

A DICTIONARY OF ELECTRIC RAILWAY MATERIAL

In the following pages will be found brief descriptions of a very large percentage of the principal types of American electric railway apparatus and supplies now on the market; also references to leading Dealers, Engineers, Contractors, Financial Institutions, etc. To make this Dictionary as representative as possible of the leading interests engaged in the manufacture and selling of electric railway material, and at the same time keep the manual within reasonable size, representation has been limited to the STREET RAILWAY JOURNAL'S advertisers, although not necessarily to those using space in this particular issue. The "definitions" have either been furnished by the advertisers, especially for this Dictionary, or have been compiled from the trade literature or published advertisements of the various companies.

HOW TO USE THE DICTIONARY.—It will be noticed that there are three main divisions in the Dictionary—"Manufacturers," "Dealers" and "Financial, Professional, etc." Under the first division it has been the aim to include in the various classifications only the manufacturers of the material described, or dealers having the exclusive selling agency for the electric railway field. In indexing these items the most distinctive word in the heading has been used—Car Wheels, for instance, being indexed under "W"; Rail Bonds under "B," and Line Material under "L." If the apparatus sought is not found under its specific heading, a more general heading should be consulted. For example, "Band Saws" will be found under "Woodworking Machinery," and "Frogs" under "Track Work." The classification under each heading is alphabetical according to the trade name of the apparatus where that differs from the name of the manufacturer.

MANUFACTURERS

ALLOYS AND BEARING METALS

(See also Bearings for Trucks and Motors.)

BRADY BABBITT METALS. These babbitt metals are made from pure raw materials, no drosses or other residues are used and the composition is guaranteed. The following are especially adapted for electric railway service: Special armature bearing babbitt metal, the highest grade babbitt metal especially adapted for high speed and heavy service conditions; No. 1 armature bearing babbitt metal, a high grade tin babbitt, suitable for the average street railway conditions; No. 2 armature bearing babbitt metal, a medium grade tin babbitt, giving good service under favorable conditions; Cyprus anti-friction metal, a babbitt metal less in grade than the foregoing, but suitable for babbitting journal bearings, or may even be used for armature work where a cheaper babbitt metal is desirable; special anti-friction metal is only suitable for babbitting journal bearings and not recommended for armature work.

—BRADY BRASS COMPANY, NEW YORK.

BRADY PHOSPHOR BRONZE. This old and well-known alloy is made up by this company in either ingot or casting form. It has great strength and is exceedingly useful for gears, pinions and in fact for all purposes where great strength is desired.

—BRADY BRASS COMPANY, NEW YORK.

BROWN PLASTIC ALLOY. A metal putty used in connection with the alkaline solid alloy for preventing rust and obtaining a permanent low resistance upon electrical contacts of rail bonds, switches, terminals, bus bars, lightning arresters, ground wires, circuit breakers, ammeter shunts, etc. Ten years' successful use in all parts of the world. Said to be higher in conductivity than the best soldered contacts.

—HAROLD P. BROWN, NEW YORK.

BROWN SOLID ALLOY. A powerful alkaline alloy used in connection with the plastic alloy for preventing rust and obtaining a permanent low resistance upon electrical contacts.

—HAROLD P. BROWN, NEW YORK.

DELOS METAL. This is a special composition metal for journal bearings.

—ELMER P. MORRIS COMPANY, NEW YORK.

"ELEPHANT BRAND" PHOSPHOR-BRONZE. A strong, non-magnetic metal not easily corroded. In the form of wire is used for springs, binding armatures and various purposes; in sheet for springs, etc.; both wire and sheet of various tempers from soft, like copper, to spring temper; rods and bars for shafting, piston rods and bolts. Castings of different varieties for bearings, gears and general machine use. Also sold in ingot form of various grades for smelting purposes.

—THE PHOSPHOR BRONZE SMELTING COMPANY, LTD., PHILADELPHIA, PA.

LOTUS LINING METAL. This is composed of tin and lead as a base, with sufficient copper and antimony to give it the proper degree of strength and hardness. The formula is said to be the best combination of metals that can be used in a lead base babbitt for high speed and heavy

pressure. In armature bearings on high speed interurban work, it is claimed to have out-lasted many of the higher priced so-called genuine babbitt. It can be remelted and used over again with equally good results by the addition of a slight amount of new metal.

—LUMEN BEARING COMPANY, BUFFALO, N. Y.

LUMEN BRONZE. This white bearing metal is composed of copper, zinc and aluminum in such proportions that it combines the strength of brass with the anti-friction properties of the highest grade babbitts. It is cast and machined in a manner similar to brass, but cannot be used as a lining metal like babbitt. It is about 20 per cent. lighter than brass, will run cooler under the same conditions and will not cut or score the shaft or journal under any circumstances. It is used largely for street railway motor axle and car journal bearings, where it is giving excellent service. One of the largest manufacturers of street railway apparatus has adopted lumen bronze as a standard bearing metal for motor axle bearings.

—LUMEN BEARING COMPANY, BUFFALO, N. Y.

METALLIC PHOSPHORO. This is a phosphorized alloy of active metallic reducing agents, combined with due regard for the specific characteristic of each element which enters into the mixture; hence they do not neutralize each other, but act in unison to increase the chemical affinity in molten alloys to which the mixture is added. This product takes the place of phosphor tin in the manufacture of brass and bronze, less than one-half the amount being required. Metallic phosphoro is also used extensively as a tempering agent in babbitt metal. It adds to the wearing period of the commercial babbitts, thereby reducing cost and improving service. (See advertisement.)

—THE NEW ERA MANUFACTURING COMPANY, KALAMAZOO, MICH.

MORE-JONES ARMATURE BABBITT METAL. A metal especially designed for electric railway armature bearing service. This metal is characterized by a high rate of heat radiation, a very low rate of wear, great elasticity and tensile strength. It has none of the brittleness of lead-base metals, nor will it creep or spread under excessive strain. Careful tests made by some of the principal electric railways in the United States, have demonstrated its superiority under severe service and high speeds, and have proven it a very economical metal for armature service.

—MORE-JONES BRASS & METAL COMPANY, ST. LOUIS, MO.

NEW ERA BABBITT METALS. The superior quality of the new process metals is due to the improved metallurgical process by which this company secures the chemical union of the constituent elements. These alloys possess the highest possible molecular tension; hence their close, fine, uniform grain, which insures superior strength, elasticity and high anti-friction quality, enabling them to withstand heavy, crushing strains and to run at high speed without becoming overheated or injuring the journals. (See advertisement.)

—THE NEW ERA MANUFACTURING COMPANY, KALAMAZOO MICH.

NICKELUMEN. Nickelumen is not a babbitt metal, but a nickel tempered aluminized white bronze which fuses at a temperature sufficiently low to admit its being

melted and recast from an iron vessel. It possesses the remarkable quality of parting very slowly with the heat which it absorbs upon fusing, which makes it possible to pour it into journal bearings the same as babbitt is used; hence, by its use a fine quality of bronze busbings can be secured without the expense of machine work. Its wearing quality is equal to the best red or yellow bronze. (See advertisement.)

—THE NEW ERA MANUFACTURING COMPANY, KALAMAZOO, MICH.

"OHIO BRASS" GENUINE BABBITT METAL. For babbitting journal bearings of street railway motors, power motors and generators, engines, etc. Made strictly in accordance with Isaac Babbitt's original formula and said to be the highest grade of anti-friction metal which can be produced. (See Catalogue No. 6, page 422.)

—OHIO BRASS COMPANY, MANSFIELD, OHIO.

PITTSBURG WHITE METAL. The company making this composition has enjoyed a wide experience in the manufacture of special alloys for babbitting, soldering, electrotyping, etc. Recently it completed a series of careful experiments resulting in a new anti-friction metal for railway service, which the company has termed "Armature." Although this metal is considerably cheaper in cost, the company has found it superior even to some of its own high priced metals, and recommends its use wherever a first-class anti-friction metal is wanted.

—PITTSBURG WHITE METAL COMPANY, PITTSBURG, PHILADELPHIA AND NEW YORK.

RIDLON BABBITT. This babbitt, made according to this company's own formula, is used exclusively in babbitting bearings, except when other babbitt is specified. It is made especially for railway and motor bearings and is the result of exhaustive experiments.

—FRANK RIDLON COMPANY, BOSTON, MASS.

STILES BABBITT. Made under special formula and claimed by the manufacturer to be the most durable, cool running babbitt made. It is asserted to be a babbitt which is a revelation to trolley and steam railroads, as it will run cool under the most trying conditions.

—A. C. STILES ANTI-FRICTION METAL COMPANY, NEW HAVEN, CONN.

ALTERNATORS

(See "Generators, Alternating Current")

AMUSEMENT ATTRACTIONS

(See Park Attractions.)

ANCHORS (GUY)

STOMBAUGH GUY ANCHOR. A device consisting of a simple cast iron helix. Made in five sizes for strains from 1,000 lbs. to 100,000 lbs. So constructed that it may be bored into the ground by turning like an augur. The smaller sizes, 5 in. and 6 in., are made both with and without rods. These sizes, whether with or without rods, each require a separate, specially designed, wrench for their installation. The larger sizes, 8 in., 10 in. and 12 in., are provided with 1½ in., 1¼ in. and 1½ in. steel rods, and can be installed without the assistance of a wrench.

—W. N. MATTHEWS & BRO., ST. LOUIS, MO.

ARMATURE AND FIELD COILS (INCLUDING WINDING AND HANDLING METHODS.)

ARMATURE AND FIELD COILS. The importance of quality is never more strongly felt than in field and armature coils, and the manufacture of good coils, while it can be done by any railway's electrical department, demands the most expert supervision to secure the best results. Good coil experts are rare and the tendency in home made coils is to use material which has been bought by the purchasing agent as a bargain instead of insisting on selected material throughout. These conditions combine to make it profitable to use coils made by specialists. Facilities for this work, impossible for individual roads to secure, and far in advance of the average shop which makes a bid for this class of work are maintained by this company.

—THE MAGNET WIRE COMPANY, NEW YORK.

CHATTANOOGA ARMATURES. Armatures for the standard types of street railway motors are built by this firm of the best quality of soft steel punchings, and are guaranteed to be exact duplicates of factory built armatures.

—CHATTANOOGA ARMATURE WORKS, CHATTANOOGA, TENN.

CHATTANOOGA FIELD COILS. These field coils are made as duplicates in every particular of factory built goods. Only the best insulating materials are employed in their construction. Asbestos covered wire for field coils is used when desired.

—CHATTANOOGA ARMATURE WORKS, CHATTANOOGA, TENN.

CLEVELAND ARMATURE AND FIELD COILS. All coils are impregnated with the best liquid insulation. The final coverings are of mica, prepared linen, and fish paper, put upon the coils and placed into a steam heated press having a die which makes every coil alike. This process so compresses and hardens the insulation that a greater amount can be used, thus reducing the chance of a ground and increasing the life of the coil. The field coils are mica insulated and are made in the same substantial way.

—CLEVELAND ARMATURE WORKS, CLEVELAND, OHIO.

COLUMBIA ARMATURE AND FIELD COILS. Made of the best magnet wire and insulating material. All coils tested before shipping.

—COLUMBIA MACHINE WORKS AND MALLEABLE IRON COMPANY, BROOKLYN, N. Y.

COMSTOCK ARMATURE AND FIELD COIL FORMS. To enable street railway companies to wind their own armature and field coils, this company makes bronze coil forms which are guaranteed to form perfect coils.

—J. F. COMSTOCK & COMPANY, WEST PITTSBURGH, PA.

DITTRICK & JORDAN ELECTRIC COMPANY, CLEVELAND, OHIO. See item on this company under Repair Work.

FORD ARMATURES AND FIELD COILS. The modern coil machinery installed in this company's shops enables it to produce high-grade coils, every one of which is an exact duplicate; each pressed in individual cells, electrically heated and pressed. No corrosion or verdigris.

—FORD ELECTRIC & MANUFACTURING COMPANY, ST. LOUIS, MO.

GENERAL ELECTRIC ARMATURE AND FIELD COILS. These are made with the greatest care from selected and oftentimes specially prepared materials. Railway motor field coils are wound with asbestos and single cotton covered wire and cotton ribbon. Many types of coils are wound on metal spools. The copper strip is insulated with asbestos and the principal coils are thoroughly impregnated by a new vacuum compound process, used exclusively by this company. The insulation on the field coils must withstand 4,000 volts A.C. The end connections of the field coils are on the outside. The armature coils are form wound and the slot portions moulded in steam presses. They are insulated with materials which have stood the test of severe practical service and are tested at 2,500 volts.

—GENERAL ELECTRIC COMPANY, SCHENECTADY, N. Y.

GRISWOLD ARMATURE COIL TAPING MACHINE. This is a simple-labor saving device for taping coils. It is stated that with this machine a hoy can tape in one hour 40 coils for a Westinghouse 12A armature.

—GEO. M. GRISWOLD, NEW HAVEN, CONN.

HERCULES TINNED STEEL WIRE FOR ARMATURE BINDING. This wire has tensile strength of 190,000 lbs. to the sq. in., and an elasticity limit of 150,000

lbs. It is used for binding armatures. Street railway companies use it for repair work.

—DRIVER HARRIS WIRE COMPANY, HARRISON, N. J.

MORRIS ARMATURE AND FIELD COILS. This firm has its own shops for making any standard types of armature and field coils.

—ELMER P. MORRIS COMPANY, NEW YORK

RIDLON ARMATURE COILS. In the manufacture of these coils only the most approved insulation is employed. All are wound on standard forms and each coil is tested before it leaves the factory.

—FRANK RIDLON COMPANY, BOSTON, MASS.

RIDLON ARMATURE COIL TAPING MACHINE. This machine was designed and is manufactured by this company. It is of the same type as those in use at the company's factory. By the employment of these machines, uniform work is obtained and a great saving of time and money secured over the old style methods. The parts are of bronze and being well made are durable and reliable.

—FRANK RIDLON COMPANY, BOSTON, MASS.

RIDLON ARMATURE COIL WINDING MACHINE. This device is very similar to the company's field coil winding machine. It has no back-gears and the face plate is designed to take armature coil forms.

—FRANK RIDLON COMPANY, BOSTON, MASS.

RIDLON ARMATURE TRUCKS. These trucks manufactured in three sizes as follows: No. 1, for G. E. 800 Westinghouse 12-12A and 49 armatures, dimensions 2 ft. 10 in. over all by 2 ft. between centers; No. 2, for G. E. 1,000 and 67 Westinghouse 3SB, 49 and 68 armatures, dimensions 3 ft. 6 in. over all by 2 ft. 8 in. between centers; No. 3, for G. E. 1,200 and 57 armatures, dimensions 4 ft. over all by 3 ft. between centers. The above trucks have four wheels, the two on the sides being 6 in. in dia. and those on the ends being 5 in. in dia.

—FRANK RIDLON COMPANY, BOSTON, MASS.

RIDLON ARMATURE WINDING STANDS. These stands are used to support the armature while being worked upon; they are of cast iron, have swivel head and rolls in head to permit of revolving the armature. They are so constructed that it is not necessary to bolt them to the floor, as the weight and diameter of base is sufficient to keep them in position, although it is an easy matter to shift them so as to adapt them to the different lengths of shafts of the various types of armatures.

—FRANK RIDLON COMPANY, BOSTON, MASS.

RIDLON FIELD COIL WINDING MACHINE. This machine has been devised especially for field winding. It has a face plate designed to take forms for any type of railway motor and may also be used for winding transformer coils. The machine is back-gearred and is run with loose belt, but provided with pulley operated by foot for tightening belt so that speed may be under control and any desired tension may be had.

—FRANK RIDLON COMPANY, BOSTON, MASS.

RIDLON FIELD COILS. These, like the company's armature coils, are wound on standard forms and manufactured of new wire only. No re-taped or re-covered wire is used. The company is prepared to manufacture field coils of Deltabeston magnet wire. These fields are made to withstand unusual temperatures and are not readily affected by weather. Consequently the life of the coil is increased. In these coils a special insulating material is used, and they are manufactured according to the manufacturer's specifications.

—FRANK RIDLON COMPANY, BOSTON, MASS.

ROSSITER-MACGOVERN ARMATURES AND FIELD COILS. This company manufactures all types of armature and field coils for electric railway service.

—ROSSITER, MACGOVERN & COMPANY, BOSTON, NEW YORK, ST. LOUIS.

VAN DORN-ELLIOTT ARMATURE AND FIELD COILS. These are all form wound and are exact duplicates of the original factory coils. The insulation used is the best obtainable. In building the armature coils they are pressed to the exact size of the slot of the armature, which makes it easy to rewind armatures. The field coils are wound with double cotton covered insulated wire, or one asbestos and one cotton covered, and insulated with mica. (See advertisement.)

—THE VAN DORN-ELLIOTT ELECTRIC COMPANY, CLEVELAND, OHIO.

WOOD ARMATURE BANDING MACHINE. An efficient device for banding armatures. The tension of the wire is always taut and uniform.

—CHAS. N. WOOD ELECTRIC COMPANY, BOSTON, MASS.

ARMATURE LIFTS

(See Cranes and Hoists)

BABBITTING DEVICES

RIDLON BABBITTING DEVICE. This is designed for babbitting solid bearings. It is provided with a collapsible arbor which is broken down by removing the center core. The operation is quick and simple. No machining is necessary on the bearing when babblitted by this method. The ends are squared and the oil holes and oil ways are finished by the same operation.

—FRANK RIDLON COMPANY, BOSTON, MASS.

WELD BABBITTING DEVICE. This is for babbitting split bearings. As in the case of the Ridlon device, the operation is simple and rapid. This machine is furnished with split arbors, one for the top and one for the bottom bearing. These cast the oil holes and oil ways and also square up the ends so that no machine work is necessary. The arbors are made to the exact size of the shaft, consequently the surface of bearings babblitted by this method is left smooth and the outer scale of the babblitt intact, giving the advantage of greater wearing qualities, whereas by the old method, where it is necessary to ream or bore out, this scale is removed.

—FRANK RIDLON COMPANY, BOSTON, MASS.

BABBITT METALS

(See Alloys and Babbitt Metals.)

BADGES AND BUTTONS

AMERICAN BADGES AND BUTTONS. This company is prepared to furnish practically anything desired in the way of first-class badges and buttons. The badges are made of any metal, with black or other colored japed background; raised figures; panels, borders and figures brightly polished.

—AMERICAN RAILWAY SUPPLY COMPANY, NEW YORK.

HEEREN BADGES. The special enamel composition of which both background and figures are made is prepared in large sheets and the parts are cut from these sheets by dies of proper shape. The letters and figures, of different color from the background are inserted as in inlaid work. The whole is then placed in a non-corrosive metal frame with an aluminum back, subjected to high temperature and pressure which welds it into one mass, and is afterwards highly polished, producing an appearance equal to jewelers' enamel work and a durability unexcelled. Made in several colors and a great many styles and shapes.

—THE INTERNATIONAL REGISTER COMPANY, CHICAGO, ILL.

RECORDING FARE REGISTER COMPANY'S BADGES AND BUTTONS. Badges of German silver from stock designs or special designs made to order. Caps and uniform buttons made of gold, silver, brass or aluminum, furnished from stock designs or made to order.

—THE RECORDING FARE REGISTER COMPANY, NEW HAVEN, CONN.

WATERBURY BUTTONS. Buttons for railway conductors, motormen and other uniformed employes are manufactured by this company, both in gilt and in nickel.

—WATERBURY BUTTON COMPANY, WATERBURY, CONN.

BALLAST CARS AND BALLASTING MACHINERY

ALLIS-CHALMERS PORTABLE BALLAST AND MACADAM PLANTS. Plants consist of a boiler and engine, or electric motor, Gates gyratory rock and ore breaker, and elevator and screen, all mounted in a platform car. Can be moved to any part of a railroad where it is convenient to feed them with quarry rock or boulders, and will produce broken stone for ballast or macadam rapidly and with economy.

—ALLIS-CHALMERS COMPANY, MILWAUKEE, WIS.

ALLIS-CHALMERS ROCK BREAKING PLANTS Complete rock breaking plants for producing ballast and macadam, specially designed to meet local conditions. Contain, according to needs, proper combinations of Gates gyratory rock and ore breakers, Gates elevators, Gates revolving iron frame screens, bins and bin gates with boilers and engines for operating. Built to be motor driven or operated from any source of power.

—ALLIS-CHALMERS COMPANY, MILWAUKEE, WIS.

BROWNING MAINTENANCE OF WAY DERICK CARS AND STANDARD LOCOMOTIVE CRANES. Especially designed and adapted for handling ballast, ties, rails, bridge material, etc.

—THE BROWNING ENGINEERING COMPANY, CLEVELAND, OHIO.

BROWNING SQUARE TYPE AUTOMATIC GRAB BUCKETS. These buckets form the simplest and most substantial outfits for handling coal, ashes, sand, gravel and ballast material.

—THE BROWNING ENGINEERING COMPANY, CLEVELAND, OHIO.

BROWNING STANDARD LOCOMOTIVE CRANES AND GRAB BUCKETS. Comprise the most developed and economical outfit for handling coal, coke, ballast, crushed stone, sand, gravel and for loading and unloading machinery, light wrecking, changing trucks, etc.

—THE BROWNING ENGINEERING COMPANY, CLEVELAND, OHIO.

GATES GYRATORY ROCK AND ORE BREAKER. This is used for breaking rock for railroad ballast, macadam and all other purposes. The working parts consist mainly of a powerful shaft suspended at its upper end and carrying a breaker head of suitable material which moves successively toward all parts of an encircling set of concaves because the lower end of the shaft is carried about through a small circle through the medium of an eccentric wheel operated by suitable bevel gear. For crushing very hard rock and ore, a manganese steel head mantle and concaves are used.

—ALLIS-CHALMERS COMPANY, MILWAUKEE, WIS.

BASES, TROLLEY

KELSEY TROLLEY BASES. Of perfectly uniform tension, regardless of the angle at which the pole stands. Guaranteed only 5 ins. high. With intermediate ring, making a perfect anti-friction swivel.

—THE RECORDING FARE REGISTER COMPANY, NEW HAVEN, CONN.

MILLOY TROLLEY BASE. This base has uniform tension. It is mounted on a double set of taper roller bearings; has no center pin, fulcrum or friction. No oiling is required. The cable connections are under cover.

—MILLOY ELECTRIC COMPANY, CLEVELAND, OHIO.

UNION STANDARD TROLLEYS. These are made in almost half a hundred designs, in compression and extension spring types, some adapted to street railway service only, others arranged especially for other work. Among the recent additions are two ball bearing types, Forms 10 and 11, with a maximum height of 4½ in. Form 10 is equipped with double springs capable of giving ample wire pressure when extreme length pole is necessary. Form 11 or single spring type is especially suited to ordinary service where a low and sensitive base is required.

—R. D. NUTTALL COMPANY, PITTSBURG, PA.

BATTERIES

BIJUR "HIGH-DUTY" BATTERY. The plates of the Bijur "High Duty" storage battery consist of multicellular grills of pure lead, welded to strong alloy frames. The active portions of both positive and negative plates are electro-chemically formed, and so disposed with respect to the grid that perfect provision for expansion is obtained, eliminating the possibility of buckled plates. The pure lead grills are open structures, having no center web, giving a thorough and through circulation of electrolyte and maintaining perfect acid diffusion, resulting in low charging voltage and constant E. M. F. on discharge.

—GENERAL STORAGE BATTERY COMPANY, NEW YORK.

"CHLORIDE ACCUMULATOR." A lead storage battery cell for electric railways; whether for central stations or sub-stations, to relieve the power house and feeder system at heavy peaks, to remove the momentary fluctuations of load and regulate the voltage, or in rotary sub-stations to allow the rotaries and transmission lines to carry a steady load; always constituting a reserve of energy instantly available when needed. These cells represent the latest development in the art, having been perfected by the highest available talent in this special field.

—THE ELECTRIC STORAGE BATTERY COMPANY, PHILADELPHIA, PA.

GOULD STORAGE BATTERIES. The plates are spun from chemically pure rolled lead which is thus homogeneous and of maximum density. They are then electro-chemically formed. The greatest possible surface per unit area of plates is exposed to the electrolyte and the variation of voltage on charge and discharge is a minimum.

Plates are not built up and contain no antimony or other injurious foreign elements. In consequence of the general design and vertical spinning the action is distributed evenly over the plate insuring maximum conductivity. The plates offer maximum base of unformed lead distributed under the active material so that their capacity is maintained throughout their life and with minimum deterioration, adapted to all classes of battery work and particularly where high charge and discharge rates are required. The company also furnishes counter electro-motive force booster systems and all battery auxiliaries. (See advertisement.)

—THE GOULD STORAGE BATTERY COMPANY, NEW YORK.

"LITTLE GIANT" STORAGE BATTERIES.

Manufactured along the latest approved lines, and of the best materials possible to obtain. They hold their charge for long periods and respond quickly when occasion demands for drawing excessively upon them. They have the greatest output for size and weight. Cases containing the accumulator batteries are of hard wood, thoroughly acid proof. Every precaution is taken to insure long life, and every battery is guaranteed to meet the specifications and perform the duty for which sold. These batteries are manufactured for every purpose for which storage batteries are used. (See advertisement.)

—CHICAGO PNEUMATIC TOOL COMPANY, CHICAGO, ILL.

RED SHIELD DRY BATTERIES. The quality of the elements contained in this cell, together with the peculiar process of its manufacture, makes this somewhat higher in price than ordinary batteries. The chemicals are expensive and are selected under rigid specifications as to purity and strength. Each cell is individually examined at each stage of its manufacture to insure absolute uniformity. It has a long life and great recuperative power.

—WESCO SUPPLY COMPANY, ST. LOUIS, MO.

SILVEY STORAGE BATTERIES. Made in several different styles, two or three of which are particularly adapted to street railway work. The suspended plate type cells are furnished in glass jars and range in capacity from 10- to 600 amp. hours, and are used as line or "floater" battery for voltage regulation. The plates are unusually heavy and durable and are so designed as to retain securely the active material. Silvey storage batteries, central station type, are furnished in lead lined tanks and range in capacity from 500 to 20,000 amp. hours. The positive plates contain a large number of corrugated lead ribbon plugs in which the active material is placed. These plates increase in capacity with increase of age.

—THE DAYTON MANUFACTURING COMPANY, DAYTON, O.

"UNIT ACCUMULATORS." In the positive plates the units, or active portions (of Plante formation), are hung in rigid antimoniated lead frame, with ample space at bottom and sides for expansion. The negative plates are of Faure, or pasted type, having antimoniated lead frame with staggered bevel shape ribs, provided with pins extending into active material, the ribs and pins insuring perfect contact. "Unit Accumulators" have high potential at high discharge rates, low internal resistance and high watt efficiency, and are used in station and railway work to carry peak loads, to regulate fluctuations and as a reserve. (See advertisement.)

—NATIONAL BATTERY COMPANY, BUFFALO, N. Y.

BEARINGS FOR TRUCKS AND MOTORS

(See also Alloys and Babbitt Metals.)

BALTIMORE CENTER AND SIDE BEARINGS. An extremely simple and remarkably durable device coming extensively into use to replace the ordinary center plates and side rub plates between the car body and its trucks. Both center and side bearings assembled and applied in two integral parts—a body and truck member. The hardened and ground balls of forged steel are so held in their retaining castings as to make their loss impossible. The balls, bearing on forged steel race plates hardened and ground to .001 of an inch, make the best known mechanical device for overcoming friction between a car body and its truck when rounding curves, effecting great saving in powers and in flange and wheel wear. (For illustration see advertisement.)

—BALTIMORE RAILWAY SPECIALTY COMPANY, BALTIMORE, MD.

BRADY MOTOR BEARINGS FOR ELECTRIC RAILWAYS. Motor bearings manufactured by this company are either east iron babbitted or solid bronze. A fine quality of gray iron is used and they are lined with armature bearing babbitt metal, especially devised to meet

street railway requirements. When bronze motor bearings are ordered, the composition is a high grade tin bronze.

—BRADY BRASS COMPANY, NEW YORK.

CYPRUS BRONZE JOURNAL BEARINGS FOR ELECTRIC RAILWAYS. These bearings are made from cyprus bronze. It is an alloy of copper, tin and lead, especially adapted to service on electric railways. It is of great strength, has the ability to carry great loads on a rapidly revolving journal, and runs with the least development of friction or heat, consequently offering an ideal metal for the purpose of a journal bearing. The bearings may be either lead lined or solid; when lined the lining consists of a high grade anti-friction metal.

—BRADY BRASS COMPANY, NEW YORK.

GENERAL ELECTRIC RAILWAY MOTOR BEARINGS. The frame heads are a one-piece casting of malleable iron, forming a strong and rigid support for the linings. The linings for armature and axle bearings are solid or split brass, babbitted, solid or split malleable iron, babbitted. The brass bearing, babbitted, forms an ideal bearing surface, the babbitt being so thin that if melted by overheating, the armature will not rub on the poles. Large oil wells, with oil wool waste packed against a large surface of the shaft through an opening on low pressure side of bearing, insures perfect lubrication. Bearings of this type have run 13,700 miles without renewal.

—GENERAL ELECTRIC COMPANY, SCHENECTADY, N. Y.

"OHIO BRASS" MOTOR BEARINGS. Genuine bell metal and babbitted motor bearings are made by this company for all standard types of railway motors. All accurately machined to size. Bell metal is a high grade anti-friction composition metal of great durability. The babbitt metal is made in accordance with Isaac Babbitt's original formula and is the best anti-friction metal that can be produced. (See pages 411 to 422 of Catalogue No. 6; and also advertisement.)

—THE OHIO BRASS COMPANY, MANSFIELD, OHIO.

RIDLON MALLEABLE IRON BEARINGS. This company makes standard motor bearings for either Westinghouse or General Electric equipments. The shells are made of malleable iron, which insures longer life and less liability to breakage than shells made from gray iron. Bearings are furnished either babbitted or unbabbitted. In babbitting bearings, the maker employs either the Ridlon or the Weld babbitting device, which leaves the outer scale of the babbitt intact and insures greater wearing qualities.

—FRANK RIDLON COMPANY, BOSTON, MASS.

ST. LOUIS SPIRAL JOURNAL BEARING. This bearing combines efficiency, economy and low first cost. The brass spiral is wedged into the malleable back; the flanges on the end being over ¼ in. in thickness permit of as much end wear on the brass as is consistent with good railroading. The babbitt is "anchored" by the malleable flanges and by the arms of the brass under which it flows in pouring. These brasses are tinned and the babbitt poured on to the hot tinned surface. The Company has observed a number of spiral bearings which have run on journals so hot as to melt out every particle of babbitt metal, and has found not even a crack in the brass.

—ST. LOUIS CAR COMPANY, ST. LOUIS, MO.

STILES' BRONZE BEARINGS. A high grade journal-bearing bronze made from secret mixtures of Mr. Albert C. Stiles. It presents a feature of special interest that is patented, viz.: Being so cast as to provide in the bronze a bearing surface which fits to the exact size of the journal, so that the journal at all times finds a perfectly fitted bed to run in. The babbitt, instead of being tinned in as usual, is inter-locked by a very ingenious method. There is no possibility of the journal ever wedging in this bearing. This company gives its entire attention to the manufacturing of bearings for steam and trolley roads, also a high grade babbitt metal.

—A. C. STILES ANTI-FRICTION METAL COMPANY, NEW HAVEN, CONN.

TAYLOR JOURNAL BEARINGS. These journal bearings are made of the best aluminum bronze and are lined with an anti-heating Eureka metal, which prevents heating and is self-fitting.

—TAYLOR ELECTRIC TRUCK COMPANY, TROY, N. Y.

BELLS AND GONGS

BRILL "DEDENDA" PLATFORM GONG. Aside from the gong the parts consist of a pedal, pedal-socket, clapper and gong-holder. The clapper is weighted and cannot come within a half-inch of the gong unless the pedal is pushed quickly down. When the blow is struck the clapper instantly rebounds, resulting in a sharp, clear

tone and making chattering impossible. A half-turn of the pedal locks it down when not in use. Any carpenter can install it. The gong is made in 8 in., 12 in., and 14 in. sizes.

—J. G. BRILL COMPANY, PHILADELPHIA, PA.
—AMERICAN CAR COMPANY, ST. LOUIS, MO.
—G. C. KUHLMAN CAR COMPANY, CLEVELAND, OHIO.
—JOHN STEPHENSON COMPANY, ELIZABETH, N. J.

BRILL "RETRIEVER" SIGNAL BELL. This bell has no springs. A leverage so powerful as to enable it to retrieve the cord through three long cars is obtained by a long clapper with a heavily weighted head and at the other end a toe which bears against a trigger. The trigger starts with a small leverage which jumps suddenly to a high leverage, sending the clapper up against the tappet with an astounding amount of energy. The pull is less than a quarter of an inch and the tone is always sharp and clear.

—J. G. BRILL COMPANY, PHILADELPHIA, PA.
—AMERICAN CAR COMPANY, ST. LOUIS, MO.
—G. C. KUHLMAN CAR COMPANY, CLEVELAND, OHIO.
—JOHN STEPHENSON COMPANY, ELIZABETH, N. J.

DAYTON GONGS. Foot gongs, roof gongs or signal bells in forty-six different patterns. Rolled steel gongs made in six sizes, 8 in., 9 in., 10 in., 12 in., 14 in., and 16 in. diameter. Furnished with foot or roof attachments if desired. Finished black, tinned or nickel plated. Any kind of a gong, either for alarm or signal, can be furnished.

—THE DAYTON MANUFACTURING COMPANY, DAYTON, O.

"OHIO BRASS" BELLS AND GONGS. The foot gongs and roof gongs made by this company are of extra heavy, high grade pressed or rolled steel of approved designs (See pages 438 and 439, Catalogue No. 6.)

—THE OHIO BRASS COMPANY, MANSFIELD, OHIO.

WALLACE STEEL GONGS. Foot gongs, overhead gongs, trip gongs and conductors' signal bells. Attachments and shells furnished separately if required. Gong shells are made of high carbon cold rolled steel of a grade that produces the best results as to tone and lasting qualities. Shells may be obtained either in plain black rough finish or polished and nicked. All attachments are made of malleable iron.

—WALLACE SUPPLY COMPANY, CHICAGO AND NEW YORK.

BELTING

BOYLE SOLID WOVEN COTTON, RUBBER FILLED BELTING. This belting is a solid woven fabric, filled and covered with rubber. There are no separate plies to "open up" and "creep." It has less stretch and better pulley adhesion, and ply for ply, is 25 per cent. stronger than the old style rubber or stitched canvas belting. This belting is well adapted for all conveying, elevating or power transmission work.

—JOHN BOYLE & COMPANY, NEW YORK.

BELT LACING

BRISTOL STEEL BELT LACING. Made for all widths, thicknesses and styles of belt that are used for driving machinery and for conveying belts. The convenience with which it can be applied is one of its great merits, as no special tools are required. The zigzag design gives the greatest strength with the least amount of material. The wedge shape points of the lacing as they are driven through the belt force the fibres aside without cutting them so that the full strength of the belt is maintained at the joint, which is not the case where the old fashioned style of leather lacings is used and holes are cut through the belt to permit the insertion of the raw-hide strips. Another valuable feature of this lacing is that when applied no lump is made on the belt causing it to jump as it passes over pulleys.

—THE BRISTOL COMPANY, WATERBURY, CONN.

BENCHES

(See Settees and Benches.)

BENDERS, RAIL

THE FAIRBANKS-MORSE RAIL BENDER. This bender is provided with wedges which feed down automatically as the lever is operated and hold absolutely the full amount of the bend secured by the throw of the eccentric, that is, there is not a particle of back spring. It is claimed to be much more powerful and durable than any type of screw bender; can be operated by fewer men and does its work in less time. Made for use on both T and girder rails.

—FAIRBANKS, MORSE & COMPANY, CHICAGO, ILL.

KALAMAZOO ROLLER RAIL BENDER AND STRAIGHTENER. After being applied to rail it is

made to run over rail rapidly by turning the lever at the top of the standard. Adjustable to the degree of curvature. Rails precisely bent without links or breakage of grain. Besides bending rails it is useful in truing up old and imperfect curves. Made in six styles covering 20 to 100 lb. rail.

—KALAMAZOO RAILWAY SUPPLY COMPANY, KALAMAZOO, MICH.

NILES-BEMENT-POND RAIL BENDERS. These rail benders are of the hydraulic type and are capable of bending rails up to 100 lbs. per yd. in weight.

—NILES-BEMENT-POND COMPANY, NEW YORK.

Q AND C-SAMSON RAIL BENDER. Exceedingly valuable in track work. It will bend 100 lb. rails into position without drawing spikes, when straightening and taking kinks out of track. One man can operate it and it is an effective substitute for expensive roller benders. The frame is made of open hearth cast steel and is very strong. Screw is of steel working in bronze nut and provided with automatic friction washers. Thrust piece is of hardened steel. Weighs 100 pounds.

—RAILWAY APPLIANCES COMPANY, CHICAGO AND NEW YORK.

BENDING TOOLS

WALLACE BENDING TOOLS. Hand power tools for quickly forming eyes on ends of rods or for bending bars or rods to an angle. The eye bending tools are built in three sizes. No. 1 for bending stock up to and including one-half in., and forming the same into rings or eyes up to 2½ in. outside diameter; No. 2 takes stock ¾ in. thick and under and forms eyes 3 in. outside dia. and under; No. 3 takes stock 1½ ins. thick and under and forms eyes or rings 7 ins. outside dia. and less. The No. 1 angle tender has a capacity for bending flat stock 2 ins. wide by ¾ in. thick, or round or square stock up to ½ in., while the No. 2 angle bender will bend flat stock up to 4 ins. wide by ½ in. thick or square or round up to 1 in.

