, Ill.
 BESLY & Co., Charles H., Chicago, Ill. (See page 465.)
 BILLINGS & Spencer Co., Hartford, Conn.
 BONNEY Vise & Tool Works, Allentown, Pa.

COLLMER Bros., South Bend, Ind. "Le Count."

LE COUNT—See Collmer Bros.

LE COUNT, Wm. G., South Norwalk, Conn.

MARK Mfg. Co., Chicago, Ill.

O. K. Tool Holder Co., Shelton, Conn.

OSWEGO Tool Co., Oswego, N. Y.

PHOENIX Hardware Co., Buffalo, N. Y.

UNION Elevator & Machine Co., Chicago, Ill.

WEST Steel Casting Co., Cleveland, O.

WESTERN Tool & Mfg. Co., Springfield, O. (See page 471.)

WILLIAMS & Co., J. H., Brooklyn, N. Y.

DOWELS

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BENSKIN Mfg. Co., Canton, O. "Perfect."

BUTLER, A. G., New York, N. Y.

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EVERETT & Son, A., Auburn, N. Y.

KNIGHT & Son, H. W., Seneca Falls, N. Y.

MORSE, Frank W., Boston, Mass.

PAXSON Co., J. W., 1019 N. Delaware Ave., Philadelphia, Pa. (See page 483.)

PERFECT—See Benskin Mfg. Co.

SHANAFELT Mfg. Co., Canton, O.

TIMMIS & Clissold, Bound Brook, N. J.

WELLMAN Pattern-Supply Co., Cleveland, O.

WINKLEY Co., Detroit, Mich. (See page 255.)

DRESSERS

EMERY WHEEL DRESSERS

BALDWIN, Tuthill & Bolton, Grand Rapids, Mich.

BAY State Stamping Co., Worcester, Mass. "Bennett."

BENNETT—See Bay State Stamping Co.

BRAUNSDORF-MUELLER Co., Elizabeth, N. J.

BROWNE & Dowd Mfg. Co., Meriden, Conn.

CALDER, Geo. H., Lancaster, Pa.

CHALLENGE Machine Co., Philadelphia, Pa.

CHICAGO Screw Co., Homan Ave. & Fillmore St., Chicago, Ill. (See page 217.)

CLIZBE Bros. Mfg. Co., Plymouth, Ind. "Crown."

COLLMER Bros., South Bend, Ind. "Huntington."

COLUMBUS Bolt Works, Columbus, O.

CROWN—See Clizbe Bros. Mfg. Co.

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To save time in the delivery of freight or passengers, to negotiate all kinds of hills and roads in all kinds of weather and to enjoy the advantage of speed without the handicap of *hurry*—these are some of the considerations that have induced so many manufacturers of high grade cars to adopt

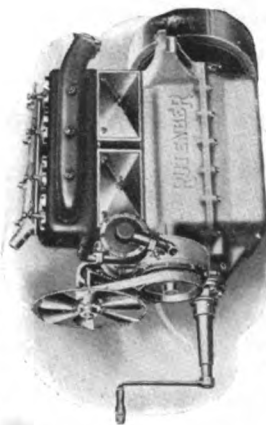
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There is no truck so heavy but what there is a Rutenber Motor perfectly adapted to its requirements; not a runabout or roadster but what there is a type of Rutenber Motor precisely suited to its needs.

More than a score of the leading pleasure and commercial cars of this year are giving daily evidence of this fact.

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(Continued)**

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"Huntington."
(See page 653.)

DIAMO-CARBO—See Desmond-Stephan Mfg. Co.

DIAMOND Saw & Stamping Works, Buffalo, N. Y. "Sterling."

ERIE Tool Works, Erie, Pa.

HUNTINGTON—See Collmer Bros.

HUNTINGTON—See Desmond-Stephan Mfg. Co.

HUNTINGTON—See Detroit Screw Works.

HUNTINGTON—See Mark Mfg. Co.

MARK Mfg. Co., Chicago, Ill. "Huntington."

OSGOOD, J. L., Buffalo, N. Y.

PENINSULA Emery Wheel Co., Detroit, Mich.

REED Mfg. Co., Erie, Pa.

ROBSON Mfg. Co., Galesburg, Ill.

SHERMAN—See Desmond-Stephan Mfg. Co.

STANDARD Tool Co., Cleveland, O.

STEPHAN Co., John E., Chicago, Ill.

STERLING—See Diamond Saw & Stamping Works.

STERLING Emery Wheel Mfg. Co., Tiffin, O.

STRICKLAND, E. M., Detroit, Mich.

WRIGLEY Co., Thomas, Chicago, Ill.

DRILLS**BREAST DRILLS**

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McCLELLAN—See Lancaster Machine & Knife Works.

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PECK, Stow & Wilcox Co., Southington, Conn.

TURNER & Deegan, Bristol, Conn.
(See page 671.)

YANKEE—See North Bros. Mfg. Co.

CENTERING DRILLS

CLEVELAND Twist Drill Co., Cleveland, O.
(See pages 451 and 497.)

SLOCOMB Co., J. T., Providence, R. I.

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CARVER—See American Electric Tool Co.

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(See page 39.)

CINCINNATI Electrical Tool Co., Cincinnati, O. "Peerless."

CLARK, Jr., Electric Co., James, 520 W. Main St., Louisville, Ky. "Willey."
(See page 453.)

COATES Clipper Mfg. Co., Worcester, Mass.

DEER Co., A. J., Hornell, N. Y. "Royal."

DUNTLEY—See Chicago Pneumatic Tool Co.

GEM Mfg. Co., Pittsburg, Pa.

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STANDARD Electric Tool Co., Cincinnati, O.
(See page 453.)

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TEMCO Electric Motor Co., Leipsic, O.

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(See page 449.)

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(See page 471.)

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PRATT & Whitney Co., Hartford, Conn.
(See page 429.)

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(See page 519.)

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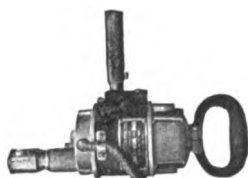
LITTLE GIANT—See Noyes & Co.

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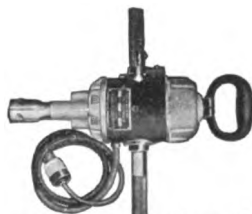
NOYES & Co., B. B., Greenfield, Mass. "Little Giant."

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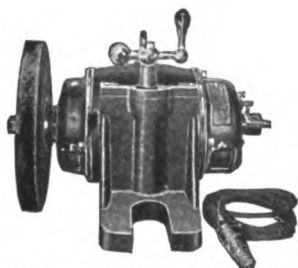
$\frac{1}{4}$ " drill, weight 9 pounds.



$\frac{3}{8}$ " drill, weight 14 pounds



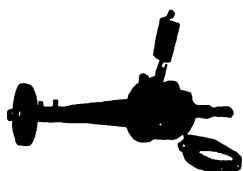
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PACKER—See Billings & Spencer Co.
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PARKER Co., Charles, Meriden, Conn. (See page 517.)
PECK, Stow & Wilcox Co., Southington, Conn.
PRATT & Whitney Co., Hartford, Conn. "Renshaw." (See page 429.)
RENSHAW—See Pratt & Whitney Co.
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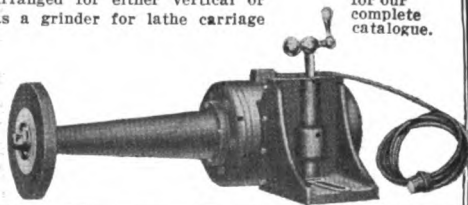
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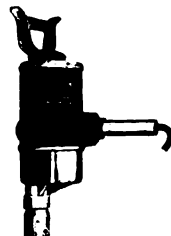
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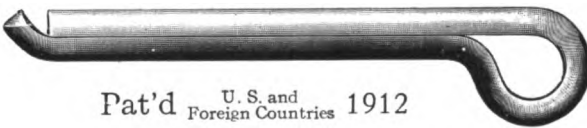
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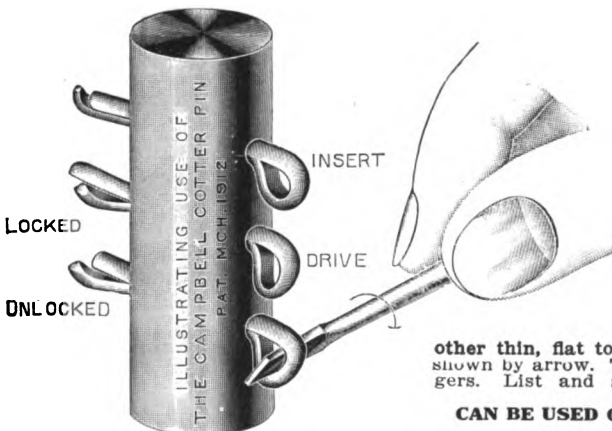
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 (See page 483.)
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 (See pages 503 and 504.)
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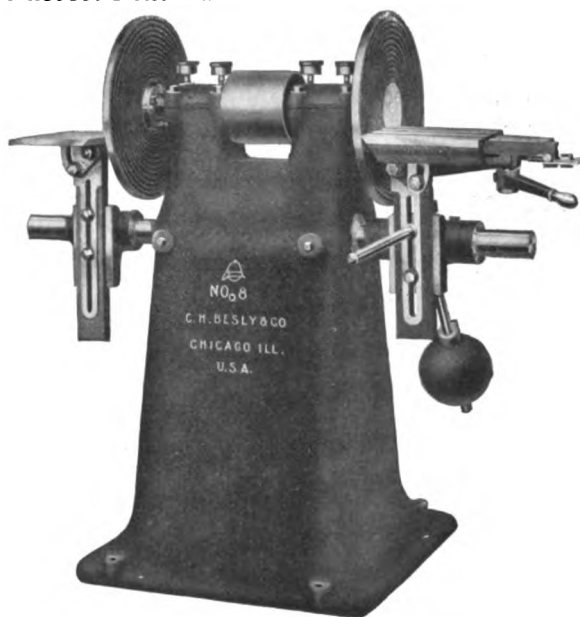
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 (See page 647.)

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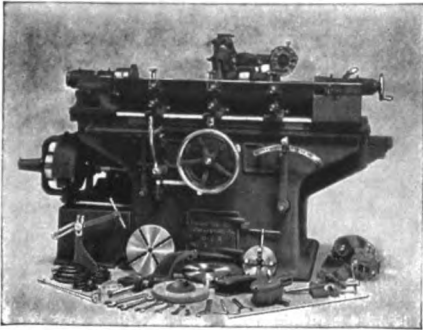
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Landis Plain Grinding Machines:—For line bearings of crank shafts—cam shaft bearings—valves (straight portion), push rods—pistons—piston rings—transmission shafts—axles, etc.



Landis Crank Grinder

Landis Crank Grinding Machine:—Capacity for single and multiple throw crank shafts with throws up to 8" single and 6" multiple.



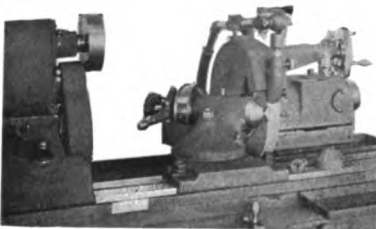
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Landis Universal Grinding Machines:—For valves (straight and taper portions), magnetos—piston rings (face grind), besides for tools—jigs, bushings, etc. This machine grinds—straight or taper internal or external—and is adapted for use with attachments such as magnetic chuck—valve seat grinding attachment—cam grinding attachment—cutter attachments, etc.

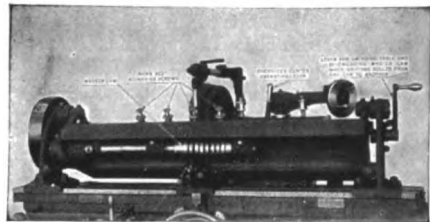


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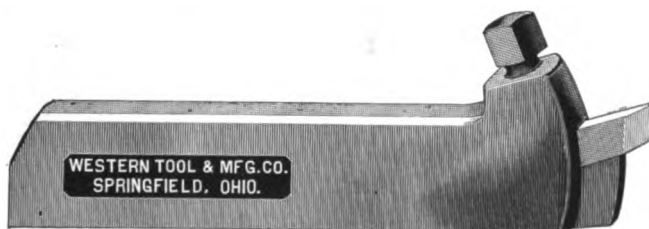
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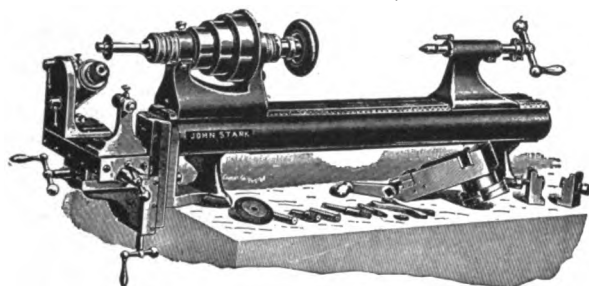
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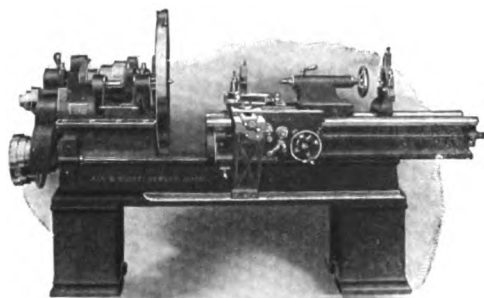
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(See page 429.)

RAHN-LARMON Co., Cincinnati, O.

REED-PRENTICE Co., Worcester, Mass.

SPRINGFIELD Machine Tool Co., Springfield, O.

STEINLE Turret Machine Co., Madison, Wis.

WALCOTT & Wood Machine Tool Co., Jackson, Mich.

WARNER & Swasey Co., Cleveland, O.

WELLS & Son Co., F. E., Greenville, Mass.

WOOD Turret Machine Co., Brazil, Ind.

WOODWORKING LATHES

AMERICAN Saw Mill Machinery Co., New York, N. Y.

AMERICAN Woodworking Machinery Co., Rochester, N. Y.

CORDESMAN-RECHTIN Co., Cincinnati, O.

DEFIANCE Machine Works, Defiance, O.

FAY & Egan Co., J. A., Cincinnati, O.

FAY & Scott, Dexter, Me.

FOX Machine Co., Grand Rapids, Mich.

GREAVES, Klusman & Co., Cincinnati, O.

OBER Mfg. Co., Chagrin Falls, O.

OLIVER Machinery Co., Grand Rapids, Mich.

PORTER Machinery Co., C. O., Grand Rapids, Mich.

POWER & Co., L., Philadelphia, Pa.

ROBBINS Machine Co., Worcester, Mass.

SMITH Machine Co., H. B., Smithville, N. J.

VALLEY City Machine Works, Grand Rapids, Mich.

LETTERS**PATTERN LETTERS**

BENSKIN Mfg. Co., Canton, O. "Perfect."

BLISS Mfg. Co., E. C., 91 Sabin St., Providence, R. I.
(See page 595.)

BRIM, A. W., Seneca Falls, N. Y.

BUTLER, A. G., New York, N. Y.

CLEVELAND Galvanizing Works Co., Cleveland, O.

DIAMOND Clamp & Flask Co., Richmond, Ind.

EVERETT & Son, A., Auburn, N. Y.

KNIGHT & Son, H. W., Seneca Falls, N. Y.

PERFECT—See Benskin Mfg. Co.

SHANAFELT Mfg. Co., Canton, O.

TIMMIS & Clissold, Bound Brook, N. J.

WELLMAN Pattern-Supply Co., Cleveland, O.

LEVELS**SPIRIT LEVELS**

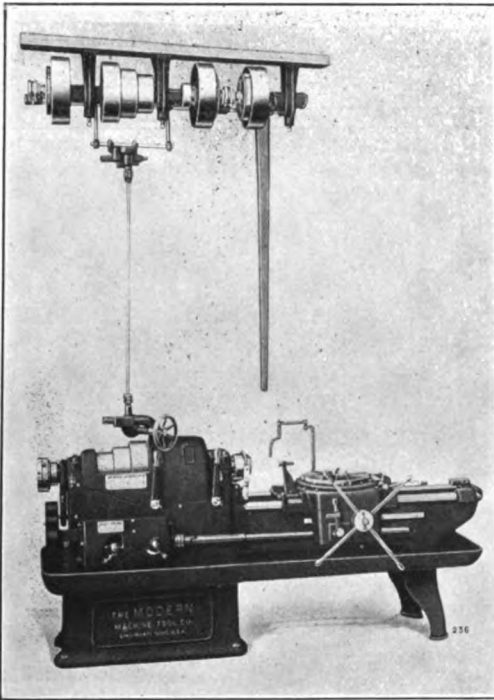
ATHOL Machine Co., Athol, Mass.

CHAPIN-STEPHENS Co., Pine Meadow, Conn.

COLUMBIA—See Smith, E. G.

COOK—See Gould & Jackson.

DISSTON & Sons, Henry, Philadelphia, Pa.



THE MODERN FLAT TURRET LATHE

**2¼" x 26" is the
LATFST AND BEST**

In the "Modern" we offer the very latest in flat turret lathe design and construction.

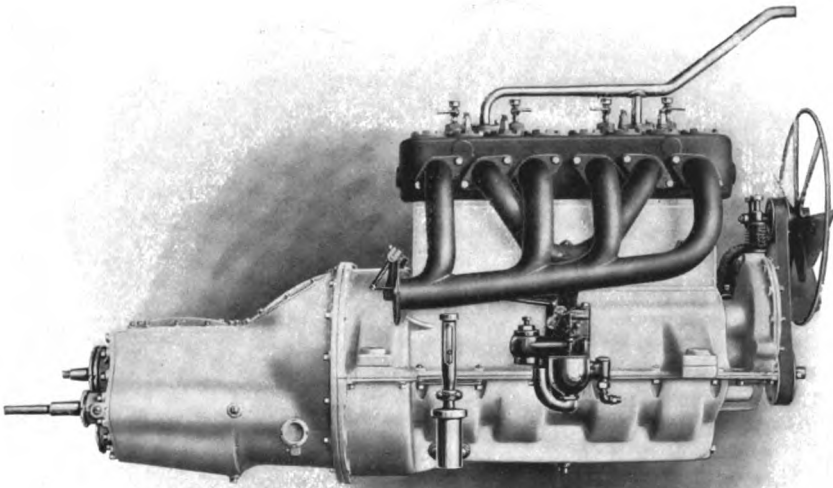
A lathe giving instantaneous change of speeds, with all parts extra heavy, insuring absolute rigidity and a capacity for handling extra sized gangs of tools; also for taking heavy cuts easily and without chatter. Variable speeds may be obtained in infinitesimal progression, with all handles, levers and wheel conveniently located for operation. In other words, we offer:

Accuracy, Power, Convenience, Manipulation, Simplicity, Strength, Durability, Rapidity and Economical Production for the Owner.

*Write for Complete Descriptive Matter.
Investigate at Once. Delays are Expensive.*

The Modern Machine Tool Co.

4659-4661 Spring Grove Avenue
CINCINNATI, OHIO



Plain or Unit 4 Cyl. cast en bloc 3½ x 5", also Plain or Unit 4 Cyl. cast en bloc 4½ x 5½"

We make a specialty of these two motors

3 Bearing off-set crank-shaft. Finest alloy metals

Our plant is equipped with the most modern machinery obtainable

Sandusky Auto Parts & Motor Truck Co.

Sandusky, Ohio.

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LEVELS (Continued)

SPIRIT LEVELS (Continued)

GOODELL-PRATT Co., Greenfield, Mass.
 GOULD & Jackson, Watertown, N. Y. "Cook."
 SMITH, E. G., Columbia, Pa. "Columbia."
 STANLEY Rule & Level Co., New Britain, Conn.
 STARRETT Co., L. S., Athol, Mass.

LOCKERS

METAL CLOTHES LOCKERS

BUFFALO Wire Works Co., Buffalo, N. Y.
 CARPENTER-McWATERS Co., Cleveland, O.
 CLARK Co., W. J., Salem, O.
 DAHLSTROM Metallic Door Co., Jamestown, N. Y.
 DARBY & Sons Co., Edward, Philadelphia, Pa.
 DURAND-STEEL Locker Co., Chicago, Ill.
 FEDERAL Steel Fixture Co., Chicago, Ill.
 HART & Cooley Co., New Britain, Conn.
 HETTS Co., Detroit, Mich.
 LYON Metallic Mfg. Co., Aurora, Ill.
 MANUFACTURING, Equipment & Engineering Co., Boston, Mass.
 MERRITT Co., Camden, N. J.
 NEW BRITAIN Machine Co., New Britain, Conn.
 SMITH Wire & Iron Works, F. P., Chicago, Ill.
 TERRELL'S Equipment Co., Grand Rapids, Mich.
 VAN Dorn Iron Works, Cleveland, O.

LUBRICANTS

CUTTING LUBRICANTS

CASTLE Lubricant Co., New York, N. Y. "Royal."
 FOOTE, Pierson & Co., New York, N. Y. "Lubria."
 LUBRIA—See Foote, Pierson & Co.
 ROYAL—See Castle Lubricant Co.

MACHINERY

DEALERS IN MACHINERY

(This is a list of Dealers in Machinery who advertise in this Publication)

FRASSE & Co., Peter A., New York, N. Y. (See page 453.)
 MONTGOMERY & Co., 105-07 Fulton St., New York, N. Y. (See page 459.)
 PRENTISS Tool & Supply Co., 149 Broadway, New York, N. Y. (See page 473.)

SAND MIXING AND CONVEYING MACHINERY

BARBOUR-STOCKWELL Co., Cambridgeport, Mass.
 PANGBORN Co., Thomas W., P. O. Box 856, Hagerstown, Md. (See page 485.)
 SELLERS Co., Wm., Philadelphia, Pa.
 STANDARD Sand & Machine Co., Cleveland, O.

MACHINES

ABRASIVE METAL CUTTING MACHINES

SLACK Mfg. Co., Springfield, Vt.

AUTOGENOUS WELDING MACHINES

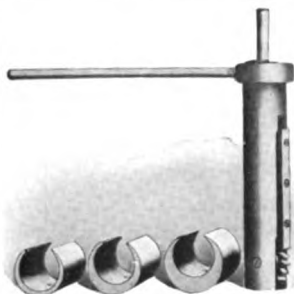
AMERICAN Welding & Auto Repair Co., St. Louis, Mo.
 BUCKEYE—See MacLeod & Co.
 DAVIS Acetylene Co., Elkhart, Ind.
 DAVIS-BOURNONVILLE Co., New York, N. Y.
 DELCAMPE Welding Co., Bridgeport, Conn.
 ECONOMY Welding Machine Co., Kansas City, Mo.
 GOODYEAR, Nelson, New York, N. Y.
 MACLEOD & Co., Walter, Cincinnati, O. "Buckeye."
 OXWELD Acetylene Co., Chicago, Ill.
 OXY-CARBI Co., New Haven, Conn.
 PREST-O-LITE Co., 1400 E. South St., Indianapolis, Ind. (See page 377.)
 ROOK & Wright Co., Jersey City, N. J.
 SANFORD Mfg. Co., F. C., Bridgeport, Conn.
 SCHAAP Automobile Co., Brooklyn, N. Y.
 WATERHOUSE Welding Co., Boston, Mass.
 WELD-IT-ALL Co., Wichita, Kans.
 WESTERN Sheet Metal Mfg. Co., Seattle, Wash.
 WESTERN Welding & Mfg. Co., Chicago, Ill.

BLUE PRINTING MACHINES

BUCKEYE Engine Co., Salem, O. (See page 579.)
 KEUFFEL & Esser Co., Hoboken, N. J.
 PEASE Co., C. F., Chicago, Ill.
 REVOLUTE Machine Co., New York, N. Y.

BOLT HEADING MACHINES

ACME Machinery Co., Cleveland, O.
 AJAX Mfg. Co., Cleveland, O.
 BROWN Co., H. B., East Hampton, Conn. "Davis."
 BURDICT—See Howard Iron Works.
 COOK Co., Asa S., Hartford, Conn.
 DAVIS—See Brown Co.



The keyways milled with the National Keyseater possess all the properties that are required of keyways. They are central, proper width and depth, parallel with axis of bore and one is a duplicate of the other.

The tools are made in the standard sizes most commonly used from $\frac{3}{8}$ " to $3\frac{1}{2}$ ".

By the use of Bushings many diameters of bores can be keywayed with one tool.

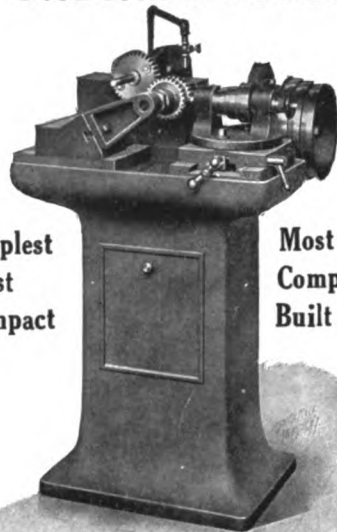
The keyseater can be made to mill double keyways so that the second keyway is milled directly opposite the first.

Taper keyways in straight holes and taper keyways in taper holes can also be milled.

All of the above are performed on your drill press. Let us send you our booklet.

National Machine Tool Company
128-130 Opera Place, CINCINNATI, OHIO

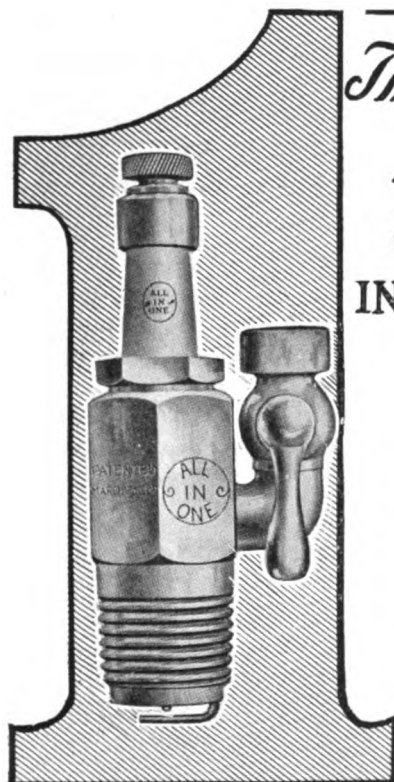
The Rochester Automatic GEAR TOOTH ROUNDING MACHINE



**Simplest
Most
Compact**

**Most
Complete
Built**

United States and Foreign Patents applied for
Will cut spur gears, internal gears, multiple gears on same shaft, special gears, etc. Its simplicity is sure to attract you, as will also the nominal cost.
Full particulars and specifications upon request.
INGLE MACHINE Co., Rochester, N. Y.



The **ALL-IN-ONE** **SPARK PLUG** **INSURES PERFECT IGNITION**

The one spark plug that gives perfect satisfaction, does not soot, and cannot burn out.

ALL-IN-ONE SPARK PLUGS are made of the best imported porcelain, perfectly handled by expert workmen. To clean the contact points, you simply pour gasoline into the priming cup and the carbon deposit is blown out into the air at each discharge of the motor. Invest \$1.50 now and save trouble and expense in future.

Frontier Specialty Co.
BUFFALO, N. Y.

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 NATIONAL Machinery Co., Tiffin, O.
 NEW Doty Mfg. Co., Jamesville, Wis.
 NILES-BEMENT-POND Co., New York, N. Y.
 PAWTUCKET Mfg. Co., Pawtucket, R. I.

BOLT POINTING MACHINES

ACME Machinery Co., Cleveland, O.
 BROWN Co., H. B., East Hampton, Conn. "Merriman."
 BURDICT—See Howard Iron Works.
 COOK Co., Asa S., Hartford, Conn.
 HOWARD Iron Works, Buffalo, N. Y. "Burdiet."
 LANDIS Machine Co., Waynesboro, Pa.
 MERRIMAN—See Brown Co.
 NATIONAL Machinery Co., Tiffin, O.
 NILES-BEMENT-POND Co., New York, N. Y.
 PAWTUCKET Mfg. Co., Pawtucket, R. I.
 WEBSTER & Perks Tool Co., Springfield, O.

BOLT THREADING MACHINES

ACME Machinery Co., Cleveland, O.
 BROWN Co., H. B., East Hampton, Conn. "Merriman."
 BURDICT—See Howard Iron Works.
 COOK Co., Asa S., Hartford, Conn.
 FOOTE-BURT Co., Cleveland, O. "Reliance."
 GREEN RIVER—See Wiley & Russell Mfg. Co.
 HERCULES—See Wells & Son Co.
 HOWARD Iron Works, Buffalo, N. Y. "Burdiet."
 LANDIS Machine Co., Waynesboro, Pa.
 LITTLE GIANT—See Wells Bros. Co.
 MERRIMAN—See Brown Co.
 MUMMERT-DIXON Co., Hanover, Pa.
 NATIONAL Machinery Co., Tiffin, O.
 NEWTON Machine Tool Works, Philadelphia, Pa.
 NILES-BEMENT-POND Co., New York, N. Y.
 PAWTUCKET Mfg. Co., Pawtucket, R. I.
 PRATT & Whitney Co., Hartford, Conn. (See page 429.)
 RELIANCE—See Foote-Burt Co.
 WEBSTER & Perks Tool Co., Springfield, O.
 WELLS Bros. Co., Greenfield, Mass. "Little Giant." (See page 513.)
 WELLS & Son Co., F. E., Greenfield, Mass. "Hercules."
 WILEY & Russell Mfg. Co., Greenfield, Mass. "Green River."

BORING MACHINES

(Horizontal)

BEAMAN & Smith Co., Providence, R. I.
 BINSSE Machine Co., Harrison, N. J. (See page 485.)
 EPESEN-LUCAS Machine Works, Philadelphia, Pa.
 GISHOLT Machine Co., Madison, Wis.
 LUCAS Machine Tool Co., Cleveland, O.
 NEWTON Machine Tool Works, Philadelphia, Pa.
 NILES-BEMENT-POND Co., New York, N. Y.
 ROCHESTER Boring Machine Co., Rochester, N. Y.
 SELLERS & Co., Wm., Philadelphia, Pa.
 UNIVERSAL Boring Machine Co., Hudson, Mass.

BORING MACHINES

(Vertical)

BAKER Bros., Toledo, O.
 BULLARD Machine Tool Co., Bridgeport, Conn.
 COLBURN Machine Tool Co., Franklin, Pa.
 HOEFER Mfg. Co., Freeport, Ill.
 KING Machine Tool Co., Cincinnati, O.
 MOLINE Tool Co., Moline, Ill.
 NILES-BEMENT-POND Co., New York, N. Y.
 ROCKFORD Drilling Machine Co., Rockford, Ill.

BUFFING AND POLISHING MACHINES

BENNETT-O'CONNELL Co., Chicago, Ill.
 BLOUNT Co., J. G., Dept. A, Everett, Mass. (See page 431.)
 BRIDGEPORT Safety Emery Wheel Co., Bridgeport, Conn.
 BUILDERS Iron Foundry, Providence, R. I.
 CHALLENGE Machine Co., Philadelphia, Pa.
 DIAMOND Machine Co., Providence, R. I.
 GARLAND—See Sibley-Houfley Machine Co.
 NEW Britain Machine Co., 10 Bigelow St., New Britain, Conn. (See page 511.)
 NORTHAMPTON Emery Wheel Co., Leeds, Mass.
 RANSOM Mfg. Co., Oshkosh, Wis.
 ST. LOUIS Machine Tool Co., St. Louis, Mo.
 SIBLEY-HOUFLEY Machine Co., Detroit, Mich. "Garland."
 SPRINGFIELD Mfg. Co., Bridgeport, Conn.
 VALLEY City Machine Works, Grand Rapids, Mich.
 WEBSTER & Perks Tool Co., Springfield, O.

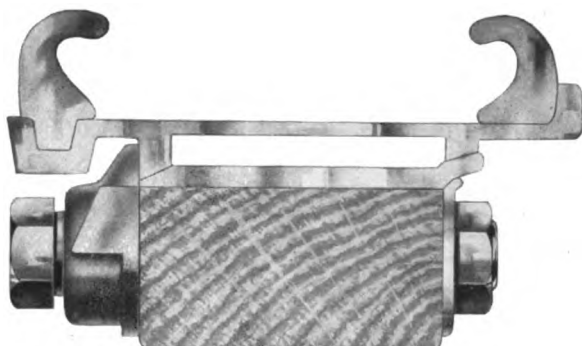
CAM CUTTING MACHINES

MANVILLE Bros. Co., Waterbury, Conn.
 PRATT & Whitney Co., Hartford, Conn. (See page 429.)
 STANDARD Machinery Co., Providence, R. I.

Standard Universal Rims

YOUR car should include equipment that the prospective purchaser wants. He wants DEMOUNTABLE RIMS. Our product is making him want them. We can furnish STANDARD UNIVERSAL RIM equipment for your cars, without increasing your manufacturing cost. Isn't it worth while considering? Let us explain the ease of operation. Two turns unlocks and two turns locks our No. 1 and No. 2 rims.

INTERCHANGEABILITY OF TIRES. A STANDARD UNIVERSAL RIM. One that any tire will fit, whether clincher or straight sided, means a great deal to you. An auto driver remembers the rim he has had the least trouble with. STANDARD UNIVERSAL RIMS always cause this pleasant remembrance. Tires can be changed on the rim by means of our QUICK DETACHABLE feature, or the rim changed with tire inflated by means of our DEMOUNTABLE feature.



NO. 1 DEMOUNTABLE RIM

THE UNITED RIM CO., Akron, Ohio

MACHINES (Continued)**CORE MAKING MACHINES**

- BROWN Specialty Machinery Co., Chicago, Ill. "Hammer."
 DIAMOND Clamp & Flask Co., Richmond, Ind.
 HAMMER—See Brown Specialty Machinery Co.

CORE WIRE STRAIGHTENING AND CUTTING MACHINES

- BLAKE Mfg. Co., Geo. F., New York, N. Y. "Climax."
 CLIMAX—See Blake Mfg. Co.
 GREGG Mfg. Co., Cleveland, O.

CRIMPING AND BEADING MACHINES

- NIAGARA Machine & Tool Works, Buffalo, N. Y.
 PECK, Stow & Wilcox Co., Southington, Conn.
 PETTINGELL Machine Co., Amesbury, Mass.

CUTTING-OFF MACHINES

- BROWN & Sharpe Mfg. Co., Providence, R. I.
 DAVIS Machine Co., W. P., Rochester, N. Y.
 HURLBURT-ROGERS Machine Co., South Sudbury, Mass.
 PRATT & Whitney Co., Hartford, Conn. (See page 429.)

DRILLING MACHINES

(See Drills)

ELECTRIC WELDING MACHINES

- THOMSON Electric Welding Co., Lynn, Mass.
 TOLEDO Electric Welder Co., Cincinnati, O.
 UNIVERSAL Electric Welding Co., New York, N. Y.
 WINFIELD Electric Welding Machine Co., Warren, O.

FILING MACHINES

- AMES & Co., B. C., Waltham, Mass.
 COCHRANE-BLY Co., Rochester, N. Y.
 HARTFORD—See Robinson Tool Works.
 ROBINSON Tool Works, Waterbury, Conn. "Hartford."

GEAR CUTTING MACHINES

- BARBER-COLMAN Co., Rockford, Ill.
 BROWN & Sharpe Mfg. Co., Providence, R. I.
 CINCINNATI Gear Cutting Machine Co., Cincinnati, O.
 FELLOWS Gear Shaper Co., 24 Pearl St., Springfield, Vt. (See page 441.)

- FLATHER Mfg. Co., E. J., Nashua, N. H.
 GARVIN Machine Co., New York, N. Y.
 GLEASON Works, Rochester, N. Y.
 GOULD & Eberhardt, Newark, N. J.
 GRANT-LEES Machine Co., 2368 69th St., Cleveland, O. (See page 183.)
 LEES-BRADNER Co., Cleveland, O.
 NEWARK Gear Cutting Machine Co., Newark, N. J.
 NEWTON Machine Tool Works, Philadelphia, Pa.
 SCHUCHARDT & Schutte, New York, N. Y. (Importers.)
 SLOAN & Chace Mfg. Co., Newark, N. J.
 STANDARD Mfg. Co., Bridgeport, Conn.
 WHITON Machine Co., D. E., New London, Conn.

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- ADAMS Co., Dubuque, Ia.
 GOULD & Eberhardt, Newark, N. J.
 LEES-BRADNER Co., Cleveland, O.
 MEISELBAACH-CATUCCI Mfg. Co., Newark, N. J.
 NEWARK Gear Cutting Machine Co., Newark, N. J.
 REYNOLDS Pattern & Machine Co., Moline, Ill.
 SCHUCHARDT & Schutte, New York, N. Y. (Importers.)

GEAR TOOTH CHAMFERING MACHINES

- INGLE Machine Co., Rochester, N. Y. "Rochester." (See page 477.)
 ROCHESTER—See Ingle Machine Co.
 SCHUCHARDT & Schutte, New York, N. Y. (Importers.)

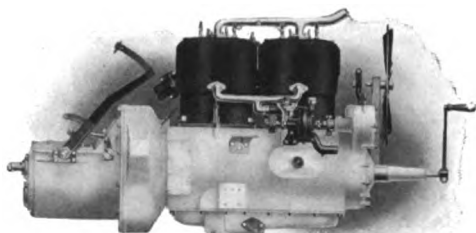
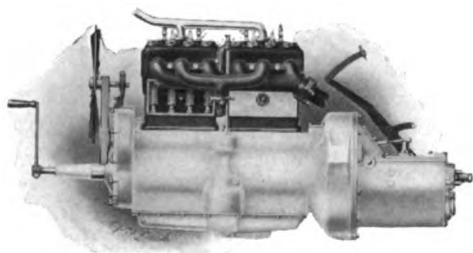
HAIR PICKING MACHINES

- LOUNSBERRY & Sons, G. H., Cincinnati, O.

KEY SEATING MACHINES

- ARMSTRONG Mfg. Co., Waterloo, Ia.
 BAKER Bros., Toledo, O. "Colburn."
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 COLBURN—See Baker Bros.
 DAVIS Machine Co., W. P., Rochester, N. Y.
 GIANT—See Mitts & Merrill.
 LAPOINTE Machine Tool Co., Hudson, Mass. (See page 431.)
 MITTS & Merrill, Saginaw, Mich. "Giant."
 NEWTON Machine Tool Works, Philadelphia, Pa.
 NATIONAL Machine Tool Co., 123-30 Opera Pl., Cincinnati, O. (See page 477.)
 NILES-BEMENT-POND Co., New York, N. Y.
 PAWTUCKET Mfg. Co., Pawtucket, R. I.

ERGON MOTOR



Power—Durability—Simplicity— Accessibility

While Ergon motors are adaptable either to commercial or pleasure vehicle usage, especial attention has been paid, in their design, to the commercial end of the industry. In this branch of the automobile industry it is absolutely essential that a motor must be remarkably simple and accessible as well as powerful. For this reason Ergon motors have been designed not only for power and durability but for simplicity and accessibility as well.

Ergon motors are four cylinder, four cycle, long stroke, $4\frac{3}{4} \times 6$ inches, water cooled, L-head, with cylinders cast in pairs. They are of the unit power plant type, with Brown-Lipe dry plate clutch, and three speed selective transmission. Renold silent chain drive replaces timing gears and provision has been made for any one of several electric and pneumatic starters. Timken bearings are used in the transmission and the clutch is supported on F. & S. bearings.

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MOTOR MANUFACTURING
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ROCHESTER, NEW YORK

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 TUFTING Machine Supply Co., Detroit, Mich.
 TURNER Tanning Machinery Co., Peabody, Mass.

MARKING MACHINES

DWIGHT Slate Machine Co., Hartford, Conn.
 GORTON Machine Co., George, Racine, Wis.

MILLING MACHINES

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 BARBER-COLMAN Co., Rockford, Ill.
 BEAMAN & Smith Co., Providence, R. I.
 BECKER Milling Machine Co., Hyde Park, Mass.
 BRIGGS—See Gooley & Edlund.
 BROWN & Sharpe Mfg. Co., Providence, R. I.
 BURKE Machine Tool Co., Conneaut, O.
 CARTER & Hakes Co., Winsted, Conn.
 CHICAGO Machine Tool Co., Chicago, Ill.
 CINCINNATI Milling Machine Co., Cincinnati, O.
 FOSDICK Machine Tool Co., Cincinnati, O.
 FOX Machine Co., Grand Rapids, Mich.
 GARVIN Machine Co., New York, N. Y.
 GOOLEY & Edlund, Syracuse, N. Y. "Briggs."
 HENDEY Machine Co., Torrington, Conn.
 INGERSOLL Milling Machine Co., Rockford, Ill.
 KEARNEY & Trecker Co., Milwaukee, Wis. "Milwaukee."
 KEMPSMITH Mfg. Co., Milwaukee, Wis.
 LE BLOND Machine Tool Co., R. K., Cincinnati, O.
 MILWAUKEE—See Kearney & Trecker Co.
 NEWTON Machine Tool Works, Philadelphia, Pa.
 OESTERLEIN Machine Co., Cincinnati, O.
 PRATT & Whitney Co., Hartford, Conn. (See page 420.)
 ROCHESTER Boring Machine Co., Rochester, N. Y.
 ROCKFORD Machine Tool Co., Rockford, Ill.
 ROCKFORD Milling Machine Co., Rockford, Ill.
 SCHUCHARDT & Schutte, New York, N. Y. (Importers.)
 STEPTOE Shaper Co., John (Brighton), Cincinnati, O. (See page 433.)
 THURSTON Mfg. Co., Providence, R. I.
 VAN NORMAN Machine Tool Co., Springfield, Mass.
 WHITNEY Mfg. Co., Hartford Conn. (See page 647.)

NUT TAPPING MACHINES

ACME Machinery Co., Cleveland, O.
 AUTOMATIC Machine Co., Bridgeport, Conn. "Coulter."
 BROWN Co., H. B., East Hampton, Conn.
 COULTER—See Automatic Machine Co.
 HOWARD Iron Works, Buffalo, N. Y. "Schlenker."
 LANDIS Machine Co., Waynesboro, Pa.
 LITTLE GIANT—See Wells Bros. Co.
 NATIONAL Machinery Co., Tiffin, O.
 NILES-BEMENT-POND Co., New York, N. Y.
 PAWTUCKET Mfg. Co., Pawtucket, R. I.
 REED Co., Francis, Worcester, Mass.
 SCHLENKER—See Howard Iron Works.
 WEBSTER & Perks Tool Co., Springfield, O.
 WELLS Bros. Co., Greenfield, Mass. "Little Giant." (See page 513.)
 WELLS & Son Co., F. E., Greenfield, Mass.

PISTON RING MACHINES

(Semi Automatic)

WINDSOR Machine Co., Windsor, Vt.

POLISHING MACHINES

(See Machines, Buffing and Polishing)

PROFILING MACHINES

BECKER Milling Machine Co., Hyde Park, Mass.
 GARVIN Machine Co., New York, N. Y.
 PRATT & Whitney Co., Hartford, Conn. (See page 420.)

RIVETING MACHINES

CINCINNATI Pulley Machinery Co., Cincinnati, O.
 GRANT Mfg. & Machine Co., Bridgeport, Conn. (See page 430.)
 NILES-BEMENT-POND Co., New York, N. Y.
 PAWTUCKET Mfg. Co., Pawtucket, R. I.
 SHUSTER Co., F. B., New Haven, Conn.
 TOWNSEND Mfg. Co., H. P., Hartford, Conn.

SAND BLAST MACHINES

AMERICAN Diamond Blast Co., New York, N. Y.
 BETTON, J. M., New York, N. Y. "Drucklieb."
 BUCKEY—See MacLeod & Co.
 CURTIS & Co., Mfg. Co., St. Louis, Mo.
 DANIC—See Nichols Iron Works.
 DRUCKLIEB—See Betton, J. M.
 MACLEOD & Co., Walter, Cincinnati, O. "Buckeye."

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The **MAGNETIC METAL SEPARATOR** is a producer in every sense of the word. In a short time it will more than have paid for itself

in the saving of labor and time alone. The Separator is extremely simple and is invaluable for the separation of iron turnings, filings, etc., from brass, composition iron from emery, etc. Brass stock cleansed with this machine can be used for the best kind of work.



SAND BLAST MACHINERY for cleaning Castings, Concrete, Bridges, Cars or other surfaces, embodying many new and improved features, is by far the most durable and economical machine on the market. **Paxson's Quality Sand Blast Equipment** should be installed in every shop. It will reduce operating expenses to the minimum. For the cleaning of castings and metals which are to be machined, electroplated, enameled, japanned, bronzed or repainted it has no superior. ONE operator with the Sand Blast can do more cleaning than six men with brushes.

We manufacture Pattern-maker's supplies. Catalogue on request

J. W. PAXSON CO.

Manufacturer's Foundry Supplies and Equipment

1019 N. Delaware Avenue

Philadelphia, Penna.

Tells the Story
at a Glance

The Perfection Visible SPARK PLUG

IS THE X-RAY OF
THE CYLINDER

Eliminates testing and searching for power trouble. Ignition and explosion in plain view, making carburetor and timing adjustments easy. Will not carbonize or clog.

The **PERFECTION** is the only Spark Plug that shows the ignition spark exploding the vapor. Refuse substitutes. Demand **PERFECTION** and stop guessing.

If not handled by your dealer we will send prepaid on receipt of price. When ordering specify size wanted and make of car.

Attractive proposition to Agents and Dealers.

**The Perfection
Specialty Mfg. Co.**

115-17 West 2nd Avenue
CINCINNATI, OHIO

Manufacturers of the
Perfection Auto Jack



Price \$1.50.

THE LITTLE STEERSMAN

Takes away all nervous
strain and most all of
the physical labor
of steering.

A WONDERFUL
SAFEGUARD TO
THE MOTORIST
AND HIS CAR.
EASILY ATTACHED
TO ANY CAR.

Special Proposition to
Jobbers and Dealers



Modern Auto Appliance Co.

Sole Manufacturers CHATHAM, N. Y.

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- NIAGARA Device Co., Buffalo, N. Y.
 NICHOLS Iron Works, D. M., New York, N. Y. "Danic."
 PANGBORN Co., Thomas W., P. O. Box 856, Hagerstown, Md.
 (See page 485.)
 PAXSON Co., J. W., 1019 N. Delaware Ave., Philadelphia, Pa.
 (See page 483.)
 TILGHMAN-BROOKSAND Sand Blast Co., Philadelphia, Pa.

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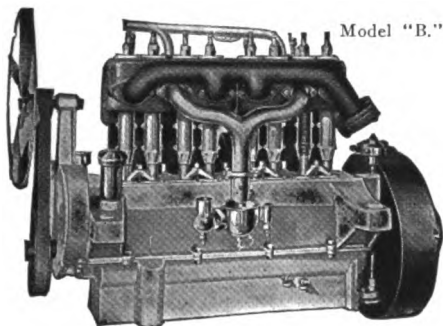
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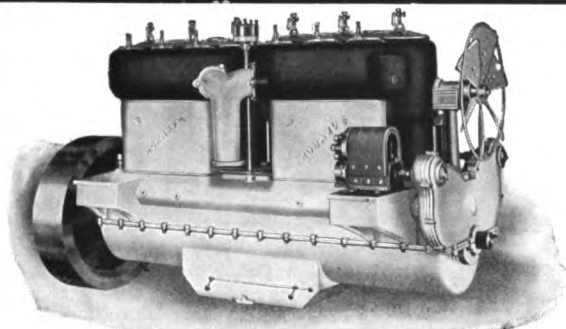
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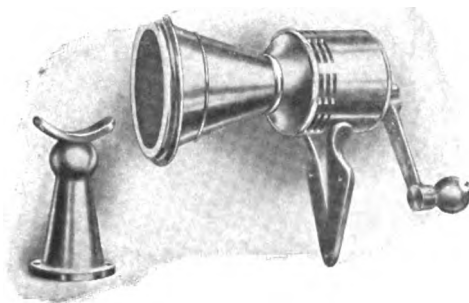
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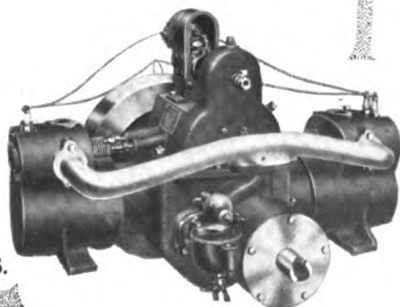
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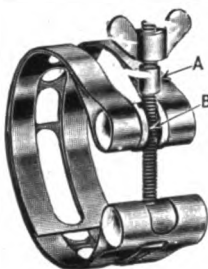


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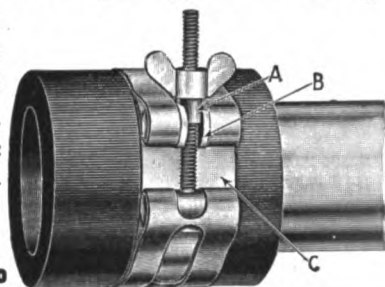


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 SPICER Mfg. Co., Groton, Conn.
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 STANDARD Pattern & Mfg. Co., Richmond, Ind.
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 (See page 519.)
 VICTOR Electric Co., Chicago, Ill.
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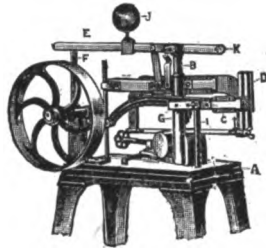
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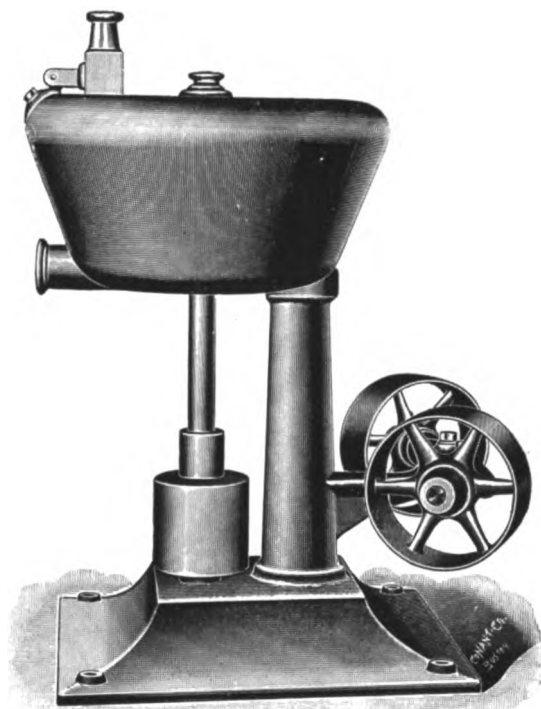
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 (See page 433.)
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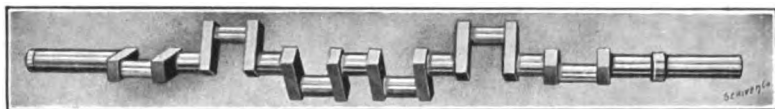
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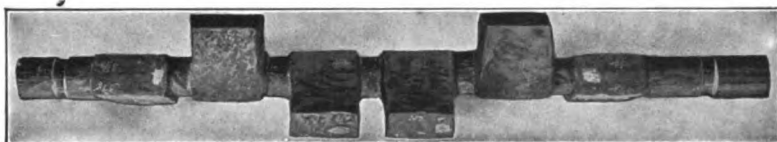
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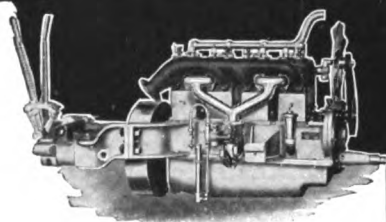
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 (See page 379.)
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 (See pages 273 and 274.)
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 (See page 617.)
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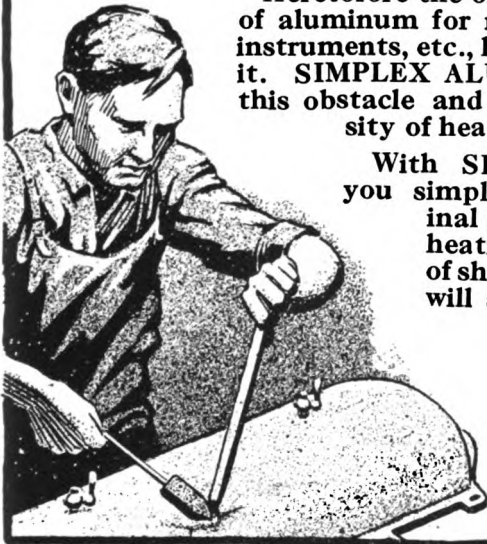
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you simply adjust your work to the original position without the necessity of heating the parts until they are out of shape. The only known solder that will stick to aluminum and permanently repair it.

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 (See page 429.)
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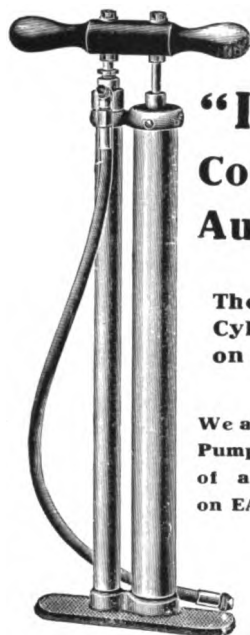
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 (See page 513.)
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 (See page 483.)
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 (See pages 503 and 504.)
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 (See page 453.)
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 (See page 450.)