—WALLACE SUPPLY COMPANY, CHICAGO, ILL.

BLOCK SYSTEMS

(See "Signal Systems")

BLOWERS

(See "Mechanical Draft Apparatus")

BLUE PRINTING MACHINES

BUCKEYE ELECTRIC BLUE PRINTING MACHINE. Each machine is equipped with two rollers, one on each side, which carry the contact curtain and are operated independently so that only one side may be printing, while the other is being unloaded or reloaded. The contact curtain is held firmly to the glass by weights attached to small wire cables engaging both ends of the rollers carrying the curtain. By this arrangement perfect contact is secured over the entire surface of the glass, entirely removing the difficulty of only partial and uneven contact when springs are employed in or attached to the rollers. The latter will remain stationary at any point on the circle and the curtain back of the roller is in perfect contact with the glass regardless of how far it has been unrolled. The value of this arrangement cannot be overestimated in making small and medium size prints.

—BUCKEYE ENGINE COMPANY, SALEM, OHIO.

FRANKLIN BLUE PRINT WASHING AND DRYING MACHINE. This machine is arranged to wash and dry either separate prints, or continuous rolls of any length. After the prints are washed and dried they are wound up on a roller ready for immediate delivery. This machine saves space, time and labor, and avoids dripping prints and wet floors.

—WILLIAMS, BROWN & EARLE, PHILADELPHIA, PA.

FRANKLIN ELECTRIC BLUE PRINT MACHINE. This continuous feed blue print machine is arranged so that prints of any length can be made. Prints of any width up to 42 in. are handled. The printing is done by electric light. The action of the machine is entirely automatic, it being necessary only to insert the roll of paper and start the print.

—WILLIAMS BROWN & EARLE, PHILADELPHIA, PA.

BOATS AND LAUNCHES

(See Park Attractions.)

BOILER CLEANERS, MECHANICAL

(See also Reseating Machines.)

DEAN BOILER TUBE CLEANER. Worked either by steam or compressed air. In the type used for

return tubular boilers the hammer head, vibrating with a pressure of 40 lbs. to 70 lbs., strikes the tubes 3,500 to 4,500 times a minute, thus setting up a vibratory motion and dislodging the scale. In the water tube boiler the hammer is changed slightly, and as the cleaner is forced through the tube it breaks up the scale into small pieces, which are blown out of the tube in front of the cleaner.

—WILLIAM B. PIERCE COMPANY, BUFFALO, N. Y.

LAGONDA TUBE CUTTER. This machine cuts off tubes in either water tube or return tubular boilers. It is a simple and effective device, doing the work quickly with little trouble. It makes a clean cut every time, without leaving any burr either on the inside or outside of the tube. It can be furnished with an extension shaft for water tube boilers so that the tubes can be cut out at any desired point, inside the boiler. This is a great time and money saving machine.

—THE LAGONDA MANUFACTURING COMPANY, SPRINGFIELD, OHIO.

LIBERTY TURBINE TUBE CLEANER. The principal advantages of this cleaner are: The turbine is constructed without ball bearings, thus insuring greater power and longer life; the cleaning tools are attached direct to the shaft, which insures solidity and durability of construction; the vanes in the revolving part are cut by a special process—not cast. Cut vanes are stronger and smoother than cast vanes and offer less resistance to the flow of the water; it is furnished with cleaning tools for both heavy and light scale, the former being capable of cleaning tubes which are entirely stopped up. A number of types of cleaning heads are furnished for different kinds of scale, the freely swinging arm head being used only for light scale. (See advertisement.)

—LIBERTY MANUFACTURING COMPANY, PITTSBURG, PA.

THOMPSON'S SOOT EJECTOR. By the use of a small amount of steam, which is first superheated by wire drawing through the aperture in the discharge tip, a vacuum is formed drawing the soot from the tubes and ejecting it with great velocity up the chimney and into the atmosphere, cleaning the tubes, flue and chimney. No steam is admitted into the tubes, no soot is blown around the boiler room or into other tubes, but drawn out in the direction of the draft, leaving clean tubes. All the parts are made of brass and will not corrode or rust. When bituminous coal is used the tubes should be cleaned every day. With this soot ejector 80 tubes can be cleaned in from five to six minutes.

—RICHARD THOMPSON & COMPANY, NEW YORK.

TWENTIETH CENTURY TUBE CLEANER. This cleaner presents an entirely new feature for cleaning boiler tubes. With a small amount of steam discharged through the apertures of a central tip a powerful current of heated air is driven through the tubes without any perceptible moisture, cleaning them quickly and thoroughly. Eighty tubes can be cleaned in five minutes. All the parts are made of brass so that they will not corrode or rust. The company makes special couplings and bands, and furnishes the best quality of steam hose when required.

—RICHARD THOMPSON & COMPANY, NEW YORK.

WEINLAND TUBE CLEANERS. These cleaners are made for all styles of water tube boilers and for all sizes of tubes. The manufacturers have recently purchased the tube cleaner business from the Gem Manufacturing Company, and thus get absolutely unrestricted liberty in the manufacture of cleaners.

—THE LAGONDA MANUFACTURING COMPANY, SPRINGFIELD OHIO.

BOILERS

AMERICAN WATER TUBE BOILER. Made by Broomell, Schmidt & Steacy Company, York, Pa.

BERRY SAFETY BOILERS. Consist of two vertical cylindrical shells, united at the top by a crowned ring and at the bottom by a conical crown-sheet. Tubes radiate from the inner to the outer shell, uniting and bracing them. A deflecting arch of fire-brick is placed in the internal flue at a point above about two-thirds of the submerged tubes, and a casing or smoke-flue surrounds the boiler on the outside. The gases rise into the internal combustion chamber, are deflected by the arch and pass through the tubes to the outside flue, thence upward and inward through the middle section of tubes to the internal flue, thence upward and outward through the superheating tubes, thence upward and inward over the top of the boiler to the stack. The circulating tubes extend back and forth under the boiler over the fire, connecting to outside shell of boiler.

—ROBERT WETHERILL & COMPANY, INC., CHESTER, PA.

BABCOCK & WILCOX WATER TUBE BOILER. This boiler is too well known to need description. The Babcock & Wilcox Company publishes a book entitled "Steam," recognized as one of the best technical works on the subject of steam published anywhere and containing full descriptions of its products. This book will be mailed free upon request.

—THE BABCOCK & WILCOX COMPANY, NEW YORK.

CAHALL HORIZONTAL WATER TUBE BOILERS. These boilers are of the sectional header type. The greatest care in the selection of material and in the methods of working it, is exercised in every detail of the construction and is combined with a design that affords perfect circulation with the utilization of the largest proportion of the heat units and permits of access to every part for cleaning, examination and repairs. These boilers have for many years been exploited by The Aultman & Taylor Machinery Company, and are now controlled by

—THE STIRLING-CAHALL BOILER COMPANY, NEW YORK.

THE HEINE BOILER. This boiler is of the horizontal water tube type, suitable for all purposes for which high steam pressure is required. Built entirely of flange steel plates, completed in shop and tested before shipment. Design gives a large combustion chamber, horizontal pass of the gases and free circulation of water, all conducting to economical operation and maximum power in minimum space. All cleaning is done from front and rear, thus permitting as many boilers to be set in battery as desired. Setting may be arranged to accommodate any stoker.

—HEINE SAFETY BOILER COMPANY, St. LOUIS, Mo.

MURRAY BOILERS. These boilers are of the tubular, internal-furnace and water tube types. The former are usually made to Hartford specifications and are distinguished for their strict adherence to stipulated requirements. The steel is of full thickness; the rivet holes are actually drilled after the plates are rolled up and the fixtures are extremely heavy and durable. Internally-fired boilers are built either with the patented corrugated furnaces or the Adamson ring furnaces with Galloway circulating tubes. The water-tube boilers are of an approved and time-tested type.

—MURRAY IRON WORKS COMPANY, BURLINGTON, IOWA.

PARKER WATER TUBE BOILER. Has straight horizontal tubes and malleable junction boxes. Large drums with separate chambers for water and dry steam which does not rise through the water in the ordinary way, but flows direct from the bottom ends of the elements to the steam chamber. The flow is downward in the steam generating tubes, and is induced by the lighter column in the upcast. A scale pocket is provided at the front ends of the drums for the scale and sediment which is discharged from the tubes by the extraordinary flow. The boiler is built double ended and with superheaters.

—PARKER BOILER COMPANY, PHILADELPHIA, PA.

PHOENIX BOILERS. Steam generators for power stations are constructed by this company.

—PHOENIX IRON WORKS COMPANY, MEADVILLE, PA.

STIRLING WATER TUBE SAFETY BOILER. Is notable for the simplicity of its construction. Special provision is made to counteract the effect of all contraction and expansion and the method of suspension employed distributes the weight of the drum among all the long tubes so that increased stability is obtained. The rapid circulation eliminates severe stresses due to unequal expansion, permits the quick raising of steam and prevents the formation of steam pockets, which quickly burn out the tubes. It is designed for positive safety and to this end all parts are of wrought metal and are either spherical or cylindrical in form. The facility with which repairs can be made, its adaptability to different kinds of fuel and its extreme compactness are points of interest to engineers.

—THE STIRLING COMPANY, NEW YORK.

BOILER CLEANING COMPOUNDS

DEARBORN BOILER WATER ANALYSIS AND TREATMENT. This company has on record reports of over twenty-three thousand water supplies, analyses of which were made in its laboratory. It has been continually furnishing preparations the past six to ten years for some eight thousand to ten thousand of these different waters. The company, therefore, has had wide experience in the treatment of water for boilers and is prepared to carry on thorough investigations along this line.

—DEARBORN DRUG & CHEMICAL WORKS, CHICAGO, ILL.

LORD'S WATER PURIFYING CHEMICALS. The business of manufacturing chemicals for use in steam boilers was originated in America by George W. Lord in

1865, and was continued by him until 1901, when the George W. Lord Company was incorporated. No stock is carried at any of the company's branches, as every order is filled direct from Philadelphia, being prepared especially and containing the exact ingredients required to treat each case. To make the preparation of these special Rixtures possible this company insists upon analyzing either a sample of scale or boiler feed water before an order for chemicals is accepted. These analyses, however, are made free of charge.

—GEO. W. LORD COMPANY, PHILADELPHIA, PA.

BOILER COVERINGS

(See "Coverings, Pipe and Boiler")

BONDS, RAIL

"ALL WIRE" RAIL BONDS. Compressed terminal "All Wire" rail bonds are made from a continuous piece of flexible soft drawn pure copper cable, exceptional conductivity resulting. Terminals compressed and carefully machined to exact size. Bonds applied under pressure and adapted for use under fish plates or on base of rail, being made in numerous forms for various requirements of bonding. Soldered "All Wire" Rail Bonds.—Identical in process with the company's "All Wire" compressed terminal, except that terminals are designed for soldering to rails, either under fish plates, to base or ball of rail. Specially adapted for bonding light weight rails; exceptional conductivity retained. (Advertisement illustrates both types.)

—THE OHIO BRASS COMPANY, MANSFIELD, OHIO.

THE AMERICAN STEEL & WIRE COMPANY'S BONDS. These bonds comprise not only the well-known Crown bonds, with pin and solid terminals, but United States bonds, with solid terminals and flat strips; soldered bonds in several styles, with tools for applying and a new terminal stud bond for application to the ball of the rail. This new bond will particularly interest railway men who are desirous of using a short, visible bond to be applied by compression.

—AMERICAN STEEL & WIRE COMPANY, CHICAGO AND NEW YORK.

BROWN SOLID COPPER RAIL BONDS. These bonds are composed of heavy copper plates held by spring pressure against the rail web across each joint. Contact is secured by non-rusting plastic alloy, and dirt is excluded by cork composition packing. At the end of three or four years service the bonds may be made as good as new at small cost by cleaning and re-amalgamating. (See advertisement.)

—HAROLD P. BROWN, 120 LIBERTY STREET, NEW YORK.

BROWN PLASTIC PLUG RAIL BONDS. These bonds are composed of a non-rusting metal putty and are designed for bonding steam roads for electric service, or for rebonding electric roads without disturbing the rail joints. The putty is placed on a $\frac{3}{8}$ -inch to $\frac{1}{2}$ -inch hole drilled through the base of the angle plate into, but not through, the rail base. They can not be injured by the motion of the rails and will transmit 1,000 amps. without heating. (See advertisement in this issue.)

—HAROLD P. BROWN, NEW YORK

BROWN PLASTIC RAIL BONDS. These bonds are composed of a non-rusting metal putty. When placed under both angle plates per joint they give practically the full conductivity of the rail. On well maintained track they will not rust nor break. A. M. Ballou, Electrical Engineer of the Denver Tramway Company, and R. E. Danforth, General Manager of the Rochester Railway, report that Plastic Bonds applied in the fall of 1896 still have the same conductivity as at first. Mr. Ballou reports that the resistance of 1 ft. of joint with bonds is equal to that of 2 ft. of unbroken rail; only one angle plate per joint bonded. (See advertisement.)

—HAROLD P. BROWN, NEW YORK.

BROWN SWITCH CONTACT BONDS. These bonds consist of rolled copper sockets soldered to web at end of each rail, with horizontal openings facing together. Into these openings slides a copper contact piece of heavy section, covered with non-rusting plastic alloy. The rails can move on each other in vertical or horizontal planes without breaking the circuit or injuring the bond which is made on the plan of a knife blade switch. (See advertisement.)

—HAROLD P. BROWN, NEW YORK

CLARK IMPROVED RAIL BOND. This is an improved rail bond of the soldered type. It is made up of either small wires or laminations with the extreme ends welded together, then spread out to increase the area of

contact between the rail and bond, and perforated to facilitate soldering. The specially shaped ends, together with the perforations, prevent any accumulation of gas in soldering, all gases being forced to escape through the perforations. This affords opportunity for the solder, or other material used, to flow freely and effect a firm and lasting union between the rail and the bond, thus prolonging the life of the bond, greatly increasing its conductivity and preventing the bond from becoming loosened by expansion and contraction or by jar of cars or other ordinary means.

—THE CLARK ELECTRIC & MANUFACTURING COMPANY, NEW YORK.

COLUMBIA RAIL BONDS. This company makes the Columbia rail bond and also the Roebbling soldered bond. The Columbia bond consists of two copper thimbles and a connecting copper rod. On each end of the rod is a truncated cone head with a fillet at the base. The inside of the thimble is tapered to fit the head while the outside is slightly tapered in the opposite direction. In applying the bond the cone shaped heads are placed in holes in the rails on one side and the thimbles are slipped over them from the other. The parts are pressed together tightly with a hand press. The Roebbling soldered bond is a one piece bond, every part of which is tinned. It has soldered pockets, assuring a thorough contact with the railway.

—JOHN A. ROEBLING'S SONS COMPANY, TRENTON, N. J.

GENERAL ELECTRIC BONDS. These bonds are made with drop forged pure copper terminals welded to a copper conductor, which may consist of ribbon, stranded cable or solid wire, by a process which insures absolute perfection of union between terminal and conductor. Ribbon bonds are furnished for use under fishplates, solid wire and stranded cable bonds for cross bonding and special work. Separate terminals, drilled and tinned for use with scrap wire, are furnished for cross bonding. A complete line of bonding tools is furnished. This company also furnishes a complete line of soldered bonds for application to the head or foot of the rail, or under the fish plate.

—GENERAL ELECTRIC COMPANY, SCHENECTADY, N. Y.

LORAIN ELECTRICALLY BRAZED BOND. This bond is used for attaching to welded track the terminals of large copper cables passing around special work. A copper block having a groove across one face is placed over the cable and both electrically brazed to the web of the rail, the cable welding to the block. The area of union for a 500,000 cm. cable is about 9 sq. in. Overhead return cables and ground cables to generators are also attached to rails by this method. These bonds are applied by the apparatus used for electrically welding rail joints, by the track welding department of the company. (See advertisement.)

—THE LORAIN STEEL COMPANY, PHILADELPHIA, PA.

PROTECTED RAIL BONDS. The principal features that have made this bond so successful are: The drawn flat wire or ribbon of which it is made is formed into a loop from a continuous strand and crimped suitably to escape the bolts—which construction gives the maximum amount of flexibility in exactly the direction in which it is demanded; and the fact that the terminals are fused to the strand in molten state insures in the terminal head one homogeneous mass of copper, and eliminates the possibility of the introduction of any electrical resistance between the body portion of the bond and the terminals. May be made to suit any special condition. (See advertisement.)

—THE MAYER & ENGLUND COMPANY, PHILADELPHIA, PA.

SHAWMUT SOLDERED BONDS. Consist of copper laminations with ends separately tinned for a short distance to insure perfect union when proper heat and flux have been applied. The laminations after tinning are clamped together and dipped, then surrounded by a tinned copper wrapper of proper length for contact area, which wrapper is soldered intimately around the strips. The bonds are applied by cleaning the rail with a rotating emery wheel or a sand blast. The rail when cleaned is tinned, the bond is clamped in position and heat is applied with a torch until the rail is sufficiently hot for a soldered union. (Several types are shown in advertisement.)

—CHASE-SHAWMUT COMPANY, NEWBURYPORT, MASS.

THERMIT WELDED THIRD RAIL. This bond consists of a lug of steel welded on the ends of the flanges of the rail on one side, the rail being held in position on the other side of the web by a simple splice bar. The operation described under "Thermit Joint" is further simplified in this case, as the thermit charge is ignited directly over the mold, in a piece of gas piping, without the use of a crucible.

—GOLDSCHMIDT THERMIT COMPANY, NEW YORK

THOMAS SOLDERED RAIL BONDS. The result of exhaustive tests and years of actual practical experience. Every detail of design, construction and application has been carefully worked out. A suitable and satisfactory type is provided for every size and style of rail and joint plate and condition of service. They are furnished in all capacities with contact terminals always at least eight times greater than the cross section. This insures a permanent and enduring contact with ample mechanical strength and current capacity. Each strip is tinned separately, after which they are securely clamped, soldered and riveted. (See illustration in advertisement.)

—LORD ELECTRIC COMPANY, BOSTON, MASS.

BOND TESTERS

ROLLER DIRECT READING BOND TESTER.

This instrument shows directly on its calibrated scale the resistance of rail bonds when same are in place on the track. The readings show what number of feet of uncut rail have the same resistance as the bonded joint. The apparatus is extremely light and arranged so that but a single operating observer is needed. It can be set to show instantaneously whether a given bond is above or below a predetermined resistance. The device for making contact with the rail has hack-saw blade contact edges which can be renewed immediately when dulled. (See advertisements.)

—WHITNEY ELECTRICAL INSTRUMENT COMPANY, MACHADO & ROLLER, NEW YORK, N. Y., GENERAL SALES AGENTS.

BONDING TOOLS

(See Tools, Track and Miscellaneous.)

BOOSTERS

GENERAL ELECTRIC BOOSTERS. The series booster built by this company embodies, in general, the same mechanical features as direct current generators of the same make. Some of the more important electrical features are as follows: Good regulation is assured by liberal distribution of the magnetic material, keeping the voltage characteristic a practically straight line. Field coils are tapped out so that connections may be made which enable the booster voltage to be regulated conveniently between given limits without rheostatic control. Boosters can be furnished for full load voltages from 50 to 500 volts.

—GENERAL ELECTRIC COMPANY, SCHENECTADY, N. Y.

BORERS, WHEEL

(See "Machine Tools")

BOXES, JOURNAL

(See "Journal Boxes")

BRACKETS AND CROSS ARMS

CREAGHEAD FLEXIBLE BRACKETS. The Creaghead flexible bracket system is used to flexibly support overhead trolley wires on both high and low speed electric railways. These brackets are peculiarly adapted to interurban construction on account of the low cost of construction and maintenance. Many styles are made to meet the varying conditions. Each style is made in any desired length, giving about one hundred kinds of brackets. Made for wooden or iron poles, with or without insulation in the span wire; plain or ornamental; with top brace or under brace or both. The fittings are of malleable iron and the other parts are steel. High carbon steel tubing is recommended and furnished, but ordinary pipe will be furnished if desired.

—THE CREAGHEAD ENGINEERING COMPANY, CINCINNATI, OHIO.

"OHIO BRASS" POLE BRACKETS. Pole brackets are supplied by this company for supporting overhead trolley wires on either direct current or single phase systems. Wood's adjustable, Wood's flexible, Richmond flexible, Detroit flexible and single phase pole brackets. Made from steel tubing or iron pipe, single or double arm, for wood and iron poles, plain or ornamental. (See catalogue No. 6, pages 5 to 60, and Bulletin No. 1, pages 666 to 676.)

—THE OHIO BRASS COMPANY, MANSFIELD, OHIO.

MAYER & ENGLUND POLE BRACKETS. The castings are of well annealed malleable iron and so proportioned as to impart the greatest strength just where it is required without necessitating the use of a mass of surplus metal. This type has been adopted by quite a number of the higher class constructions of recent years.

—MAYER & ENGLUND COMPANY, PHILADELPHIA, PA.

S.-H. BRACKET ARMS. These bracket arms are manufactured in the following types: Standard, standard

flexible, special flexible and combination flexible. They are constructed with 1½ in. welded wrought iron pipe threaded at both ends. The castings are of best malleable iron, and are especially heavy, and will stand any strain to which they are likely to be subjected in service, with a large margin to take care of all contingencies. The guy rods are of heavy ½ in. steel with buttonhead. Galvanized seven strand either ¼ in. or 5-16 in is furnished with all flexible arms. All types are neat, well made and reliable. (See advertisement.)

—STUART HOWLAND COMPANY, BOSTON, MASS.

BRAKES AND BRAKE SYSTEMS

BRILL RATCHET BRAKE-HANDLE. This brake has the form and mechanism to enable the motorman to get the most effective service from the brakes because he is able to use his strength to the utmost advantage. The form gives the leverage and the ratchet mechanism keeps the leverage at its greatest power. It differs from all others in strength and simplicity as well as in rapidity and effectiveness. The simplicity of the mechanism cannot be exceeded, as a spring and upper ratchet comprise all the movable parts, aside from the handle itself. The handle is made in all standard sizes.

—J. G. BRILL COMPANY, PHILADELPHIA, PA.

—AMERICAN CAR COMPANY, ST. LOUIS, MO.

—G. C. KUHLMAN CAR COMPANY, CLEVELAND, OHIO.

—JOHN STEPHENSON COMPANY, ELIZABETH, N. J.

CHRISTENSEN AIR BRAKE SYSTEM. A very compact motor driven air compressor, having the motor mounted directly above the compressor, is used to furnish compressed air to a suitable reservoir. An automatic governor is used to stop and start the compressor motor when the pressure in the reservoir rises above or falls below certain limits. From the reservoir air is admitted by aid of a special valve at the end of the car, known as the engineer's valve, to the brake cylinder; the compressed air forces the piston out and thus through suitable leverage applies the brake shoes to the wheels. Over 15,000 equipments in operation throughout all parts of the world. (See advertisement.)

—NATIONAL ELECTRIC COMPANY, MILWAUKEE, WIS.

COLUMBIA CAR BRAKES. The brakes are between the wheels. No brake beams or long chains are required. They are easily adjusted, and the shoes are so arranged as to wear equally on all of the wheels. The brakes are adjusted independently on either side. They are quick-acting, requiring only a three-quarter turn of the brake handle for their application.

—COLUMBIA MACHINE WORKS AND MALLEABLE IRON COMPANY, BROOKLYN, N. Y.

FRESH'S EMERGENCY CAR BRAKE. This brake consists of chucks operated under the wheels on the rails, using the weight and momentum for stopping the car. The chucks employ wool felt, compressed into a detachable friction plate on the rail. As the wool felt is absorbent and elastic, it offers the greatest resistance on the wet or icy rail without jar or derailing the car. The chucks are carried by the drawbars and instantly dropped by one-half turn of the brake staff. This equipment is independent of power, simple and durably constructed and offers greatest protection against accidents.

—EMERGENCY CAR BRAKE COMPANY, CUMBERLAND, MD.

DAYTON BRAKE HANDLES. The No. 7 Kling-Leen ratchet handle insures positive engagement of the ratchet and pawl. It is made in three sizes, 10 in., 12 in. and 14 in. swing. The gravity brake handle is of more recent production. To make sure that it was up to its claims, the company put this brake to a two years' test before placing it on the market. It has no ratchets to wear out or spring to catch and miss action; no pawls to break. There are simply three strong and durable steel gravity rollers.

—THE DAYTON MANUFACTURING COMPANY, DAYTON, O.

QUICK ACTION SAFETY CAR BRAKE. Has pinion, gear, two chains and horizontal drum. One of the important features is that the two chains secured, one on each side of the drum by staples riveted into drum heads, divide the strain on the links and diminish chances for breakage of chain; the slack chains are taken up quickly by the drum. One turn of the brake handle puts a car under full control. The pinion shaft has a square hole in it to receive the brake staff, thus making it impossible for it to slip. The brake is designed for use on light or heavy equipment on electric or steam roads.

—TRACTION EQUIPMENT COMPANY, BROOKLYN, N. Y.

PEACOCK BRAKE. A hand brake, adapted for any kind of car up to the heaviest and fastest suburban type. The brake is durably constructed, has few parts and is

easily operated and applied because the drum works on roller bearings. The speed obtained when taking up the slack chain and the great power gained when applying the brake are very valuable features. The spiral drum, with its eccentricity-gear construction, not only accomplishes these objects but extends sufficiently to provide for the taking up of any surplus chain caused by the car-house men neglecting to keep the brakes properly adjusted. (See advertisement.)

—NATIONAL BRAKE COMPANY, BUFFALO, N. Y.

PHILADELPHIA AIR BRAKE. This company presents a complete air brake equipment which through two years of practical use has proven to be economical, well built and reliable. The compressor is compact, with all wearing parts easy of access and running in oil. The design of the engineer's valve is entirely different from anything else in use and eliminates many of the causes of trouble. The automatic cut-off is simple, easy to adjust and positive in action. The duplex jam cylinder gives the operator two independent air brakes, reducing the chance of accident to a minimum.

—PHILADELPHIA AIR BRAKE COMPANY, PHILADELPHIA, PA.

ST. LOUIS VERTICAL WHEEL BRAKE. The company recommends its vertical wheel brake because it is easy to operate. Motorman can use both hands in operating. It is strong, though simple in construction. It saves platform space. Removes possibility of injuring operator and passengers—a frequent occurrence where brake handle is used. The action on the brake is at once quick and effective. Heavy equipment nowadays has the modern air brake, and a hand brake is added for emergencies only. For this reason the vertical brake wheel is to be especially recommended as the hand brake should not take up much space on the platform.

—ST. LOUIS CAR COMPANY, ST. LOUIS, MO.

STERLING SAFETY BRAKE. Consists of a pinion shaft, ratchet, pinion, gear, double sprocket (cast with the gear) and two chains. The pinion shaft receives the brake staff and actuates the pinion. The force exerted on a 14 in. handle is multiplied by this brake 17 times. Operation is easy and smooth. The chains attach to two hooks on the brake rod. One chain does the work. The idle chain runs slack, always new, ready for instant service should the working chain break, as such chains do. This brake, therefore, anticipates a common danger. Properly installed, one turn of the handle stops any car. (See advertisement.)

—STERLING-MEAKER COMPANY, NEWARK, N. J.

TAYLOR BRAKES. All Taylor trucks are equipped with a compound lever brake, through which the power is applied centrally, and an even and direct pressure of the brake shoes put upon all the wheels. These brakes are so hung that the shoe adjusts itself accurately to the periphery of the wheel, thereby securing uniform wear of the brake shoes. The shoe is entirely independent of the brake head and is held to it by a key which can be readily removed, allowing the worn out shoe to be replaced without unscrewing a single bolt. The brakes are also supplied with an adjustable release spring which can be so nicely adjusted that each shoe can be set at an equal distance from the wheel.

—TAYLOR ELECTRIC TRUCK COMPANY, TROY, N. Y.

U. S. COMBINED WHEEL AND RAIL-BRAKE.

The brake shoes are normally supported by spiral springs to permit the free movement of the shoes both toward and away from the wheels and rails. The first movement of the brake spindle brings the brake applying cams into contact with inclines on the shoe backs and presses the brake shoes hard against the wheels. In emergencies, if necessary, an extra pressure on the brake spindle will force the rail brake at the bottom of shoes into contact with the rails.

—U. S. METAL & MANUFACTURING COMPANY, NEW YORK, CHICAGO, PITTSBURG.

WESTINGHOUSE AUTOMATIC AIR-BRAKE SYSTEM.

As adapted to electric railways, this system consists of a motor-driven air compressor supplying compressed air to a main reservoir and the brake system; an automatic governor controlling minimum and maximum pressures in main reservoir; a motorman's brake valve by which brakes are applied and released; a brake cylinder piston rod which is connected through suitable levers to brake shoes; an auxiliary reservoir in which air is stored for use in the brake cylinder; a triple valve forming connection between brake pipe, auxiliary reservoir and brake cylinder, and suitable piping, air strainer, cut-out cocks, reducing valve, hose couplings, etc., to connect the various pieces of apparatus above mentioned, and to connect different cars. In this system the brake pipe, which runs throughout the train and connects the motorman's brake valve with the various triple valves, is normally under pressure, the

brakes being applied whenever this pressure is reduced, whether such reduction is caused by the motorman or by accident.

—THE WESTINGHOUSE AIR BRAKE COMPANY, PITTSBURG, PA.

WESTINGHOUSE STRAIGHT AIR-BRAKE SYSTEM. This system consists of a motor-driven air compressor furnishing compressed air to a reservoir; an automatic governor controlling the minimum and maximum pressures in the reservoir; a motorman's operating valve by which brakes are applied and released; a brake cylinder, piston rod which connects through suitable system of levers to the brake shoes; piping connecting the various apparatus above mentioned, and cut-out cocks, air strainers and fittings. The brake pipe is under pressure only during a brake application; the motorman allows air to flow from the reservoir to the brake cylinder to apply the brakes, and from the brake cylinder to the atmosphere to release them. Entirely safe only when applied to single cars; for trains of two or more cars the Westinghouse automatic air brake should be applied.

—THE WESTINGHOUSE AIR BRAKE COMPANY, PITTSBURG, PA.

BRAKE SLACK ADJUSTERS

AMERICAN AUTOMATIC BRAKE-SLACK ADJUSTER. This device consists of a worm, the rotation of which causes the fixed end of the air brake cylinder lever in the foundation brake gear to move so as to take up the slack due to worn brake shoes. On the end of the worm is a toothed wheel, opposite to which and at right angles to the worm, is an air cylinder, the single acting piston of which connects by a ratchet-finger with the toothed wheel in such a manner that whenever air pressure is admitted back of the piston, the latter is pushed forward and the ratchet-finger engages with the toothed wheel; when the air leaves the cylinder, a spring back of the piston forces it to its former position, while the ratchet-finger is engaged with the toothed wheel, thereby causing the worm to rotate. The cylinder is connected by a small pipe to the brake cylinder, so that when the piston in the latter moves out to a certain point, air pressure is admitted to the slack-adjuster cylinder. In this manner the brake cylinder is made to be an automatic valve for the slack adjuster, only admitting air to the latter when it is necessary to take up slack.

—THE AMERICAN BRAKE COMPANY, ST. LOUIS, MO.

BRAKE SHOES

AMERICAN BRAKE SHOES. This line embraces an extensive variety of brake shoes for all classes of railway car braking. For electric railway service five brands of shoes are made a specialty: The Streeter shoe, of soft cast iron with curved face-inserts of hard iron; the Corning shoe of hard cast iron body surrounding an insert of very soft iron in the wearing face; the Diamond "S" shoe of hard iron cast about a bundle of expanded sheet steel; the "U" brake shoe of car wheel iron with extended inclined ends chilled from the back, and the Morrison "Filled" shoe of a strong cast iron body with recessed face containing a block of elastic filling.

—THE AMERICAN BRAKE SHOE AND FOUNDRY COMPANY, MAHWAH, N. J.

BRILL BRAKE-SHOE. This shoe is made of soft iron and has oblong sections of wrought iron set in the contact surface. It is made on the principle of smallest possible wear to the wheel as well as the shoe. The chilled surface of wheels is too thin to permit the use of inserts composed of sand or extremely hard metal. This manufacturer's experience has proved wrought iron to be the best material for this purpose, and the amount necessary to obtain the best results has been thoroughly demonstrated.

—J. G. BRILL COMPANY, PHILADELPHIA, PA.

—AMERICAN CAR COMPANY, ST. LOUIS, MO.

—G. C. KUHLMAN CAR COMPANY, CLEVELAND, OHIO.

—JOHN STEPHENSON COMPANY, ELIZABETH, N. J.

BUDA FLANGED BRAKE SHOES. These shoes are designed to permit a greater braking power by extending not only along the tread, but over the flange. Especially adapted to street car service where the narrower tread of the wheel and the consequent decreased frictional surface is increased by the bearing which goes over the flange.

—BUDA FOUNDRY & MANUFACTURING COMPANY, CHICAGO, ILL.

MURRAY BRAKE SHOES. These brake shoes are not cast from the tailings of the cupola, as is frequently done, but are poured from a special mixture of steel and iron, insuring toughness, durability and good friction.

—THE MURRAY IRON WORKS COMPANY, BURLINGTON, IA.

ST. LOUIS BRAKE SHOES. The "K" brake shoe

has a hard iron insert, around which is cast a gray iron casting which is not permitted to chill, differing, in this respect, from all other insert shoes. This hard iron insert is a dovetail casting, and is made from high grade malleable iron before it is annealed. The company's process of casting gray iron body around insert, without chilling, not only gives great strength to body of shoe, but also produces a better gripping and wearing effect, with less liability of glazing. None but high grade iron used.

—ST. LOUIS CAR COMPANY, ST. LOUIS, MO.

SPEAR BRAKE SHOE. This is an insert brake shoe, the insert being chilled iron and the balance of the shoe soft iron. Has long life, highest braking power, and saves tires and wheels. It rides the tread at the points where there is the least track wear. There is no cutting edge as the shoe wears down. (See illustrated advertisement.)

—THE DORNER MANUFACTURING COMPANY, CHICAGO, ILL.

"STANDARD" BRAKE SHOES. This company's brake shoes include the following: Gray iron shoes, of special mixture, plain, inserted or filled; steel back shoes, of special mixture, plain, inserted or filled; filled shoes with "corrugated pocket" and steel back shoes with "re-enforced lug."

—STANDARD BRAKE SHOE COMPANY, AURORA, ILL.

TAYLOR BRAKE SHOES. These brake shoes are made of the best hard gray iron, and are guaranteed to fit the brake heads accurately.

—TAYLOR ELECTRIC TRUCK COMPANY, TROY, N. Y.

THE WHEEL TRUING BRAKE SHOE. A wheel grinding shoe, used in place of the ordinary shoe whenever the car wheels need grinding. It trues the wheels while the car is in service; each pair will true a number of pairs of wheels. It consists of an iron shell containing pockets filled with an abrasive substance, so that whenever the brake is applied the wheels are being ground. It is made in any style, so as to fit any type of brake head.

—THE WHEEL TRUING BRAKE SHOE COMPANY, DETROIT, MICH.

BRAZING PROCESSES

FERROFIX FOR BRAZING CAST IRON. The principal feature is the uniting of the surfaces of broken castings by the use of "Ferrofix" and spelter employed in conjunction therewith. The fractures when brazed are as strong as any other part of the casting of equal dimensions, and in all cases the joint is guaranteed, in that should the casting break again it will not do so in the line of the old fracture. This process is particularly applicable to the repairing of motor frames, trucks and gear cases, but has many other applications. (See advertisement.)

—THE AMERICAN FERROFIX BRAZING COMPANY, PHILADELPHIA, PA.

BRIDGES AND BUILDINGS

AMERICAN BRIDGES AND BUILDINGS. This company is a large manufacturer of structural steel and is prepared to design and build steel railway and highway bridges of any desired length and carrying capacity; also to furnish steel construction for buildings.

—AMERICAN BRIDGE COMPANY OF NEW YORK, NEW YORK.

BRIDGES AND BUILDINGS. Bridges, viaducts, steel buildings and structural steel work of every description.

—THE PENNSYLVANIA STEEL COMPANY, PHILADELPHIA, PA.

CONCRETE BRIDGES AND BUILDINGS. The Concrete Steel and Tile Construction Company, a corporation organized under the laws of the State of Michigan, undertakes contracts for the erection of reinforced concrete buildings, bridges, arches, etc., using for its reinforcement the Kahn trussed bar. Its experience in building construction covers a vast range, as it has under way at the present time some 200 contracts of various types. Having a competent corps of engineers always in its employ the company gladly offers its services in submitting designs to prospective customers.

—CONCRETE STEEL AND TILE CONSTRUCTION COMPANY, DETROIT, MICH.

KAHN CONCRETE STEEL CONSTRUCTION. In reinforced concrete girders and beams provision must be made not only for the tension existing in the bottoms thereof, but also for the transverse stresses occurring within the constructions. It is therefore absolutely essential that the reinforcement be arranged not only along the bottom edge but also transversely to the concrete. For efficiency these transverse reinforcing members must be rigidly connected to the main horizontal tension bar. The Kahn

trussed bar accomplishes this result by striking up from the member a portion of the section where a reduced area is permissible on account of the reduction in the tensile strain. The Kahn trussed bar possesses the following decided advantages: Reinforcement along theoretical as well as practical lines, absolute assurance of the proper installation of the steel, greater ease and facility for handling, greater speed of erection, less need of skilled labor, less deflection under a given load, greater economy in the use of steel, and saving in time and money without sacrificing the value of the construction.

—TRUSSED CONCRETE STEEL COMPANY, DETROIT, MICH.

THE OWEGO BRIDGE COMPANY, OWEGO, N. Y.; OFFICE, PHILADELPHIA, PA. This company has been established for about fifteen years; its shops are on the lines of three railroads, and have a capacity of from 1,200 to 2,000 tons. Its facilities are of the best for building bridges economically and promptly. About two years ago this company was reorganized by the Transit Finance Company of New York (builders of the Lackawanna & Wyoming Valley Railroad, Buffalo, Rochester and Lockport Railway, etc.); through such connections the new Owego Bridge Company has been naturally led into the electric railway field, and to specializing traction road bridges. Its engineering department will submit plans and estimates upon request.

REINFORCED CONCRETE CAR HOUSES. The value of reinforced concrete in fire-proof construction has been thoroughly well established. It is peculiarly well adapted to electric railway car houses, as it is possible with this material to construct a building absolutely without any combustible material. Owing to the simplicity of its design and the duplication of parts, such a building can be constructed at a cost not materially exceeding that of first class mill construction using brick and steel. It is not necessary to carry insurance on such a building. An example may be seen in the new car houses of the Central Pennsylvania Traction Company at Harrisburg, Pa.

—MASON D. PRATT, HARRISBURG, PA.

RIVERSIDE BRIDGES AND BUILDINGS. This company is prepared to construct railway bridges, viaducts and other heavy structural work. Its equipment is modern in every respect for carrying out its contracts quickly and efficiently.

—RIVERSIDE BRIDGE COMPANY, WHEELING, W. Va.

SCOFIELD REINFORCED CONCRETE SYSTEM. Concrete work to be reliable must have the concrete carefully made and placed; offset bars, so that reliance is not placed upon adhesion; some mechanical means of retaining bars in their proper position while concrete is placed. If these characteristics are achieved, the strength which is calculated will develop in practice. The "Scotfield" system of reinforced concrete construction accomplishes these ends, and enables the inspector to see that all steel work is in proper place before concreting begins. It has been used with marked success in powerhouse construction, car barns, coal bunkers, reservoirs, track stringers, railroad bridges, etc. (See advertisement.)

—THE SCOFIELD COMPANY, PHILADELPHIA, PA.

BRUSHES, CARBON

"NATIONAL CARBON" FLEXIBLE CONNECTION FOR CARBON BRUSHES. In this flexible connection for carbon brushes the woven wire is inserted into the brush the full length of the hole, the sleeve is then slipped in and the screw following expands the sleeve to make a contact superior to that obtained by driving in a plug. The greatest feature this connection has, however, is that it is much closer to the commutator surface than any other connection, thereby reducing the resistance between the commutator and the terminal to a minimum and increasing the carrying capacity of the brush because there is less carbon resistance between the commutator surface and the end of the flexible connection.

—NATIONAL CARBON COMPANY, CLEVELAND, OHIO.

GENERAL ELECTRIC BRUSHES AND HOLDERS. The company's brush holders for street railway motors are of bronze with carbon brushes. The brushes slide in finished ways, giving a large surface of contact. Independent brush springs insure freedom of motion, with no tendency to stick. All carbon brushes are provided with "pig tails" or shunts so that the springs are short circuited. A simple and efficient mechanism is used for the adjustment of wear and ease of renewal.

—GENERAL ELECTRIC COMPANY, SCHENECTADY, N. Y.

"HIKO" CARBON BRUSHES. These brushes are especially adapted for street railway and other service

where it is inconvenient to apply a commutator compound. With these brushes there is no scratching, as both the commutator and brushes remain smooth.

—ATLANTIC MANUFACTURING COMPANY, ALLENHURST, N. J.

LE VALLEY VITAE CARBON BRUSHES. These brushes are permanently self-lubricating. They last long, have low resistance, give excellent contact, wear smooth, run cool and do not throw off any carbon dust to cause short circuits. As the brushes will not cut or scratch the commutator, no sandpapering or turning down is required. Many styles are manufactured, each being best adapted for certain conditions and guaranteed by the maker.

—LE VALLEY VITAE CARBON BRUSH COMPANY, NEW YORK.

NATIONAL CARBON BRUSHES. This company is well-known as a manufacturer of carbon and other electrical specialties for railway work. Among these are carbon brushes, battery carbons, lighting carbons, dry batteries, wet batteries, electrodes, etc. The "Columbia" dry cell, one of the company's specialties, is described elsewhere in this dictionary.

—NATIONAL CARBON COMPANY, CLEVELAND, OHIO.

SPEER CARBON BRUSHES. While these brushes contain no grease or oil, they are self-lubricating. They give the commutator a hard glossy finish and keep it clean, thereby increasing the conductivity. They reduce the wear on the commutator and prevent sparking and short circuiting. This brush is of uniform texture and offers a soft frictional surface, and it is guaranteed not to heat up under the most severe circumstances.

—SPEER CARBON COMPANY, ST. MARY'S, PA.

BUMPERS. CAR

BRILL ANGLE-IRON BUMPER. Composed of a single solid forging, the angle-iron bumper possesses all the qualities essential to large effectiveness. The wrought metal is immensely tough, and, in combination with angle-iron construction and semi-elliptic form, gives a strength capable of resisting shocks which would crush a steel-faced wooden bumper and injure platform and framing. The frequent collisions in coupling cars, and the constant liability to damage through the negligence of motormen, make a good bumper an important factor in the saving of repairs. The angle-iron bumper is made in shapes and sizes suitable to every style of car. (Advertisements in last pages.)

—J. G. BRILL COMPANY, PHILADELPHIA, PA.

—AMERICAN CAR COMPANY, ST. LOUIS, MO.

—G. C. KUHLMAN CAR COMPANY, CLEVELAND, OHIO.

—JOHN STEPHENSON COMPANY, ELIZABETH, N. J.

BUTTONS

(See "Badges and Buttons")

CABLES

(See "Wires and Cables")

CARBON BRUSHES

(See "Brushes, Carbon")

CARS

(Passenger, Freight and Express)

"AMERICAN CAR AND FOUNDRY" CARS. This company, incorporated in 1899, having formed a consolidation of the largest and oldest car building interests in the United States, is the largest builder of cars in the world. Its specialty is any type of cars of wood or steel construction. The plants for the manufacture of these various products are located as follows: Passenger and street railway car shops—St. Charles, Mo.; Jeffersonville, Ind.; Wilmington, Del.; Berwick, Pa. Freight car shops—Detroit, Mich.; Berwick, Pa.; St. Louis, Mo.; Madison, Ill.; Chicago, Ill.; Huntington, W. Va.; St. Charles, Mo.; Terre Haute, Ind.; Jeffersonville, Ind.; Buffalo, N. Y.; Milton, Pa.; Indianapolis, Ind.; Memphis, Tenn. In addition to these the company operates axle forges, saw-mills, malleable foundries, brass foundries, etc.

—AMERICAN CAR AND FOUNDRY COMPANY, ST. LOUIS AND NEW YORK.

AMERICAN CAR COMPANY'S CARS. For cars manufactured by this company see item beginning "Brill."

BRILL BAGGAGE AND EXPRESS CARS. The cars are powerfully framed and trussed for carrying heavy loads, are provided with one or two sliding doors at each side and usually have doors at diagonally opposite corners, to admit long pieces of material and for the motorman's

use. A removable gate extending across the car behind the motorman, against which material may be piled, may be used instead of a compartment. It is usually advisable to have baggage and express cars of the largest capacity that conditions permit, as the difference in cost of handling is comparatively small and the earnings are increased proportionally to the tonnage carried. (Advertisements on last pages.)

—J. G. BRILL COMPANY, PHILADELPHIA, PA.

—AMERICAN CAR COMPANY, ST. LOUIS, MO.

—G. C. KUHLMAN CAR COMPANY, CLEVELAND, OHIO.

—JOHN STEPHENSON COMPANY, ELIZABETH, N. J.

BRILL "CALIFORNIA" CAR. A single-truck car with closed compartment at the center, and long dropped platforms, each having two seats back-to-back with bulkhead between. A pair of angle irons, with the upper flange under the side sills, is offset and prolonged to support the long dropped platforms without strain to the body. Ingress and egress are facilitated by the dropped platforms which have running boards only 13 ins. from the track, and 12 ins. from board to platform. Sashes in the bulk head, and side curtains which can be drawn to the floor, provide for stormy weather. Double-truck "Californias" are also built. (Advertisements in last pages.)

—J. G. BRILL COMPANY, PHILADELPHIA, PA.

—AMERICAN CAR COMPANY, ST. LOUIS, MO.

—G. C. KUHLMAN CAR COMPANY, CLEVELAND, OHIO.

—JOHN STEPHENSON COMPANY, ELIZABETH, N. J.

BRILL CENTER-VESTIBULE CAR. As there are no platform steps to be avoided, the trucks may be placed so as to reduce the objectionable overhang and thus enable the car to be satisfactorily operated on narrow and crowded streets where the curves are of short radius. The entrance and exit of passengers can be easily watched and controlled by the conductor. A heavy stirrup-iron, which connects the sills, allows the steps to be kept within the line of body and preserves the stiffness and strength of sills. The seating capacity is increased by a sliding seat in the vestibule. (Advertisements in last pages.)

—J. G. BRILL COMPANY, PHILADELPHIA, PA.

—AMERICAN CAR COMPANY, ST. LOUIS, MO.

—G. C. KUHLMAN CAR COMPANY, CLEVELAND, OHIO.

—JOHN STEPHENSON COMPANY, ELIZABETH, N. J.

BRILL COMBINATION CONVERTIBLE AND SEMI-CONVERTIBLE CARS. Where railways are laid out to enable cars to run in one direction and have the entrances all on one side, it has been found advantageous to have the entrance side convertible, with sashes and panels that can be raised into roof pockets, and the other side of the car semi-convertible, with built-in panels and only the sashes to be raised into pockets. The Brill patented convertible and semi-convertible systems are well suited to such a combination as the sash arrangement of both is identical. Several types of cars have been built with this combination for both motor and trailer service.

—J. G. BRILL COMPANY, PHILADELPHIA, PA.

—AMERICAN CAR COMPANY, ST. LOUIS, MO.

—G. C. KUHLMAN CAR COMPANY, CLEVELAND, OHIO.

—JOHN STEPHENSON COMPANY, ELIZABETH, N. J.

BRILL CONVERTIBLE CAR. Large double-sash windows slide into roof pockets in the same manner as in the Brill semi-convertible car. The panels also slide into the same roof pockets by means of metal guides on the posts which are straddled by the projecting edges of the two sheets of thin steel which compose the panels. These metal sheets are held $\frac{3}{8}$ -in. apart by horizontal wooden slats and have spaces between which successfully air-jacket the car against cold. The car is as substantially built and as weather-proof as a standard closed car, and costs no more for maintenance. No rattling of sliding sashes and panels. (Advertisements in last pages.)

—J. G. BRILL COMPANY, PHILADELPHIA, PA.

—AMERICAN CAR COMPANY, ST. LOUIS, MO.

—G. C. KUHLMAN CAR COMPANY, CLEVELAND, OHIO.

—JOHN STEPHENSON COMPANY, ELIZABETH, N. J.

BRILL DRAWING-ROOM CARS. Among those designed and built for officials, and for regular service, are cars with staterooms, bathrooms, kitchens and dining-rooms, observation ends with windows which reach nearly to the floor, large platforms enclosed with dashes and gates of dull brass grill work. The compartments are finished in rich woods handsomely carved and inlaid, and the upholstery and appointments are all of the most luxurious character. Drawing-room cars are being profitably used on many interurban lines. A number of these cars have included the Brill semi-convertible window system, which adds to their comfort in summer.

—J. G. BRILL COMPANY, PHILADELPHIA, PA.

—AMERICAN CAR COMPANY, ST. LOUIS, MO.

—G. C. KUHLMAN CAR COMPANY, CLEVELAND, OHIO.

—JOHN STEPHENSON COMPANY, ELIZABETH, N. J.

BRILL INTERURBAN CARS. These companies do not follow the common methods of building interurban cars, which are drawn largely from steam car practice. Their forms of construction are not excessively heavy. The proper form and amount of bracing and trussing reduces the weight and bulk. That these methods are correct and that infinite care is given to their application in every case, is amply proved by the straight sills, tight joints and thoroughly satisfactory condition of the cars after they have been in service long enough to demonstrate their strength and durability. The Brill semi-convertible window system is frequently included in interurban car designs and is adaptable to the arched-top twin-window arrangement. (Advertisements in last pages.)

—J. G. BRILL COMPANY, PHILADELPHIA, PA.

—AMERICAN CAR COMPANY, ST. LOUIS, MO.

—G. C. KUHLMAN CAR COMPANY, CLEVELAND, OHIO.

—JOHN STEPHENSON COMPANY, ELIZABETH, N. J.

BRILL "METROPOLITAN" CAR. This combination open and closed car is used in a number of large cities in conjunction with standard equipment. One-half of the car is simply a standard open car and the other half a standard closed. It was designed for the Metropolitan Street Railway, of New York, when the Board of Health of that city demanded that every fourth car in summer be closed, and has proved so popular that it is used as a regular part of the winter equipment, smoking being allowed in the open part. The car is designed to be carried on "Eureka" maximum-traction trucks. (Advertisements in last pages.)

—J. G. BRILL COMPANY, PHILADELPHIA, PA.

—AMERICAN CAR COMPANY, ST. LOUIS, MO.

—G. C. KUHLMAN CAR COMPANY, CLEVELAND, OHIO.

—JOHN STEPHENSON COMPANY, ELIZABETH, N. J.

BRILL "NARRAGANSETT" CAR. The summer excursion car for handling crowds safely, and the only practical double-truck open car. A double-step is provided by having the upper step on the middle web of Z-iron sills. The width over all is no greater than a single-step double-truck open car as the sill step is within the line of the posts. The double steps of the Narragansett make it possible for women and children to get in and out safely and quickly. It is the safest open car. The Z-iron sills make it the strongest open car ever built. The seats are full standard length. (Advertisements in last pages.)

—J. G. BRILL COMPANY, PHILADELPHIA, PA.

—AMERICAN CAR COMPANY, ST. LOUIS, MO.

—G. C. KUHLMAN CAR COMPANY, CLEVELAND, OHIO.

—JOHN STEPHENSON COMPANY, ELIZABETH, N. J.

BRILL SEMI-CONVERTIBLE CAR. Each pair of sashes is joined together with brass tongue-and-groove sliding connections and conducted into a pocket in the side roof by means of small metal roller-brackets, moving on bow-shaped steel guides, which extend from top-plate to lower ventilator rail, and are within the pocket. This is the improved patented system known as the "grooveless-post." Having the window pockets in the roof adds 6 ins. to $7\frac{1}{2}$ ins. to the interior width; the pockets cannot be used for rubbish receptacles; the window sills may be as low as desired; the operation of the sashes is easier than with wall pockets. (Advertisements in last pages.)

—J. G. BRILL COMPANY, PHILADELPHIA, PA.

—AMERICAN CAR COMPANY, ST. LOUIS, MO.

—G. C. KUHLMAN CAR COMPANY, CLEVELAND, OHIO.

—JOHN STEPHENSON COMPANY, ELIZABETH, N. J.

BRILL STANDARD CLOSED CARS. Single- and double-truck closed cars longitudinal seats and drop-sash windows are still built in large numbers. For city service, the wide space between the seats is often an important advantage over the limited aisle space of the transverse seat arrangement, as greater carrying capacity is obtained and the movement of passengers in and out is facilitated. When cars are built with entrance at one side only of either open or vestibule platforms, it is usual to include the company's "semi-accelerator" doors at the body ends, which permit passengers standing on the platforms without obstructing the passage from step to door. (Advertisements in last pages.)

—J. G. BRILL COMPANY, PHILADELPHIA, PA.

—AMERICAN CAR COMPANY, ST. LOUIS, MO.

—G. C. KUHLMAN CAR COMPANY, CLEVELAND, OHIO.

—JOHN STEPHENSON COMPANY, ELIZABETH, N. J.

JEWETT CARS. This company is particularly well-known in the electric railway field on account of the many handsome and substantial cars which it has furnished to the high-speed interurban electric railways of the middle West. In addition to interurban cars this company has built some fine types of surface cars, a characteristic example being the style used for handling the local traffic on the new East River bridge between New York and Brooklyn.

—JEWETT CAR COMPANY, NEWARK, OHIO.

(CONTINUED ON PAGE IX.)

CARS—Continued.

BRILL STANDARD OPEN CARS. As usually constructed, the seats have reversible backs with the exception of the four against the bulkheads, so that the passengers, on all but two seats, face forward. The cars are sometimes built without bulkheads, vestibule ends with stout corner posts taking their place, thereby permitting all seats to have reversible backs. If bulkheads are used and weather conditions require protection for passengers outside of them, light but substantial vestibules may be employed to advantage. All open cars are provided with the company's "round-corner seat-end panels," which facilitate ingress and egress and permit the curtains to be drawn to the floor.

—J. G. BRILL COMPANY, PHILADELPHIA, PA.

—AMERICAN CAR COMPANY, ST. LOUIS, MO.

—G. C. KUHLMAN CAR COMPANY, CLEVELAND, OHIO.

—JOHN STEPHENSON COMPANY, ELIZABETH, N. J.

BRILL TOP-SEAT CARS. These companies build every type of single- and double-truck top-seat car, with and without canopies and enclosures, with longitudinal seats on the deck, facing outwardly, or transverse seats. A form of stairway, which they have devised, reduces the length of the platforms, provides a covering for the motor-man, and keeps him out of the way of passengers. Other features, developed by long experience, include a variety of window systems which adapt the cars to local conditions.

—J. G. BRILL COMPANY, PHILADELPHIA, PA.

—AMERICAN CAR COMPANY, ST. LOUIS, MO.

—G. C. KUHLMAN CAR COMPANY, CLEVELAND, OHIO.

—JOHN STEPHENSON COMPANY, ELIZABETH, N. J.

DORNER CARS. Are rebuilt equal to new by taking out all defective and worn parts, substituting new and thoroughly overhauling every portion of the cars; adding new trimmings, vestibuling, repainting and mounting on new trucks. (See advertisement.)

—THE DORNER MANUFACTURING COMPANY, CHICAGO, ILL.

JONES CARS. Ever since the establishment of this firm in 1839, its rolling stock has continued to enjoy that popularity that comes from keeping abreast with the changes of time. This company makes a specialty of equipment for electric railway service, cars for steam railroads not being built by them. It has brought out numerous up-to-date designs of high grade cars for electric street railways.

—J. M. JONES' SONS, WEST TROY, N. Y.

KUHLMAN CARS. For cars manufactured by the G. C. Kuhlman Car Company see items beginning "Brill."

LACONIA PASSENGER CARS. Made on the company's own plans and specifications or to specifications of the railway company. The Laconia semi-convertible car is built in any length to suit purchaser; has straight sides; steam car type of roof; all side windows have double sash, and arranged to drop into pockets flush with window stool, making when windows are lowered a very comfortable summer car. The open cars are furnished with closed or vestibuled ends, either 9, 10, 12, 13, 14 or 15 benches; with malleable iron seat panels; folding running boards; drop side guards; curtains running between posts to floor; solid bronze trimmings; extra strong bottom framing, reinforced by steel plates.

—THE LACONIA CAR COMPANY WORKS, BOSTON, MASS.

LACONIA EXPRESS AND COAL CARS. These cars are built on standard specifications, in capacities from ten to forty tons, to suit requirements of purchaser. Cars are built on steam car lines with modifications to suit electric service, for either standard or narrow gage tracks.

—THE LACONIA CAR COMPANY WORKS, BOSTON, MASS.

NILES CARS. Consist of all styles and sizes of electric railway cars, heavy interurban, medium size suburban and city service cars of closed, open and convertible types, but the company's specialty is large cars for fast interurban service and electric parlor cars for limited extra fare service. It furnishes drawings and specifications of standard types of cars to prospective purchasers or builds all classes of cars on purchaser's specifications. The works are new and of latest plan, are centrally located and have economical shipping facilities. (See Niles standard type of car illustrated in advertisement.)

—NILES CAR & MANUFACTURING COMPANY, NILES, O.

PRESSED STEEL CARS. See items under the heading of "Cars, Pressed Steel."

ST. LOUIS CARS. At this plant cars of every description are turned out, from the ten bench open to the handsome interurban car and steam railway coach. For city and light interurban service the company draws attention to its steel channel bottom semi-convertible car, which is

the car for all year round. This form of bottom construction permits car body to be hung low, resulting in but one step from platform to ground. There being no intermediate sills, there is plenty of room for trucks to radiate. This type car is strong and durable, weighing no more than those of ordinary construction.

—ST. LOUIS CAR COMPANY, ST. LOUIS, MO.

STEPHENSON SEMI-CONVERTIBLE CAR. This window system combines the wall pocket and roof pocket methods of disposing of the sashes. Both pockets are narrow and the side lining is set in between the posts to add additional interior width to the car. In opening a window, the lower sash is dropped into the wall pocket, which is covered with a hinged cap, and the upper sash is raised into the roof, where it is held securely. This window system is suitable for use with arched-top twin-window type of cars, as well as for the ordinary form. The car is successfully used on elevated lines and in all forms of city and interurban service. (See illustration in advertisement.)

—JOHN STEPHENSON COMPANY, ELIZABETH, N. J.

STEPHENSON CARS. In addition to the above item see also those beginning "Brill."

CARS, PRESSED STEEL

AMERICAN CAR AND FOUNDRY PRESSED STEEL CARS. This company is the largest builder of steel passenger cars in the world. The principal plants for the manufacture of steel cars are at Berwick, Pa., and Detroit, Mich.

—AMERICAN CAR AND FOUNDRY COMPANY, ST. LOUIS AND NEW YORK.

PRESSED STEEL STREET CAR. A type of street or interurban traction car which, while conserving the general contour and appearance of the usual wooden construction, is built entirely of steel. The material used in construction is pressed steel and rolled shapes in the underframing and superstructure, with steel plates for sides, floor and ends. The design accomplishes a vehicle of extreme rigidity, coupling lightness with practical indestructibility by collision, fire or other accident.

—PRESSED STEEL CAR COMPANY, PITTSBURG, PA.

CARS, PORTABLE SUBSTATION

BRILL PORTABLE SUB-STATION CARS. Instead of building sub-stations which could only be used part of the year, a car containing a rotary converter and transformers may be placed on a siding wherever needed and connection made to the transmission lines with a pole. The delivery of a heavy voltage of direct current over a long line is expensive and as the percentage of waste is slight with alternating current, the car may be placed as far from the powerhouse as desired. The roof of these cars is constructed to be removable in a single piece to permit installation of machinery by crane.

—J. G. BRILL COMPANY, PHILADELPHIA, PA.

—AMERICAN CAR COMPANY, ST. LOUIS, MO.

—G. C. KUHLMAN CAR COMPANY, CLEVELAND, OHIO.

—JOHN STEPHENSON COMPANY, ELIZABETH, N. J.

CARS, CONSTRUCTION AND REPAIR

BUDA HAND CARS AND PUSH CARS. These cars are made in various styles for all track purposes. The wheels are pressed from a single plate of steel; they are spun into shape while hot, so that they are perfectly true and do not require to be "turned-up." The natural skin of the metal is thus preserved on the tread and the life is considerably prolonged. Being of one piece they are not affected by climatic changes. The form of construction was pronounced the strongest by a test made at the University of Illinois, where a number of prominent wheels were tested at the same time.

—BUDA FOUNDRY & MANUFACTURING COMPANY, CHICAGO, ILL.

KALAMAZOO GASOLINE MOTOR CARS. Four-passenger inspection car, fitted with 7 hp. automobile type engine, two speeds ahead and one reverse, capable of attaining a speed of 35 miles per hour, operates like an automobile, comfortably upholstered in leather. A car is also made for section gang purposes, having the same motor, but with a flat deck with seats for large section gangs; will also carry full equipment of tools and if necessary haul push cars. This section gang car can also be fitted with a tower for trolley line work, which tower can be raised or lowered as desired.

—KALAMAZOO RAILWAY SUPPLY COMPANY, KALAMAZOO, MICH.

KALAMAZOO HAND CAR. Equipped with all the desirable features, such as taper-wheel and pinion-fit axles; machine-cut gears; 20 in. dia. pressed steel wheels; flexible steady-box; double-acting brake; wrought walking-beam; specially stout gallow-frame, with vertical and diagonal bracing; car frame made of dry white ash, gained and thoroughly bolted together, braced diagonally and trussed with longitudinal and transverse wrought iron rods against any chance of sagging or getting out of true. Ten styles of hand cars are made by this company.

—KALAMAZOO RAILWAY SUPPLY COMPANY, KALAMAZOO, MICH.

KALAMAZOO PUSH CAR. The platform of this car is 7 ft. long, 5 ft. 8 in. wide; frame and deck of seasoned hard wood; axles, 1½ in. dia.; bearings, brass; wheels, 20 in. dia., all metal; ends strapped with 2x½ in. iron; weight, 480 lbs.

—KALAMAZOO RAILWAY SUPPLY COMPANY, KALAMAZOO, MICH.

KALAMAZOO RAIL CAR. The frame is of thoroughly seasoned oak, gained and reinforced by tie-rods; cross beams faced with flat steel bars; axles, 2½ in. dia.; wheels, 16 in. dia., 6 in. tread. Stout hooks for pulling car are provided, one at each corner; 6 in. dia. rollers, two at each end to facilitate handling iron; weight, 1,620 lbs.

—KALAMAZOO RAILWAY SUPPLY COMPANY, KALAMAZOO, MICH.

KALAMAZOO TOWER HAND CAR. Car platform 4 ft. 4 ins. by 7 ft. 6 ins. Wheels, 20 ins. dia., all metal or wood center. Axles, 1½ in. dia., steel. Fitted with roller bearings when desired, for which a slight extra charge is made. Weight about 800 lbs. Tower is built to any height specified, and, if required, may be made adjustable to different heights at small additional cost. Tower can be easily removed and car then used as an ordinary section car. This car is always ready to be run over the rails directly to breaks which are often inaccessible to horses and wagon.

—KALAMAZOO RAILWAY SUPPLY COMPANY, KALAMAZOO, MICH.

OLDSMOBILE INSPECTION CARS. Made in several types especially adapted to street railway uses. The Number 1 inspection car is used as a line car and when fitted with a ladder is a practical car for quick repair work and getting out on the line in case of emergencies. It is simple in operation, easy to handle and made to suit grades and special rails. This car is manufactured by the Olds Motor Works and sold only by the

—RAILWAY APPLANCES COMPANY, CHICAGO AND NEW YORK.

SHEFFIELD TROLLEY REPAIR CAR. This car is designed for repair work on electric railways. Furnished with tower, either of angle steel or wood construction, as preferred, in two sections; the upper section is telescoped inside of the lower when traveling over the line. Car is equipped with 6 hp. vertical single cylinder automobile type gasoline engine, and has two speeds forward and one reverse. Has a maximum speed of about 15 miles per hour, and reverse speed of 5 miles per hour. The car is under control of the operator at all times. Ample space is provided on car for gang of men and full complement of tools. Several different designs made for inspection, construction and repair work.

—FAIRBANKS, MORSE & COMPANY, CHICAGO, ILL.

CAR EQUIPMENT

(For Fenders, Heaters, Registers, Wheels, etc., see those headings)

CAR TRIMMINGS

(See also Curtain Fixtures, Register Fixtures, etc.)

DAYTON CAR TRIMMINGS. A very extensive line of car trimmings is made by this company in thousands of patterns. The company's catalogue illustrating them has over 1,000 pages, showing more than 8,000 articles of brass hardware used in the construction of passenger cars, for interior, platform and vestibule construction. Many patterns are of recent design, finished in bronze, brass, silver, nickel, oxidized, sand blast or satin as desired.

—THE DAYTON MANUFACTURING COMPANY, DAYTON, O.

RECORDING FARE REGISTER COMPANY'S CAR TRIMMINGS. Highly finished bronze trimmings for all kinds of cars. Individual or continuous package racks for steam or interurban cars. Door, window and seat trimmings; hand grab straps, etc.

—THE RECORDING FARE REGISTER COMPANY, NEW HAVEN, CONN.

WALLACE CAR TRIMMINGS. Brass, bronze, nickled and oxidized trimmings made free from blow holes in castings or other imperfections. Steel sash springs, deck sash pivots, deck sash operating mechanism and in fact all metal furnishings for car bodies.

—WALLACE SUPPLY COMPANY, CHICAGO AND NEW YORK.

CASTINGS

AMERICAN BRIDGE COMPANY'S CASTINGS. Steel and iron castings form one of the important products of this company.

—AMERICAN BRIDGE COMPANY OF NEW YORK, NEW YORK.

AMERICAN BRAKE SHOE AND FOUNDRY COMPANY'S MISCELLANEOUS CASTINGS. Castings of soft and hard iron, from all sizes and shapes of patterns are undertaken, and manhole castings are a specialty of this company.

—AMERICAN BRAKE SHOE & FOUNDRY COMPANY, MAHWAH, N. J.

BEAVER DAM CASTINGS. (See item under Track Work.)

—BEAVER DAM MALLEABLE IRON COMPANY, BEAVER DAM, WIS.

BRADY INGOT COPPER. For street railways operating their own brass foundries this company is enabled to offer ingot copper of the best quality for immediate supply.

—BRADY BRASS COMPANY, NEW YORK.

COLUMBIA CASTINGS. The gray iron castings are made of best pig iron and are soft and smooth. The brass castings are made of the best composition.

—COLUMBIA MACHINE WORKS AND MALLEABLE IRON COMPANY, BROOKLYN, N. Y.

FALK CASTINGS. Founders of miscellaneous iron and steel castings.

—THE FALK COMPANY, MILWAUKEE, WIS.

LACONIA CASTINGS. The malleable castings used in this company's cars and trucks are of its own manufacture. The company also manufactures malleable castings for all kinds of electrical work, making a specialty of this work in its foundry. Material used is the best grade of charcoal iron, and after passing through the annealing furnaces the iron becomes very tough and is easily machined.

—THE LACONIA CAR COMPANY WORKS, BOSTON, MASS.

MICHIGAN CASTINGS. Brass, bronze and grey iron castings.

—MICHIGAN MACHINERY MANUFACTURING COMPANY, YPSILANTI, MICH.

MORRIS CASTINGS. All classes of small castings furnished in connection with electric railway line material and other work.

—ELMER P. MORRIS, NEW YORK.

MURRAY CASTINGS. Made in large foundries in Iowa and Illinois and are the result of the experience of a third of a century. The mixtures are made by analysis and there are separate cupolas for different grades; therefore every casting is especially suited and adapted for its particular purpose.

—THE MURRAY IRON WORKS COMPANY, BURLINGTON, IA.

"OHIO BRASS" CASTINGS. Brass, bronze and aluminum castings and special brass work of all kinds are the specialties of this company.

—THE OHIO BRASS COMPANY, MANSFIELD, OHIO.

PENNSYLVANIA STEEL CASTINGS. Steel castings and special steels for all purposes.

—PENNSYLVANIA STEEL COMPANY, PHILADELPHIA, PA.

RIDLON CASTINGS. This company has an up-to-date brass foundry and is prepared to make all classes of castings in bronze, brass or composition, either in the rough or finished; a brass finishing department is connected with the factory, making it possible to turn out any class of work in this line. A specialty is made of register fittings and car trimmings.

—FRANK RIDLON COMPANY, BOSTON, MASS.

CAST-WELDED JOINTS

(See Joints, Rail.)

CATCHERS AND RETRIEVERS. TROLLEY

AMERICAN CATCHER. An ordinary trolley-pole catcher that prevents pole from getting beyond control and doing damage, and with special provision for taking care

of slack rope. Its principal features are its simplicity, durability, and its low cost. Its simple mechanism and small number of parts make dis-arrangement almost impossible, and as each part is a solid piece of malleable iron it is practically indestructible, thereby greatly reducing the cost of maintenance.

—THE TROLLEY SUPPLY COMPANY, CANTON, OHIO.

EARL TROLLEY CATCHER. Weight 10 lbs. diameter $7\frac{1}{2}$ in.; projects 5 ins. from dash of car. Drum will wind 25 ft. No. 10 rope. Contains no screws or pins. Made entirely of steel and malleable iron. Drum runs on shaft supported at both ends. Bearings $3\frac{1}{2}$ ins. long. Check pawl is cushioned when the trolley jumps and the centrifugal pawl is relieved of all pressure due to checking the pole. Contains only three working parts, the drum and two pawls. Is very light, strong and durable.

—CHARLES I. EARL, NEW YORK.

EARL TROLLEY RETRIEVER. Weight 14 to 17 lbs., diameter $7\frac{1}{2}$ ins.; projects $5\frac{1}{2}$ ins.; large rope capacity. Taken apart and assembled without tools in two minutes. Adjustable for any power within limits of retrieving spring without changing spring. Reset by merely pulling out the rope. May reset by reciprocating rope up and down in short strokes with assistance of pole without permitting pole to strike, should car be in motion. Conductor compelled to reset completely. Contains release by which the rope may be instantly withdrawn before resetting or in case of any accident to the mechanism.

—CHARLES I. EARL, NEW YORK.

KNUTSON TROLLEY RETRIEVER. A device that prevents damage to poles, overhead, car tops, etc., by pulling down the trolley-pole instantly when it leaves the wire and holding it several feet below. Built for service under severe trolley conditions on high speed lines, and has a record of three years of successful usage. Now in use on a majority of high speed lines throughout the country and in many foreign countries. The distinguishing feature of its mechanism is that it is entirely automatic, the retrieving spring being wound by pulling out rope without touching machine till mechanism locks itself at the proper point. The pole is held below wire till retrieving mechanism is automatically locked.

—THE TROLLEY SUPPLY COMPANY, CANTON, OHIO.

MILLOY AUTOMATIC TROLLEY RETRIEVER. This retriever is operated by compressed air and can be used on any type of car with any air brake. It is installed on the roof beside the running board, is self-operating and requires no attention from the car crew. The retriever is durably constructed and is not affected by the weather.

—MILLOY ELECTRIC COMPANY, CLEVELAND, OHIO.

RIDLON TROLLEY CATCHER. This device has a permanent stop on reel and in case, with an action devised to prevent the partial locking of the reel. When used on oscillating single truck cars it will not catch and pull the wheel from the wire. When the wheel does leave the wire it catches quickly and has the advantage of having an action devised to retard the unlocking should the pole rebound. The reel spring is housed inside the case, thereby protecting it against the entrance of rain water, which would cause the spring to rust and consequently shorten its life. The construction of the case allows ample room for the trolley rope so that with the pole down, the reel will take up the slack. The lower part of the case has a large opening, giving access to the reel without removing it from the case. The rope may be unwound without taking the catcher apart. This also provides a drip so that in wet, sleety or freezing weather the reel cannot become blocked.

—FRANK RIDLON COMPANY, BOSTON, MASS.

WILSON TROLLEY CATCHERS AND RETRIEVERS. These devices have been in successful service for more than five years, and are in use on many representative electric railway systems.

—WILSON TROLLEY CATCHER COMPANY, BOSTON, MASS.

CATTLE GUARDS

(See Stock Guards.)

CEMENT

ASBESTOS CEMENTS. These cements are found adaptable for many conditions. No. 302 asbestos cement felting is a high grade insulation for covering boilers and other flat steam heated surfaces. It possesses high insulating qualities. Asbestos "Retort" cement, the base of which is asbestos, is in general use in gas and chemical works for repairing broken retorts and pipes; hardens rapidly, and is not affected by heat, nitric or sulphuric acids, petroleum, oils, etc. Asbestos "Fireite" is a strong

and durable cement for setting up broken furnaces, ranges and finishing cracks. It vitrifies rapidly and adheres to the casts.

—H. W. JOHNS-MANVILLE COMPANY, NEW YORK.

"J-M" ASBESTOS ROOF CEMENT. This is a very convenient material for cementing or pointing up and making water-tight difficult joints, entrance tubes, nail holes on roofs, or repairing leaks around windows, etc. It comes in a plastic form ready for application with a knife or trowel. (See advertisement.)

—H. W. JOHNS-MANVILLE COMPANY, NEW YORK.

CHAINS

AMERICAN CHAINS. Among the products of this company are steel chains.

—AMERICAN BRIDGE COMPANY OF NEW YORK, NEW YORK.

JEFFREY CHAINS. Among the chains made by this company are coil chains for lumber and saw mills; "Climax" steel chain for especially heavy elevating and conveying work; phosphor bronze and standard steel bushed chain for gritty material; ores, broken stone, coal, sand, coke, etc.; steel drag and transfer chains; "Hercules" malleable and steel combination detachable, etc.

—THE JEFFREY MANUFACTURING COMPANY, COLUMBUS

TAYLOR CHAINS. These brake chains are made of B. B. iron of large size and twisted links, and the auxiliary links and eye bolts are hand made out of the above brand of wrought iron, thereby giving most absolute assurance of safety.

—TAYLOR ELECTRIC TRUCK COMPANY, TROY, N. Y.

CHANGE CARRIERS

RAPID READY CHANGE CARRIER. This device consists of four tubes attached to an adjustable belt, which is worn about the waist, either inside or outside the coat, according to weather conditions. The tubes have slots at the top for pennies, nickels, dimes and quarters respectively, which are released one at a time by the wearer of the carrier. By the manipulation of the finger and thumb the bottom coin is unlocked and readily removed. The tubes can be filled either at the top or bottom, but only released at the bottom.