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 (See page 513.)
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 (See page 465.)
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 (See page 429.)
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 (See page 513.)
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 (See page 429.)
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 (See page 471.)
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 (See page 439.)
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 (See page 457.)
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 (See page 485.)
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 (See page 305.)
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 DIAMANTIN—See Globe Gas Light Co.
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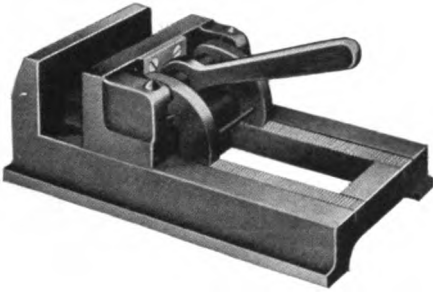
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Holds an unlimited variety of work. Has powerful and positive grip. All working parts made of steel. It is machined throughout and is true. Suitable for drill presses of all sizes. The vise is fully guaranteed. The vise is especially adapted to automobile work.

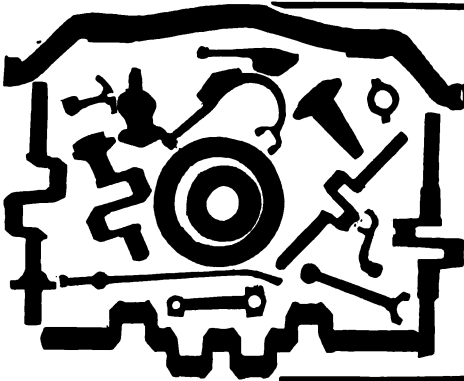
Dimensions

Length of vise, 14 inches; width of vise, 8½ inches; height of vise, 4¾ inches; width of jaws, 7 inches; depth of jaws, 3 inches; vise opens, 8 inches; weight, 50 pounds.

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 (See page 515.)
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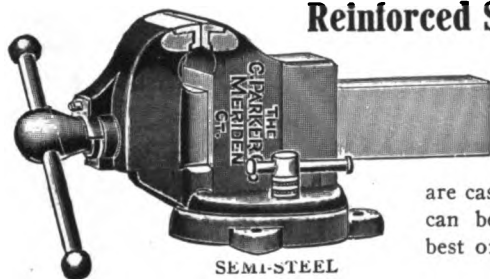
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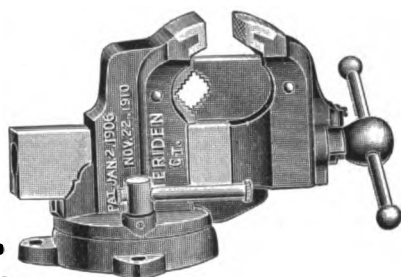
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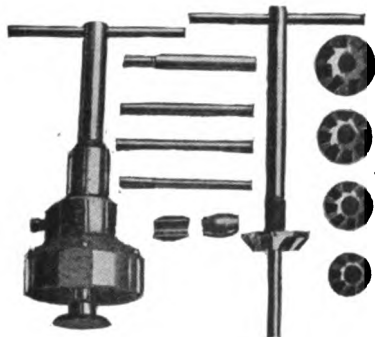
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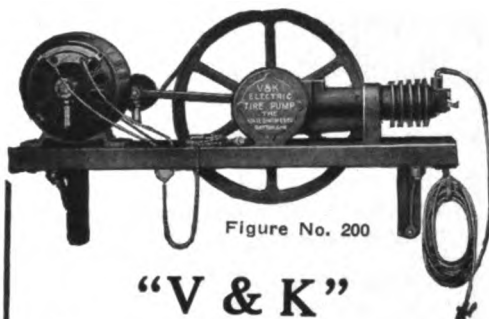


Figure No. 200

"V & K" Electric Tire Pumps

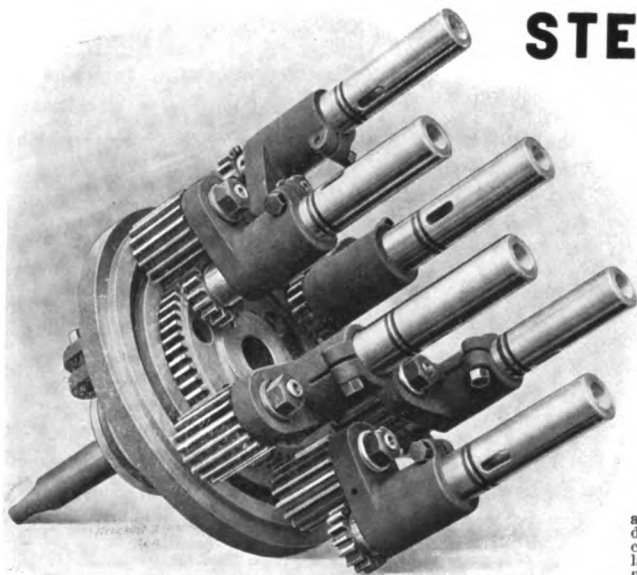
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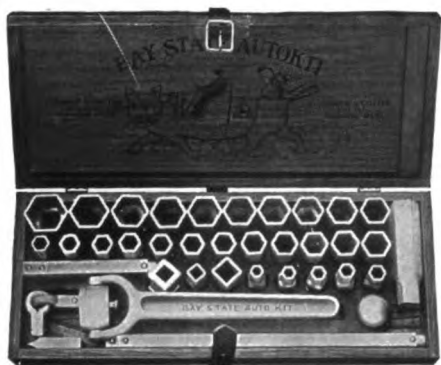
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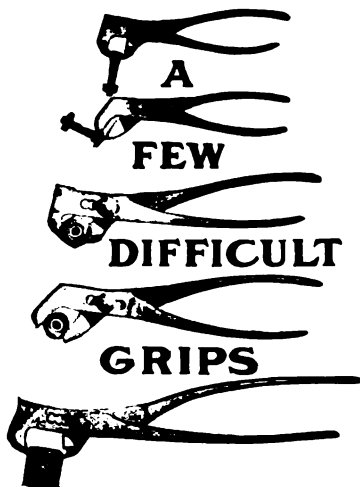
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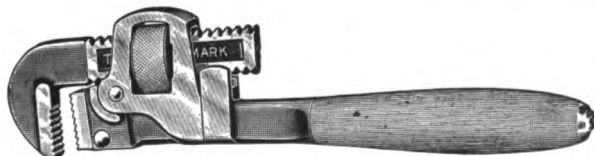
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(See page 513.)
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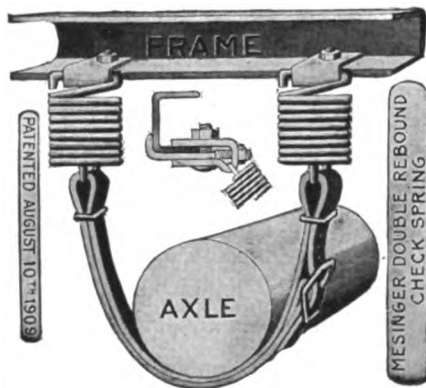
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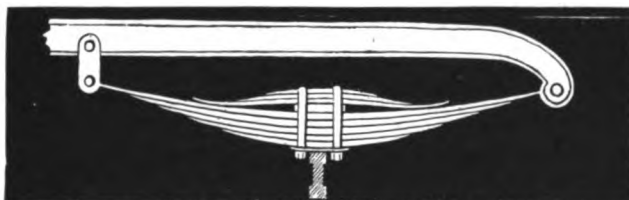
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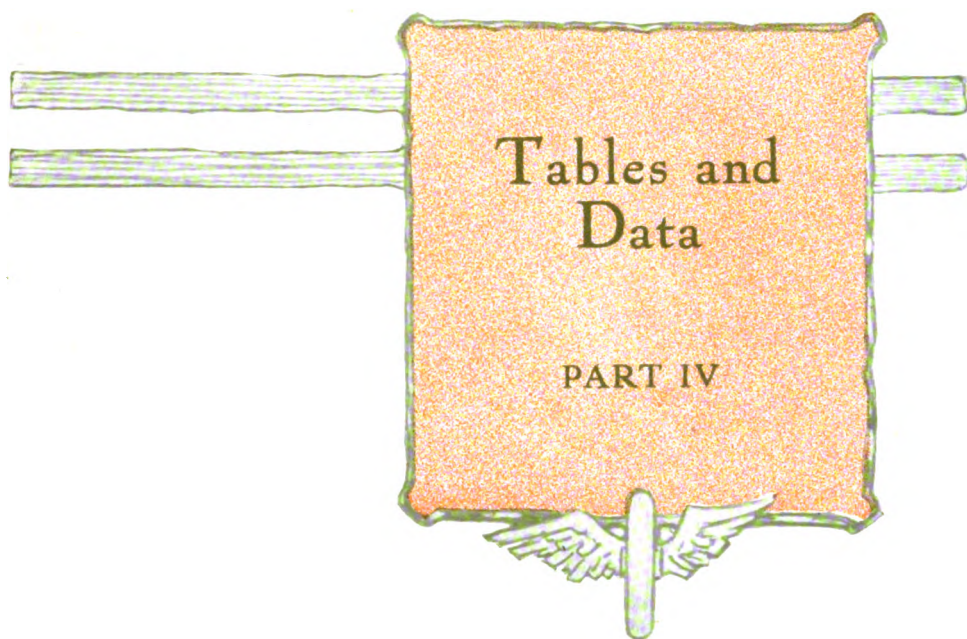
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 MOORE Drop Forging Co., Springfield, Mass.
 OSWEGO Tool Co., Oswego, N. Y.
 RIPLEY Pipe Wrench Co., Ripley, N. Y. "Leader."
 ROGERS-SHEAR Co., Warren, Pa. "American," "Fairbanks."
 STANDARD Wrench & Tool Co., Providence, R. I. "Fitzall."
 STILLSON—See Walworth Mfg. Co.
 STOVER—See Wright Wrench & Forging Co.
 TRIMO—See Trimont Mfg. Co.
 TRIMONT Mfg. Co., Roxbury, Mass. "Trimont."
 (See page 521.)
 VICTOR—See Bonner Mfg. Co.
 WALWORTH Mfg. Co., Boston, Mass. "Stillson."
 (See page 495.)
 WELLS & Son Co., F. E., Greenfield, Mass.
 WESTCOTT—See Keystone Mfg. Co.
 WRIGHT Wrench & Forging Co., Canton, O. "Stover."

TAP AND REAMER WRENCHES

ALERT Tool Co., Philadelphia, Pa.
 AMERICAN Tap & Die Co., Greenfield, Mass. "Eagle."
 (See page 513.)
 ARMSTRONG Mfg. Co., Bridgeport, Conn.
 BASCOM—See Smart Mfg. Co.
 BAY State Tap & Die Co., Mansfield, Mass.
 BERGMAN Tool Mfg. Co., Buffalo, N. Y.
 BESLY & Co., Charles H., Chicago, Ill.
 (See page 465.)
 BILLINGS & Spencer Co., Hartford, Conn.

BRAUNSDORF-MUELLER Co., Elizabeth, N. J.
 BRUBAKER & Bros., W. L., Millersburg, Pa.
 BUTTERFIELD & Co., Derby Line, Vt.
 CARD Mfg. Co., S. W., Mansfield, Mass. "Handy," "Horsfield."
 CARPENTER Tap & Die Co., J. M., Pawtucket, R. I. "Nichols."
 CONANT & Donelson Co., Conway, Mass. "Reliable."
 DIKEMAN Mfg. Co., Norwalk, Conn.
 EAGLE—See American Tap & Die Co.
 GOODELL-PRATT Co., Greenfield, Mass.
 GREEN RIVER—See Wiley & Russell Mfg. Co.
 HANDY—See Card Mfg. Co.
 HART Mfg. Co., Cleveland, O.
 HERCULES—See Wills & Son Co.
 HOLROYD & Co., Waterford, N. Y.
 HORSFIELD—See Card Mfg. Co.
 KEYSTONE Mfg. Co., Buffalo, N. Y.
 LIGHTNING—See Wiley & Russell Mfg. Co.
 LITTLE GIANT—See Wells Bros. Co.
 MORSE Twist Drill & Machine Co., New Bedford, Mass.
 (See page 579.)
 NICHOLS—See Carpenter Tap & Die Co.
 RELIABLE—See Conant & Donelson.
 SAUNDERS' Sons, D., Yonkers, N. Y.
 SMART Mfg. Co., A. J., Greenfield, Mass. "Bascom."
 STANDARD Tool Co., Cleveland, O.
 STARRETT Co., L. S., Athol, Mass.
 VAN Buren Tool Co., Van Buren, Ind.
 WELCH Co., Thomas F., Boston, Mass.
 WELLS Bros. Co., Greenfield, Mass. "Little Giant."
 (See page 513.)
 WELLS & Son Co., F. E., Greenfield, Mass. "Hercules."
 WEST Haven Mfg. Co., New Haven, Conn.
 WILEY & Russell Mfg. Co., Greenfield, Mass. "Green River," "Lightning."



**Reference Tables, Data and Formulæ,
including Reports on Tests of Materials,
S. A. E. Standards, etc., also a Directory
of National Trade Associations**

A complete index to this section appears on pages 23 to 26





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PART IV

TABLES AND DATA

REFERENCE TABLES FOR INDICATED HORSEPOWER

It is often convenient to have a ready reference table, by the aid of which an immediate approximation to the horsepower of a motor can be made when the bore and stroke are known. Such a table has been prepared by Worby Beaumont, the well-known English engineer, who gave permission to the editor of *The Automobile Club Journal* in London to publish it. One table gives the ratings of engines with the cylinder dimensions in inches and fractions, and the other table gives the results with cylinders built to metric measurements. Of course, in a table of this sort, an arbitrary set of conditions as to revolutions, mean effective pressure and mechanical efficiency have to be assumed; those employed represent average practice and the table is not offered as a substitute for experimentation when the most accurate results are desired.

It will be noted from Table I that in a very small space the estimated indicated power of engines with bore and stroke dimensions varying from 2-in. bore and 2-in. stroke to 6-in. bore and 6 1-2-in. stroke is given. Similarly, in Table II, a similar series is given in metric measurement, covering sizes from 70 mm. bore and 70 mm. stroke to 150 mm. bore and 165 mm. stroke. In Table I there is a quarter of an inch difference of size of bore and stroke measurements between any two powers given, and in Table II a difference of 5 mm. In explanation of the tables, it will be seen that in column 1 the bore or cylinder diameter of the engine may be found, and in the columns to the right of this, commencing with the column headed 0, the power of the engine having that cylinder diameter and a stroke of the same dimension. Columns 3 to 10 in each table give the powers of engines of, for instance, the same bore, but having a stroke greater than the bore by the amount stated at the top of the column. For example, referring to Table I, an engine having a cylinder 4 inches in diameter and a stroke of 4 inches would develop, under conditions to be stated, 4.27 i.h.p., as shown in the column headed 0; that is, column 2. If, however, the engine has a cylinder bore of 4 inches and a stroke of 5 1-2 inches, then the power developed is as shown in column 8, 5.89 i.h.p.

Similarly, for example, referring to Table II, an engine having a bore and stroke of 100 mm. would give 4.09 i.h.p., and an engine with a cylinder 100 mm. diameter and 140 mm. stroke would give 5.72 i.h.p.

It will be observed that to each bore dimension in column 1, two horizontal lines are given. The first of these gives the calculated power at a speed of 750 revolutions per minute, and the second the power at 1,000 revolutions per minute. The figures for the higher speed are printed in italic type.

The powers given in the tables represent the calculated indicated power given by one cylinder, and when multi-cylinder engines are being considered, the power shown by the table must be multiplied by the number of cylinders to give the total power.

To determine the useful power or brake horsepower, the mechanical efficiency of the engine has to be considered. No general rule can be given for this, and it may vary from a little less than 80 per cent. of the indicated power to as much as 88 per cent. For the majority of four-cylinder engines of good design and in good condition, run at speeds not unsuited to their design, and for powers of not less than 20 b.h.p., the efficiency may be considered to be 85 per cent. within reasonably close limits of accuracy. This figure is, however, merely suggestive, and it is necessary to be familiar with engine design and performances to correctly estimate the brake horsepower from the estimated indicated power of these small high-speed engines.

Very frequently an approximation to the calculated indicated power, or power developed in the cylinders, is all that is required to be known, and this may be taken direct from the tables, for the two named speeds; i.e., 750 or 1,000 revolutions per minute. For other speeds the difference may be taken as arithmetically proportionate through a limited range according to the type and design of the engine.

(Continued on page 528.)

HORSE POWER TABLE I—Cylinder Dimensions in Inches and Fractions

Bore	0	$\frac{1}{4}$	$\frac{1}{2}$	$\frac{3}{4}$	1	$\frac{1}{4}$	$\frac{1}{2}$	$\frac{3}{4}$	2
2.....	0.54	0.60	0.67	0.74	0.81	0.88	0.94	1.01	1.08
	0.72	0.80	0.89	0.98	1.08	1.17	1.25	1.35	1.44
2 $\frac{1}{4}$	0.76	0.84	0.92	1.01	1.09	1.18	1.26	1.35	1.43
	1.01	1.12	1.22	1.34	1.45	1.57	1.68	1.81	1.90
2 $\frac{1}{2}$	1.04	1.15	1.25	1.35	1.46	1.56	1.67	1.77	1.88
	1.39	1.53	1.67	1.81	1.95	2.09	2.23	2.37	2.51
2 $\frac{3}{4}$	1.39	1.51	1.64	1.77	1.89	2.02	2.14	2.27	2.40
	1.85	2.02	2.19	2.36	2.55	2.70	2.87	3.04	3.20
3.....	1.80	1.95	2.10	2.25	2.40	2.55	2.70	2.85	3.00
	2.40	2.60	2.80	3.00	3.21	3.40	3.61	3.81	4.00
3 $\frac{1}{4}$	2.30	2.47	2.65	2.82	3.00	3.18	3.36	3.53	3.70
	3.06	3.28	3.52	3.76	3.99	4.22	4.45	4.70	4.92
3 $\frac{1}{2}$	2.86	3.06	3.27	3.48	3.68	3.88	4.09	4.30	4.50
	3.81	4.09	4.36	4.63	4.90	5.18	5.45	5.72	6.00
3 $\frac{3}{4}$	3.53	3.76	4.00	4.35	4.47	4.71	4.95	5.18	5.41
	4.71	5.02	5.34	5.65	5.97	6.28	6.60	6.91	7.23
4.....	4.27	4.65	4.81	5.08	5.35	5.61	5.89	6.15	6.41
	5.71	6.06	6.42	6.78	7.13	7.50	7.85	8.20	8.55
4 $\frac{1}{4}$	5.13	5.44	5.74	6.04	6.34	6.64	6.95	7.25	7.55
	6.84	7.24	7.64	8.05	8.45	8.85	9.25	9.66	10.06
4 $\frac{1}{2}$	6.19	6.53	6.87	7.22	7.56	7.90	8.25	8.59	8.93
	8.25	8.68	9.16	9.62	10.08	10.54	10.96	11.41	11.89
4 $\frac{3}{4}$	7.18	7.55	7.94	8.31	8.70	9.07	9.45	9.82	.....
	9.57	10.07	10.57	11.09	11.58	12.08	12.59	13.09	.....
5.....	8.38	8.80	9.22	9.65	10.05	10.46	10.90	.....	.....
	11.16	11.72	12.28	12.84	13.40	13.95	14.50	.....	.....
5 $\frac{1}{4}$	9.70	10.16	10.62	11.09	11.54	12.00	.....	.....	.....
	12.92	13.54	14.15	14.76	15.40	16.00	.....	.....	.....
5 $\frac{1}{2}$	11.12	11.65	12.15	12.66	13.15	.....	.....	.....	.....
	14.84	15.51	16.20	16.86	17.54	.....	.....	.....	.....
5 $\frac{3}{4}$	12.71	13.27	13.82	14.38	.....	.....	.....	.....	.....
	16.96	17.70	18.42	19.10	.....	.....	.....	.....	.....
6.....	14.45	15.05	15.65	.....	.....	.....	.....	.....	.....
	19.25	20.05	20.85	.....	.....	.....	.....	.....	.....

(Continued on page 530.)

Index to Tables and Data appears on Pages 23 to 26.

REGARDING THE PULLMAN AGENCY

In addition to keeping abreast of the times in design, material and equipment, the men responsible for Pullman success have anticipated trade conditions for 1913 with the result that a selling organization has been perfected whereby Pullman dealers are offered a distinct advantage over any competition. Our interest in the dealer does not end with his contract. We co-operate on sales and service. The selling plan is unique and the results positive. For nine years we have advertised that Pullman dealers are always good dealers—the reputation of the Pullman product is unquestioned. Some valuable territory is still open and it is possible that we may have some inquiries from your immediate section. Send for the Pullman selling plan and agency proposition. It is thoroughly worth while.

Electric self starter and electric lighting system are included in the regular equipment of all 1913 Pullman models.

4-36
\$1875

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\$2150

6-66
\$2750

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Two Fours and a Six —one Chassis Design

¶ Only one chassis design can be "best"—that's why we use the same construction on the MOON "39" (a four), the MOON "48" (a

four), and the MOON "65" (a six).

¶ The different models vary in size only.

Moon Motor Car Co.
Saint Louis



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45-H.P. TOURING CAR	FOR FIVE	\$1600.00
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45-H.P. COUPE	FOR FOUR	\$2100.00
55-H.P. TOURING CAR	FOR SEVEN	\$2250.00

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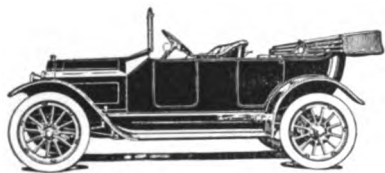
Staver Carriage Co., 76th and Wallace Sts., Chicago

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HORSE POWER TABLE II—Cylinder Dimensions in Millimeters (Metric System)

Bore	0	5	10	15	20	25	30	35	40
70.....	1.40	1.50	1.59	1.69	1.80	1.89	1.99	2.10	2.20
	1.87	2.00	2.13	2.26	2.40	2.53	2.66	2.80	2.94
75.....	1.72	1.84	1.95	2.07	2.18	2.29	2.41	2.53	2.64
	2.30	2.45	2.60	2.76	2.91	3.06	3.22	3.37	3.52
80.....	2.09	2.23	2.35	2.49	2.62	2.76	2.88	3.02	3.14
	2.70	2.97	3.14	3.32	3.49	3.67	3.84	4.02	4.19
85.....	2.43	2.65	2.80	2.95	3.09	3.24	3.39	3.54	3.69
	3.34	3.54	3.73	3.93	4.12	4.32	4.52	4.72	4.91
90.....	2.97	3.14	3.30	3.46	3.64	3.80	3.96	4.13	4.30
	3.96	4.18	4.40	4.62	4.85	5.06	5.28	5.50	5.72
95.....	3.50	3.68	3.87	4.05	4.24	4.42	4.61	4.80	4.98
	4.67	4.91	5.16	5.40	5.65	5.90	6.15	6.40	6.64
100.....	4.09	4.29	4.49	4.70	4.90	5.11	5.30	5.51	5.72
	5.45	5.71	5.99	6.26	6.58	6.81	7.07	7.35	7.62
105.....	4.73	4.95	5.17	5.40	5.63	5.85	6.08	6.30	6.53
	6.30	6.60	6.90	7.20	7.50	7.80	8.10	8.40	8.70
110.....	5.43	5.69	5.93	6.19	6.44	6.68	6.96	7.16	7.42
	7.23	7.58	7.90	8.25	8.57	8.90	9.23	9.55	9.90
115.....	6.22	6.48	6.77	7.03	7.30	7.56	7.85	8.11	8.37
	8.30	8.65	9.02	9.38	9.74	10.01	10.46	10.81	11.18
120.....	7.07	7.37	7.66	7.96	8.25	8.53	8.84	9.13	9.41
	9.42	9.82	10.21	10.61	11.00	11.39	11.79	12.18	12.57
125.....	7.97	8.30	8.63	8.94	9.25	9.57	9.89	10.21	10.54
	10.64	11.06	11.50	11.91	12.34	12.76	13.20	13.61	14.04
130.....	8.95	9.30	9.65	9.90	10.34	10.70	11.01	11.38	.....
	11.94	12.40	12.86	13.31	13.79	14.25	14.70	15.16	.....
135.....	10.08	10.44	10.80	11.18	11.56	11.92	12.30	.....	.....
	13.41	13.91	14.40	14.90	15.41	15.90	16.40	.....	.....
140.....	11.22	11.65	12.04	12.44	12.84	13.25	.....	.....	.....
	14.99	15.51	16.05	16.60	17.12	17.68	.....	.....	.....
145.....	12.52	12.98	13.41	13.82	14.25	.....	.....	.....	.....
	16.70	17.30	17.88	18.42	19.00	.....	.....	.....	.....
150.....	13.81	14.26	14.72	15.40
	18.41	19.01	19.64	20.23

Index to Tables and Data appears on Pages 23 to 26.



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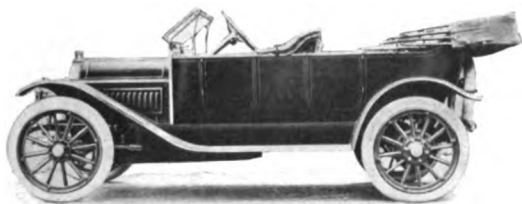
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**BRAKES EQUALIZED WITH
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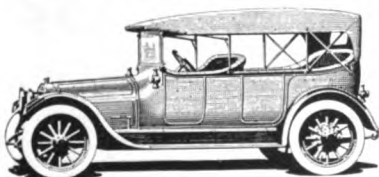
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Owing to the great number of factors which influence the power delivered by high speed internal combustion engines the only sure way of determining this is by a brake test. Nevertheless, for purposes of easy comparison or for a basis for handicapping, various authorities and associations have compiled various formulas from which the approximate D. H. P. can be calculated when certain data are known. In some cases a certain piston speed is assumed, while in others a certain r. p. m. is assumed. In these cases only the diameter and the stroke of the piston need be known.

In some of these formulas as originally compiled the area of the bore was taken as one of the factors, in others the stroke was expressed in feet or decimal fractions thereof. For the sake of uniformity and to save work the formulas are altered so that the square of the bore is used and the stroke is expressed in inches.

TABLES OF HORSEPOWER FORMULAS

Four-cycle Engines

D = Diameter of cylinder in *inches*. L = Stroke of piston in *inches*. R = Revolutions per minute of crank shaft. n = Number of cylinders.

AUTHORITY FOR FORMULA	FACTORS USED	CONSTANT OR DIVISOR
Roberts. For gas.	$D^2 \times L \times R \times n$	19000
Roberts. For gasoline.	$D^2 \times L \times n \times R$	18000
A. L. A. M.	$D^2 \times n$	2.5

This formula is on a basis of 1000-ft. piston speed.

American Power Boat Association.*	$D^2 \times n$	$\frac{2.000}{0.7854} = 2.5338$
A. P. B. A.* for motors of less than 6 inches stroke.	$D^2 \times L \times n$	$\frac{1.000 \times 12}{.7854} = 15.20$

*The two formulas given above are for motors of boats rated as automobile boats. For others the rating should be taken as two-thirds of that given by these formulas. In case some device is used to force the charge into the cylinder 10 per cent. should be added to the ratings.

If an expansion or lower pressure-cylinder is used 20 per cent. of the square of the diameter of this cylinder or cylinders shall be added to the $D^2 \times n$ and divided by the regular constant.

(Continued on page 534.)

Armleder Motor Wagons

THREE MODELS

1,500 lbs. capacity, chassis price...	\$1,250.00
2,000 " " " " " "	\$2,200.00
3,000 " " " " " "	\$2,400.00

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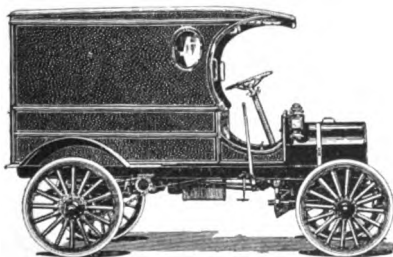
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ALL STYLES OF BODIES

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Blair Mfg. Co.
NEWARK, O.

Two-cycle Engines

D = Diameter of cylinder in *inches*. L = Stroke of piston in *inches*. R = Revolutions per minute of crank shaft. n = Number of cylinders.

AUTHORITY FOR FORMULA	FACTORS USED	CONSTANT OR DIVISOR
Roberts. Gas.	$D^3 \times L \times R \times n$	14000
Roberts. Gasoline.	$D^3 \times L \times R \times n$	13500
American Power Boat Association.*	$D^3 \times n$	$\frac{1.65}{.7854} = 2.1008$
Same for less than 6 inches stroke.	$D^3 \times L \times n$	$\frac{12 \times .85}{\times .7854} = 12.987$

*The above are for automobile racing boat engines; for others the rating is taken as two-thirds of the above formulas. For engines having a displacer cylinder or cylinders the above rating is increased in the ratio that the displacer piston's displacement bears to that of the working cylinders.

INDICATED HORSEPOWER

On account of the great difficulty of securing good indicator cards at the high-piston and rotative speeds of automobile motors this is very little employed. The manograph which is employed for obtaining cards or diagrams from high-speed motors, as a general thing does not have an equal pressure scale and therefore does not readily lend itself to the accurate determination of I. H. P.

The indicated H. P. may of course be determined approximately by assuming a certain mechanical efficiency for the motor under consideration. This varies from as high as 90 per cent. in some cases to lower than 70 per cent. in others; the average would probably be not far from 80 per cent.

The formula for I. H. P., the bore and stroke being known as well as the R. P. M. and the mean effective pressure, is,

$$\frac{D^3 \times L \times R. P. M. \times n \times M. E. P.}{33,000. \times 12 \times 2} = I. H. P. \text{ (for 4-cycle).}$$

$$\frac{33,000. \times 12 \times 2}{.7854}$$

This constant equals 550,000 and the formula becomes $\frac{D^3 \times L \times n \times M. E. P. \times K}{550,000}$.

The constant for 2-cycle is 275,000.

A formula which is given by Grover for the mean effective pressure, the compression being known, is as follows:

$$M. E. P. = .9C - 0.01 C^2$$

C = Compression pressure above atmosphere in pounds per square inch.

This formula does not hold good for compression pressures over 100 pounds per square inch above atmosphere. Comparatively recent data seems to prove the reliability of this formula, also the fact, which Grover points out, that under favorable conditions, the values given by this formula may be slightly exceeded. Tests with higher pressures than 100 pounds show that the M. E. P. tends to remain at 100 pounds per square inch.

The compression pressure may be obtained by some form of gauge, the ignition for that cylinder being cut off, or in case the volume of the explosion chamber is known it may be obtained from the formula.

$PV^{1.3} = \text{Constant}$. P being the absolute pressure.

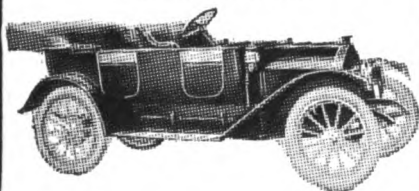
V being taken in the one case as the volume of the combustion chamber and in the other as the above plus the piston displacement. P being in one case atmospheric pressure and in the other the absolute compression pressure. Of course for C in Grover's formula, the assumed atmospheric pressure should be subtracted from the result obtained by this formula.

Great Western Forty

With Automatic Engine Starter.
For Dependability, Power, Speed
and Utility, the "Great Western
Forty" has never been surpassed
by any car, at any price. Hand-
somely finished and equipped.

LIVE DEALERS EVERYWHERE
will find the Great Western a great
money maker. Some choice terri-
tory is still left. Better write to-day
for our great offer to dealers.

Great Western Automobile Co.
PERU, INDIANA



Mighty Michigan "40"

\$1585

Fully Equipped

Designed by Engineer W. H. Cameron,
known both in America and Europe for his
success in designing famous cars.

Mighty Michigan motor, 40 to 46 horse-
power.

Car electric lighted throughout by genera-
tor system.

Four forward speed transmission, with di-
rect drive on the fourth, special design of
Engineer Cameron, the most perfect trans-
mission yet produced. Means utmost econo-
my and efficiency.

Left-hand drive center control.

35x4½-inch tires, front and rear. The
Mighty Michigan "40" is the only car in
America tired in excess of its weight's de-
mand.

Wheel base, 118 inches.

Body by J. H. Campbell, America's fore-
most body designer. Big, roomy body on
straight simple lines—the most approved pat-
tern for 1913.

Deep upholstery of finest leather. 14-inch
cushions.

Rear seat 50 inches wide inside.

Steering post, clutch and brake pedals ad-
justable to any sized driver.

Write for catalog and proposition to dealers.

Michigan Motor Car Co.

Owned by Owners of Michigan Buggy Company
Kalamazoo, Mich.

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cars will give your customers real
service and satisfaction.

When you sell a Stutz your profit
goes into the bank—not back into
the car in repairs.

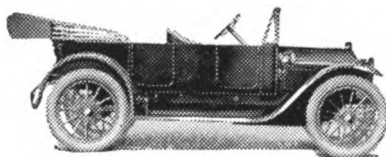
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announcement, Series B.*

The Ideal Motor Car Co.
Manufacturers of Stutz Cars,
Indianapolis, Ind.



Stutz Six-Cylinder, Six-Pas-
senger Touring Car, \$2300.

Paterson



Model 43—40 H. P. 5 Passenger Touring car
Price, \$1,600.00

Model 47—45 H. P. 7 Passenger Touring car
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All Paterson Cars Have

Long Stroke Motors, Long Wheel-base,
Unit Power Plant, Three Point Suspen-
sion, Complete Equipment, Electric
Lights, Self Starters.

And all the tried-out successful devices that
tend to reduce the up-keep and improve the
riding qualities and ease of operation.

W. A. PATERSON CO.
Flint, Michigan

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APPROXIMATE HORSE-POWER OF FOUR-CYCLE AUTOMOBILE ENGINES*

TABLE OF CONSTANTS FOR VARIABLE SPEEDS AND STROKES

Stroke in Ins.	REVOLUTIONS PER MINUTE OF MOTOR														
	500	550	600	650	700	750	800	850	900	950	1,000	1,050	1,100	1,150	1,200
2.00.....	.089	.098	.107	.116	.124	.134	.142	.153	.161	.169	.178	.187	.196	.205	.214
2.25.....	.100	.110	.120	.130	.140	.151	.160	.171	.181	.190	.200	.210	.220	.231	.241
2.50.....	.112	.125	.133	.145	.156	.167	.176	.189	.201	.212	.223	.233	.245	.257	.268
2.75.....	.123	.135	.146	.159	.172	.184	.196	.208	.221	.233	.245	.256	.270	.282	.295
3.00.....	.134	.147	.160	.174	.187	.201	.214	.227	.241	.254	.267	.279	.294	.308	.322
3.25.....	.145	.158	.173	.188	.203	.219	.232	.246	.261	.275	.289	.303	.319	.333	.349
3.50.....	.156	.173	.186	.203	.218	.234	.250	.265	.281	.296	.312	.326	.343	.359	.375
3.75.....	.167	.184	.200	.218	.234	.252	.266	.284	.301	.317	.334	.349	.368	.385	.401
4.00.....	.178	.196	.214	.232	.249	.268	.285	.303	.321	.339	.356	.373	.392	.411	.429
4.25.....	.189	.208	.227	.246	.264	.285	.303	.322	.341	.360	.378	.396	.416	.436	.456
4.50.....	.200	.220	.240	.261	.280	.305	.321	.341	.361	.381	.400	.419	.441	.461	.485
4.75.....	.212	.233	.253	.275	.295	.319	.339	.360	.381	.402	.423	.443	.466	.486	.509
5.00.....	.223	.245	.266	.290	.312	.335	.357	.379	.401	.423	.445	.466	.491	.512	.530
5.25.....	.234	.257	.279	.304	.327	.351	.375	.398	.421	.444	.467	.490	.515	.538	.563
5.50.....	.245	.270	.293	.318	.343	.368	.393	.417	.441	.465	.489	.513	.540	.564	.590
5.75.....	.258	.282	.307	.332	.369	.385	.410	.436	.461	.486	.512	.536	.564	.589	.616
6.00.....	.268	.294	.320	.348	.375	.402	.428	.455	.481	.508	.535	.559	.589	.615	.643

Bore in Ins.	Square of Bore
2.00	4.00
2.25	5.06
2.50	6.25
2.75	7.55
3.00	9.00
3.25	10.56
3.50	12.25
3.75	14.05
4.00	16.00
4.25	18.05
4.50	20.20
4.75	22.55
5.00	25.00
5.25	27.50
5.50	30.20
5.75	33.05
6.00	36.00

Rule:—Multiply number to right of bore by number in upper table at intersection of proper R.P.M. and stroke columns.

Example:—Find approximate horsepower developed by motor having 4.25" bore and 5" stroke at 800 revolutions per minute. Under 4.25 bore we find 18.05.

At intersection of 5" stroke line and 800 R.P.M. column in upper table we find .357.

The product of these numbers gives the horsepower, thus:

Approximate horsepower = $18.05 \times .357 = 6.45$ H.P.

These figures have been computed for the average M.E.P. as found in the ordinary motor car engine, but of course will vary with increase or decrease in compression and with different mechanical efficiencies.

*For multi-cylinder engines, multiply by number of cylinders. Above formula gives H. P. for only one cylinder.

Pratt—Forty

Fully Equipped

Bosch Magneto, Prest-O-Self-Starter, Prestolite Tank, Demountable Rims and one extra, Gray & Davis Nickel and Black Enamel Lamps electric side and tail with storage battery for same, top, hood, windshield, speedometer, ventilators, tools, repair kit, pump, horn, jack, foot and cloak rails and cocoa mat.

ONE CHASSIS FOR ALL MODELS

Unit power plant, three-point suspension, 4½x4½ motor, 40 H. P., 36x4 in. wheels, direct straight line drive, 120-inch wheel base.



Model "H." Price \$2000

Write for our interesting agency proposition

Elkhart Carriage & Harness Mfg. Co.
Elkhart, Indiana

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"A Year Ahead of the Times"



TOURING CAR fully equipped, \$3500.

Has every essential of service, style, elegance, comfort and power possessed by the highest priced foreign cars. Knight Engine, Dry Multiple Disc Clutch, Electric Starting and Lighting Device, Power Tire Pump. Cantilever Springs and Wire Wheels make it the easiest riding car in the world.

Send for booklet giving full description.

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EDWARDS KNIGHT

COLE

All Coles equipped with Delco Electric Starting, Lighting and Ignition System; unit power plant; enclosed valves; standard construction throughout.

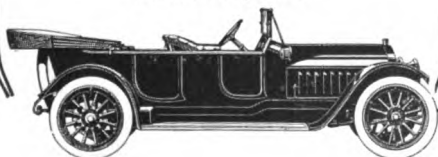
Cole "40"—116-inch wheelbase, completely equipped.....\$1685

Cole "60"—6 cylinder, five passenger, convertible to seven passenger, 132-inch wheelbase, completely equipped.....\$2485

Write for Cole Blue Book and information for dealers.

"The Car that is writing gasoline history"

Cole Motor Car Company
Indianapolis



Croton "Six"

—The Season's Great
\$3000 Car



Here is a car which shows such an important advance in automobile design and construction that every buyer and every dealer should be sure to see it.

The Croton has all the features that make any car desirable, and it has many which you can't find in any other.

The man who runs the Croton has a car that embodies engineering skill of the highest order, as well as the utmost elegance in line.

The Croton is made in a full line of models, "Fours" and "Sixes."

Write or wire today for full details and specifications. Ask for Booklet A.

The Croton Motor Car Co.
Washington, Penn.

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BRAKE HORSEPOWER OF 2-CYCLE GASOLINE MOTORS

Determined by Tests of Marine Motors

HORSEPOWER OF 2 CYCLE ENGINES—ONE CYLINDER								
	Bore and Stroke.	3 x 2½	3 x 3	3 x 3½	3 x 4	3½ x 3	3½ x 3½	3½ x 3¾
R.P.M...	300	.52	.62	.73	.83	.85	.99	.85
	400	.69	.83	.97	1.10	1.13	1.32	1.14
	500	.87	1.04	1.21	1.38	1.41	1.65	1.42
	600	1.04	1.25	1.45	1.66	1.70	1.97	1.71
	700	1.21	1.45	1.70	1.93	2.00	2.30	2.00
	800	1.38	1.65	1.94	2.20	2.26	2.62	2.28
	900	1.55	1.87	2.20	2.50	2.55	2.96	2.56
	1000	1.75	2.10	2.40	2.76	2.84	3.30	2.90
R.P.M...		4 x 3	3½ x 3½	4 x 3½	3¾ x 4	3¾ x 3¾	4 x 4	4½ x 4
	300	1.10	1.14	1.28	1.30	1.22	1.48	1.67
	400	1.47	1.50	1.72	1.73	1.62	1.97	2.22
	500	1.84	1.90	2.15	2.16	2.00	2.46	2.78
	600	2.20	2.30	2.58	2.60	2.44	2.94	3.34
	700	2.58	2.65	3.00	3.00	2.84	3.44	3.89
	800	2.94	3.00	3.42	3.45	3.24	3.92	4.45
	900	3.30	3.40	3.86	3.88	3.65	4.45	5.00
R.P.M...	1000	3.70	3.80	4.30	4.40	4.05	4.92	5.55
		4½ x 4½	4½ x 4	4 x 5	4½ x 4½	4½ x 4½	4½ x 5	4½ x 5½
	300	1.77	2.08	1.85	1.87	2.10	2.34	2.58
	400	2.36	2.78	2.46	2.50	2.80	3.12	3.42
	500	2.95	3.46	3.07	3.12	3.50	3.90	4.30
	600	3.54	4.15	3.70	3.75	4.20	4.68	5.15
	700	4.13	4.85	4.30	4.37	4.90	5.45	6.00
	800	4.70	5.55	4.93	5.00	5.60	6.25	6.90
R.P.M...	900	5.30	6.20	5.50	5.60	6.30	7.00	7.70
	1000	5.90	6.90	6.15	6.25	7.00	7.80	8.60
		4½ x 5	5 x 5	5 x 5½	5 x 6	5½ x 5½	5½ x 5	5½ x 5
	300	2.60	2.88	3.00	3.46	3.44	3.50	3.80
	400	3.48	3.82	4.00	4.60	4.57	4.65	5.10
	500	4.35	4.80	5.05	5.75	5.70	5.80	6.35
	600	5.20	5.75	6.10	6.90	6.85	7.00	7.60
	700	6.10	6.70	7.05	8.05	8.15	8.15	8.90
R.P.M...	800	6.95	7.65	8.10	9.25	9.30	9.30	10.30
	900	7.80	8.65	9.20	....	10.50	10.50	11.40
	1000	8.70	9.60	10.00	....	....	11.60	12.70
		5½ x 5½	5½ x 6½	5½ x 6½	6 x 6	6½ x 6½	6 x 7	
	300	3.84	4.35	4.50	4.95	6.30	5.80	....
	400	5.10	5.82	6.00	6.60	8.40	7.75	....
	500	6.40	7.25	7.60	8.30	10.50	9.70	....
	600	7.67	8.75	9.25	9.95	12.60	11.60	....
R.P.M...	700	9.00	10.20	10.60	11.60	14.70	13.50	....
	800	10.25	11.60	....	....	....	....	....
	900	11.50	....	....	....	....	....	....
	1000	....	....	....	....	....	....	....

Index to Tables and Data appears on Pages 23 to 26.

Stearns

THE ULTIMATE CAR
(Knight Type Motor)

¶ Since adopting the Knight type motor, Stearns sales have practically doubled. Never before in the seventeen years' history of the company have our shipments been as heavy. Our output is still greater this year.

Dealers considering Open
Territory write to

The F. B. Stearns Co.
Cleveland, Ohio

VELIE

Motor Cars

14 Body Styles

\$1900-\$3300

*Service
Included*

VELIE CO.
CHICAGO

MIDLAND

Read This Startling Agency Proposition

Here are a few of the many advantages the man who secures the Midland Agency will enjoy:

No Deposit Required On Car Contracts—Not a penny is needed in advance. We don't want his money to run our business—we have plenty of our own. Buy first—then pay.

Demonstrator Shipped for Trial Without Advance Payment—We won't ask him to buy "sight-unseen." We don't believe in "pig in a poke" methods. He will know what wonderful car value the Midland represents before spending a cent.

Close co-operation—Special Service Station—We will establish a service station right at his door—no waiting to send to factory for parts. Help—advice—parts, "on tap," for instant action always.

Big Advertising Campaign Over His Name—We will run a liberal advertising campaign over our dealer's name—for his benefit—at our expense.

The Midland Model T, 6-50, 7 passenger car sells for \$2450 and the Model T 4-40, 5 passenger car sells for \$2385—both big bargains and quick easy sellers.

GET THE FACTS

Write for full information regarding the Midland 1913 Agency Proposition—the most liberal offered. Don't delay. You may lose your territory. Act now.

MIDLAND MOTOR CO., East Moline, Illinois

Ever Circularize?

May be you have had experience with incomplete and obsolete lists, if so, you will appreciate the thorough and up-to-date listing of the trade as exemplified by THE AUTOMOBILE TRADE DIRECTORY'S MAILING LIST.

This List is acknowledged to be the only complete work of its kind in existence, and one in great demand among manufacturers, who "follow up" their advertising through the mails.

You can secure a copy for your own use—a letter of request will bring the details.

The Automobile Trade Directory

243-49 West 39th Street
NEW YORK, - N. Y.

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O'GORMAN'S HORSE-POWER REFERENCE TABLE

HORSE-POWER FROM BORE AND STROKE—FORMULA $KD^{1.6}S^4$

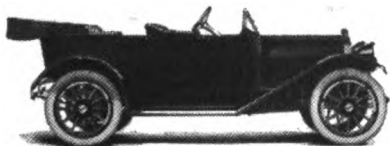
To find the comparative horse-power number of a car, find the bore in mm. given in the extreme left-hand column and follow the horizontal line till you reach the column vertically below the stroke in mm. Thus, if the bore is 101.5 mm. and the stroke 114 mm. the horse-power number is 30.9. This is not the maximum power, but a representative figure for power.

Bore in MM.	STROKE IN MILLIMETRES															Bore in Inches
	55	57	60	63.5	65	70	75	76	80	82.5	85	89	90	95.2	100	
55	8.6	8.8	9	9.2	9.3	9.5	9.8	9.8	10	10.2	10.3	10.5	10.6	10.8	11	2½
57	9.25	9.3	9.5	9.8	9.9	10.2	10.5	10.5	10.75	10.8	11	11.1	11.2	11.5	11.75	2½
63.5	11	11.1	11.25	11.5	11.5	12	12.3	12.4	12.6	12.8	13	13.2	13.25	13.5	13.8	2½
65	11.2	11.3	11.6	11.8	12	12.3	12.7	12.8	13	13.2	13.4	13.6	13.7	14.0	14.3	2½
70	12.75	12.9	13.2	13.4	13.5	14	14.5	14.5	14.75	14.9	15.2	15.4	15.5	15.8	16	2½
75	14.2	14.3	14.6	15	15.1	15.5	16	16.1	16.5	16.7	16.9	17.2	17.3	17.7	18.1	2½
76	14.5	14.8	15	15.4	15.5	16	16.5	16.6	17	17.1	17.4	17.7	17.75	18.2	18.5	3
80	15.7	16	16.2	16.6	16.8	17.3	17.8	17.9	18.3	18.5	18.8	19.1	19.2	19.6	20	3½
82.5	16.4	16.6	17	17.3	17.5	18	18.6	18.7	19	19.3	19.5	19.9	20	20.5	20.8	3½
89	18.7	18.9	19.3	19.7	20	20.5	21	21.2	21.6	21.9	22.2	22.6	22.7	23.2	23.7	3½
90	19.1	19.3	19.7	20.2	20.25	21	21.6	21.7	22.1	22.4	22.7	23.1	23.3	23.8	24.3	3½
95.2	20.9	21.1	21.6	22	22.25	22.9	23.55	23.7	24.2	24.5	24.75	25.2	25.4	25.9	26.4	3½
100	22.5	22.8	23.2	23.8	24	24.7	25.5	25.6	26.2	26.5	26.9	27.3	27.4	28	28.6	3½
101.5	23	23.4	23.9	24.4	24.6	25.4	26	26.2	26.75	27.1	27.5	27.9	28	28.66	29.25	4
105	24.5	24.9	25.3	26	26.2	27	27.9	28	28.6	29	29.3	29.8	30	30.6	31.3	4½
108	25.25	25.6	26.2	26.8	27.2	28	28.8	29	29.6	29.9	30.3	30.8	31	31.66	32.3	4½
114.5	28.3	28.8	29.3	30.3	30.3	31.2	32.1	32.3	32.9	33.3	33.7	34.3	34.5	35.2	36	4½
115	30.4	30.7	31.3	32.3	32.8	33.2	34	34.3	35	35.4	35.9	36.5	36.7	37.5	38.3	4½
120	31.8	32.2	32.8	34	34	35	36	36.2	36.9	37.4	37.8	38.5	38.7	39.6	40.4	4½
125	33.2	33.5	34.3	35.2	35.3	36.3	37.3	37.6	38.3	38.8	39.25	40.0	40.2	41	41.8	5
127	33.2	33.5	34.3	35.2	35.3	36.3	37.3	37.6	38.3	38.8	39.25	40.0	40.2	41	41.8	5
130	34.1	34.6	35.2	36.4	36.4	37.5	38.6	38.8	39.5	40	40.5	41.1	41.3	42.3	43.2	5½
		2½		2½		2½		3		3½		3½		3½		
STROKE IN INCHES																

Bore in MM.	STROKE IN MILLIMETRES															Bore in Inches
	101.5	105	108	110	114	115	120	125	127	130	133	135	139	140	145	
55	11.1	11.2	11.3	11.4	11.6	11.7	11.8	12	12.1	12.2	12.3	12.3	12.4	12.5	12.6	2½
57	11.7	12	12	12.2	12.3	12.4	12.5	12.75	12.8	13	13.1	13.1	13.2	13.3	13.4	2½
63.5	13.9	14.1	14.2	14.4	14.5	14.6	14.8	15	15.2	15.4	15.5	15.5	15.6	15.7	15.8	2½
65	14.4	14.6	14.8	14.9	15.2	15.3	15.5	15.7	15.8	15.9	16.1	16.1	16.2	16.3	16.4	2½
70	16.2	16.5	16.6	16.75	17	17	17.4	17.6	17.7	18	18.1	18.1	18.2	18.3	18.4	2½
75	18.2	18.4	18.6	18.8	19	19.1	19.4	19.7	19.8	20	20.2	20.2	20.3	20.4	20.5	2½
76	18.6	18.9	19.1	19.2	19.4	19.5	19.85	20.2	20.3	20.5	20.7	20.7	20.8	20.9	21	2½
80	20.0	20.4	20.6	20.8	21	21.2	21.5	21.8	21.9	22.2	22.4	22.4	22.5	22.6	22.7	3
82.5	20.9	21.2	21.4	21.6	21.9	22	22.35	22.7	22.8	23.0	23.3	23.3	23.4	23.5	23.6	3
89	23.8	24.1	24.4	24.55	24.9	25	25.4	25.8	26	26.2	26.5	26.5	26.6	26.7	26.8	3½
90	24.4	24.7	25	25.2	25.5	25.6	26.0	26.5	26.6	26.9	27.2	27.2	27.3	27.4	27.5	3½
95.2	26.6	26.9	27.2	27.45	27.9	28	28.4	28.9	29.0	29.4	29.7	29.7	29.8	29.9	30	3½
100	28.8	29.2	29.4	29.7	30	30.2	30.8	31.2	31.4	31.7	31.9	32	32.1	32.2	32.3	3½
101.5	29.4	29.85	30.2	30.4	30.9	31	31.5	32	32.2	32.6	32.9	33	33.5	33.5	34	3½
105	31.4	31.4	32.2	32.5	33	33.1	33.7	34.2	34.4	34.8	35.1	35.2	35.8	35.9	36.3	4
108	32.5	33	33.3	33.5	34	34.2	34.75	35.3	35.5	35.9	36.2	36.4	36.8	37	37.5	4½
114.5	35.5	36	36.3	36.6	37.2	37.3	37.9	38.6	38.8	39.2	39.6	39.8	40.3	40.4	41	4½
115	36.1	36.1	37	37.4	37.9	38	38.7	39.3	39.5	39.9	40.3	40.5	41.1	41.2	41.8	4½
120	38.5	39	39.5	39.8	40.4	40.6	41.3	42	42.2	42.7	43	43.3	44	44	44.6	4½
125	40.6	41.2	41.6	42	42.5	42.7	43.5	44.2	44.4	44.8	45.3	45.4	46.1	46.3	46.9	4½
127	42.0	42.7	43.1	43.5	44.0	44.25	45	45.75	46	46.5	46.9	47.2	47.8	48	48.6	5
130	43.4	44	44.5	45	45.5	45.7	46.5	47.3	47.5	48	48.5	48.7	49.4	49.6	50.2	5½
	4		4½		4½		4¾		5		5½		5½			
STROKE IN INCHES																

(Table continued on page 542.)

Index to Tables and Data appears on Pages 23 to 26.