—CHAS. F. ETTER, HARRISBURG, PA.

CHIMNEYS

CHIMNEYS. Made by Broomell, Schmidt & Steacy Company, York, Pa.

WEBER STEEL-CONCRETE CHIMNEYS. The company makes a specialty of the erection of reinforced concrete chimneys. Weber chimneys have been successfully adopted by many leading concerns and in different countries. The materials used in the construction of these chimneys are steel, Portland cement and selected sand. They have a great many advantages over the old style of brick, radial brick and steel chimneys, and are rapidly superseding them. They are light, monolithic, absolutely air tight, occupy less space, are said to be more durable, and better in appearance than either brick or steel chimneys. The company takes contracts in every part of the globe.

—THE WEBER STEEL-CONCRETE CHIMNEY COMPANY, CHICAGO, ILL.

CIRCUIT BREAKERS

CONDIT OIL CIRCUIT BREAKERS. Made in desired styles and capacities for electric railway, lighting and power installations.

—CONDIT ELECTRICAL MANUFACTURING COMPANY, BOSTON, MASS.

GENERAL ELECTRIC CIRCUIT BREAKERS. Are built for 125 to 650 volts service and in capacities from 1 to 10,000 amps. These breakers are low in price and reliable. All parts are readily and cheaply renewable. A final carbon break is used for the protection of the main contacts, and the carbon contacts are sweated into clamping jaws without the use of screws. The breakers may be equipped with reverse current, shunt trip, low voltage, undertoad or overload release, shunt trip and auxiliary bell alarm switches. The standard finish is dull black with polished copper current carrying parts.

—GENERAL ELECTRIC COMPANY SCHENECTADY N. Y.

I-T-E CIRCUIT BREAKERS. The Cutter I-T-E and circuit breakers are almost synonymous. The development of the circuit breaker is due in no small measure to the attention paid this important piece of apparatus by this company. The business established by Henry

B. Cutter in 1888 was incorporated in 1891, so that The Cutter Company is entitled to rank among the old-time institutions. Mr. Cutter retired from the management in 1900, since which time it has been under the control of A. Edw. Newton, with William M. Scott as general manager and chief engineer. Mr. Scott's ability in his line is a matter of common knowledge. Many of the important developments in the circuit breaking devices are due to his ingenuity and skill.

—THE CUTTER ELECTRICAL & MANUFACTURING COMPANY, PHILADELPHIA, PA.

WESTINGHOUSE CIRCUIT BREAKERS. This line includes breakers from the smallest built up to those having a continuous capacity of 10,000 amps. and over and for circuits up to 33,000 volts for street railway service, switchboards or individual motor protection. They are made in all types; overload release, no-voltage release, underload release, overvoltage release, etc. Are made for either hand or electrical operation, and oil or air break.

—WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY, PITTSBURGH, PA.

CLAMPS AND CONNECTORS FOR WIRES AND CABLES

CLARK INTERLOCKING INSULATOR CLAMP, TYPE A. This clamp is designed to securely hold cable or transmission conductor in the groove of the insulator. The insulator is constructed with an undercut recess on either side of the groove in the center of insulator top, so that when the clamp is in position it is interlocked under the projecting portion in such a manner that wire cannot be removed or the clamp separated from the insulator without unlocking the clamp. The construction is such that the end strain on the clamp is distributed so that excessive pressure can at no time be concentrated on a small area of porcelain, and at the same time sufficient clearance is allowed so that the cable and clamp together may move freely when the cable or conductor is in place in the insulator, avoiding the hinge action which takes place when the wire is rigidly held in the insulator. Made in sizes ranging from No. 2 bare to 500,000 C.M. weather proof.

—THE CLARK ELECTRIC & MANUFACTURING COMPANY, NEW YORK.

CLARK INTERLOCKING INSULATOR CLAMP, TYPE B. This clamp is designed to be used on a recessed insulator same as Type A, where the strain on the conductor is not excessive. The two halves of the clamp are placed in the undercut recesses of the insulator; the wire is then dropped in place between the two halves and clamp is drawn together on the wire. Seating the nut tightens the clamp on the wire and locks clamp and wire within the insulator, but with sufficient play to enable the swing of the wire to be transmitted from one span to the next, avoiding bending strains on the conductor. This type is especially recommended for sizes No. 1-0 and smaller.

—THE CLARK ELECTRIC & MANUFACTURING COMPANY, NEW YORK.

CLARK IMPROVED SPLICING SLEEVE. This splicing sleeve is intended for splicing hard drawn copper wires and cables where solder cannot be used on account of the annealing of the wire in making a splice. The sleeve is made of special copper tube with soft interior so formed that the ends of the wire or cable to be spliced are passed through the tube and the tube and wires together twisted to form a tight mechanical and electrical joint. Special tools are provided for making the splices. These sleeves are being extensively used for splicing high tension transmission lines on long span work.

—THE CLARK ELECTRIC & MANUFACTURING COMPANY, NEW YORK.

CLARK STANDARD INSULATOR CLAMP. This clamp is designed for use with standard insulators. The two clamps are tightened firmly to the conductor on either side of the insulator by means of bolt and nut. The projecting lips engaging the groove of the insulator, transfer the end strain to the porcelain in an effective manner. The loops surrounding the neck of the insulator hold the clamps firmly in position and prevent the conductor from being lifted from the groove. This is the type of clamp in use on the transmission lines of the Mexican Light & Power Company.

—THE CLARK ELECTRIC & MANUFACTURING COMPANY, NEW YORK.

CLARK UNDERLOCKING INSULATOR CLAMP, TYPE B. This clamp is designed to clamp firmly on cable or conductor on each side of the insulator. The

projections or lips engage a deep circular groove in the neck of the insulator which prevents the wire from being lifted from the groove and transfers the end strain on the conductor to the insulator without concentrating an excessive pressure at one point. Two of these clamps are required for each insulator. This clamp is being used on the transmission lines of the Rio de Janeiro Tramway, Light & Power Company, with complete success.

—THE CLARK ELECTRIC & MANUFACTURING COMPANY, NEW YORK.

KEARNEY CABLE CLAMP. This clamp is made in one size, but is adaptable to any diameter cable from 0000 to 1,000,000 cm. By its use a great saving is effected at every corner, turn or dead end, as no splicing is required and neater and quicker work is secured.

—W. N. MATTHEWS & BROTHER, ST. LOUIS, MO.

"DOSSERT" SOLDERLESS CONNECTORS. A mechanical joint which requires no solder. Two types. "A" for solid wires, consisting of two compression nuts, one nipple and two double beveled, split cones; and "B" for stranded cables, consisting of two compression nuts, one nipple, two outside rings and two inside rings. The inside rings are forced under the first layer of strands, forming a "hump," the strands being moulded back to their original position and the nipple screwed into the nut. Made in two-ways, three-ways, four-ways, "Y's" and all styles of lugs. Also a cable tap which can be applied in one-tenth the time it takes to make a soldered tap.

—DOSSERT & COMPANY, NEW YORK.

RIDLON TWO-WAY CONNECTORS. This company manufactures standard size two-way connectors or can furnish special sizes to specifications.

—FRANK RIDLON COMPANY, BOSTON, MASS.

CLEANERS AND SCRAPERS, TRACK

BRILL TRACK SCRAPER. The three special features of this track scraper are: Elastic arms, diagonal cross bracing and removable shoes. The elastic arms allow the blades to spring over crossings and obstructions. The diagonal cross-bracing gives rigidity and strength exactly where it is needed, and prevents bending and breaking. Removable shoes receive the wear and are easily and inexpensively replaced. The apparatus can be installed under platforms of any height without blocking or cutting of timbers. The blades may be drawn up to any desired height by the handle, and dropped instantly on the track by kicking a trigger.

—J. G. BRILL COMPANY, PHILADELPHIA, PA.

—AMERICAN CAR COMPANY, ST. LOUIS, MO.

—G. C. KUHLMAN CAR COMPANY, CLEVELAND, OHIO

—JOHN STEPHENSON COMPANY, ELIZABETH, N. J.

CLARK TRACK CLEANERS. These cleaners are designed to meet the requirements of street and suburban electric railways, for the removal of snow, ice, or mud from the rails. They are constructed of the best material, are strong and durable, and will last the life of a car, requiring but few repairs, with the exception of replacing the blades, which are made of shovel steel and will last several seasons. (See illustration in advertisement.)

—THE VAN DORN & DUTTON COMPANY, CLEVELAND, OHIO.

KALAMAZOO NO. 5 SCRAPER. This scraper is raised and lowered by the same device as the company's single scraper, and is easily handled by the motorman alone. It is designed to clean all the snow from between the rails, and 9 ins. outside the same, throwing it each way from the center; also cleans top of rail and groove. It is claimed that with this scraper practical work can be done, and more track cleaned than with the sweeper, as it can be run much faster; in fact, better results are obtained when the car is moving quite rapidly, if the pressure on rail is increased correspondingly, because the snow is deposited farther from the track. The cost is not more than one-twentieth of a sweeper, making it a very economical track cleaner. It is now in use on many railways.

—KALAMAZOO RAILWAY SUPPLY COMPANY, KALAMAZOO, MICH.

MONARCH TRACK CLEANER. This cleaner is designed for removing snow, ice, sleet, mud or gravel from the track. The scrapers are held in position by two powerful flat steel springs, which provide for the various track and pavement conditions, and permit each blade to raise independently. The blades can be set at any desired angle, and are protected from wear by removable shoes, which can be readily replaced at small cost. (See page 446 of Catalogue No. 6 and also advertisement.)

—THE OHIO BRASS COMPANY, MANSFIELD, OHIO.

"OHIO BRASS" TRACK CLEANERS. Adjustable track brush holder, designed for attachment to guard board under the car. This device is unequalled for keeping the track clear of light snow, dirt, sand or gravel. Can be adjusted to hold brush at any desired height over the rail. When not in use, brush is held clear of the track by spiral spring. Simple in design and strongly made. (See pages 440 and 441, Catalogue No. 6; also advertisement.)

—THE OHIO BRASS COMPANY, MANSFIELD, OHIO.

RELIANCE TRACK CLEANER. In satisfactory use on electric railways for over fifteen years. A positive scraper, keeping snow, ice and mud from rail at all times. Made for light or heavy pressure, strongly built and made to fit any car. It is easy to attach. (See illustrated advertisement.)

—THE DORNER MANUFACTURING COMPANY, CHICAGO, ILL.

ROOT RAILWAY SPRING SCRAPERS. These scrapers are made in several styles to meet any and all conditions on city or interurban lines, and give the same results on any type of rail. They are easily installed on any type of car, either single or double track. They require little power, deposit the snow far from the track, and leave the rail and groove so clean that contact from wheel to rail is perfect. When in working position, they need no attention, and do not have to be raised for switches, crossings or high blocks in pavement. They clean the rail and groove even when the track is two in. below pavement, and give the same results whatever the conditions of snow—wet, dry or packed.

—KALAMAZOO RAILWAY SUPPLY COMPANY, KALAMAZOO MICH.

CLEANERS, BOILER

(See "Boiler Cleaners")

CLEANING POWDERS AND WASHES

SACARBOLATE CAR WASHING COMPOUND. A non-poisonous washing and disinfecting fluid soap, possessing all the qualities of a good washing soap but acting also as a disinfectant. Does not stain or ruin paint or varnish work but improves the luster of such surfaces. If the slight carbolic odor is found objectionable, other compositions can be furnished of lesser disinfecting power but more pleasant as deodorizers.

—FRANK S. DE RONDE COMPANY, NEW YORK.

SAVROGAN CLEANING POWDER. Carries the essentials required for a general washing powder, constructed of pure materials that are a necessity for clean cleaning, avoiding the soapy or greasy odors. Used for twenty-five years on steam and street railways.

INDIA ALKALI WORKS, BOSTON, MASS.,

SHIELD OIL SOAP. A soap for varnish and paint cleaning, of the consistency of tallow, and made from pure linsed oil.

—INDIA ALKALI WORKS, BOSTON, MASS.

CLUSTERS AND SOCKETS

BENJAMIN WIRELESS CLUSTERS AND RECEPTACLES. This company manufactures a line of lighting specialties for railway and general lighting purposes, chief among which is the wireless cluster. These clusters are simply made, are highly insulated, have ample air gap between contacts, and present a neat appearance. Wireless clusters are also furnished for out door lighting, with porcelain enameled steel shades, and goosenecks for attaching to poles or walls of buildings. Other products are the "Beuco" W. P. socket, sign receptacles for metallic signs, angle sockets, lamp guards, etc., etc.

—BENJAMIN ELECTRIC MANUFACTURING COMPANY, CHICAGO, NEW YORK, SAN FRANCISCO.

DAYTON ELECTRIC LIGHT CLUSTERS. Designed particularly for railway and street car lighting. They are made extra heavy and substantial so as to withstand the unusual jarring and jolting to which they are subjected. Many of the designs are of very great beauty and the leaf work surrounding the lamps is most elaborate. At the same time the interior construction of the clusters has been carefully worked out so as to insure perfect insulation. The designs include clusters and pendants suitable for all classes of work, from a plain baggage car pendant to a multi-lamp cluster for a private car. Special fixtures are furnished for cars equipped with Silvey portable train lighting batteries.

—THE DAYTON MANUFACTURING COMPANY, DAYTON, O.

GENERAL ELECTRIC CLUSTERS AND SOCKETS. The company manufactures a special line of sockets

and clusters for street railway work. The sockets and receptacles are fitted with spring centers which insure against lamp breakage due to jars. The receptacles may be supplied with white or chocolate color porcelain bases, the latter color being preferable as it harmonizes better with woodwork. A special 500 volt socket can be supplied, with aluminum or brass shell. The lamp base screws into one solid piece of porcelain. The base is weather-proof, and is particularly adapted to air work. Two to five-light clusters can be furnished.

—GENERAL ELECTRIC COMPANY, SCHENECTADY, N. Y.

COACHES, MOTOR

OLDSMOBILE MOTOR COACH. This is a new type of car for interurban use, designed for light passenger service. It carries sixteen persons and is reliable in operation. This car is manufactured by the Olds Motor Works and sold only by the

—RAILWAY APPLIANCES COMPANY, CHICAGO AND NEW YORK.

COAL HANDLING MACHINERY

(See "Conveyors")

COILS, ARMATURE AND FIELD

(See "Armature and Field Coils")

COMMUTATORS AND PARTS

CAMERON COMMUTATORS AND COMMUTATOR SEGMENTS. This company manufactures commutator segments, also commutators complete with shell, either standard or special. All segments are made from the hard drawn copper bar, which is believed to excel all other styles of commutator segments in at least three things, i. e., uniformity, density and unequalled conductivity. It is as hard, if not harder, than either the cast or drop forged bar. Where a high lug segment is required, the lug is inserted into the end of the bar, by milling a narrow slot into the center of the end of the segment, afterwards inserting the riser with countersunk rivets. To perfect this connection mechanically and electrically, the entire end of the segment, lug and all, thoroughly sweated in solder.

—H. P. CAMERON ELECTRICAL MANUFACTURING COMPANY, ANSONIA, CONN.

CLEVELAND COMMUTATORS. These commutators are made from pure lake copper segment (drop-forged). Insulated between segments with amber mica and from core with white mica. These commutators are not put together with hydraulic pressure which does not insure a firm bearing for each segment, but are bored out to the proper angle, thereby insuring a true bearing for each segment and giving always a tight commutator.

—CLEVELAND ARMATURE WORKS, CLEVELAND, OHIO.

COLUMBIA COMMUTATORS AND COMMUTATOR BARS. The commutators made by this company are made of lake copper. The bars are drop-forged and separated by amber mica.

—COLUMBIA MACHINE WORKS AND MALLEABLE IRON COMPANY, BROOKLYN, N. Y.

HOMER COMMUTATORS. For motors and dynamos; made of the best bars and mica insulation obtainable. The mechanical perfection of these commutators constitutes their greatest claim for superiority. Manufactured by the largest exclusively commutator house in the world, its output permits the company to specialize workmen upon each particular part of the commutator thus obtaining the best results. The size of the output also allows it to maintain a stock of assembled commutators ready for instant shipment.

—THE HOMER COMMUTATOR COMPANY, CLEVELAND, O.

GENERAL ELECTRIC COMMUTATORS. The segments are made of hard drawn copper, insulated throughout with the best grade of split mica. The mica cones are built up and pressed compactly in steam moulds. The segment mica is somewhat softer, that it may wear evenly with the copper. Cone surfaces are machined with great care, with long creepage distances to prevent grounding. Commutators up to about 20 ins. in diameter are tinned by dipping in the molten metal. This practice subjects the commutator to a severe temperature test which cheaper grades of material and construction could not withstand. The segments are clamped very tightly and cap is pressed down securely in a hydraulic press before the commutator nut is tightened. This construction insures long life and uniformity of wear.

—GENERAL ELECTRIC COMPANY, SCHENECTADY, N. Y.

MORRIS COMMUTATORS AND BARS. This company is prepared to furnish all kinds of commutators, either of the drop forged or other types.

—EMER P. MORRIS COMPANY, NEW YORK.

RIDLON ASSEMBLED COMMUTATOR SEGMENTS. The commutators are made of pure copper, only selected mica being used to insulate the bars. The company does not limit itself to railway commutators, but can furnish bars or assembled segments for generators or motors of any type or size, standard or obsolete.

—FRANK RIDLON COMPANY, BOSTON, MASS.

ROSSITER-MACGOVERN COMMUTATORS AND BARS. This company builds commutators and parts thereof of every description.

—ROSSITER, MACGOVERN & COMPANY, BOSTON, NEW YORK, ST. LOUIS.

VAN DORN-ELLIOTT COMMUTATORS AND COMMUTATOR BARS. These are all made of hard drawn copper. The insulation used is the best amber mica, which will wear evenly with the copper bars. The commutators are pressed together hydraulically, assuring an absolutely tight commutator, which prevents the commutator from burning up, due to loose bars. Assembled bars are bored entirely to gages and will fit the shell perfectly to which they belong. (See advertisement.)

—THE VAN DORN-ELLIOTT ELECTRIC COMPANY, CLEVELAND, OHIO.

WESTINGHOUSE COMMUTATORS. These commutators are made of hard drawn copper and built-up amber mica. The copper is of uniform density and high bars never occur. The mica is of such a quality that it wears at exactly the same rate as the copper segments. The commutators are seasoned by being subjected to a very high temperature for several hours before the finishing cut is made, and are afterward tested to eliminate all danger from grounds or short circuits after the commutator is in service.

—WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY, PITTSBURG, PA.

COMMUTATOR COMPOUNDS AND TRUING DEVICES

"HIKO" COMMUTATOR COMPOUND. The application of this compound on the commutator from the time of starting the machine will keep the commutator smooth, producing in time the desired hard face and gloss which increase the life of the commutator and brushes. The compound contains no injurious ingredients, and as it is an excellent non-conductor, there is no danger of short-circuits between the commutator segments.

—ATLANTIC MANUFACTURING COMPANY, ALLENBURST, N. J.

JORDAN COMMUTATOR TRUING DEVICE.

This tool trues the commutator without requiring its removal from the machine. It consists of a grinding wheel in adjustable ball bearings and equipped with suitable clamps, whereby it can be fastened to the rocker arm or the motor frame. The wheel used contains no emery or other mineral matter injurious to the commutator insulation and grinds down both the copper and mica to the same height. It greatly increases the life of the commutator as there is no waste from taking unnecessarily large cuts when using the old truing methods.

—JORDAN BROTHERS, NEW YORK.

RIDLON COMMUTATOR STONES. These stones are used for grinding and smoothing commutators. By their occasional application ridges, which are frequently the cause of sparking, can be prevented and their use in many cases will save the expense of having the commutator turned down in the machine shop.

—FRANK RIDLON COMPANY, BOSTON, MASS.

COMPOUNDS, BOILER CLEANING

(See "Boiler-Cleaning Compounds")

COMPOUNDS, INSULATING

(See "Insulating Compounds")

COMPRESSORS, AIR

CLAYTON CLIMAX COMPRESSORS. Air valves are made of steel, light and durable. Valve seats are of gun metal composition, each valve and seat being a complete unit. Steam cylinder is not located near main shaft bearings, thus obviating heating from radiation and permitting the use of a standard engine crosshead with adjustable slippers and a single connecting rod with adjustable

bearings at each end. All reciprocating parts adjustable for wear. Climax compressors are made single and duplex steam driven, single and duplex electric driven, by means of gear or noiseless chain, also belt driven. The particular point always in mind in designing this compressor was good economy, absolute reliability and the least possible expense for maintenance.

—CLAYTON AIR COMPRESSOR WORKS, NEW YORK.

CHRISTENSEN MOTOR-DRIVEN AIR COMPRESSORS. More than 15,000 of these motor-driven air compressors of capacities from 7½ to 800 cu. ft. free air per minute are in daily use, mostly in connection with air-brake equipments for electric cars, the license for which use has been granted by N. A. Christensen to the Christensen Engineering Company, all other rights for the use of such patents being reserved to the patentee. To meet the constantly increasing demand for these air compressors for general service in various industries where compressed air is indispensable, N. A. Christensen is marketing a line of motor and steam driven air compressors in capacities from 400 to 2,000 cu. ft. free air per minute, as well as special air compressors for high pressures; also belt driven air compressors and compressors combined with gas or gasoline engines.

—N. A. CHRISTENSEN, MILWAUKEE, WIS.

CHRISTENSEN COMPRESSORS. This company has developed a line of motor driven air compressors for either stationary or portable service. The machines operate continuously or intermittently, depending upon their requirements, and have been carefully designed to form a compact, self-contained unit. All working parts are enclosed, affording protection from mechanical injury, and so constructed that thorough lubrication of working parts is assured.

—NATIONAL ELECTRIC COMPANY, MILWAUKEE, WIS.

FRANKLIN AIR COMPRESSORS. These compressors when first introduced attracted attention among users of compressed air, because of their sound design, massive, yet graceful proportions, and the exceptionally high engineering plane upon which their lines were based. They are manufactured in over 100 styles and sizes to meet every requirement of the trade. (See advertisement.)

—CHICAGO PNEUMATIC TOOL COMPANY, CHICAGO, ILL.

GENERAL ELECTRIC AIR COMPRESSORS. For braking systems on railway cars, also about car shops and barns, for cleaning motors, controllers, upholstering etc. The motor is similar in design to the G. E. railway motor, and embodies all the excellent features of that type. All parts of the compressor are very accessible, the cranks are solid forged steel, and the bearings and all wearing parts are readily replaceable. The compressor is equipped with an efficient oiling system and the gearing is of the herringbone type, insuring noiseless operation.

—GENERAL ELECTRIC COMPANY, SCHENECTADY, N. Y.

MURRAY AIR COMPRESSORS. These compressors are attached tandem to Murray-Corliss engines and are made single and two stage. They are effective, durable and economical.

—THE MURRAY IRON WORKS COMPANY, BURLINGTON, IA.

REYNOLDS AIR COMPRESSORS. Remarkable for their excellence of commercial design, combining strength and lasting qualities with high steam economy and efficiency. Electrically driven; belt driven; hydraulically driven. Single, duplex and two-stage. Corliss inlet, automatic outlet. Special governor, automatically controlling speed within safe limits and leaving compressor free within the limit to operate at any speed needed to meet demands for air. Steam ends with all Corliss valve gear. Reliance and heavy duty types, single, duplex and compound, in combinations with air ends, direct-connected or belted.

—ALLIS-CHALMERS COMPANY, MILWAUKEE, WIS.

SMITH-VAILE AIR COMPRESSORS. These machines are built in all sizes and for all pressures and small electrically driven machines have recently been constructed for pressures as high as 1,500 lbs. per sq. in. They are without gears and operate with a minimum amount of noise and vibration. Their small weight and space requirements render them especially well adapted for uses requiring a portable compressor.

—PLATT IRON WORKS COMPANY, DAYTON, OHIO.

WESTINGHOUSE MOTOR-DRIVEN AIR COMPRESSOR. This device consists of a horizontal, duplex, single-acting air pump connected by gear drive to an electric motor, both mounted on a common cast-iron bed plate. The motors are wound for 110, 220 and 600 volts D.C.; for 110 and 500 volts A.C.; single phase, 3,000 alternations

per minute; and for multi-phase current of ordinary voltage and frequency as required. They are dust and weather proof for outdoor use, or ventilated for indoor application. The pumps have either plain or water jacketed air cylinders to suit conditions.

—THE WESTINGHOUSE AIR BRAKE COMPANY, PITTSBURG, PA.

CONCRETE STEEL

(See Bridges and Buildings.)

CONDENSERS

ALBERGER BAROMETRIC CONDENSER. An improved type of jet condenser operating on the dry system, in which the desirable features of the counter and parallel current principles are combined. The air and water are each handled by a special pump designed for its particular service, these being usually separate units for greater flexibility. To insure complete intermingling of the steam and water, the spraying device is automatically regulated. The air before leaving the condenser is cooled in passing through an interior jet cooler. The condenser is self-supporting and is extremely simple in design, there being no exterior pipes or contrivances.

—ALBERGER CONDENSER COMPANY, NEW YORK.

ALBERGER COUNTER-CURRENT SURFACE CONDENSER. A departure from past practice in which a condenser, primary feed water heater and air cooler are combined in one unit. The steam enters at the bottom and the dry air pump connection is taken off the top. The condensed steam falls through the entering steam into a hot well and is recovered at the temperature of the vacuum, giving water from 15 degs. F. to 25 degs. hotter than with the old types. The circulation water enters at the top and passes down and out at the bottom, carrying with it any dirt or sediment that may be entrained. Twenty-eight in. and higher vacuums are maintained.

—ALBERGER CONDENSER COMPANY, NEW YORK.

BULKLEY CONDENSERS. The "Injector" condenser requires no air pump but forms a high vacuum by the action of the exhaust steam and condensing water. An air pump condenser of improved design is also made by this firm.

—HENRY W. BULKLEY, NEW YORK AND ORANGE, N. J.

CONOVER CONDENSERS. See item under Pumps.

—WATSON MACHINE COMPANY, PATERSON, N. J.

CONDENSERS.

—HENRY R. WORTHINGTON, NEW YORK.

—THE GEO. F. BLAKE MANUFACTURING COMPANY, NEW YORK.

—KNOWLES STEAM PUMP WORKS, NEW YORK.

—DEANE STEAM PUMP COMPANY OF HOLYOKE, MASS.

REYNOLDS AIR PUMP AND JET CONDENSER. Condenser and air pump separate. Fly wheel type of air pump. Gives uniformity of speed. No racing. Condensing water introduced to condenser by nozzle carefully designed to secure most efficient and complete commingling of steam and water. Water openings not liable to clog. Ease of access to all parts for examination. Capacities 100 h.p. to 1,000 h.p.

—ALLIS-CHALMERS COMPANY, MILWAUKEE, WIS.

SMITH-VAILE CONDENSING APPARATUS. The surface condensers built by the Platt Iron Works are furnished with direct-acting combined air and circulating pumps or with independent hot-well pumps and relative dry-vacuum pumps, according to the size of the plant and the vacuum desired. The jet condensers are of the ordinary suction type or of the elevated type, depending upon circumstances and locations. Where high vacuum is wanted the elevated jet condensers are supplied with dry-vacuum pumps.

—PLATT IRON WORKS COMPANY, DAYTON, OHIO.

TOMLINSON BAROMETRIC TUBE CONDENSING SYSTEM. Includes condenser and system of handling the air in the condensing apparatus. Requires no adjustment or attention of any kind, other than to regulate the amount of injection water to condense the steam. Water is broken up in its passage through the condenser and thoroughly mixed with the steam without any spray nozzles or contracted passages to become stopped up with dirty water. Instead of discharging the dry air pump into the atmosphere, the air is discharged through the main tail pipe, combining the water and air, and the descending column of water carries the air down to the hot well with the water. The dry air pump, instead of working against the atmospheric pressure, discharges into a vacuum a little less than the vacuum in the condenser, thereby producing an effect similar to a two-stage

air pump, the main tail pipe acting as the second cylinder of the two-stage pump, thereby greatly increasing the efficiency of the air pump and decreasing the power required to drive it about 70 per cent., due to the low pressure that the pump discharges into two tail pipes. The main or center pipe into which the air pump discharges is of a proper size to give the necessary velocity to carry the air away, while the overflow pipe acts as a safety device.

—ALLIS-CHALMERS COMPANY, MILWAUKEE, WIS.

W. H. BLAKE CONDENSERS. In the jet condenser the injection water is so sprayed into the exhaust steam as to secure the most intimate mixture and produce instantaneous condensation. The possibility of flooding is entirely obviated. In the smaller sizes the pumps are horizontal, and in the larger they are twin vertical or vertical compound. Capacities range from 600 to 135,000 lbs. of steam condensed per hour. The surface condensers range in capacity from 4,100 to 40,000 lbs. steam condensed per hour. The tubes are of Muntz metal, so held in the tube sheets as to allow for free expansion. Rapid condensation is secured by the introduction of baffle plates which force the steam into close contact with the exterior of all pipes through which the water flows.

—W. H. BLAKE STEAM PUMP COMPANY, BOSTON, MASS.

WHEELER CONDENSERS. The types made by this company are known as surface and jet condensers. The surface type has tubes on which the steam impinges, while the cooling water circulates through the tubes. The jet type has a vessel in which the exhaust steam mingles directly with a jet of water. This company's condensers are among the pioneers in the field; they are built in types and sizes to suit conditions, and to give the highest and best results.

—WHEELER CONDENSER & ENGINEERING COMPANY, NEW YORK.

C. H. WHEELER SURFACE CONDENSER. Circulating water chambers, steam dome and tube arrangement of special design and efficiency.

—C. H. WHEELER CONDENSER AND PUMP COMPANY, PHILADELPHIA, NEW YORK, CHICAGO, SAN FRANCISCO.

WHEELER-MULLAN HIGH VACUUM SYSTEM. C. H. Wheeler surface condensers with Mullan suction valveless crank and fly-wheel air pumps; horizontal and vertical designs; single, duplex and triplex; steam or electric.

—C. H. WHEELER CONDENSER AND PUMP COMPANY, PHILADELPHIA, NEW YORK, CHICAGO, SAN FRANCISCO.

WHEELER-PRATT WATER-COOLING APPARATUS. Cooling towers for water or liquids from any temperature to below the temperature of the atmosphere. Forced draught and natural draught systems.

—C. H. WHEELER CONDENSER AND PUMP COMPANY, PHILADELPHIA, NEW YORK, CHICAGO, SAN FRANCISCO.

CONDUITS, UNDERGROUND

AMERICAN UNDERGROUND CONDUIT. The conduit manufactured by this company is of the vitrified, salt glazed clay type, for carrying lighting, power and railway feeders. The ducts are made either single or multiple as desired.

—AMERICAN VITRIFIED CONDUIT COMPANY, NEW YORK.

BITUMINIZED FIBER CONDUITS. These conduits are used for all classes of underground electrical construction and are made in sizes ranging from 1 in. inside diameter to 6 ins. inside diameter, or larger on special order. Bends of any radius or degree of curvature are furnished. The ducts are in 7 ft. lengths and are united with the male and female joint which is sealed with the compound as the conduit is slipped together in the trench, giving a water tight duct.

—AMERICAN CONDUIT COMPANY, CHICAGO, NEW YORK, LOS ANGELES.

CAMP CONDUITS. This clay conduit was the first of its kind for carrying underground lighting and power wires, and still enjoys wide use. It is made in single and multiple duct as desired.

—H. B. CAMP COMPANY, NEW YORK AND CHICAGO.

GEST CONDUIT WORK. Contracts carried out for underground conduit construction of any extent for railway, lighting and power installations.

—GUY M. GEST, NEW YORK AND CINCINNATI.

CONTROL SYSTEMS

SPRAGUE GENERAL ELECTRIC TYPE M CONTROL. Is designed primarily for the control of a train of motor and trail cars, the whole being operated as one

unit. It is adapted to all classes of severe railway service, and comprises an electrically operated motor controller for each motor car and master controllers operating these. The system is very flexible. The current is cut off if operator's hand is removed from master controller handle, insuring safety. The operation entirely by electric current at full line potential. Ease of operation makes its use advantageous on large locomotives, and heavy motor equipments. All parts subject to wear are readily replaceable.

—GENERAL ELECTRIC COMPANY, SCHENECTADY, N. Y.

WESTINGHOUSE MULTIPLE UNIT CONTROL.

This system employs a combination of electro-magnetic and pneumatic devices to produce a method of controlling from a single platform single cars or trains, all or part of which are equipped with motors. Each motor can operate as an independent self-propelling unit which may be connected to other similar units or to trailer cars in any operating combination whatsoever. It is applicable alike to alternating and direct current motors, and to double and quadruple equipment. It may be arranged for either automatic or non-automatic acceleration and with or without a train bus line.

—WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY, PITTSBURG, PA.

CONTROLLERS

GENERAL ELECTRIC CONTROLLERS. Are made in various series—parallel and rheostatic types. They combine requirements of accessibility, interchangeability, strength and ease of renewal. The covers are attached with hinge clamps, all parts are machine made and tested, and the wearing parts are quickly replaceable. Cut-outs, magnetic blow-outs and interlocks add to the safety and reliability of operation. Controllers are also manufactured for automobiles, crane and mine works; see also Control Systems.

—GENERAL ELECTRIC COMPANY, SCHENECTADY, N. Y.

WESTINGHOUSE CONTROLLERS. These controllers include every form of controlling device from a rheostat for the operation of the smallest motor to the heaviest railway controllers. The operating parts are interchangeable, and the wearing parts such as fingers and contact segments are removable and easily renewed. Railway controllers for use with two or more motors are provided with special cutout switches, so arranged that either motor of a pair, or either pair of a four-motor equipment, may be cut out of circuit.

—WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY, PITTSBURG, PA.

CONTROLLER REGULATORS

AUTOMOTONEER. A regulator for railway and other electric controllers. Limits feeding to fastest rate that will give maximum acceleration for which motors are designed. Made in two styles. Applied to top of controller, completely self-contained and enclosed to prevent tampering. In one style, a pawl, working in a zig-zag slot, requires a pause on each controller point. In another the release of pawl is limited by adjustable dash-pot. Prevents abuse of equipment, waste of current, peak starting loads, jerking passengers and other "fast feeding" evils. Insures operation of controllers in the manner for which they are designed.

—GARTON-DANIELS COMPANY, KEOKUK, IA.

DURKIN CONTROLLER HANDLE. Attached to the top of the dial of any standard controller simply by drilling three holes for bolts, this device regulates the rate of feed, thus preventing damage and economizing power. The working parts are simple, positive in action, efficient and durable. A dog suspended under the handle is, by a series of projecting teeth, thrown against the stops in turn, compelling a temporary pause at each, until the dog drops by gravity. It presents no obstruction to rapid "throw off." Incidentally, it keeps all the contacts on the controller perfect and always the same—all the controller fingers wear alike, doubling their life.

—DURKIN CONTROLLER HANDLE COMPANY, PHILADELPHIA, PA.

CONVERTERS, ROTARY

BULLOCK ROTARY CONVERTERS. These 25 cycle rotary converters for railway work range in output from 100 Kw. to 1,000 Kw. at 600 volts. Sixty cycle converters for 500-600 volts are not made, as they are not considered desirable, but for 250 volts or lower, 60 cycle machines are regularly furnished. Collector rings are of cast copper. Field yokes are of cast iron with solid steel poles bolted in place. The armature, commutator and field coils are designed to secure thorough ventilation, thus

giving a correspondingly low temperature rise and large overload capacity.

—ALLIS-CHALMERS COMPANY, MILWAUKEE, WIS. (ELECTRICAL DEPARTMENT, BULLOCK ELECTRIC MANUFACTURING COMPANY, CINCINNATI, OHIO.)

GENERAL ELECTRIC ROTARY CONVERTERS.

This company manufactures rotary converters ranging in capacity from 50 kw. to 2,000 kw. inclusive. In general they embody the same notable features of structural detail as direct current generators of the same make. Forced ventilation assures low temperature rise. Connections at collector rings are so arranged as to equalize field strength and provide perfect commutation. Even wear on commutator is attained by special end play devices. Standard field winding gives flat compound characteristic. Compound wound converters are fitted with speed limiting devices which prevent excessive speed should the alternating current source be accidentally cut off. Converters are started without the aid of auxiliary motors.

—GENERAL ELECTRIC COMPANY, SCHENECTADY, N. Y.

WESTINGHOUSE ROTARY CONVERTERS.

The rotary converter serves as the transforming agency after the alternating-current has been transmitted to conveniently located substations. Westinghouse rotary converters are very similar in construction to the direct-current generators, with the addition of collector rings and brushes. The Interborough Rapid Transit Company of New York operates eighty 1,500 kw. rotaries of this type, which are the largest ever built.

—WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY PITTSBURG, PA.

CONVEYORS, COAL AND ASHES

(Including Auxiliary Apparatus.)

BROWN FUEL CONVEYING APPARATUS. This company has designed an extensive line of coal and ash conveyors for power houses, besides various devices for hoisting coal from boats, storing, weighing, etc.

—THE BROWN HOISTING MACHINERY COMPANY, CLEVELAND, NEW YORK, PITTSBURG.

BROWNING LOCOMOTIVE CRANES AND AUTOMATIC GRAB BUCKETS. Adapt themselves for all conditions arising in the conveyance of fuel and ashes in connection with power houses.

—THE BROWNING ENGINEERING COMPANY, CLEVELAND, OHIO.

DODGE CONVEYOR. Consists of non-overlapping gravity buckets pivoted between chains, and buckets of less capacity rigidly suspended from the side bars of the chains and extending beneath the gaps which separate the gravity buckets. The initial leakage at the loading point as well as the spill at the first upward turn in the conveyor path is caught by these supplementary buckets, and as they come into position above the gravity buckets on the ascending run discharge the leakage each holds into the gravity bucket next following. The conveyor is reversible and may make as many turns in the same plan as necessary.

—THE LINK-BELT ENGINEERING COMPANY, PHILADELPHIA, PA.

JEFFREY CONVEYORS. The coal and ash conveyors made by this company are of the chain and pivoted swinging bucket type. In addition it builds traveling chutes for feeding stokers, coal crushers with receiving hoppers and dump cars for ashes, together with a large variety of other machinery.

—THE JEFFREY MANUFACTURING COMPANY, COLUMBUS, OHIO.

MCCASLIN CONVEYOR DRIVING MECHANISM for operating the conveyor is of either direct connected or belt driven type. The direct connected type is operated by enclosed dust proof electric motors, and the steam driven type is operated by means of direct connected double steam engines. The belt driven type can be either operated by an electric motor or steam engine as preferred.

—JOHN A. MEAD & COMPANY, NEW YORK.

MCCASLIN OVERLAPPING GRAVITY BUCKET CONVEYOR. This conveyor for the handling of coal and ashes consists of a series of malleable iron conveyor buckets, so arranged that when mounted in the chain and upon a horizontal track, the lips of the buckets overlap and form a continuous trough, thereby preventing the spilling of coal, and doing away entirely with the cumbersome filler, the only loading apparatus necessary being an ordinary chute. Large cast iron chilled wheels arranged for internal lubrication are located at the articulating point of the conveyor chain. The chain is of heavy design with large bearing surfaces, and is made in various sizes to

suit the tonnage required. The conveyor system is in many large up-to-date power stations. As an illustration regarding the handling of ashes, this conveyor successfully handles cement clinker direct from the kilns at a temperature of about 2,000 deg without injury to the working parts.

—JOHN A. MEAD & COMPANY, NEW YORK.

MCCASLIN SINGLE ROLL COAL CRUSHERS.

The McCaslin single roll coal crusher mechanism for crushing run-of-mine coal to size for stoker use is of the self-contained type for direct connection to electric motors or steam engines, also made for belt drive. This crusher consists of a heavy cast iron single roll with removable cast steel teeth, and so arranged that any foreign substance such as a car link, coupling pin, etc., will pass through without injury to the roll. This is accomplished by having the cast iron roll work against a cast iron counterweight, corrugated, battle plate, the corrugations arranged so as to fit around the teeth on the crusher roll.

—JOHN A. MEAD & COMPANY, NEW YORK.

MEAD-MORRISON COAL HANDLING MACHINERY.

This apparatus comprises the following: Cable roads, cars, motors; automatic railways; automatic shovels; case elevators; Harrison conveyors; skip hoists; narrow gage railways and cars for industrial plants; electric cars, flat top and side discharge cars for narrow gage track; storage battery locomotives; geared and direct-acting hoisting engines and electric hoists. The company also acts as contractors for complete discharging and reclaiming plants, railway power house, coal and ash handling installations.

—MEAD-MORRISON MANUFACTURING COMPANY, BOSTON, NEW YORK AND CHICAGO.

ROBINS CONVEYORS. The Robins system has but two component parts—a rubber belt and fixed sets of pulleys. The material never comes in contact with the pulleys, to retard or clog their action. The toughness and elasticity of the reinforced rubber covering of the belt give it great durability. The point where the load is received is the only point of abrasion or friction between the material and the belt. The advantage in this respect over any form of flight conveyor, in which the friction is constant all along the haul, is very apparent. Every reduction in friction not only means a corresponding reduction in the power required for operation, but also saves breaking of the material conveyed, and insures a longer life for every part of the conveyor. The shut-downs which repairs to more complex conveyors necessitates are absolutely avoided by the simplicity of this system. The Robins system conveys noiselessly, which fact alone indicates high efficiency.

—ROBINS CONVEYING BELT COMPANY, NEW YORK.

"STEEL CABLE" CONVEYING MACHINERY.

The coal and ash handling apparatus made by this company covers the following: Gravity bucket and pan and bucket conveyors; drag and cable conveyors; plain interlocking pan and troughed rubber belt conveyors; continuous bucket and double-strand steel cable elevators; vertical barrel type coal breakers; double-cam conveyor driver, etc.

—STEEL CABLE ENGINEERING COMPANY, BOSTON, MASS.

COOLING TOWERS

(See "Towers, Cooling")

CORD, BELL AND TROLLEY

INTERNATIONAL WATERPROOF TROLLEY CORD. Distinguished by a red, white and blue strand in the center. This cord is made of the finest upland middlings cotton of long, strong fiber, bought directly from the growers and ginned at the mill. The yarn used is three ply, i. e., three yarns twisted, not simply grouped together, which increases the tensile strength and ability to stand abrasive wear. The threads are then water-proofed before braiding, so that the water-proofing compound thoroughly permeates the body of the cord. The braiding is not done as tightly as possible and the cord is therefore more flexible and consequently more durable.

—THE INTERNATIONAL REGISTER COMPANY, CHICAGO, ILL.

RECORDING FARE REGISTER COMPANY'S BELL AND TROLLEY CORD. Woven bell and register cord, plain or with wire center; in all sizes; also leather cord in all sizes. Trolley cord "Yale" brand; hard woven, smoothly finished, thoroughly water-proofed trolley cord, made in all sizes.

—THE RECORDING FARE REGISTER COMPANY, NEW HAVEN, CONN.

S-H "SPIRAL" TROLLEY CORD. A superior grade of cotton cord, suitable for trolley rope, bell register,

are lamp suspensions, etc. Manufactured from the best grade of cotton yarn and so woven or braided as to give the greatest degree of flexibility, together with the longest wearing quality. It is furnished in all sizes from No. 7 to No. 12, inclusive, the number representing 32ds of an inch diameter. In braiding this cord one strand is furnished in green dyed cotton so inserted that a spiral line of green appears in the finished product on its outside surface. Furnished paraffined for out door use or without weather-proofing if desired. (See advertisement.)

—STUART-HOWLAND COMPANY, BOSTON, MASS.

SAMSON SPOT WATERPROOFED TROLLEY CORD. The colored "Spot" is the trade mark used only in this extra quality cord which is guaranteed free from imperfections of braid or finish. The smoothness of this cord, together with the extra quality stock, makes it wear much longer than the common grades of cord. It is put up in coils of about 1,200 ft. each, and the sizes most commonly used are:

Number.....	8	9	10	12
Diameter.....	1/4 in.	9-32 in.	5-16 in.	1/2 in.
Approximate weight per coil.....	30 lbs.	35 lbs.	45 lbs.	60 lbs.

—SAMSON CORDAGE WORKS, BOSTON, MASS.

THE SILVER LAKE COMPANY, BOSTON, MASS. This company has been manufacturing braided cordage for over forty years and its goods have long been recognized as standard. For street railway use the company manufactures the Silver Lake weather-proof trolley cord which is used by many of the large street railway companies throughout the country, and has an established reputation as a first class article for the purpose. Bell and register cord is also made for street railway service.

COTTON DUCK

BOYLE COTTON DUCK. This material is employed for car roofs, covers, used in shipping, tarpaulins, etc. All weights and widths, white and colored. Also striped. (See "Curtain Material.")

—JOHN BOYLE & COMPANY, NEW YORK

COUPLERS, CAR

BRILL RADIAL DRAW-BAR. A draw-and-recoil spring on the bar is the entire drawing and buffing apparatus. No loose parts—the whole bar is removed by releasing the draw-bolt. It is made of wrought iron, with malleable iron mouth and spring seat. The bar is made of channel iron for cars more than 30 ft. over body. Standard size of bar is 4 ft. from center of draw-bolt to center of drop-pin hole; the channel bar, 4 ft. 3 ins. (Advertisements in last pages.)

—J. G. BRILL COMPANY, PHILADELPHIA, PA.

—AMERICAN CAR COMPANY, ST. LOUIS, MO.

—G. C. KUHLMAN CAR COMPANY, CLEVELAND, OHIO

—JOHN STEPHENSON COMPANY, ELIZABETH, N. J.

S. & W. AUTOMATIC COUPLERS. This coupler is calculated to meet a demand for a perfectly reliable automatic coupler for interurban and elevated cars. Made entirely of steel castings and drop forgings. Makes a perfectly rigid coupling with connecting hooks having about four times the section and strength of other types of automatic couplers for street railway service. This coupler allows of a vertical plane movement of 6 ins., without uncoupling, a specially desirable feature, as it takes care of the variation in heights of couplers on different cars on account of heavy loads, unevenness of track or other conditions.

—WALLACE SUPPLY COMPANY, CHICAGO AND NEW YORK.

VAN DORN AUTOMATIC COUPLER. One of the leading features of this well-known coupling bar is an elongated point extending beyond the hook, practically straight on the side opposite the hook, and sufficient in length to interlock between the pin and the inner side of the spring when the springs are under maximum compression. Under no conditions can this style of link be accidentally disengaged when coupled up in train service. It holds under all conditions, on the push or on the pull. The company has brought all of its couplings to a high standard of efficiency, and thickened and widened the faces. Van Dorn couplers are made in twenty-two distinct patterns for any emergency.

—W. T. VAN DORN COMPANY, CHICAGO, ILL.

VAN DORN AUTOMATIC COUPLER, NO. 19 This coupler is the latest achievement in which the company has embodied some new features, both the coupling and the uncoupling works the same, but round pins are used instead of flat pins. The point of the coupling bar is of sufficient size so that when the cars come together to couple the point of the link entering, the mouth of the draw bar strikes

the side wall and is deflected past the round pin and locks on the pin. It is built for extra heavy service and couples automatically within 1-32 of an inch. The No. 20 uses the same style link and pin as the No. 19, except that it is made to fit an 80-lb. rail instead of a tail bolt.
—W. T. VAN DORN COMPANY, CHICAGO, ILL.

WASHBURN ELECTRIC RAILWAY COUPLERS. The pin is so arranged that by raising it half way the knuckle is released for uncoupling. If the knuckle is closed and it is desired to throw it open to make a coupling, the pin or lock is raised to the full height. By so doing the knuckle is not only unlocked but thrown open ready for coupling, making it unnecessary to throw the knuckle around by hand. When a coupling is made, the couplers present to each other faces with considerable bearing surface which makes the rigid joint necessary with swivel draw-bars.
—EDWIN C. WASHBURN, MINNEAPOLIS, MINN.

WASHBURN ELECTRIC RAILWAY DRAFT RIGGING. Two forms are made for use with Washburn couplers. In one the draft box is bolted directly to the car body, and in the other the swivel is placed behind the draft box, and the draft box turns with the draw bar. In both types one spring serves to cushion both the buffing and pulling.
—EDWIN C. WASHBURN, MINNEAPOLIS, MINN.

WESTINGHOUSE FRICTION DRAFT GEAR. This device consists of a cylindrical shell, the inner surface of which has "V" shaped grooves; a number of friction strips are made to fit in these grooves and during heavy buffing and pulling strains are made to rub along their surface. A combination of wedges and springs in the center of the device causes the friction due to the rubbing between the strips and the cylinder to increase as the movement of the strips increases, consequently the energy generated by buffing and pulling strains is dissipated by friction, leaving little recoil.
—THE WESTINGHOUSE AIR BRAKE COMPANY, PITTSBURG, PA.

COVERINGS, PIPE AND BOILER

J-M PIPE AND BOILER COVERINGS. This line of asbestos and magnesia pipe and boiler coverings covers the whole range of modern engineering. The prominent coverings for high pressure steam are Asbestos-Sponge Felt, Asbestos Fire Felt, and "85 per cent. Magnesia." There are furnished in addition to these, coverings of air cell and solid construction for low pressure and heating purposes, and a complete line of frost-proof, brine and ammonia insulation. All these coverings are furnished in sectional form for pipes, or blocks and sheets for flat surfaces. (See advertisement.)
—H. W. JOHNS-MANVILLE COMPANY, NEW YORK.

CRANES, HOISTS AND LIFTS

BARRETT MOTOR ARMATURE LIFTS. For the rapid and economical handling of motors and armatures in car barn pits. Particularly adapted to removing and transferring armatures from the motor frame or replacing them in position. Manufactured in two general styles—one with jack mounted on a truck, and the other with a wheel and screw movement, mounted on a truck. The "Jack" style is somewhat quicker in action, but the wheel and screw lift is better adapted to pits where it would be difficult to operate the jack handle. Both motor lifts have a side adjustment of 6 in. and are provided with either flat or cradle tops, or both, which can be interchanged when handling complete motors or armatures separately.
—THE DUFF MANUFACTURING COMPANY, PITTSBURG, PA.

BRILL MOTOR LIFT. A powerful machine for pit work and suited to the heaviest work and roughest usage. It is made entirely of metal and has an oblong bed mounted on small wheels with four pillars which telescope in casings to keep the table horizontal. A vertical screw at the center raises the table eighteen inches and is turned by a crank to which it is geared at a ratio enabling a heavy motor to be raised or lowered quickly, and with comparatively little effort. From floor to top of table in lowered position is 36 ins.
—J. G. BRILL COMPANY, PHILADELPHIA, PA.

BROWNHOIST CRANES. These locomotive cranes are especially suitable for lifting car motors and other heavy objects around a power house or car barn. This company also manufactures electric traveling cranes, overhead trolleys for engine rooms, wrecking and construction cranes for street railways, etc.
—THE BROWN HOISTING MACHINERY COMPANY, CLEVELAND, NEW YORK, PITTSBURG.

BROWNING STANDARD LOCOMOTIVE CRANES. Comprise the most developed standard machines for wrecking, yard service, construction work and for operating automatic grab buckets.
—THE BROWNING ENGINEERING COMPANY, CLEVELAND-OHIO.

CASE MANUFACTURING COMPANY, COLUMBUS, OHIO. Builder of cranes and power transmission appliances. The company is represented in the East by McClave, Rimmer & Company, New York; in the central West by Bradley & Kamschutte, Chicago, Ill., and in the far West by Lilly & Thurston, San Francisco, Cal.

CLEVELAND LIFTING MAGNETS. The magnetic lift finds its widest and most advantageous use in places where large amounts of track or other steel and iron materials must be hoisted quickly. A 22 in. magnet will lift fully 3,500 lbs., and other sizes even more. The magnet itself is a solid steel casting which is practically indestructible.
—CLEVELAND ARMATURE WORKS, CLEVELAND, OHIO.

"MARINE ENGINE" TROLLEY HOIST. A special electric hoist made by this company for shop use.
—MARINE ENGINE AND MACHINE COMPANY, NEW YORK.

NILES CRANES AND HOISTS. These electric traveling cranes are built in capacities from 2 tons to 150 tons. The box girder is the standard bridge construction, but for small cranes, I-beams are occasionally used, and for extra long spans, lattice girders. The gearing on the trolleys is enclosed and runs in oil. Any standard motors can be used. The company's electric traveling hoists are built in capacities from 1 ton to 6 tons, and are arranged to run on a single I-beam or between two channels, if desired.
—NILES-BEMENT-POND COMPANY NEW YORK.

NORTHERN CRANES AND HOISTS. This company builds numerous styles of electric and hand traveling cranes. High grade cranes for power stations a specialty.
—NORTHERN ENGINEERING WORKS, DETROIT, MICH.

VAN DORN & DUTTON ARMATURE AND MOTOR LIFTS. These lifts are made for use in pits of car houses for raising and lowering armatures and motor frames. The frame is made of iron and the saddle has wood rolls to prevent injury to the armature. It is raised and lowered with a powerful screw through a hand wheel. It is easily operated, does not get out of order, and will stay in any position placed. It requires no track to run on if bottom of pit is hard, but where a track is preferred, wheels are furnished with flanges to run on the same.
—THE VAN DORN & DUTTON COMPANY, CLEVELAND, OHIO.

YALE & TOWNE ELECTRIC HOIST. A simple electric portable hoist; swings on a single upper hook; lifts readily at an angle, and may be hooked in trolleys of any type or other overhead supports. All parts under tension or subject to transverse strain are of forged steel or wrought iron. Improved oiling devices preclude heating, or injury from high temperature. It gives good service in inexperienced hands and withstands rough usage. It is as easily wired as an incandescent lamp. All parts are interchangeable. Used in repair shops and manufacturing plants generally.
—THE YALE & TOWNE MANUFACTURING COMPANY, NEW YORK.

YALE & TOWNE TRIPLEX CHAIN BLOCK. Built with frictionless automatic brake and balanced spur gearing—efficiency 80 per cent. Hooks and chains (the vital parts of a chain block) are made of specially tough but ductile iron, which stretches and gives warning before breaking. Every part is made of the best material obtainable and is carefully inspected, making the block absolutely safe. The Triplex lifts quickly, easily and smoothly. One man with a one-ton block can lift 2,000 lbs. four feet in one minute. It may be used in the car barn or by the construction gang independently of weather conditions. Made in fourteen sizes, 1/2 to 20 tons. (See advertisement.)
—THE YALE & TOWNE MANUFACTURING COMPANY, NEW YORK.

CROSS ARMS

(See "Bracket and Cross Arms")

CROSSINGS, TRACK

(See "Track Work")

CRUCIBLES

MCCULLOUGH-DALZELL CRUCIBLES. The line of crucibles made by this company embraces practically every type and size needed for smelting purposes. A large number is used by many electric railway companies operating brass and iron foundries for the manufacture of detail parts.
—MCCULLOUGH-DALZELL COMPANY, PITTSBURG, PA.

CURTAINS, CURTAIN FIXTURES AND CURTAIN MATERIAL

(See also Sash Fixtures.)

BOYLE CURTAIN MATERIAL. Especially woven and extra close striped cotton duck for side curtains on open cars. This material has been in successful use for 30 years. It is made in different colorings to harmonize with any car.
—JOHN BOYLE & COMPANY, NEW YORK.

BRILL CURTAIN AND CURTAIN FIXTURES. These companies manufacture or furnish every style of curtain and fixture for closed and open cars.
—J. G. BRILL COMPANY, PHILADELPHIA, PA.
—AMERICAN CAR COMPANY, ST. LOUIS MO.
—G. C. KUHLMAN CAR COMPANY, CLEVELAND, OHIO.
—JOHN STEPHENSON COMPANY, ELIZABETH, N. J.

BRILL CURTAIN-ROLLER SPRING ADJUSTER. A useful little tool which enables any workman to determine the proper amount of tension and to tighten all the springs alike in a car. Instead of the nuisance of having cars with some curtains that fly up at the slightest provocation and others that crawl down continually, companies that provide themselves with this tool are able to keep their car curtains in perfect condition for raising and lowering, save them from being pulled out or torn by rough handling of passengers or conductors. The adjuster is 6 ins. long, of simple mechanism that can never get out of order, and will operate with any brace.
—J. G. BRILL COMPANY, PHILADELPHIA, PA.
—AMERICAN CAR COMPANY, ST. LOUIS, MO.
—G. C. KUHLMAN CAR COMPANY, CLEVELAND, OHIO.
—JOHN STEPHENSON COMPANY, ELIZABETH, N. J.

CURTAIN SUPPLY COMPANY'S CURTAIN FIXTURES. For closed cars. The most desirable are the Forsyth roller tip fixture, No. 86, and the Keeler eccentric fixture. For open cars the Acme open car cable fixture, Climax open car cable fixture and the Forsyth open car cable fixture. The advantages of curtain fixtures are many. They hold a curtain in any desired position, remaining level in the window opening; can be operated by anybody, and add greatly to the durability and convenience of the curtains.
—CURTAIN SUPPLY COMPANY, CHICAGO, ILL.

CURTAIN SUPPLY COMPANY'S AUTOMATIC CURTAINS. These curtains are easy to operate, never stick, cannot rattle, do not sway, always hang straight, have no catches nor delicate parts which can get out of order: work quickly and stop exactly where left. They can be made of any kind of curtain material, such as Pantasote, Oakette, Crown, Woolen Terry, etc., etc., and are supplied with any kind of curtain fixture, such as Forsyth roller tip pinch handle fixture, No. 86; Keeler pinch handle fixture; Keeler eccentric fixture; Acme cable fixture; Climax cable fixture; and Forsyth car cable fixture.
—CURTAIN SUPPLY COMPANY, CHICAGO, ILL.

EDWARDS CURTAIN ROLLERS, TIN BARREL. Tin barrel spring rollers and accessories of the highest degree of excellence in material, workmanship and design, including the pawl designs for general shade work, with all patterns of plain brackets, and the ratchet design (without pawls) for use with curtains having frictional holding devices or where a continuous action of spring is desired. The ratchet design can be used with any of the general patterns of plain brackets or with the worm gear brackets, by which the roller can be regulated to any power of spring required without removing the roller from the brackets.
—THE O. M. EDWARDS COMPANY, SYRACUSE, N. Y.

EDWARDS SASH BALANCES AND FIXTURES. Tin spring roller sash balances, special ratchet design and worm gear roller brackets rendering the roller adjustable to the strength of spring required without removal from the brackets. The ratchet design when used as a sash lift or balance avoids the danger of sashes falling, which exists with the pawl design.
—THE O. M. EDWARDS COMPANY, SYRACUSE, N. Y.

EDWARDS WINDOW FIXTURES. Standard and in extensive use upon the leading railway systems, various designs rendering the sashes automatic or balanced and conforming to various requirements and construction. All designs render the windows tight, forcing the sash against the outer stops with yielding pressure, which is self-adjusting to varying conditions such as shrinking or swelling, preventing rattle of the sash, excluding dust and air from the car and rendering the windows easy of operation.
—THE O. M. EDWARDS COMPANY, SYRACUSE, N. Y.

HART DECK SASH RATCHETS. The No. 8 improved ratchet is made with an adjustable foot or pivot which permits of the fixture being applied to and operated in connection with a variety of forms of deck sash; avoids the necessity of a special construction of each particular form, and is designed especially for semi-circular, oval, rectangular and other forms of deck sash. The No. 12 Hart ratchet combines not only the important features as above described, but it is also furnished with a retaining lip extending down over the end of the ratchet segment and retains the sash in position against the action of strong winds and other forces which frequently displace the sashes and cause them to fall out.
—THE DAYTON MANUFACTURING COMPANY, DAYTON, O.

HARTSHORN SPRING ROLLERS. For car work this company has developed the well-known tin barrel, self-acting shade rollers. They are made in the following diameters: $\frac{3}{4}$, 1, $1\frac{1}{4}$, $1\frac{1}{2}$ and $1\frac{3}{4}$ ins. For closed cars and railway coaches, where shades are to be hung on windows of ordinary size, the company recommends the use of rollers 1 in. and $1\frac{1}{4}$ in. in dia. For open cars the diameter of the rollers should in no case be less than $1\frac{1}{2}$ in.; when the shade cloth in such cars is long or extra heavy, it should invariably be mounted on rollers $1\frac{3}{4}$ in. in dia.
—STEWART HARTSHORN COMPANY, EAST NEWARK, N. J.

NATIONAL CURTAIN FIXTURE. This fixture locks the curtain against upward pull, is not easily tilted, and as heads are stationary, cannot possibly get out of grooves when finger pieces are compressed. It automatically locks against the tension of spring roller by spring pressed cams, pivoted in the heads or guides at each end of fixture, and bearing against the bottom of the grooves. Strong tension is put on spring roller at the top, and with fixture locked at the bottom, the pull all comes on curtain, causing it to set perfectly smooth, thus preventing a loose, flapping curtain. This strong tension in the roller also insures quick action when curtain is raised, and holds curtain firmly when wind is blowing. The locking against upward pull positively prevents curtain creeping upward; and jarring of car, wind or wear will have no effect on
—THE NATIONAL LOCK WASHER COMPANY, NEWARK, N. J.

PANTASOTE. This material is standard on many important trunk line railway systems and electric traction lines for closed and open car curtains and for seat covers. The company manufactures a great variety of printed and woven fabrics in cotton, wool and silk for car curtains, all coated on the outside with Pantasote, for protection against rain and the dirt and dust of travel. These materials outlast all other car shades many times, and are therefore much the cheapest in the long run, of any materials manufactured.
—THE PANTASOTE COMPANY, NEW YORK.

DAMPER REGULATORS

LAGONDA DAMPER REGULATOR. This device controls the dampers in boilers, whether the damper be in the stack or in the breeching of the boilers. It can also be used to regulate the speed of draught fans and for other similar purposes. It is a remarkably durable machine, simple, easily installed, sensitive and thoroughly reliable. One machine can be used for controlling several dampers.
—THE LAGONDA MANUFACTURING COMPANY, SPRINGFIELD, OHIO.

THOMPSON AUTOMATIC DAMPER REGULATOR. This regulator has the power to move the damper or dampers in both directions by water pressure, and is not of necessity wide open or shut. It will close or open the damper or dampers on a variation of 1 lb. of steam; or will make a partial stroke in either direction and stand at any intermediate point between the open and closed positions. On account of this positive power in both directions, connections to the damper or dampers can be made (if the situation is favorable) by rod direct to damper lever, bell crank, or counter shaft, dispensing with chain, pulleys and counter weights, except in places where the damper cannot be reached otherwise. Every regulator is tested and guaranteed to work as above stated; hence its advantage in the saving of coal, even steam pressure, the preservation of boilers and grate bars. And as a safeguard against excessive pressure, or preventive

of explosions, its value can hardly be estimated. One of these regulators will govern from one to twenty boilers by working as many individual dampers, or one or more main dampers.

—RICHARD THOMPSON & COMPANY, NEW YORK.

DERAILING DEVICES

(See also Track Work.)

LORAIN DERAILING DEVICES. All the tongue switches of "Guarantee" construction or built up construction, as may be required, and in either guder or tee rail, with chain pull-up box, lever pull-up box, or with upright lever stand, operated from the curb. Alternatively such devices may be operated with lever pull-up box or upright stand, operated in advance of car. (See advertisement.)
—THE LORAIN STEEL COMPANY, PHILADELPHIA, PA.

WEIR DERAILERS. This company has ten different designs of derailing devices, to be placed in electric railway track, for the purpose of reminding the conductor of the rule of the company, which makes it imperative for him to leave his car and go forward to cross the steam road track before giving the motorman the safety signal. Some of these derailing devices are arranged with the operating handle on the curb opposite the derailing switch; some with the handle located on the inner side of the steam road track, and some with the handle on the far side of the steam road track. This company can furnish either split switches for use in private right-of-way, or tongue switches for use in paved streets.

—WEIR FROG COMPANY, CINCINNATI, OHIO.

DESPATCHING SYSTEMS

EGRY DESPATCHING SYSTEM. This method of train despatching is extensively and satisfactorily used by prominent interurban lines throughout the country. By this system verbal orders are entirely eliminated, errors and mishaps avoided, life and property protected, schedules maintained and accuracy demanded and obtained from employees. It is economical and extremely convenient.

—THE EGRY AUTOGRAPHIC REGISTER COMPANY, DEPT. D, DAYTON, OHIO.

DISINFECTANTS

(See also Cleaning Powders and Washes.)

CHLORO-NAPHTHOLEUM DISINFECTANT. This germicide will not injure, mark or stain fabrics or woodwork. It is non-poisonous, but it will destroy disease germs, foul odors and vermin. It should be sprinkled before sweeping and added to all water used for cleaning. Chloro-naphtholeum and this company's automatic disinfecting appliances for toilets are used by the United States Government, leading railroads, corporations, etc., etc.
—WEST DISINFECTING COMPANY, NEW YORK.

DOORS AND DOOR FIXTURES,

BRILL VESTIBULE DOOR CONTROLLER. Until this controller was patented, vestibule folding doors were allowed to swing free in being closed or opened, with liability of striking against passengers, and by a sudden movement of the car, be violently closed or opened, resulting in broken glass and wrenched frames. The extensive use of the dividing rail on vestibuled "Detroit" platforms makes such a device absolutely necessary to prevent defacement of the woodwork of the door by swinging against the railing. The apparatus consists of a roller mounted vertically on the outer leaf of the folding door which moves between guide-rails attached to the lintel of the door, and the folding doors are provided with specially devised spring catches.

—J. G. BRILL COMPANY, PHILADELPHIA, PA.

—AMERICAN CAR COMPANY, ST. LOUIS, MO.

—G. C. KUHLMAN CAR COMPANY, CLEVELAND, OHIO.

—JOHN STEPHENSON COMPANY, ELIZABETH, N. J.

THE "DUPLIX" DOUBLE DOOR FIXTURE

A compact and ingeniously arranged mechanism for operating two sliding doors simultaneously, so that when force is applied to one door it will move the opposite door reciprocally. It is compact and self contained, so it can be applied between bulkheads above the doors in a few moments' time. Cold rolled steel machine cut racks and gear wheel are used in combination with channel iron guideways and malleable iron supporting brackets and hangers in such a manner as to always insure maximum strength, wear, perfect alignment and easy running of all moving parts. (For illustration see advertisement.)

—WALLACE SUPPLY COMPANY, CHICAGO AND NEW YORK.

EDWARDS TRAP DOORS. (EXTENSION PLATFORM.) In general use upon the leading railway systems for covering over the steps in wide vestibule or open plat-

form cars. The door is actuated by torsional spring bars located within the hinge, which may be regulated at will, either to balance the door or render it automatic upon being released by the operating means, the spring bars being held at one end in the hinge and at the other end in a ratchet wheel located in the bracket or journal bearing which supports the end of the hinge. There are various designs conforming to various requirements and construction.
—THE O. M. EDWARDS COMPANY, SYRACUSE, N. Y.

PITT BALANCE DOOR. This door is designed for use in railroad stations, railway cars and other places where an easy means of egress and ingress is required for handling crowds. The doors cannot be blown open by the strongest wind, yet open at the gentlest pressure of the hand, and fold closely against the wall, giving the full width of the opening. They work both ways, never "slam" or "bang," shut out dust, and make draughts impossible, simply constructed, quick in action, and wind proof, dust-proof and storm proof.

—THE PITT BALANCE DOOR COMPANY, NEW YORK.

RIDLON AUTOMATIC LOCK FOR FOLDING VESTIBULE DOORS. This device is of great value in the saving of glass alone, to say nothing about its other advantages. It prevents the doors from swinging and is positive in its action. The first half of the door can be opened without opening the second half. This latter cannot be opened until the first half is folded back against the catch, which unlocks the second half and locks the two doors together automatically, when they both can be swung back together and hooked; or reversing the operation, the two halves remain locked together until, in closing, the second half strikes the catch, when the first half is released, the second half being locked also automatically in its normal closed position. The first half is then free to be closed and locked.

—FRANK RIDLON COMPANY, BOSTON, MASS.

DOORS, STEEL ROLLING

KINNEAR STEEL ROLLING DOORS. A door constructed of steel slats running in guides and having interlocking hinges along its entire length. It coils up at the top of the opening into a small roll, thus occupying no wall nor floor space. It is operated easily and speedily by one man, is entirely fireproof, and very durable. By means of hinged posts, an opening of any width may be divided into convenient sized doors, yet leaving the opening entirely free when doors are open. The trolley connection automatically provides a smooth and continuous path for the trolley when the door is open.

—KINNEAR MANUFACTURING COMPANY, COLUMBUS, OHIO.

DRAFT RIGGING AND DRAW BARS

(See "Couplers, Car")

DRAFT, MECHANICAL

(See Mechanical Draft Apparatus.)

DRYING APPARATUS

(See also Heating and Ventilating Apparatus.)

"ABC" DRYING APPARATUS. For many years the drying of materials of all kinds from which moisture can be successfully extracted by artificial means has been one of this company's specialties. Each of the dryers which it furnishes is especially designed for the work which it is to accomplish, the plans for same embodying the results of the company's extensive and successful experience. In some of the dryers the same types of apparatus are used as are employed in the company's heating and mechanical draft systems; in others, as in the case of the "Moist Air" lumber dryers, the apparatus is entirely different.
—AMERICAN BLOWER COMPANY, DETROIT, MICH.

STURTEVANT DRYING APPARATUS. A positive circulation of air is essential to the successful drying of all classes of material. In this system the apparatus, consisting of a fan and a heater, is placed outside of the drying room. The air is positively drawn or forced through the heater by means of the fan and is discharged under pressure at any desired point or points within the drying chamber. When the material is not excessively moist the air is returned to the heating apparatus and reheated, thereby increasing the efficiency. Special arrangements of the dry room are usually required for each specific material. (See also Heating and Ventilating Apparatus.)

—B. F. STURTEVANT COMPANY, HYDE PARK, MASS.

(CONTINUED ON PAGE XVII.)

DRILLS, TRACK

BROWN TRACK DRILL. This machine is a self-feeding hand-power drill, with a pair of fly wheels on which it can be easily rolled. On reaching the work, the drill is up-ended and placed so that the frame-bars rest across the track rails. Two ordinary laborers can drill holes up to 1 in. as rapidly as with a motor-driven machine. Drills holes in vertical or diagonal planes.
—HAROLD P. BROWN, NEW YORK.

DUNTLEY AIR-COOLED ELECTRIC DRILLS. Manufactured in single and tri-motor types with capacities ranging from $\frac{3}{8}$ in. to 2 $\frac{1}{2}$ ins. Friction clutch is used as protection against damage to motors in case drill is fed so rapidly the amperage exceeds the rating. Should this occur drill spindle stops and motors continue at full speed. Slight turn of feed screw or pilot wheel will start drill spindle rotating. (See advertisement.)
—CHICAGO PNEUMATIC TOOL COMPANY, CHICAGO, ILL.

MOORE TRACK DRILL. Some of the advantages of this new drill for heavier rail work are: The adjustable feed attachment permits the feed to be regulated to suit the requirements; the drill bit, which can be quickly fed up to or returned from the work by throwing the feed mechanism out of gear; the top section carrying the upright and the operating mechanism, which can be quickly detached from the lower portion, leaving the same in position but lying below the top of the rail to admit the passing of trains; after the train has passed, the upper portion can be readily attached again. Can also be used for drilling holes in the base of the rail by the substitution of a few parts, and be equipped with either the over or the under clutch rigging, as desired.
—KALAMAZOO RAILWAY SUPPLY COMPANY, KALAMAZOO, MICH.

PAULUS AUTOMATIC FEED TRACK DRILLS. The only practical device whereby the operator may stand erect while drilling. The action of the bit is continuous and the feed is automatic. The heaviest rail may be drilled through without stopping. The drill is attached to the rail by two hooks which go over the top. For trains to pass the hooks are raised and the top collapses backward, the bit remaining undisturbed. A special pattern is made for guard rails.
—BUDA FOUNDRY & MANUFACTURING COMPANY, CHICAGO, ILL.

RIDLON TRACK DRILL. This machine drills $\frac{7}{8}$ in. holes in heavy rails for bonding. It is the result of experience gained in drilling the holes for bonding the rails on the new structure of the Boston Elevated Railway. As now constructed, it weighs 185 lbs., and is easily handled by two men. When once adjusted, it may be quickly set in place for each new hole. The parts, while heavy, are not cumbersome, and the gearing is of cut steel. The drill is provided with an automatic friction feed that may be adjusted to feed fast or slow. This also acts as a quick return of the spindle by reversing the cranks and the drill backs out much faster than could possibly be done in any other way.
—FRANK RIDLON COMPANY, BOSTON, MASS.

SHEFFIELD TRACK DRILLS. The No. 5 is a vertical drill operated by means of cranks and insuring maximum speed. The gear wheels are all cast steel. It has a "quick feed" by which the drill bit can be run up quickly against the metal, or withdrawn quickly after hole is drilled, thus saving a great deal of time over other styles. It has also two drilling speeds, the faster being used for soft metals and the slower for hard. The change of speed as above is accomplished in a simple manner—the pushing of a lever by the foot. The upright is removable to allow trains to pass.
—FAIRBANKS, MORSE & COMPANY, CHICAGO, ILL.

SWEET'S TRACK DRILL. This drill works rapidly, has a powerful feed, making the drilling of 1 $\frac{1}{2}$ -inch holes easy in girder or tee rails. The motion is uniform and continuous. The feeding and withdrawing of the drill is accomplished by one lever. The construction of the spindle head decreases the friction to a minimum, and the fulcrum lever furnishes a powerful and variable feed with a quick return. The wheels serve as a truck for moving the drill without carrying
—MICHIGAN MACHINERY MANUFACTURING COMPANY, YPSILANTI, MICH.

VAN DORN-ELLIOTT ELECTRIC PORTABLE DRILL. This is designed and built to do rapid work in drilling and reaming holes in tracks and for use about repair shops and power houses. It is constructed with an automatic switch, and is at all times reliable and entirely automatic in its operation. Built for 110, 220 or 500 volts
—THE VAN DORN-ELLIOTT ELECTRIC COMPANY, CLEVELAND, OHIO.

WILSON DRILL. This is a continuous action drill for drilling holes for $\frac{1}{4}$ to $\frac{3}{8}$ in. bond wires. It has an automatic feed which is even and continuous forward or back when the crank is turned. The machine is simple and of but few parts. Is attached to rail by means of books and may be readily secured to or taken from the rail.
—BUDA FOUNDRY & MANUFACTURING COMPANY, CHICAGO, ILL.

DUST GUARDS

(See Lubricating Devices)

DYNAMOS

(See "Generators")

ECONOMIZERS, FUEL

AMERICAN FUEL ECONOMIZER. Made by Broomell, Schmidt & Steacy Company, York, Pa.