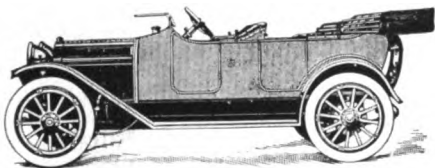
THE IMPERIAL "44"**Costs Less Gives More****SPECIFICATIONS****Long Stroke Motor $4\frac{1}{2} \times 5\frac{1}{2}$** **Unit Power Plant****122 inch Wheel Base 36x4 Tires****Center Control****Electric Started****Electric Lighted****Fully Equipped****FOUR OTHER MODELS***Write for Catalog and Comparative Chart, and Honest Comparison.***IMPERIAL AUTOMOBILE CO.**
JACKSON, MICHIGAN**AMERICAN
UNDERSLUNG****A Car for Discriminating Buyers**

Now that buyers have come to understand the manifold advantages of Underslung construction, its great safety, comfort and economy, we now make an underslung car to fit every condition and every purse.

"American Traveler" Type 56-A.
six passenger, \$4500**"American Traveler" Type 54-A**
four passenger, \$4250**"American Tourist," Type 34-A.**
four passenger, \$2350**"American Roadster," Type 32-A.**
two passenger, \$2350**"American Scout," Type 22-A.**
two passenger, \$1475*We write the fairest sales agreement ever made.***AMERICAN MOTORS COMPANY**

Desk 7

Indianapolis, Ind.

PAIGE 36
A Next Year's Car

THE new Paige "36" is a revelation in motor car building. It's a next year's car. No other manufacturer is building such a car to sell at such a price. Maybe later, but not now.

The Paige "36" is a big car, excellently designed and constructed, and phenomenally equipped. People say the price—\$1275—seems impossible. But that's the price.

116 inch wheel base, 4x5 inch motor, cork insert multiple disc clutch, left-side drive, center control, silent chain-driven motor gears, Gray & Davis electric starting and lighting system, Bosch magneto, 34x4 inch tires.

For those who want a smaller car, the Paige "25" at \$950 offers a value just as extraordinary. Come and see the Paige before you choose any car. Both models are offered in a variety of beautiful body types.

PAIGE-DETROIT MOTOR CAR CO.

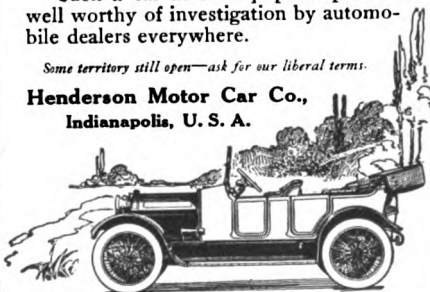
Dept. C

301 Twenty-first St., DETROIT, MICH.**HENDERSON***The Car of Today***Six Sizes—\$1285 to \$1685**

Ward Leonard Electric Self Starter
—Dynamo Electric Lights—Wire
Wheels (Including one extra wheel)—
Left Side Drive—Single Lever Center
Control—Gasoline Tank Under Cowl.

THIS equipment—built into the car—and the stylish body design of the Henderson has led many experienced automobile people to refer to it as a foreign car.

Such a car at such popular prices is well worthy of investigation by automobile dealers everywhere.

*Some territory still open—ask for our liberal terms.***Henderson Motor Car Co.,**
Indianapolis, U. S. A.

Please mention The Automobile Trade Directory when writing to advertisers.

O'GORMAN'S HORSE-POWER TABLE (Continued)

Bore in MM.	STROKE IN MILLIMETRES															Bore in Inches
	146	150	152	155	158	160	165	170	171	175	178	180	184	185	190	
55																2 ⁵ / ₃₂
57																2 ¹ / ₄
63.5																2 ¹ / ₂
65																2 ⁹ / ₁₆
70																2 ³ / ₈
75																2 ¹ / ₂
76																3
80																3 ⁹ / ₆₄
82.5																3 ¹ / ₄
89																3 ¹ / ₂
90																3 ¹ / ₂
95.2																3 ¹ / ₂
100																3 ¹ / ₂
101.5																4
105	34.1	34.5	34.7	35	35.2	35.4	35.8	36.2	36.3	36.7	36.9	37		37.4		4 ¹ / ₁₆
108	36.4	36.8	37	37.3	37.5	37.7	38	38.5	38.6	38.9	39.1	39.3		39.6		4 ¹ / ₈
114.5	37.6	38	38.2	38.5	38.8	39	39.5	39.9	40	40.4	40.6	40.8		41.2		4 ¹ / ₈
115	41.2	41.5	41.8	42	42.5	42.6	43.2	43.7	43.8	44	44.4	44.6		45		4 ¹ / ₈
120	41.9	42.3	42.6	43	43.4	43.6	44	44.6	44.7	45.1	45.3	45.5		45.9		4 ¹ / ₈
125	44.7	45.2	45.5	45.8	46.2	46.4	47	47.5	47.6	48	48.3	48.6		49		4 ³ / ₈
127	47	47.5	47.9	48.3	48.7	48.9	49.5	50.1	50.2	50.6	50.9	51.2		51.6		4 ³ / ₈
130	48.7	49.3	49.5	50	50.4	50.5	51.2	51.8	52	52.4	52.8	53		53.5		5
	50.2	50.8	51.2	51.6	52	52.2	52.8	53.5	53.6	54.2	54.4	54.7		55.2		5 ¹ / ₈
	5 ³ / ₄		6		6 ¹ / ₄		6 ¹ / ₂		6 ³ / ₄		7			7 ¹ / ₄	7 ¹ / ₂	
STROKE IN INCHES																

A. L. A. M. STANDARD HORSE-POWER FORMULA

(BORE OF CYLINDER SQUARED x NO. OF CYLINDERS, ÷ 2.5)

BORE		HORSE POWER			
Inches	Mill	1 Cyl.	2 Cyl.	4 Cyl.	6 Cyl.
2 ¹ / ₂	64	2 ¹ / ₂	5	10	15
2 ⁵ / ₈	68	2 ³ / ₄	5 ¹ / ₂	11	16 ¹ / ₂
2 ³ / ₄	70	3	6	12 ¹ / ₁₀	18 ¹ / ₂
2 ⁷ / ₈	73	3 ⁵ / ₁₆	6 ⁵ / ₈	13 ¹ / ₄	19 ⁷ / ₈
3	76	3 ³ / ₈	7 ¹ / ₈	14 ¹ / ₂	21 ³ / ₈
3 ¹ / ₈	79	3 ¹ / ₂	7 ¹ / ₂	15 ¹ / ₄	23 ¹ / ₈
3 ¹ / ₄	83	4 ¹ / ₄	8 ¹ / ₂	16 ⁹ / ₁₀	25 ³ / ₈
3 ³ / ₈	85	4 ⁹ / ₁₆	9 ¹ / ₈	18 ¹ / ₄	27 ³ / ₈
3 ¹ / ₂	89	4 ⁹ / ₁₀	9 ⁴ / ₅	19 ³ / ₈	29 ³ / ₈
3 ⁵ / ₈	92	5 ¹ / ₄	10 ¹ / ₂	20 ¹ / ₄	31 ³ / ₈
3 ³ / ₄	95	5 ⁵ / ₈	11 ¹ / ₄	22 ¹ / ₂	33 ³ / ₈
3 ⁷ / ₈	99	6	12	24	36 ¹ / ₈
4	102	6 ³ / ₈	12 ³ / ₈	25 ³ / ₈	38 ³ / ₈
4 ¹ / ₈	105	6 ¹ / ₂	13 ³ / ₈	27 ¹ / ₄	40 ⁹ / ₁₀
4 ¹ / ₄	108	7 ¹ / ₄	14 ¹ / ₂	28 ⁹ / ₁₀	43 ³ / ₈
4 ³ / ₈	111	7 ⁵ / ₈	15 ⁵ / ₈	30 ⁵ / ₈	45 ¹ / ₂
4 ¹ / ₂	114	8 ¹ / ₁₀	16 ¹ / ₂	32 ³ / ₄	48 ³ / ₈
4 ⁵ / ₈	118	8 ⁹ / ₁₆	17 ¹ / ₈	34 ¹ / ₄	51 ³ / ₈
4 ³ / ₄	121	9	18	36 ¹ / ₁₀	54 ¹ / ₁₀
4 ⁷ / ₈	124	9 ¹ / ₂	19	38	57
5	127	10	20	40	60
5 ¹ / ₈	130	10 ¹ / ₂	21	42	63
5 ¹ / ₄	133	11	22	44 ¹ / ₁₀	66 ¹ / ₈
5 ³ / ₈	137	11 ⁹ / ₁₆	23	46	69 ¹ / ₁₀
5 ¹ / ₂	140	12 ¹ / ₁₀	24 ¹ / ₈	48 ³ / ₈	72 ³ / ₈
5 ⁵ / ₈	143	12 ⁵ / ₈	25 ⁵ / ₈	50 ⁵ / ₈	75 ¹ / ₄
5 ³ / ₄	146	13 ¹ / ₄	26 ¹ / ₂	53	79 ¹ / ₂
5 ⁷ / ₈	149	13 ¹ / ₂	27 ⁵ / ₈	55 ¹ / ₄	82 ⁹ / ₁₀
6	152	14 ³ / ₈	28 ³ / ₈	57 ³ / ₈	86 ³ / ₈

Computed at 1,000 feet per minute piston speed.

Index to Tables and Data appears on Pages 23 to 26.

AVOID inferior MIRROR REFLECTORS that discolor and peel off. Discriminating buyers specify the true focusing Mangin Ground

LANCASTER LENS

It's made right, of the best materials, by the most modern improved equipment and methods. **True focusing** and efficient. Heavy Silver backing, protected by a substantial electroplating of Copper which positively eliminates peeling or discoloration of Silver backing. They have powerful reflecting properties which flood the road far ahead with brilliant illumination.

THE LANCASTER LENS CO., Lancaster, Ohio



HIPWELL MFG. CO.

MANUFACTURERS OF

**ELECTRIC HORNS
ELECTRIC LIGHT OUTFITS
GREASE GUNS
VULCANIZERS
MFRS. OF SPECIALTIES**

831,833,835 North Ave. West, Pittsburg, Penn.

NO LIGHTING ENGINEER



would consider an electric lighting installation complete unless suitable meters were included. ***Is your Auto Lighting Plant complete?***

**HOYT METERS HAVE PROVED THEIR
WORTH IN AUTOMOBILE LIGHTING**

HOYT ELECTRICAL INSTRUMENT WORKS, Penacook, N. H.



VICTOR

Trade Mark Reg.

**WILL INFLATE a TIRE in ONE-THIRD
THE number of STROKES of any Com-
petitive Pump.**

**Its METALLIC TANNED PACKINGS
will wear forever and are guaranteed.**

REMEMBER

No Pump is STRONGER than its PACKINGS.

**Judd & Leland Mfg. Co.
Clifton Springs, N. Y.**

MEAN EFFECTIVE PRESSURES

In standard modern vehicle motors the mean effective pressure is about 5 kilograms per square centimeter (71 pounds per square inch). This pressure has increased since the beginning of the automobile industry but in a lesser proportion than the speed. It varies with the size of the motor. Thus, in a current type of motor with 60x120 mm. cylinders (2.4x4.8 inches), it attains 4 kilograms (57 pounds per square inch). In a motor of 80x130 mm. (3.2x5.2 in.) it is about 5 kilograms (71 pounds per square inch), and in a motor of 110x140 mm. (4.4x5.6 inches) it is about 6 kilograms (85 pounds), all other things being equal. This at 1,000 revolutions per minute.

The mean effective pressure increases as the result of increased compression. It decreases as the number of revolutions per minute increases.

The thermal efficiency of a motor, by which is understood the ratio between the work done and the thermal energy contained in the fuel consumed, is in the neighborhood of 14 to 15 per cent., corresponding to a fuel consumption of one-eighth of a gallon per horsepower hour. The mechanical efficiency, by which is understood the ratio between the work actually done to the energy expended on the piston by the expanding gases, is approximately 70 per cent. The efficiency of transmission, that is, the ratio of the work done at the wheel rims to that delivered at the crank shaft, is generally taken as 75 per cent.—Translated from "La Locomotion," by "The Horseless Age."

MEAN EFFECTIVE PRESSURES

DISREGARDING MECHANICAL LOSSES

Make	Cylinders	Horse-power	Revolutions per Minute	Mean Effective Pressure
Daimler	Four 124x130 mm.....	58.0	1,172	106.8
National.....	Four 5x5 1 $\frac{1}{8}$ in.....	64.0	1,400	81.1
National.....	Four 5x5 1 $\frac{1}{8}$ in.....	54.1	1,055	90.9
Pierce.....	Six 4x4 $\frac{3}{4}$ in.....	44.5	1,263	76.1
Pierce.....	Six 4x4 $\frac{3}{4}$ in.....	30.9	800	85.4
Rambler.....	Four 5x5 $\frac{1}{2}$ in.....	43.5	1,091	73.1
Rambler.....	Four 5x5 $\frac{1}{2}$ in.....	40.0	900	81.3
Rambler.....	Four 4 $\frac{1}{2}$ x4 $\frac{1}{2}$ in.....	34.0	1,333	72.2
Rambler.....	Four 4 $\frac{1}{2}$ x4 $\frac{1}{2}$ in.....	29.0	900	89.2
Thomas.....	Six 4 $\frac{1}{4}$ x5 $\frac{1}{2}$ in.....	49.0	1,091	76.0
Thomas.....	Six 4 $\frac{1}{4}$ x5 $\frac{1}{2}$ in.....	34.5	700	83.4

*Fitted with Knight-Daimler sleeve valve engine.

SEQUENCE OF FIRING OF VARIOUS AMERICAN SIX-CYLINDER AUTOMOBILE MOTORS

Pierce-Arrow	fires	1-5-3-6-2-4
Winton	"	1-5-3-6-2-4
Lozier	"	1-2-3-6-5-4
Peerless	"	1-3-2-6-4-5
Matheson	"	1-4-2-6-3-5
Stevens-Duryea	"	1-4-2-6-3-5
Knox	"	1-5-3-6-2-4
Alco	"	1-4-2-6-3-5
Thomas (K)	"	1-4-2-6-3-5
Thomas (L)	"	1-3-5-6-4-2
Franklin	"	1-4-2-6-3-5

We are in a position to furnish drop forgings made under expert supervision from the finest material that can be purchased.

We are also in a position to finish crankshafts and grey iron cylinder castings.

Let us quote on your requirements.

REDMOND ENGINEERING CO.,

DREXEL BLDG.,

PHILADELPHIA, PA.

Vanadium Gear Bronze

Vanadium gives to bronze the same remarkable wearing qualities it gives to steel.

VANADIUM GEAR BRONZE used for timing gears and for worm gears stays right on the job.

Silent and efficient operation result from its use because it was developed for just this service.

Send us your patterns.

VANADIUM METALS COMPANY

General Offices, Vanadium Bldg., Pittsburgh, Pa.

Foundries, East Braintree, Mass.; Groton, Conn.

TOLERANCE TABLE FOR RADIAL BALL BEARINGS

BORE

M.M. Diam.	M.M.	M.M.
6 to 10,5	+0	-0,008
11 to 18	+0	-0,01
19 to 30	+0	-0,012
31 to 48	+0	-0,014
49 to 75	+0	-0,016
76 to 115	+0	-0,018
116 to 175	+0	-0,02
176 to 400	+0	-0,025

OUTSIDE

M.M. Diam.	M.M.	M.M.
6 to 10,5	+0	-0,003
11 to 18	+0	-0,004
19 to 30	+0	-0,005
31 to 48	+0	-0,006
49 to 75	+0	-0,008
76 to 115	+0	-0,01
116 to 175	+0	-0,012
176 to 265	+0	-0,015
266 to 400	+0	-0,02

WIDTH

+0,01 M.M. -0,01

VARIATION OF VOLUME AND TEMPERATURE WITH COMPRESSION

Gauge Pressure	Volume	Temperature
0	1.000	60
2	.910	80.4
5	.810	106
10	.690	145
20	.543	207
30	.454	252
40	.393	302
50	.350	339
75	.276	420
100	.232	485
115	.213	518
130	.197	550
145	.184	580
160	.172	607
175	.163	632
200	.149	672

The foregoing table is based on the assumption that no heat is added or subtracted.



Size 66 6 Volts 60 Amperes
PRICE \$20

GEISZLER

NON-SULPHATING STORAGE BATTERY

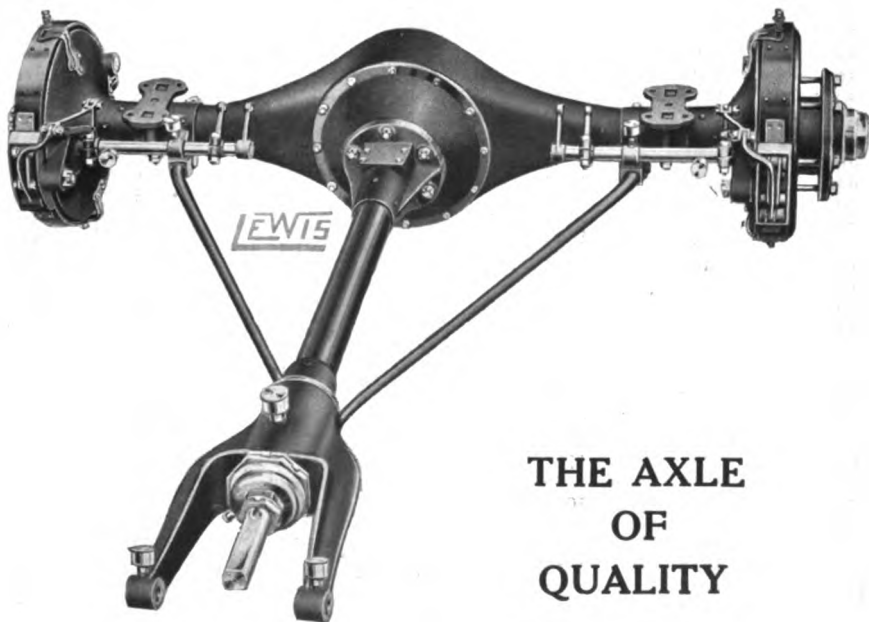
IGNITION BATTERIES
LIGHTING BATTERIES
MIDGET BATTERIES

SUPERIOR TO ANY OTHER STORAGE
BATTERY REGARDLESS OF PRICE

THE GEISZLER GUARANTEE.—We guarantee Geiszler batteries against deterioration when standing idle, whether charged or discharged. Any Geiszler battery which fails to operate to the user's satisfaction may be returned to us at any time within twelve months from the date of sale, and the purchase price will be refunded.

— COMPLETE CATALOGUE ON REQUEST —

Geiszler Bros. Storage Battery Co.
1512-1520 WEST 57th STREET NEW YORK CITY



THE AXLE
OF
QUALITY

THE LEWIS SPRING and AXLE CO., JACKSON, MICH.

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TABLE OF CRANK ANGLES AND CORRESPONDING PISTON POSITIONS

Out denotes the stroke towards the crankshaft.

In denotes the stroke away from the crankshaft.

Crank Angles in Degrees	CONNECTING ROD TO CRANK RATIO = 4		CONNECTING ROD TO CRANK RATIO = 4.5		CONNECTING ROD TO CRANK RATIO = 5	
	Out	In	Out	In	Out	In
2	.0004	.0002	.0004	.0003	.0004	.0003
4	.0015	.0010	.0015	.0010	.0015	.0010
6	.0034	.0021	.0033	.0021	.0033	.0022
8	.0061	.0036	.0060	.0038	.0058	.0039
10	.0095	.0057	.0092	.0059	.0091	.0061
12	.0136	.0082	.0133	.0087	.0131	.0088
14	.0185	.0112	.0181	.0116	.0178	.0119
16	.0241	.0146	.0236	.0152	.0232	.0156
18	.0304	.0185	.0298	.0192	.0293	.0197
20	.0375	.0228	.0367	.0237	.0360	.0243
22	.0452	.0276	.0442	.0286	.0434	.0294
24	.0536	.0329	.0524	.0340	.0515	.0349
26	.0627	.0385	.0613	.0399	.0602	.0410
28	.0724	.0447	.0708	.0462	.0696	.0475
30	.0827	.0513	.0809	.0531	.0796	.0545
32	.0936	.0583	.0916	.0603	.0901	.0619
34	.1051	.0658	.1029	.0680	.1012	.0698
36	.1172	.0738	.1147	.0762	.1128	.0782
38	.1298	.0822	.1271	.0848	.1250	.0870
40	.1430	.0910	.1400	.0939	.1377	.0962
42	.1565	.1002	.1534	.1034	.1509	.1059
44	.1707	.1099	.1673	.1134	.1646	.1161
46	.1853	.1201	.1816	.1237	.1787	.1267
48	.2003	.1306	.1963	.1345	.1932	.1377
50	.2156	.1416	.2115	.1458	.2081	.1491
52	.2314	.1530	.2270	.1574	.2234	.1609
54	.2474	.1648	.2428	.1695	.2391	.1732
56	.2638	.1769	.2589	.1819	.2550	.1858
58	.2805	.1896	.2754	.1947	.2713	.1988
60	.2974	.2026	.2920	.2079	.2878	.2122
62	.3146	.2159	.3090	.2215	.3046	.2260
64	.3320	.2297	.3262	.2355	.3215	.2401
66	.3495	.2438	.3435	.2498	.3387	.2545
68	.3672	.2582	.3610	.2644	.3561	.2693
70	.3850	.2730	.3786	.2794	.3735	.2844
72	.4028	.2881	.3963	.2947	.3911	.2998
74	.4208	.3036	.4141	.3103	.4088	.3155
76	.4388	.3193	.4319	.3261	.4266	.3315
78	.4568	.3353	.4498	.3422	.4444	.3477
80	.4747	.3516	.4677	.3586	.4622	.3642
82	.4927	.3682	.4857	.3753	.4799	.3809
84	.5105	.3849	.5034	.3921	.4977	.3978
86	.5283	.4019	.5211	.4091	.5154	.4149
88	.5460	.4191	.5388	.4263	.5330	.4321
90	.5635	.4365	.5563	.4437	.5505	.4495
92	.5802	.4540	.5737	.4612	.5670	.4670
94	.5981	.4787	.5909	.4789	.5851	.4846
96	.6151	.4895	.6079	.4966	.6022	.5028
98	.6318	.5073	.6247	.5143	.6191	.5201
100	.6484	.5253	.6414	.5323	.6358	.5378
102	.6647	.5432	.6578	.5502	.6523	.5556
104	.6807	.5612	.6739	.5681	.6685	.5734
106	.6964	.5792	.6897	.5859	.6845	.5912
108	.7119	.5972	.7053	.6037	.7002	.6082
110	.7270	.6150	.7206	.6214	.7156	.6265
112	.7418	.6328	.7356	.6390	.7307	.6439
114	.7562	.6503	.7502	.6565	.7455	.6613

(Continued on page 550.)

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Full Floating Pressed Steel Axles of Quality

**Deliveries
Guaranteed**

**Prices
Right**

Salisbury Wheel & Mfg. Co.
JAMESTOWN, N. Y.

MALLEABLE CASTINGS

FOR AUTOMOBILE PARTS

**TRUE TO PATTERNS
AND OF HIGHEST TENSILE STRENGTH**

**LARGE CAPACITY
PROMPT DELIVERIES**

**The right kind of castings for the right kind of car.
Write and let's get together on your requirements.**

SYRACUSE MALLEABLE IRON WORKS
SYRACUSE, N. Y.

Crank Angles in Degrees	CONNECTING ROD TO CRANK RATIO=4		CONNECTING ROD TO CRANK RATIO=4.5		CONNECTING ROD TO CRANK RATIO=5	
	Out	In	Out	In	Out	In
116	.7703	.6680	.7645	.6738	.7597	.6785
118	.7841	.6854	.7785	.6910	.7740	.6954
120	.7974	.7026	.7921	.7080	.7878	.7122
122	.8104	.7195	.8053	.7246	.8012	.7287
124	.8230	.7362	.8181	.7411	.8142	.7450
126	.8352	.7526	.8305	.7572	.8268	.7609
128	.8470	.7686	.8426	.7730	.8391	.7766
130	.8584	.7844	.8542	.7885	.8509	.7919
132	.8694	.7997	.8655	.8037	.8623	.8068
134	.8799	.8147	.8763	.8184	.8733	.8213
136	.8901	.8293	.8866	.8327	.8839	.8354
138	.8998	.8434	.8966	.8466	.8941	.8491
140	.9090	.8570	.9061	.8600	.9038	.8623
142	.9178	.8702	.9152	.8729	.9130	.8750
144	.9262	.8828	.9238	.8853	.9218	.8872
146	.9342	.8949	.9320	.8971	.9302	.8988
148	.9417	.9064	.9397	.9084	.9381	.9099
150	.9487	.9173	.9469	.9191	.9455	.9204
152	.9553	.9276	.9538	.9292	.9525	.9304
154	.9617	.9373	.9601	.9387	.9590	.9398
156	.9671	.9464	.9660	.9476	.9651	.9485
158	.9724	.9548	.9714	.9558	.9706	.9566
160	.9772	.9625	.9763	.9633	.9757	.9640
162	.9815	.9696	.9806	.9702	.9803	.9707
164	.9854	.9759	.9848	.9764	.9844	.9767
166	.9888	.9815	.9884	.9819	.9881	.9822
168	.9918	.9864	.9913	.9867	.9912	.9869
170	.9943	.9905	.9941	.9908	.9939	.9909
172	.9963	.9939	.9962	.9940	.9961	.9942
174	.9979	.9966	.9979	.9967	.9978	.9967
176	.9990	.9985	.9990	.9985	.9990	.9985
178	.9998	.9996	.9997	.9996	.9997	.9996
180	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000

This table should be useful for engine timing and for port design in two-cycle engines. The quantities are expressed in fractions of the stroke.

RACING OF MOTOR AT HIGH SPEEDS

Experiments were conducted by S. F. Edge at the Brooklands (England) track to determine whether the motor of an automobile "races" through the road (driving) wheels leaving the ground on rough roads and at high speeds. A Napier car was used. With high gear engaged, the car was towed a complete lap of the Brooklands track, a distance of approximately $2\frac{5}{8}$ miles, and the number of revolutions of the motor was found to be 3,372. Towing was effected following the 50-foot line of the track and the subsequent tests of the car under its own power were made on or about this line. Following is a tabulated result of the several tests:

Test	Distance (about $2\frac{5}{8}$ miles)	Speed in Miles per Hour	Engine Revolutions	Total Slip (in Engine Revs.)
1	1 lap $2\frac{5}{8}$ miles	Car towed	3,732	
2	1 lap $2\frac{5}{8}$ miles	Driven very slow speed	3,748	16
3	1 lap $2\frac{5}{8}$ miles	Driven 20	3,776	44
4	1 lap $2\frac{5}{8}$ miles	Driven 30	3,772	40
5	1 lap $2\frac{5}{8}$ miles	Driven 40	3,770	38
6	1 lap $2\frac{5}{8}$ miles	Driven 50	3,780	58
7	1 lap $2\frac{5}{8}$ miles	Driven 60	3,804	72

Index to Tables and Data appears on Pages 23 to 26.

Radium Steam Vulcanizer

For Kerosene or Gas

**INVESTIGATE THIS
VULCANIZER**

Write for our Catalogue

Simple, perfectly practical and economical.

Will repair 4 tubes or 2 tubes and 2 tires at same time in 20 to 30 minutes.

Heated by kerosene — can be used anywhere.

Steam heat under absolute steady control.

Automatic control makes perfect cure throughout. Heated in 10 minutes.

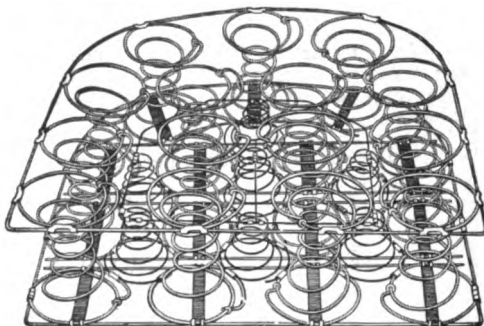
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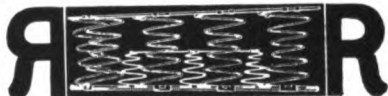
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ROUGH RIDER SPRINGS (Patented)



Best Automobile Spring Ever Made

No Possible Bumps or Jars

See those Auxiliary Springs?

The Best Cushions

Ventilated Buttons

are made with

AND

Rough Rider Springs



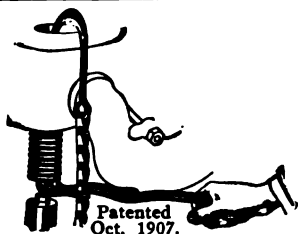
**NOTHING SO
COMFORTABLE**

No Shocks or Jars when Rough Riders are used

Manufactured by

JACKSON CUSHION SPRING CO., Jackson, Mich.
RANDOLPH EDWARDS CO. Exclusive Selling Agents

The Flexible Valve Remover



This Reliable Chain Tool has proven to be the best motor valve tool made, in fact it is the only practical tool of its kind on the market.

It is used with ease around pipes and fittings, the chain allows this. Every link is an adjustment.

Flexible Valve Remover, No. 1

Size 12½ inches long. Retalls for \$1.50 each.

Flexible Valve Remover, No. 2

Made on the Same Principle as Our Small No. 1 Tool. Size 17 inches long. Extra heavy for big cars. Retalls for \$2.00 each.

Both sizes of Flexible Valve Removers are made of malleable iron and nickel plated. We are also manufacturing valve grinders.

Flexible Valve Remover Co.
110 West Exchange Street, Providence, R. I.

FITZGERALD Battery Connectors Terminals and Clips



have always given satisfactory service, but we have brought out a new line on which a Spring Clip is used. This Clip insures positive contact at all times, and can be used with or without the nut. The Terminals are made to fit all sizes of Cable from 3/16" up to 1/2". They fill a long felt want for quick attaching of wire to storage batteries.

Let us send samples and quote prices.

FITZGERALD MFG. CO.
TORRINGTON, CONN.

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WIND RESISTANCE

Dating back to the time of Smeaton various formulas have been used for determining the relation between wind pressure and velocity as affecting the stability of buildings and other exposed structures. Smeaton's table, which is largely used at the present day, is as follows:

Miles per Hour	Feet per Second	Pressure per sq. ft. in Pounds	Wind Called
1	1.47	0.005	Hardly perceptible.
2	2.93	0.020	Just perceptible.
3	4.4	0.044	
4	5.87	0.079	
5	7.33	0.123	Gentle pleasant wind.
6	8.8	0.177	
7	10.25	0.241	
8	11.75	0.315	
9	13.2	0.400	
10	14.67	0.492	
12	17.6	0.708	Pleasant brisk gale.
14	20.5	0.964	
15	22.00	1.107	
16	23.45	1.25	
18	26.4	1.55	Very brisk.
20	29.34	1.968	
25	36.67	3.075	
30	44.01	4.429	High wind.
35	51.34	6.027	
40	58.68	7.873	
45	66.01	9.963	Very high storm
50	73.35	12.30	
55	80.7	14.9	
60	88.02	17.71	
66	95.4	20.85	Great storm.
70	102.5	24.1	
75	110.	27.7	Hurricane.
80	117.36	31.49	
100	146.67	49.2	Immense hurricane.

The foregoing table is applicable to automobile work assuming that the machine is moving in still air at the varying rates of speed given in miles per hour. It is generally admitted that the Smeaton formula gives results too high. The formula is $P = 0.005 V^2$. Other and more recent formulas are those of Martin, $P = 0.004 V^2$, and Dines, $P = 0.0029 V^2$. At a rate of speed of 60 miles an hour these formulas give the following results in pounds per square foot: Smeaton, 18; Martin, 14.4; Dines, 10.44.

In the case of pleasure cars the wind resistance at ordinary rates of speed is so low that it does not greatly influence design while in the case of racing machines many ingenious forms of construction have been tried out with a view to the reduction of the loss from this source.

POWER REQUIRED TO OVERCOME WIND RESISTANCE
(FORREST JONES)

A formula for use in approximating the power required to overcome wind resistance is given as follows:

$$HP = \frac{PA (M \ 5,280 \mid 60)}{33,000} = 0.00267 PAM$$

In which HP = Horsepower required to overcome wind resistance
 P = Pressure of wind in pounds per square foot.
 A = Front area of body in square feet.
 M = Speed of car in miles per hour.

Numerical example:

Assuming a car with a front area of 10 square feet and a speed of 60 miles per hour, the power required to overcome this wind resistance will be:

$$HP = \frac{13 \times 10 (60 \times 5,280 \mid 60)}{33,000} = 20.8$$

It is not believed that this formula will hold out for all ranges in speed, nor can it be said with certainty that the front area total will be correctly stated if the areas of all the parts without respect to shape or location are figured in on the same basis. In all probability, the most certain way to ascertain the amount of power required to overcome wind resistance is to take a certain car and with suitable instrument under road conditions measure the power required

Arthur C. Harvey Co.

Special Steel
for
Automobile Work

Bars, Sheets and Shapes
Auto Body Steel
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For Automobile and Mechanical Construction.

STEEL AND IRON
for all special purposes.

Great assortment and large stock carried.

E. K. Morris & Co.

311-313-315-317 W. 2d St.

CINCINNATI, Ohio

DIMENSIONS AND LIFT OF POPPET VALVES FOR A GIVEN SIZE OF OPENING

D = Smaller diameter of valve seat.

d = diameter of piping to which valve opening must correspond.

$$r = \frac{D}{d}$$

FLAT-SEATED VALVES.

For $r = 1$	Lift = $d \times 0.250 = D \times 0.250$.
" $r = 1.25$	" = $d \times 0.200 = D \times 0.160$.
" $r = 1.5$	" = $d \times 0.166 = D \times 0.111$.
" $r = 2$	" = $d \times 0.125 = D \times 0.162$.
" $r = 2.5$	" = $d \times 0.100 = D \times 0.040$.

CONE-SEATED VALVES; 45° ANGLE OF CONE.

For $r = 1$	Lift = $d \times 0.307 = D \times 0.307$.
" $r = 1.25$	" = $d \times 0.256 = D \times 0.205$.
" $r = 1.5$	" = $d \times 0.219 = D \times 0.146$.
" $r = 2$	" = $d \times 0.170 = D \times 0.084$.
" $r = 2.5$	" = $d \times 0.138 = D \times 0.055$.

It will be noted that cone-seated valves require a lift from one-fifth to one-quarter greater than the corresponding flat-seated valves.

The proportions of lift given in connection with flat-seated valves are geometrically correct. It should, however, be borne in mind that flat-seated valves generally introduce a certain amount of wire drawing of the incoming charge. A slight increase over the theoretically correct lifts should consequently be provided. A definite coefficient cannot be given, as this will depend considerably upon the valve seat and valve chest design as well as upon the proportions of the fillet between valve stem and valve head. The matter is one of personal intuition by the designer; in the best French designs the extra allowance seldom exceeds 25 per cent. of the theoretical lift. It is well to so arrange the contour of the valve and valve chamber profiles that a minimum of lift be required, as this is favorable to silence in running and to flexibility.

FORMULA FOR PISTON VELOCITY

The ratio of connecting rod length to stroke influences the velocity of the piston, and the following will hold: Let,

- l = eccentricity of crank (half the stroke);
- L = length of connecting rod;
- v = linear velocity of crank-pin;
- θ = crank angle;
- S = piston velocity in feet per minute;
- r = ratio;

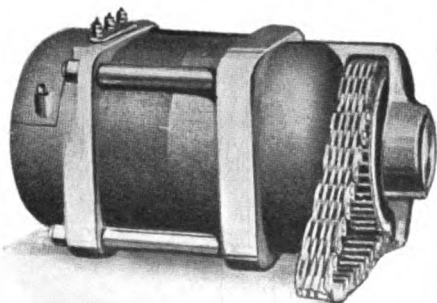
when,

$$r = \frac{L}{l}$$

and,

$$S = v(\sin \theta \times l / 2a \sin 2\theta)$$

In the above expression for the piston velocity, all terms higher than 2θ are neglected because of their small value, which affects the result little, and only makes the formula cumbersome.

*Apico***Electric
Engine
Starters**

Made in three styles with shaft drive, flexible gear drive, or of the flywheel type. Absolutely dependable systems, combining all the electric functions for the automobile. Simple, efficient, reliable.

Special proposition to automobile manufacturers. Write for it today. We are builders of electric lighting systems for automobiles, also motor lamps and lighting fixtures.

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GIANT PLUG**

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Hughson & Merton, Inc.: San Francisco, Los Angeles, Portland, Seattle, Denver.

Mr. Manufacturer:**Equip your cars for 1913 with
Benford's New Monarch Spark Plugs.**

We guarantee these to your customer for one year's continual use which cuts down the running expenses of your car.

We are the largest and only producers of spark plugs from the rolled bar to the finished article.

Write us for samples and price.

We are also manufacturers of high-grade timers at interesting prices.

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PROOF****SPARK
PLUGS****"The Original
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Trouble Proof
Produce Most Power
Make Cars Sweetest
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Cure the "Jerk"
Outwear and Outlast
All Others

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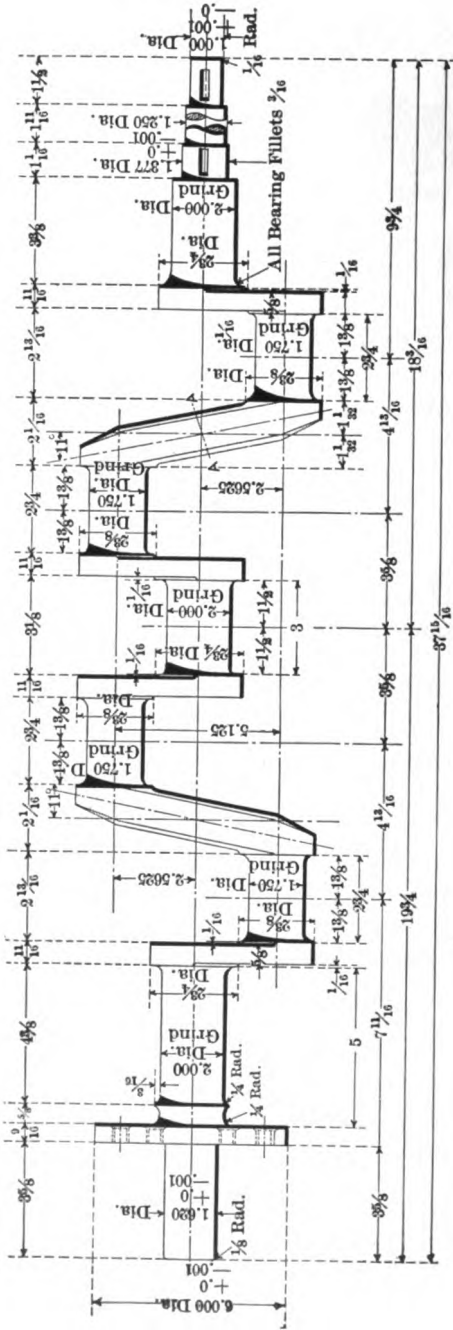
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trodes and condenser
terminal.

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SHAFT





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Long Stroke— $4\frac{1}{4} \times 5\frac{1}{4}$.

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7000 lb. Load on 2-Ton Truck

Victor Motor Trucks

are built for the hard usage of constant service. Every truck is tested for an overload of one hundred per cent. of its guaranteed capacity. Every part is extra heavy—carefully and accurately fitted—thoroughly tested. You run no chances when you sell the Victor.

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Victor Motor Truck Co.
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SIX THOUSAND MILES WITHOUT A RIP!

Zip prevents loss of air from punctures and leaks. It is easily put in tire through valve; simply Jack wheel up—let air out—put Zip in—inflate tire again—and then motor without fear of puncture trouble. Does this not sound comforting?

Painful puncture memories compel the "Yes" answer from all the auto drivers.

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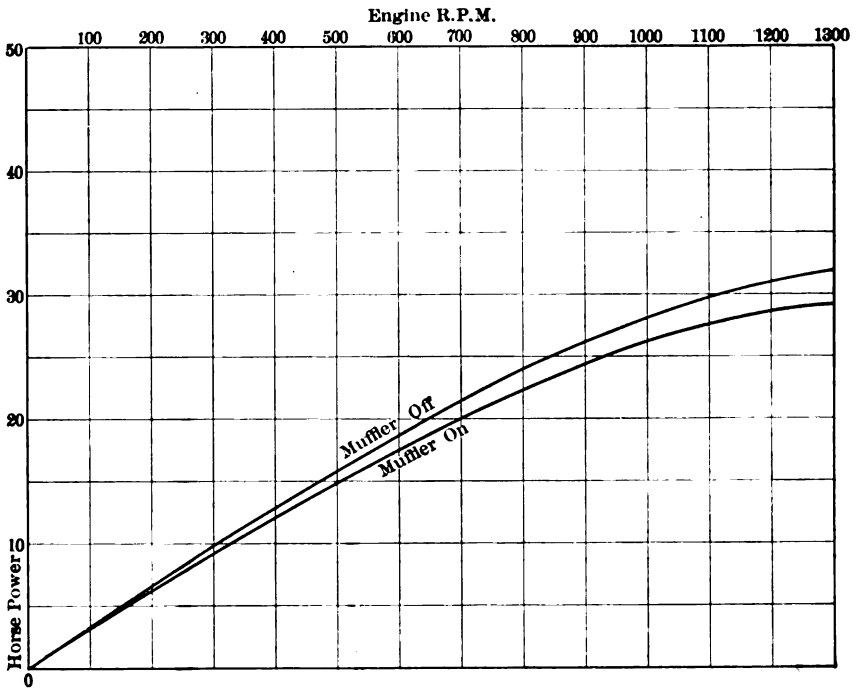
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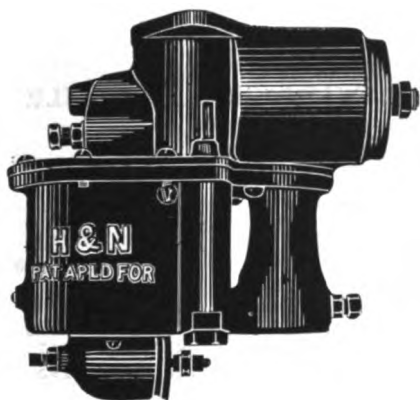
TEST CONDUCTED BY RAMBLER TESTING LABORATORY

Engine R.P.M.	Test No. 724			Test No. 730		
	Horse Power		Loss	Horse Power		Loss
	Muffler	No Muffler		Muffler	No Muffler	
600	17.6	18.9	1.3	17.4	18.6	1.2
700	20.0	21.5	1.5	19.8	21.2	1.4
800	22.3	24.0	1.7	22.1	23.8	1.7
900	24.3	26.2	1.9	24.3	26.1	1.8
1,000	26.1	28.1	2.0	26.1	28.1	1.9
1,100	27.5	29.7	2.2	27.6	29.7	2.1
1,200	28.6	30.9	2.3	28.6	30.8	2.2
1,300	29.3	31.8	2.5	29.2	31.6	2.4



H & N

The Master Carburetor



More power, speed, with increase of from 25% to 100% greater mileage per gallon.

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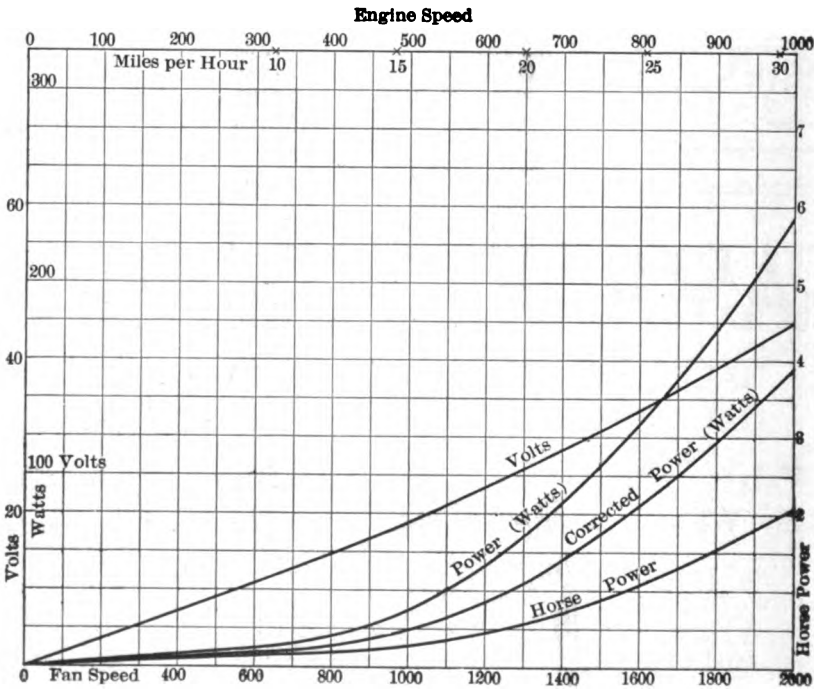
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MOTOR COOLING FAN
CONDUCTED BY RAMBLER TESTING LABORATORY

Car Speed M.P.H.	R.P.M.		Power Watts	R.P.M. Correction	Corrected Power Curve		
	Engine	Fan			Net R.P.M.	Watts	H.P.
5	162	324	5	40	284	40	.00536
10	324	648	9	81	567	80	.0107
15	486	972	28	130	842	17.5	.0235
20	648	1,296	68	178	1,122	43.0	.0576
25	810	1,620	133	215	1,405	87.5	.117
30	972	1,944	224	270	1,674	146.0	.195

Fan run by separately excited motor.



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They always give a good compression and save gasoline.

They are accurately machined and highly finished.

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Source of Loss of Power	Amount of Loss Per Cent.	Efficiency Per Cent.
		100
When driving direct:		
One chain.....	3.0	....
One and one-half pairs of bearings.....	7.5	89.5
With epicyclic speed gear in operation, add.....	15.0	74.5
When driving direct:		
One set of gear.....	5.0	....
Two pairs of bearings.....	10.0	....
Partially active bearings.....	3.0	82.0
With change-speed reduction gear in operation, add.....	12.0	70.0
One set of gear.....	5.0	....
Three pairs of bearings.....	15.0	....
Equivalent of two chains.....	6.0	74.0
Two sets of gear.....	10.0	....
Four pairs of bearings.....	20.0	70.0
Two sets of gear.....	10.0	....
Five pairs of bearings.....	25.0	....
Equivalent of one chain.....	3.0	62.0
Equivalent of three sets of gear.....	15.0	....
Five pairs of bearings.....	25.0	60.0

TRACTION EFFORT ON VARIOUS SURFACES (NORRIS)

On rails or plates.....	5.16 pounds per ton
Asphalt or hardwood.....	12.24 " " "
Macadam.....	30.60 " " "
Loose gravel.....	140 to 200 " " "
Sand.....	400 " " "

With different tires (comparatively):

Iron.....	60	"	"	"
Solid Rubber.....	60	"	"	"
Pneumatic.....	45	"	"	"

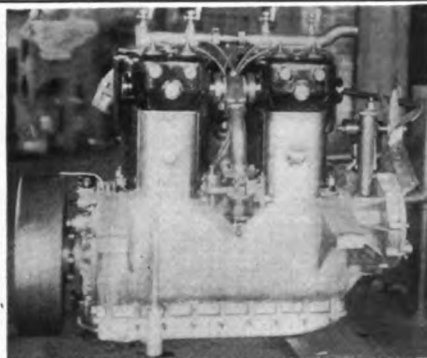
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Can also be furnished with 4¼" x 6" or 4½" x 6".
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LARGE VALVES (2¼" clear opening) AND
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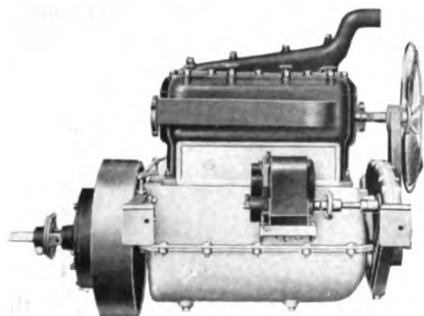
TOTAL PROJECTED CRANK SHAFT BEARING
AREA, 26.7".

CONSTRUCTION THROUGHOUT REPRESENTS
THE LATEST DEVELOPMENT IN MOTOR
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FACTORY CAPACITY, 6000 MOTORS PER AN-
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SALES OFFICES:

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Model "B" 4 1-8" x 5

**The Oswald Motor
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DESIGNERS AND BUILDERS OF MOTORS FOR PLEASURE AND
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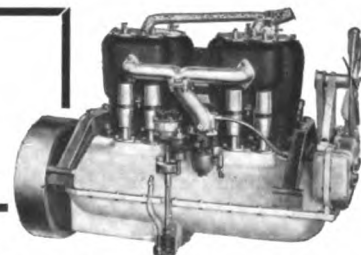
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Wisconsin
CONSISTENT
Long Stroke Motors

Designed for slow speed heavy work
For heavy duty work investigate the Wisconsin Long Stroke
Motors. They give the utmost in service and satisfaction. Write
for catalog.

1000-2000 lbs.	3¾" x 5"
2 ton	4¼" x 5"
3 ton	4¾" x 5½"
5 ton	5¼" x 7"



Long Stroke
Large Bearings
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Large Valves
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WORK DONE BY CLUTCH AND BRAKES (C. H. TAYLOR)

Energy absorption of the clutch in accelerating a motor vehicle, assuming the ideal condition of uniform acceleration

$$W = \frac{MV(2Q - FV)}{2(F - Mg\theta)}$$

and

$$w = Q - \frac{FV}{2}$$

$$f = \frac{MV}{F - Mg\theta}$$

where W = total energy absorbed by clutch in accelerating the mass M from zero to V ft. per second when coupled with a motor developing Q foot-pounds per second; w = energy

per second absorbed by clutch under the above conditions = $\frac{W}{f}$ where f = time re-

quired for acceleration in seconds. θ = tangent of the grade angle, or the per cent. of grade; F = accelerative force applied by the propelling system; g = gravity = 32.2. Also.

$$W = MV\left(\frac{Q}{F} - \frac{V}{2}\right)$$

where $\theta = 0$ and

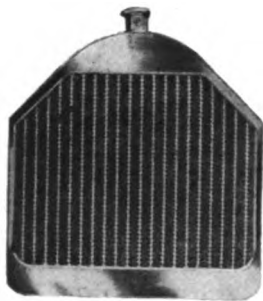
$$f = \frac{MV}{F}$$

Energy required to be absorbed by the brakes when stopping a motor vehicle, on the level, from full speed is equal to

$$E = \frac{MV^2 + Mg\theta fV}{2}$$

$$f = \frac{MV}{F - Mg\theta}$$

using the same symbols as for the clutch formula, but applied to retardation instead of acceleration



"The Candler Special"

BUILT RIGHT :: PRICED RIGHT

No Leaks No Freezing Effects
Maximum Efficiency Strong, Light, Durable
Excellent Appearance

REPAIRING A SPECIALTY

Candler Radiator Co., 1086-88-90 Jefferson Ave. East
Detroit, Mich.



DRAGON BRAND ^{Up To} _{Date} METAL POLISH

As times have progressed with new inventions and improvements, so through our long experience in the Metal Polish line, we have succeeded in offering the public a Polish of the highest merits and especially for out-door metals, as brass trimmings and lamps on automobiles. The slightest friction will remove all stains and tarnish from the metal. It does it so easily and quickly that it becomes a pleasure to use it.

Samples free on application.

J. C. Paul & Co., **MFRS., CHICAGO, ILL.**

PRICES

1 pts., per gross	- -	\$ 8.00	1 qts., per gross	- -	\$24.00
1 pts., per gross	- -	\$14.40	1 gals., per dozen	- -	\$ 5.00

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REG. U. S. PAT. OFF.

THE PHOSPHOR BRONZE SMELTING CO.

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ELEPHANT BRAND "Phosphor-Bronze"

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**POWER CONSUMED IN MOVING A PLANE SURFACE AT DIFFERENT
VELOCITIES IN THE OPEN AIR (KEMPE)**

SPEED IN		Horse-power per Square Foot of Effective Surface	SPEED IN		Horse-power per Square Foot of Effective Surface
Miles per Hour	Feet per Minute		Miles per Hour	Feet per Minute	
10	880	0.013	50	4,400	1.64
15	1,320	0.044	75	6,600	5.54
20	1,760	0.105	100	8,800	13.13
25	2,200	0.205	150	13,200	44.29
30	2,640	0.354	200	17,600	105.00

STRIKING ENERGY OF AUTOMOBILES (DURAND)

Let W = weight of automobile, measured in pounds.

F = average force over the distance required to bring automobile to rest, measured in pounds.

L = distance over which force is exerted to bring automobile to rest, measured in feet.

V = velocity in feet per second,

Then Energy = $\frac{W V^2}{64.4}$ in foot pounds,

$F L$ = measure of destructive work done in stopping the machine.

Then $F L = \frac{W V^2}{64.4}$

$$F = \frac{W V^2}{64.4 L}$$

$$L = \frac{W V^2}{64.4 F}$$

Or, otherwise and more generally, let E be any fraction or amount of energy which is lost in overcoming an average resistance F over a distance L .

Then:

$$E = F L$$

$$F = E \div L$$

$$L = E \div F$$

In the actual case of automobile collision, F , as has been carefully noted, is merely a distance average of the force developed. It means simply that there will be as much destructive work done as would correspond to the exhibition of a force F over a distance L . Actually, the destructive work will be made up of parts, each one of which may consist of a very much larger force, acting through such smaller distance as may be needed for the rupture of the part in question.