GREEN FUEL ECONOMIZER. An apparatus for heating the feed water for steam boilers by means of the heat that would otherwise be wasted in the flue gases leaving the boilers. This saving varies from 10 to 20 per cent. according to the type of boiler and the method of firing. This apparatus also prolongs the life of the boiler by obviating the use of cold feed water and by precipitating a large part of the sediment that would otherwise enter and encrust the boiler. It further provides a large reserve of feed-water at the evaporator point. (See advertisement for illustration.)
—THE GREEN FUEL ECONOMIZER COMPANY, MATTEWAN, N. Y.

PARKER ECONOMIZERS. This device is placed between the steam generating tubes and the drums of Parker water tube boilers or it may be used in connection with other types of boilers. It is constructed of straight horizontal charcoal iron tubes and the same junction boxes as used in the Parker boiler. The tubes are connected in series and the water is fed in at the top end. A connection with the drum supplies water for circulation when the feed is stopped. A check valve compels the feed to go through the coil and another forces water from the drum through the coil when blowing out.
—PARKER BOILER COMPANY, PHILADELPHIA, PA.

STURTEVANT FUEL ECONOMIZERS. The metal-to-metal pipe joints insure ease of erection and permanent tightness. There are no gaskets. The staggered pipes completely break up the gas currents and greatly increase the efficiency of the pipe surface. Expansion and contraction are free to occur without straining the joints. These economizers are preferably installed in connection with mechanical draft. They save from 10 to 20 per cent. in fuel, increase the boiler capacity from 20 to 40 per cent., prolong the life of the boilers, purify the feed water and decrease the smoke nuisance.
—B. F. STURTEVANT COMPANY, HYDE PARK, MASS.

ELECTRICAL TESTING

ELECTRICAL TESTING. The recognition of the value and importance of testing and a demand for a competent, independent laboratory prompted the equipment of the Electrical Testing Laboratories. In these laboratories tests are made by skilled experts for the exclusive benefit of patrons. Here are testing facilities which would be otherwise within the reach of few, but by this method are at the command of all. If secrecy is preferred private rooms well equipped for the purpose are available, where customers can make their own tests unobserved.
—ELECTRICAL TESTING LABORATORIES, NEW YORK.

ELEVATORS

BATES PASSENGER AND FREIGHT ELEVATORS. The elevators made by this firm have been in successful use for over twenty-five years. At present the company is installing for the Philadelphia Rapid Transit Company one direct-acting plunger hydraulic freight elevator, capacity 50,000 lbs., at 20 ft. per minute, steel car 12 ft. 6 in. wide, by 42 ft. long.
—F. A. & H. P. BATES, SWARTMORE, PA.

"MARINE ENGINE" ELEVATORS. All types of electric and hydraulic elevators for passenger, freight and sidewalk service are made by this company, and the special features of the electric elevators are the elimination of keys and pins from the driving mechanism, and the use of the full automatic electric control. The company makes a specialty of the Pratt rail-gripping car safety device, this being a combination of old and tried devices producing a new and effective result.
—MARINE ENGINE AND MACHINE COMPANY, NEW YORK

ENGINES, GAS AND OIL

ALLIS-CHALMERS NURNBERG GAS ENGINES. This gas engine is horizontal, four cycle, double-acting; built as a two-cylinder tandem or twin in units of 300 to 2,500 h.p., and as a four-cylinder twin tandem in units of 600 h.p. to 5,000 h.p., suitable for all fuel gases and all power purposes, including driving line shafting direct coupled to the crank shaft, or by means of belts, ropes, or gearing; driving electric generators, both direct and alternating current, directly connected to crank shaft; operating directly coupled air compressing and blowing cylinders, or pumps. Over 115,000 h.p. in "Nurnberg" gas engines now in construction and operation.
—ALLIS-CHALMERS COMPANY, MILWAUKEE, WIS.

AMERICAN CROSSLEY GAS ENGINE. The rights to build the Crossley gas engine in this country have been acquired by the Power & Mining Machinery Company, New York, successor to the Loomis-Pettibone Gas Machinery Company. Although the American Crossley engine embodies the principal fundamental features of the English engine, several modifications of details have been made, notably in the valve gear. The engine is of the single-acting, four-stroke-cycle type, and is built in single-cylinder, double-cylinder and four-cylinder units of from 50 to 1,300 h.p. rated output. The maximum ability exceeds the rated ability by about 15 per cent.
—POWER & MINING MACHINERY COMPANY, CUDAHY, WIS.

BUCKEYE GAS ENGINES FOR POWER STATIONS.

—BUCKEYE ENGINE COMPANY, SALEM, OHIO.

KOERTING AND HORNSBY-AKROYD INTERNAL COMBUSTION ENGINES. Besides its well-known refrigerating machines, this company builds the following: Koerting two-cycle gas engines, from 400 hp. to 3,000 hp.; four-cycle Koerting gas engines from 65 hp. to 360 hp., and Hornsby-Akroyd safety oil engines which operate on kerosene, crude or fuel oil, up to 125 hp in single cylinder units and 250 hp. in twin units.
—DE LA VERGNE MACHINE COMPANY, NEW YORK.

SECOR OIL ENGINES. See Generating Sets.

WEBER GAS AND GASOLINE ENGINES. See under Gas Producers.

WESTINGHOUSE SINGLE ACTING GAS ENGINES. Built in numerous sizes up to 300 h.p. Operate upon the four cycle principle. Engines of this type are of vertical construction, having two cylinders in the smaller sizes and three cylinders in larger sizes. Mounted upon enclosed crank cases. In the latter the cranks are spaced at 120 deg. regularity, giving a power impulse at each two-thirds revolution. This type is well adapted to generator driving, either D.C. or A.C. in electric parallel. Natural, illuminating, producer or oil gases are suitable for fuel.
—THE WESTINGHOUSE MACHINE COMPANY, PITTSBURG, PA.

WESTINGHOUSE DOUBLE ACTING HEAVY DUTY GAS ENGINES. Built in sizes up to 4,000 h.p., either single crank or double crank, the former with two double acting cylinders arranged in tandem, the latter with this arrangement duplicated, making a four cylinder engine with cranks at 90 deg. The engine operates on the four cycle principle, and, therefore, makes four impulses per revolution. Double acting designs are especially adapted for driving direct connected generators, either of the D.C. or A.C. type, operated either separately or in parallel. The gases suitable for fuel comprise natural, illuminating producer, blast furnace and oil gas.
—THE WESTINGHOUSE MACHINE COMPANY, PITTSBURG, PA.

ENGINES, HOISTING

ALLIS-CHALMERS DOUBLE DRUM DIRECT ACTING CORLISS HOISTING ENGINE. Made either with Stephenson links, Gooch links, Allen links or spur gear rolling reverse. Steam actuated. Ball throttle valve obviating the use of special steam cylinder for operating. Under control of governor at all times. Governor safety device in connection with overwinding arrangement, as it is operated in conjunction with it. Automatic safety stop acts in cut off and sets the brake. Post brakes have parallel motion. Standard size of cylinders, 24 in. dia., with 60 in. stroke, with 125 lb. steam. hoists 17,000 lb., equipped with 10 ft. drum and ball friction clutch 9 ft. in. dia.
—ALLIS-CHALMERS COMPANY, MILWAUKEE, WIS.

ALLIS-CHALMERS DUPLEX DOUBLE REEL HOISTING ENGINE. On reels 5 ft. in diameter at center 2,500 feet of 5 in. by $\frac{3}{8}$ in. flat rope may be wound. Friction clutches. Automatic safety stop prevents overwinding. Clutches, brakes and reversing gear steam operated. All auxiliary steam cylinders have oil cataract cylinders arranged tandem with the steam cylinders to give an easy and

steady motion. Pillow Blocks provided for center bearing of crank shaft. Worm gear. Indicator drives direct and positive. Coupling with special L.W. with regard to such devices. Gray cage chairs, indicators, skips, buckets and all other accessories supplied direct.
—ALLIS-CHALMERS COMPANY, MILWAUKEE, WIS.

ENGINES, STEAM

"ABC" TYPE A ENGINES. This engine will run continuously at high speeds for from three to six months without oiling or adjusting being especially adapted for operating blowers, generators, pumps, etc. The perfect balance due to the method of lubrication employed coupled with other unique features of design and construction. Each vertical and horizontal engine, the bearing being positive contact between shaft and bearing, hence the wear is almost entirely eliminated. The engine fully enclosed, yet the working parts are as readily accessible as in an open frame engine. Automatic relief cocks prevent all liability of breaking by water.
—AMERICAN BLOWER COMPANY, DUNFRIE

ARMINGTON & SIMS ENGINES. All of these engines embody the devices and improvements which long practical experience has shown to be essential for the highest efficiency in portable engines of this character. Most important among these devices and improvements are the multiplied self-adjusting cylinder valves, improved automatic inertia governor, automatic self-oiling devices and four-piece valve shell self-oiling bearings. All working parts are adjustable for wear, and are at all times readily accessible for inspection, adjustment and repair. All parts are accurately made to size and duplicates can be furnished at short notice. This company is a builder of a great variety of sizes and types of these engines, designed to meet the requirements of any service. These engines are of massive construction and fitted with heavy mechanism especially designed for the highest and most economical economy.
—MAYNARD ENGINE & MACHINE COMPANY, NEW YORK.

BALWOOD CORLISS VALVE STEAM ENGINE. This engine has no releasing gear, having a positive connection between the wrist plate and the valve stem lock arm. The design of valve gear is such that practically the Corliiss steam distribution is obtained while the greater speed of revolution makes the losses less, resulting in higher efficiencies than can be obtained by the slow speed Corliiss. The admission valves are controlled by the inertia shaft governor while the exhaust valves are driven by a separate fixed eccentric. The valves are placed in the cylinder heads and are partially unbalanced so that the ports are short and direct, the clearance a minimum, and the valves automatically take up their own wear, remaining tight for an indefinite period.
—THE BALL & WOOD COMPANY, NEW YORK.

BROWN-CORLISS ENGINES. These engines include heavy duty and girder frame engines. High speed vertical engines in units from 25 to 500 h.p. The company makes a specialty of furnishing complete power plants, including electrical apparatus, either for high speed or heavy duty Corliiss engines.
—BROWN CORLISS ENGINE COMPANY, CORLISS, WIS.

BUCKEYE STEAM ENGINES. The engines made by this company embrace several types especially suitable for electric railway and other power houses operating under severe conditions. Among these are tandem engines; tandem compound engines; single engines; horizontal vertical compound engines for direct connection to railway generators; cross compound engines for alternating current generators of the revolving field type as well as for direct current machines; and high speed, vertical cross-compound engines. Capacities range all the way from 50 hp. to 8,000 hp.
—BUCKEYE ENGINE COMPANY, SALEM, OHIO.

COOPER-CORLISS ENGINES. An economical and reliable type of engine specially adapted for driving direct connected electric light and railway generators in sizes ranging between 100 Kw. and 5,000 Kw., at speeds from 75 r.p.m. to 125 r.p.m. These engines are built in single cylinder, cross and tandem compound, also horizontal-vertical types. (See advertisement.)
—THE C. & G. COOPER COMPANY, MT. VERNON, OHIO

FLEMING ENGINES. This is an automatic self-oiling horizontal engine, comprising sixteen different styles and 900 sizes, ranging from 6 to 3,000 hp. capacity, each size particularly adapted to its special service, thus enabling the selection of an engine exactly suited to the conditions. The four-valve particularly stands in a class of its own, being built for hard work and highest efficiency. Separate and direct fired super-heaters also furnished when desired

Complete power plants installed upon a guarantee basis per kilowatt cost per hour. (See advertisement.)
—HARRISBURG FOUNDRY AND MACHINE WORKS, HARRISBURG, PA.

HAMILTON-CORLISS VERTICAL CROSS COMPOUND ENGINES. Made in sizes from 10 in. by 12 in. by 36 in. to 48 in. by 96 in. by 60 in., adapted for medium speeds and any desired steam pressure, run belted or direct connected. Have cylinders of cast grained charcoal iron, double ported, cooled steam and exhaust valves actuated by separate eccentrics, box-section type bed plate, cast in one piece and carried around the crank at full height, forming a deck crank pin to retain oil; range of cut-off, zero to three-quarter stroke.
—HOOVER OVENS, REINOLDS COMPANY, HAMILTON, O.

MCINTOSH SEYMOUR ENGINES. Made in all sizes and types, including engines to meet special requirements.
—MCINTOSH SEYMOUR & COMPANY, ALBURN, N. Y.

MURRAY CORLISS ENGINES. These are of the latest design. The frame or beds are of the girder, heavy duty and rolling mill types. The cylinders are cast from the same iron as that is poured into the locomotive cylinders for which the Murray foundry is famous, and all the castings are of the highest grade. As evidence of this, there has never been a case of a Murray fly, band or rope wheel bursting. The capacity of the works is large and the heaviest engines can be built complete in thirty days if the requirements do not depart from the standard practice of the company. There are about 1,000 engines of this type in use.
—THE MURRAY IRON WORKS COMPANY, BURLINGTON, IA.

PHOENIX ENGINES. This company is a builder of engines of the automatic cut-off type.
—PHOENIX IRON WORKS COMPANY, MEADVILLE, PA.

QUINCY CORLISS ENGINES. Designed especially to meet the exacting requirements of street railway service. Differs from the well-known Corliiss type only in the small details, to which special attention has been given. Have many features not commonly found in engines of their type, which are appreciated by both owners and operators.
—QUINCY ENGINE WORKS, QUINCY, ILL.

QUINCY VERTICAL ENGINES. Ideal engines for use with moderate speed generators, and where space is limited. The steam is distributed by four valves, the admission valves being controlled by a shaft governor. In use in some of the best equipped power houses in the country.
—QUINCY ENGINE WORKS, QUINCY, ILL.

REYNOLDS CORLISS ENGINES. This type includes the Reynolds horizontal-vertical engine, said to give the best turning movement of any engine built, and is especially adapted for direct connection to electrical generators; Reliance engines, single and compounded, belted and direct connected; heavy duty engines, single and compounded, belted and direct connected; girder frame engines and vertical engines, single and compounded, belted and direct connected.
—ALLIS-CHALMERS COMPANY, MILWAUKEE, WIS.

RICE & SARGENT STEAM ENGINES. Special designs of these engines are made for direct connection to both a.c. and d.c. generators. The Rice & Sargent engine of the Corliiss type with releasing gear and belted inertia governor, is adapted to run at speeds up to 150 r.p.m. For higher speeds, the four valve non-releasing type with shaft governor is adapted to speeds up to 250 r.p.m. Both types show small friction, close regulation, low steam consumption, fine workmanship, quiet action, and great durability.
—PROVIDENCE ENGINEERING WORKS, PROVIDENCE, R. I.

ROCKING VALVE ENGINES. Specially designed or service requiring a heavy machine. Built on standard engine frame. Frame and side cast in one piece, having a bearing the full length of the foundation, thus insuring great stiffness. Slide has bored guides. Pins and wearing surfaces extra large. Cylinders neatly lagged with planished sheet steel. Rocking valve placed at bottom of the cylinder, thus allowing the cylinder to be thoroughly drained. Port openings through the valve and into the cylinder are exceptionally large, preventing wire drawing of the steam. Strong, simple compact, and economical in operation.
—ALLIS-CHALMERS COMPANY, MILWAUKEE, WIS.

RUSSELL CORLISS ENGINES. These engines are high grade four valve semi-Corliiss engines designed for heavy duty and especially adapted to driving electric railway generators, where durability, efficiency and economy are required. The company also builds self-oiling engines

of the enclosed type which are in great demand in large buildings where elevators and lights are operated from the same generator and regulation must be perfect. These engines when in operation are noiseless; as all bearings run in oil, they require the minimum amount of attention.
—THE RUSSELL ENGINE COMPANY, MASSILLON, OHIO.

SHEPHERD STEAM ENGINES. These engines are made in single and multiple valve types, both single cylinder and compound. They are designed with a special view to direct connection to electric generators, are of massive construction, provided with unusually large wearing surfaces for the moving parts, and, in simplicity of design, close regulation, and economy of operation, are typical of the highest development of the art. While generally arranged for direct connection to electric generators, they are also made for belted service.
—SHEPHERD ENGINEERING COMPANY, LEANING, PA.

STURTEVANT STEAM ENGINES. These are built in large variety up to 250 h.p. Entirely new designs represented by a line of vertical, triple, vertical compound and horizontal engines especially designed for direct connection to generators. The frame are entirely enclosed forced lubrication under 15 lbs. pressure is provided for the bearings and a water bell partition prevents passage of oil from case to cylinder, and of water from cylinder to case. Rites governors regulate the speed within 1/4 per cent. (See also Generating Sets.)
—B. F. STURTEVANT COMPANY, HYDE PARK, MASS.

WHEELER STEAM ENGINES. For the hard and continuous duty of driving centrifugal pumps in connection with condensers, a type of steam engine has been produced, extra heavy in design, and arranged with all modern appliances for lubrication, etc., while in continuous operation. These are made especially for this company's work either of the slide or piston valve type, and for saturated or superheated steam.
—WHEELER CONDENSER & ENGINEERING COMPANY, NEW YORK.

WESTINGHOUSE CORLISS HEAVY DUTY STEAM ENGINES. Built in sizes up to 10,000 h.p. in three types, horizontal tandem or cross compound, vertical cross compound and vertical three-cylinder compound. These engines are especially suitable for central station service, the first for plants of moderate capacity, the second for large and compact plants and the third for exceptionally compact stations of large capacity. They are suited to either saturated or superheated steam. Either Corliiss or poppet valves are employed according to the steam temperature.
—THE WESTINGHOUSE MACHINE COMPANY, PITTSBURG, PA.

WESTINGHOUSE SINGLE ACTING STEAM ENGINES. Built in three styles, Compound, Junior and Standard, in sizes up to 500 h.p., automatic, high speed, either simple or compound. These engines are all of the vertical type with enclosed crank cases and balanced piston valves. Owing to the single acting principle, giving non-reversible stresses, high speed is possible, making this type of engine especially suitable for driving direct connected generators, either D.C. or A.C. The single acting compound engine is suited either for condensing or non-condensing service, although designed especially for the latter. The Junior and Standard types, being simple engines with two cylinders, are suited for non-condensing work.
—THE WESTINGHOUSE MACHINE COMPANY, PITTSBURG, PA.

WETHERILL CORLISS STEAM ENGINES. In this Corliiss engine all the elements for the highest economy in the consumption of steam have been most carefully considered, and only those details which the company's long experience in engine building has found to combine simplicity, certainty of action in valve motion, and to reduce cost of maintenance, have been adopted. The governing mechanism is prompt and effective, enabling these engines to produce a greater amount of work by maintaining a regular speed under various pressures and conditions of load. The changes made from time to time in the detail and construction of this engine, with the unusual weight of parts, and proper distribution of metal, render them equally stiff and rigid when running either under or over.
—ROBERT WETHERILL & COMPANY, INC., CHESTER, PA.

ENGINE STOPS

KINSMAN AUTOMATIC STATIONARY ENGINE STOP. A modification of the company's automatic locomotive stop, generally known as the Kinsman block system. This device is so arranged that a breakage or the over-loading of the circuit will regulate the steam supply or cut it off entirely. It will also automatically apply a retarding device or brake to the fly wheel when the drive wheel attains too

high a speed. In case of failure of governing device causing engine to race and accident is imminent, this feature is of great importance.

—KINSMAN ELECTRIC & RAILWAY SUPPLY COMPANY, NEW YORK.

MONARCH AUTOMATIC SPEED LIMIT. This speed limit is installed in connection with the Monarch engine stop system. It can be applied to any type of engine, steam, oil or gas and of any size or speed; also all types of steam turbines and water wheels. It can be set at any predetermined number of revolutions of the main shaft and will close the valve automatically and shut down the unit when that predetermined point is reached. It checks racing and prevents fly wheel wrecks. It is extensively used in a variety of other ways, such as lighting a red light or sounding a gong when a certain speed is attained.

—CONSOLIDATED ENGINE STOP COMPANY, NEW YORK.

MONARCH ENGINE STOP SYSTEM. This system is a mechanical safety device operated by electricity that can be applied to any type of engine without regard to make, size or speed; also steam turbines and water wheels. It supplements the governor and automatically shuts down the unit at any predetermined overspeed. It also shuts off automatically the steam if the cylinder head blows out. It further provides a means of stopping the engine, turbine or water wheel, or throwing the main switch of a motor from any part of the plant in case of an accident to employes or machinery. It enables the user to get a rebate on liability insurance. It embraces, in addition to the engine stop, an automatic vacuum breaker and circuit breaker trip that operate simultaneously with the shutting down of the unit. The Monarch system surrounds the power end of a plant with complete protection against accidents.

—CONSOLIDATED ENGINE STOP COMPANY, NEW YORK.

EXHAUST HEADS

BURT EXHAUST HEAD. This device is attached to the exhaust pipe, and prevents oil and wet steam from escaping. It is constructed with perpendicular sides, giving a large inside area and providing abundant room for the expansion of the steam, so that there is no back pressure. There is no baffle plate, diaphragm or scrap metal, thus avoiding friction and increasing the life of the apparatus. The head is built of extra heavy iron, lapped, riveted and soldered.

—THE BURT MANUFACTURING COMPANY, AKRON, OHIO.

STANDARD EXHAUST HEAD. This head utilizes centrifugal force for separating the water and oil from the exhaust steam. The incoming steam is given a whirling motion at the top of the head, and the water and oil strike the sides, flow down to the drip outlet at the bottom and therefore do not come in contact with the incoming steam. When the exhaust steam comes in contact with the cold air, some of it is condensed into water, which drips down the collar, is caught in trough-shaped lugs and flows down into copper tubes which carry it to the outlet at the bottom.

—THE BURT MANUFACTURING COMPANY, AKRON, OHIO.

EXTINGUISHERS, FIRE

(See "Fire Extinguishers")

FANS

(See "Mechanical Draft Apparatus")

FEED-WATER APPARATUS

(See "Heaters and Purifiers, Feed-Water")

FELTS, FIREPROOF

"NIAGRITE." A flexible strip of fire-proof felt to encase high and low tension electrical cables to prevent, in case of short-circuiting or arcing, flames setting fire to adjacent cables. It is furnished in strips 3 ins. wide, approximately 15 ft. long, and 3-32 in. to 1/2 in. thick, with sufficient immersing and finishing fire-proof glue with which to adhere the strips to the cables, thus doing away with all metallic fastenings. The company's fire-proof glue thoroughly impregnates the "Niagrite" felt. When dry the entire casing becomes hard like stone, thus carrying away the heat generated in the cables without danger of melting the insulation. (See advertisement.)

—H. W. JOHNS-MANVILLE COMPANY, NEW YORK.

FENCES

WHELOCK FENCE. Made of No. 8 and No. 9 galvanized wires, locked at intersections with Wheelock fence clamp, galvanized. Wires tightened with automatic ratchets at end of each stretch, giving absolute control of the whole stretch. As wires are left loose in the staples,

the stretch of fence may be tightened in a moment with a common wrench. Wires are strung singly, hence uneven ground is as easy to fence as level ground. Can be built any desired mesh, with as many wires and uprights placed as often as desired, according to requirements. Easy to handle and easy to build. Boys' work. (For illustration see advertisement.)

—WRIGHT WIRE COMPANY, WORCESTER, MASS.

WOVEN WIRE FENCE. This woven wire fence is now used on almost all steam and electric railways in the United States. It is one of the most effective designs ever devised for the protection of the right of way of railroads, and has taken the place of many other forms of fencing for railroad use. It assures the maximum of protection at the minimum of cost. The company's No. 3 railroad catalogue contains useful suggestions for fence builders. The rapid strides which have been made in recent years in reducing the cost of production puts this material within the reach of all.

—AMERICAN STEEL & WIRE COMPANY, NEW YORK.

FENDERS AND WHEEL GUARDS

CHAMPION FENDER. This car fender possesses many desirable features, among them being strength, lightness, ease of operation, positive action, economy in installation, low maintenance and reasonable price.

—THE STAR BRASS WORKS, KALAMAZOO, MICH.

CLARK AUTOMATIC FENDER. A simple spring scoop truck fender adapted to both single and double trucks, city or interurban cars, of all speeds; consists of four 2 ins. by 1/2 in. spring steel arms, to which a steel frame is attached, holding the galvanized netting made of No. 16 wire 1/2 in. mesh, galvanized after weaving, which solders the netting where wires cross. It never fails to save life. Has no complicated mechanism, having no trips nor triggers to get out of order and fail to work when needed. It works automatically, the obstruction striking the point of fender, which is carried from 2 ins. to 3 ins. above rail, and springs backward and downward to rail or road bed.

—CLARK'S AUTOMATIC CAR FENDER COMPANY, DECATUR, ILL.

ECLIPSE FENDER. The platform of this fender stands at an angle of 45 deg., with a hollow rubber hose 4 ins. in dia., stretched across the lower end, which rides about 3 ins. from the ground, but can be adjusted either higher or lower if desired. Any person on the track in front of the car will be struck about the ankles first by this tube or hose. This blow takes up the first jar, knocking the man's feet and legs from under him and giving him somewhat the momentum of the car, dropping the weight of the body back against the platform. The platform, which swings on a pivot, immediately falls back, bringing the front end with the roll on about 20 ins. above the ground, while the rear end is about 6 ins. to 8 ins. lower, thus forming a basket from which a man cannot get out without assistance.

—ECLIPSE RAILWAY SUPPLY COMPANY, CLEVELAND, O.

HIPWOOD CAR FENDER. The fender in ordinary use is carried clear of road-bed. The distance from rails easily and quickly regulated by motorman. It can be dropped to the road bed instantaneously. This fender can be removed from car in a few seconds and can be placed in position for use in the same short time. When housed under car it takes up no extra space in car depot and does not interfere with the free use of the draw bar or any other equipment. Manufactured at Lakeport, N. H.

—HIPWOOD-BARRETT FENDER COMPANY, LAKEPORT, N. H.

PARMENTER FENDER. This fender is built entirely of metal, and can be easily folded and transferred to the other end of the car. It projects in front of the car for a short distance, and is under the absolute control of the motorman, who can, by a slight motion of his foot, drop the fender to the track, thus enabling a person to be picked up even if lying prostrate.

—PARMENTER FENDER AND WHEEL GUARD COMPANY, BOSTON, MASS.

PARMENTER WHEEL GUARD. This wheel guard makes it absolutely impossible for the car wheels to pass over a body. The device consists of a trigger placed immediately under the front end of the platform and so designed that it will be pressed back by any object on the track. When pressed back the trigger operates an arm, which in turn permits the guard to drop to the rail immediately in front of the wheels.

—PARMENTER FENDER AND WHEEL GUARD COMPANY, BOSTON, MASS.

PROVIDENCE FENDER AND WHEEL GUARD. Composed of two distinct parts—the cradle and the cushion

The cradle is formed of curved steel rails, parallel to the car axis. The back of this cradle is hinged to the front to the platform, and may be turned up against the dash rest with its front edge on the track, or occupy any intermediate position. The front edge of the cradle has rubber rolls. The cradle may be instantly dropped to the ground by pressing a foot latch or trigger. The cushion is a resilient steel band shield covering the bumper and all other projecting parts of the platform to cushion the blow when a person is struck.

—THE CONSOLIDATED CAR FENDER COMPANY, NEW YORK.

PROVIDENCE WHEEL GUARD. Made on the same lines as the Providence fender, but is attached to the truck of the car directly in front of the wheels. It can be dropped to the track at the same time, and by the same action on the part of the motorman, by which the front fender is dropped. If desired, an automatic attachment can be used which operates entirely independent of the motorman. The wheel guard is practically a small front fender without the cushion, and attached to the truck of the car close to the wheels, hence the name.

—THE CONSOLIDATED CAR FENDER COMPANY, NEW YORK.

STERLING FENDER. This fender has been in use seven years. A pilot-shaped life guard, attachable to any truck, it throws prostrate persons and other objects off the track, preventing contact with wheels and motors, thus saving lives and preventing severe injuries. Many thousands in use. It is strongly made, inexpensive and economical to maintain.

—STERLING-MEAKER COMPANY, NEWARK, N. J.

FIBER

AMERICAN VULCANIZED FIBER. This company manufactures vulcanized fiber of a special grade suitable for insulating purposes, which owing to its remarkable toughness and strength permits its use where other insulating materials fail to stand the strain. Vulcanized fiber is made in sheets, tubes, rods, and special shapes, and is, in addition to its uses as an insulator, especially adapted for dust guards and oil box covers, owing to its strength and the fact that it is absolutely unaffected by oils or grease.

—AMERICAN VULCANIZED FIBER COMPANY, WILMINGTON DEL.

FIELD COILS

(See "Armature and Field Coils")

FILTERS, OIL

(See also Oil and Waste-Saving Machines.)

AMERICAN OIL FILTER. This is a round-bodied filter recommended especially for purifying heavy oils. The hot water in the chamber at the top surrounds the entering oil and renders it easy flowing. To operate the filter, warm water is poured in at the top until it flows out of a certain faucet, after which the upper chamber is filled with water and exhaust steam connections made. The waste oil then enters and undergoes purification as in the Cross oil filter described elsewhere in this dictionary.

—THE BURT MANUFACTURING COMPANY, AKRON, OHIO

AMERICAN OIL FILTERING SYSTEM. The oil is fed to the different bearings by gravity from an overhead oil reservoir. After passing through the bearings, it is piped to oil filter or filters in the basement and upon being purified is again pumped to the reservoir. The oil flow is continuous and the machinery thus gives the best results, as a liberal supply can be used in the bearings without loss. This system can be constructed and put into operation by any power plant engineer.

—THE BURT MANUFACTURING COMPANY, AKRON, OHIO.

CROSS OIL FILTERS. The dirty oil is poured into an upper chamber, passes down through waste, which collects the heavier impurities, and thence goes through a perforated bottom into a tube and to a filter plate under which it spreads out in a very thin film. The latter constantly changes in surface and grows thinner as it travels from the center to the outer edge of the plate, thus exposing every particle of waste oil to the action of the water. This process is repeated on two other plates, after which the oil again filters through a stratum of waste and enters the pure oil reservoir.

—THE BURT MANUFACTURING COMPANY, AKRON, OHIO.

LIBERTY FAMOUS OIL FILTER. This filter uses a temperature bath to precipitate the impurities in the oil. The oil is heated by either a steam or electric jacket, which surrounds the filtering chamber. These jackets are not placed near the bottom of the filtering chamber, but at the sides of it, and are so arranged that the action is not violent. This causes the clean oil to rise to the top

and the impurities to be precipitated to the bottom, where they are drawn off. This filter does not use any water as a purifying or heat transmission medium. Made in all sizes. The clogging system at the World's Fair in St. Louis consisted of six of these filters. (See advertisement.)

—LIBERTY MANUFACTURING COMPANY, PITTSBURG, PA.

TURNER OIL FILTER. In this filter the dirty oil is poured into a pan in section 1, and descends through a pipe discharging into water, below a perforated plate. The oil rises through the perforations of the plate and passes up through filtering material and water into a cone, escaping through the perforations at the top of the collar of this cone. The oil now rises, passing through the second perforated plate and filtering material, while a certain amount of the heavy dirt settles in a dirt chamber and should be drawn out. The partially filtered oil, having reached the pipe running from section 1 to 2, passes into section 2, repeating the same operation as in section 1, and so on until section 4 is reached, when it enters a pipe in the chamber of this section, descending through filtering material into the oil reservoir. The arrangements of the dirt chambers in sections 1, 2 and 3 go away with the passing of the oil through the furnaces left by previous filtrations.

—M. A. TURNER, SOUTH BEND, IND.

"UNIT TYPE" AMERICAN OIL FILTER. Each unit is so constructed that it can be used in connection with, or independent of, an oiling system. Hence where increased filtering capacity becomes necessary, any number of units can be added without changing the original piping. These square-bodied "unit" filters can be used in connection with any oiling system.

—THE DURT MANUFACTURING COMPANY, AKRON, OHIO.

WARDEN OIL FILTER. In this filter the bottom chamber is filled with water heated by a steam pipe. The dirty oil is poured in at the top and passes through a pan of waste which collects nearly all of the impurities. The oil then flows down a perforated tube and from there to a perforated filter plate over which it spreads in a thin film of ever changing surface. Every particle of waste oil is exposed to the cleansing by the water and when the remaining impurities have settled by gravity, the clean oil is ready to be drawn off.

—THE DURT MANUFACTURING COMPANY, AKRON, OHIO.

WILTBONCO-HOGAN WASTE OIL FILTER. The lower portion of the chamber is filled with steam-heated water to a certain height. The waste oil is poured into the chamber and passes through a wire screen which removes the heavier impurities. Then it flows through feed holes and a pipe into a settling chamber, from whence it goes through a series of plates, the oil spreading in a thin film on their lower surfaces with the result that it is completely scoured by the water. The pure oil, after leaving the plates, rises to the surface of the water, gradually filling the upper portion of the chamber where it is drawn off.

—THE WM. T. BONNER COMPANY, BOSTON, MASS.

FIRE EXTINGUISHERS

ESTY AUTOMATIC SPRINKLER EQUIPMENTS. When it is considered that many non-fireproof car barns are used for the storage of valuable rolling stock which, aside from the high property loss, cannot be quickly replaced for traffic handling, little excuse exists for not installing an efficient sprinkler system. The experience gained by this company enables it to offer a thoroughly reliable method of automatically extinguishing fires, and to furnish and install all the necessary apparatus for this purpose.

—H. G. VOGL COMPANY, NEW YORK, PHILADELPHIA, BOSTON, BUFFALO.

GRINNELL AUTOMATIC SPRINKLERS. These sprinklers render car barns and other buildings practically fireproof. Opening automatically by the heat of the fire, they thus confine the damage, whether by fire or water, to a limited area and minimum amount. The saving, effected in the reduced cost of insurance soon pays for a sprinkler equipment.

—GENERAL FIRE EXTINGUISHER COMPANY, PROVIDENCE, R. I.

INTERNATIONAL AUTOMATIC SPRINKLERS. The protection afforded by a modern, carefully planned and approved system of the sprinklers is the highest form of fire protection known. The underwriters of the entire world approve this system and allow substantial reductions in insurance rates wherever same is installed, for it is fully automatic and is always in service when required. Each device used is manufactured under exceedingly careful supervision, and of the highest grade of materials. These systems are protecting property valued at \$100,000,000.

—INTERNATIONAL SPRINKLER COMPANY, PHILADELPHIA.

"MANUFACTURERS" SPRINKLER SYSTEM. This automatic sprinkler equipment consists of an installation of automatic sprinkler heads, valves, pipes and other appliances to protect car barns, shops, business buildings, etc., against loss by fire, and a system of piping with fittings, valves and appliances to carry the water supply to all sprinkler heads from two acceptable supplies. The sprinkler heads are distributed attached to the pipes located close to the ceilings, usually in lines from 8 to 10 ft. apart, and from 8 to 10 ft. on the run of the pipes, so as to protect thoroughly all portions of the interior of building sprinkled. The sprinkler head consists of a valve held in place by fusible solder, to be released by the action of heat when fire occurs. The solder melts at temperatures varying from 15 deg. F. to 400 deg. F. The valve is heat in accordance with the normal temperature of the space protected. When a fire occurs the heat automatically releases the valve by the melting of the fusible solder, the head is opened—viz., a free water way given—and the water is distributed to cover and protect approximately 80 sq. ft. of ceiling and floor space. Built for both wet and dry systems.

—MANUFACTURERS' AUTOMATIC SPRINKLER COMPANY, NEW YORK.

FIREPROOFING MATERIALS

(See also Lumber, Artificial.)

ELECTROBESTOS. A composition, the body of which is a better. It is hard, fire proof material, not brittle like porcelain nor insular like rubber. It has been used successfully in all places where fire proofing for electric conductors is desired and is especially adapted for housing or encasing electrical trolley feed wires, and wires common to electric car service. Made in channels for separating electrical wires, lamp rosettes, grooves for insulating and protecting electric light wires, buttons for grid work, socket rings of incandescent lamp sockets, centers for sealing joints of insulating pieces, and in sheets for mounting electrical parts and various forms where high heat resistance is required. Capable of being molded into any desired shape. (Illustrated in Electrical Catalogue No. 14; see also advertisement.)

—H. W. JOHNS-MANVILLE COMPANY, NEW YORK.

TELEPHONE "TRANSITE." A specially prepared fire and water resisting sheet finished with a smooth, black insulating surface. It is hard and tough, being so designed to meet the requirements of telephone operating and manufacturing companies for partition linings for fireproof barriers to eliminate the spread of fire from one set of conductors to another, and for similar uses common to this service. These sheets are made in standard sizes, 40 in. by 40 in., 42 in. by 44 in., and from $\frac{1}{8}$ in. to $\frac{1}{2}$ in. thick. Telephone "Transite" has been adopted by many large companies, among them the New York Telephone Company. (See advertisement.)

—H. W. JOHNS-MANVILLE COMPANY, NEW YORK.

FORGES

STURTEVANT FORGES. A complete line embracing both the portable and stationary types. The former are particularly adapted for local repair work and are operated by hand, by belt or by blast from independent blower. The stationary forges are larger, are provided with either down-draft or up-draft hoods and are substantially built of cast-iron, except in the largest sizes which are of heavy steel plate. The tuyeres in these forges are carefully designed to prevent clinking and to give the maximum blast.

—B. F. STURTEVANT COMPANY, HYDE PARK, MASS.

FROGS, TRACK

(See "Track Work")

FUEL ECONOMIZERS

(See "Economizers, Fuel")

FUSES

D. & W. FUSES. This company's non-arcing fuses and safety devices are made in a wide range of capacities for alternating and direct current circuits. These cover cartridge fuses, cut-outs, fuse clips, telephone and telegraph protectors, and numerous devices used in connection with fuses. For details see Lists Nos. 9 and 10.

—D. & W. FUSE COMPANY, PROVIDENCE, R. I.

GENERAL ELECTRIC FUSES. The General Electric Company manufactures a most extensive line of National Electrical Code Standard enclosed fuses and cut-outs. These fuses comply in all details with the standard set by the national underwriters. They may be obtained for capacities from 30 to 600 amps., for both 250

and 600 volts. This company also supplies fittings of all descriptions, joints, terminal nuts, etc.

—GENERAL ELECTRIC COMPANY, SCHENECTADY, N. Y.

"NOARK" ENCLOSED FUSES. Particularly adapted to street railway service because their operation is attended by absolutely no noise, flash or arc. They consist of fiber tubes supplied with suitable terminals and containing a fusible strip surrounded with a filling material which combines with the metal at the point of blowing, absorbing the arc. These fuses may be used in "Noark" car fuse boxes of various types for the protection of motor circuits or in cut-out blocks for the protection of heating and lighting circuits. The superiority of these devices is demonstrated by the fact that there are over 20,000 equipments in daily use. (See advertisement.)

—H. W. JOHNS-MANVILLE COMPANY, NEW YORK.

SHAWMUT FUSES. Each railway cutout equipment consists of a malleable iron box carefully japanned for protection from the weather, containing a slate base with terminals for clamping and soldering the wire. Bases are made to take National Electric Code Standard enclosed fuses, which are especially convenient on cars. Fuse arc blocked until the cover is closed, but are readily removed when the cover is opened. The cover is held closed by a spring clasp. The boxes are made in three sizes to take fuses of respectively 60, 100, 101, 200, 201, 400 amps. Special attention is called to the malleable instead of cast iron box, and the use of National Electric Code Standard fuses.

—CHASE SHAWMUT COMPANY, NEWBURYPORT, MASS.

WESTINGHOUSE FUSES AND FUSE BLOCKS. The fuses, both open link and enclosed, with suitable fuse blocks, manufactured by this company embody features which contribute to safety, accuracy, neat appearance and ease of manipulation. The enclosed fuses are of the cartridge type having ferrule ends to fit and including the 60 amp. size. The larger fuses have at the ends simple knife blades which make contact in blocks of the simple knife-switch jaw type. Each fuse has an indicating device which shows when it is blown. The fuse are designed to meet the requirements of the National Board of Fire Underwriters, and are rated at 80 per cent of their maximum continuous carrying capacity.

—WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY, PITTSBURG, PA.

GAGES, OIL AND WATER

REFLEX WATER GAGE. The principle of this reflex glass depends upon the total reflection of light when passing from one medium to another of lesser refractive power. Grooved facets cut in the inner surface of the glass eliminate all light from the vacant space back of the glass, but light passes through that portion of the grooves covered with liquid. Thus a sharp clear line marks the height of the fluid, above which the air or steam space has a bright mirror-like appearance, while the liquid takes the color of the chamber background, usually black.

—THE WM. T. BONNER COMPANY, BOSTON, MASS.

WILLIAMS GAGE DEVICES. These include the Williams quick-closing water gage and the Williams rotating regrinding gage cock. Each time the latter is operated the spiral causes the steel to rotate and regrind the seat.

—THE WILLIAMS GAGE COMPANY, PITTSBURG, PA.

GAS PRODUCERS

AMERICAN-CROSSLEY SUCTION GAS PLANT. This apparatus gets its name from the principles on which it operates, as the air used in generating gas is "sucked" through the apparatus by the action of the engine piston, and consequently gas is generated only as required. The fuel is consumed in the gas generator, from which is delivered a hot, raw gas, which must be purified before being sent to the engine on account of tar and condensable vapors which it contains. These are absorbed and the gas cooled by wet and dry scrubbers and a hydraulic box. A large part of the heat of the gases is saved by a saturator in the top of the gas generator, and the steam formed in this saturator is passed through the fire and used to enrich the gas.

—POWER & MINE MACHINERY COMPANY, CUDAHY, WIS.

GAS PRODUCERS. Made by Broomell, Schmidt & Steacy Company, York, Pa.

LOOMIS-PETTIBONE GAS PRODUCER. Capable of burning all kinds of wood, coal and coke. Parts include two gas generators, a vertical boiler, water-cooled valves, producer gas valve and water gas valve. In starting fires in generators, a 5 ft. layer of coal or coke is put in and ignited at the top, the exhauster creating a downward draft.

After ignition fuel is added to make a permanent 8 ft. layer. Air is admitted, drawn by exhauster through the burning fuel, converted to producer gas, cleaned and delivered to gas holder. When, and during the time, the fuel is incandescent, water-gas is produced by passing steam through the hot coal.

—POWER & MINING MACHINERY COMPANY, CUDAHY, WIS.

WESTINGHOUSE AUTOMATIC GAS PRODUCER. Built in sizes up to 500 h.p. in two types, water sealed bottom and enclosed bottom, the former for continuous and the latter for intermittent operation. Suited to the use of non-bituminous fuel. The complete equipment consists of a producer, boiler, combination scrubber and drier. It is self-contained, automatic and does not require a gas holder. The producer utilizes its waste heat for making steam, no extra coal being used. Gas production is automatically proportioned to the demand, the producer responding instantaneously to load changes.

—THE WESTINGHOUSE MACHINE COMPANY, PITTSBURG, PA.

WEBER GAS PRODUCER POWER PLANTS. In his system three cylinder vertical gas engines are used in combination with a suction gas producer, which automatically generates gas from pea anthracite coal, coke, charcoal, lignite, peat, etc. It is especially adapted for heavy duty power plants.

—WEBER GAS & GASOLINE ENGINE COMPANY, KANSAS CITY, MO.

GATES, CAR

BRILL FOLDING GATE. The gate is constructed on the pantograph or lazy-tongue principle and is made of flat iron, strongly riveted together at the joints. It is unequaled for compactness, strength and adaptability to all conditions. It is made for any width of opening and for any height. The gate may be attached to the car-body, vestibule or dasher, and may be arranged to fold on the outside of the vestibule or dasher. When mounted on the platform steps it increases standing room on the platform. (Advertisements in last pages.)

—J. G. BRILL COMPANY, PHILADELPHIA, PA.

—AMERICAN CAR COMPANY, ST. LOUIS, MO.

—G. C. KUHLMAN CAR COMPANY, CLEVELAND, OHIO.

—JOHN STEPHENSON COMPANY, ELIZABETH, N. J.

PITT DOUBLE-ACTING GATE. A gate designed for use on surface railway cars, so arranged that it always swings away from the passengers, whether they are crowding on or off the car. In discharging passengers the latch is lifted and the gate swings outward, away from the outgoing passengers. When the car arrives at a point where crowds are waiting to board the car, the latch is lifted and the gate swings inward away from the passengers. The latch is arranged to hold the gate firmly in place in any of its three positions.

—THE PITT CAR GATE COMPANY, NEW YORK.

PITT DUPLEX GATE. This gate consists of two gates, one on the front and one on the rear platform. These are connected under the car seats, both gates being absolutely under the control of the motorman, and neither can be opened or closed by conductor or passengers, thus forming a safeguard against claims for damages by the passenger who says, "The car started too soon and threw me off." These gates are operated without difficulty, are positive in action and easily opened and closed, even on crowded car platforms.

—THE PITT CAR GATE COMPANY, NEW YORK.

PITT ELEVATED RAILROAD GATES. These gates insure safety and comfort to passengers, while their easy, rapid opening and closing save more than half the landing time of trains during rush hours. In discharging passengers, the gates are opened without the slightest disturbance to those on the platforms, and when the flow is into the cars, these gates permit as many as the platform will hold to get on, and then are closed behind the last passenger without difficulty.

—THE PITT CAR GATE COMPANY, NEW YORK.

WOOD'S SAFETY GATE. The single folding gate is especially adapted to cars with narrow platforms, while for very wide platforms, the double folding gate may be preferred. The simplicity of its construction and the few working parts make the cost of maintenance little or nothing. Either style of gate makes a neat and attractive appearance and a very desirable fixture to a first-class car.

—THE R. BLISS MANUFACTURING COMPANY BRANCH, PAWTUCKET, R. I.

GATES, WATER

(See "Valves and Gates")

GEAR CASES

BLISS COMBINATION GEAR CASES. These gear cases are made with specially treated wood sides and sheet steel top and bottom, with wrought steel lugs. They are made to fit on standard motors, and weigh only about one-third as much as a malleable iron case. They do all that a malleable case will do, the special advantage being that when meeting with any obstruction on the road they do not jam under the car, thus throwing it off the track or damaging the gears, pinions or motor, but the lower half simply gives way, and the car proceeds. The standard types of these cases are carried in stock, their cost being considerably less than the malleable cases.

—E. W. BLISS COMPANY, BROOKLYN, N. Y.

CORBETT GEAR CASES. Improved sheet steel as well as steel and wood gear cases are made by this company.

—ELMER P. MORRIS, NEW YORK.

GENERAL ELECTRIC GEAR CASES. These gear cases are made of malleable iron, precluding danger of breakage. Radiating from the points where it is attached to the motor frame are strengthening ribs to prevent the case from cracking. Both the top and bottom halves of the case are bolted to the lower magnet frame. With this construction the gear case is not affected by loose bolts in other parts of the motor, and as excessive vibration is prevented, liability of breakage is reduced to the minimum. So successful has been this method of suspension that it is considered a salient feature in the construction of the General Electric Company's motors.

—GENERAL ELECTRIC COMPANY, SCHENECTADY, N. Y.

LYON SHEET STEEL GEAR CASES. Made entirely of sheet steel, each section so riveted and seamed as to give strength where needed. Re-inforced at both ends by heavy plates both inside and out, and all brackets brace triple re-inforced, making it impossible to work loose from vibration. A case being made of steel is 75 to 100 lbs. lighter than cast iron or malleable ones and is therefore more easily adjusted. Non-breakable; in case of accident they become bent or dented, not broken, like malleable cases and can be hammered into shape without injury.

—THE LYON METALLIC MANUFACTURING COMPANY, CHICAGO, ILL.

GEARS AND PINIONS

BLISS GEARS. Motor gears are now made in two types, namely, split, i.e., made in two halves to bolt over axle, and solid, i.e., made in one piece and pressed on axle by removing car wheel. The gears are made from open hearth steel castings best suited for this work. Split gears are made in halves, and are held together with eight heavy bolts of high tensile strength and elastic limit. The bolt nuts are locked by lock-washers and a cotter pin is put through each bolt to prevent the nut from coming off. Crown nuts are supplied when desired. Solid gears are made in one piece, no bolts being used. They are forced on the axles by pressure, the bore being usually made a shade under the size of the axle. All gears are finished to the same dimensions as the standards supplied by the motor manufacturers, and are machined and cut by the most up-to-date methods. The standard types are kept in stock.

—E. W. BLISS COMPANY, BROOKLYN, N. Y.

BLISS CUT PINIONS. These pinions are made from individual forged billets, of high grade open hearth steel of high carbon. They are most accurately machined and cut on the most up-to-date machinery. The pinions fit on the armature shaft of the motors, and are made to the same dimensions as those supplied by the motor manufacturers. They mesh with the gear which fits on the car axle, and as they revolve five or six times while the gear is making a single revolution, and as the power is supplied from the pinion to the gear, it is most essential that they be made strong and durable, and of high grade stock. Standard types are carried in stock.

—E. W. BLISS COMPANY, BROOKLYN, N. Y.

BLISS PRESSED PINIONS. These pinions are made of a high grade, high carbon open hearth steel. Individual billets are used, and the teeth are formed by forcing the steel into dies by hydraulic pressure of over 1,000,000 lbs., which greatly solidifies and toughens the metal, making it thoroughly homogeneous. The skin of the billet is retained, and the process admits of using very hard steel, and a pinion of great strength and durability is produced. Standard pinions are carried in stock.

—E. W. BLISS COMPANY, BROOKLYN, N. Y.

FALK GEARS AND PINIONS. The steel used in these gears is made in the company's open hearth steel

foundry. The facilities of the company enable it to produce any type of gear on receipt of drawing showing dimensions. The pinions are made of hammered steel. The best grade of open hearth steel billets, of high carbon, is used, thus producing a strong and long-lived pinion. (See advertisement in this issue.)

—THE FALK COMPANY, MILWAUKEE, WIS.

FOGARTY SECTIONAL GEAR. This gear wheel is a radical departure from the other gears now in use, as the hub and rim are cast separately. After pressing the hub in position on the axle, it will stay there until the axle is worn out. When the rims are worn out it is a simple matter to put on a new one instead of purchasing a complete gear wheel.

—JAMES H. FOGARTY, NEW YORK.

GENERAL ELECTRIC GEARS AND PINIONS. Are made of a superior grade of cast steel, and pinions of forged steel, extra hammered to improve the quality of the metal. The teeth are accurately cut by tools specially designed for doing this work, a fact which assures long life and smooth running. The finished product is carefully gaged, and rigidly inspected before shipment. The high class of material used is expensive, but the increased cost of manufacture is more than offset by greater reliability in service. Cast iron gears, even at lower first cost, are decidedly more expensive per car mile.

—GENERAL ELECTRIC COMPANY, SCHENECTADY, N. Y.

NEW PROCESS RAWHIDE PINIONS. This company's rawhide pinions have attained considerable popularity owing to their long life, noiseless running and general reliability. They also tend to prolong the life of the metal gear wheels.

—THE NEW PROCESS RAW HIDE COMPANY, SYRACUSE, N. Y.

NUTTALL GEARS AND PINIONS. These are now made in many designs, weights and ratios. To meet successfully the varied haulage conditions all these items must be taken into consideration, as well as the grade of material and workmanship. The split type of gear is at present most in evidence, but since the more general use of large axles, solid gears are rapidly gaining favor. The pinion part of the transmission is equally important. The use of only the very highest grade of open hearth cast steel for gears, and a special grade of hammered steel for pinions, is absolutely necessary.

—R. D. NUTTALL COMPANY, PITTSBURG, PA.

VAN DORN & DUTTON GEARS AND PINIONS. The best quality of open hearth steel castings is used in making these gears. Heavy patterns are employed, either split or solid, as required, for all types of motors. The pinions are made from hammered steel billets, high in carbon, accurately machined and teeth cut with standard B. & S. cutters. (See cut in advertisement.)

—THE VAN DORN & DUTTON COMPANY, CLEVELAND, OHIO.

GENERATORS. ALTERNATING CURRENT

BULLOCK BELTED TYPE ALTERNATORS.

All of these generators are of the revolving field type; belted machines are made in a wide range of sizes for 60 cycles and 25 cycles, single, two or three phase. The largest 3-phase belted alternator is 750 Kw at 360 r.p.m., the smallest, 50 Kw. at 1,200 r.p.m. Fields are of copper strip wound on edge and are designed for 120 volt excitation. The collector rings are of cast copper with at least two carbon brushes for each ring. All armature coils are insulated by a special process whereby the insulation is formed under pressure in steam heated moulds.

—ALLIS-CHALMERS COMPANY, MILWAUKEE, WIS. (ELECTRICAL DEPARTMENT, BULLOCK ELECTRIC MANUFACTURING COMPANY, CINCINNATI, OHIO.)

BULLOCK ENGINE TYPE ALTERNATORS.

These alternators are built for 60 or 25 cycles, single, two or three phase, in sizes from 110 Kw. at 277 r.p.m., to 3,500 Kw. at 75 r.p.m. Wound for all standard voltages and designed for direct connection to high or low speed steam engines. They are not provided with base, bearings or shaft, but adjustable sole plates are supplied whereby the stator can be accurately centered. In machines of large diameter, the stator frame is split horizontally and the copper collector rings for large machines are made in halves. The field poles are attached to a spider that is entirely separate from the engine flywheel.

—ALLIS-CHALMERS COMPANY, MILWAUKEE, WIS. (ELECTRICAL DEPARTMENT, BULLOCK ELECTRIC MANUFACTURING COMPANY, CINCINNATI, OHIO.)

BULLOCK FLYWHEEL ALTERNATORS. These are similar to engine type machines except that the field

poles and coils are mounted directly on the rim of the engine flywheel instead of on a separate spider. They are built in the larger sizes only, 500 Kw. at 100 r.p.m., being the smallest standard machine, and 5,000 Kw. at 75 r.p.m., the largest. The construction of the stator collector rings, field winding, etc., is the same as for engine-type alternators. These flywheel type machines are at present built only for 60 cycles.

—ALLIS-CHALMERS COMPANY, MILWAUKEE, WIS. (ELECTRICAL DEPARTMENT, BULLOCK ELECTRIC MANUFACTURING COMPANY, CINCINNATI, OHIO.)

BULLOCK TURBO-ALTERNATORS. These turbo-alternators are designed for direct connection to Allis-Chalmers steam turbines and at present made in sizes up to 7,500 Kw. The revolving field is provided with deep radial slots in which the field exciting coils are placed. Ducts are provided in the rotor to allow free circulation of air. The stator is built up of annealed sheet steel punchings, and ducts are provided in the core through which air is forced by the revolving field. Standard turbo-alternators are built for 60 or 25 cycles, wound for all ordinary voltages.

—ALLIS-CHALMERS COMPANY, MILWAUKEE, WIS. (ELECTRICAL DEPARTMENT, BULLOCK ELECTRIC MANUFACTURING COMPANY, CINCINNATI, OHIO.)

BULLOCK WATER-WHEEL TYPE GENERATORS (ALTERNATING CURRENT). These generators have a cast iron base, but differ from belted machines in having only two bearings. The shaft is extended for the reception of a flange coupling instead of a pulley. The general construction is the same as for belted machines, but in some cases where peripheral speeds are very high, the field spider is made with a laminated rim. The outputs range from 50 Kw. at 1,200 r.p.m. to 5,000 Kw. at 300 r.p.m. The arrangement of collector rings and brushes is the same as for belted machines, and excitation is at 120 volts.

—ALLIS-CHALMERS COMPANY, MILWAUKEE, WIS. (ELECTRICAL DEPARTMENT, BULLOCK ELECTRIC MANUFACTURING COMPANY, CINCINNATI, OHIO.)

GENERAL ELECTRIC ALTERNATING-CURRENT GENERATORS. These are made in all types: Direct driven, belt driven, revolving field and revolving armature. The direct driven revolving field alternator is particularly adapted to street railway station work. The concentration of energy in large size alternators of this class insures high efficiency with economical operation. The stationary armature mounted on rails may be moved, exposing field windings for easy inspection or repair. The armature coils are readily replaceable in case of accident. The field coils in the larger sizes are wound of copper ribbon on edge, insuring great solidity and low temperature rise. The company's alternators are adapted to winding for very high or low potentials.

—GENERAL ELECTRIC COMPANY, SCHENECTADY, N. Y.

NATIONAL ALTERNATORS. These are all of the revolving field type, the armature being stationary and easily accessible. The difficulties of properly insulating the armature coils of high tension alternators are, therefore, eliminated, as the windings are not subject to any mechanical strains, nor are sliding contacts necessary for the armature current. The revolving fields on the engine type machines are of large diameter, which gives additional flywheel effect to the engine. The construction of the field coils makes them practically indestructible, and being supplied with a low voltage current, they can be easily insulated.

—NATIONAL ELECTRIC COMPANY, MILWAUKEE, WIS.

WESTINGHOUSE ALTERNATING-CURRENT GENERATORS. The alternating-current generators of this company range from 30 kw. capacity up, with either field or armature rotating, and for direct connection or belt driving. The successful construction of alternating-current generators for the Niagara Falls power plant and for the Manhattan and Subway Divisions of the Interborough Rapid Transit Company of New York, of much larger capacity than ever built before, demonstrates the ability of this company to design and construct machines of any capacity demanded by modern practice.

—WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY, PITTSBURG, PA.

WESTINGHOUSE TURBINE TYPE GENERATORS. The high economy of the steam turbine at light loads has made practicable the installation of larger units in central stations, with the result that fewer units are necessary and a great saving in equipment cost and better commercial efficiency made possible. They are constructed in sizes and with winding appropriate for every class of alternating-current work. Five 7,500 kw. machines are now in course of construction by this company.

—WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY, PITTSBURG, PA.

GENERATORS, DIRECT CURRENT

BULLOCK ENGINE TYPE GENERATORS (DIRECT-CURRENT). Standard engine type generators, Type "L," for 120, 240 or 500 volts are made in sizes ranging from 12 Kw., 120 volts, 2,000 r.p.m., to 2,500 Kw., 500 volts, 75 r.p.m. These generators have no base, bearings or shaft; the armature is mounted directly on the engine shaft and the brush holder yoke is carried by the magnet frame. In most cases the field poles are laminated, and in all machines they are bolted to the yoke. Armature coils are held in place by wedges, thus dispensing with band wires in the armature core.

—ALLIS-CHALMERS COMPANY, MILWAUKEE, WIS. (ELECTRICAL DEPARTMENT, BULLOCK ELECTRIC MANUFACTURING COMPANY, CINCINNATI, OHIO.)

BULLOCK RAILWAY GENERATORS. These railway generators, both belted and engine types, are similar in general construction to the standard lighting and power generators, but the overload and sparking guarantees are more liberal. They will stand safely non-entirely overloads of 75 to 100 per cent. Standard generators are over-compounded to give a rise in voltage from 525 volts at no load to 575 volts at full load. Belted generators range from 100 kw. at 900 r.p.m. to 500 kw. at 375 r.p.m. engine type generators are built for any output from 85 Kw. up.

—ALLIS-CHALMERS COMPANY, MILWAUKEE, WIS. (ELECTRICAL DEPARTMENT, BULLOCK ELECTRIC MANUFACTURING COMPANY, CINCINNATI, OHIO.)

CROCKER-WHEELER GENERATORS. Absolute reliability in severe conditions is demanded of railway generators. This company has developed a line of machines especially for this service, which in design, material and workmanship cannot be improved upon, and which are therefore thoroughly reliable. Its patented brush-holder (one of the many strong features of the C-W railway generator) is in use on a number of different competitors' machines; improvement in operation has resulted in each case. The company publishes bulletins fully describing its railway generators and various notable plants where they are installed. (See advertisement).

—CROCKER-WHEELER COMPANY, AMPERE, N. J.

GENERAL ELECTRIC GENERATORS, DIRECT CURRENT. Direct current generators are manufactured for all purposes, and in all desirable types, including belt driven and direct driven. The latter are built in a form particularly suited to railway power generation. The field poles may be slipped out laterally without disturbing the armature. The pole tips are so shaped as to secure sparkless commutation. Excellent ventilation is attained by fan blades which are cast integrally with the spider. The compounding is so arranged that with proper engine governors, machines in parallel divide all load fluctuations in exact ratio with their relative capacities, without manipulation of field rheostats. (See also Alternators.)

—GENERAL ELECTRIC COMPANY, SCHENECTADY, N. Y.

NATIONAL DIRECT CURRENT GENERATORS. Built for lighting, power or railway service in all capacities. Combine those features of design, material and construction which have been found most desirable by past experience. They are liberally rated, compact, substantial in construction and present a neat and pleasing appearance. The mechanical as well as the electrical features have received careful consideration. The design is such that there is no superfluous metal, thus reducing the weight to a safe minimum for a given output, and making these generators efficient and reliable.

—NATIONAL ELECTRIC COMPANY, MILWAUKEE, WIS.

WESTINGHOUSE DIRECT-CURRENT GENERATORS. These generators are manufactured in the self-contained and engine types, both having the same mechanical and electrical features, such as multipolar frames, bolted-in pole pieces, slotted armature cores, balanced magnetic circuits, and the arrangement of brush holders and shifting devices. Designed for railway, lighting or industrial service at 125, 250 and 550 volts. The self-contained machines are alone adapted for belt driving, while both types may be run direct connected. Engine type generators have been built from 6 kw. to 2,700 kw., and machines with bearings are standard from 100 kw. to 300 kw. although larger capacities may be obtained if desired. Type S direct-current generators with bracket bearings are built from 2 kw. to 85 kw.

—WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY, PITTSBURG, PA.

GENERATORS, GAS

(See Gas Producers.)

GENERATING SETS

SECOR OIL-ELECTRIC GENERATING SETS. The Secor oil-electric generating plants are well adapted for suburban railway and electric lighting central stations, either for continuous operation, or during "peak load" hours. These plants automatically convert safe oil into low-cost electric current, eliminating boilers, pumps, heaters, condensers and firemen; they are durable, compact, self-contained, quickly started and are shipped complete, ready for installation. The advantage of using this system is due to the unequalled automatic control which provides constant voltage and complete exclusion of oil without requiring re-adjustment for variations in amperage or temperature.

—MARINE ENGINE & MACHINE COMPANY, NEW YORK.

STURLEVANT GENERATING SETS. Constructed in thirty-six sizes ranging from 3 to 100 kw., direct connected. The vertical cross compound engines were designed to meet the rigid specifications of the U. S. Navy Department, which in the case of the 100 kw. demands an efficiency of 31 pounds per kw. hour. These engines, as well as the vertical and horizontal simple engines, are entirely enclosed, provided with forced lubrication and water-tight partitions. The generators are multi-polar, capable of carrying 50 per cent. secondary overload and 25 per cent. excess for two hours without sparking or undue heating. The smaller sizes of these sets are particularly adapted to service as boosters. (See also Engine, Steam.)

—B. F. STURLEVANT COMPANY, HYDE PARK, MASS.

GENERATORS AND MOTORS, SPARE PARTS OF

CROCKER-WHEELER SPARE PARTS FOR GENERATORS AND MOTORS. As this company's standard machines are manufactured in large quantities, spare parts may be ordered from stock and supplied without delay. The parts are made interchangeable in order that the customer may keep a supply on hand if he so desires. The spare parts are of the same excellence as the parts of assembled machines, and undergo, before shipment, the same exacting tests.

—CROCKER-WHEELER COMPANY, AMPERE, N. J.

GLASS

ZAFEST GLASS. Extra tough, non-breakable. A special annealed glass particularly adapted for ventilators, car windows, lamps, peep holes and other places where rough usage of extreme variations in temperature make the use of ordinary glass impracticable or impossible. By combining certain rare metals with the usual ingredients required for making high grade glass and afterward putting the product through a special annealing or toughening process, a glass of great strength is produced. "Zafest" glass, as it is called, can be hammered or thrown about with impunity, and even when heated to the temperature of high pressure steam may be plunged into cold water without fear of breakage. Having very great tensile strength with a maximum degree of transparency and refractive power, it is particularly well adapted for the manufacture of the "Reflex" water gages now so generally used with high pressure steam boilers.

—THE WM. T. BONNER COMPANY, SOLE U. S. AGENTS, BOSTON AND NEW YORK.

GRATES

(See also Mechanical Stokers)

THOMPSON'S DUMPING GRATE. With this grate a fire can be cleaned in from four to six minutes—according to size—without waste. It is fitted up with a very substantial frame with adjustable legs, everything being independent of the side or bridge walls. It is made to dump in two, four or six sections according to size of furnace, and is very easily handled. The frame and rockers are not subject to intense heat and are practically indestructible, the grates are interchangeable and can be renewed when necessary at a very nominal cost.

—RICHARD THOMPSON & COMPANY, NEW YORK.

THOMPSON'S TWENTIETH CENTURY SHAKING AND DUMPING GRATE. This grate is very simply and substantially constructed. It is fitted up with a frame and adjustable legs in the same manner as the Thompson dumping grate. This, however, can be used for shaking and dumping, and is preferable for the larger grades of anthracite and bituminous coal, where a shaking grate is efficient and practicable. For small furnaces this grate is operated in one and in very large furnaces in four sections.

—RICHARD THOMPSON & COMPANY, NEW YORK.

GONGS

(See "Bells and Gongs")

GRAPHITE PAINTS

(See Paints and Varnishes.)

GREASES

(See "Lubricants")

GRINDERS

BROWN EMERY WHEELS. Special emery wheels for slow speed work with the Brown hand power grinder and flexible shaft. Will save time and money over the ordinary wheel made for shop use at high speed. (See advertisement.)

—HAROLD P. BROWN, NEW YORK.

PORTABLE HAND POWER GRINDERS. These strong, simple and compact machines are designed for use with the Brown flexible shafts on track construction, rail bonding, etc. They are very largely used for preparing rail contacts for plastic and soldered rail bonds, electric and cast welding. Two laborers with this machine can do cheaper work than the sand blast in preparing contacts. (See advertisement.)

—HAROLD P. BROWN, NEW YORK.

ROYAL CARBORUNDUM GRINDER. A hand power machine geared to high speed, easily put into position along track or in the shop; designed for maintenance of way work, rail bonding or bridge work. Grinding wheel is carborundum, fastest cutting abrasive known; will not glaze, light pressure required. All spindles are steel. Size of wheel, 4 in. dia., 1 in. face. Size of machine, 11 in. high, 7½ in. wide. Will sharpen all kinds of tools, including drills. (See illustration in advertisement.)

—ROYAL MANUFACTURING COMPANY, LANCASTER, PA.

GUARDS, CATTLE

(See Stock Guards.)

GUMS

CLARK JOINT GUM. This material is cut from pure sheet rubber. It is put up in ½ lb. boxes in strips about 1 ft. long and ¾ in. wide.

—EASTERN ELECTRIC CABLE & WIRE COMPANY, BOSTON, MASS.

GUTTA PERCHA OR RUBBER INSULATION

(See Insulators and Insulating Compounds.)

HANDLES, CONTROLLER

(See "Controller Regulators")

HARPS, TROLLEY

BAYONET DETACHABLE TROLLEY HARP

Consists of stem firmly riveted in pole and harp head which is instantly attached or detached by passing sleeve of head over stem, compressing lock spring until lock pin passes through vertical internal grooves to upper face of collar and the head is given a quarter turn, when the lock spring firmly seats the lock pin in the locking recess. Being instantly interchangeable, a head, with wheel and parts all properly adjusted, is usually carried in car so that delays on account of broken wheel or worn out parts are entirely eliminated. No tools necessary to make change.

—BAYONET TROLLEY HARP COMPANY, SPRINGFIELD, OHIO

KALAMAZOO TROLLEY HARPS. These harps are made to collect the current from the wheel and deliver it to the motor through the intervening pole and wire, with the least possible friction. To do this successfully the contact surfaces are large enough to insure a free flow of the current. To prevent injury to the contact springs, they are placed outside the harp, and do not come in contact with the wheel at any time except through the medium of the heavy washers, which take all the wear. These are easily changed when worn out.

—THE STAR BRASS WORKS, KALAMAZOO, MICH.

LIBERTY TROLLEY HARP. This harp permits the wheel to turn freely in rounding curves, thereby avoiding the grinding contact which rapidly wears out the wheel and wire. Other important advantages are the arrangements for readily removing and replacing the trolley wheel, and for insuring continuous contact between the wheel and harp to prevent arcing. The ease in rounding curves is secured by the use of a spring in the harp shaft carrying the wheel.

—FRANK RIDLON COMPANY, BOSTON, MASS., GENERAL U. S. SELLING AGENTS.

MULTI-AMPERE TROLLEY HARP. This harp is made for high speed roads where high amperage is used. Consists of very large area of contact for the trolley wheel, having a 3 in. contact for each side of the wheel. This is also a perfectly detachable harp, containing only one additional part over the ordinary standard harp.

—THE RECORDING FARE REGISTER COMPANY, NEW HAVEN, CONN.

UNION STANDARD TROLLEY HARP. The Union Standard list of harps includes twenty-five forms capable of accommodating a wide range of wheels; all are fitted with patented contact springs or brushes, hardened steel axle pins and cold-rolled steel shank. The frames are made either of brass or a special grade of malleable iron and designed to combine strength and light weight, two very necessary features to be considered in modern street railway practice.

—R. D. NUTTALL COMPANY, PITTSBURG, PA.

HEADLIGHTS

CROUSE-HINDS HEADLIGHT. One of the strongest objections to an arc headlight on a double-track system is the fact that when two cars meet, each motorman is blinded by the headlight on the other car. In this interurban type headlight this difficulty has been overcome by constructing the reflector so that the light is projected in a narrow beam down the track, and not spread over both tracks. As many cities do not permit the use of arc headlights within the city limits, this headlight is provided with an incandescent attachment which can readily be turned on or off at will by the motorman.

—CROUSE-HINDS COMPANY, SYRACUSE, N. Y.

DAYTON INCANDESCENT HEADLIGHTS. Are either set into or attached on the outside of dash; provided with an adjustable socket holder, whereby lamp can be adjusted so as to be in focus and obtain best results. These headlights are practically indestructible, as the case is made of heavy cast iron. The glass holder is of cast bronze or malleable iron, as desired, so there is absolutely nothing to get out of order.

—THE DAYTON MANUFACTURING COMPANY, DAYTON, O.

DAYTON ARC HEADLIGHTS. Designed for use on urban and interurban traction lines. Made to hang on the outside of dash or to set in the dash; manufactured in several sizes, 10 in. being the smallest, 16 in. the largest. Are simple in construction, made strong and durable, have many recent improved features, generate from two to five thousand candle power, consume three amperes, prevent accidents, eliminate slitting, and enable the motorman to see well and feel easy.

—THE DAYTON MANUFACTURING COMPANY, DAYTON, O.

GENERAL ELECTRIC HEADLIGHTS. These arc headlights are designed for street railway, suburban and interurban service, and are made of sheet steel, strengthened by a heavy cast iron door frame. They are compact but of sufficient depth to insure proper reflection. Simple clutch mechanism is used for feeding carbons. The light may be run in series with incandescent lamps, or with a resistance. It is easily trimmed and focussed. The enclosing globe is mounted with springs, avoiding breakage, due to jars. The arc throws a light 1,000 or 1,500 feet ahead of car. A screen can be provided to modify the strength of the light where necessary. The headlights are provided with suitable handle, hooks, rubber humpers and connecting cable.

—GENERAL ELECTRIC COMPANY, SCHENECTADY, N. Y.

RIDLON INCANDESCENT HEADLIGHT. This is a neat and durable headlight, the case being made of cast iron and the reflector of planished copper nickel plated. The outside rim is a brass casting and therefore not easily bent or broken. The outside diameter of the rim is 10½ in. and takes a glass of 10 in. in dia. The headlight attaches to the outside, thus doing away with the necessity of cutting away the dasher. These lights are furnished with porcelain receptacles for Edison base lamps unless otherwise specified.

—FRANK RIDLON COMPANY, BOSTON, MASS.

ST. LOUIS ARC HEADLIGHTS. This headlight weighs 22 lbs., complete, and is easily carried from end to end of car. It gives a strong, steady light of 2,500 cp. As an equalizer or governor it is necessary to use a very compact resistance in connection with these lights to take up the difference in voltage across the arcs and the voltage of the line. The resistance coils are wound according to the number of lights which are desired in series. The mechanism of the lamp is positively automatic; construction simple and strong; low cost of maintenance; economy in current consumption; steadiness of light, and longevity are some of the features of this arc headlight.

—ST. LOUIS CAR COMPANY, ST. LOUIS, MO.

S-H STANDARD HEADLIGHT. This headlight consists of a malleable iron shell cast in one piece having a lug formed to take a standard porcelain receptacle and a flange cast integral with the shell to support the highly polished parabolic reflector furnished. This reflector is recessed at base to permit the incandescent lamp to enter the receptacle through it, and so arranged as to bring the point of greatest brilliancy of the filament at the focus of the parabola. A bronze ring containing the glass front is held to the frame by a spring catch so that it can not jar loose. (See advertisement.)

—STUART-HOWLAND COMPANY, BOSTON, MASS.

HEATERS, CAR (ELECTRIC)

CONSOLIDATED ELECTRIC HEATERS OF SPECIAL TYPES. Among these are the following: Heater No. 118M, originally designed to meet the specifications of and adopted by The Manhattan Railway Company, of New York City, and contains the company's standard spiral coil construction, but there are three independent circuits through each heater, while the coils are all alike and regulation is secured by the operation of one, two or three circuits, as required. Nos. 118WS and 115W for longitudinal seats without risers; No. 143LL and No. 146F for longitudinal seats with risers; and No. 192MS for motorman's cab.

—CONSOLIDATED CAR HEATING COMPANY, ALBANY, NEW YORK, CHICAGO.

CONSOLIDATED ELECTRIC HEATERS FOR CROSS-SEAT CARS. The heater known as No. 192 was recently designed for use where a small heater operated at a comparatively low temperature is required. With this type, all lead wires are brought out at one end of the heater, and then carried in moulding along the side of the car. This is accomplished by running a copper wire through the porcelain spindle, connecting it at one end to the heater coil, and at the opposite end to the lead wire. This heater is considerably longer than many cross-seat heaters, and operated at a comparatively low temperature to prevent any overheating of seats. The cases are of heavy, perforated sheet steel, and ends of cast iron. Other styles for this service are No. 118W, No. 192H and No. 192W.

—CONSOLIDATED CAR HEATING COMPANY, ALBANY, NEW YORK, CHICAGO.

CONSOLIDATED ELECTRIC HEATERS FOR CROSS-SEAT CARS AND PARLOR CARS. This heater (No. 93T) is designed to attach to the truss plank, occupying about the same space as steam pipes in a railroad coach. It is particularly adapted to cross-seat cars and parlor cars. The heating element consists of the company's standard spiral coil. The lead wires are carried directly from the heater to a grooved moulding, there being no exposed wires. Coils are covered by an insulated iron case of attractive design, finished in gold bronze. For private cars having dark trimmings, the heater case is sometimes finished in copper. With this heater it is impossible to overheat the seats, the heaters being placed near the floor and the maximum consumption of a 30 in. heater being only 500 watts. This heater is also adapted for express compartments of combination cars. Other types for this work are No. 203H and No. 203M.