Die Castings.

All the Babbitt, zinc, tin and aluminum alloys.

Sand Castings

of aluminum, bronze, brass—either rough, or finished to your drawings.

Manufacturers of automobile parts, water pumps, oil pumps, carburetors, etc., dies and light machinery.

**A. W. Morris
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ACCESSORIES, MACHINERY, ETC.

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DASH PLATES

SKELETON RADIATOR

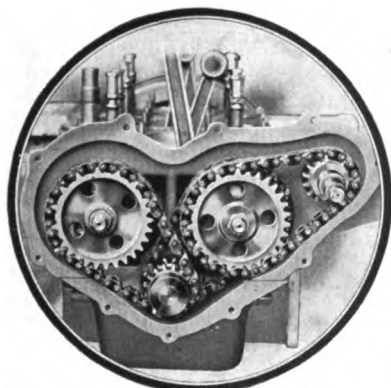
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AND FORMING

LET US FIGURE ON YOUR
REQUIREMENTS

WE SUBMIT DESIGNS & SAMPLES

CAREFUL EXECUTION
PROMPT DELIVERIES

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Engraving Co. Chicago**



The consistent silence, reliability and efficiency of

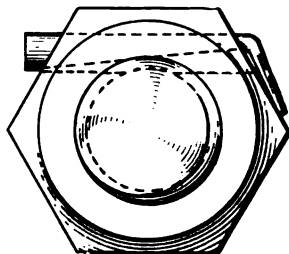
"THE COVENTRY" Noiseless Chains

For Camshaft, Magneto, and Pump Drives of Automobiles is Proved by the Fact That All the Makers of the Most Silent and Reliable Engines Fit Them as Standard.

U. S. Representative
SARCO ENGINEERING CO.
118 Broad Street, New York

THE PIN HOLE LOCK

is the simplest and most efficient method of locking nuts. It is an absolute lock that can't be vibrated or jarred loose;



Patented Feb. 6, 1912.

applied or removed in a few moments without injuring the thread. Write for folder.

THE PIN HOLE LOCKED NUT CO.
1790 Broadway New York City

ALLOWANCES FOR FITS IN AUTOMOBILE CONSTRUCTION

Fits in automobile construction can be divided into,

FORCE FITS.

To be used in parts where disassembling will hardly be required, and which are assembled by means of hydraulic or screw presses, or when hot.

DRIVING FITS.

To be used in parts where close adherence is required, but which must be as embled and disassembled with no other help than an ordinary hammer; such as fly-wheels, gear wheels, ball-bearing inner races, etc.

PUSH FITS.

To be used in parts without relative motion in actual work but which must have sufficient freedom to be assembled by hand; such as bolts, slip joints, ball-bearing outer races, etc.

RUNNING FITS.

To be used in parts possessed of relative motion in normal running; these can be subdivided into,

Easy Fits; where great freedom of running is required with possibility of scant lubrication, such as valve guides, control connections, clutch shafts, etc.

Close Fits; to be used in all high-speed work and especially the engine and transmission.

Fine Fits; to be used in parts where great accuracy is required or where, while the motion is slight the stresses are of an alternating or vibratory nature, such as connecting rod small ends, steering connections etc.; efficient lubrication must be provided if the motion is frequently recurring.

FIT ALLOWANCES

In the allowances given in the following the expansion of metals when of different nature or exposed to heat in a different degree, such as is the case in some parts of engine construction, has not been taken into account.

ALLOWANCE OVER NOMINAL DIAMETER FOR FORCE FITS				
Nominal diameter.....	$\frac{1}{4}$ "	1"	2"	3"
Maximum ".....	0.50100	1.00200	2.00400	3.00600
Minimum ".....	0.50050	1.00150	2.00300	3.00450

ALLOWANCE OVER NOMINAL DIAMETER FOR DRIVING FITS				
Nominal diameter.....	$\frac{1}{4}$ "	1"	2"	3"
Maximum ".....	0.50050	1.00100	1.00125	1.00250
Minimum ".....	0.50025	1.00075	1.00100	1.00150

ALLOWANCE BELOW NOMINAL DIAMETER FOR PUSH FITS				
Nominal diameter.....	$\frac{1}{4}$ "	1"	2"	3"
Maximum ".....	0.49975	0.99950	1.99900	2.99850
Minimum ".....	0.49925	0.99900	1.99850	2.99800

ALLOWANCE BELOW NOMINAL DIAMETER FOR RUNNING FITS				
EASY FITS				
Nominal diameter.....	$\frac{1}{4}$ "	1"	2"	3"
Maximum ".....	0.49900	0.99875	1.99825	2.99800
Minimum ".....	0.49800	0.99725	1.99650	2.99575

CLOSE FITS				
Nominal diameter.....	$\frac{1}{4}$ "	1"	2"	3"
Maximum ".....	0.59925	0.99900	1.99875	2.99850
Minimum ".....	0.59875	0.99800	1.99750	2.99700

FINE FITS				
Nominal diameter.....	$\frac{1}{4}$ "	1"	2"	3"
Maximum ".....	0.59950	0.99925	1.99925	2.99900
Minimum ".....	0.59925	0.99875	1.99850	2.99800

For intermediate dimensions comparison between the size immediately below and that immediately above will give the safe allowances in each case.

Torbensen Internal Gear Drive Axle

Noiseless Efficient Compact



To be up to date in Trucks means using gear-driven Axles. The "TORBENSEN" has no equal. Its solid I beam is proof against breakdowns. Its high-grade workmanship makes for reliability, efficiency and low cost of upkeep. Twelfth year of successful use.

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New York, N. Y. Chicago, Ill.
Ford Bldg., Detroit, Mich.

Our Facilities for Making

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Radius Rods
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Cranks
Front Axles

Machined and Ground Parts of All Descriptions

insure our customers against loss on material in process; also prevent delays.

We cordially invite an inspection of our works.

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Corporation**

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DIFFERENTIALS**

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CHAPIN CO.**
SYRACUSE N.Y.

82C

THE CARVER COMPOUND DOUBLE-ACTING PUMP

**Compound
and
Double-Acting**

Will inflate a tire
to working pressure
with less effort than
any pump made.

Price \$7.50

Write for Descriptive
matter.



The Osborne & Stephenson Mfg. Co.
West Main St., Plainville, Conn.

ENERGY CONSUMPTION OF COMMERCIAL VEHICLES (CHURCH- WARD)

The tractive effort of pneumatic tires on hard level asphalt varies from 15 pounds per ton for special tires designed for electric runabouts up to 35 pounds per ton for the standard type used on gasoline touring cars.

The tractive effort of pneumatic tires is also greatly affected by the air pressure increasing rapidly as the air pressure is reduced.

The tractive effort of solid tires on hard level asphalt varies from 18 pounds to 26 pounds per ton, depending upon:

- (1) The diameter of driving wheels.
- (2) Revolutions per minute.
- (3) Load in pounds, per square inch or pounds per inch width.
- (4) Composition of the compound used.
- (5) Method of attaching tire to wheel rim.

The tractive effort of a vehicle will vary with the road surface as per table, taking the tractive effort of a vehicle on hard level asphalt as unity.

(1) Level asphalt (hard).....	1.00
(2) Wood pavement.....	1.15
(3) Level macadam.....	1.15 to 3
(4) Plank road.....	.9
Cobble stones.....	1.75
(5) Good dirt road.....	1.10 to 2
(6) Ordinary country road (dirt).....	2.
(7) Sand.....	20 .

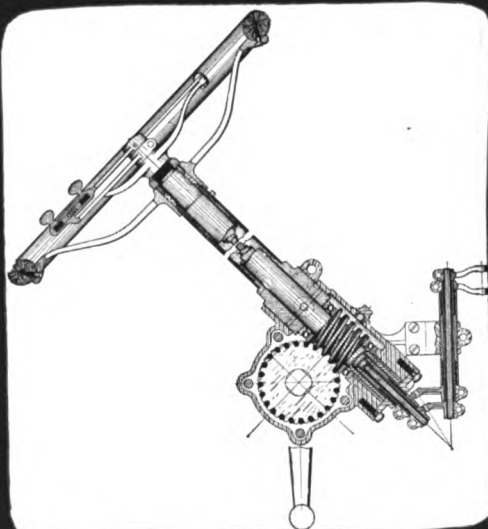
The tractive effort due to grades must be added to the tractive effort for a given road surface. Example: 5 per cent. grade on hard level asphalt. Hard level asphalt 25 pounds per ton. 5 per cent. grade = 100 pounds per ton, due to grade alone. 100 + 25 = total tractive effort = 125 pounds per ton, total.

Taking everything into consideration, that is to say, life of engine, transmission, tires and maintenance of vehicle as a whole, experience shows that the following table of economic speeds is approximately correct:

Gross Weight	Type of Tires	Speed in M.P.H.
1,500 lbs.	Pneumatic	20
2,000 "	"	20
3,000 "	"	18
4,000 "	"	16
2,000 "	Solid	16
3,000 "	"	15
4,000 "	"	13
5,000 "	"	11
7,000 "	"	9
10,000 "	"	8
15,000 "	"	7
20,000 "	"	6



MODEL C GEAR

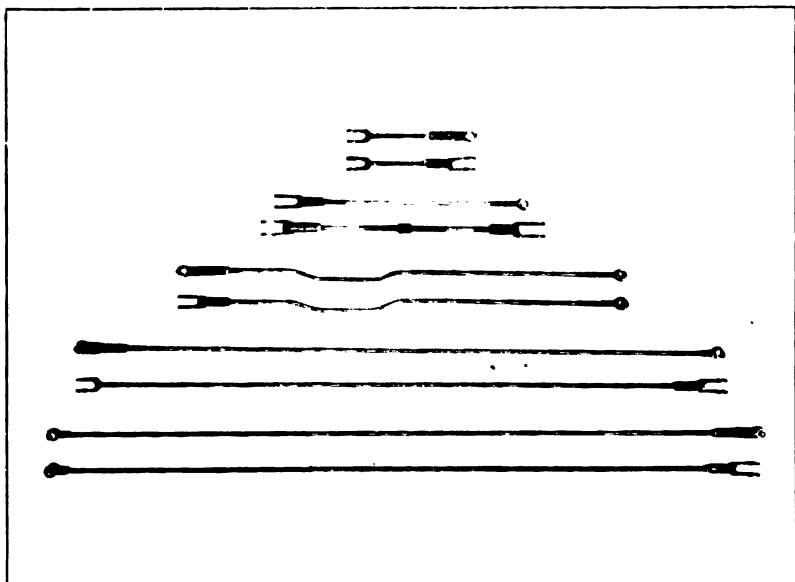


MODEL O GEAR

**GEARS OF QUALITY
MADE BY
STEERING GEAR SPECIALISTS**

**GEMMER
MANUFACTURING
COMPANY**
DETROIT, MICHIGAN

COMPLETE BRAKE ROD ASSEMBLIES



All the big Automobile Shows are over, now let us get right down to business.

Our specialty is the furnishing of BRAKE ROD ASSEMBLIES complete, ready to place in the chassis.

DRAG LINKS

We also furnish DRAG LINKS, solid or adjustable.

Let us have your blue prints for these parts. Our delivery will please you.

MICHIGAN ELECTRIC WELDING COMPANY

514 Hart Avenue, DETROIT, MICH.

128-Inch Wheel Base.
Adjustable, ventilating and
Shield.

Multiple Jet Carburetor.
Hofecker steady-hand Speed
Tire Carrier in rear.
Silk Mohair Top, Top Cover.
Full-floating Rear Axle.
Resilient Springs, $\frac{3}{4}$ -Elliptic
in front.

Large gasoline pressure-
Gauge in rear.

Robe Rail and Foot Rest.

Foot Mat in Running Board.

Plain, continuous enclosed

Oiling System, demonstrates

fect oiling system.

CYLINDERS: Six, cast in pairs,

Head.

COOLING: Water, with gear pump

and tubular radiator.

CARBURETOR: Peerless.

IGNITION: Dual system, with

Gray & Davis dynamo and W

terry.

STARTER: Gray & Davis el

TIRES: Front, 38 x $\frac{3}{4}$ in

Wheel Base: 140 inches

DESIGN AND CONSTRUCTION

Left Side Drive, Center Control

Silent Chain Drive for Cam

Pump and Generator, enclosed

Corb Insert Multiple Disc Clutch

116 inch Wheel Base.

4 x 8 inch Motor, cast on bloc

Selective Type Transmitten

24 x 4 inch Tires, Demountable

Flotation Type Rear Axle.

Full Elliptic Rear Axle

16 x 8 inch Brake Drums.

Imported Annular and Hyatt

Bearings.

Aluminum Crank and Transm

Cases.

Gasoline Tank under Shroud

Gas and Spark Controls on top

Steering Wheel.

Dash Adjustment for Carbure

16 inch Steering Wheel, Irrevers

Gear.

Rear Door 21 inches wide; Fro

19 inches.

16 inch Upholstery, Deep Ti

Cushions.

Long, Green, Linoleum Covered

ing Boards.

All Dash Equipment, Speedome

Ammeter, Carburetor Adjustm

Magneto and Lighting Switc

etc., imbedded in Auxiliary D

Convenient to Operator.

DISCO Bell Starter.

Prest-O-Lite Tank.

Warner Speedometer

Nickled Trimmings

Tools, Tire Iron.

Center Control.

Dynamo Electric Lightin

Q. D. Demountable Rims, C

Mohair Top, Boot, Storm Cur

Brewster Green or Deep Wine

Plate Glass Windshield.

Concealed Tool Boxes.

CYLINDERS: Four, cast all in bloc

inches, inlet valves in head, exhaust

left side.

COOLING: Water, with centrifuga

honeycomb cellular radiator.

CARBURETOR: Rayfield.

IGNITION: Dual system, with magneto

age battery.

STARTER: Chalmers compressed air

TIRES: Front, 36 x 4 inches; rear,

WHEEL BASE: 115 inches.

WEIGHT: 3,058 pounds.

TYPE OF SPRINGS: Front, $\frac{3}{4}$

elliptic.

Long-stroke ($4\frac{1}{4}$ x 6) f

Motor with enclosed

Left-Side Drive

Center Control.

Gray & Davis Electric S

Truffault-Hartford shock

Gray & Davis Dynamo E

System.

Bosch dual double Magneto

12-inch Turkish Upholstery

Full heavy nickel Trimmings

Electric Horn

Six passenger, four cylinders,

Electric self-starter

34x4 inch Goodrich tires

Detachable, demountable rims

Extra rim

Tire holders

Electric lights

Stewa
Thre
Full
Ele
Sill

OVERLOOKED?

The clippings at the left are taken from the advertising of some of the leading automobile manufacturers. They show that the buyer has little interest in the matter of valves.

The buyer may overlook the valves you put in your car. They are small items and he puts it up to you to make them right.

But—he will not overlook the loss of power, motor troubles and the expense of frequent regrinding that will result from the use of inferior valves.

You cannot afford to decide on valve equipment until you have thoroughly investigated our proposition.

The valves shown here only represent three of the types which we furnish to leading automobile makers. We can make a valve to suit your motor from your own designs.

Write us and send your blue prints.

THE ELECTRIC WELDING PRODUCTS COMPANY

CLEVELAND, OHIO



Cast Iron Seat Valve.

A cast-iron seat is welded to the special steel head. It combines the advantages of cast iron with the strength of steel.



Reinforced Cast Iron Valves.

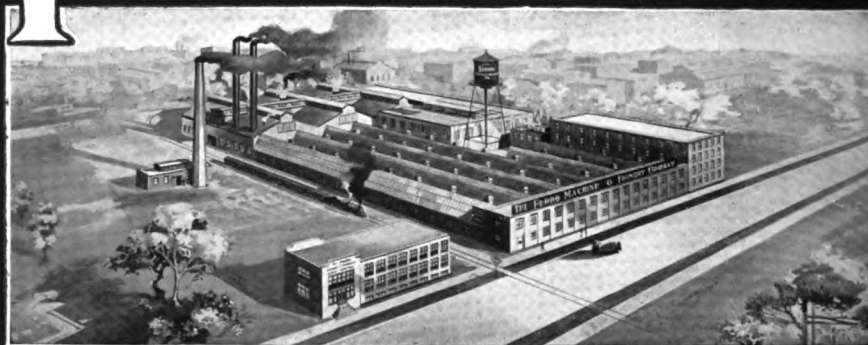
The cast-iron head is reinforced by a saucer shaped steel disc, adding to its strength and preventing breakage.



Special Steel Valves.

The head and stem are each made of special steel suited for the service. They are electrically welded together to make a solid piece.

FERRO



This factory with a national reputation for Scientific Management is at your Service.

CONTRACT FOUNDRY and MACHINE WORK OF ALL KINDS SOLICITED

If you are interested in the manufacture of any metal specialty such as

**Automobile Engines
Marine Engines
Motor Cycle Engines
Stationary Engines
Air Compressors
Transmission
Light Machinery of all
Kinds**

you will find it to your advantage to have the work turned out in a modern factory like this, where castings are made scientifically by the best foundry men money can hire under the super-

vision of a competent chemist, and more than \$250,000 worth of machine tools, jigs, dies and fixtures are available for use, so that each particular operation is done with the greatest efficiency and economy.

We are equipped to work from your blue prints or specifications, preparing patterns, etc., making castings, doing all necessary machining and delivering you either individual parts or the complete product assembled and tested, relieving you entirely of responsibility and risk in manufacture, and leaving you free to devote all your time and energy to the selling proposition. Write for estimate.

THE FERRO MACHINE & FOUNDRY CO.

FERRO



SOME CASTINGS FURNISHED
SATISFIED CUSTOMERS

Castings and Machined Parts

THE above cut illustrates a few of the parts we are turning out on contract for some of the largest and best known manufacturers in America.

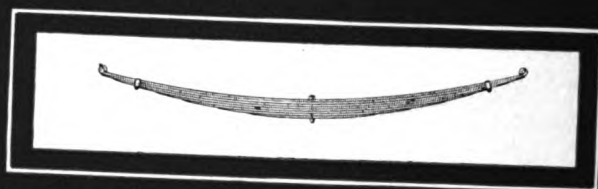
We have had fifteen years' experience in the foundry and machine business, specializing on internal combustion engine work.

We absolutely protect you on deliveries. Accurate work guaranteed. Our prices will be found lower than the majority of factories can produce this class of work. Let us quote you from your blueprints.

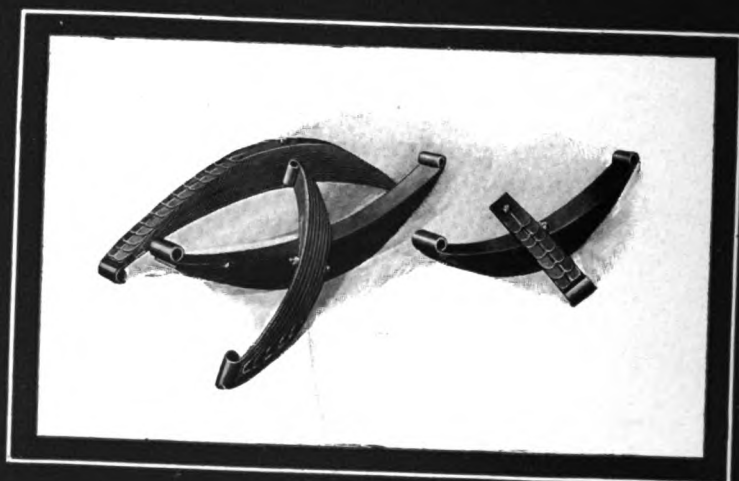
THE FERRO MACHINE & FOUNDRY CO.

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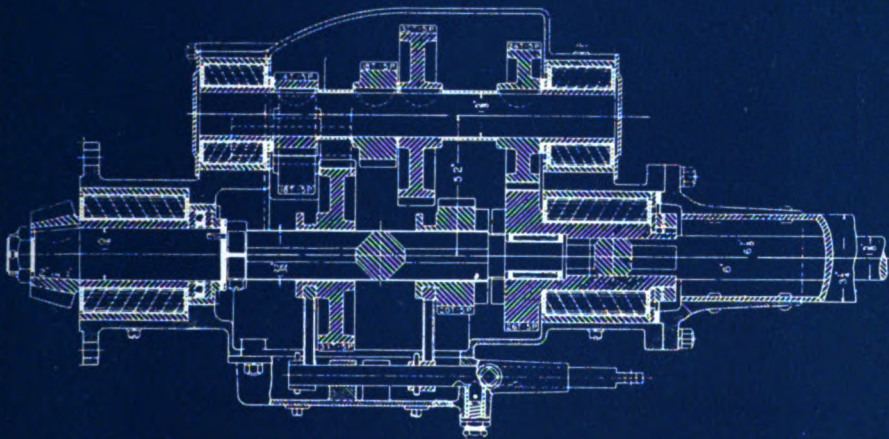


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ON COMMERCIAL CARS THAN ON PLEASURE CARS



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SPRING
COMPANY
CLEVELAND, O.

COVERT



The Transmission of Recognized Quality

The recognized standing of Covert Transmissions gives them a value to the automobile and truck builder which is wholly aside from the fact of their mechanical perfection.

If another specialist could produce as good a transmission from the standpoints of design, materials and workmanship, it would still lack the sense of dependability associated with the Covert name.

Prominent automobile and truck builders have found we can furnish better transmissions at less cost than they can build themselves. Specializing, with unequalled experience and equipment is the reason.

Let our engineers solve your transmission problems. Send blue prints or write for catalogue.

Covert Motor Vehicle Company

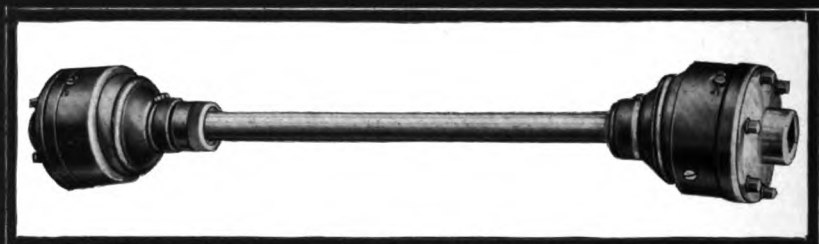
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Lockport, N. Y.

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HARTFORD UNIVERSAL JOINTS

We are able to offer manufacturers universal joints manufactured by specialists in one of the largest plants in the world.

The wearing surfaces of Hartford Universal Joints are hardened and ground, the grinding being accomplished by a specially devised machine whose use eliminates depressions or elevations so common in steel parts that have been simply reamed.

The reputation of your car demands the best universal joints that can be made, and we have them.

HARTFORD CONE CLUTCHES

Hartford Cone Clutches require no introduction to the American car manufacturers.

Automobile makers who don't want the trouble and inefficient service resulting from warped discs should investigate Hartford Cone Clutches. They are as efficient as the best disc type at half the price. Let us know your requirements.



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Send for catalog containing full information.

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We can make immediate shipment

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"MORSE" TAPER PINS



Are Famous for Their Accuracy and Finish.

They are in constant use by the leading Automobile Manufacturers. We have been forced to enlarge our Taper Pin Department and increase our stock to supply the demand which is ever increasing. We are well prepared to make quick shipments of any amount and guarantee satisfaction.

Morse Twist Drill & Machine Company
New Bedford, Mass., U. S. A.



All types of Ductile Drawn
wire Tungsten Automobile
Lamps

INDEPENDENT LAMP & WIRE CO.
1733 BROADWAY, NEW YORK

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RESULTS OF 1910 FRENCH MILITARY WAGON TRIALS

Official results of the French regularity and fuel tests of military motor vehicles in 1910 issued by the Automobile Club of France are contained in the accompanying table. The tests covered a total distance of 1570 miles. Gasoline, benzol and alcohol were used as fuels at different stages of the test. The results show an average mileage for the different fuels as follows: Gasoline, 9.7 miles to the gallon; benzol, 10.4 miles to the gallon; alcohol, 8.2 miles to the gallon. Weather and road conditions during the trials were favorable.

FUEL CONSUMPTION OF MOTOR WAGONS IN FRENCH MILITARY TRIALS.

	Total Wgt., Lbs.	Useful Load, Lbs.	Lubricating Oil 1570 Miles		Gasoline 560 Miles			Benzol 560 Miles			Carbureted Alcohol 450 Miles		
			Total in Galls.	Miles per Gall.	Avg. Speed m.p.h.	Total Galls.	Miles per Gall.	Avg. Speed m.p.h.	Total Galls.	Miles per Gall.	Avg. Speed m.p.h.	Total Galls.	Miles per Gall.
*Saurer.....	12,658	5,796	....	368	14.6	....	9.4	....	....	10.8	....	....	8.1
*Delahaye.....	14,524	7,896	....	194	11.0	....	11.1	....	....	11.15	....	....	10.5
DeDion Bouton.....	13,299	8,427	6.2	254	9.5	49.5	11.3	9.8	47.9	11.7	9.6	49.0	9.2
DeDion Bouton.....	13,161	7,444	4.9	320	9.5	54.5	10.3	9.8	50.0	11.4	9.7	49.0	9.2
Peugeot.....	13,106	7,903	8.8	178	10.4	54.5	10.3	9.5	53.0	10.6	10.4	54.3	8.3
Peugeot.....	13,346	8,143	8.8	178	10.4	55.1	10.1	9.5	50.8	11.0	10.5	53.0	8.5
Delahaye.....	13,855	8,593	7.5	209	8.6	63.0	8.9	8.2	65.0	8.6	7.7	62.4	7.2
Delahaye.....	13,822	8,553	8.8	178	8.6	68.8	8.2	8.2	67.0	8.4	7.8	69.2	6.5
Panhard-Levasor.....	12,323	7,609	15.0	145	9.6	49.8	11.2	9.5	51.0	10.9	9.8	49.4	9.1
Panhard-Levasor.....	12,336	7,640	18.5	85	9.7	50.4	11.1	9.5	49.6	11.3	9.8	50.5	8.9
Panhard-Levasor.....	13,653	8,703	19.8	79	9.8	56.1	10.0	9.8	58.3	9.6	10.2	51.2	8.8
Panhard-Levasor.....	13,564	8,670	16.3	96	9.7	54.5	10.3	9.9	55.5	10.1	10.2	56.2	8.1
Berliet.....	11,827	7,465	7.5	209	8.5	62.6	9.0	8.8	59.4	9.5	8.5	63.8	7.1
Berliet.....	11,838	7,473	7.5	209	8.5	63.5	8.8	8.8	53.6	10.4	8.5	58.2	7.6
Berliet.....	14,651	9,801	14.3	110	8.3	75.2	7.5	8.5	54.0	10.4	8.3	55.8	8.0
Berliet.....	14,631	9,781	15.6	100	8.2	76.5	7.3	8.5	56.3	10.0	8.3	70.6	6.4
Vinot-Deguingand.....	10,987	6,864	5.9	266	9.8	45.5	12.3	9.5	44.4	12.6	9.8	41.8	10.7
Vinot-Deguingand.....	10,932	6,710	9.7	162	9.8	46.4	12.1	9.7	46.0	12.2	10.3	45.4	9.

*1909 Winner.

Useful load includes weight of body.

CO-EFFICIENTS OF FRICTION

The relative value of different materials of construction ascertained as the result on tests made by the National Brake & Clutch Company is tabulated as follows:

Materials	Co-efficient
Metal and cork,	} on dry metal..... 0.35
Leather and cork,	
Fibre and cork,	
Metal and cork,	} on oily metal..... 0.32
Leather and cork,	
Fibre and cork,	
Fibre on dry metal.....	0.27
Fibre on oily metal.....	0.10
Leather on dry metal.....	0.23
Leather on oily metal.....	0.15
Charred leather on oily metal.....	0.08
Metal on dry metal.....	0.15
Metal on oily metal.....	0.07

The co-efficient will vary with the condition of the contacting surfaces. Smooth and unyielding surfaces offer less resistance than rough and yielding ones. In metal to metal contacts different metals are usually employed for the opposing surfaces, as bronze and steel in plate clutches and cast iron and steel in brakes of the shoe type.

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Willard Storage Battery Co.

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Our special process applies only to cylinders scored from loose wrist pin. Bore not enlarged—no need for new pistons and rings. If your cylinder is damaged in this manner we offer you an economical and satisfactory remedy.

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We will re bore your cylinders and fit new pistons and rings so that your motor will again be as powerful and quiet as when new. You cannot afford to send your cylinders to any jobbing machine shop—it requires skill and experience to insure a first-class job. Let us explain why we think we can serve you best. Our charges are reasonable.

CONSIDER THIS

Above all else you need to know that the firm you entrust with your cylinders is reputable and responsible. Motorists in nearly every state know us favorably from experience. Let us give you references from your vicinity. Ask about us of any Waterbury Bank or Manufacturer. If you require such services as we offer write for complete information and estimates.

Waterbury Welding Co.
Waterbury, Conn.

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Smooth Tread and Non-Skid
Clincher
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Straight Side Types

Solid Tires

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Cellular Non-Skid
Block Sectional
Clincher Truck

All Demountable — Quick Detachable. S.A.E. Standard.

The most durable tires in the World.

The Swinehart Tire & Rubber Co.
AKRON, OHIO

PRINCIPAL OVERALL DIMENSIONS OF TYPICAL MODERN CARS

H.P.	TYPE—REMARKS	Wheelbase	Length	Width	Height
		Ft. In.	Ft. In.	Ft. In.	Ft. In.
14-16	Side entrance.....	8 4	12 6	5 2	5 3
14-16	Side entrance (hood up).....	8 4	12 6	5 2	7 5
14-16	Side entrance (hood folded)....	8 4	13 6	5 2	5 6
14-16	Single landaulette.....	9 0	13 0	5 2	7 0
14-16	Limousine.....	9 0	13 0	5 2	7 0
14-16	City carriage.....	6 10	10 8	5 5	7 4
16-20	Side entrance.....	9 0	13 0	5 3	5 5
16-20	Side entrance (hood up).....	9 0	13 0	5 3	7 7
16-20	Side entrance (hood folded)....	9 0	14 0	5 3	5 8
16-20	Seven-seater side entrance.....	9 9	13 10	5 3	5 5
16-20	Three-quarter landaulette.....	9 9	13 10	5 3	7 7
16-20	Limousine.....	9 9	13 10	5 3	7 7
26-30	Side entrance.....	9 3	13 4	5 7	5 5
26-30	Side entrance (hood up).....	9 3	13 4	5 7	7 7
26-30	Side entrance (hood folded)....	9 3	14 4	5 7	5 8
26-30	Three-quarter landaulette.....	10 0	14 1	5 5	7 8
26-30	Limousine.....	10 0	14 1	5 7	7 8
40	Side entrance.....	9 8	13 8	6 0	5 6
40	Side entrance (hood up).....	9 8	13 8	6 0	7 8
40	Side entrance (hood folded)....	9 8	14 8	6 0	5 9
40	Seven-seater side entrance.....	10 4	14 4	6 0	5 6
40	Three-quarter landaulette.....	10 4	14 4	6 0	7 8
40	Limousine.....	10 4	14 4	6 0	7 8

N.B.—In some cases the lamps mean a further increase in length.

From these figures it is possible to deduce the fact that the average additive quantity which the car projects beyond the centers of the wheels is 4 feet 4½ inches. Taking this at 4 feet 6 inches, it is possible to compute the overall length of any car.

FORMULA FOR RATE OF SPEED (TREGO)

To find the rate of speed of an automobile in miles per hour when the total distance covered and the total running time are known:

Given: Time in minutes and seconds and distance.

Using minutes.

Formula is:

$$\frac{D}{\frac{T}{60}} = \text{MPH}$$

Divide the time in minutes and fractions thereof by 60. Then divide the distance by this quotient, disregarding decimal points, and the result will be the average speed in miles per hour for the distance.

Example: 105.5 miles in 113 minutes 30 seconds.

60)113.5

$$1.89 \overline{)105.5} (55.8 \text{ miles per hour.}$$

945

1100

945

1550

1512

Using seconds,

Formula is: 36

$$\frac{T}{36} (\text{Time in seconds}) = \text{MPH.}$$

Divide 36 by the time in seconds, the distance being 1 mile.

Example: 1 mile in 45 seconds—

45)36 (80 miles per hour.

360

Add \$10 to \$20 Profit to Each Automobile Sale

Here's an easy way to pick up an extra Ten or Twenty Dollar Bill whenever you sell an automobile. Just send us the name of the purchaser and we will endeavor to sell him an Edwards Private Portable Steel Garage.

That's all we want you to do—merely furnish us the name.

You Invest No Money or Time

It means \$9.25 to \$20 profit **FOR YOU** on each sale. And you've no **money** or **time** invested. Send us a list of all automobile owners in your locality, and on this plan you'll make a nice, clean profit—perhaps several hundred dollars.

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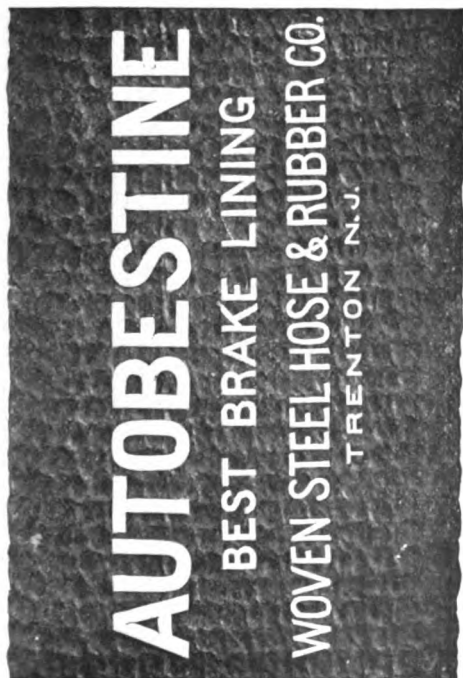
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Miles per Hour	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	22	24	26	28	30	35	40
Feet per Minute	88	176	264	352	440	528	616	704	792	880	968	1,056	1,144	1,232	1,320	1,418	1,496	1,584	1,672	1,760	1,936	2,112	2,288	2,464	2,640	3,080	3,520
12	28	56	84	112	140	168	196	224	252	280	308	336	364	392	420	448	476	504	532	560	616	672	728	784	840	980	1,120
14	24	48	72	96	120	144	168	192	216	240	264	288	312	336	360	384	408	432	456	480	528	576	624	672	720	840	960
16	21	42	63	84	105	126	147	168	189	210	231	252	273	294	315	336	357	378	399	420	462	504	546	588	630	735	840
18	18.6	37.3	56	72	88	104	120	136	152	168	184	200	216	232	248	264	280	296	312	328	344	360	376	392	408	453	496
20	16.8	32.6	50.4	67.2	84	100.8	117.6	134.4	151.2	168	184.8	201.6	218.4	235.2	252	268.8	285.6	302.4	319.2	336	369.6	403.2	436.8	470.4	504	588	672
22	15.27	30.54	45.81	61.09	76.36	91.63	106.90	122.18	137.45	152.72	168	183.27	198.54	213.81	229.09	244.36	259.63	274.90	290.18	305.45	336	366.54	397.09	427.63	458.18	534.54	611.09
24	14	28	42	56	70	84	98	112	126	140	154	168	182	196	210	224	238	252	266	280	308	336	364	392	420	490	560
26	12.92	21.84	38.76	51.69	63.61	77.53	90.46	103.38	116.30	129.23	142.15	155.07	168	180.92	193.84	206.76	219.69	232.61	245.53	258.46	284.30	310.15	336	361.84	397.09	452.30	516.92
28	12	24	36	48	60	72	84	96	108	120	132	144	156	168	180	192	204	216	228	240	264	288	312	336	360	420	480
30	11.2	22.4	33.6	44.8	56	67.2	78.4	89.6	100.8	112	123.2	134.4	145.6	156.8	168	179.2	190.4	201.6	212.8	224	246.4	268.8	291.2	313.6	336	392	448
32	10.5	21	31.5	42	52.5	63	73.5	84	94.5	105	115.5	126	136.5	147	157.5	168	178.5	189	199.5	210	231	252	273	294	315	367.5	420
34	9.88	19.76	29.64	39.52	49.41	59.29	69.17	79.05	88.94	98.82	108.70	118.58	128.47	138.35	148.23	158.11	168	177.88	187.76	197.64	217.41	237	256.94	276.70	296.47	345.88	395.29
36	9.33	18.66	27.99	37.33	46.66	56	65.33	74.66	84	93.33	102.66	112	121.33	130.66	140	149.33	158.66	168	177.33	186.66	205.33	224	242.66	261.33	280	326.66	373.33
38	8.8	17.6	26.4	35.2	44	53.05	61.89	70.73	79.57	88.42	97.27	106.10	114.94	123.78	132.63	141.47	150.31	159.15	168	176.84	194.52	212.21	230.89	249.57	268.25	309.21	353.42
40	8.4	16.8	25.2	33.6	42	50.4	58.8	67.2	75.6	84	92.4	100.8	109.2	117.6	126	134.4	142.8	151.2	159.6	168	184.8	201.6	218.4	235.2	252	294	336
42	8	16	24	32	40	48	56	64	72	80	88	96	104	112	120	128	136	144	152	160	176	192	208	224	240	280	320
44	7.63	15.27	22.90	30.54	38.18	45.81	53.45	61.09	68.72	76.36	84	91.63	99.24	106.87	114.50	122.13	129.76	137.39	145.02	152.65	160.28	176	192	208	224	260	297

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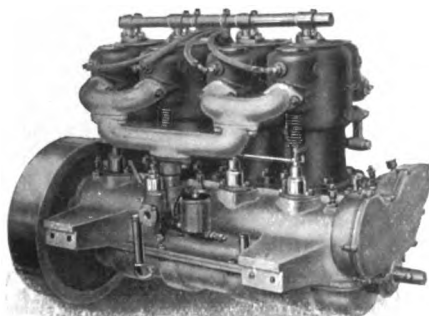
Such as the Glidden Tour, the Harrisburg Reliability, the Chicago Motor Club Reliability, etc., etc., STROMBERG carburetors are invariably used by those who wish to win.

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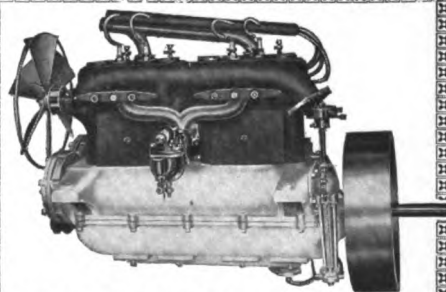


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RATE OF SPEED IN MILES PER HOUR FOR ELAPSED TIME OVER THE MEASURED MILE FROM ONE TO THREE MINUTES

Time Over Measured Mile		Rate of Speed in Miles per Hour	Time Over Measured Mile		Rate of Speed in Miles per Hour	Time Over Measured Mile		Rate of Speed in Miles per Hour
<i>Min.</i>	<i>Sec.</i>		<i>Min.</i>	<i>Sec.</i>		<i>Min.</i>	<i>Sec.</i>	
1	0	60.00	1	27	41.38	1	54	31.58
1	1	59.00	1	28	40.91	1	55	31.30
1	2	58.06	1	29	40.45	1	56	31.03
1	3	57.14	1	30	40.00	1	57	30.77
1	4	56.25	1	31	39.56	1	58	30.50
1	5	55.38	1	32	39.13	1	59	30.25
1	6	54.54	1	33	38.71	2	0	30.00
1	7	53.73	1	34	38.29	2	3	29.26
1	8	52.94	1	35	37.89	2	6	28.57
1	9	52.17	1	36	37.50	2	9	27.90
1	10	51.42	1	37	37.11	2	12	27.27
1	11	50.70	1	38	36.73	2	15	26.66
1	12	50.00	1	39	36.36	2	18	26.08
1	13	49.31	1	40	36.00	2	21	25.53
1	14	48.65	1	41	35.64	2	24	25.00
1	15	48.00	1	42	35.29	2	27	24.49
1	16	47.37	1	43	34.95	2	30	24.00
1	17	46.75	1	44	34.61	2	33	23.53
1	18	46.15	1	45	34.28	2	36	23.07
1	19	45.57	1	46	33.96	2	39	22.64
1	20	45.00	1	47	33.64	2	42	22.22
1	21	44.44	1	48	33.33	2	45	21.81
1	22	43.90	1	49	33.03	2	48	21.42
1	23	43.37	1	50	32.72	2	51	21.05
1	24	42.85	1	51	32.43	2	54	20.69
1	25	42.35	1	52	32.14	3	0	20.00
1	26	41.86	1	53	31.86

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1 mile per hour = 88 ft. per minute.
 = 1.46 ft. per second.
 = 27.8 metres per minute.
 = 0.463 metre per second.
 1 km. per hour = 0.624 miles per hour.
 = 54.9 ft. per minute.
 = 0.914 metre per second.

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**REFERENCE TABLE SHOWING EQUIVALENT SPEED IN MILES AND
KILOMETERS PER HOUR FOR ELAPSED TIME OVER THE
MEASURED MILE OR MEASURED KILOMETER
FROM 24 SECONDS PROGRESSIVELY BY
1-5 SECOND TO 59 4-5 SECONDS**

Time for One Mile. m. s.	Equal to miles per hour.	Equal to Kilo- metres. per hour.	Time of one Kilome- tre m. s.	Equal to Kilo- metres. per hour.	Equal to miles per hour.	Time for One Mile. m. s.	Equal to miles per hour.	Equal to Kilo- metres per hour.	Time of one Kilome- tre m. s.	Equal to Kilo- metres per hour.	Equal to miles per hour.
24	150.00	241.54	24	150.00	93.15	35	102.85	165.62	35	102.85	63.87
$\frac{1}{2}$	148.76	239.55	$\frac{1}{2}$	148.76	92.38	$\frac{1}{2}$	102.27	164.68	$\frac{1}{2}$	102.27	63.51
$\frac{3}{4}$	147.54	237.58	$\frac{3}{4}$	147.54	91.62	$\frac{3}{4}$	101.69	163.75	$\frac{3}{4}$	101.69	63.15
$\frac{5}{8}$	146.34	235.65	$\frac{5}{8}$	146.34	90.87	$\frac{5}{8}$	101.12	162.83	$\frac{5}{8}$	101.12	62.79
$\frac{7}{8}$	145.16	233.75	$\frac{7}{8}$	145.16	90.14	$\frac{7}{8}$	100.56	161.93	$\frac{7}{8}$	100.56	62.44
25	144.00	231.88	25	144.00	89.42	36	100.00	161.03	36	100.00	62.10
$\frac{1}{2}$	142.86	230.05	$\frac{1}{2}$	142.86	88.71	$\frac{1}{2}$	99.44	160.13	$\frac{1}{2}$	99.44	61.75
$\frac{3}{4}$	141.73	228.23	$\frac{3}{4}$	141.73	88.01	$\frac{3}{4}$	98.90	159.26	$\frac{3}{4}$	98.90	61.41
$\frac{5}{8}$	140.62	226.44	$\frac{5}{8}$	140.62	87.32	$\frac{5}{8}$	98.36	158.39	$\frac{5}{8}$	98.36	61.08
$\frac{7}{8}$	139.53	224.67	$\frac{7}{8}$	139.53	86.64	$\frac{7}{8}$	97.82	157.52	$\frac{7}{8}$	97.82	60.74
26	138.46	222.96	26	138.46	85.98	37	97.29	156.67	37	97.29	60.41
$\frac{1}{2}$	137.40	221.25	$\frac{1}{2}$	137.40	85.32	$\frac{1}{2}$	96.77	155.83	$\frac{1}{2}$	96.77	60.09
$\frac{3}{4}$	136.36	219.58	$\frac{3}{4}$	136.36	84.68	$\frac{3}{4}$	96.25	155.00	$\frac{3}{4}$	96.25	59.77
$\frac{5}{8}$	135.34	217.94	$\frac{5}{8}$	135.34	84.04	$\frac{5}{8}$	95.74	154.17	$\frac{5}{8}$	95.74	59.45
$\frac{7}{8}$	134.33	216.31	$\frac{7}{8}$	134.33	83.42	$\frac{7}{8}$	95.23	153.34	$\frac{7}{8}$	95.23	59.13
27	133.33	214.70	27	133.33	82.80	38	94.73	152.55	38	94.73	58.82
$\frac{1}{2}$	132.25	213.12	$\frac{1}{2}$	132.25	82.19	$\frac{1}{2}$	94.24	151.75	$\frac{1}{2}$	94.24	58.52
$\frac{3}{4}$	131.38	211.56	$\frac{3}{4}$	131.38	81.58	$\frac{3}{4}$	93.75	150.96	$\frac{3}{4}$	93.75	58.22
$\frac{5}{8}$	130.43	210.03	$\frac{5}{8}$	130.43	80.10	$\frac{5}{8}$	93.26	150.17	$\frac{5}{8}$	93.26	57.91
$\frac{7}{8}$	129.50	208.53	$\frac{7}{8}$	129.50	80.42	$\frac{7}{8}$	92.78	149.40	$\frac{7}{8}$	92.78	57.61
28	128.57	207.03	28	128.57	79.84	39	92.30	148.64	39	92.30	57.32
$\frac{1}{2}$	127.66	205.57	$\frac{1}{2}$	127.66	79.27	$\frac{1}{2}$	91.83	147.87	$\frac{1}{2}$	91.83	57.02
$\frac{3}{4}$	126.76	204.12	$\frac{3}{4}$	126.76	78.71	$\frac{3}{4}$	91.37	147.13	$\frac{3}{4}$	91.37	56.74
$\frac{5}{8}$	125.87	202.69	$\frac{5}{8}$	125.87	78.16	$\frac{5}{8}$	90.91	146.39	$\frac{5}{8}$	90.91	56.45
$\frac{7}{8}$	125.00	201.29	$\frac{7}{8}$	125.00	77.62	$\frac{7}{8}$	90.45	145.65	$\frac{7}{8}$	90.45	56.17
29	124.13	199.88	29	124.13	77.08	40	90.00	144.92	40	90.00	55.89
$\frac{1}{2}$	123.28	198.52	$\frac{1}{2}$	123.28	76.55	$\frac{1}{2}$	89.55	144.20	$\frac{1}{2}$	89.55	55.61
$\frac{3}{4}$	122.45	197.18	$\frac{3}{4}$	122.45	76.04	$\frac{3}{4}$	89.11	143.49	$\frac{3}{4}$	89.11	55.33
$\frac{5}{8}$	121.62	195.84	$\frac{5}{8}$	121.62	75.52	$\frac{5}{8}$	88.67	142.78	$\frac{5}{8}$	88.67	55.06
$\frac{7}{8}$	120.80	194.52	$\frac{7}{8}$	120.80	75.01	$\frac{7}{8}$	88.23	142.07	$\frac{7}{8}$	88.23	54.79
30	120.00	193.23	30	120.00	74.52	41	87.80	141.39	41	87.80	54.52
$\frac{1}{2}$	119.20	191.95	$\frac{1}{2}$	119.20	74.02	$\frac{1}{2}$	87.38	140.70	$\frac{1}{2}$	87.38	54.26
$\frac{3}{4}$	118.42	190.69	$\frac{3}{4}$	118.42	73.54	$\frac{3}{4}$	86.95	140.01	$\frac{3}{4}$	86.95	53.99
$\frac{5}{8}$	117.64	189.43	$\frac{5}{8}$	117.64	73.05	$\frac{5}{8}$	86.53	139.34	$\frac{5}{8}$	86.53	53.73
$\frac{7}{8}$	116.88	188.21	$\frac{7}{8}$	116.88	72.58	$\frac{7}{8}$	86.12	138.68	$\frac{7}{8}$	86.12	53.48
31	116.13	187.00	31	116.13	72.11	42	85.71	138.02	42	85.71	53.22
$\frac{1}{2}$	115.38	185.79	$\frac{1}{2}$	115.38	71.65	$\frac{1}{2}$	85.30	137.35	$\frac{1}{2}$	85.30	52.97
$\frac{3}{4}$	114.65	184.62	$\frac{3}{4}$	114.65	71.20	$\frac{3}{4}$	84.90	136.71	$\frac{3}{4}$	84.90	52.72
$\frac{5}{8}$	113.90	183.41	$\frac{5}{8}$	113.90	70.73	$\frac{5}{8}$	84.50	136.07	$\frac{5}{8}$	84.50	52.47
$\frac{7}{8}$	113.21	182.28	$\frac{7}{8}$	113.21	70.30	$\frac{7}{8}$	84.11	135.44	$\frac{7}{8}$	84.11	52.23
32	112.50	181.16	32	112.50	69.86	43	83.72	134.81	43	83.72	51.99
$\frac{1}{2}$	111.80	180.03	$\frac{1}{2}$	111.80	69.43	$\frac{1}{2}$	83.33	134.18	$\frac{1}{2}$	83.33	51.75
$\frac{3}{4}$	111.11	178.92	$\frac{3}{4}$	111.11	69.00	$\frac{3}{4}$	82.95	133.57	$\frac{3}{4}$	82.95	51.51
$\frac{5}{8}$	110.43	177.82	$\frac{5}{8}$	110.43	68.57	$\frac{5}{8}$	82.57	132.96	$\frac{5}{8}$	82.57	51.27
$\frac{7}{8}$	109.75	176.73	$\frac{7}{8}$	109.75	68.15	$\frac{7}{8}$	82.19	132.35	$\frac{7}{8}$	82.19	51.04
33	109.09	175.67	33	109.09	67.74	44	81.81	131.75	44	81.81	50.80
$\frac{1}{2}$	108.43	174.60	$\frac{1}{2}$	108.43	67.33	$\frac{1}{2}$	81.44	131.14	$\frac{1}{2}$	81.44	50.57
$\frac{3}{4}$	107.78	173.56	$\frac{3}{4}$	107.78	66.93	$\frac{3}{4}$	81.08	130.56	$\frac{3}{4}$	81.08	50.35
$\frac{5}{8}$	107.14	172.53	$\frac{5}{8}$	107.14	66.53	$\frac{5}{8}$	80.71	129.96	$\frac{5}{8}$	80.71	50.12
$\frac{7}{8}$	106.51	171.51	$\frac{7}{8}$	106.51	66.14	$\frac{7}{8}$	80.35	129.38	$\frac{7}{8}$	80.35	49.89
34	105.88	170.50	34	105.88	65.75	45	80.00	128.82	45	80.00	49.68
$\frac{1}{2}$	105.26	169.50	$\frac{1}{2}$	105.26	65.36	$\frac{1}{2}$	79.64	128.24	$\frac{1}{2}$	79.64	49.45
$\frac{3}{4}$	104.65	168.52	$\frac{3}{4}$	104.65	64.98	$\frac{3}{4}$	79.29	127.68	$\frac{3}{4}$	79.29	49.24
$\frac{5}{8}$	104.04	167.53	$\frac{5}{8}$	104.04	64.61	$\frac{5}{8}$	78.94	127.11	$\frac{5}{8}$	78.94	49.02
$\frac{7}{8}$	103.45	166.58	$\frac{7}{8}$	103.45	64.24	$\frac{7}{8}$	78.60	126.57	$\frac{7}{8}$	78.60	48.81

(Continued on page 590.)



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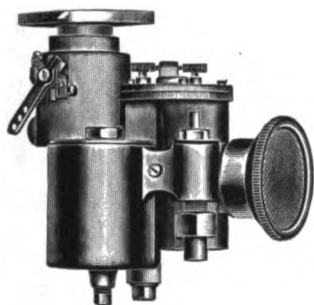
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46	78.26	126.02	46	78.26	48.60	53	67.92	109.38	53	67.92	42.18
$\frac{1}{2}$	77.92	125.47	$\frac{1}{2}$	77.92	48.39	$\frac{1}{2}$	67.66	108.95	$\frac{1}{2}$	67.66	42.01
$\frac{3}{4}$	77.58	124.92	$\frac{3}{4}$	77.58	48.17	$\frac{3}{4}$	67.41	108.55	$\frac{3}{4}$	67.41	41.86
$\frac{5}{8}$	77.25	124.39	$\frac{5}{8}$	77.25	47.97	$\frac{5}{8}$	67.16	108.14	$\frac{5}{8}$	67.16	41.70
$\frac{7}{8}$	76.92	123.86	$\frac{7}{8}$	76.92	47.76	$\frac{7}{8}$	66.91	107.74	$\frac{7}{8}$	66.91	41.55
47	76.59	123.34	47	76.59	47.56	54	66.66	107.34	54	66.66	41.39
$\frac{1}{2}$	76.27	122.81	$\frac{1}{2}$	76.27	47.36	$\frac{1}{2}$	66.42	106.95	$\frac{1}{2}$	66.42	41.24
$\frac{3}{4}$	75.95	122.30	$\frac{3}{4}$	75.95	47.16	$\frac{3}{4}$	66.17	106.55	$\frac{3}{4}$	66.17	41.09
$\frac{5}{8}$	75.63	121.78	$\frac{5}{8}$	75.63	46.96	$\frac{5}{8}$	65.93	106.16	$\frac{5}{8}$	65.93	40.94
$\frac{7}{8}$	75.31	121.27	$\frac{7}{8}$	75.31	46.76	$\frac{7}{8}$	65.69	105.78	$\frac{7}{8}$	65.69	40.79
48	75.00	120.77	48	75.00	46.57	55	65.45	105.40	55	65.45	40.64
$\frac{1}{2}$	74.68	120.25	$\frac{1}{2}$	74.68	46.37	$\frac{1}{2}$	65.21	105.00	$\frac{1}{2}$	65.21	40.49
$\frac{3}{4}$	74.38	119.77	$\frac{3}{4}$	74.38	46.19	$\frac{3}{4}$	64.98	104.63	$\frac{3}{4}$	64.98	40.35
$\frac{5}{8}$	74.07	119.27	$\frac{5}{8}$	74.07	46.00	$\frac{5}{8}$	64.74	104.25	$\frac{5}{8}$	64.74	40.20
$\frac{7}{8}$	73.77	118.79	$\frac{7}{8}$	73.77	45.81	$\frac{7}{8}$	64.51	103.88	$\frac{7}{8}$	64.51	40.06
49	73.47	118.30	49	73.47	45.62	56	64.28	103.52	56	64.28	39.92
$\frac{1}{2}$	73.17	117.82	$\frac{1}{2}$	73.17	45.44	$\frac{1}{2}$	64.05	103.14	$\frac{1}{2}$	64.05	39.77
$\frac{3}{4}$	72.87	117.34	$\frac{3}{4}$	72.87	45.25	$\frac{3}{4}$	63.83	102.78	$\frac{3}{4}$	63.83	39.64
$\frac{5}{8}$	72.58	116.87	$\frac{5}{8}$	72.58	45.07	$\frac{5}{8}$	63.60	102.41	$\frac{5}{8}$	63.60	39.49
$\frac{7}{8}$	72.29	116.40	$\frac{7}{8}$	72.29	44.89	$\frac{7}{8}$	63.38	102.06	$\frac{7}{8}$	63.38	39.36
50	72.00	115.94	50	72.00	44.71	57	63.16	101.70	57	63.16	39.22
$\frac{1}{2}$	71.71	115.47	$\frac{1}{2}$	71.71	44.53	$\frac{1}{2}$	62.93	101.33	$\frac{1}{2}$	62.93	39.08
$\frac{3}{4}$	71.42	115.00	$\frac{3}{4}$	71.42	44.35	$\frac{3}{4}$	62.71	100.98	$\frac{3}{4}$	62.71	38.94
$\frac{5}{8}$	71.14	114.55	$\frac{5}{8}$	71.14	44.18	$\frac{5}{8}$	62.50	100.64	$\frac{5}{8}$	62.50	38.81
$\frac{7}{8}$	70.86	114.10	$\frac{7}{8}$	70.86	44.00	$\frac{7}{8}$	62.28	100.29	$\frac{7}{8}$	62.28	38.67
51	70.58	113.67	51	70.58	43.83	58	62.07	99.95	58	62.07	38.54
$\frac{1}{2}$	70.31	113.22	$\frac{1}{2}$	70.31	43.66	$\frac{1}{2}$	61.85	99.59	$\frac{1}{2}$	61.85	38.41
$\frac{3}{4}$	70.04	112.78	$\frac{3}{4}$	70.04	43.49	$\frac{3}{4}$	61.64	99.25	$\frac{3}{4}$	61.64	38.28
$\frac{5}{8}$	69.76	112.33	$\frac{5}{8}$	69.76	43.32	$\frac{5}{8}$	61.43	98.92	$\frac{5}{8}$	61.43	38.15
$\frac{7}{8}$	69.49	111.90	$\frac{7}{8}$	69.49	43.15	$\frac{7}{8}$	61.22	98.58	$\frac{7}{8}$	61.22	38.01
52	69.23	111.48	52	69.23	42.99	59	61.01	98.24	59	61.01	37.88
$\frac{1}{2}$	68.96	111.04	$\frac{1}{2}$	68.96	42.82	$\frac{1}{2}$	60.81	97.92	$\frac{1}{2}$	60.81	37.76
$\frac{3}{4}$	68.70	110.62	$\frac{3}{4}$	68.70	42.66	$\frac{3}{4}$	60.60	97.58	$\frac{3}{4}$	60.60	37.63
$\frac{5}{8}$	68.44	110.21	$\frac{5}{8}$	68.44	42.50	$\frac{5}{8}$	60.40	97.26	$\frac{5}{8}$	60.40	37.51
$\frac{7}{8}$	68.18	109.79	$\frac{7}{8}$	68.18	42.34	$\frac{7}{8}$	60.20	96.94	$\frac{7}{8}$	60.20	37.38

**REFERENCE TABLE SHOWING EQUIVALENT SPEED IN MILES AND
KILOMETERS PER HOUR FOR ELAPSED TIME OVER THE
MEASURED MILE OR MEASURED KILOMETER
FROM 1 MINUTE TO 30 MINUTES**

Time for One Mile. m. s.	Equal to miles per hour.	Equal to Kilo-metres. per hour.	Time of one Kilo-metre m. s.	Equal to Kilo-metres. per hour.	Equal to miles per hour.	Time for One Mile. m. s.	Equal to miles per hour.	Equal to Kilo-metres. per hour.	Time of one Kilo-metre m. s.	Equal to Kilo-metres. per hour.	Equal to mile per hour.
1 0	60.00	96.61	1 0	60.00	37.26	1 17	46.75	75.28	1 17	46.75	29.03
1 1	59.00	95.03	1 1	59.00	36.64	1 18	46.15	74.31	1 18	46.15	28.66
1 2	58.06	93.49	1 2	58.06	36.05	1 19	45.57	73.38	1 19	45.57	28.30
1 3	57.14	92.01	1 3	57.14	35.48	1 20	45.00	72.46	1 20	45.00	27.94
1 4	56.25	90.58	1 4	56.25	34.93	1 21	44.44	71.56	1 21	44.44	27.60
1 5	55.38	89.17	1 5	55.38	34.39	1 22	43.90	70.69	1 22	43.90	27.26
1 6	54.54	87.82	1 6	54.54	33.87	1 23	43.37	69.84	1 23	43.37	26.93
1 7	53.73	86.52	1 7	53.73	33.36	1 24	42.85	69.00	1 24	42.85	26.61
1 8	52.94	85.25	1 8	52.94	32.87	1 25	42.35	68.19	1 25	42.35	26.30
1 9	52.17	84.01	1 9	52.17	32.40	1 26	41.86	67.40	1 26	41.86	26.00
1 10	51.42	82.80	1 10	51.42	31.93	1 27	41.38	66.63	1 27	41.38	25.7
1 11	50.70	81.64	1 11	50.70	31.48	1 28	40.91	65.87	1 28	40.91	25.40
1 12	50.00	80.51	1 12	50.00	31.05	1 29	40.45	65.13	1 29	40.45	25.10
1 13	49.31	79.40	1 13	49.31	30.62	1 30	40.00	64.41	1 30	40.00	24.84
1 14	48.65	78.34	1 14	48.65	30.21	1 31	39.56	63.70	1 31	39.56	24.56
1 15	48.00	77.29	1 15	48.00	29.81	1 32	39.13	63.01	1 32	39.13	24.30
1 16	47.37	76.28	1 16	47.37	29.41	1 33	38.71	62.33	1 33	38.71	24.04

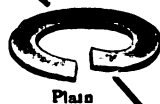
(Continued on page 592.)

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Positive

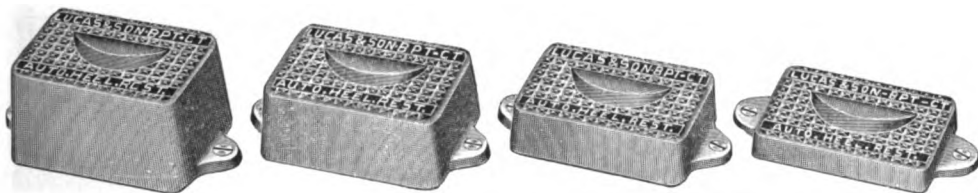
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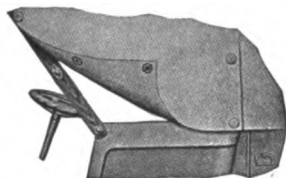
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1 34	38.29	61.66	1 34	38.29	23.77	3 6	19.35	31.16	3 6	19.35	12.01
1 35	37.89	61.01	1 35	37.89	23.53	3 12	18.75	30.19	3 12	18.75	11.64
1 36	37.50	60.38	1 36	37.50	23.28	3 18	18.18	29.27	3 18	18.18	11.29
1 37	37.11	59.76	1 37	37.11	23.04	3 24	17.64	28.40	3 24	17.64	10.95
1 38	36.73	59.14	1 38	36.73	22.81	3 30	17.14	27.60	3 30	17.14	10.64
1 39	36.36	58.55	1 39	36.36	22.58	3 36	16.66	26.82	3 36	16.66	10.34
1 40	36.00	57.97	1 40	36.00	22.35	3 42	16.21	26.10	3 42	16.21	10.06
1 41	35.64	57.39	1 41	35.64	22.13	3 48	15.79	25.42	3 48	15.79	9.80
1 42	35.29	56.82	1 42	35.29	21.91	3 54	15.38	24.76	3 54	15.38	9.55
1 43	34.95	56.28	1 43	34.95	21.70	4 0	15.00	24.15	4 0	15.00	9.31
1 44	34.61	55.73	1 44	34.61	21.50	4 6	14.63	23.56	4 6	14.63	9.08
1 45	34.28	55.20	1 45	34.28	21.28	4 12	14.28	22.99	4 12	14.28	8.86
1 46	33.96	54.68	1 46	33.96	21.09	4 18	13.95	22.46	4 18	13.95	8.66
1 47	33.64	54.17	1 47	33.64	20.89	4 24	13.63	21.95	4 24	13.63	8.46
1 48	33.33	53.67	1 48	33.33	20.70	4 30	13.33	21.46	4 30	13.33	8.28
1 49	33.03	53.19	1 49	33.03	20.51	4 36	13.04	21.00	4 36	13.04	8.10
1 50	32.72	52.69	1 50	32.72	20.32	4 42	12.76	20.54	4 42	12.76	7.92
1 51	32.43	52.22	1 51	32.43	20.14	4 48	12.50	20.13	4 48	12.50	7.76
1 52	32.14	51.75	1 52	32.14	19.96	4 54	12.24	19.71	4 54	12.24	7.60
1 53	31.86	51.30	1 53	31.86	19.78	5 0	12.00	19.32	5 0	12.00	7.45
1 54	31.58	50.85	1 54	31.58	19.61	5.12	11.54	18.58	5.12	11.54	7.16
1 55	31.30	50.40	1 55	31.30	19.43	5.24	11.11	17.89	5.24	11.11	6.90
1 56	31.03	49.96	1 56	31.03	19.27	5.36	10.71	17.24	5.36	10.71	6.65
1 57	30.77	49.55	1 57	30.77	19.11	5.48	10.34	16.65	5.48	10.34	6.42
1 58	30.50	49.11	1 58	30.50	18.94	6 0	10.00	16.10	6 0	10.00	6.21
1 59	30.25	48.71	1 59	30.25	18.78	6.15	9.60	15.46	6.15	9.60	5.96
2 0	30.00	48.30	2 0	30.00	18.63	6.30	9.23	14.86	6.30	9.23	5.73
2 3	29.26	47.11	2 3	29.26	18.17	6.45	8.88	14.30	6.45	8.88	5.51
2 6	28.57	46.00	2 6	28.57	17.74	7 0	8.57	13.80	7 0	8.57	5.32
2 9	27.90	44.92	2 9	27.90	17.32	7.15	8.27	13.31	7.15	8.27	5.13
2 12	27.27	43.91	2 12	27.27	16.93	7.30	8.00	12.88	7.30	8.00	4.97
2 15	26.66	42.93	2 15	26.66	16.55	7.45	7.74	12.46	7.45	7.74	4.80
2 18	26.08	42.00	2 18	26.08	16.20	8 0	7.50	12.08	8 0	7.50	4.66
2 21	25.53	41.11	2 21	25.53	15.85	8.30	7.06	11.37	8.30	7.06	4.38
2 24	25.00	40.25	2 24	25.00	15.52	9 0	6.66	10.72	9 0	6.66	4.13
2 27	24.49	39.43	2 27	24.49	15.21	9.30	6.31	10.16	9.30	6.31	3.92
2 30	24.00	38.64	2 30	24.00	14.90	10 0	6.00	9.66	10 0	6.00	3.72
2 33	23.53	37.89	2 33	23.53	14.61	10.30	5.71	9.19	10.30	5.71	3.54
2 36	23.07	37.15	2 36	23.07	14.32	11 0	5.45	8.77	11 0	5.45	3.38
2 39	22.64	36.45	2 39	22.64	14.06	11.30	5.21	8.39	11.30	5.21	3.23
2 42	22.22	35.78	2 42	22.22	13.80	12 0	5.00	8.05	12 0	5.00	3.10
2 45	21.81	35.12	2 45	21.81	13.54	13 0	4.61	7.42	13 0	4.61	2.86
2 48	21.42	34.49	2 48	21.42	13.31	14 0	4.28	6.89	14 0	4.28	2.66
2 51	21.05	33.89	2 51	21.05	13.07	15 0	4.00	6.44	15 0	4.00	2.48
2 54	20.69	33.31	2 54	20.69	12.85	20 0	3.00	4.83	20 0	3.00	1.86
2 57	20.34	32.75	2 57	20.34	12.63	30 0	2.00	3.22	30 0	2.00	1.24
3 0	20.00	32.20	3 0	20.00	12.42						

**SPEED IN MILES PER HOUR WITH DIFFERENT GEAR RATIOS AND
ROAD WHEEL SIZES AT 1000 R. P. M. OF ENGINE (WITH
3 PER CENT. LOSS ALLOWANCE)**

GEARS	4:1	3½:1	3:1	2½:1	2:1	1:1
30-in. Wheel . . .	21.64	24.73	28.86	34.63	43.29	86.57
32 " " " " " " " "	23.09	26.38	30.78	36.94	46.17	92.34
33 " " " " " " " "	23.81	27.21	31.74	38.09	47.62	95.23
34 " " " " " " " "	24.53	28.03	32.70	39.25	49.06	98.12
36 " " " " " " " "	25.98	29.68	34.63	41.55	51.94	103.89
38 " " " " " " " "	27.41	31.33	36.55	43.86	54.83	109.66
40 " " " " " " " "	28.85	32.97	38.37	46.16	57.71	115.41

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HILL-CLIMBING FORMULAS (WORBY BEAUMONT) W = Weight of car and load in pounds. w = Weight of car and load in tons. H = Total ascent in feet. L = Length of hill in feet. R = Road resistance in pounds per ton weight of car and load. r = Air resistance in pounds = $V^2 A 0.0017$. V = Velocity of car in feet per second. A = Area of car in square feet presented to air resistance. T = Time occupied in ascent in seconds. E = Efficiency of transmission of power from engine to road wheels. HP = Effective horse power of engine. p = Power given off at road wheels or work done in ascending hill. S = Speed of ascent in miles per hour.Then if P = Mean effective cylinder pressure. L = Length of stroke in feet. A = Area of piston in square inches. N = Number of useful or firing strokes per minute,the brake horse-power of petrol or steam engines, having a mechanical efficiency of E , is

$$\frac{EPLAN}{33000}$$

$$33000$$

For compound steam engines the number of useful working strokes are those occurring in the low-pressure cylinder, and the mean effective pressure in the high-pressure cylinder or cylinders is referred to the area of the low-pressure cylinder.

The power given off at the road wheels during the ascent of the hill is

$$p = \frac{HW + (Rw + r)L}{T 550}$$

and the brake horsepower required at the engine with a selected value or E is

$$HP = \frac{HW + (Rw + r)L}{TE 550}$$

With the other conditions known, the efficiency may be found from

$$E = \frac{HW + (Rw + r)L}{HP \cdot T 550}$$

the speed of the ascent in miles per hour from

$$S = \frac{L}{\frac{HWL + (Rw + r)L}{HP \cdot E 550}} L \times 1.466$$

and the time occupied in the ascent from

$$T = \frac{HW + (Rw + r)L}{HP \cdot E 550}$$

Unless the probable speed of the car is high, or the wind velocity such that the pressure upon the surface of the car presented to air resistance opposing motion approaches that due to the speed of the car through still air, then the quantity r may be omitted from the foregoing expressions without introducing more than slight error.

Automobile Mountings, Accessories and Parts

Catalog E, 1913 number, just out, showing a most complete and comprehensive line of:—

Limousine Fittings	Lever Handles and Plates
Tire Holders	Side Door Handles and Parts
Robe Rails	Gasoline Tank Parts
Foot Rests	“ Separators

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318-320 BOWERY STREET

GRAND RAPIDS, MICH.

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Freedom From Ignition Troubles

A Hot Spark Perfectly Timed—Simplest System of Wiring—One Coil for Any Number of Cylinders—Immediate Accessibility Without Tools—All are found in the model “D” distributor, the best system for marine or automobile use.

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Philadelphia

Pennsylvania

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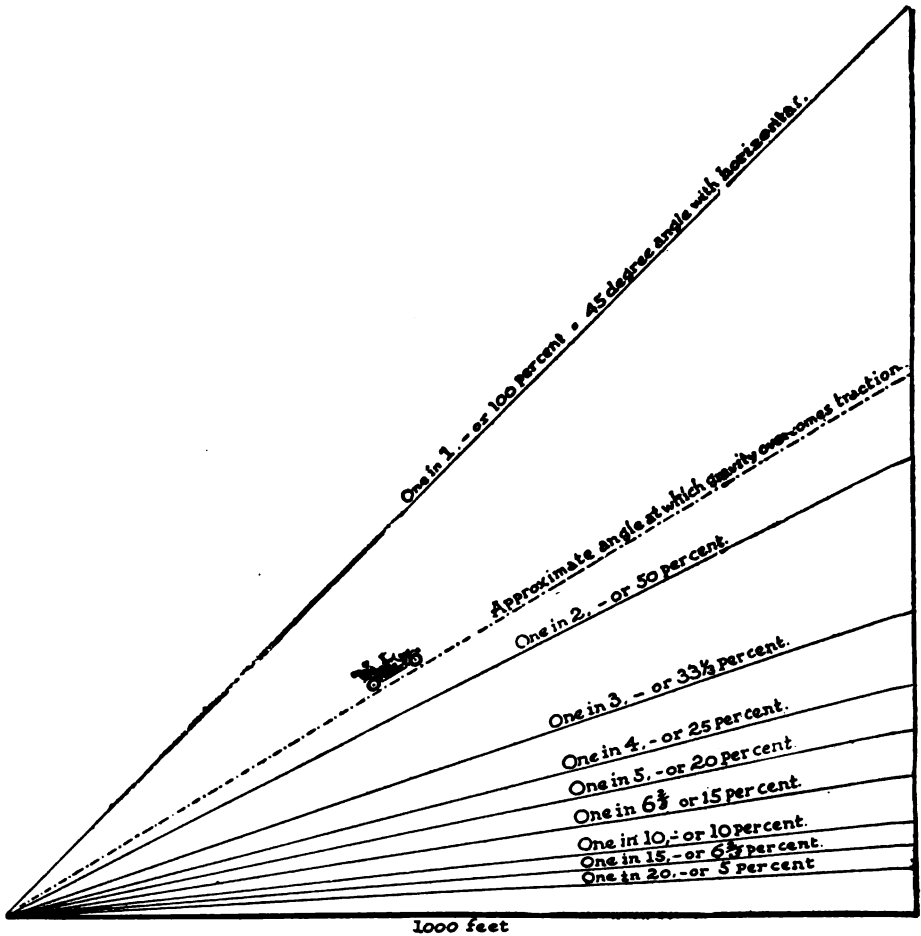
Originators and Manufacturers of Heat-treated Frames

Detroit, Mich.

Reading, Penna.

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MEASUREMENT OF GRADES



ILLUSTRATING METHOD OF CALCULATING GRADE PERCENTAGES

If it be assumed that the base of the triangle represents a line 1,000 feet long and that the first sloping line represents a road having a rise that brings it 50 feet above the starting point, this is figured as 50 feet in a thousand, or 5 per cent. In other words, one foot of rise for every 20 feet, but the latter distance does not mean distance actually traveled by a car in ascending such a slope, but distance measured horizontally with reference to that slope. The grade is measured by the tangent of the angle of inclination and not by its sine, so that a grade which represents 100 per cent. corresponds to an angle of inclination of but 45 degrees, and not 90 degrees, or perpendicular, as is commonly supposed. At the upper end of the next sloping line the elevation would amount to 66 $\frac{2}{3}$ feet, which is equivalent to a rise of 6 $\frac{2}{3}$ feet for each 100 feet traveled horizontally. So one in three corresponds to a 33 $\frac{1}{3}$ per cent. grade, one in two to a 50 per cent. grade, and so on until a 100 per cent. grade is reached, which, as noted, is the equivalent of a 45 degree angle.



The Problem of Lubrication Solved by the use of the Henry Grease Cup

Look at its construction!

No cap to jar off, no threads to cross, no wear out to it. Cap quickly put on and removed by the pressure of a finger. A steady pressure and positive automatic lubrication at all times, once filled and regulating screw adjusted, nothing further required than a glance at the plunger, which is acting as an accurate indicator in regard to the amount of grease in the cup

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Absolutely Silent Ball Bearings

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100% Radio Thrust

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TABLE OF GRADIENTS

GRADE		Equal to Angle of	Rise or Fall in One Mile, Feet
Per Cent	Units		
20	1 in 5	11° 19'	1056
17	1 " 6	9° 26'	880
14	1 " 7	8° 09'	754
12.5	1 " 8	7° 08'	635
11	1 " 9	6° 17'	586
10	1 " 10	5° 43'	528
9	1 " 11	5° 11'	480
8	1 " 12	4° 46'	440
7.75	1 " 13	4° 24'	406
7	1 " 14	4° 05'	337
6.5	1 " 15	3° 49'	352
6.25	1 " 16	3° 35'	330
6	1 " 17	3° 22'	310
5.5	1 " 18	3° 11'	293
5	1 " 19	3° 00'	277
5	1 " 20	2° 52'	204
4	1 " 25	2° 18'	218
3.3	1 " 30	1° 55'	155
2.8	1 " 35	1° 38'	151
2.5	1 " 40	1° 26'	132

COMPOUND EQUIVALENTS

Atmosphere (14.7 lbs. per square inch) = 1.0335 kilogrammes per square centimetre.

1 Foot-pound = 0.1382 kilogrammetre.

1 lb. per square inch = 0.0703077 kilogramme per square centimetre = 0.7031 gramme per square millimetre = 5.170 centimetres of mercury at 0 degrees Centigrade.

1 Kilogramme per square millimetre = 1422.32 lbs. per square inch = 0.635 ton per square inch.

1 Kilogramme per square centimetre = 14.2232 lbs. per square inch.

1 Gramme per square millimetre = 1.422 lbs. per square inch.

1 Kilogrammetre = 7.233 foot-pounds.

1 Gramme per square centimetre = 0.01422 lb. per square inch.

1 Calorie or French unit of heat = 3.968 British Thermal Units.

French mechanical equivalent of heat (425 kilogrammetres) = 3,074 foot-pounds per unit.

1 Calorie per square metre = 0.369 heat-unit per square foot.

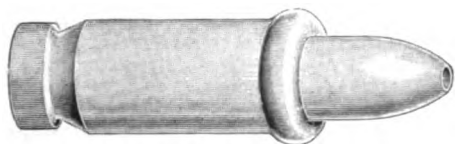
1 Calorie per kilogramme = 1.800 heat-units per lb.

English unit of heat, or heat-unit = 0.252 calorie.

English mechanical equivalent to one heat-unit (778 foot-pounds) = 10.67 kilogrammetres.

1 English heat-unit per square foot = 2.713 calories per square metre.

1 English heat-unit per lb. = 5.9 calorie per kilogramme.



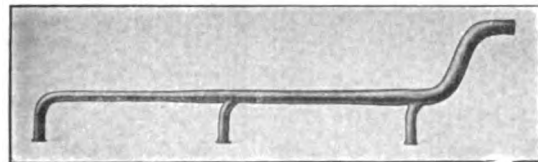
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Operates between the coils of the Spring, releasing all pressure from the Valve Stem, leaving the Valve, Spring, Disc and Key free to be removed.

A Spring can be compressed in the motor, removed from the motor compressed or can be compressed out of the motor, replaced and released.

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**TOPS FOR TOURING CARS
TOPS FOR RUNABOUTS**

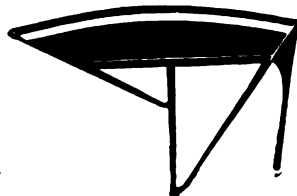
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THE MICHIGAN TOP CO., Detroit, Mich.
E. H. Coombs, Manager, 313 Riopelle Street



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STORAGE BATTERY CHARGING AND DISCHARGING

The positive plate of a lead-storage battery during charge absorbs oxygen gas turning a brown color (Peroxide of Lead, PbO_2) during the process, while the negative is reduced by the hydrogen, changing to a dull gray or slate color—spongy lead.

During discharge the positive plate parts with some of its oxygen and being gradually reduced to a lower oxide of lead is attacked by the sulphuric acid, forming lead sulphate, PbSO_4 , while the negative plate gives up some of its hydrogen and is also gradually attacked by the acid, forming lead sulphate too. Meanwhile the density of the electrolyte has become less, owing to the formation of water from the H_2O set free from the plates.

This formation of a film of sulphate on both plates brings them both to a state of balance, and the electromotive force of the battery will fall in proportion to the amount of sulphate abstracted from the acid until only water is left. In practice, the voltage should not be allowed to drop below 1.7 volts, for the reason that the excessive sulphate is almost impossible to remove entirely, and as it is to a considerable extent an insulator it causes a lowering of the voltage of the cell. When discharged the plates will be found to have changed their color somewhat again, both becoming of a lighter shade.

On charging again, both plates give up their sulphate, which returns to the acid, increasing its density to its normal condition as before—the positive plate becoming lead peroxide and the negative, spongy lead, until the cell is fully charged. The sequence of operations might aptly be termed the battery cycle.

This may be better represented in the form of an equation, thus:

BATTERY FULLY CHARGED

Positive Plates	Electrolyte	Negative Plates
PbO_2	H_2SO_4	Pb
	Sp.Gr. 1.275	
	(Strong)	

HALF DISCHARGED

$\text{PbO}_2 + \text{PbSO}_4$	H_2SO_4	$\text{Pb} + \text{PbSO}_4$
	Sp. Gr. 1.240	
	(Medium)	

FULLY DISCHARGED

PbSO_4	H_2SO_4	PbSO_4
	Sp. Gr. 1.180	
	(Weak)	

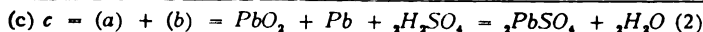
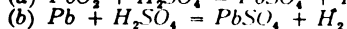
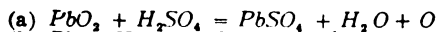
Where PbO_2 represents the chemical symbol for lead peroxide or dioxide.

Where PbSO_4 represents the chemical symbol for lead sulphate.

Where H_2SO_4 represents the chemical symbol for sulphuric acid.

REVERSIBLE CHEMICAL EQUATIONS SHOWING CHANGES WHICH TAKE PLACE IN THE LEAD STORAGE BATTERY (LAMAR LYNDON)

CHARGE



DISCHARGE

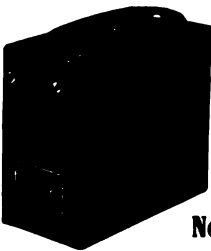
Equation (a) expresses the reactions at the positive plate; (b) those at the negative and (c) the combined effect is the fundamental equation of the lead storage battery.

PHILADELPHIA BATTERY**PHILADELPHIA
STORAGE
BATTERY
COMPANY****VEHICLE
LIGHTING
SPARKING****ONTARIO AND
C STREETS
PHILADELPHIA
PENNSYLVANIA****The Only Perfect Battery Construction
in the NEW WITHERBEE**

THE heavy hard rubber bolted cover takes the strain, splash cell covers and semi-fluid sealing compound make the New Witherbee Battery absolutely acid tight. No other construction will. Besides we give greater capacity in proportion to rating than any other maker. Write us if you seek quality.

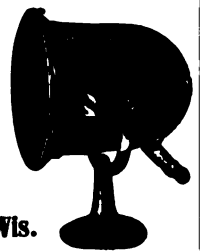
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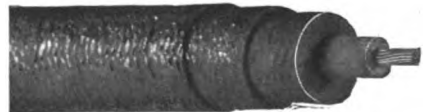
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Northwestern Storage Battery Co., Milwaukee, Wis.**A SPECIALTY OF OURS
AND YOU WILL FIND****"B.I.W." CABLE THE BEST****SECONDARY, 1/2, 3/4 and 5/8 inch diam.****PRIMARY, 1, 2, 3 and 4 conductors.****THE BRAID IS THOROUGHLY****OIL-PROOFED Protecting the Rubber****WIRES AND CORDS FOR LIGHTING**

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USEFUL ENGINEERING DATA

Water weighs 62.4 pounds per cubic foot, and 8.3 pounds per gallon.

There are 7.5 gallons in a cubic foot of water.

Gasoline has a specific gravity of .72, and consequently weighs 5.96 pounds per gallon.
This applies to 76° gasoline.

A foot-pound represents the work required to raise a weight of one pound to a height of one foot. There are 33,000 foot-pounds to a horsepower.

A British Thermal Unit represents the amount of heat required to raise the temperature of one pound of water one degree Fahrenheit at or near 39° F. Its symbol is B. T. U.

There are 778 foot-pounds in a B. T. U.

There are 42.4 B. T. U. to a horsepower.

The thermal efficiency of a good internal combustion motor is from 30 to 35 per cent.

The mechanical efficiency of a good internal combustion motor should be between 85 and 90 per cent.

On direct drive, with an efficient transmission and differential, about 88 per cent. of the power furnished by the motor should be delivered at the rear wheels

Under the best conditions, about 75 per cent. of the indicated horsepower of the engine should be available for useful work.

If the work performed at the rear wheels is reduced to heat units, it will be found that about 23 per cent. of the energy represented by the heating value of the fuel is available as useful work.

The piston speed of a motor should not exceed 1,000 feet per minute.

The peripheral velocity of a cast iron flywheel should not exceed 5,000 feet per minute. Should it exceed this speed, there would be danger of the flywheel bursting from centrifugal force.

USEFUL FUNCTIONS OF π

$\pi = 3.14159265$	$\pi = 0.44879895$	$\pi^2 = 9.86960440$	$\sqrt{\pi} = 1.77245385$
$\pi = 1.57079633$	$\pi = 0.19634954$	$\pi^3 = 31.00627668$	$\sqrt{\pi} = 1.46459189$
$\pi = 1.04719755$	$\pi = 0.13089969$	$\frac{1}{\pi} = 0.31830989$	$\frac{1}{\sqrt{\pi}} = 0.56418958$
$\pi = 0.78539816$	$\pi = 0.09817477$	$\frac{1}{\pi^2} = 0.10132118$	$\frac{1}{\sqrt[3]{\pi}} = 0.68278406$
$\pi = 0.52359878$	$\pi = 0.01754329$	$\frac{1}{\pi^3} = 0.03225153$	$\text{Log } \pi = 0.49714987$
$\pi = 0.26179939$	$\pi = 0.00175433$		
$\pi = 0.13089969$	$\pi = 0.00017543$		
$\pi = 0.06544984$	$\pi = 0.00001754$		
$\pi = 0.03272492$	$\pi = 0.00000175$		
$\pi = 0.01636246$	$\pi = 0.00000017$		
$\pi = 0.00818123$	$\pi = 0.00000001$		
$\pi = 0.00409061$	$\pi = 0.00000000$		
$\pi = 0.00204531$	$\pi = 0.00000000$		
$\pi = 0.00102265$	$\pi = 0.00000000$		
$\pi = 0.00051133$	$\pi = 0.00000000$		
$\pi = 0.00025566$	$\pi = 0.00000000$		
$\pi = 0.00012783$	$\pi = 0.00000000$		
$\pi = 0.00006391$	$\pi = 0.00000000$		
$\pi = 0.00003196$	$\pi = 0.00000000$		
$\pi = 0.00001598$	$\pi = 0.00000000$		
$\pi = 0.00000799$	$\pi = 0.00000000$		
$\pi = 0.00000399$	$\pi = 0.00000000$		
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$\pi = 0.00000049$	$\pi = 0.00000000$		
$\pi = 0.00000025$	$\pi = 0.00000000$		
$\pi = 0.00000012$	$\pi = 0.00000000$		
$\pi = 0.00000006$	$\pi = 0.00000000$		
$\pi = 0.00000003$	$\pi = 0.00000000$		
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$\pi = 0.00000000$	$\pi = 0.00000000$		

STEERING GEARS

We will make and deliver 75,000 for 1913 cars.
THEY MUST BE RIGHT

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Transmissions, Steering Gears, Jack Shafts
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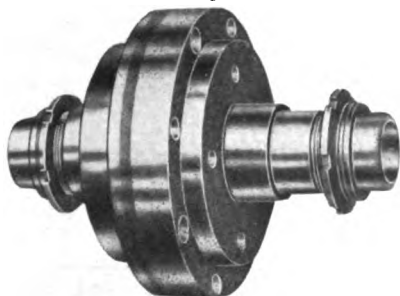
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Shafts

NEW YORK GEAR
WORKS

Greenpoint Ave. and West
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Fits Any Axle



Transmit the Power to the
Point of Greatest Advantage

It's the simplest, most durable,
most powerful, gearless dif-
ferential that does this.

Ask for booklet

WAYNE AUTO AXLE CO., Ft. Wayne, Ind.

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HEAT LOSSES DUE TO INCOMPLETE COMBUSTION IN GASOLINE MOTORS

Assuming that it were possible to secure complete combustion of the fuel, the result would be,

Carbon dioxide (CO_2) and water (H_2O).

With incomplete combustion the carbon is usually burned to carbon monoxide (CO) only, with consequent serious heat loss as the following table shows:

PRODUCTS OF COMBUSTION, FULL AND PARTIALLY LOADED

	Full Load	Partial Load	Slow Free
Carbon monoxide.....	3.13	6.9	—
Hydrogen.....	1.19	2.4	—
Hydrocarbons.....	0.30	0.9	—
Carbon dioxide.....	11.90	9.9	6.3
Oxygen.....	.23	0.3	11.2
Nitrogen.....	83.33	79.6	82.5
Total.....	100.0	100.0	100.0

Fuel value of carbon burned to carbon monoxide.....=4,400 B.T.U.
 Fuel value of carbon burned to carbon dioxide.....=14,500 B.T.U.
 Fuel value of hydrogen gas to water.....=62,032 B.T.U.
 Fuel value of hydrocarbon fuels to carbon dioxide.....=20,000 B.T.U.

If we assume that the total as above given is 100 pounds and taking the fuel values as above set down for the respective elements and compounds, it will be possible to show that the loss will be enormous if the combustion is incomplete, as, for illustration, 6.9 pounds of carbon monoxide (shown at the top of the column for partial load) would mean a loss of 62,790 British thermal units of heat (B.T.U.). What is more to the point, the 2.4 pounds of hydrogen would mean a loss of 148,877 B.T.U. In the same way, all the losses may be determined.

COMBUSTION CONSTANTS OF VARIOUS GASES AND FUELS

	Atomic Weight Hydrogen=1	Molecular Weight H_2 2	Specific Gravity at 32° F. and Atmospheric Pressure Water=1	Density in Pounds per Cubic Foot	Specific Heat at Constant Pressure	Specific Heat at Constant Volume	Coefficient of Expansion of Volume at Constant Pressure per Deg. Centigrade	Coefficient of Expansion of Volume at Constant Pressure per Deg. Fahrenheit	British Thermal Units Given Out During Combustion with Oxygen
Air.....			.00130	.0809	.2377	.1690	.003665	.002036	
Carbon.....	11.97		2.33		.2411				14,540
Carbonic acid gas.....		CO_2 43.89	.00198	.1225	.2164	.1535	.003688	.002049	
Carbonic oxide.....		CO 27.93	.00126	.0784	.2479	.1758	.003667	.002037	4,370
Coal gas (average).....			.00054	.0335					17,800
Hydrogen.....	1	H_2 - 2	.00009	.0056	3.4046	2.414	.003667	.002037	61,260
Methane.....		CH_4 15.97	.00072	.0448	.5929	.4701			26,400
Oxygen.....	15.96	O_2 31.92	.00144	.0896	.2182	.156			
Steam at 212° F.....		H_2O 17.96	.0008	.05	.4750	.34			
Refined petroleum.....			.8						22,000
Crude petroleum.....			.9						20,000

Specific heat of gas engine exhaust gases = .258 at constant pressure and .189 at constant volume.

Index to Tables and Data appears on Pages 23 to 26.

"SCANDINAVIA"**BRAKE LINING
AS EFFICIENT AS AN AIR BRAKE****Solid Woven—No Wire—Never Slips—COSTS LESS****WRITE FOR PARTICULARS****THE SCANDINAVIA BELTING CO.****127-129 White Street****NEW YORK, N. Y.****Cable Address, "Impose" New Castle, Indiana****NATIONAL SPRING COMPANY****MAKERS OF****Highest Grade Automobile Springs****DETROIT OFFICE
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COMPARATIVE TABLE OF FUEL COSTS FOR DIFFERENT MOTIVE POWERS

(Published by Farm Implement News)

Kind of Motive Power.	Rate of Fuel Consumed.	COST OF FUEL PER BRAKE TEST HORSE POWER											
		For 1 Hour				For 24 Hours				For 300 Days of 10 Hours			
Gas Engine on Producer Gas.	In lbs. per h.p. per hour.	Coal per 2,000-lb. Ton at				Coal per 2,000-lb. Ton at				Coal per 2,000-lb. Ton at			
	8	\$3.06	\$4.00	\$5.00	\$6.00	\$7.00	\$3.00	\$4.00	\$5.00	\$6.00	\$7.00	\$3.00	\$4.00
	1.00	\$c.12	\$c.16	\$c.20	\$c.24	\$c.28	c 2.9	c 3.9	c 4.8	c 5.7	c 6.7	\$8.64	\$11.52
Gas Engine on Natural Gas.	1.25	.15	.20	.25	.30	.35	3.6	4.8	6.0	7.2	8.4	10.80	14.40
	1.50	.19	.25	.31	.38	.44	4.5	6.0	7.5	9.0	10.50	13.50	18.00
		.23	.30	.38	.45	.53	5.4	7.2	9.0	10.80	12.60	16.20	21.60
Gas Engine on Natural Gas.	In cu.ft. per h.p. per hour.	Natural Gas per 1,000 cu.ft. at				Natural Gas per 1,000 cu.ft. at				Natural Gas per 1,000 cu.ft. at			
	9	15c.	20c.	25c.	30c.	35c.	15c.	20c.	25c.	30c.	35c.	15c.	20c.
	10	c .14	c .18	c .23	c .27	c .32	c 3.2	c 4.3	c 5.4	c 6.5	c 7.6	\$9.72	\$12.96
Gas Engine on Artificial Gas.	11	.15	.20	.25	.30	.35	3.6	4.8	6.0	7.2	8.4	10.80	14.40
	12	.17	.22	.28	.33	.39	4.0	5.3	6.6	7.9	9.2	11.88	15.84
		.18	.24	.30	.36	.42	4.3	5.8	7.2	8.6	10.0	12.96	17.28
Gas Engine on Artificial Gas.	In cu.ft. per h.p. per hour.	Artificial Gas per 1,000 cu.ft. at				Artificial Gas per 1,000 cu.ft. at				Artificial Gas per 1,000 cu.ft. at			
	15	60c.	70c.	80c.	90c.	\$1.00	60c.	70c.	80c.	90c.	\$1.00	60c.	70c.
	17	c .90	c 1.05	c 1.20	c 1.35	c 1.50	c 21.6	c 25.2	c 28.8	c 32.4	c 36.0	\$64.80	\$75.60
Gasoline Engine.	In pints per h.p. per hour.	Gasoline per Gallon at				Gasoline per Gallon at				Gasoline per Gallon at			
	.80	10c.	12c.	14c.	16c.	18c.	10c.	12c.	14c.	16c.	18c.	10c.	12c.
	1.00	c 1.00	c 1.20	c 1.40	c 1.60	c 1.80	c 24.0	c 28.8	c 33.6	c 38.4	c 43.2	\$72.00	\$86.40
Electric Motor (85% efficiency of wiring) 746 w=h.p.	1.10	1.25	1.50	1.75	2.00	2.25	30.0	36.0	42.0	48.0	54.0	90.00	108.00
		1.37	1.65	1.92	2.20	2.47	33.0	39.6	46.2	52.8	59.4	99.00	118.80
Steam Engine on Coal.	In lbs. per h.p. per hour.	Coal per 2,000-lb. Ton at				Coal per 2,000-lb. Ton at				Coal per 2,000-lb. Ton at			
	4	\$3.00	\$4.00	\$5.00	\$6.00	\$7.00	\$3.00	\$4.00	\$5.00	\$6.00	\$7.00	\$3.00	\$4.00
	6	c .60	c .80	c 1.00	c 1.20	c 1.40	c 14.4	c 19.2	c 24.0	c 28.8	c 33.6	\$13.20	\$17.60
	8	.90	1.20	1.50	1.80	2.10	21.6	28.8	36.0	43.2	50.4	64.80	86.40
	10	1.20	1.60	2.00	2.40	2.80	28.8	38.4	48.0	57.6	67.2	86.40	115.20
		1.50	2.00	2.50	3.00	3.50	36.0	48.0	60.0	72.0	84.0	108.00	144.00

Index to Tables and Data appears on Pages 23 to 26.

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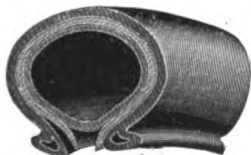
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PROPORTIONS OF ATMOSPHERIC AIR

- (1) To find the quantity of nitrogen by volume corresponding to one volume of oxygen, multiply by 3.77092.
- (2) To find the quantity of oxygen by volume corresponding to one volume of nitrogen, multiply by 0.265182.
- (3) To find the quantity of nitrogen by weight corresponding to one part by weight of oxygen, multiply by 3.313022.
- (4) To find the quantity of oxygen by weight corresponding to one part by weight of nitrogen, multiply by 0.301839.
- (5) To find the quantity of nitrogen by volume corresponding to one part by weight of oxygen, multiply by 2.6365411.
- (6) To find the quantity of oxygen by volume corresponding to one part by weight of nitrogen, multiply by 0.2730071.
- (7) To find the quantity of nitrogen by weight corresponding to one part by volume of oxygen, multiply by 3.6629154.
- (8) To find the quantity of oxygen by weight corresponding to one part by volume of nitrogen, multiply by 0.3792848.

Formula for correcting the volume of gases for temperature and pressure:

$$\frac{V}{V^1} = \frac{(273 + t)P^1}{273 + t^1P}$$

When,

- V = original volume;
 V^1 = corrected volume;
 t = original temperature in degrees Centigrade;
 t^1 = final temperature in degrees Centigrade;
 P = original pressure;
 P^1 = final pressure;
 273 = absolute temperature in degrees Centigrade.

Absolute temperature, if measured in Fahrenheit units, instead of in Centigrade as above given, would be 491.13 below the melting point of ice. The volume of a perfect gas increases $1/273$ of its volume at 0 degrees Centigrade for every increase of 1 degree on the same scale. According to this, absolute zero corresponds to the temperature at which the same perfect gas would reduce to nothing.

RELATION OF GASOLINE VAPOR TO AIR

In any discussion of the relation of gasoline to atmospheric air, it becomes necessary to carefully distinguish as between vaporized and liquid gasoline. With air at 60 degrees Fahrenheit, about 15 per cent. of true gasoline vapor will produce a state of saturation. Such a mixture would be non-explosive, and in practice the following holds:

Volumes of Gasoline Vapor in Per Cent. of Air Volumes	*Volumes of Atmospheric Air at 60° F. Corresponding	
15.0	.....	Saturation point of air at 60° F.
5.5	3,400	Too rich to serve for the purpose
4.0	4,000	Uncertain in its action.
....	5,000	.....
....	6,000	.....
....	7,000	.....
2.4	8,000	Suitable for the best results.
....	9,000	.....
1.9	10,000	Too uncertain to be of value.

* In the above table the volumes of air relate to one volume of liquid gasoline whereas the vapor volumes are in percentage of the air volumes used in each case. Absolutely accurate determinations will depend upon the mixture being of a definite character.

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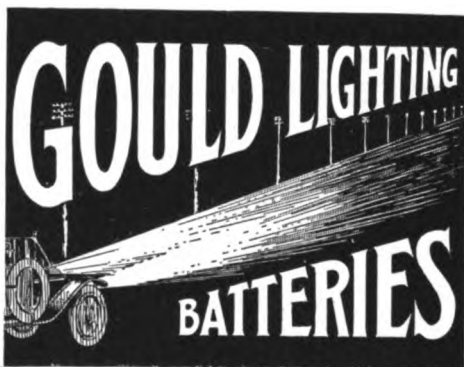
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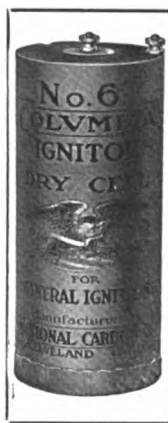
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Stationary Engine.

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PROPERTIES OF GASOLINE AND DENATURED ALCOHOL (MUNTZ)

Properties	Gasoline	Denatured Alcohol
Carbon.....	84.3 per cent.	41.5 per cent.
Hydrogen.....	15.7 per cent.	13.0 per cent.
Oxygen.....	.....	45.5 per cent.
Density at 15° C.....	.708	.834
Boiling point.....	88° C.	78.5° C.
Calories per Kg.....	*11,359.65	‡6,521.75
Weight evaporated per hour per dm. ² (15.5 sq. in.) of surface:		
1. In experiment room: 18° C.....	9.37 g. (0.33 oz.)	3.47 g. (0.12 oz.)
2. Outside in the sun; 25° C.....	47.21 g. (1.66 oz.)	27.08 g. (0.95 oz.)

* 20,488 British heat units per lb. ‡ 11,762 British heat units per lb.

TESTS WITH BRITISH MOTOR FUEL

GASOLINE AND BENZOL TESTS

Six-Cylinder Napier Engine

	Specific Gravity	Temperature of Testing Room Fahr.	Average of Three Tests, B.H.P.	Remarks
Ordinary gasoline687	67.1	64.25	Exhaust has a sulphurous, pungent smell. Engine started quite easily.
" " .....	.699	69.8	64.4
" " .....	.713	65.3	64.4
" " .....	.714	60.8	65.5
" " .....	.759	67.1	63.5
Benzol.....	.873	75.2	64.1	

PROPERTIES OF GASES

(1*)	(2*)	(3*)	(4*)	(5*)
Hydrogen.....	H	.0692	.00559	52230
Oxygen.....	O	1.106	.08921	.....
Nitrogen.....	N	.971	.07831	.....
Carbon Monoxide.....	CO	.967	.07807	4380
Carbon Dioxide.....	CO ₂	1.529	.12267	.....
Dry Air.....	.....	1.000	.08072	.....
Water Vapor.....	H ₂ O	.625	.05020	.....
Acetylene.....	C ₂ H ₂	.915	.07251	20673
Methane.....	CH ₄	.554	.04464	21385
Ethylene.....	C ₂ H ₄	.974	.07805	20025
Alcohol.....	C ₂ H ₅ O	1.601	.12598	12000

*1 Gases.

*2 Chemical Formula or Symbol.

*3 Density (Air=1).

*4 Weight per cubic foot under standard conditions.

*5 Heating values per pound in B. T. U.

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SPECIFIC HEAT OF HYDROCARBONS

In order to be able to estimate the losses in the exhaust of a motor it is necessary to know the specific heat of the elements and compounds determined by analysis of the exhaust, together with the range of temperatures, as well as the weight of the exhaust gases. The specific heat values are as follows:

Elements and Compounds	Specific Heat
Carbon.....	0.241
Carbon monoxide.....	0.2479
Oxygen.....	0.218
Hydrogen.....	0.244
Nitrogen..... (approximately)	0.240

Since over 80 per cent. of the whole weight of gas (mixture) will be nitrogen, it follows that much of the heat lost to the exhaust is taken away in the nitrogen. This fact, coupled with the absence of heat value, in nitrogen, tends to the contention that nitrogen is an evil without a recompense. In the absence of nitrogen, however, the fuel would be so quick-burning that the pistons would not be capable of receding rapidly enough to enable the functions to be performed, and it follows that some element has to be present, the nature of which will serve to dampen the rate of flame propagation. Nitrogen is at hand in the right proportion and the cost of its provision is therefore nil, since, as exemplified above, it has no heat value.

PROPERTIES OF SOME OF THE CONSTITUENTS OF GASOLINE

Name	Per Cent. of Carbon	Per Cent. of Hydrogen	Boiling Point—Fahr.	Specific Gravity	Vapor Density
Pentane.....	83.20	16.71	87	.640	2.538
Hexane.....	83.68	16.32	143	.676	3.053
Heptane.....	83.90	16.04	165	.718	3.547

PROPORTIONS OF HYDROGEN AND CARBON IN FUELS

Commercial Names of Fuels	Hydrogen by Weight	Carbon by Weight*
Gasoline.....	16	84
Benzine.....	8	92
Kerosene.....	15	85
Tar benzol.....	8	92
*Grain Alcohol.....	8	32

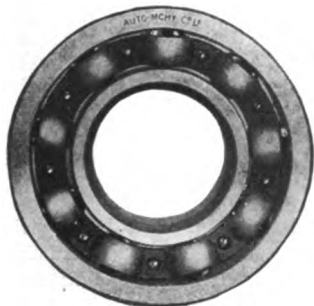
*Alcohol, in addition to carbon and hydrogen, holds 50 per cent. of oxygen.

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BANTAM, CONN.**

CAPACITY OF ATMOSPHERIC AIR FOR VAPOR AT DIFFERENT TEMPERATURES

Temperature in Degrees Fahrenheit	Pounds per Cubic Feet Dry Air	Pounds of Vapor in One Pound of Air	Weight in Pounds, Cubic Feet Saturated Air	Vapor in Air	A | V
32	0.0807	0.00379	0.0802	0.000304	263.7
42	0.0791	0.00561	0.0784	0.000440	178.18
52	0.0776	0.00819	0.0766	0.000627	122.
62	0.0761	0.01179	0.0747	0.000881	85.
72	0.0747	0.01680	0.0727	0.001221	59.5
82	0.0733	0.02361	0.0706	0.001667	42.3
92	0.0720	0.03289	0.0684	0.002250	30.3
102	0.0707	0.04547	0.0659	0.002997	22.

VISCOSITY OF GASOLINE

In considering the functioning of the gasoline carbureter, changes in viscosity of the fuel due to differences in temperature should be considered. It is a mistake to assume that because gasoline does not noticeably thicken up at the lower atmospheric temperatures (usual in the Northern States in winter) it will flow through the nozzle of a carbureter at the same rate under all heat conditions. Taking gasoline of a specific gravity of 0.71, it has been shown by experiment that the amount which will pass through a nozzle of a carbureter under a given pressure will increase as the temperature is increased in the following manner:

Temperature in ° F.....	50	59	68	77	86	95
Relative flow.....	1	1.073	1.145	1.212	1.27	1.335

Since nozzles in carbureters are not readily adjustable, and with any degree of certainty, it follows that such a great difference in the weight of fuel ejected, considering the differences in temperature named, is bound to lead to a certain amount of carbureter inefficiency of the kind which does not readily yield to treatment.

The following table gives the density and viscosity (expressed in C. G. S. units) of gasoline at different temperatures centigrade.

Density at 15 Degrees Centigrade	5 Degrees Centigrade	Viscosity at 15 Degrees Centigrade	25 Degrees Centigrade
0.680*.....	0.00376	0.00342	0.00319
0.684.....	0.00380	0.00352	0.00332
0.704.....	0.00406	0.00380	0.00359
0.707.....	0.00445	0.00420	0.00398
0.714.....	0.00431	0.00404	0.00385
0.719.....	0.00445	0.00420	0.00398
0.720.....	0.00450	0.00421	0.00400
0.721.....	0.00454	0.00421	0.00400
0.725.....	0.00486	0.00454	0.00430

*Hexane.

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CHEMICAL COMPOSITION AND PHYSICAL PROPERTIES OF VARIOUS SUBSTANCES THAT HAVE A HEAT VALUE

Fuel	Chemical Proportions	Weight of Gas at 30°, per Cubic Foot	Volume of 1 Pound of Gas at Atmospheric Pressure		Volume Required to Burn 1 Cubic Foot of Gas	Weight Required to Burn 1 Pound of Gas		Specific Heat of Gas at Constant Pressure	Heat of Combustion	
			Cubic Feet			Pounds	O		Air	B.T.U. per Pound of Fuel	R.T.U. per Cubic Foot of Gas at 62°
			32°	62°	O							Air
Oxygen, O ₂	23 lb. O + 77 lb. N = 100 lb. air.....	.08927	11.20	11.88	.....	.....	.....	.21751	.....	.....
Nitrogen, N ₂	21 vol. O + 79 vol. N = 100 vol. air.....	.07847	12.77	13.55	.....	.....	.....	.24380	.....	.....
Hydrogen, H ₂	2H + O = H ₂ O.....	.00562	178.80	189.80	.5	2.38	8.00	34.80	3.40900	62,000
Carbon, C.....	C + O = CO.....	.....	.....	.....	.....	.....	.....	.....	.....	4,400
Carbon, C.....	C + 2O = CO ₂.....	.....	.....	.....	.....	.....	.....	.....	.....	14,600
Carbon monoxide, CO.....	CO + O = CO ₂.....	.07704	12.77	13.55	.5	2.38	.57	2.48	.24790	.....
Carbon dioxide, CO ₂	1 lb. C + 2.66 lb. O = 3.66 lb. CO ₂.....	.12323	8.12	8.60	.....	.....	.....	.21700	4,385	.....
Methane (marsh gas), CH ₄	CH ₄ + 4O = 2H ₂ O + CO ₂.....	.04538	22.37	23.73	2.0	9.52	4.00	17.40	.59290	23,976
Ethylene (olefiant gas), C ₂ H ₄	C ₂ H ₄ + 6O = 2H ₂ O + 2CO ₂.....	.07830	12.77	13.55	3.0	14.28	3.43	14.90	.40400	21,476
Ethane, C ₂ H ₆	C ₂ H ₆ + 7O = 3H ₂ O + 2CO ₂.....	.08369	11.94	12.67	3.5	16.66	.....	.....	.....	22,356
Benzol vapors, C ₆ H ₆	C ₆ H ₆ + 15O = 3H ₂ O + 6CO ₂22363	4.47	4.74	7.5	35.737540	18,183
Acetylene, C ₂ H ₂	C ₂ H ₂ + 5O = H ₂ O + 2CO ₂07251	13.79	14.63	2.5	11.9	21,421

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MOLECULAR WEIGHT OF PETROLEUM DISTILLATES

The atomic weight of the elements entering into the fractions may be set down thus:

Hydrogen.....	1
Carbon.....	12
Oxygen.....	16

The molecular weight may be found as follows:

- (a) butane, $C_4H_{10} = 4 \times 12 + 10 \times 1 = 58$;
 (b) pentane, $C_5H_{12} = 5 \times 12 + 12 \times 1 = 72$;
 (c) hexane, $C_6H_{14} = 6 \times 12 + 14 \times 1 = 86$;
 (d) heptane, $C_7H_{16} = 7 \times 12 + 16 \times 1 = 100$;
 (e) octane, $C_8H_{18} = 8 \times 12 + 18 \times 1 = 114$;
 (f) nonane, $C_9H_{20} = 9 \times 12 + 20 \times 1 = 128$;
 (g) decane, $C_{10}H_{22} = 10 \times 12 + 22 \times 1 = 142$.

In like manner the molecular weight of any of the compounds may be found, the rule for which may be stated as follows:

Multiply the atomic weight of each element by the number of atoms for each element and the sum of the respective products will be the molecular weight of the resultant compound.

In general practice it has been the custom to consider that gasoline was largely hexane, the molecular weight of which was taken in the further determinations. It is highly improbable that this method will serve, for the reason that hexane is not now used to the same extent as formerly and the chances are that heptane and octane will have to be taken into account.

TABLE OF APPROXIMATE CAPACITIES IN LIQUID GALLONS

1	2	3	4	5	6	7	8	9	10	Gallons	Gal'ns per Inch
5x12	6x18 7x12	6x24	6x36	6x42						6" diam'r	.122
		7x18	7x24	7x30	7x36	7x42	7x48			7" "	.165
		8x15	8x18	8x24	8x30	8x36	8x42	8x45	8x48	8" "	.217
		9x12	9x15	9x18	9x24	9x30	9x34	9x36	9x40	9" "	.275
					10x20	10x24	10x26	10x28	10x32	10" "	.340
						12x16	12x18	12x20	12x24	12" "	.486

10	15	20	25	30	35	40	45	50	Gallons	Gal'ns per Inch
8x48 9x40 10x32 12x24 14x18	10x48 12x34 14x24 16x18	12x42 14x30 16x24	12x50 14x38 16x30	12x60 14x44 16x36	14x52 16x42	14x60 16x48	16x54	16x60	8" diam'r 9" " 10" " 12" " 14" " 16" "	.217 .275 .340 .486 .666 .870

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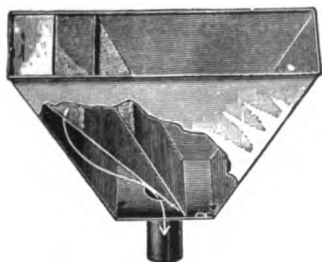
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In a horizontally disposed cylindrical tank the contents cannot be measured without the knowledge of certain geometrical relations existing between the height at which the liquid stands and the volume it occupies. These are given hereafter: 1st, In relation of volume to height; 2nd, In relation of height to volume.

V = total volume of tank;
 v = volume occupied by liquid;
 D = diameter of tank;
 h = height of liquid in tank.

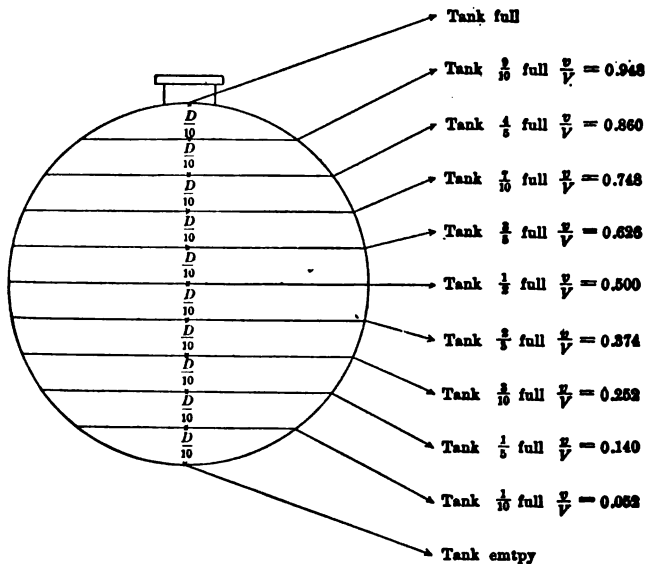


Fig. 1 -Tank divided into 10 parts of equal height. (Case in which measurement is taken with an ordinary foot rule.)

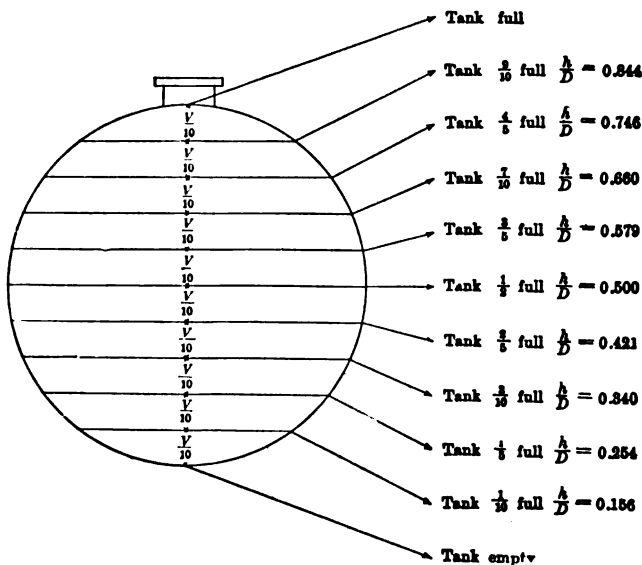


Fig. 2.—Tank divided in 10 parts of equal volume. (Case in which it is desired to make a gauge for a given tank.)

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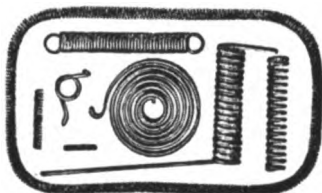
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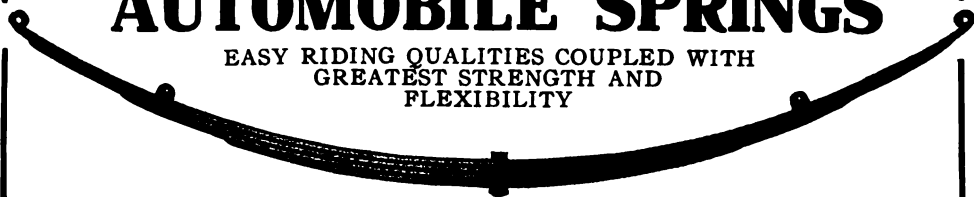


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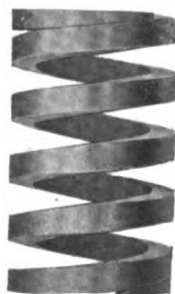
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TABLE FOR THE DIVISION OF THE CIRCUMFERENCE

Number of Divisions in the Circumference	Angle of Corresponding Division of Circle; Degrees	Length of Chord in Decimal Fraction of Radius	Number of Divisions in the Circumference	Angle of Corresponding Division of Circle; Degrees	Length of Chord in Decimal Fraction of Radius
3	120	1.73206	52	6.55	0.120356
4	90	1.41422	53	6.47	0.118032
5	72	1.17558	54	6.40	0.11629
6	60	1	55	6.32	0.113966
7	51.25	0.86732	56	6.25	0.111644
8	45	0.76536	57	6.18	0.1099
9	40	0.68404	58	6.12	0.108158
10	36	0.61804	59	6.06	0.106414
11	32.43	0.563	60	6	0.104672
12	30	0.51764	61	5.54	0.102928
13	27	0.4782	62	5.48	0.101186
14	25	0.4448	63	5.42	0.099442
15	24	0.41582	64	5.37	0.0977
16	22.30	0.39018	65	5.32	0.096538
17	21.10	0.36734	66	5.27	0.094794
18	20	0.3473	67	5.22	0.093632
19	18.56	0.32894	68	5.17	0.091888
20	18	0.31286	69	5.13	0.090765
21	17.08	0.29792	70	5.08	0.089564
22	16.21	0.2841	71	5.04	0.088402
23	15.39	0.272	72	5	0.087238
24	15	0.26106	73	4.55	0.085496
25	14.24	0.25066	74	4.51	0.084332
26	13.50	0.24086	75	4.48	0.083752
27	13.20	0.23218	76	4.44	0.083588
28	12.51	0.22352	77	4.40	0.081426
29	12.24	0.216	78	4.36	0.080264
30	12	0.20906	79	4.33	0.0791
31	11.36	0.20212	80	4.30	0.078518
32	11.15	0.19574	81	4.26	0.077356
33	10.54	0.18996	82	4.23	0.076194
34	10.35	0.18416	83	4.20	0.075612
35	10.17	0.17894	84	4.17	0.07445
36	10	0.17432	85	4.14	0.073868
37	9.43	0.1691	86	4.11	0.072706
38	9.28	0.16504	87	4.08	0.072124
39	9.13	0.1604	88	4.05	0.070962
40	9	0.15692	89	4.02	0.07038
41	8.46	0.15286	90	4	0.069798
42	8.34	0.14938	91	3.57	0.0686362
43	8.22	0.1459	92	3.54	0.0680546
44	8.10	0.14242	93	3.52	0.0674732
45	8	0.13952	94	3.49	0.0663104
46	7.49	0.13603	95	3.47	0.0657288
47	7.39	0.133128	96	3.45	0.0651474
48	7.30	0.130806	97	3.42	0.064566
49	7.20	0.127904	98	3.40	0.0639844
50	7.12	0.125582	99	3.38	0.63403
51	7.03	0.122678	100	3.36	0.0628216

This table should be useful for gear and chain wheel calculation and design

CIRCUMFERENCES AND AREAS OF CIRCLES

ADVANCING BY EIGHTHS

Diam.	Circum.	Area	Diam.	Circum.	Area	Diam.	Circum.	Area
$\frac{1}{64}$	.04909	.00019	2 $\frac{3}{8}$	7.4613	4.4301	6 $\frac{1}{8}$	19.242	29.465
$\frac{1}{32}$	.09818	.00077	$\frac{7}{16}$	7.6576	4.6664	$\frac{1}{4}$	19.635	30.680
$\frac{3}{64}$	.14726	.00173	$\frac{1}{2}$	7.8540	4.9087	$\frac{3}{8}$	20.028	31.919
$\frac{1}{16}$	.19635	.00307	$\frac{5}{8}$	8.0503	5.1572	$\frac{1}{2}$	20.420	33.183
$\frac{5}{64}$	.29452	.00690	$\frac{3}{4}$	8.2467	5.4119	$\frac{5}{8}$	20.813	34.472
$\frac{1}{8}$	.39270	.01227	$1\frac{1}{16}$	8.4430	5.6727	$\frac{3}{4}$	21.206	35.785
$\frac{3}{32}$	.49087	.01917	$\frac{3}{8}$	8.6394	5.9396	$\frac{7}{8}$	21.598	37.122
$\frac{1}{4}$	.58905	.02761	$1\frac{1}{8}$	8.8357	6.2126	7	21.991	38.485
$\frac{5}{32}$	.68722	.03758	$\frac{7}{8}$	9.0321	6.4918	$1\frac{1}{8}$	22.384	39.871
			$1\frac{1}{4}$	9.2284	6.7771	$1\frac{1}{4}$	22.776	41.282
$\frac{1}{4}$	.78540	.04909				$1\frac{3}{8}$	23.169	42.718
$\frac{3}{32}$	.88357	.06213	3	9.4284	7.0686	$1\frac{1}{2}$	23.562	44.179
$\frac{1}{16}$	.98175	.07670	$\frac{1}{4}$	9.6211	7.3662	$1\frac{5}{8}$	23.955	45.664
$1\frac{1}{32}$	1.0799	.09281	$\frac{1}{8}$	9.8175	7.6699	$1\frac{3}{4}$	24.347	47.173
$\frac{5}{8}$	1.1781	.11045	$\frac{3}{16}$	10.014	7.9798	$1\frac{7}{8}$	24.740	48.707
$1\frac{1}{8}$	1.2763	.12962	$\frac{1}{2}$	10.210	8.2958	8	25.133	50.265
$\frac{7}{16}$	1.3744	.15033	$\frac{5}{16}$	10.407	8.6179	$1\frac{1}{8}$	25.525	51.849
$1\frac{5}{32}$	1.4726	.17257	$\frac{3}{8}$	10.603	8.9462	$1\frac{1}{4}$	25.918	53.456
			$\frac{7}{16}$	10.799	9.2806	$1\frac{3}{8}$	26.311	55.088
$\frac{1}{2}$	1.5708	.19635	$\frac{1}{2}$	10.996	9.6211	$1\frac{1}{2}$	26.704	56.745
$1\frac{1}{8}$	1.6690	.22166	$\frac{5}{8}$	11.192	9.9678	$1\frac{5}{8}$	27.096	58.426
$\frac{3}{16}$	1.7671	.24850	$\frac{3}{4}$	11.388	10.321	$1\frac{3}{4}$	27.489	60.132
$1\frac{3}{32}$	1.8653	.27688	$1\frac{1}{16}$	11.585	10.680	$1\frac{7}{8}$	27.882	61.862
$\frac{5}{8}$	1.9635	.30680	$\frac{3}{8}$	11.781	11.045	9	28.274	63.617
$1\frac{1}{2}$	2.0617	.33824	$1\frac{1}{8}$	11.977	11.416	$1\frac{1}{8}$	28.667	65.397
$1\frac{1}{16}$	2.1598	.37122	$\frac{7}{8}$	12.174	11.793	$1\frac{1}{4}$	29.060	67.201
$1\frac{5}{8}$	2.2580	.40574	$1\frac{1}{4}$	12.370	12.177	$1\frac{3}{8}$	29.452	69.029
			4	12.566	12.566	$1\frac{1}{2}$	29.845	70.882
$\frac{3}{4}$	2.3562	.44179	$\frac{1}{4}$	12.763	12.962	$1\frac{5}{8}$	30.238	72.760
$1\frac{3}{8}$	2.4544	.47937	$\frac{1}{8}$	12.959	13.364	$1\frac{3}{4}$	30.631	74.662
$1\frac{1}{16}$	2.5525	.51849	$\frac{3}{16}$	13.155	13.772	$1\frac{7}{8}$	31.023	76.589
$1\frac{3}{32}$	2.6507	.55914	$\frac{1}{2}$	13.352	14.186	10	31.416	78.540
$\frac{7}{8}$	2.7489	.60132	$\frac{5}{16}$	13.548	14.607	$1\frac{1}{8}$	31.809	80.516
$1\frac{1}{2}$	2.8471	.64504	$\frac{3}{8}$	13.744	15.033	$1\frac{1}{4}$	32.201	82.516
$1\frac{5}{16}$	2.9452	.69029	$\frac{7}{16}$	13.941	15.466	$1\frac{3}{8}$	32.594	84.541
$1\frac{3}{8}$	3.0434	.73708	$\frac{1}{2}$	14.137	15.904	$1\frac{1}{2}$	32.987	86.590
			$\frac{5}{8}$	14.334	16.349	$1\frac{5}{8}$	33.379	88.664
1	3.1416	.7854	$\frac{3}{4}$	14.530	16.800	$1\frac{3}{4}$	33.772	90.763
$\frac{1}{4}$	3.3379	.8866	$1\frac{1}{16}$	14.726	17.257	$1\frac{7}{8}$	34.165	92.886
$\frac{1}{8}$	3.5343	.9940	$\frac{3}{16}$	14.923	17.728	11	34.558	95.033
$\frac{3}{16}$	3.7306	1.1075	$1\frac{1}{8}$	15.119	18.190	$1\frac{1}{8}$	34.950	97.205
$\frac{1}{4}$	3.9270	1.2272	$\frac{7}{8}$	15.315	18.665	$1\frac{1}{4}$	35.343	99.402
$\frac{5}{16}$	4.1233	1.3530	$1\frac{1}{4}$	15.512	19.147	$1\frac{3}{8}$	35.736	101.62
$\frac{3}{8}$	4.3197	1.4849	5	15.708	19.635	$1\frac{1}{2}$	36.128	103.87
$\frac{7}{16}$	4.5160	1.6230	$\frac{1}{4}$	15.901	20.129	$1\frac{5}{8}$	36.521	106.14
$\frac{1}{2}$	4.7124	1.7671	$\frac{1}{8}$	16.101	20.629	$1\frac{3}{4}$	36.914	108.43
$\frac{5}{8}$	4.9087	1.9175	$\frac{3}{16}$	16.297	21.135	$1\frac{7}{8}$	37.306	110.75
$\frac{3}{4}$	5.1051	2.0739	$\frac{1}{2}$	16.493	21.648	12	37.699	113.10
$1\frac{1}{16}$	5.3014	2.2365	$\frac{5}{16}$	16.690	22.166	$1\frac{1}{8}$	38.092	115.47
$\frac{3}{8}$	5.4978	2.4053	$\frac{3}{8}$	16.886	22.691	$1\frac{1}{4}$	38.485	117.86
$1\frac{1}{8}$	5.6941	2.5802	$\frac{7}{16}$	17.082	23.221	$1\frac{3}{8}$	38.877	120.28
$\frac{1}{2}$	5.8905	2.7612	$\frac{1}{2}$	17.279	23.758	$1\frac{1}{2}$	39.270	122.72
$1\frac{5}{16}$	6.0868	2.9483	$\frac{5}{8}$	17.475	24.301	$1\frac{5}{8}$	39.663	125.19
			$\frac{3}{4}$	17.671	24.850	$1\frac{3}{4}$	40.055	127.68
2	6.2832	3.1416	$1\frac{1}{8}$	17.868	25.406	$1\frac{7}{8}$	40.448	130.19
$\frac{1}{4}$	6.4795	3.3410	$\frac{3}{8}$	18.064	25.967	13	40.841	132.73
$\frac{1}{8}$	6.6759	3.5466	$1\frac{1}{4}$	18.261	26.535	$1\frac{1}{8}$	41.233	135.30
$\frac{3}{16}$	6.8722	3.7583	$\frac{1}{2}$	18.457	27.109	$1\frac{1}{4}$	41.626	137.89
$\frac{1}{4}$	7.0686	3.9761	$1\frac{1}{8}$	18.653	27.688	$1\frac{3}{8}$	42.019	140.50
$\frac{5}{16}$	7.2649	4.2000	6	18.850	28.274	$1\frac{1}{2}$	42.412	143.14

AREAS OF SMALL CIRCLES

Diameter	AREAS									
	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09
.0	.0	.000078	.00031	.0007	.00125	.00196	.00283	.00385	.00503	.00636
.1	.0078	.0095	.0113	.0133	.0154	.0177	.0201	.0227	.0255	.0283
.2	.0314	.03464	.038	.0415	.0452	.0491	.0531	.0572	.0616	.066
.3	.0706	.0755	.0804	.0855	.0908	.0962	.1018	.1075	.1134	.1195
.4	.1256	.132	.1385	.1452	.1520	.1590	.1662	.1735	.181	.1886
.5	.1963	.2043	.2124	.2206	.2290	.2376	.2463	.2552	.2642	.2734
.6	.2827	.2922	.3014	.3117	.3217	.3318	.3421	.3526	.3632	.3739
.7	.3848	.3959	.4071	.4185	.4301	.4418	.4536	.4657	.4778	.4902
.8	.5026	.5153	.5281	.5411	.5542	.5674	.5809	.5945	.6082	.6221
.9	.6362	.6504	.6648	.6793	.694	.7088	.7238	.739	.7543	.7698

DECIMAL EQUIVALENTS OF FRACTIONS OF AN INCH

1/64 = .0156	17/64 = .2656	33/64 = .5156	49/64 = .7656
1/32 = .0312	9/32 = .2812	17/32 = .5312	25/32 = .7812
3/64 = .0468	19/64 = .2968	35/64 = .5468	51/64 = .7968
1/16 = .0625	5/16 = .3125	9/16 = .5625	13/16 = .8125
5/64 = .0781	21/64 = .3281	37/64 = .5781	53/64 = .8281
3/32 = .0937	11/32 = .3437	19/32 = .5937	27/32 = .8437
7/64 = .1093	23/64 = .3593	39/64 = .6093	55/64 = .8593
1/8 = .1250	3/8 = .3750	5/8 = .6250	7/8 = .8750
9/64 = .1406	25/64 = .3906	41/64 = .6406	57/64 = .8906
5/32 = .1562	13/32 = .4062	21/32 = .6562	29/32 = .9062
11/64 = .1718	27/64 = .4218	43/64 = .6718	59/64 = .9218
3/16 = .1875	7/16 = .4375	11/16 = .6875	15/16 = .9375
13/64 = .2031	29/64 = .4531	45/64 = .7031	61/64 = .9531
7/32 = .2187	15/32 = .4687	23/32 = .7187	31/32 = .9687
15/64 = .2343	31/64 = .4843	47/64 = .7343	63/64 = .9843
1/4 = .2500	1/2 = .5000	3/4 = .7500	1 = 1.0000

THERMOMETER SCALES

There are two thermometer scales in general use in the United States: Fahrenheit and Centigrade. In the Fahrenheit thermometer the temperature of melting ice is taken at 32 degrees and boiling point at 212 degrees; thus there are 180 degrees between the two extremes. In the Centigrade thermometer the distance between these two points on the scale is divided into exactly 100 degrees. In order to convert degrees Fahrenheit into degrees Centigrade: Subtract 32, multiply the remainder by 5, and divide by 9. Thus, convert 158 degrees Fahrenheit to degrees Centigrade:

$$\text{Then } (158 - 32) \times \frac{5}{9} = 70^{\circ} \text{ Cent.}$$

Or to convert degrees Centigrade into degrees Fahrenheit: Multiply by 9, divide by 5 and add 32. Thus, convert 70 degrees Centigrade into degrees Fahrenheit:

$$\text{Then } (70 \times \frac{9}{5}) + 32 = 158^{\circ} \text{ Fahr.}$$

Following is a table giving the equivalent degrees of the Fahrenheit and Centigrade scales, from 1 to 100 Centigrade:

Cent.	Fahr.	Cent.	Fahr.	Cent.	Fahr.
0	*32.0	35	95.0	70	158.0
1	33.8	36	96.8	71	159.8
2	35.6	37	98.6	72	161.6
3	37.4	38	100.4	73	163.4
4	39.2	39	102.2	74	165.2
5	41.0	40	104.0	75	167.0
6	42.8	41	105.8	76	168.8
7	44.6	42	107.6	77	170.6
8	46.4	43	109.4	78	172.4
9	48.2	44	111.2	79	174.2
10	50.0	45	113.0	80	176.0
11	51.8	46	114.8	81	177.8
12	53.6	47	116.6	82	179.6
13	55.4	48	118.4	83	181.4
14	57.2	49	120.2	84	183.2
15	59.0	50	122.0	85	185.0
16	60.8	51	123.8	86	186.8
17	62.6	52	125.6	87	188.6
18	64.4	53	127.4	88	190.4
19	66.2	54	129.2	89	192.2
20	68.0	55	131.0	90	194.0
21	69.8	56	132.8	91	195.8
22	71.6	57	134.6	92	197.6
23	73.4	58	136.4	93	199.4
24	75.2	59	138.2	94	201.2
25	77.0	60	140.0	95	203.0
26	78.8	61	141.8	96	204.8
27	80.6	62	143.6	97	206.6
28	82.4	63	145.4	98	208.4
29	84.2	64	147.2	99	210.2
30	86.0	65	149.0	100	†212.0
31	87.8	66	150.8	..	.....
32	89.6	67	152.6	..	.....
33	91.4	68	154.4	..	.....
34	93.2	69	156.2	..	.....

* Freezing point.

† Boiling point.

It will be noticed that for each degree Centigrade the Fahrenheit scale rises 1.8 degrees, so that if we multiply the degrees Centigrade by 1.8 and add 32 we will get the equivalent number of degrees Fahrenheit. In the Fahrenheit thermometer the freezing and boiling points of water are taken at the mean atmospheric pressure at the sea level, 14.7 pounds to the square inch.

FORMULAS FOR CONVERSION OF THERMOMETER SCALES

To convert degrees, Centigrade or Réaumur, into degrees Fahrenheit:

Let F = No. of degrees Fahrenheit.

C = " " " Centigrade.

R = " " " Réaumur.

$$F = \frac{9C}{5} + 32;$$

$$F = \frac{9R}{4} + 32;$$

$$C = \frac{5(F - 32)}{9}$$

$$R = \frac{4(F - 32)}{9}$$

Freezing point, or 32° Fah. = zero in Cent. or Réaumur.

Boiling point, or 212° Fah. = 100° Cent., or 80° Réaumur.

BAUME HYDROMETER AND SPECIFIC GRAVITY EQUIVALENTS (AMERICAN STANDARD)

For liquids heavier than water,

$$\text{Sp. Gr.} = \frac{145}{145 - ^\circ\text{Bé}} \text{ at } 60^\circ \text{ F.}$$

Baumé	Specific Gravity	Baumé	Specific Gravity	Baumé	Specific Gravity
0.0	1.000	17.5	1.137	35.0	1.318
0.5	1.003	18.0	1.141	36.0	1.330
1.0	1.006	18.5	1.146	37.0	1.342
1.5	1.010	19.0	1.150	38.0	1.355
2.0	1.014	19.5	1.155	39.0	1.367
2.5	1.017	20.0	1.160	40.0	1.381
3.0	1.021	20.5	1.164	45.0	1.450
3.5	1.024	21.0	1.169	50.0	1.526
4.0	1.028	21.5	1.174	55.0	1.611
4.5	1.032	22.0	1.178	60.0	1.705
5.0	1.035	22.5	1.183	65.0	1.812
5.5	1.039	23.0	1.188	70.0	1.933
6.0	1.043	23.5	1.193	....	....
6.5	1.046	24.0	1.198	....	....
7.0	1.050	24.5	1.203	....	....
7.5	1.054	25.0	1.208	....	....
8.0	1.058	25.5	1.213	....	....
8.5	1.062	26.0	1.218	....	....
9.0	1.066	26.5	1.223	....	....
9.5	1.070	27.0	1.228	....	....
10.0	1.074	27.5	1.234	....	....
10.5	1.078	28.0	1.239	....	....
11.0	1.082	28.5	1.244	....	....
11.5	1.086	29.0	1.250	....	....
12.0	1.090	29.5	1.255	....	....
12.5	1.094	30.0	1.260	....	....
13.0	1.098	30.5	1.266	....	....
13.5	1.102	31.0	1.271	....	....
14.0	1.106	31.5	1.277	....	....
14.5	1.111	32.0	1.283	....	....
15.0	1.115	32.5	1.288	....	....
15.5	1.119	33.0	1.294	....	....
16.0	1.124	33.5	1.300	....	....
16.5	1.128	34.0	1.306	....	....
17.0	1.132	34.5	1.312	....	....

BOILING POINT OF WATER AT VARIOUS ALTITUDES

Altitude Above Sea Level in Feet	Boiling Point of Water in Degrees Fahrenheit
1,025	212
2,063	210
3,115	208
4,169	206
5,225	204
6,304	202
7,381	200
8,431	198
9,579	196
10,685	194
	192

It is considered good practice to maintain the temperature of the water in an automobile motor cooling system at about 202 degrees Fahrenheit, under normal operating conditions. This allows a working margin, under boiling point, for adverse conditions, such as climbing a long grade, car standing with motor running idle, or running with a retarded spark. Such a system would steam when a car running under normal conditions attained an altitude of about one mile. In cases where steaming occurs under normal conditions, at sea level, mountain climbing is practically impossible or necessitates very frequent stops for water to make up for evaporation.

DECIMAL FRACTIONS OF A LINEAL INCH IN MILLIMETRES

Inch	Milli- metres	Inch	Milli- metres	Inch	Milli- metres	Inches	Milli- metres
.01	.254	.29	7.366	.57	14.478	.85	21.590
.02	.508	.30	7.620	.58	14.732	.86	21.844
.03	.762	.31	7.874	.59	14.986	.87	22.098
.04	1.016	.32	8.128	.60	15.240	.88	22.352
.05	1.270	.33	8.382	.61	15.494	.89	22.606
.06	1.254	.34	8.636	.62	15.748	.90	22.860
.07	1.778	.35	8.890	.63	16.002	.91	23.114
.08	2.032	.36	9.114	.64	16.256	.92	23.368
.09	2.286	.37	9.398	.65	16.510	.93	23.622
.10	2.540	.38	9.652	.66	16.764	.94	23.876
.11	2.794	.39	9.906	.67	17.018	.95	24.130
.12	3.048	.40	10.160	.68	17.272	.96	24.384
.13	3.302	.41	10.414	.69	17.526	.97	24.638
.14	3.556	.42	10.668	.70	17.780	.98	24.892
.15	3.810	.43	10.922	.71	18.034	.99	25.146
.16	4.064	.44	11.176	.72	18.288	1.00	25.400
.17	4.318	.45	11.430	.73	18.542	2.00	50.799
.18	4.572	.46	11.684	.74	18.796	3.00	76.199
.19	4.826	.47	11.938	.75	19.050	4.00	101.598
.20	5.080	.48	12.192	.76	19.304	5.00	126.998
.21	5.334	.49	12.446	.77	19.558	6.00	152.397
.22	5.588	.50	12.700	.78	19.812	7.00	177.797
.23	5.842	.51	12.945	.79	20.066	8.00	203.196
.24	6.096	.52	13.208	.80	20.320	9.00	228.596
.25	6.350	.53	13.462	.81	20.574	10.00	253.995
.26	6.604	.54	13.716	.82	20.828	11.00	279.395
.27	6.858	.55	13.970	.83	21.082	12.00	304.794
.28	7.112	.56	14.224	.84	21.336	=1 foot	

UNITED STATES OFFICIAL MILLIMETERS CONVERSION TABLE

Millimeters	Equivalent in Inches	Millimeters	Equivalent in Inches
1	0.03,937	51	2.00,787
2	0.07,874	52	2.04,724
3	0.11,811	53	2.08,661
4	0.15,748	54	2.12,598
5	0.19,685	55	2.16,535
6	0.23,622	56	2.20,472
7	0.27,559	57	2.24,409
8	0.31,496	58	2.28,346
9	0.35,433	59	2.32,283
10	0.39,370	60	2.36,220
11	0.43,307	61	2.40,157
12	0.47,244	62	2.44,094
13	0.51,181	63	2.48,031
14	0.55,118	64	2.51,968
15	0.59,055	65	2.55,905
16	0.62,992	66	2.59,842
17	0.66,929	67	2.63,779
18	0.70,866	68	2.67,716
19	0.74,803	69	2.71,653
20	0.78,740	70	2.75,590
21	0.82,677	71	2.79,527
22	0.86,614	72	2.83,464
23	0.90,551	73	2.87,401
24	0.94,488	74	2.91,338
25	0.98,425	75	2.95,275
26	1.02,362	76	2.99,212
27	1.06,299	77	3.03,149
28	1.10,236	78	3.07,086
29	1.14,173	79	3.11,023
30	1.18,110	80	3.14,960
31	1.22,047	81	3.18,897
32	1.25,984	82	3.22,834
33	1.29,921	83	3.26,771
34	1.33,858	84	3.30,708
35	1.37,795	85	3.34,645
36	1.41,732	86	3.38,582
37	1.45,669	87	3.42,519
38	1.49,606	88	3.46,456
39	1.53,543	89	3.50,393
40	1.57,480	90	3.54,330
41	1.61,417	91	3.58,267
42	1.65,354	92	3.62,204
43	1.69,291	93	3.66,141
44	1.73,228	94	3.70,078
45	1.77,165	95	3.74,015
46	1.81,102	96	3.77,952
47	1.85,039	97	3.81,889
48	1.88,976	98	3.85,826
49	1.92,913	99	3.89,763
50	1.96,850	100	3.93,700

POUNDS PER SQUARE INCH IN KILOGRAMMES PER SQUARE CENTIMETRE

Lbs. per Square Inch	Kilo- grammes per Square Centimetre	Lbs. per Square Inch	Kilo- grammes per Square Centimetre	Lbs. per Square Inch	Kilo- grammes per Square Centimetre	Lbs. per Square Inch	Kilo- grammes per Square Centimetre
1	.0703	41	2.8826	81	5.6949	205	14.4129
2	.1406	42	2.9529	82	5.7652	210	14.7645
3	.2109	43	3.0232	83	5.8355	215	15.1160
4	.2812	44	3.0935	84	5.9058	220	15.4675
5	.3515	45	3.1638	85	5.9761	225	15.8191
6	.4218	46	3.2341	86	6.0464	230	16.1706
7	.4921	47	3.3044	87	6.1167	235	16.5221
8	.5624	48	3.3747	88	6.1870	240	16.8737
9	.6328	49	3.4450	89	6.2573	245	17.2252
10	.7031	50	3.5153	90	6.3276	250	17.5767
11	.7734	51	3.5856	91	6.3979	255	17.9283
12	.8437	52	3.6559	92	6.4682	260	18.2798
13	.9140	53	3.7263	93	6.5385	265	18.6313
14	.9843	54	3.7966	94	6.6088	270	18.9829
15	1.0546	55	3.8669	95	6.6722	275	19.3344
16	1.1249	56	3.9372	96	6.7495	280	19.6860
17	1.1952	57	4.0075	97	6.8198	285	20.0375
18	1.2655	58	4.0778	98	6.8901	290	20.3890
19	1.3358	59	4.1481	99	6.9604	295	20.7406
20	1.4062	60	4.2184	100	7.0307	300	21.0921
21	1.4764	61	4.2887	105	7.3822	310	21.7951
22	1.5467	62	4.3590	110	7.7338	320	22.4981
23	1.6171	63	4.4293	115	8.0853	330	23.2012
24	1.6874	64	4.4996	120	8.4368	340	23.9043
25	1.7577	65	4.5699	125	8.7884	350	24.6073
26	1.8280	66	4.6402	130	9.1399	360	25.3104
27	1.8983	67	4.7106	135	9.4914	370	26.0135
28	1.9686	68	4.7809	140	9.8430	380	26.7166
29	2.0389	69	4.8512	145	10.1945	390	27.4196
30	2.1092	70	4.9215	150	10.5460	400	28.1227
31	2.1795	71	4.9918	155	10.8976	410	28.8258
32	2.2498	72	5.0621	160	11.2491	420	29.5288
33	2.3201	73	5.1324	165	11.6006	430	30.2319
34	2.3905	74	5.2027	170	11.9522	440	30.9350
35	2.4607	75	5.2730	175	12.3037	450	31.6380
36	2.5310	76	5.3433	180	12.6553	460	32.3411
37	2.6013	77	5.4136	185	13.0068	470	33.0442
38	2.6717	78	5.4939	190	13.3583	480	33.7473
39	2.7420	79	5.5542	195	13.7099	490	34.4503
40	2.8123	80	5.6246	200	14.0614	500	35.1533

A CONVENIENT METRIC CONVERSION (Compiled by C. W. HUNT)

Millimeters $\times .03937$ = inches.
 Millimeters $\div 25.4$ = inches.
 Centimeters $\times .3937$ = inches.
 Centimeters $\div 2.54$ = inches.
 Meters = 39.37 inches. (Act of Congress.)
 Meters $\times 3.281$ = feet.
 Meters $\times 1.094$ = yards.
 Meter per second = 196.86 feet per minute.
 Kilometers $\times .621$ = miles.
 Kilometers $\times 3280.7$ = feet.
 Square Millimeters $\times .00155$ = square inches.
 Square Millimeters $\div 645.1$ = square inches.
 Square Centimeters $\times .155$ = square inches.
 Square Centimeters $\div 6.451$ = square inches.
 Square Meters $\times 10.764$ = square feet.
 Square Kilometers $\times 247.1$ = acres.
 Hectares $\times 2.471$ = acres.
 Cubic Centimeters $\div 16.383$ = cubic inches.
 Cubic Meters $\times 35.315$ = cubic feet.
 Cubic Meters $\times 1.308$ = cubic yards.
 Cubic Meters $\times 264.2$ = gallons (231 cubic inches).
 Liters $\times 61.022$ = cubic inches. (Act of Congress.)
 Liters $\times .2642$ = gallons (231 cubic inches).
 Liters $\div 3.78$ = gallons (231 cubic inches).
 Liters $\div 28.316$ = cubic feet.
 Grammes $\times 15.432$ = grains. (Act of Congress.)
 Grammes (water) $\div 29.57$ = fluid ounces.
 Grammes $\div 28.35$ = ounces avoirdupois.
 Grammes per cubic cent. $\div 27.7$ = pounds per cubic inch.
 Joule $\times .7373$ = foot pounds.
 Kilograms $\times 2.2046$ = pounds.
 Kilograms $\times 35.3$ = ounces avoirdupois.
 Kilograms $\div 1102.3$ = tons (2,000 pounds).
 Kilograms per square millimeters $\times 1422.3$ = pounds per square inch
 Kilograms per square cent. $\times 14.223$ = pounds per square inch.
 Kilo-watts $\times 1.34$ = horse-power.
 Watts $\div 746$ = horse-power.
 Caloric $\times 3.968$ = B. T. U.
 Cheval vapeur $\times .9863$ = horse-power.
 (Centigrade $\times 1.8$) $\div 32$ = degrees Fahrenheit.
 Francs $\times .193$ = dollars.

FRENCH AND AMERICAN EQUIVALENT MEASURES

MEASURES OF LENGTH

<i>French</i>	<i>United States</i>
1 meter.....	39.37 inches, or 3.28083 feet
.3048 meter.....	1 foot
1 centimeter.....	.3937 inch
2.54 centimeters.....	1 inch.
1 millimeter.....	.03937 inch, or $\frac{1}{25}$ inch nearly
25.4 millimeters.....	1 inch
1 kilometer.....	1093.61 yards, or .62137 mile

MEASURES OF WEIGHT

1 gramme.....	15.432 grains
.0648 gramme.....	1 grain
28.35 grammes.....	1 ounce avoirdupois
1 kilogramme.....	2.2046 pounds
.4536 kilogramme.....	1 pound
1 tonne or metric ton.....	{ .9842 ton of 2,240 pounds 19.68 cwt.
1000 kilogrammes.....	
	2204.6 pounds

MEASURES OF CAPACITY

Liter (1 cubic decimeter).....	{ 61.023 cubic inches .03531 cubic foot 2.642 gallon (American)
8.317 liters.....	
4.543 liters.....	1 cubic foot
3.785 liters.....	1 gallon (British)
	1 gallon (American)

TABLE OF KILOGRAMME CALORIES, EQUIVALENT TO BRITISH THERMAL UNITS

Brit. Th'm'l	0	1	2	3	4	5	6	7	8	9	Brit. Th'm'l
0	.....	.252	.504	.756	1.008	1.260	1.512	1.764	2.016	2.268	0
10	2.52	2.772	3.024	3.276	3.528	3.780	4.032	4.284	4.536	4.788	10
20	5.04	5.292	5.544	5.796	6.048	6.300	6.552	6.804	7.056	7.308	20
30	7.56	7.812	8.064	8.316	8.568	8.820	9.072	9.324	9.576	9.828	30
40	10.08	10.332	10.584	10.836	11.088	11.340	11.592	11.844	12.096	12.348	40
50	12.60	12.852	13.104	13.356	13.608	13.860	14.112	14.364	14.616	14.868	50
60	15.12	15.372	15.624	15.876	16.128	16.380	16.632	16.884	17.136	17.388	60
70	17.64	17.892	18.144	18.396	18.648	18.900	19.152	19.404	19.656	19.908	70
80	20.16	20.412	20.664	20.916	21.168	21.420	21.672	21.924	22.176	22.428	80
90	22.68	22.932	23.184	23.436	23.688	23.940	24.192	24.444	24.696	24.948	90
Brit. Th'm'l	0	1	2	3	4	5	6	7	8	9	Brit. Th'm'l

1 British thermal unit = 251.996 therms, or gramme calories.

LIST OF NINE DIFFERENT STANDARD GAUGES USED IN THE UNITED STATES

DECIMAL EQUIVALENTS (Inches)

No. of Gauge	American or Brown & Sharpe Iron Wire	Birmingham or Stubbs Iron Wire	Washburn & Moen Iron Wire	Imperial Wire Gauge	U. S. Standard for Plate (Iron & Steel)	Stubbs Steel Wire	Twist Drill and Steel Wire	Washburn & Moen Music Wire	Wood and Machine Screws	No. of Gauge	Fractional Parts of an Inch	Decimal Equiv. of Sixty-fourths, etc.
8-0	.....	.....	.....	.....	.....	.....	This gauge from one to three thousandths and three larger than same Nos. of Stubbs steel wire gauge	.0083	.....	8-0	$\frac{1}{64}$	.01563
7-0	.....	.....	.....	.....	.500	.....		.0087	.....	7-0	$\frac{1}{32}$	.03125
6-0	.....	.....	.....	.464	.469	.....		.0095	.....	6-0	$\frac{1}{16}$	.0625
5-0	.....	.....	.....	.432	.438	.....		.010	.....	5-0	$\frac{3}{64}$	.07813
4-0	.460	.454	.394	.400	.406	.....		.011	.....	4-0	$\frac{1}{8}$	.09375
3-0	.410	.425	.363	.372	.375	.....		.012	.032	3-0	$\frac{3}{32}$	.10938
2-0	.365	.380	.331	.348	.344	.....	.....	.013	.045	2-0	$\frac{1}{4}$	.125
0	.325	.340	.307	.334	.313	.....		.014	.058	0	$\frac{1}{2}$	.14063
1	.289	.300	.283	.300	.281	.277		.016	.071	1	$\frac{5}{32}$	.15625
2	.258	.284	.263	.276	.266	.219		.017	.084	2	$\frac{3}{16}$	.17188
3	.229	.259	.244	.252	.250	.212		.018	.097	3	$\frac{1}{8}$	.1875
4	.204	.238	.225	.232	.234	.207		.019	.110	4	$\frac{5}{64}$	.20313
5	.182	.220	.207	.212	.219	.204	.206	.020	.124	5	$\frac{3}{32}$	.21875
6	.162	.203	.192	.192	.203	.201	.204	.022	.137	6	$\frac{1}{8}$	.23438
7	.144	.180	.177	.176	.188	.199	.201	.023	.150	7	$\frac{1}{4}$	.25
8	.128	.165	.162	.160	.172	.197	.199	.024	.163	8	$\frac{3}{16}$	.26563
9	.114	.148	.148	.144	.156	.194	.196	.026	.176	9	$\frac{1}{4}$	.28125
10	.102	.134	.135	.128	.141	.191	.194	.027	.189	10	$\frac{1}{8}$	.29688
11	.091	.120	.121	.116	.125	.188	.191	.028	.203	11	$\frac{5}{64}$	.3125
12	.081	.109	.106	.104	.109	.185	.189	.030	.216	12	$\frac{3}{32}$	.32813
13	.072	.095	.092	.092	.094	.182	.185	.031	.229	13	$\frac{1}{8}$	.34375
14	.064	.083	.080	.080	.078	.180	.182	.033	.242	14	$\frac{3}{64}$	.35938
15	.057	.072	.072	.072	.070	.178	.180	.035	.255	15	$\frac{1}{4}$	.375
16	.051	.065	.063	.064	.063	.175	.177	.036	.268	16	$\frac{5}{64}$	.39063
17	.045	.058	.054	.056	.056	.172	.173	.038	.282	17	$\frac{3}{32}$	.40625
18	.040	.049	.048	.048	.050	.168	.170	.040	.295	18	$\frac{1}{8}$	.42188
19	.036	.042	.041	.040	.044	.164	.166	.041	.308	19	$\frac{5}{64}$	.4375
20	.032	.035	.035	.036	.038	.161	.161	.043	.321	20	$\frac{3}{32}$	.45313
21	.028	.032	.032	.032	.034	.157	.159	.046	.334	21	$\frac{1}{4}$	.46875
22	.025	.028	.029	.028	.031	.155	.157	.048	.347	22	$\frac{5}{64}$	.48438
23	.023	.025	.026	.024	.028	.153	.154	.051	.360	23	$\frac{1}{2}$	.5
24	.020	.022	.023	.022	.025	.151	.152	.055	.374	24	$\frac{3}{16}$	.51563
25	.018	.020	.020	.020	.022	.148	.150	.059	.387	25	$\frac{1}{4}$	.53125
26	.016	.018	.018	.018	.019	.146	.147	.063	.400	26	$\frac{5}{64}$	.54688
27	.0141	.016	.0173	.0164	.0171	.143	.144	.066	.413	27	$\frac{1}{8}$	.5625
28	.0126	.014	.0162	.0149	.0156	.139	.141	.072	.426	28	$\frac{3}{32}$	.57813
29	.0112	.013	.015	.0136	.014	.134	.136	.076	.439	29	$\frac{1}{4}$	.59375
30	.010	.012	.014	.0124	.0125	.127	.129	.080	.453	30	$\frac{5}{64}$	.60938
31	.0089	.010	.0132	.0116	.0109	.120	.120	.....	.466	31	$\frac{1}{2}$	.625
32	.0079	.009	.0128	.0108	.0101	.115	.116	.....	.479	32	$\frac{3}{16}$	.64063
33	.007	.008	.0118	.010	.0093	.112	.113	.....	.492	33	$\frac{1}{4}$	.65625
34	.0063	.007	.0104	.0092	.0085	.110	.111	.....	.505	34	$\frac{5}{64}$	.67188
35	.0056	.005	.0095	.0084	.0078	.108	.110	.....	.518	35	$\frac{1}{8}$	.6875
36	.005	.004	.009	.0076	.007	.106	.1065	.....	.532	36	$\frac{3}{32}$	.70313
37	.0044	.....	.....	.0068	.0066	.103	.104	.....	.545	37	$\frac{1}{4}$	.71875
38	.0039	.....	.....	.006	.0062	.101	.1015	.....	.558	38	$\frac{5}{64}$	.73438
39	.0035	.....	.....	.0052	.....	.099	.0995	.....	.571	39	$\frac{1}{2}$	.75
40	.0031	.....	.....	.0048	.....	.097	.098	.....	.584	40	$\frac{3}{16}$	.76563
41	.....	.....	.....	.....	.....	.095	.096	.....	.597	41	$\frac{1}{4}$	.78125
42	.....	.....	.....	.....	.....	.092	.094	.....	.611	42	$\frac{5}{64}$	.79688
43	.....	.....	.....	.....	.....	.088	.089	.....	.624	43	$\frac{1}{8}$	.8125
44	.....	.....	.....	.....	.....	.085	.086	.....	.637	44	$\frac{3}{32}$	.82813
45	.....	.....	.....	.....	.....	.081	.082	.....	.650	45	$\frac{1}{4}$	.84375
46	.....	.....	.....	.....	.....	.079	.081	.....	.663	46	$\frac{5}{64}$	.85938
47	.....	.....	.....	.....	.....	.077	.079	.....	.676	47	$\frac{1}{2}$	.875
48	.....	.....	.....	.....	.....	.075	.076	.....	.690	48	$\frac{3}{16}$	.89063
49	.....	.....	.....	.....	.....	.072	.073	.....	.703	49	$\frac{1}{4}$	.90625
50	.....	.....	.....	.....	.....	.069	.070	.....	.716	50	$\frac{5}{64}$	.92188

LETTER SIZES STUBBS STEEL WIRE

A.....	.234	I.....	.272	R.....	.339
B.....	.238	J.....	.277	S.....	.348
C.....	.242	K.....	.281	T.....	.358
D.....	.246	L.....	.290	U.....	.368
E.....	.250	M.....	.295	V.....	.377
F.....	.257	N.....	.302	W.....	.386
G.....	.261	O.....	.316	X.....	.397
H.....	.266	P.....	.323	Y.....	.404
		Q.....	.332	Z.....	.413

SIZES OF NUMBERS OF THE UNITED STATES STANDARD GAUGE FOR SHEET AND PLATE IRON AND STEEL

AN ACT ESTABLISHING A STANDARD GAUGE FOR SHEET AND PLATE IRON AND STEEL

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled: That for the purpose of securing uniformity the following is established as the only gauge for sheet and plate iron and steel in the United States of America namely:

NUMBER OF GAUGE	Approximate Thickness in Fractions of an Inch	Approximate Thickness in Decimal Parts of an Inch	Weight per Square Foot in Ounces Avoirdupois	Weight per Square Foot in Pounds Avoirdupois
0000000	$\frac{1}{2}$	.5	320	20.00
000000	$\frac{1}{32}$	.46875	300	18.75
00000	$\frac{7}{16}$	.4375	280	17.50
0000	$\frac{15}{32}$	.40625	260	16.25
000	$\frac{3}{4}$	.375	240	15.00
00	$\frac{11}{32}$	.34375	220	13.75
0	$\frac{5}{16}$	.3125	200	12.50
1	$\frac{9}{32}$	.28125	180	11.25
2	$\frac{17}{64}$	.265625	170	10.625
3	$\frac{1}{4}$	.25	160	10.00
4	$\frac{19}{64}$	.234375	150	9.375
5	$\frac{7}{32}$	.21875	140	8.75
6	$\frac{13}{64}$	.203125	130	8.125
7	$\frac{3}{16}$	.1875	120	7.5
8	$\frac{11}{64}$	.171875	110	6.875
9	$\frac{5}{32}$	.15625	100	6.25
10	$\frac{9}{64}$	.140625	90	5.625
11	$\frac{1}{8}$	.125	80	5.00
12	$\frac{7}{64}$	.109375	70	4.375
13	$\frac{3}{32}$	.09375	60	3.75
14	$\frac{5}{64}$	.078125	50	3.125
15	$\frac{11}{128}$	.0703125	45	2.8125
16	$\frac{1}{16}$	.0625	40	2.5
17	$\frac{9}{160}$	.05625	36	2.25
18	$\frac{1}{20}$	.05	32	2.
19	$\frac{7}{160}$	.04375	28	1.75
20	$\frac{3}{80}$	.0375	24	1.50
21	$\frac{11}{320}$	.034375	22	1.375
22	$\frac{1}{32}$	.03125	20	1.25
23	$\frac{9}{320}$	.028125	18	1.25
24	$\frac{1}{40}$	.025	16	1.
25	$\frac{7}{320}$	.021875	14	.875
26	$\frac{3}{160}$	.01875	12	.75
27	$\frac{11}{640}$	.0171875	11	.6875
28	$\frac{1}{64}$	.015625	10	.625
29	$\frac{9}{640}$	.0140625	9	.5625
30	$\frac{1}{80}$	.0125	8	.5
31	$\frac{7}{640}$	.0109375	7	.4375
32	$\frac{11}{1280}$	.01015625	6 $\frac{1}{2}$	.40625
33	$\frac{3}{320}$	.009375	6	.375
34	$\frac{11}{1280}$	.00859375	5 $\frac{1}{2}$	.34375
35	$\frac{5}{640}$	.0078125	5	.3125
36	$\frac{7}{1280}$	.00703125	4 $\frac{1}{2}$	.28125
37	$\frac{11}{560}$	.006640625	4 $\frac{1}{4}$	.265625
38	$\frac{1}{160}$	.00625	4	.25

And on and after July first, eighteen hundred and ninety-three, the same and no other shall be used in determining duties and taxes levied by the United States of America on sheet and plate iron and steel. But this act shall not be construed to increase duties upon any articles which may be imported.

SEC. 3.—That in the practical use and application of the standard gauge hereby established a variation of two and one-half per cent. either way may be allowed.

Approved March 3. 1893.

Index to Tables and Data appears on Pages 23 to 26.

WEIGHTS OF METALS

	Lbs. per Cu. Ft.	Lbs. per Cu. In.
Aluminum, cast.....	160	.0926
Brass, cast.....	506.3	.293
Brass, sheet.....	528	.3056
Babbitt metal.....	440.6	.255
Bronze, aluminum.....	471.2	.2727
Bronze, phosphor.....	575.8	.3332
Copper wire.....	555.1	.3212
Cast iron.....	450.	.2604
Wrought iron, bars.....	486.8	.2817
Steel, Bessemer.....	490.7	.284
Lead, cast.....	709.5	.4106
Nickel.....	548.7	.3175
Tin.....	458.3	.2652
Zinc.....	436.5	.2526

PROPORTIONATE WEIGHT OF CASTINGS TO WEIGHT OF
WOOD PATTERNS

A PATTERN WEIGHING ONE POUND, MADE OF (Less Weight of Core Prints)	Cast Iron	Brass	Copper	Bronze	Bell Metal	Zinc
Pine or Fir.....	16	15.8	16.7	16.3	17.1	13.5
Oak.....	9	10.1	10.4	10.3	10.9	8.6
Beech.....	9.7	10.9	11.4	11.3	11.9	9.1
Linden.....	13.4	15.1	16.7	15.5	16.3	12.9
Pear.....	10.2	11.5	11.9	11.8	12.4	9.8
Birch.....	10.6	11.9	12.3	12.2	12.9	10.2
Alder.....	12.8	14.3	14.9	14.7	15.5	12.2
Mahogany.....	11.7	13.2	13.7	13.5	14.2	11.2
Brass.....	0.85	0.95	0.99	0.98	1.0	0.81

WEIGHT OF STEEL PER LINEAL FOOT
FLAT SIZES

	$\frac{1}{8}$	$\frac{3}{16}$	$\frac{1}{4}$	$\frac{5}{16}$	$\frac{3}{8}$	$\frac{1}{2}$	$\frac{5}{8}$	$\frac{3}{4}$	$\frac{7}{8}$	1	$1\frac{1}{8}$	$1\frac{1}{4}$	$1\frac{1}{2}$	$1\frac{3}{4}$	2	$2\frac{1}{4}$	$2\frac{1}{2}$	$2\frac{3}{4}$	3	$3\frac{1}{2}$	4	5	6	7
$\frac{3}{8}$	.213	.266	.320	.372	.426	.479	.530	.585	.640	.745	.850	.955	1.07	1.18	1.28	1.43	1.60	1.76	1.92	1.49	1.70	2.13	2.56	2.98
$\frac{7}{16}$	.319	.399	.480	.558	.639	.718	.790	.878	.960	1.12	1.28	1.43	1.60	1.76	1.92	2.13	2.34	2.56	2.76	2.24	2.55	3.20	3.83	4.47
$\frac{1}{2}$	.425	.533	.640	.743	.852	.958	1.06	1.17	1.28	1.49	1.70	1.91	2.13	2.34	2.56	2.87	3.19	3.46	3.72	2.98	3.40	4.26	5.11	5.96
$\frac{5}{8}$	.531	.665	.800	.929	1.06	1.20	1.33	1.46	1.60	1.86	2.13	2.39	2.66	2.92	3.19	3.46	3.72	3.98	4.25	3.72	4.25	5.32	6.38	7.44
$\frac{3}{4}$	.638	.798	.960	1.12	1.28	1.43	1.59	1.75	1.91	2.23	2.55	2.87	3.20	3.51	3.83	4.15	4.46	4.77	5.08	4.46	5.10	6.40	7.66	8.92
$\frac{7}{8}$	.744	.931	1.12	1.30	1.49	1.67	1.86	2.05	2.23	2.60	2.98	3.35	3.72	4.09	4.46	4.83	5.20	5.57	5.94	5.21	5.95	7.44	8.92	10.40
$1\frac{1}{8}$	.850	1.07	1.28	1.49	1.70	1.91	2.13	2.34	2.55	2.98	3.40	3.83	4.26	4.68	5.10	5.53	5.96	6.39	6.82	6.09	6.80	8.52	10.20	11.90
$1\frac{1}{4}$	.955	1.20	1.44	1.67	1.91	2.15	2.39	2.63	2.87	3.35	3.83	4.30	4.78	5.26	5.74	6.22	6.70	7.17	7.65	6.69	7.65	9.56	11.50	13.40
$1\frac{1}{2}$	1.07	1.33	1.60	1.86	2.12	2.39	2.66	2.92	3.19	3.72	4.26	4.79	5.32	5.86	6.39	6.91	7.46	7.97	8.50	7.44	8.52	10.64	12.78	14.90
$1\frac{3}{4}$	1.20	1.49	1.76	2.04	2.34	2.63	2.92	3.22	3.51	4.09	4.68	5.26	5.84	6.43	7.01	7.60	8.19	8.77	9.36	8.18	9.35	11.70	14.00	16.40
$2\frac{1}{8}$	1.33	1.65	1.96	2.23	2.55	2.86	3.19	3.50	3.83	4.46	5.10	5.74	6.40	7.02	7.65	8.29	8.94	9.56	10.20	8.92	10.20	12.80	15.30	17.90
$2\frac{1}{4}$	1.46	1.81	2.12	2.41	2.76	3.11	3.45	3.80	4.14	4.83	5.53	6.22	6.91	7.60	8.29	8.94	9.56	10.20	10.84	9.67	11.10	13.80	16.60	19.30
$2\frac{1}{2}$	1.59	1.97	2.28	2.58	2.93	3.28	3.63	3.98	4.33	5.08	5.80	6.52	7.24	7.97	8.69	9.36	10.00	10.64	11.28	10.42	11.92	14.87	17.88	20.80
$2\frac{3}{4}$	1.72	2.13	2.44	2.74	3.09	3.44	3.79	4.14	4.49	5.28	6.02	6.76	7.50	8.24	8.94	9.56	10.20	10.84	11.48	11.20	12.80	15.90	19.10	22.40
$3\frac{1}{8}$	1.85	2.29	2.60	2.90	3.25	3.60	3.95	4.30	4.65	5.48	6.24	7.00	7.76	8.52	9.16	9.76	10.40	11.04	11.68	11.92	13.60	17.04	20.40	23.80
$3\frac{1}{4}$	1.98	2.45	2.76	3.06	3.41	3.76	4.11	4.46	4.81	5.68	6.46	7.24	8.02	8.80	9.40	10.00	10.64	11.28	11.92	13.41	15.30	19.17	22.95	26.80
$3\frac{1}{2}$	2.11	2.61	2.92	3.22	3.57	3.92	4.27	4.62	4.97	5.88	6.68	7.48	8.28	9.08	9.60	10.16	10.80	11.44	12.08	14.90	17.00	21.30	25.61	29.76
$3\frac{3}{4}$	2.24	2.77	3.08	3.38	3.73	4.08	4.43	4.78	5.13	6.08	6.90	7.72	8.54	9.36	9.84	10.40	11.04	11.68	12.32	14.90	20.40	25.56	30.60	35.70

WEIGHT IN POUNDS OF SHEET AND BAR ALUMINUM, BRASS AND STEEL

THICKNESS OR DIAM. IN INCH		SHEETS PER SQUARE FOOT			SQUARE BARS, ONE FOOT LONG			ROUND BARS, ONE FOOT LONG		
Frac- tion	Dec.	Alum.	Brass	Steel	Alum.	Brass	Steel	Alum.	Brass	Steel
$\frac{1}{16}$	.0625	.869	2.77	2.52	.004	.014	.013	.003	.011	.010
$\frac{1}{8}$	.125	1.739	5.55	5.10	.018	.057	.053	.014	.047	.042
$\frac{3}{16}$	.1875	2.609	8.32	7.65	.041	.131	.119	.032	.102	.094
$\frac{1}{4}$	.2500	3.479	11.10	10.20	.072	.230	.212	.057	.182	.167
$\frac{5}{16}$	.3125	4.348	13.87	12.75	.114	.380	.333	.089	.284	.261
$\frac{3}{8}$	.3750	5.218	16.64	15.30	.163	.520	.478	.128	.408	.375
$\frac{7}{16}$	.4375	6.088	19.42	17.85	.222	.708	.651	.174	.555	.511
$\frac{1}{2}$	.5000	6.958	22.20	20.40	.290	.925	.850	.227	.724	.667
$\frac{9}{16}$	.5625	7.827	24.97	22.95	.367	1.171	1.076	.288	.919	.845
$\frac{5}{8}$	.6250	8.697	27.74	25.50	.453	1.445	1.328	.356	1.136	1.043
$1\frac{1}{16}$	.6875	9.567	30.52	28.05	.548	1.748	1.608	.430	1.372	1.262
$\frac{3}{4}$	.7500	10.436	33.29	30.60	.652	2.080	1.913	.516	1.646	1.502
$1\frac{1}{8}$	.8125	11.306	36.07	33.15	.766	2.445	2.245	.601	1.917	1.763
$\frac{7}{8}$	.8750	12.175	38.84	35.70	.888	2.833	2.603	.697	2.223	2.044
$1\frac{1}{2}$	.9375	13.045	41.61	38.25	1.019	3.251	2.989	.800	2.552	2.347
1	1.0000	13.915	44.39	40.80	1.159	3.697	3.400	.911	2.906	2.670
$1\frac{1}{8}$	1.0625	14.784	47.16	43.35	1.309	4.176	3.838	1.028	3.279	3.014
$1\frac{1}{4}$	1.125	15.654	49.94	45.90	1.467	4.630	4.303	1.152	3.675	3.379
$1\frac{3}{8}$	1.1875	16.524	52.71	48.45	1.635	5.216	4.795	1.284	4.096	3.766
$1\frac{1}{2}$	1.2500	17.394	55.48	51.00	1.812	5.780	5.312	1.423	4.539	4.173
$1\frac{5}{8}$	1.3125	18.263	58.26	53.55	1.997	6.370	5.857	1.569	5.003	4.600
$1\frac{3}{4}$	1.3750	19.133	61.04	56.10	2.192	6.992	6.428	1.722	5.491	5.049
$1\frac{7}{8}$	1.4375	20.002	63.81	58.65	2.396	7.644	7.026	1.882	6.002	5.513
$1\frac{1}{2}$	1.5000	20.872	66.58	61.20	2.609	8.322	7.650	2.049	6.536	6.008
$1\frac{9}{8}$	1.5625	21.741	69.35	63.75	2.831	9.030	8.301	2.223	7.091	6.520
$1\frac{5}{4}$	1.6250	22.611	72.13	66.30	3.062	9.768	8.978	2.405	7.672	7.057
$1\frac{11}{8}$	1.6875	23.481	74.90	68.85	3.302	10.53	9.682	2.593	8.271	7.603
$1\frac{3}{4}$	1.7500	24.350	77.67	71.40	3.550	11.32	10.41	2.789	8.896	8.178
$1\frac{13}{8}$	1.8125	25.250	80.54	73.95	3.810	12.15	11.17	2.992	9.544	8.773
$1\frac{7}{4}$	1.8750	26.090	83.22	76.50	4.075	13.00	11.95	3.202	10.21	9.388
$1\frac{15}{8}$	1.9375	26.960	86.00	79.05	4.352	13.88	12.76	3.417	10.90	10.02
2	2.0000	27.829	88.77	81.60	4.638	14.79	13.60	3.642	11.62	10.68

WEIGHT OF ALUMINUM, IRON, COPPER, BRASS AND LEAD BALLS

Dia. In.	Alum., Lbs.	Iron, Lbs.	Copper, Lbs.	Brass, Lbs.	Lead, Lbs.	Dia., In.	Alum., Lbs.	Iron, Lbs.	Copper, Lbs.	Brass, Lbs.	Lead, Lbs.
1	.045	.136	.166	.158	.214	7	15.58	46.76	57.1	54.5	73.7
$1\frac{1}{2}$	.153	.46	.562	.537	.727	$7\frac{1}{2}$	19.17	57.52	70.0	67.11	90.0
2	.363	1.09	1.3	1.25	1.7	8	23.27	69.81	85.2	81.4	110.1
$2\frac{1}{2}$	.710	2.13	2.60	2.50	3.35	$8\frac{1}{2}$	27.91	83.73	102.3	100.0	132.3
3	1.22	3.68	4.5	4.3	5.8	9	33.10	99.4	121.3	115.9	156.7
$3\frac{1}{2}$	1.94	5.84	7.14	6.82	9.23	$9\frac{1}{2}$	38.90	116.9	143.0	136.4	184.7
4	2.90	8.72	10.7	10.2	13.8	10	45.45	136.35	166.4	159.0	215.0
$4\frac{1}{2}$	3.13	12.42	15.25	14.5	19.6	$10\frac{1}{2}$	52.60	157.84	193.0	184.0	250.0
5	5.68	17.04	20.8	19.9	26.9	11	60.49	181.48	221.8	211.8	286.7
$5\frac{1}{2}$	7.56	22.68	27.74	26.47	36.0	$11\frac{1}{2}$	69.12	207.37	253.5	242.0	327.7
6	9.81	29.45	35.9	34.3	46.4	12	78.54	235.62	288.1	275.0	372.9
$6\frac{1}{2}$	12.48	37.44	45.76	43.67	59.13						

SPECIFICATIONS FOR CYLINDER CASTINGS (ALCO)**DOMESTIC IRON CASTINGS**

		Per Cent.
Silicon.....		1.25 to 1.60
Sulphur.....	less than	0.11
Phosphorus.....		0.50 to 0.80
Manganese.....		0.50 to 0.80
Combined carbon.....	over	0.40
Graphitic carbon.....	under	3.00

IMPORTED CYLINDER CASTINGS

		Per Cent.
Silicon.....		2.50 to 3.00
Sulphur.....	under	0.10
Phosphorus.....		1.50 to 1.80
Manganese.....		0.30 to 0.50
Combined carbon.....	over	0.50
Graphitic carbon.....	under	3.00

RESULTS OF TESTS OF PARSONS' MANGANESE BRONZE (CONDUCTED BY R. W. HUNT & CO.)**TENSION TESTS**

Kind of Metal	Rolled		Cast	
Length, test section.....	2.00	2.00	2.00	2.00
Original diameter.....	.499	.50	.505	.505
Original area.....	.1956	.1963	.200	.200
Reduced diameter.....	.387	.372	.390	.395
Reduced area.....	.1176	.1087	.1194	.1225
Elongation in 2 in.....	.58	.70	.72	.69
Elastic limit, lbs.....	9,740	9,900	9,230	8,950
Maximum load, lbs.....	13,970	13,970	17,600	16,950
Elastic limit, lbs. per sq. in.....	49,790	50,430	46,150	43,250
Maximum load.....	71,420	71,160	78,000	74,750
Reduction of area, per cent.....	39.8	44.6	40.3	38.7
Elongation, per cent.....	29	35	36	34.5
Fracture.....	$\frac{1}{2}$ Cup silky and granular	$\frac{1}{2}$ Cup silky and granular	$\frac{1}{2}$ Cup silky and granular	$\frac{1}{2}$ Cup silky and granular

COMPRESSION TESTS

Kind of Metal	Rolled	
Length of test piece.....	2.00	2.00
Diameter of test piece.....	1.03	1.02
Area of test piece.....	.790	.7886
Total compression.....	.584	.629
Approximate elastic limit.....	52,500	52,500
Maximum load, lbs.....	113,500	116,300
Approximate elastic limit, lbs. per sq. in.....	66,460	66,570
Maximum load, lbs. per sq. in.....	143,770	147,500
Failed by.....	Shear angle with vertical 36 deg.	Shear angle with vertical 33 deg.
Fracture.....	Silky	Silky

PROPERTIES OF CAST ALUMINUM

The tensile strength of aluminum varies with the thickness of the castings, about as follows:

Thickness in Inches	Relative Tensile Strength in Pounds per Square Inch
0.10	108
0.20	100
0.30	98
0.40	94
0.50	90

The specific gravity of aluminum increases as the walls of castings are made thinner approximately as follows:

Thickness in Inches	Specific Gravity Corresponding
1 (square)	2.964
3-4	3.004
5-8	3.002
9-16	3.004
1-2	3.012
3-8	3.024
1-4	3.007
1-8	3.007

Shrinkage in aluminum castings is about 17.64th inch per foot. The effect of heat on tensile strength and expansion of pure aluminum is shown in the following table:

Temperature, Fahrenheit	Tensile Strength, Tons per Square Inch	Expansion in Volume
58°	11.7	.000884
212°	9.5	.006120
302°	8.1	.009180
392°	6.3	.012240
482°	4.8	.015300
572°	3.6	.018360
752°	2.4	.024480
842°	1.5	.027540
860°	1.0	.028152

MATERIALS FOR MOTOR POPPET VALVES

The materials of construction most commonly used include the following: Special high carbon steel, high nickel alloy steel, nickel steel heads on carbon steel stems, cast iron heads on carbon steel stems.

HIGH CARBON STEEL FOR VALVES

Chemical Composition

Carbon	Silicon	Sulphur	Phosphorus	Manganese
115	10	0.015	0.012	0.40

PHYSICAL PROPERTIES

Tensile Strength in Pounds per Square Inch	Elastic Limit in Pounds per Square Inch	Elongation per cent. in 2 Inches	Reduction of Area in per cent.
149,800	50,000	5	16

HIGH NICKEL ALLOY STEEL FOR VALVES

Chemical Composition

Nickel	Carbon	Silicon	Sulphur	Phosphorus	Manganese
35	0.10	0.15	0.012	0.012	0.35

PHYSICAL PROPERTIES

Tensile Strength in Pounds per Square Inch	Elastic Limit in Pounds per Square Inch	Elongation per cent. in 2 Inches	Reduction of Area in per cent.
85,000	55,000	25	50

When the alloy steel is used for the heads and the soft steel for the stems union can be affected by the autogenous or electric welding processes.

STRENGTH OF AUTOMOBILE MATERIALS

	Modulus of Rigidity	Elastic Limit	Tensile Strength
Aluminum alloys.....	8 to 11 million	10 M to 15 M	20 M to 30 M
Phosphor bronze.....	12 to 14 "	20,000	30,000
Manganese bronze.....	15 "	35,000	50,000
Aluminum bronze.....	15 "	50,000	75,000
Wrought iron.....	28 "	30,000	40,000
Mild open hearth steel.....	28 "	40,000	60,000
Tool steel.....	29 "	80,000	110,000
Nickel steel.....	28 "	80,000	110,000
Nickel chrome steel.....	30 "	160,000	180,000
Vanadium steel treated.....	30 "	220,000	228,000

All of the above materials stand well under dynamic stress with the exception of the tool steel, which should not be used for this purpose.

TEST OF HIGH QUALITY NICKEL CHROME STEEL (KRUPP)

DIMENSIONS OF TEST BARS, 5.91 INS. LONG AND 0.59 INS. DIAMETER

	Normal	Slightly Hardened	Greater Degree of Hardness
Elastic limit, pounds per square inch.....	86,909	148,072	193,589
Tensile strength, pounds per square inch.....	111,943	155,326	221,325
Elongation, per cent.....	14.5	9.1	7.7
Contraction, per cent.....	64.0	55.6	46.2

Foregoing tests assume correct heat treatment.

MELTING POINTS OF METALS

Cast iron.....	2210 deg. Fahr
Wrought iron.....	2912 " "
Steel.....	2500 " "
Copper.....	2160 " "
Brass.....	1900 " "
Aluminum (pure).....	1112 " "
Lead.....	608 " "
Tin.....	446 " "

MALLEABLE IRON TESTS

Results of Test of Sample Malleable Iron Bar made for the Ohio Malleable Iron Company, Columbus, O.

Test No.	Test made by	Elastic Limit Lbs. per sq. in.	Tensile Strength Lbs. per sq. in.	Elongation per cent.	Reduction of Area per cent.
58491	The Detroit Testing Laboratory.	37195	53283	15.62	21.38
32504	Pittsburg Testing Laboratory	34750	54340	18.00	21.1
	Robert W. Hunt & Co.....	41195	52940	17.00	25.63

SPECIFICATIONS FOR CAST IRON PARTS (GERMAN).

(Translated from "Metall Technick")

Specifications for cast-iron parts have only of relatively recent date been subjected to regulations of recognized value, and this has been one of the reasons for discrediting castings as parts in automobile construction, their strength being difficult to determine in advance. The reason why practice and science have refrained from formulating basic rules for deciding the strength and properties of cast-iron parts, even though foundry science has progressed by leaps and bounds, is to be sought in the fact that the unit strength of a casting, even in the case of comparison between materials derived from the same ladle, depends largely upon the dimensions of the piece and the more or less rapid cooling to which it has been subjected. The same difference arises with regard to a single cast piece, according to the direction and location of the stress. The strength along one cross-section varies from the strength through another section, and the difference is not pro rata with the dimensions. Slow cooling, as where the diameter is greatest, produces a coarser structure and also causes carbon to be precipitated as graphite between the walls of adjacent crystals, greatly reducing strength. Flexion tests made by O. Leyde with bars of square section of different dimensions and all cast in one piece with a heavier bar uniting them across one end showed that the softest iron developed the most pronounced differences in unit strength, in favor of the bars of small section. A bar 10 by 10 millimeters in section endured a stress of 47 kilograms per square millimeter, while a bar of 150 by 150 millimeters cross-section endured only 18 kilograms per square millimeter. In three series of tests the materials differed mainly in silicon, this metalloid running from 2.1 per cent. in the hardest to 1.5 per cent. and 1.2 per cent. in the softer grades. The composition otherwise was carbon 3, phosphorus 0.6, manganese 0.7 and sulphur 0.12. Similar results were reached in tests by Sulzer Brothers of Winterthur with bars from 5 to 50 millimeters in diameter, giving a strength decreasing from 63 kilograms for a bar of 5 millimeters diameter to 27 kilograms for the largest size. The Society of German Iron Foundries has now created regulations for cast-iron tests in which the principal source of error in previous rules—the use of only a single dimension of bar—is eliminated. The new regulations distinguish between: A, machine castings of (1) medium, (2) high and (3) very high strength; B, architectural and construction castings and C, pipe castings, comprising (1) gas and water pipe and (2) steam pipe. Each subdivision is further divided according to dimensions of the casting in three classes: (1) Pieces with walls up to 15 millimeters thick; (2) between 15 and 25 millimeters, and (3) average wall thickness of more than 25 millimeters. Further regulations extend to shapes, properties of the material and method of producing test bars. In addition to flexion tests here is provided test by internal hydraulic pressure for tubular castings. The testing work which was called into action by these regulations at the various foundries has created a demand for a special machine for facilitating the measurements, and one such has been produced by the Düsseldorf Machine Company, Inc., and is provided with automatic stress-measuring instrument and recording manometer giving direct reading in kilograms.

EFFICIENCY TEST OF AUTOMOBILE RADIATOR (McCORD)

Height, 28.5"; Width, 25"; Thickness, 3.25"; Weight, 60 pounds. Made up of 144 Vertical Water Tubes $\frac{1}{4}$ " Diameter

Time in Mins.	R.P.M. of Motor	Pounds on Scale	TEMPERATURE F.				
			WATER		AIR		
			To Radiator	From Radiator	To Fan	From Fan	In Room
00	1000	20.00	160.00	152.00	90.25	91	86.0
05	1000	20.00	181.00	172.00	91.75	99	87.8
10	1000	19.75	189.00	180.00	91.75	100	88.5
15	1000	20.00	193.00	184.00	91.75	102	89.0
20	1000	19.75	195.00	185.00	91.75	109	89.6
25	1000	20.00	197.00	187.00	92.50	104	90.3
30	1000	20.00	198.00	188.00	92.50	104	90.3
35	1000	20.00	197.00	187.00	92.50	103	89.9
40	1000	20.00	197.00	187.00	95.50	103	90.1
45	1000	20.00	197.25	187.25	92.50	102	90.1
50	1000	20.00	197.00	187.25	92.50	102	89.6
55	1000	20.00	197.00	187.25	93.25	104	89.6
60	1000	20.00	197.00	187.00	91.75	102	90.5
65	1000	30.00	207.00	196.00	94.00	105	91.0
70	1000	30.00	211.00	201.50	96.25	107	92.5
71	1000	30.00	212.00	202.00	96.25	107	92.8

Note.—144 pounds of jacket water per minute.

The test as here given was made by an automobile builder. The table shows, among other points of interest, that it took 25 minutes before the water reached a constant temperature, after which the radiator abstracted 1,431.4 B.T.U. of heat from the jacket water, with a difference in the water between inlet and outlet of 9.94 degrees Fahrenheit, working between the limits of 197 and 187 degrees Fahrenheit. The amount of water circulated was (as given in the table) 144 pounds. Since the temperature did not reach the maximum allowable in practice (the boiling point of water) it is a fair inference that the capacity of this radiator can be taken as about equal to 1,500 B.T.U. (British thermal units of heat) under the conditions of this test, considering round numbers.

APPROXIMATE WOOD WHEEL DIAMETERS FOR VARIOUS SIZES AND TYPES OF RIMS

Size Tire	Clincher and Uni- versal	Firestone De- mount- able	Fisk Bolted On	Fisk De- mount- able	Conti- nental De- mount- able	Continental Demountable Metric Sizes
30 × 3½	22½ ₁₆	21½ ₁₆	21½ ₁₆	19¾ ₁₆	22	.....
32 × 3½	24½ ₁₆	23½ ₁₆	23½ ₁₆	21¾ ₁₆	24	810 × 90 — 23¾ ₁₆
34 × 3½	26½ ₁₆	25½ ₁₆	25½ ₁₆	23¾ ₁₆	26	870 × 90 — 25¾ ₁₆
36 × 3½	28½ ₁₆	27½ ₁₆	27½ ₁₆	.....	28	910 × 90 — 27¾ ₁₆
30 × 4	21½ ₁₆	20½ ₁₆	20¾ ₁₆	.....	21	.....
32 × 4	23½ ₁₆	22½ ₁₆	22¾ ₁₆	20	23	.....
34 × 4	25½ ₁₆	24½ ₁₆	24¾ ₁₆	22	25	875 × 105 — 25¾ ₁₆
36 × 4	27½ ₁₆	26½ ₁₆	26¾ ₁₆	24	27	915 × 105 — 27¾ ₁₆
32 × 4½	22¾ ₈	21¾ ₈	21½	.....	.....	820 × 120 — 21½ ₁₆
34 × 4½	24¾ ₈	23¾ ₈	23½	20½ ₁₆	23¾ ₁₆	880 × 120 — 23¾ ₁₆
36 × 4½	26¾ ₈	25¾ ₈	25½	21¾ ₁₆	25¾ ₁₆	920 × 120 — 25¾ ₁₆
34 × 5	23¾ ₈	22¾ ₈	.....	19¾ ₁₆	22¾ ₁₆	.....
36 × 5	25¾ ₈	24¾ ₈	.....	21¾ ₁₆	24¾ ₁₆	.....
36 × 5½	24¾ ₈	23¾ ₈	.....	.....	.....	935 × 135 — 24¾ ₁₆
47 × 5½	25¾ ₈	24¾ ₈	.....	.....	24¾ ₁₆	.....

Index to Tables and Data appears on Pages 23 to 26.

AUTOMOBILE WHEEL DATA

The following information is approximately correct, but the weights, etc., may vary according to the height of wheels, etc.:

WEIGHT OF WHEELS PER SET OF FOUR

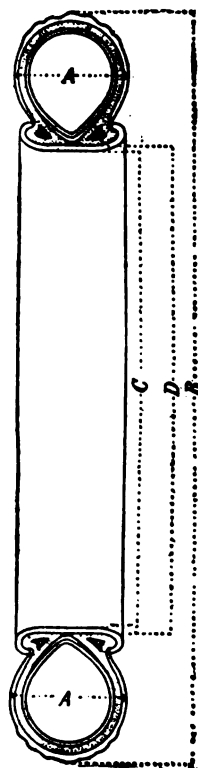
Weight of wheels and hubs without rims or channels, size of spoke $\frac{7}{8}$ to 1" or $1\frac{1}{8}$ ", about.....		50 pounds
" same size with steel rims for $2\frac{1}{2}$ " or 3" tire.....		110 "
" 1" or $1\frac{1}{8}$ " spokes.....		65 "
" including rims for 3" or $3\frac{1}{2}$ " tires.....		145 "
" $1\frac{1}{4}$ " or $1\frac{3}{8}$ " spokes.....		100 "
" including rims for $3\frac{1}{2}$ " or 4" tires.....		210 "
" $1\frac{3}{8}$ " or $1\frac{1}{2}$ " spokes.....		112 "
" including rims for 4" or $4\frac{1}{2}$ " tire.....		250 "

Axles are not included in above.

METRIC TIRES AND THEIR AMERICAN EQUIVALENTS

Metric Sizes	Approximate Size in Inches
650 x 65	26 x $2\frac{1}{2}$
700 x 65	28 x $2\frac{1}{2}$
750 x 65	30 x $2\frac{1}{2}$
800 x 65	32 x $2\frac{1}{2}$
830 x 65	33 x $2\frac{1}{2}$
860 x 65	34 x $2\frac{1}{2}$
700 x 85	28 x $3\frac{1}{4}$
750 x 85	30 x $3\frac{1}{4}$
800 x 85	32 x $3\frac{1}{4}$
860 x 85	34 x $3\frac{1}{4}$
760 x 90	30 x $3\frac{1}{2}$
810 x 90	32 x $3\frac{1}{2}$
840 x 90	32 x $3\frac{1}{2}$
870 x 90	34 x $3\frac{1}{2}$
910 x 90	36 x $3\frac{1}{2}$
960 x 90	38 x $3\frac{1}{2}$
1010 x 90	40 x $3\frac{1}{2}$
815 x 105	32 x 4
875 x 105	34 x 4
915 x 105	36 x 4
820 x 120	32 x $4\frac{1}{4}$ -5
850 x 120	33 x $4\frac{1}{4}$ -5
880 x 120	34 x $4\frac{1}{4}$ -5
920 x 120	36 x $4\frac{1}{4}$ -5
1020 x 120	40 x $4\frac{1}{4}$ -5
1080 x 120	42 x $4\frac{1}{4}$ -5

CLINCHER TIRE AND RIM DIMENSIONS



A	B	C	D
Inches	Inches	Inches	Inches
2 ½	26	20 ¾	21
3	26	19 ¾	20
2 ½ and 3	28	21 ¾	22
2 ½ and 3	30	23 ¾	24
3	32	25 ¾	26
3	34	27 ¾	28
3	36	29 ¾	30
3 ½	28	20 11/16	21
3 ½	30	22 11/16	23
3 ½	32	24 11/16	25
3 ½	34	26 11/16	27
3 ½	36	28 11/16	29
4	30	21 11/16	22
4	32	23 11/16	24
4	34	25 11/16	26
4	36	27 11/16	28
4 ½	32	22 11/16	23
4 ½	34	24 11/16	25
4 ½	36	26 11/16	27

PROPORTIONS BETWEEN AXLE LOADS AND TIRE SIZES ADOPTED BY AMERICAN TIRE MAKERS

2 ½-inch tires, all diameters.....	225 pounds per wheel
3 inch tires, all diameters.....	350 " " "
3 ½ x 28-inch tires.....	400 " " "
3 ½ x 30-inch tires.....	450 " " "
3 ½ x 32-inch tires.....	555 " " "
3 ½ x 34-inch tires.....	600 " " "
3 ½ x 36-inch tires.....	600 " " "
4 x 30-inch tires.....	550 " " "
4 x 32-inch tires.....	550 " " "
4 x 34-inch tires.....	700 " " "
4 x 36-inch tires.....	750 " " "
4 ½ x 32-inch tires.....	700 " " "
4 ½ x 34-inch tires.....	800 " " "
4 ½ x 36-inch tires.....	900 " " "

For weights in excess of 1,000 pounds per wheel, 5-inch tires and over are recommended. Weights given apply to car without passengers.

AIR PRESSURES FOR INFLATING PNEUMATIC TIRES RECOMMENDED BY LEADING MAKERS

Diameter of Tire, Inches	Maximum Weight on Wheel, lbs.	Air Pressure in Tire, lbs. per Square Inch
2½	225	50
3	350	60
3½	600	70
4	750	80
4½	1,000	90
5	1,000	90

INCREASE IN AIR PRESSURES CAUSED BY DRIVING

The figures given by tire manufacturers as the most suitable for initial inflation generally take into account the increase in temperature and pressure created by prolonged running. It, however, is useful to know what this increase is. The figures given in the following table are given by a French authority and are averages computed on tires from 3 to 4½ inches diameter under usual touring car weight and speed conditions. For larger tires the increase is greater on account of the greater rigidity of the cover walls, resulting in greater internal strains in the fabric at the points of bending.

INITIAL PRESSURE IN TIRE, COLD	WORKING PRESSURE IN TIRE, WARM	INCREASE RESULTING FROM WORK
<i>Lbs. per Sq. In.</i>	<i>Lbs. per Sq. In.</i>	<i>Lbs. per Sq. In.</i>
71.116	88.183	17.067
85.339	105.750	20.411
99.562	123.546	23.984
113.785	141.920	28.135
128.008	158.588	30.580
142.232	176.368	34.136

CAUSES OF PNEUMATIC TIRE TROUBLES

The following tables were prepared by one of the largest tire makers as a result of investigations in several thousand repair jobs:

SHOES

- 17.3 per cent. in consequence of insufficient inflation.
- 3.5 per cent. in consequence of rusty and dented rims.
- 1.5 per cent. in consequence of cutting off of cover pad through inadequate fastening of butterfly screw, whereby the cover could shift on the rim.
- .8 per cent. in consequence of sudden braking, which scoured through tire at one place.
- .2 per cent. in consequence of contact with oil or other fatty substances, which are known to decompose rubber.
- 29.4 per cent. in consequence of perforation by nails, stones and pieces of iron.
- 4.3 per cent. in consequence of light damages and cuts on the threads, easily repaired.
- 4.9 per cent. in consequence of considerable outer damages, whereby the upper canvas layers were destroyed.
- 37.1 per cent. in consequence of normal wear and tear.

100.0

TUBES

- 13.0 per cent. nipped in mounting.
- 7.2 per cent. places scoured through in consequence of defective mounting or the presence of sand and small stones in tire.
- 9.5 per cent. through defective mounting.
- 6.8 per cent. through riding on deflated tubes.
- 5.8 per cent. damages through defective and wrong cover holders.
- 10.0 per cent. valve defects through wrong manipulation of valve.
- 43.7 per cent. normal wear and tear.

100.0

MILEAGE OF PNEUMATIC TIRES

The accompanying tabulated statement of tire mileage is the result of an extensive investigation made by W. A. Weygandt of Akron, Ohio. The table covers 144½ sets of tires of ten leading makes, in use in every part of the United States on thirty different makes of touring cars. The general average of mileage per set is 5199½. (The usual tire guarantee is 3500 miles.) The average of casings replaced for any and all causes is three-fourths of one to each set of tires used. The average life of an inner tube is found to be 3543.3 miles.

TIRE MILEAGE RESULTS OBTAINED BY AUTOMOBILE OWNERS

Make of tire	A	B	C	D	E	F	G	H	I	J
Sets reported.....	41½	43	13	12½	8	7	6	7	4	3
Grand total, mileage..	256,539	239,975	70,300	65,798	34,100	21,594	20,236	20,200	14,000	8,450
Grand average, mileage.....	6,221	5,580	5,361	5,371	4,262	3,084	3,372	2,825	3,500	2,816
Grand total, time in use, months.....	339½	404½	122½	82	93½	61½	37	46½	26	12½
Grand total, extra casings used.....	23	34	6	6	9	6	9	3	5	1
Grand total, extra tubes used.....	54	73	24	10	9	17	7	9	5	4
Average period of use, months.....	8½	9.3	9½	6.7	11.7	8½	6½	6½	6½	4½
Average monthly mileage.....	755.9	593½	573½	802½	364.7	351.1	546.9	436½	538½	676

AUTOMOBILE SPRING CONSTRUCTION

A formula for determining the safe loading of semi-elliptic leaf springs for automobiles is as follows:

Let,

- B = Width of plate in inches.
- T = Thickness of plates in 1-16 inches.
- N = Number of plates used.
- S = Span of spring in inches.
- C = A constant = 11.3.

Then,

$$\text{Safe load in tons} = \frac{B T^3 N}{C S}$$

To find the amount of deflection in inches per ton of load: Let,

- D = Deflection in inches per ton of load.
- L = Span of spring in inches.
- C = Constant—40,000.
- B = Width of plates in inches.

Then,

$$D = \frac{L^3}{C B T^3 N}$$

FORMULA FOR DETERMINING DIAMETERS OF SPROCKETS FOR ROLLER CHAINS (WHITNEY MFG. CO.)

N = Number of teeth in sprocket.
 P = Pitch of chain.
 D = Diameter of roller.
 $a = 180^\circ$

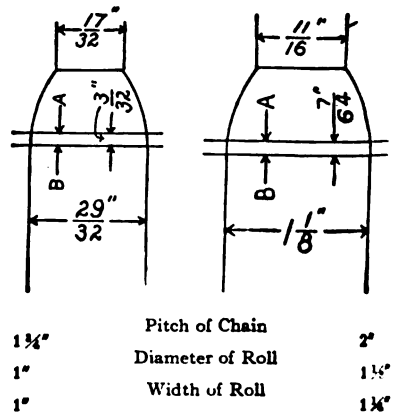
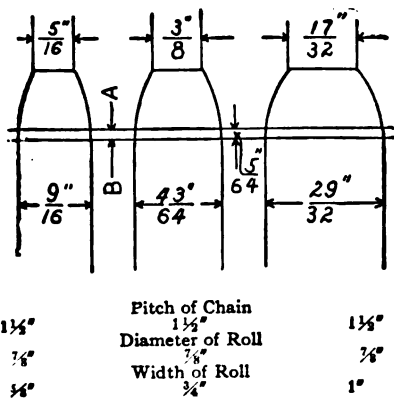
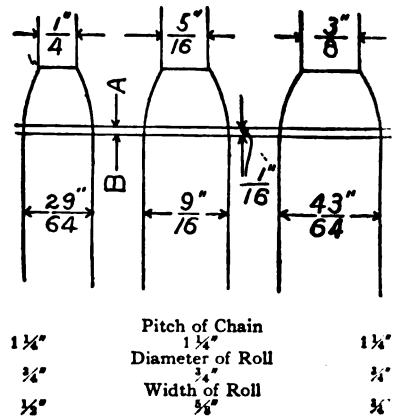
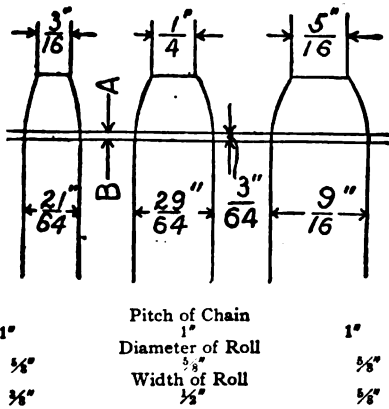
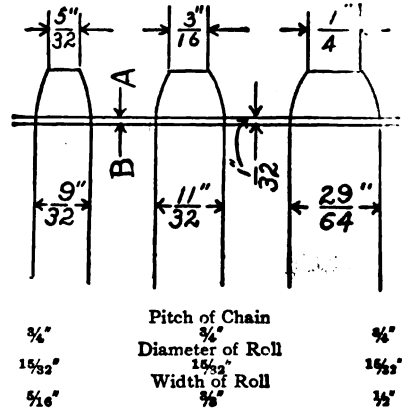
$$a = \frac{180^\circ}{N}$$

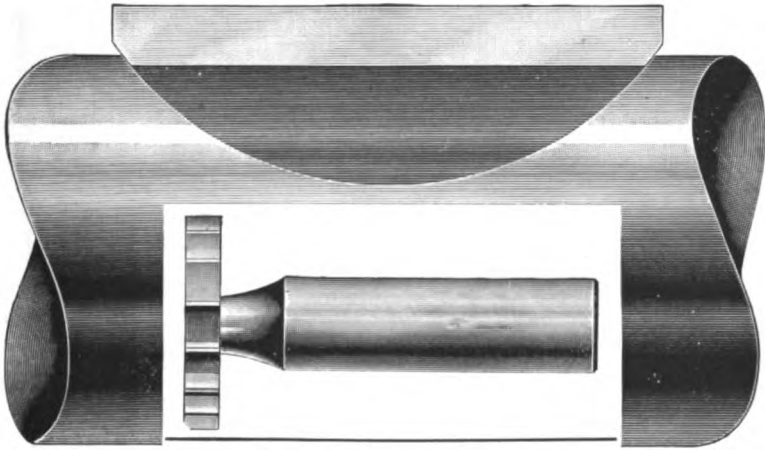
$$\text{Pitch Diameter} = \frac{P}{\sin a}$$

Outside Diameter = Pitch Diameter + D .
 Bottom Diameter = Pitch Diameter - D .

The accompanying drawings show width and shape of sprocket blanks as they should be machined before cutting the teeth to fit (Whitney) chains.

The line "A" indicates pitch line and the line "B" below the pitch line indicates the point at which the clearance curves should start.





“WHITNEY” Keys and Cutters

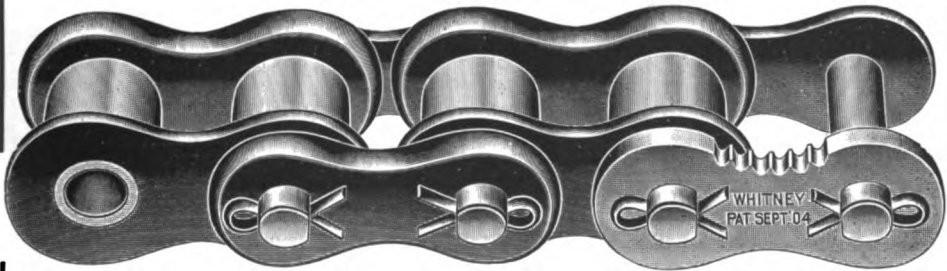
For “The Woodruff System of Keying”

“WHITNEY” Keys are made in 114 different sizes and are furnished in three grades of steel as follows:

REGULAR CARBON STEEL KEYS
 REGULAR CARBON STEEL KEYS, CASE HARDENED
 NICKEL STEEL KEYS, HEAT TREATED

“WHITNEY” Cutters for “The Woodruff System of Keying” are furnished in Carbon Steel and High-Speed Steel.

It will pay you to investigate.



“Whitney” Chains Are Built for Strains

and are used by the leading truck makers

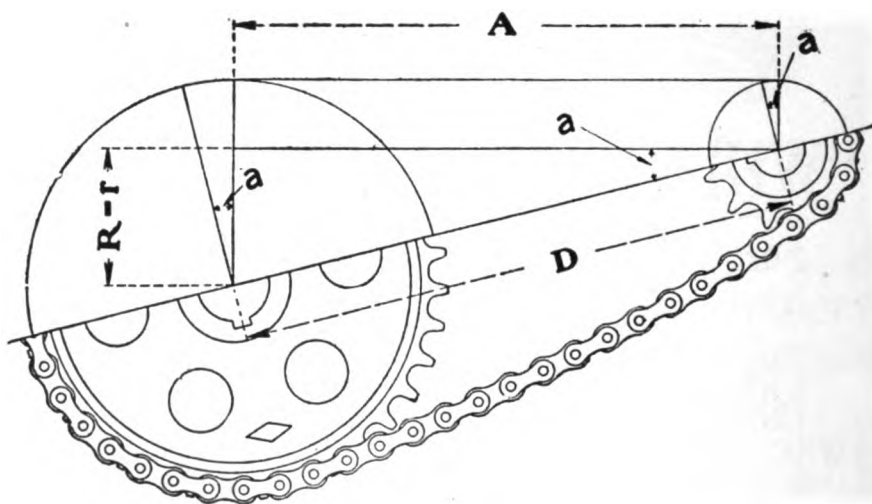
THE WHITNEY MFG. CO., Hartford, Conn.

Manufacturers of High Grade Driving Chains, Hand and Weight (feed) Milling Machines, 20-inch Water Tool Grinders, The Woodruff System of Keying, Presto Chucks, Collets and Friction Tapping Devices.

Please mention The Automobile Trade Directory when writing to advertisers.

FORMULA FOR CALCULATING LENGTH OF CHAIN

(DIAMOND CHAIN AND MFG. CO.)



(All Dimensions in Inches)

- D = Distance between centers.
 A = Distance between limits of contact.
 R = Pitch radius of large sprocket.
 r = Pitch radius of small sprocket.
 N = No. of teeth on large sprocket.
 n = No. of teeth on small sprocket.
 P = Pitch of chain and sprockets.
 $180^\circ + 2^\circ$ = Angle of contact—large sprocket.
 $180^\circ - 2^\circ$ = Angle of contact—small sprocket.

$$\sin \alpha = \frac{R - r}{D}$$

$$A = D \cos \alpha$$

Length of chain = L

$$L = \frac{(90 + \alpha) N P}{180} + \frac{(90 - \alpha) n P}{180} + 2 D \cos \alpha$$

ANTI-FREEZING SOLUTIONS FOR MOTOR COOLING SYSTEMS

Saline solutions and mixtures of alcohol and water are the most commonly used to prevent freezing up of the cooling system in water-cooled motor vehicles when operated in low winter temperatures. Of the former, that in best repute is a solution of calcium chloride. Crystallized calcium chloride contains about 50 per cent. water of crystallization and dissolves in half its weight of cold water; consequently 8 pounds of calcium chloride dissolved in $\frac{1}{2}$ gallon of water will make 1 gallon of saturated solution. The accompanying table (Fig. 1) shows the percentages of calcium chloride and corresponding specific gravity required to prevent freezing at temperature ranges from freezing point to -40 degrees Fahrenheit. In the use of this solution its thermal capacity, which is lower than water, should be borne in mind.

Taking the specific heat of water as 1.000, the specific heat of a 20 per cent. solution of calcium chloride is 0.834.

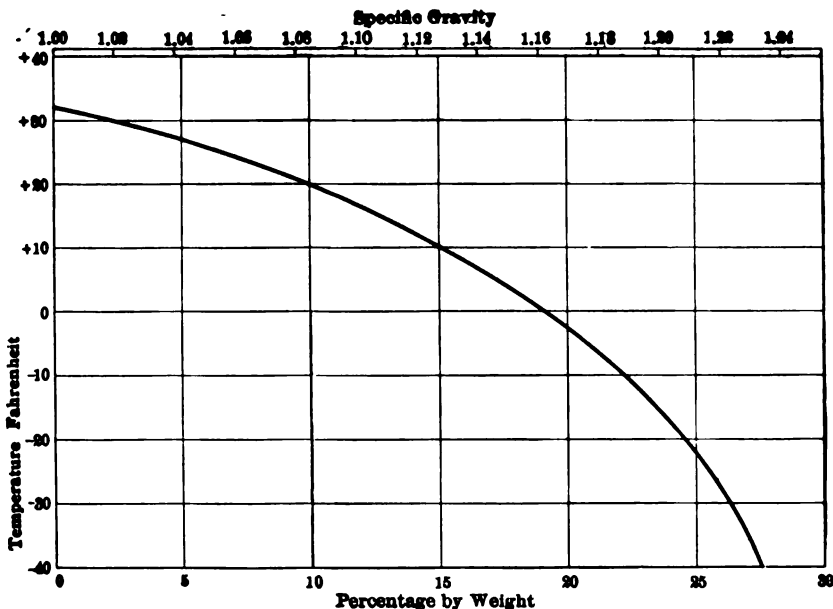


Fig. 1.—Diagram of Freezing Points of Various Solutions of Calcium Chloride in Water.

Mixtures of alcohol and water may be made with either wood alcohol or denatured alcohol. The latter is simply ordinary spirits distilled from grain with an admixture of certain substances that render it unfit for drinking and which may be disregarded in its consideration as a cooling medium. In the accompanying table (Fig. 2) the respective anti-freezing values for wood alcohol and denatured alcohol are given in terms of percentages of the liquid used in the motor-cooling system. These values cover a temperature range from freezing point to -50 degrees Fahrenheit. The specific gravity readings are also included. It will be noted that wood alcohol gives the best results, although objection is frequently made to its use on account of its unpleasant odor.

(Continued on page 650)

In the use of this mixture the constant tendency of the alcohol to evaporate out and the consequent raising of the freezing point of the mixture should be borne in mind. At any time after the filling of the cooling system with the mixture, a sample can be drawn off and its specific gravity determined by the use of the hydrometer. If the reading is too high, sufficient alcohol can be added to make up for loss by evaporation, taking care, of course, that the amount of water in the system has not been diminished by steaming.

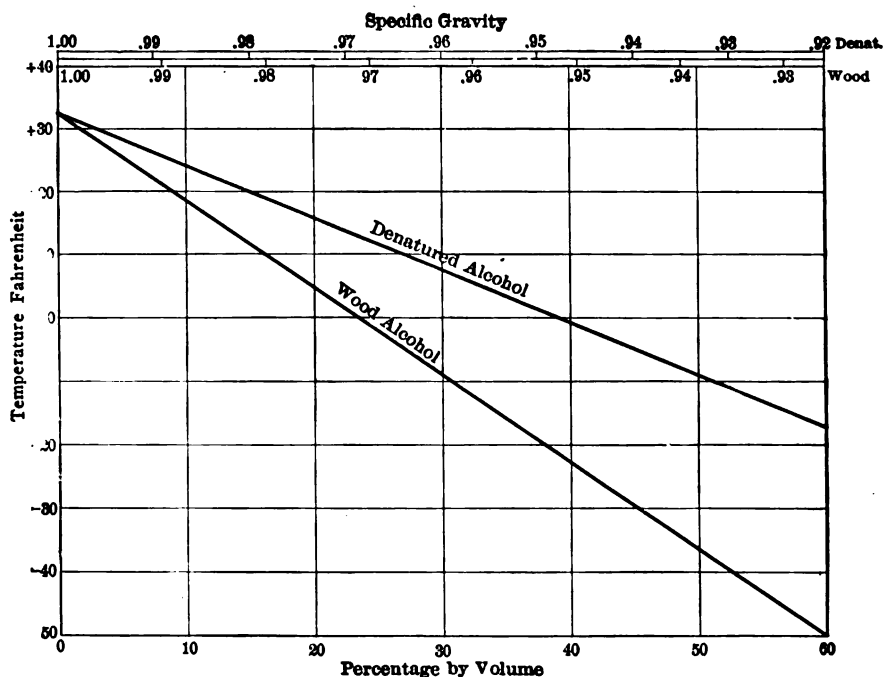


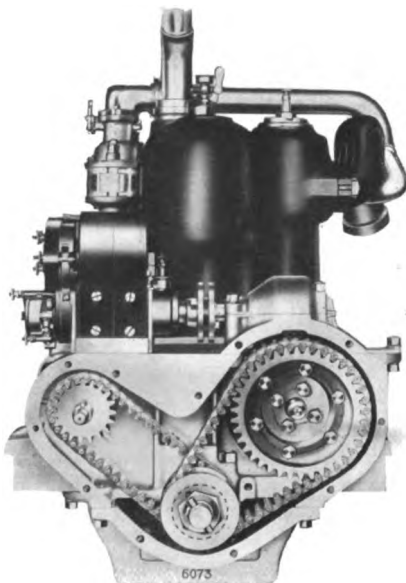
FIG. 2.—Diagram Showing Freezing Temperatures of Mixtures of Alcohol and Water.

STEEL BALLS. "STANDARD" SIZE AND WEIGHTS

Size	Decimal	No. per Pound	Size	Decimal	Ounces
$\frac{1}{16}$ "	.0625	27,904	$\frac{13}{16}$ "	.8125	1 $\frac{1}{2}$
$\frac{3}{32}$ "	.0937	8,264	$\frac{7}{8}$ "	.8750	1 $\frac{3}{4}$
$\frac{1}{8}$ "	.1250	3,400	$\frac{15}{16}$ "	.9375	2
$\frac{5}{32}$ "	.1563	1,770	1"	1.000	2 $\frac{1}{2}$
$\frac{3}{16}$ "	.1875	1,030	$1\frac{1}{8}$ "	1.125	3 $\frac{1}{2}$
$\frac{7}{32}$ "	.2188	640	$1\frac{1}{4}$ "	1.250	4 $\frac{3}{4}$
$\frac{1}{4}$ "	.2500	430	$1\frac{3}{8}$ "	1.375	6 $\frac{1}{4}$
$\frac{9}{32}$ "	.2613	300	$1\frac{1}{2}$ "	1.500	8
$\frac{5}{16}$ "	.3125	220	$1\frac{5}{8}$ "	1.625	10
$1\frac{1}{32}$ "	.2438	165	$1\frac{3}{4}$ "	1.750	13
$\frac{3}{8}$ "	.3750	125	$1\frac{7}{8}$ "	1.875	15 $\frac{1}{2}$
$\frac{7}{16}$ "	.4375	80	2"	2.000	19 $\frac{1}{4}$
$\frac{1}{2}$ "	.5000	52	$2\frac{1}{4}$ "	2.250	27
$\frac{9}{16}$ "	.5625	36	$2\frac{1}{2}$ "	2.500	37
$\frac{5}{8}$ "	.6250	28	$2\frac{3}{4}$ "	2.750	49
$1\frac{1}{16}$ "	.6875	21	3"	3.000	64
$\frac{3}{4}$ "	.7500	16	$3\frac{1}{4}$ "	3.250	81 $\frac{1}{2}$
			$3\frac{1}{2}$ "	3.500	101 $\frac{1}{2}$
			$3\frac{3}{4}$ "	3.750	125
			4"	4.000	152

Index to Tables and Data appears on Pages 23 to 26.

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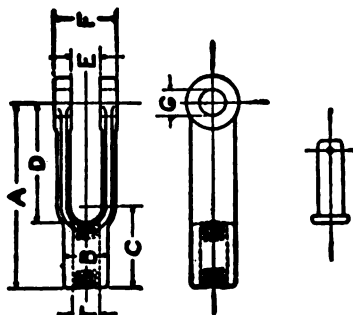
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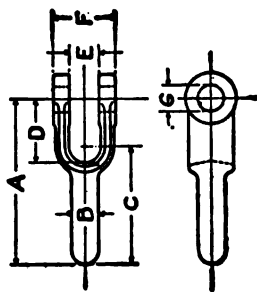
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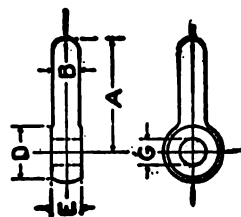
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ROD ENDS.



A	B	C	D	E	F	G	T	A	B	C	D	E	F	G	A	B	C	D	E	F	G
1 1/2	5/16	1 1/16	1	5/16	7/16	5/16	3/16 32 U. S.	1 1/4	3/16	7/16	7/16	3/16	7/16	5/16	1 1/4	3/16	7/16	7/16	3/16	7/16	5/16
2	7/16	7/16	1 1/4	5/16	5/16	1/4	28 A.L.A.M.	1 1/4	1/4	1 1/4	5/16	5/16	5/16	1/4	1 1/4	1/4	1 1/4	5/16	5/16	5/16	1/4
2 1/4	1/2	1	1 7/16	1 1/16	5/16	5/16	24 A.L.A.M.	2	5/16	1 1/4	5/16	1 1/16	5/16	5/16	1 1/4	5/16	1 1/4	1 1/16	1 1/16	5/16	5/16
2 1/2	5/8	1 1/8	1 1/8	5/16	7/16	5/16	24 A.L.A.M.	2 1/4	5/8	1 1/2	27/32	7/16	7/16	5/16	1 1/2	5/8	1 1/2	27/32	7/16	7/16	5/16
2 3/4	3/4	1 1/4	1 3/4	1/2	1	7/16	20 A.L.A.M.	2 1/4	7/16	1 1/2	1	1/2	1	7/16	1 1/2	7/16	1 1/2	1	1	7/16	5/16
3	3 1/16	1 3/4	1 3/4	5/16	1 1/4	1/2	1/2 20 A.L.A.M.	2 3/4	1/2	1 1/2	1 1/8	5/16	1 1/8	1/2	2 1/2	1/2	1 1/2	1 1/8	5/16	1 1/8	1/2

Index to Tables and Data appears on Pages 23 to 26.

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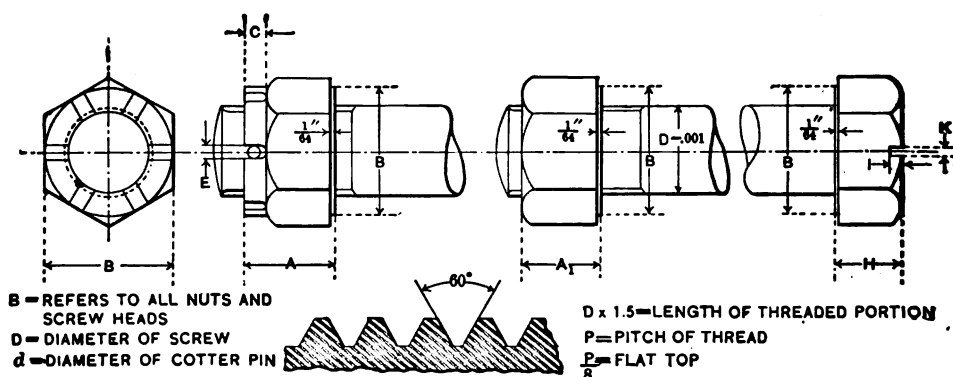
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SOCIETY OF AUTOMOBILE ENGINEERS' STANDARD FOR HEXAGON HEAD SCREWS, CASTLE AND PLAIN NUTS.

It is assumed that where screws are to be used in soft material, such as cast-iron, brass, bronze or aluminum, the existing United States standard pitches will be used.

DIMENSIONS



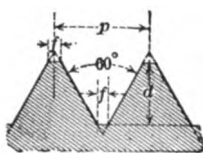
D	1/4	5/16	3/8	7/16	1/2	9/16	5/8	11/16	3/4	7/8	1	1 1/8	1 1/4	1 3/8	1 1/2
P	28	24	24	20	20	18	18	16	16	14	14	12	12	12	12
A	9/32	21/64	13/32	29/64	9/16	39/64	23/32	49/64	13/16	29/32	1	1 5/32	1 1/4	1 13/32	1 1/2
A1	7/32	17/64	21/64	3/8	7/16	31/64	35/64	19/32	21/32	49/64	7/8	69/64	1 3/32	1 13/64	1 5/16
B	7/16	1/2	9/16	5/8	3/4	7/8	15/16	1	1 1/16	1 1/4	1 7/16	1 5/8	1 13/16	2	2 3/16
C	3/32	3/32	1/8	1/8	3/16	3/16	1/4	1/4	1/4	1/4	1/4	5/16	5/16	3/8	3/8
E	5/64	5/64	1/8	1/8	1/8	5/32	5/32	5/32	5/32	5/32	5/32	7/32	7/32	1/4	1/4
H	3/16	15/64	9/32	21/64	3/8	27/64	15/32	33/64	9/16	21/32	3/4	15/16	15/16	1 1/32	1 1/8
I	3/32	7/64	1/8	1/8	1/8	1/8	1/8	1/8	1/8	1/8	1/8	7/32	7/32	1/4	1/4
K	1/16	1/16	3/32	3/32	3/32	3/32	3/32	3/32	3/32	3/32	3/32	5/32	5/32	3/16	3/16
d	1/16	1/16	3/32	3/32	3/32	1/8	1/8	1/8	1/8	1/8	1/8	11/64	11/64	13/64	13/64

INTERNATIONAL (METRIC SYSTEM) STANDARD 60° THREAD

Diameter of Screw	Pitch	Diameter at Root of Thread	Width of Flat at Top and Bottom of Thread
<i>Millimetres</i>	<i>Millimetres</i>	<i>Millimetres</i>	<i>Millimetres</i>
3	.5	2.35	.06
4	.75	3.03	.09
5	.75	4.03	.09
6	1.0	4.70	.13
7	1.0	5.70	.13
8	1.0	6.70	.13
8	1.25	6.38	.16
9	1.0	7.70	.13
9	1.25	7.38	.16
10	1.5	8.05	.19
11	1.5	9.05	.19
12	1.5	10.05	.19
12	1.75	9.73	.22
14	2.0	11.40	.25
16	2.0	13.40	.25
18	2.5	14.75	.31
20	2.5	16.75	.31
22	2.5	18.75	.31
22	3.0	18.10	.38
24	3.0	20.10	.38
26	3.0	22.10	.38
27	3.0	23.10	.38
28	3.0	24.10	.38
30	3.5	25.45	.44
32	3.5	27.45	.44
33	3.5	28.45	.44
34	3.5	29.45	.44
36	4.0	30.80	.5
38	4.0	32.80	.5
39	4.0	33.80	.5
40	4.0	34.80	.5
42	4.5	36.15	.56
44	4.5	38.15	.56
45	4.5	39.15	.56
46	4.5	40.15	.56
48	5.0	41.51	.63
50	5.0	43.51	.62
52	5.0	45.51	.63

NOTE.—This thread is largely used by Italian constructors.

UNITED STATES 60° SCREW THREAD



$$\text{Formula} \left\{ \begin{array}{l} p = \text{pitch} = \frac{\text{No. threads per inch}}{1} \\ d = \text{depth} = p \times .6495 \\ f = \text{flat} = \frac{p}{8} \end{array} \right.$$

Diameter of Screw	Threads to Inch	Diameter at Root of Thread	Width of Flat
1/4	20	.185	.0063
5/16	18	.2403	.0069
3/8	16	.2936	.0078
7/16	14	.3447	.0089
1/2	13	.4001	.0096
9/16	12	.4542	.0104
5/8	11	.5069	.0114
3/4	10	.6201	.0125
7/8	9	.7307	.0139
1	8	.8376	.0156
1 1/8	7	.9394	.0179
1 1/4	7	1.0644	.0179
1 3/8	6	1.1585	.0208
1 1/2	6	1.2835	.0208
1 5/8	5 1/2	1.3888	.0227
1 3/4	5	1.4902	.0250
1 7/8	5	1.6152	.0250
2	4 1/2	1.7113	.0278
2 1/4	4 1/2	1.9613	.0278
2 1/2	4	2.1752	.0313
2 3/4	4	2.4252	.0313
3	3 1/2	2.6288	.0357
3 1/4	3 1/2	2.8788	.0357
3 1/2	3 1/2	3.1003	.0385
3 3/4	3	3.3170	.0417
4	3	3.5670	.0418
4 1/4	2 1/2	3.7982	.0455
4 1/2	2 1/2	4.0276	.0455
4 3/4	2 1/2	4.2551	.0476
5	2 1/2	4.4804	.0500
5 1/4	2 1/2	4.7304	.0500
5 1/2	2 1/2	4.9530	.0526
5 3/4	2 1/2	5.2030	.0526
6	2 1/2	5.4226	.0556

STANDARD PROPORTIONS FOR MACHINE SCREWS

The report of the committee on standard proportions for machine screws of the American Society of Mechanical Engineers is published in the October, 1906, proceedings of the society. The report is substantially in agreement with the recommendations adopted at the joint meeting held in New York, April 11, 1904.

The committee believes the following combined details to be essential in establishing and maintaining a standard for the diameters, threads and heads of machine screws, including, as it does, diameters, threads and limits for the taps which are to be used in connection therewith: (a) form of thread, (b) diameters, (c) number of threads per inch, (d) standard reference thread gauges, basic and for screws and taps, (e) working gauges for screws and taps, (f) limits of variation, measured in the angle of the thread, (g) limits of variation in external diameter, (h) limits of variation in the pitch of the thread screws and taps, (k) proportions of the heads.

DRILL SIZES FOR STANDARD THREADS

These sizes give an allowance above the bottom of thread on sizes $\frac{3}{16}$ to 2; varying respectively as follows: for "V" Threads, .010" to .055"; for U. S. S. and Whitworth threads, .005" to .027".

These are found by adding to the size at bottom of thread $\frac{1}{4}$ of the pitch for "V" threads, and $\frac{1}{8}$ of the pitch for U. S. S. and Whitworth, the pitch being equal to $1" \div \text{No. of threads per } 1"$.

In practice it is better to use a larger drill if the exact size called for cannot be had.

Size Screw	No. of Threads	SIZE OF DRILL			Size Screw	No. of Threads	SIZE OF DRILL		
		U. S. S.	" V "	W.			U. S. S.	" V "	W.
$\frac{1}{4}$	24	.201	.196	.202	$1\frac{5}{16}$	9	.808	.790	.810
$\frac{1}{4}$	20	.191	.184	.192	1	8	.854	.832	.856
$\frac{5}{16}$	18	.248	.239	.249	$1\frac{1}{16}$	8	.917	.894	.919
$\frac{3}{8}$	16	.302	.293	.303	$1\frac{1}{8}$	7	.957	.932	.960
$\frac{7}{16}$	14	.354	.345	.355	$1\frac{1}{4}$	7	1.082	1.057	1.085
$\frac{1}{2}$	13	.409	.399	.410	$1\frac{3}{8}$	6	1.179	1.144	1.182
$\frac{1}{2}$	12	.402	.391	.403	$1\frac{1}{2}$	6	1.304	1.269	1.307
$\frac{9}{16}$	12	.465	.453	.466	$1\frac{5}{8}$	$5\frac{1}{2}$	1.412	1.372	1.416
$\frac{5}{8}$	11	.518	.506	.520	$1\frac{5}{8}$	5	1.390	1.347	1.394
$1\frac{1}{16}$	11	.581	.568	.583	$1\frac{3}{4}$	5	1.515	1.472	1.519
$\frac{3}{4}$	10	.632	.618	.634	$1\frac{7}{8}$	5	1.640	1.597	1.644
$1\frac{1}{8}$	10	.695	.680	.697	$1\frac{7}{8}$	$4\frac{1}{2}$	1.614	1.566	1.619
$\frac{7}{8}$	9	.745	.728	.747	2	$4\frac{1}{2}$	1.739	1.691	1.744

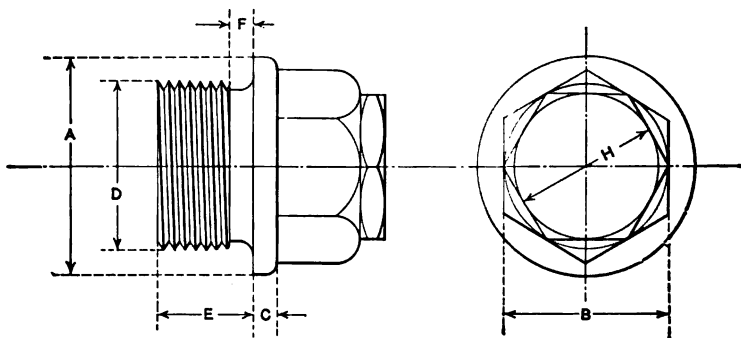
DRILL SIZES FOR S. A. E. THREADS

Size of Tap	Size of Drill
$\frac{1}{4}$ inch x 28 threads	$\frac{7}{32}$ inch
$\frac{5}{16}$ " x 24 "	$\frac{17}{64}$ "
$\frac{3}{8}$ " x 24 "	$\frac{21}{64}$ "
$\frac{7}{16}$ " x 20 "	$\frac{3}{8}$ "
$\frac{1}{2}$ " x 20 "	$\frac{7}{16}$ "
$\frac{9}{16}$ " x 18 "	$\frac{1}{2}$ "
$\frac{5}{8}$ " x 18 "	$\frac{9}{16}$ "
$1\frac{1}{16}$ " x 16 "	$\frac{39}{64}$ "
$\frac{3}{4}$ " x 16 "	$\frac{43}{64}$ "
$\frac{7}{8}$ " x 14 "	$\frac{25}{32}$ "
1 " x 14 "	$\frac{29}{32}$ "
$1\frac{1}{8}$ " x 12 "	$1\frac{1}{8}$ "
$1\frac{1}{4}$ " x 12 "	$1\frac{9}{16}$ "
$1\frac{3}{8}$ " x 12 "	$1\frac{17}{64}$ "
$1\frac{1}{2}$ " x 12 "	$1\frac{25}{64}$ "

The above tap drills allow a thread within $\frac{1}{64}$ in. of full thread.

S. A. E. STANDARD SPARK PLUG

The spark plug adopted as a standard has a $\frac{7}{8}$ -inch diameter, straight thread, 18 pitch, and the design and dimensions shown in the following drawing and specifications:



A—One and one-eighth inch ($1\frac{1}{8}$ ").

B—Seven-eighths inch ($\frac{7}{8}$ ").

C—One-eighth inch ($\frac{1}{8}$ ").

D—Seven-eighths inch ($\frac{7}{8}$ ").

E—Not less than one-half inch (min. $\frac{1}{2}$ ").

F—Not more than one-eighth inch (max. $\frac{1}{8}$ "). (Depth of recess—not over depth of thread).

H—Three-quarters inch ($\frac{3}{4}$ ").

SPECIFICATIONS

STOCK— $1\frac{1}{8}$ inch round.

HEAD FORM—Milled Hex.

SHORT DIAMETER— $\frac{7}{8}$ inch.

FLANGE FORM—Circular.

DIAMETER— $1\frac{1}{8}$ inch.

THICKNESS— $\frac{1}{8}$ inch.

FACE—Annular seat $\frac{1}{8}$ inch wide. (Suitable for McKim Type Copper-Asbestos Gasket.)

BLANK FOR THREAD—DIAMETER— $\frac{7}{8}$ inch.

LENGTH—Not less than $\frac{1}{2}$ inch.

RECESS ADJACENT TO FLANGE—WIDTH—Not over $\frac{1}{8}$ inch.

DEPTH—Not over depth of thread.

THREAD DIAMETER— $\frac{7}{8}$ inch straight.

PITCH—18.

FORM—U. S. Standard.

CUT—Perfect into recess.

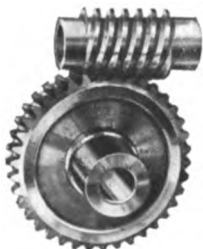
Tolerance in third diameter + 0"—.003".

PACKING-GLAND NUT HEAD—FORM—Hexagonal.

SHORT DIAMETER— $\frac{3}{4}$ inch.

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Helical Gears
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DIMENSIONS OF SQUARE AND HEXAGON BOLT HEADS AND SIZE OF STOCK REQUIRED

UNITED STATES STANDARD SIZES

Diameter	Distance Across Flats, Square and Hexagon	Distance Across Corners, Hexagon	Thickness of Head	Stock for Square Head	Stock for Hexagon Head	Diameter
<i>Inches</i>	<i>Inches</i>	<i>Inches</i>	<i>Inches</i>	<i>Inches</i>	<i>Inches</i>	<i>Inches</i>
$\frac{1}{4}$	$\frac{1}{2}$	$\frac{9}{16}$	$\frac{1}{4}$	$1\frac{1}{32}$	$1\frac{1}{32}$	$\frac{1}{4}$
$\frac{3}{8}$	$11\frac{1}{16}$	$25\frac{1}{32}$	$11\frac{1}{32}$	$1\frac{1}{2}$	$1\frac{1}{4}$	$\frac{3}{8}$
$\frac{1}{2}$	$\frac{7}{8}$	1	$\frac{7}{16}$	$1\frac{29}{32}$	$1\frac{1}{2}$	$\frac{1}{2}$
$\frac{5}{8}$	$1\frac{1}{4}$	$1\frac{7}{32}$	$1\frac{7}{32}$	2	$1\frac{11}{16}$	$\frac{5}{8}$
$\frac{3}{4}$	$1\frac{1}{4}$	$1\frac{7}{16}$	$\frac{5}{8}$	$2\frac{7}{32}$	$1\frac{15}{16}$	$\frac{3}{4}$
$\frac{7}{8}$	$1\frac{7}{16}$	$1\frac{21}{32}$	$2\frac{1}{32}$	$2\frac{1}{2}$	$2\frac{5}{32}$	$\frac{7}{8}$
1	$1\frac{5}{8}$	$1\frac{7}{8}$	$1\frac{3}{16}$	$2\frac{3}{4}$	$2\frac{3}{8}$	1
$1\frac{1}{8}$	$1\frac{13}{16}$	$2\frac{5}{32}$	$2\frac{9}{32}$	3	$2\frac{19}{32}$	$1\frac{1}{8}$
$1\frac{1}{4}$	2	$2\frac{5}{16}$	1	$3\frac{1}{4}$	$2\frac{27}{32}$	$1\frac{1}{4}$
$1\frac{3}{8}$	$2\frac{3}{16}$	$2\frac{1}{2}$	$1\frac{3}{32}$	$3\frac{5}{16}$	3	$1\frac{3}{8}$
$1\frac{1}{2}$	$2\frac{3}{8}$	$2\frac{3}{4}$	$1\frac{3}{16}$	$3\frac{13}{16}$	$3\frac{5}{16}$	$1\frac{1}{2}$
$1\frac{5}{8}$	$2\frac{9}{16}$	$2\frac{15}{16}$	$1\frac{9}{32}$	$4\frac{1}{16}$	$3\frac{1}{2}$	$1\frac{5}{8}$
$1\frac{3}{4}$	$2\frac{3}{4}$	$3\frac{3}{16}$	$1\frac{3}{8}$	$4\frac{3}{8}$	$3\frac{3}{4}$	$1\frac{3}{4}$
$1\frac{7}{8}$	$2\frac{15}{16}$	$3\frac{13}{32}$	$1\frac{15}{32}$	$4\frac{5}{8}$	4	$1\frac{7}{8}$
2	$3\frac{1}{8}$	$3\frac{5}{8}$	$1\frac{9}{16}$	$4\frac{7}{8}$	$4\frac{1}{4}$	2
$2\frac{1}{4}$	$3\frac{1}{2}$	$4\frac{1}{16}$	$1\frac{3}{4}$	$5\frac{7}{16}$	$4\frac{25}{32}$	$2\frac{1}{4}$
$2\frac{1}{2}$	$3\frac{7}{8}$	$4\frac{1}{2}$	$1\frac{15}{16}$	$5\frac{15}{16}$	$5\frac{1}{16}$	$2\frac{1}{2}$
$2\frac{3}{4}$	$4\frac{1}{4}$	$4\frac{7}{8}$	$2\frac{1}{8}$	$6\frac{7}{16}$	$5\frac{1}{2}$	$2\frac{3}{4}$
3	$4\frac{5}{8}$	$5\frac{11}{32}$	$2\frac{5}{16}$	7	$6\frac{1}{16}$	3

MANUFACTURERS' STANDARD SIZES

Diameter	Distance Across Flats, Square	Distance Across Flats, Hexagon	Thickness of Head	Stock for Square Head	Stock for Hexagon Head	Diameter
<i>Inches</i>	<i>Inches</i>	<i>Inches</i>	<i>Inches</i>	<i>Inches</i>	<i>Inches</i>	<i>Inches</i>
$\frac{1}{4}$	$\frac{3}{8}$	$\frac{7}{16}$	$\frac{3}{16}$	$1\frac{7}{32}$	$2\frac{9}{32}$	$\frac{1}{4}$
$\frac{3}{8}$	$\frac{9}{16}$	$\frac{5}{8}$	$\frac{9}{32}$	$1\frac{3}{16}$	$1\frac{5}{16}$	$\frac{3}{8}$
$\frac{1}{2}$	$\frac{3}{4}$	$1\frac{1}{16}$	$\frac{3}{8}$	$1\frac{1}{16}$	$1\frac{3}{8}$	$\frac{1}{2}$
$\frac{5}{8}$	$1\frac{1}{16}$	1	$1\frac{13}{32}$	$1\frac{11}{32}$	$1\frac{13}{32}$	$\frac{5}{8}$
$\frac{3}{4}$	$1\frac{1}{8}$	$1\frac{3}{16}$	$\frac{9}{16}$	$1\frac{5}{8}$	$1\frac{9}{16}$	$\frac{3}{4}$
$\frac{7}{8}$	$1\frac{9}{16}$	$1\frac{3}{8}$	$2\frac{1}{32}$	$1\frac{7}{8}$	$1\frac{7}{8}$	$\frac{7}{8}$
1	$1\frac{1}{2}$	$1\frac{9}{16}$	$\frac{3}{4}$	$2\frac{5}{32}$	$2\frac{1}{32}$	1
$1\frac{1}{8}$	$1\frac{11}{16}$	$1\frac{3}{4}$	$2\frac{7}{32}$	$2\frac{13}{32}$	$2\frac{7}{32}$	$1\frac{1}{8}$
$1\frac{1}{4}$	$1\frac{7}{8}$	$1\frac{15}{16}$	$1\frac{15}{16}$	$2\frac{11}{16}$	$2\frac{7}{16}$	$1\frac{1}{4}$
$1\frac{3}{8}$	$2\frac{1}{16}$	$2\frac{1}{8}$	$1\frac{1}{16}$	$3\frac{1}{32}$	$2\frac{27}{32}$	$1\frac{3}{8}$
$1\frac{1}{2}$	$2\frac{1}{4}$	$2\frac{5}{16}$	$1\frac{1}{8}$	$3\frac{7}{32}$	3	$1\frac{1}{2}$
$1\frac{5}{8}$	$2\frac{7}{16}$	$2\frac{1}{2}$	$1\frac{1}{4}$	$3\frac{19}{32}$	$3\frac{1}{4}$	$1\frac{5}{8}$
$1\frac{3}{4}$	$2\frac{5}{8}$	$2\frac{11}{16}$	$1\frac{9}{16}$	$3\frac{3}{4}$	$3\frac{15}{32}$	$1\frac{3}{4}$
$1\frac{7}{8}$	$2\frac{13}{16}$	$2\frac{7}{8}$	$1\frac{7}{16}$	$4\frac{9}{32}$	$3\frac{29}{32}$	$1\frac{7}{8}$
2	3	$3\frac{1}{4}$	$1\frac{1}{2}$	$4\frac{9}{16}$	4	2
$2\frac{1}{4}$	$3\frac{3}{8}$	$3\frac{7}{16}$	$1\frac{3}{4}$	5	$4\frac{9}{16}$	$2\frac{1}{4}$
$2\frac{1}{2}$	$3\frac{3}{4}$	$3\frac{13}{16}$	$1\frac{7}{8}$	$5\frac{3}{8}$	$4\frac{13}{16}$	$2\frac{1}{2}$
$2\frac{3}{4}$	$4\frac{1}{8}$	$4\frac{1}{4}$	$2\frac{1}{16}$	$5\frac{29}{32}$	$5\frac{3}{8}$	$2\frac{3}{4}$
3	$4\frac{1}{2}$	$4\frac{9}{16}$	$2\frac{1}{4}$	$6\frac{7}{16}$	$5\frac{11}{16}$	3

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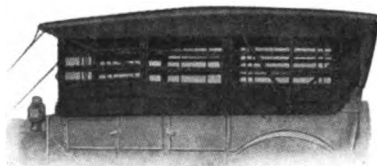


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Better pay \$1.50 once than a dollar a dozen times. That's about the ratio of Anderson Spark Plug life, compared with ordinary plugs.

ALL SIZES

Anderson Spark Plug Co.
 206 North Holliday Street, Baltimore, Md.



On in a flash—off in a flash. Clear vision the entire length of car; operated by simply pulling a strap and it is up; all fastenings are made from the inside of car; no flapping in the wind; no bulging in slip cover; takes no head room; automatic in action; efficient, durable, cheap, up-to-the-minute; shop rights to factories; retail branches in all large cities.

Detroit Flash Curtain Co.
 613 Free Press Bldg., Detroit, Mich.

UNITED STATES STANDARD BOLTS AND NUTS

Diameter of Bolt Inches	Area at Bottom of Thread	Tensile Strength at 10,000 Pounds per Square Inch	Threads per Inch	Thickness of Head.	Thickness of Nut	Short Diameter Square or Hexagon Head or Nut	Long Diameter Square Head or Nut	Long Diameter Hexagon Head or Nut	Weight Each Square Nut	Weight Each Hexagon Nut	Weight per 100 Square Nuts	Weight per 100 Hexagon Nuts	Weight per Inch Length of Bolt
$\frac{1}{4}$	.0269	269	20	$\frac{1}{4}$	$\frac{1}{4}$	$\frac{1}{2}$	$\frac{11}{16}$	$\frac{9}{16}$	.0138	.0131	1.38	1.31	.0136
$\frac{5}{16}$	.0454	454	18	$\frac{19}{64}$	$\frac{5}{16}$	$\frac{19}{32}$	$\frac{13}{16}$	$\frac{11}{16}$	.0231	.0192	2.31	1.92	.0213
$\frac{3}{8}$	.0678	678	16	$\frac{11}{32}$	$\frac{3}{8}$	$\frac{11}{16}$	1	$\frac{13}{16}$	.0426	.0333	4.26	3.33	.0306
$\frac{7}{16}$	.0933	933	14	$\frac{25}{64}$	$\frac{7}{16}$	$\frac{25}{32}$	$1\frac{1}{8}$	$\frac{7}{8}$	.0613	.0500	6.13	5.00	.0417
$\frac{1}{2}$	.1257	1,257	13	$\frac{7}{16}$	$\frac{1}{2}$	$\frac{7}{8}$	$1\frac{1}{4}$	1	.0893	.0700	8.93	7.00	.0545
$\frac{5}{8}$	.2018	2,018	11	$\frac{17}{32}$	$\frac{5}{8}$	$1\frac{1}{8}$	$1\frac{1}{2}$	$1\frac{1}{4}$	.1560	.1350	15.60	13.50	.0852
$\frac{3}{4}$	.3020	3,020	10	$\frac{5}{8}$	$\frac{3}{4}$	$1\frac{1}{4}$	$1\frac{3}{4}$	$1\frac{1}{2}$	.2630	.2220	26.30	22.20	.1227
$\frac{7}{8}$	.4193	4,193	9	$\frac{23}{32}$	$\frac{7}{8}$	$1\frac{1}{8}$	$2\frac{1}{8}$	$1\frac{1}{2}$	.3570	.3240	35.70	32.40	.1670
1	.5510	5,510	8	$\frac{13}{16}$	1	$1\frac{5}{8}$	$2\frac{1}{8}$	$1\frac{7}{8}$	.5880	.4630	58.80	46.30	.2181
$1\frac{1}{8}$	.6931	6,931	7	$\frac{29}{32}$	$1\frac{1}{8}$	$1\frac{13}{16}$	$2\frac{1}{2}$	$2\frac{1}{8}$	.7690	.6760	76.90	67.60	.2760
$1\frac{1}{4}$	.8899	8,899	7	1	$1\frac{1}{4}$	2	$2\frac{13}{16}$	$2\frac{1}{2}$	1.04	.9010	104	90.10	.3410
$1\frac{3}{8}$	1.0541	10,541	6	$\frac{13}{32}$	$1\frac{3}{8}$	$2\frac{1}{8}$	$3\frac{1}{8}$	$2\frac{1}{2}$	1.43	1.18	143	118	.4120
$1\frac{1}{2}$	1.2938	12,938	6	$\frac{13}{16}$	$1\frac{1}{2}$	$2\frac{3}{8}$	$3\frac{3}{8}$	$2\frac{3}{4}$	1.72	1.47	172	147	.4906
$1\frac{3}{4}$	1.7441	17,441	5	$1\frac{3}{8}$	$1\frac{3}{4}$	$2\frac{3}{4}$	$3\frac{7}{8}$	$3\frac{3}{8}$	2.94	2.50	294	250	.6686
2	2.3001	23,001	4	$1\frac{15}{16}$	2	$3\frac{1}{8}$	$4\frac{1}{8}$	$3\frac{5}{8}$	4.35	3.45	435	345	.8720

TABLE OF RIVETS IN 100 POUNDS
APPROXIMATE NUMBER

Length Rivets	DIAMETER OF RIVETS											
	$\frac{1}{8}$	$\frac{3}{16}$	$\frac{1}{4}$	$\frac{5}{16}$	$\frac{3}{8}$	$\frac{7}{16}$	$\frac{1}{2}$	$\frac{5}{8}$	$1\frac{1}{16}$	$\frac{3}{4}$	$\frac{7}{8}$	1
$\frac{1}{2}$	17500	15900	8000	5100	3200	1900	.....	.....	.....	.....	.....	.....
$\frac{5}{8}$	16000	13800	7000	4500	2900	1800	.....	.....	.....	.....	.....	.....
$\frac{3}{4}$	14400	12200	6300	4100	2373	1476	1103	642	.....	.....	.....	.....
$\frac{7}{8}$	13500	10900	5700	3700	2190	1371	1030	604	.....	.....	.....	.....
1	12600	9800	5200	3400	2034	1280	968	571	400	345	.....	.....
$1\frac{1}{8}$	11600	9000	4700	3100	1898	1200	910	541	382	322	208	.....
$1\frac{1}{4}$	10800	8300	4400	2900	1780	1129	862	514	365	311	206	.....
$1\frac{3}{8}$	10000	7600	4100	2700	1675	1066	815	489	350	295	204	.....
$1\frac{1}{2}$	9300	7100	4000	2500	1582	1010	776	462	335	284	201	.....
$1\frac{5}{8}$	8700	.....	3800	2300	1498	960	740	446	324	275	199	132
$1\frac{3}{4}$	8100	6300	3500	2200	1424	914	707	428	311	266	192	128
$1\frac{7}{8}$	.....	.....	3400	2000	1356	872	672	411	302	257	185	124
2	.....	5600	3000	1900	1295	834	648	395	293	249	178	120
$2\frac{1}{8}$	.....	.....	.....	.....	1238	800	623	381	285	240	172	116
$2\frac{1}{4}$	.....	5000	2800	1800	1187	768	599	367	277	233	167	112
$2\frac{3}{8}$	.....	.....	.....	.....	1139	738	577	354	269	226	162	108
$2\frac{1}{2}$	.....	4600	2500	1700	1095	711	556	343	261	219	157	104
$2\frac{5}{8}$	.....	.....	.....	.....	1052	687	537	332	253	212	152	106
$2\frac{3}{4}$	.....	4200	2300	1500	1017	662	519	321	245	206	148	96
$2\frac{7}{8}$	982	636	503	311	237	201	144	92
3	3900	2200	1400	949	611	487	302	230	196	140	88

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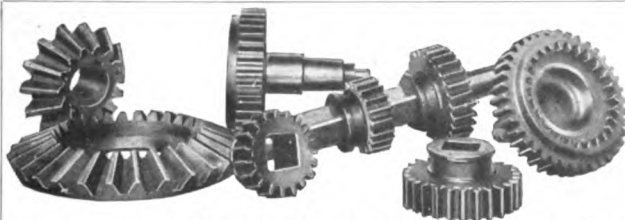
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**ABSOLUTELY FREE FROM IMPURITIES, FOR STORAGE
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Specialists on Heavy Hardened Gears for Farm Tractors,
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The merchant who has ten trucks to install, the doctor who wants an electric runabout, the banker who wants a \$6,000 car and even the man who wants a \$500 car.

Men who own cars ask advice about accessories—such as tires, shock absorbers, oils, even what kind of paint to repaint a car.

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Compressed air—	Fits any car—
Kellogg pump—	Starts from drivers
No air in engine	seat—Air for tires
cylinders—No	—Easy to under-
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Starts Motor Naturally

We also manufacture the
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WEIGHT IN POUNDS OF A LINEAL FOOT OF ROUND, SQUARE AND OCTAGON STEEL

Size in Inches	Round	Octagon	Square	Size in Inches	Round	Octagon	Square
$\frac{1}{16}$	.010	.011	.013	$2\frac{1}{2}$	16.79	17.71	21.37
$\frac{1}{8}$	.042	.044	.053	$2\frac{5}{8}$	18.51	19.52	23.56
$\frac{3}{16}$	.094	.099	.120	$2\frac{3}{4}$	20.31	21.42	25.86
$\frac{1}{4}$	.168	.177	.214	$2\frac{7}{8}$	22.20	23.41	28.27
$\frac{5}{16}$	.262	.277	.334	3	24.17	25.50	30.78
$\frac{3}{8}$	.378	.398	.491	$3\frac{1}{8}$	26.23	27.66	33.40
$\frac{7}{16}$	.514	.542	.655	$3\frac{1}{4}$	28.37	29.92	36.12
$\frac{1}{2}$	.671	.708	.855	$3\frac{3}{8}$	30.59	32.27	38.95
$\frac{9}{16}$	.850	.896	1.082	$3\frac{1}{2}$	32.90	34.70	41.89
$\frac{5}{8}$	1.049	1.107	1.336	$3\frac{5}{8}$	35.29	37.23	44.94
$1\frac{1}{16}$	1.270	1.339	1.616	$3\frac{3}{4}$	37.77	39.84	48.09
$\frac{3}{4}$	1.511	1.594	1.924	$3\frac{7}{8}$	40.33	42.54	51.35
$1\frac{1}{8}$	1.773	1.870	2.258	4	42.97	45.33	54.72
$\frac{7}{8}$	2.056	2.169	2.618	$4\frac{1}{4}$	48.51	51.17	61.77
$\frac{9}{8}$	2.361	2.490	3.006	$4\frac{1}{2}$	54.39	57.37	69.25
	2.686	2.833	3.420	$4\frac{3}{4}$	60.60	63.92	77.16
$1\frac{1}{8}$	3.399	3.585	4.328	5	67.15	70.83	85.50
$1\frac{1}{4}$	4.197	4.427	5.344	$5\frac{1}{4}$	74.03	78.08	94.26
$1\frac{3}{8}$	5.078	5.356	6.466	$5\frac{1}{2}$	81.25	85.70	103.45
$1\frac{1}{2}$	6.044	6.374	7.695	$5\frac{3}{4}$	88.80	93.67	113.07
$1\frac{5}{8}$	7.093	7.481	9.031	6	96.69	101.99	123.12
$1\frac{3}{4}$	8.226	8.674	10.474	7	131.61	138.82	167.58
$1\frac{7}{8}$	9.443	9.960	12.023	8	171.90	181.32	218.88
2	10.744	11.332	13.680	9	217.57	229.48	277.02
$2\frac{1}{8}$	12.129	12.793	15.443	10	268.60	283.31	342.00
$2\frac{1}{4}$	13.598	14.343	17.314	11	325.01	342.80	413.82
$2\frac{3}{8}$	15.151	15.981	19.291	12	386.79	407.97	492.48

The THURBER ROTARY STARTER

is operated by compressed air—the BEST principle

Compressed air has been universally recognized as the best means of starting and stopping heavy bodies. It is used on railroad brakes throughout the world, and it is used on the THURBER ROTARY STARTER for automobiles.

The THURBER ROTARY STARTER is operated by compressed air, furnished by the Kellogg water-cooled high pressure pump, which makes it possible to carry 200 pounds pressure at all times.

The air is stored in a tank of welded steel, located beneath the body of the car.

In starting, the driver simply presses his foot on the patented double-acting valve, shown below. Air is immediately delivered by pipe to the starter, which spins the motor. As soon as the motor starts, an automatic clutch disengages the starter and it remains idle until a new start is to be made.

There is nothing complicated, no intricate mechanism to operate or keep up.

Manufacturers, if you are desirous of adding self-starting equipment as a selling argument on your new models, you should investigate the THURBER ROTARY STARTER. It will spin the most obstinate motor at all times and in any temperature. It never goes wrong.

**The Thurber Rotary Starter Company
DETROIT, MICH.**

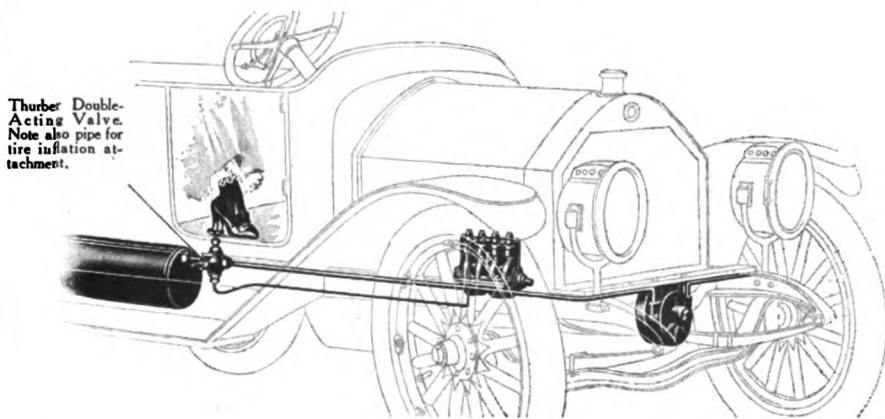


Fig. 1.

Thurber Rotary Starter system attached to car. Rotary in front is the only part exposed to view. Pump is under hood and tank under body of car. Note few parts and simple, clean arrangement. Note small size of starter as compared to lamps.

138 E.

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DIMENSIONS OF STANDARD WEIGHT WROUGHT-IRON PIPE

1¼ and smaller proved to 300 pounds per square inch by hydraulic pressure.

1½ and larger proved to 500 pounds per square inch by hydraulic pressure.

Inside diameter.	Actual Outside Diameter.	Thickness.	Actual Inside Diameter.	Inside Circumference.	Outside Circumference.	Length of Pipe per square foot of inside surface.	Length of Pipe per square foot of outside surface.	Inside Area.	Outside Area.	Length of Pipe containing one cubic foot.	Weight per foot.	No. of Threads per inch of screw.	Taper of threads per inch of screw.
<i>In.</i>	<i>In.</i>	<i>In.</i>	<i>In.</i>	<i>In.</i>	<i>In.</i>	<i>Ft.</i>	<i>Ft.</i>	<i>In.</i>	<i>In.</i>	<i>Ft.</i>	<i>Lbs.</i>		<i>In.</i>
⅛	0.405	0.068	0.270	0.848	1.272	14.15	9.44	0.0572	0.129	2500.	0.243	27	⅜
¼	.54	.088	.364	1.144	1.696	10.50	7.075	.1041	.229	1385.	.422	18	⅜
⅜	.675	.091	.494	1.552	2.121	7.67	5.657	.1916	.358	751.5	.561	18	⅜
½	.84	.109	.623	1.957	2.652	6.13	4.502	.3048	.554	472.4	.845	14	⅜
¾	1.05	.113	.824	2.589	3.299	4.635	3.637	.5333	.866	270.	1.126	14	⅜
1	1.315	.134	1.048	3.292	4.134	3.679	2.903	.8627	1.357	166.9	1.670	11½	⅜
1¼	1.66	.140	1.380	4.335	5.215	2.768	2.301	1.496	2.164	96.25	2.258	11½	⅜
1½	1.90	.145	1.611	5.061	5.969	2.371	2.01	2.038	2.835	70.65	2.694	11½	⅜
2	2.375	.154	2.067	6.494	7.461	1.848	1.611	3.355	4.430	42.36	3.600	11½	⅜
2½	2.875	.204	2.468	7.754	9.032	1.547	1.328	4.783	6.491	30.11	5.773	8	⅜
3	3.50	.217	3.067	9.636	10.996	1.245	1.091	7.388	9.621	19.49	7.547	8	⅜

SIZING AND CUTTING OF GEAR WHEELS

The word "diameter," when applied to gears, is always understood to mean the pitch diameter.

Diametral pitch of the gear is the number of teeth to each inch of its pitch diameter.

If a gear has 40 teeth and the pitch diameter is 4 inches there are ten teeth to each inch of the pitch diameter, and the diametral pitch is 10, or in other words the gear is 10 diametral pitch.

Circular pitch is the distance from the center of one tooth to the center of the next tooth, measured along the pitch circle.

If the distance from the center of one tooth to the center of next tooth, measured along the pitch circle, is ½ inch the gear is ½ inch circular pitch.

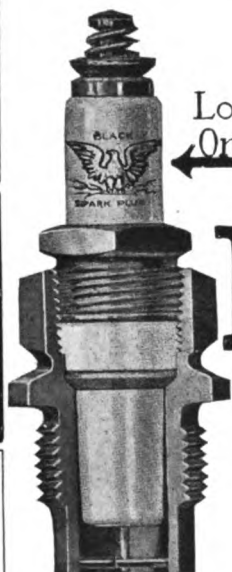
The *diametral pitch* given, to obtain the circular pitch divide 3.1416 by the diametral pitch.

If the diametral pitch is 4 divide 3.1416 by 4, and the quotient, .7854 inch is the circular pitch.

(Continued on page 668)



This is the TradeMark
of the Spark Plug
without an Apology



Look for it
On the Plug



Black Eagle Spark Plug

A spark plug for 50c equal to any plug
ranging in price from 75c to \$3.00!

We sell the Black Eagle spark plug at a certain fixed profit over manufacturing cost—and we do not follow established price precedent—

We find that we are able to turn out a plug—high grade in every particular—which can be sold at our price.

No better materials than we use can be had by any other manufacturer.

No more expert, highly paid workmen can be found in any factory.

No manufacturing facilities in this line can surpass ours.

That we can sell you the sturdiest, strongest plug at 50c argues only the fact that we can well afford quick sales at small profits.

Remember, our guarantee of perfection of all electrical and insulating features protects you—we have been making this guarantee for some years and—

"We are in the habit of making our guarantee good."

Order a set to-day—from your dealer or from us. We pay all shipping charges.

THE STANDARD COMPANY
TORRINGTON, CONN.

The circular pitch given, to obtain the diametral pitch divide 3.1416 by the circular pitch.

If the circular pitch is 2 inches, divide 3.1416 by 2, and the quotient, 1.5708, is the diametral pitch.

The number of teeth and the diametral pitch given, to obtain the pitch diameter divide the number of teeth by the diametral pitch.

If the number of teeth is 40 and the diametral pitch 4 divide 40 by 4, and the quotient, 10, is the pitch diameter.

The number of teeth and the diametral pitch given, to obtain the whole diameter or size of blank of gear add 2 to the number of teeth and divide by the diametral pitch.

If the number of teeth is 40 and the diametral pitch is 4 add 2 to the 40, making 42, and divide by 4; the quotient, $10\frac{1}{2}$ is the whole diameter of the gear or blank.

The number of teeth and the diameter of the blank given, to obtain the diametral pitch add 2 to the number of teeth and divide by the diameter of the blank.

If the number of teeth is 40, and the diameter of the blank is $10\frac{1}{2}$ inches, add 2 to the number of teeth, making 42, and divide by $10\frac{1}{2}$; the quotient, 4, is the diametral pitch.

The pitch diameter and the diametral pitch given, to obtain the number of teeth multiply the pitch diameter by the diametral pitch.

If the diameter of the pitch circle is 10 inches and the diametral pitch is 4 multiply 10 by 4, and the product, 40, will be the number of teeth in the gear.

The whole diameter of the blank and the diametral pitch given, to obtain the number of teeth in the gear multiply the diameter by the diametral pitch and subtract 2.

If the whole diameter is $10\frac{1}{2}$ and the diametral pitch is 4 multiply $10\frac{1}{2}$ by 4 and the product, 42 less 2, or 40, is the number of teeth.

The thickness of a tooth at the pitch line is found by dividing the circular pitch by 2, or divide 1.57 by the diametral pitch.

If the circular pitch is 1.047 inches, or the diametral pitch is 3, divide 1.047 by 2 or 1.57 by 3, and the quotient, .523 inch, is the thickness of the tooth.

The whole depth of a tooth is found by dividing 2.157 by the diametral pitch.

If the diametral pitch of a gear is 6, the whole depth is 2.157 divided by 6, equals .3595.

The whole depth of a tooth is about 11-16, or exactly .6866 of the circular pitch.

If the circular pitch is 2 the whole depth of tooth is about 11-16 of 2 inches, or $1\frac{3}{4}$ inches nearly.

The distance between the centers of two gears is found by adding the number of teeth together and dividing half the sum by the diametral pitch.

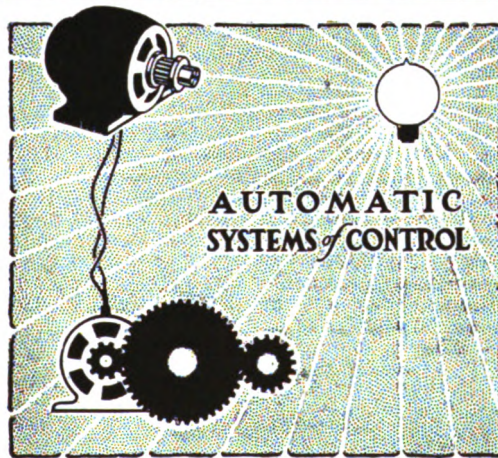
If two gears have 50 and 30 teeth, respectively, and are 5 pitch, add 50 and 30, making 80, divide by 2, and then divide the quotient, 40, by the diametral pitch 5, and the result, 8 inches, is the center distance.

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7 East 42d St., New York, N. Y.

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Treasurer, H. H. Rice

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General Manager, S. A. Miles

Asst. Gen. Mgr., J. S. Marvin

Counsel, Charles Thaddeus Terry

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7 East 42d St., New York, N. Y.

Objects: To foster the interests of those engaged in the trade or business of manufacturing automobiles and all other self-propelling vehicles.

To reform abuses relative thereto.

To secure freedom of its members from unjust or unlawful exactions.

To diffuse accurate and reliable information as to the standing of merchants and others dealing with members, as to all inventions, patents, processes or devices designed or intended for use in, upon, or in connection with such vehicles and the manufacture thereof, as to the state of the art relative thereto, and as to the condition and development of the trade in which the members are engaged, in the United States and foreign countries.

To procure uniformity and certainty in the customs and usages of such trade.

To promote the construction of better highways.

To advocate the enactment of just and equitable laws affecting members.

To settle differences between members.

To promote a more enlarged and friendly intercourse among business men engaged in such trade or dealing with persons engaged therein.

To acquire by grant, gift, purchase, device or bequest, to hold and to dispose of such property as the purposes of the corporation shall require, subject to such imitations as may be prescribed by law, including inventions, letters patent and processes, or rights thereunder, for the benefit of its members and not for pecuniary profit.

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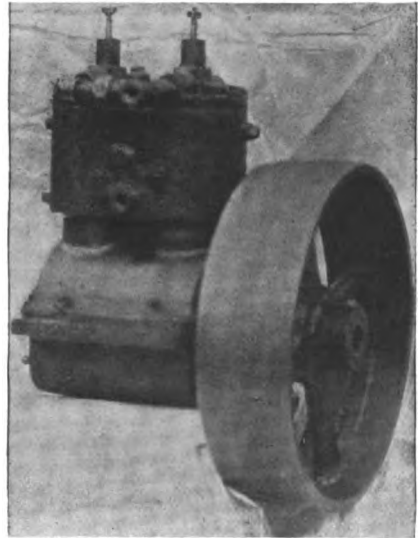
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Second Vice-President	Russell Huff
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80 Wall St., New York, N. Y.

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 Secretary and Treasurer, Franz Neilson, 80 Wall St., New York, N. Y.

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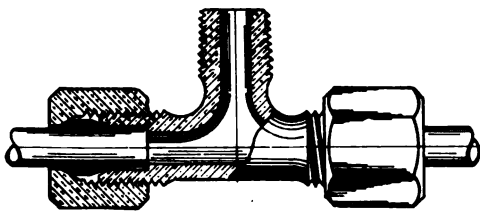
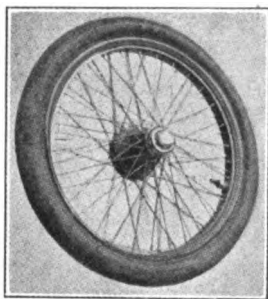
Objects: To promote in all lawful ways the interests of makers of motors, motor parts, and accessories.
 To aid in the protection of its members.
 To secure the advantages to be obtained by mutual co-operation.
 To facilitate the collection of the claims of its members and the diffusion of information concerning trade.
 To co-operate with similar associations in other states.

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124 West 42d St., New York, N. Y.

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INTERNAL COMBUSTION ENGINEERS ASSOCIATION

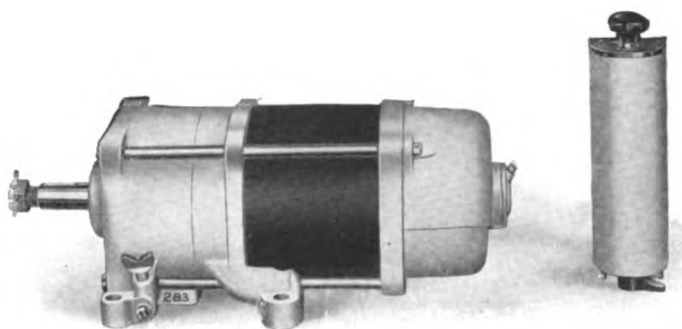
416 W. Indiana St., Chicago, Ill.

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Riggs Bldg, Washington, D. C.

Objects: To unite in one body all the automobile clubs and individual motorists of the country to secure reasonable and just legislation.

To aid in proper enforcement of automobile laws and ordinances; to advocate and obtain local, State, and Federal aid in the construction and maintenance of good roads.

To encourage touring, and to secure, prepare, and disseminate information relative thereto; and To support sportsmanlike contests and other movements that will advance motoring interests.

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To assist in the good-roads movement.
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29 West 39th St., New York, N. Y.

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Cincinnati, Ohio.

Object: To promote, further and advance the interests of the trade, also to hold a national convention once a year of the interested parties, the purpose of such convention to be for the promoting of education and sociability among the members of the Association.

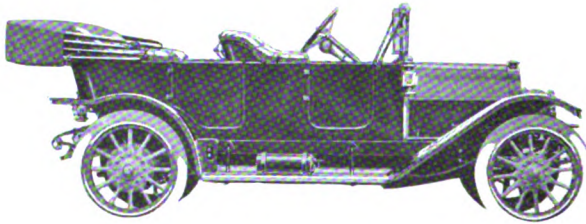
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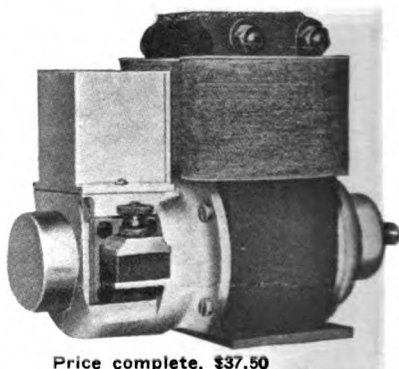
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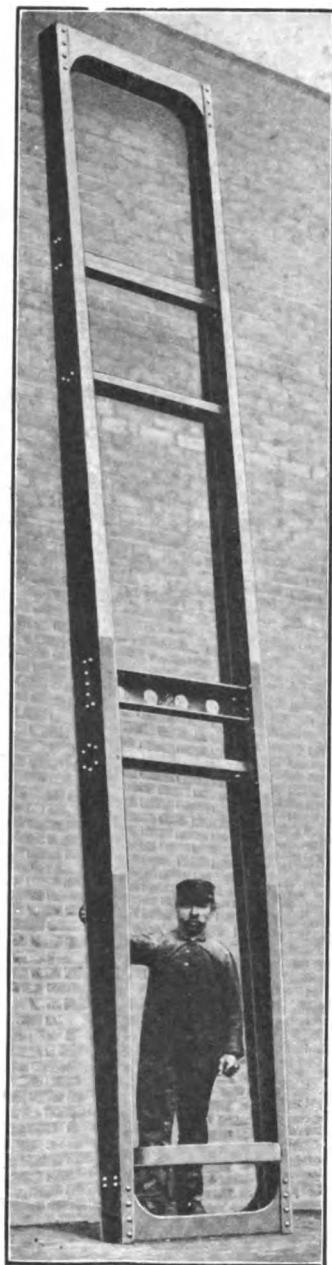
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