—CONSOLIDATED CAR HEATING COMPANY, ALBANY, NEW YORK, CHICAGO.

GOLD ELECTRIC HEATER FOR BAGGAGE AND CROSS SEAT CARS. This heater is designed for attachment to the riser or heel board when undesirable to set heater in panel, for use in baggage and cross seat cars where it is necessary to place a heater between the seats and against the truss plank. The construction permits a very free circulation of air through and around the resistant coils. The air in passing through the heater is thoroughly divided by the heater wires and each little particle of air, by reason of the rapid circulation developed, carries its share of the heat out into the space to be heated.

—GOLD CAR HEATING & LIGHTING COMPANY, NEW YORK.

GOLD IMPROVED STANDARD ONE DEGREE ELECTRIC HEATER. This heater is fitted with one coil and arranged to provide only one degree of heat. The company is now furnishing this type of heater for the London Underground Railways, where only one intensity of heat is required. There are a number of places where this type of heater may be used. In localities where but little heat is needed, just enough to take the chill off the car, and even in cities where a large enough number may be supplied per car, such an equipment should prove very satisfactory.

—GOLD CAR HEATING & LIGHTING COMPANY, NEW YORK.

GOLD PANEL TYPE ELECTRIC HEATER. In this heater three degrees of heat are obtained by the use of two coils, the smaller one of which provides one-third of

the heat and the larger one two-thirds. Both heaters taken together deliver the full capacity of the heater. This valuable feature avoids waste of current and discomfort to passengers in moderate weather.

—GOLD CAR HEATING & LIGHTING COMPANY, NEW YORK.

GOLD RESISTANT COIL AND SUPPORT USED IN ELECTRIC HEATERS. The insulated crimped steel rod support used in this company's resistant coil has been employed for eight years. It holds the entire helix firmly and in such a way as to overcome vibration entirely. Occupying but little space, it does not retard the flow of air through the heater, nor does it allow an accumulation of sediment to rest upon it. This latter feature makes it very sanitary and much more desirable than a bulky support that fills with dirt and causes the diffusion of unpleasant odors when heat is used.

—GOLD CAR HEATING & LIGHTING COMPANY, NEW YORK.

J-M CAR HEATERS. In the "Johns-Manville" system of electric car heating, the heaters are distributed over as large an area as possible. These heaters are made in several types and designs to meet all conditions of service. The resistance wires are wound upon specially enameled steel rods set in granite supports at the ends. The metal casings are steel or iron japanned, silver or gold bronzed as per specifications. All of the car heaters are controlled by the manufacturers' double break knife switch. Each heater equipment is protected with a "Noak" enclosed fuse. (See advertisement.)

—H. W. JOHNS-MANVILLE COMPANY, NEW YORK.

MCELROY SPIRAL HEATER COILS. All of the resistance coils used in this company's heaters are made of specially galvanized iron wire, which experience has shown to be the best material for this purpose. By reason of the large radiating surface which is made possible by the McElroy spiral coil construction, which gives the greatest possible length of wire in a given space, the wire is only heated to a moderate degree, thus avoiding the excessive temperature to which a high resistance wire is necessarily subjected, and which invariably crystallizes the wire, especially when accompanied by vibration. A property of iron wire which makes it especially valuable for electric heaters is its rapid increase of resistance with the rise of temperature. By reason of this property these heaters automatically regulate the flow of current through considerable ranges of voltage, a very important feature on roads which have a heavy line drop.

—CONSOLIDATED CAR HEATING COMPANY, ALBANY, NEW YORK, CHICAGO.

SIMPLEX ELECTRIC CAR HEATERS. These are enameled heaters consisting of cast-iron plates, on one side of which is embedded the resistance wire in enamel fused to the iron. The enamel holds the wire firmly in place, furnishes high insulation, yet permits quick conduction of heat. The most compact and desirable form for cross-seat cars. For side-seat cars, the standard "F" type Simplex panel heaters have the heating coils made of nickel copper wire which will not rust nor oxidize and coils cannot creep nor produce arcs.

—SIMPLEX ELECTRIC HEATING COMPANY, CAMBRIDGEPORT, MASS.

HEATERS, CAR, HOT WATER AND STOVES

DORNER CAR HEATERS. The Dorner combination coil and water jacket hot water heater heats quickly, uses minimum amount of coal, requires little attention, has self-feed take up small space and will keep car at 70 degs. in the coldest weather. (See advertisement.)

—THE DORNER MANUFACTURING COMPANY, CHICAGO, ILL.

GOLD SEALED JET ACCELERATOR SYSTEM OF HOT WATER CIRCULATION. Used for warming interurban cars and cars of similar or larger capacity. Its arrangement is simple and its operation very easy. It takes up no space within the car nor on the platform and it warms the car in the most effective manner. The apparatus is protected by a special safety valve. The generator is located beneath the floor, where it is out of the way and able to work more effectively than if placed within the car or on the platform. Being outside the car, no dirt or ashes, so noticeable with other heaters, can accumulate. The fire area is large and ample and the magazine will hold enough coal to operate the system for twelve hours. The water jacket above and surrounding the fire space gets the full benefit of all the coal used.

—GOLD CAR HEATING & LIGHTING COMPANY, NEW YORK.

PETER SMITH HOT WATER HEATERS. Made in three sizes and three styles, viz.: Magazine coil heater, magazine water jacket heater, and open fire coil heater.

Will heat 25 ft. cars at a maximum consumption of coal not to exceed 75 lbs. during 24 hours to an even temperature in zero weather. Castings made from close grained iron and perfectly fitted. Coals made of 14 in. and 11 in. extra heavy steel pipe. Castings are of heavy sheet iron, between which there is one inch air space open at top and bottom, through which the cold air passes, preventing damage to surrounding wood work. Can be placed in vestibule or car proper, as desired. Magazine heaters fitted with damper which encircle the magazine and set above the coal, insuring an even fire and perfect control.

—PETER SMITH HEATER COMPANY, DETROIT, MICH.

"RADIANT" CAR FURNACE. Designed as simple, compact, economical method of heating car, controlled from the end of the car. This use furnace, has been proved to be much more efficient than stove. Located inside car. (See advertisement.)

—GEORGE S. HASTINGS & COMPANY, CLEVELAND, OHIO.

HEATERS AND PURIFIERS. FEEDWATER

(Including Feed-Water Regulators.)

COCHRANE FEEDWATER HEATERS AND PURIFIERS. Cochrane heaters are valuable appliances in railway plants, whether the engines are operated condensing or non-condensing. They will heat the feed water to the boiling point with about one seventh less exhaust steam than is required by the ordinary type of heaters, or where the supply of exhaust steam is limited they will heat the feed water to a higher temperature than will the ordinary heaters. They will, therefore, save more coal than can a closed heater under the same conditions. They also save water—usually from 10 to 15 per cent. of all the water required by the boilers. Over 3,000,000 hp. of "Cochranes" in present successful and satisfactory operation. (See advertisement.)

—HARRISON SAFETY BOILER WORKS, PHILADELPHIA, PA.

GOUBERT WATER TUBE FEEDWATER HEATERS. This apparatus is composed essentially of two cast iron water chambers, connected by a cluster of seamless drawn brass tubes rigidly secured at their ends to the tube plates by a roller tube expander, in the same manner that boiler tubes are secured to the heads. These are the only heater parts under boiler pressure. The cast iron shell surrounding the tubes merely provides an envelope for the exhaust steam and is not subjected to any particular pressure. It does not interfere with the expansion of the tubes.

—THE GOUBERT MANUFACTURING COMPANY, NEW YORK.

MURRAY FEEDWATER HEATERS AND PURIFIERS. Murray feedwater heaters are made of both the closed and open types and are effective and durable. Not being patented they are sold at lower prices.

—THE MURRAY IRON WORKS COMPANY, BURLINGTON, VA.

PHOENIX HEATERS. Feedwater heaters for power stations are among the manufactures of this company.

—PHOENIX IRON WORKS COMPANY, MEADVILLE, PA.

SORGE-COCHRANE FEEDWATER SYSTEM. This system is a comprehensive and practical method for preventing the formation of hard scale in boilers, while heating the feed supply to the highest temperature obtainable with exhaust steam. It takes the place and performs all of the functions of a feed water heater, while providing means for both mechanical and chemical treatment of the impure water. It is a hot treatment process, with all the consequent advantages, and represents the minimum cost for obtaining thorough purification. It is simple, easy to operate and requires no extra attendants.

—HARRISON SAFETY BOILER WORKS, PHILADELPHIA, PA.

STILWELL FEEDWATER HEATER. A device in which the exhaust steam from the main engines or the auxiliaries is used to heat the boiler-feed water. This not only effects a considerable saving in fuel and feed water, but heating the water precipitates most of the matter that would otherwise incrust the boiler, thus obviating much of the expense and labor usually required for cleaning and repairs. The heater itself is arranged to be easily cleaned and recent improvements in this heater absolutely prevent oil in the exhaust steam from reaching the boiler.

—PLATT IRON WORKS COMPANY, DAYTON, OHIO.

WAINWRIGHT FEEDWATER HEATERS. These represent the most advanced ideas in heater construction. Even flow of both steam and water in counter currents through straight, clean, tight corrugated tubes. The high rate of flow over the corrugated surfaces gives a rate of heat transmission per sq. ft. of surface said to break all records and provides a scouring and cleaning action on the tubes.

Perfect accessibility for any repairs and the cleaning of water chambers. A large amount of horse power in a small space.

—ALBERGER CONDENSER COMPANY, NEW YORK.

WETHERILL OPEN FEEDWATER HEATER. Built from 100 to 7,000 hp. capacity. At base of heater an oil separator is provided separating and preventing the oil in the steam from mixing with the feed water, the steam and water being brought together by means of baffle plates. A surface overflow is provided to remove the dirt and scum. The water supply to heater is controlled by balanced valve operated by float in heater. With this method of heating a large portion of the exhaust steam is condensed and returned to the boiler as distilled water effecting a saving in water consumption, and providing an improved quality of feed supply. The water after being heated flows to the pump to be forced into the boiler.

—ROBERT WETHERILL & COMPANY, CHESTER, PA.

WETHERILL PATENT FEEDWATER HEATER. The feed-water is heated by passing it through a coil or series of continuous copper coils which are surrounded by exhaust steam. No danger from leaky joints as the coils are made without joints and united at ends to brass manifolds forming inlet and outlet pipes. The superior elasticity of the copper pipes enables them to contract and expand without liability to fracture, while the conducting and non-corrosive qualities of the copper make the heating surface more efficient and the heater practically indestructible. The coils are encased in steel shells, provided with inlet and outlet nozzles for exhaust connections and dip openings. This construction is arranged to set either horizontal or vertical.

—ROBERT WETHERILL & COMPANY, CHESTER, PA.

WETHERILL VERTICAL WATER-TUBE FEEDWATER HEATER. All the tubes are of seamless drawn copper, expanding in steel tube heads, these being subjected to internal pressure cannot collapse or leak. There is no straining action from contraction and expansion of the parts, one end only of the nest of tubes is rigidly secured, the other end is free to move and adjust itself to temperature variations. The feed water enters the bottom, which, in the upward passage through the tubes moves slowly, and, being completely enveloped in the exhaust steam, raises the feed-water to the highest temperature and allows sufficient time for the impurities to precipitate to bottom and collect in settling chamber, where they can be blown off, thus purifying the feed-water in its passage through the heater.

—ROBERT WETHERILL & COMPANY, CHESTER, PA.

C. H. WHEELER IMPROVED FEEDWATER HEATER. Vertical and horizontal design, closed type, steam chamber provided with a special steam belt; tubes of seamless drawn brass.

—C. H. WHEELER CONDENSER AND PUMP COMPANY, CHICAGO, PHILADELPHIA, NEW YORK, SAN FRANCISCO.

WHEELER FEEDWATER HEATERS. The higher in temperature that feed water for the boilers can be fed to them, the greater the economy in fuel consumption. Feed water heaters are designed to accomplish this purpose, by transferring the heat in the exhaust steam in the auxiliary machines to the feed water. These are built in various sizes, either of the vertical or horizontal type, for any pressure, and can be arranged either in primary, auxiliary system or compound. A long experience in this line has enabled this company to perfect its designs, with the most economical results.

—WHEELER CONDENSER & ENGINEERING COMPANY, NEW YORK.

WILLIAMS AUTOMATIC FEEDWATER REGULATOR. This feed water regulator permits a fluctuation in the water level not exceeding $\frac{1}{2}$ in. in most cases. The results of keeping a constant water level are: A fuel saving of at least 3 per cent, decreased engine repairs and a smaller oil bill, both due to the use of dry steam, less boiler repairs, due to the lessened expansion and contraction.

—WILLIAMS GAUGE COMPANY, PITTSBURG, PA.

HEATING AND VENTILATING APPARATUS

(See also Mechanical Draft.)

AMERICAN DISTRICT STEAM COMPANY, LOCKPORT, N. Y. Originator of central station heating by underground pipes, constructor of heating plants and manufacturer of all steam devices; also builder of systems of underground piping for railroad car yard heating.

(CONTINUED ON PAGE XXV.)

HEATING AND VENTILATING APPARATUS—Continued.

"ABC" HEATING AND VENTILATING APPARATUS. This company's fan or blower system is especially adapted to the heating of large buildings, including railway shops and barns. The steam pipes are banked into heaters and not scattered around the building. A uniform temperature and frequent air change are among other advantageous features. In car barns the system is frequently so arranged that a current of heated air is forced into the car pits, rendering it easy to thaw out cars that are frozen up, and to dry out "grounded" cars in wet weather.

—AMERICAN BLOWER COMPANY, DETROIT

GREEN AIR HEATER. This device operates on the same principle utilized in the Green fuel economizer, in that it makes it possible to use the heat otherwise wasted in the flue gases from the boilers to heat air for drying out insulation, heating car barns, round houses, etc. The heated dry air when delivered into the pits under the cars during winter weather quickly melts off the snow and ice and reduces the time required for repairs and inspection. This apparatus may be installed in connection with the fuel economizer.

—THE GREEN FUEL ECONOMIZER COMPANY, MATTEAWAN, N. Y.

STURTEVANT HEATING AND VENTILATING APPARATUS. The hot blast apparatus consists of a steel plate fan arranged to be driven by belt or by direct attached engine or motor, and a steel pipe heater through which the air is drawn or forced, and thence discharged through ducts to the points of delivery. The high velocity of the air across the pipes increases their efficiency from three to five times that secured with direct radiation. The entire heating surface is massed under the control of a single valve. The apparatus utilizes either live or exhaust steam. An excess of pressure is maintained within the building, and outward leakage is the result.

—B. F. STURTEVANT COMPANY, HYDE PARK, MASS.

HOISTS

(See "Cranes, Hoists and Lifts")

HOSE BRIDGES

"OHIO BRASS" HOSE BRIDGE. This fire hose bridge accommodates four lines of fire hose. Made entirely of steel and malleable iron. Can be quickly attached to tee or girder rails. Will bear weight of heaviest interurban cars. (See page 626 of Bulletin No. 1; also advertisement.)

—THE OHIO BRASS COMPANY, MANSFIELD, OHIO.

HOSE, COTTON

BOYLE COTTON ELECTRIC HOSE. Used for insulating purposes. This hose is of full standard size and quality, especially close woven and full weight.

—JOHN BOYLE & COMPANY, NEW YORK.

HYDRAULIC MACHINERY

ALLIS-CHALMERS STANDARD OIL GOVERNORS FOR WATER TURBINES AND IMPULSE WHEELS. Self-contained automatic governors, operating with oil pressure produced in a pump attached to the governor, are entirely independent of the operating water. Can also be made with all parts perfectly interchangeable. They are provided with fly-balls or speed recorders. They have a synchronizing attachment which permits of paralleling the generators easily from the switchboard. Each governor is a complete piece of apparatus that does not require skilled attention during operation.

—ALLIS-CHALMERS COMPANY, MILWAUKEE, WIS.

ALLIS-CHALMERS RELIEF VALVES FOR HYDRAULIC POWER PLANTS. Hydraulic power plants, utilizing high falls, have penstocks of considerable length. Effective automatic governors close the speed gates of the turbines or impulse wheels within a few seconds. This causes a dangerous shock to the penstocks. In an effort to prevent these shocks, a relief valve is generally used, which is operated by a spring adjustable to the maximum pressure allowed. A spring, however, can not operate the valve until it is compressed by the increased pressure in the penstock. Dangerous shocks result therefore from the use of such devices. The Allis-Chalmers relief valve ("pressure regulating apparatus") has no spring, but is directly connected with the governor, so that it opens without increase of pressure. The valve does not open when the governor closes the speed gate slowly, and if opened slowly closes itself even if the governor remains in its former opened or closed position. This apparatus is a

water saving relief valve and passes just sufficient water to prevent shocks.

—ALLIS-CHALMERS COMPANY, MILWAUKEE, WIS.

FRANCIS TYPE CENTRAL DISCHARGE HYDRAULIC TURBINES. Escher-Wyss & Company designs are particularly adapted for direct-connection to electric generators for power production and easily subject to close regulation. Adapted to high or low heads of water and made in any size required. Set horizontally or vertically as may be required and adapted to the use of draft tubes. Special attention is called to the design and fitting together of the guide vanes in these turbines so that when the speed gate is closed it forms, with the revolving runner, a hydraulic brake and stops the turbine without the need of a friction brake.

—ALLIS-CHALMERS COMPANY, MILWAUKEE, WIS.

ESCHER-WYSS IMPULSE WATER TURBINES. Turbines for the utilization of waters with high heads and made with several shapes of buckets or vanes according to the height of fall, quantity of water and the amount and character of work to be performed. Choice of the proper design can be made only by engineers of skill and experience. The experience gained by Escher-Wyss & Company and the skill of their licensees guarantee success.

—ALLIS-CHALMERS COMPANY, MILWAUKEE, WIS.

VICTOR TURBINE WATER WHEELS. These wheels are built singly or in pairs and with horizontal or vertical shafts. They are built in a great variety of sizes and styles, including both low-head work and high-pressure work, such as is encountered in some of the recent power developments on the Pacific coast. More machines of this type are in use than of any other make.

—PLATT IRON WORKS COMPANY, DAYTON, OHIO.

INDICATORS, STEAM

TWENTIETH CENTURY INDICATOR. The general design of this indicator is not new, but in construction the company has made such changes as its experience has shown to be desirable. Great care has been taken to have each part properly proportioned for the duty to be performed, giving strength and weight where required, and the working parts of such light weight that a quick and accurate response to the steam pressure is always insured. The body of the indicator is made strong without undue weight, so that there will be practically no vibration of the instrument when in use. The company makes but one grade, on the principle that the best is none too good.

—RICHARD THOMPSON COMPANY, NEW YORK.

IMPREGNATING COMPOUNDS

(See also "Vacuum Impregnating Apparatus")

STANDARD IMPREGNATING COMPOUNDS. These compounds are solids and used only in connection with vacuum drying and impregnating apparatus. They require liquefying under heat and in this state are forced by atmospheric pressure into a previously exhausted chamber. Possess high dielectric strength and ability to resist moisture. Made with dropping points from 90 deg. C. to 150 deg. C., and especially designed for impregnating railway motor field coils, magnet coils, air cooled transformer coils, etc. SPECIALTIES FOR ELECTRIC RAILWAY WORK—Impregnating Compounds Nos. 1, 2, 3 and 4.

—STANDARD VARNISH WORKS—NEW YORK, CHICAGO, LONDON—OR INTERNATIONAL VARNISH CO., LTD., TORONTO, CANADA.

O. B. TRANSFORMER COMPOUNDS. Used for impregnation of transformer coils designed to operate in oil baths. Possess high insulating properties and absolutely resist the action of hot mineral oils.

—STANDARD VARNISH WORKS—NEW YORK, CHICAGO, LONDON—OR INTERNATIONAL VARNISH CO., LTD., TORONTO, CANADA

INSTRUMENTS, ELECTRICAL MEASURING

KEYSTONE ELECTRICAL INSTRUMENTS. This line comprises indicating voltmeters, ammeters, wattmeters differential voltmeters, ground detectors, millivoltmeters, milliammeters and bond testers in switchboard and portable form for either direct or alternating current circuits. Made in all possible ranges from the lowest to the highest, the complete line covering seven distinct types of switchboard instruments in all standard and special finishes and five types of portables. Every instrument is accompanied by a signed certificate guaranteeing accuracy, durability and workmanship. (See illustrations in advertisement.)

—KEYSTONE ELECTRICAL INSTRUMENT COMPANY, PHILADELPHIA, PA.

SANGAMO WATTMETERS. These meters, of the mercury motor type, are simpler in construction than other direct current meters, owing to the absence of commutator, brushes, wound armature and heavy weight on the jeweled bearing. The armature shaft has a thrust of only one-fifteenth ounce against the jewel, which, therefore, suffers no injury from vibration or pounding of the meter support under the most severe conditions of service. The Sangamo meter is, therefore, well suited to the measurements of power taken by car motors. A valuable feature is the use of shunts with large capacity meters, rendering them very easy to install. (See advertisement.)

—SANGAMO ELECTRIC COMPANY, SPRINGFIELD, ILL.

SIMPLEX DIRECT CURRENT INSTRUMENTS.

Unlike the ordinary instruments, these have no needle-sharp steel pivots to become rusted by moisture; no delicate jeweled bearings to become fractured by jars or continued vibration. The moving coil and the Simplex instrument are supported by yielding straight band conducting filaments. These filaments are made of a highly resilient and non-oxidizable patented bronze alloy. These two features, the yielding supports and the non-oxidizable conducting filaments, protect these instruments from any damage by jar, continued vibration or atmospheric change. They assure permanent accuracy in any position and under any condition.

—THE SIMPLEX COMPANY, NEWARK, N. J.

THOMSON RECORDING WATTMETERS FOR RAILWAY SERVICE.

These wattmeters are constructed for permanent installation upon cars, for the purpose of recording accurately the energy used. High torque is secured by the use of laminated iron fields and a soft iron armature coil. An extremely light moving element and the use of diamond jewels ensure satisfactory operation under most severe operating conditions. The General Electric Company also manufactures a complete line of recording wattmeters up to 10,000 amps. capacity for measuring generator and total station output. The entire current is carried through copper field coils of highest conductivity, a construction which gives minimum losses and maximum accuracy. These meters are highly finished and arranged for mounting on the front of switchboard panels.

—GENERAL ELECTRIC COMPANY, SCHENECTADY, N. Y.

WESTINGHOUSE MEASURING INSTRUMENTS.

This company manufactures instruments for direct and alternating current, of the switchboard, portable and precision type—including frequency meters; ammeters; voltmeters; integrating, indicating and prepayment wattmeters; ground detectors; power factor meters, and synchroscopes. The portable instruments are especially adapted for general testing purposes, and the precision instruments for accurate measurements in general laboratory work and the calibration of other instruments. The switchboard instruments are finished in different types, are in dust-proof cases and have long scales with large divisions.

—WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY, PITTSBURG, PA.

WESTON ELECTRICAL MEASURING INSTRUMENTS.

In all of the instruments the moving element is a light coil of wire on which is mounted an index or pointer, and through which a proper proportion of the current passes, tending to cause rotation of the coil in the magnetic field by which it is encompassed. For the direct current instruments, a permanent steel magnet is utilized for the field, and its design furnishes the means of producing a uniform field. The alternating current instruments call for a different type of field; a coil of wire suitably designed to give the required lines of force, effecting, in conjunction with the moving element, an operation on the "dynamometer principle." Notable characteristics of Weston instruments are their accuracy and economy of current consumption, combined with the excellent degree of mechanical and electrical workmanship and design. These instruments are made up as voltmeters, ammeters, wattmeters, ground detectors, milli-voltmeters, bond testers, galvanometers, laboratory standards, etc.

—WESTON ELECTRICAL INSTRUMENT COMPANY, WAVERLY PARK, NEWARK, N. J.

WESTINGHOUSE PREPAYMENT WATTMETERS.

The principle of this wattmeter is the same as the integrating wattmeter, with the addition of the coin mechanism. The latter consists of a circular dial and pointer, indicating the amount of money remaining to the customer's credit, and a coin slot arranged with contacts for closing a switch and allowing current to flow upon the insertion of a coin. The dial is marked in ten divisions, each representing 25 cents. Up to ten quarters may be used, the current paid for at any time being indicated by the pointer's position. The pointer is so connected with the train recording the consumption, as indicated on four

smaller dials, that as the current is consumed, the larger pointer travels backward until the amount paid for is used and the pointer reaches zero, when the current is automatically cut off.

—WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY, PITTSBURG, PA.

WESTINGHOUSE TESTING INSTRUMENTS.

This company manufactures a portable incandescent lamp-testing volt-wattmeter which is very popular with central station operators and others for testing a lamp in actual service. The lamp is removed from its socket and placed in the receptacle upon the instrument. The leads are attached to the socket from which the lamp was taken, and the voltage is read. The switch button is turned and the voltage noted, thus giving all the data necessary to determine whether the lamp employed has the proper characteristics to give the best service.

—WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY, PITTSBURG, PA.

WHITNEY ELECTRICAL INSTRUMENTS. These comprise a full line of portable and switchboard volt-meters and ammeters for both direct and alternating current; also ohmmeters which are suitable for use in testing out ear wiring and motor fields. Wheatstone bridges for general work, and "testers" for tracing out connections and performing in a more efficient manner the work ordinarily allotted to a magneto. (See advertisements in current numbers for various types.)

—WHITNEY ELECTRICAL INSTRUMENT COMPANY, MACHADO & ROLLER, NEW YORK, N. Y., GENERAL SALES AGENTS.

INSTRUMENTS, RECORDING

BRISTOL RECORDING INSTRUMENTS FOR PRESSURE, TEMPERATURE AND ELECTRICITY. Automatic registering instruments which make permanent records in ink on a moving chart of changes that occur in the pressure, temperature and electricity in any power or industrial plant. This company has developed a very extended line of these recorders, covering over five hundred different varieties, so designed as to be extremely accurate and durable when placed in operation, without sacrificing extreme sensitiveness and delicacy. The operative part is either directly connected to the marking pen or with the least possible number of parts, thus avoiding possibilities of friction and liability of being thrown out of adjustment. Thousands of these recorders are in use throughout the world.

—THE BRISTOL COMPANY, WATERBURY, CONN.

GENERAL ELECTRIC RECORDING INSTRUMENTS. These instruments are particularly adapted for the study of phenomena of quick acceleration, and in the investigation of motor losses, efficiency, etc. They record accurately on a continuous chart rapidly fluctuating current and voltage values. They will operate satisfactorily when subjected to severe shocks and vibration, occasioned by a car moving at high speed over a rough track. They have an exceptionally high torque so that the friction of the pen on the chart is negligible, and are perfectly damped, which prevents over-running of the pen, notwithstanding violent and sudden changes in the quantities being measured. The company also manufactures a complete line of indicating instruments for all classes and conditions of service.

—GENERAL ELECTRIC COMPANY, SCHENECTADY, N. Y.

INSULATIONS AND INSULATING COMPOUNDS

(See also Paints and Varnishes.)

AETNA INSULATING COMPOUND. This compound is manufactured especially for electric railway insulation. The various forms in which it is made are obtained by pressing the compound in dies under high pressure. The finished product, as used for insulation in trolley line suspensions, strain insulators, third rail insulators, etc., is extremely tough, and impervious to weather exposure. It is the first of this class of insulating compounds for electric railway use, and has come into extensive use in all civilized parts of the world.

—ALBERT & J. M. ANDERSON MANUFACTURING COMPANY, BOSTON, MASS.

BISHOP GUTTA-PERCHA INSULATION. This company makes high-grade rubber insulations for all purposes. Its india rubber or gutta-percha insulation does not need lead to protect it from moisture.

—BISHOP GUTTA-PERCHA COMPANY, NEW YORK.

ELECTROSE INSULATION. After careful and exhaustive tests made by some of the foremost experts in

electrical engineering, it is conceded that "Electrose" is one of the best insulating materials on the market. It has been in practical use for a sufficient number of years to give it thorough weather and wearing tests, and the company is pleased to inform its patrons that it has fulfilled all requirements in a highly satisfactory manner. It possesses the highest insulating qualities, thereby assuring efficiency, strength and durability. The company is now prepared to furnish this insulating material on all forms of overhead line fixtures, insulators, etc.

—WESTERN ELECTRIC COMPANY, NEW YORK AND CHICAGO.

GENERAL ELECTRIC INSULATING COMPOUNDS. The General Electric Company uses a special water-proof insulating compound which guarantees all armature and field magnet winding proof against moisture.

—GENERAL ELECTRIC COMPANY, SCHENECTADY, N. Y.

J-M INSULATING COMPOUNDS. The insulation is a very essential part of electrical machinery, because the best designed machine is useless if the insulation fails. Many years of experience have demonstrated that Vulcaneston is one of the best insulating compounds for general use in electrical apparatus. It can be furnished in sheets of convenient size, or moulded in a large variety of forms, with great accuracy in dimensions. (See advertisement.)

—H. W. JOHNS-MANVILLE COMPANY, NEW YORK.

MACON ELECTROLAC. A plastic black insulating compound for coil insulation where water, oil and heat resistance are desired. It is a permanently plastic compound and will not become hard or brittle under the severest service conditions. When used on armatures its pliable nature allows the replacing of burned out coils without injury to insulation on coils "lifted." To obtain best results it should be baked for eight or ten hours at 175 deg. to 195 deg. (80 deg. to 90 deg. C.)

—MACON-EVANS VARNISH COMPANY, PITTSBURG, PA.

MACON-EVANS PARAFFINE INSULATING COMPOUND. This company's black paraffine insulating compound for coil insulation is a new material that air dries in a short period, yet retains indefinitely its plastic properties so essential for street railway work where short circuited coils may be replaced without injuring the insulation of the coils "lifted."

—MACON-EVANS VARNISH COMPANY, PITTSBURG, PA.

M. I. C. COMPOUND. This is a black enamel, acting as a perfect insulator, wet or dry. It is both durable and elastic and it is made in four grades: No. 1, for armature coils, field magnet coils, wires, cables, etc.; No. 2, for all out door work, generators, motors, arc lamps, overhead line constructions, etc.; No. 3, same purpose as No. 2, but a quicker dryer; No. 4, a rapid dryer adapted for quick work on coils, magnets, etc., street car trucks and fenders, armatures and transformers, discs and plates.

—MICA INSULATOR COMPANY, NEW YORK.

OKONITE. "The standard for rubber insulation." Okonite insulation for wires and cables is not affected by extremes of temperature, commercial acids or alkalis, is flexible and tough, and made to give uniformly high and satisfactory service.

—THE OKONITE COMPANY, LTD., NEW YORK.

"OZITE." An insulating compound composed of inorganic substances, with a lower specific inductive capacity than any other kind of insulating material suitable for or now used in connection with lead covered cables. It can also be subjected to high temperature without deterioration. It is furnished in various degrees of hardness depending upon service requirements and is largely used for filling joints terminals, converters, etc. No. 1 melts at approximately 190 deg. F., No. 2, 150 deg. F., and No. 3, 115 deg. F., and special terminal compound melts at not less than 200 deg. F.

—STANDARD UNDERGROUND CABLE COMPANY, PITTSBURG, PA.

RUBEROID MOTOR WIRE INSULATION. The wires are laid in a strip of motor cloth, cut sufficiently wide to go once and a half around. The cloth, which is soft and flexible, is then wrapped tightly about the wires, the whole bound together with P. & B. insulating tape and all given an exterior coat of P. & B. electrical compound, which sufficiently excludes dust and dirt and also prevents the entrance of water. The result is a positive insulation and protection for the wires. The tape is tough, strong and absolutely water-proof, being thoroughly saturated with a water-proof and acid-proof compound and, preserving permanently its peculiar adhesiveness, can be depended upon to maintain a perfect bond with the Ruberoid motor cloth. The latter material is a high grade canvas of great strength, every fibre of which is thoroughly impregnated with Ruberoid water-proof and acid-proof compound.

—THE STANDARD PAINT COMPANY, NEW YORK.

WESCO INSULATING COMPOUND. Used in connection with this company's trolley and feed wire appliances, is elastic, non-inflammable, tough and strong. It has great resistance in crushing strain and high non-conductive properties. It is superior in its resistance to high temperature and exclusion of moisture. Where galvanizing is required, the malleable parts are cold galvanized by a process which enables the coating of the threaded parts and still preserves the strength without injury. With hot galvanizing this has been impossible.

—WESCO SUPPLY COMPANY, ST. LOUIS, MO.

INSULATING PAPER AND CLOTHS

AMERICAN INSULATING PAPER. This company supplies the very best grades of insulating paper and "Insulite" which can be furnished in rolls or sheets, of such width and thickness as may be desired, and in red, black, and gray colors. The softness or flexibility can be varied to suit the purpose required.

—THE AMERICAN VULCANIZED FIBER COMPANY, WILMINGTON, DEL.

EMPIRE CLOTH AND PAPER. These are linseed oil coated materials made to endure the extended, increased temperatures which insulations have to stand in practice. The base of Empire cloth is of the finest woven muslin. The company has adopted numbers for its various cloths, the number denoting the thickness in thousandths of an inch. The standards are: No. 5, No. 7, No. 8, No. 10, No. 12, No. 15, No. 16. The standard grades of Empire paper are: No. "D," .005 thick, manilla; No. "E," .005 thick, bond; No. "F," .009 thick, gray rope. (See advertisement.)

—MICA INSULATOR COMPANY, NEW YORK.

GENERAL ELECTRIC INSULATING PAPER AND CLOTH. All papers and cloths supplied for insulating purposes on field and armature windings are of selected materials, combining strength and durability and are the result of careful experimentations.

—GENERAL ELECTRIC COMPANY, SCHENECTADY, N. Y.

GIANT AND P. & B. INSULATING AND SHEATHING PAPERS. These papers are guaranteed to be entirely waterproof. It is impossible for moisture to penetrate, for every fibre is thoroughly saturated with a water-repelling compound manufactured by this company. The moisture never gets beyond the surface, for the compound-filled pores reject it, and it is thence absorbed by the air. The papers are therefore perfect non-conductors. They are uninjured by atmospheric changes, acids, alkalis or gases. These papers are also air-tight.

—THE STANDARD PAINT COMPANY, NEW YORK.

MACON-EVANS INSULATING CLOTHS. This company handles a complete line of insulating cloths of various thicknesses treated with Macon insulating varnish. These cloths possess the highest insulating properties and retain their flexibility for an indefinite period, the same care being exercised in selecting the cloth on which varnish is applied as in the manufacture of the varnish itself.

—MACON-EVANS VARNISH COMPANY, PITTSBURG, PA.

SLEEVEING. All grades, sizes and colors used in the construction and repairing of electrical apparatus.

—HOPE WEBBING COMPANY, PROVIDENCE, R. I.

STERLING INSULATING CLOTHS AND PAPERS. The company's products are used for coating cloths and papers by many of the largest producers of such articles.

—STERLING VARNISH COMPANY, PITTSBURG, PA.

INSULATING TAPES

GENERAL ELECTRIC INSULATING TAPE. This tape is made in two styles, Paragon, for outside work, and Acme, for taped joints in dynamos or motors. Paragon tape is thoroughly impregnated with a water-proof compound and has great adhesive qualities. It is furnished in black only and wrapped in tin foil. Acme friction tape is used for armature and field windings, and for general splicing work where a friction tape is desired. It is furnished in black or white, packed in tin boxes. No substance is used in either tape which has an oxidizing effect.

—GENERAL ELECTRIC COMPANY, SCHENECTADY, N. Y.

HOPE TAPES AND WEBBINGS. For the construction and repair of dynamos, motors, etc.

—HOPE WEBBING CO., PROVIDENCE, R. I.

LINOTAPE. An insulating tape whose coating consists of a film of oxidized linseed oil. It is put up in rolls containing 72 yds. and is cut to any width desired. The widths $\frac{3}{4}$ in. and 1 in. are kept in stock. The thickness of the tape is .010 in. and is cut either lengthwise or on the bias. Another form of tape made by this company is its

cable linotype, a thoroughly impregnated linseed oil tape, The oxidation of the oil is carried to the utmost limit rendering its surface smooth and slippery, so as to allow a sharp bending of the cable insulated with this material. The ohmic resistance and puncture voltage are high. (See advertisement.)

—MICA INSULATOR COMPANY, NEW YORK

INSULATING TAPE. P. & B. tape has been in successful use in all parts of the world, under all climates. Its specific advantages are its permanent flexibility and the fact that it does not dry out. Its flexibility ensures permanent resistance against mechanical damage; ease of application in difficult places, and the use of the material over and over again. Its non-drying out qualities ensure storing without risk of deterioration, and lasting insulation power.

—THE STANDARD PAINT COMPANY, NEW YORK.

INSULATORS, INCLUDING THIRD RAIL

(See also Line Material.)

BOURBON STRAIN INSULATORS. Made with a view of withstanding the greatest strain and at the same time securing high insulation resistance. The metal parts are two steel chain links of special shape with a porcelain spreader to separate and insulate the links. Around the metal parts and porcelain spreader is moulded by hydraulic pressure a high grade insulating compound, which thoroughly seats the metal parts and protects the whole from the weather, giving a long surface distance between metal parts and a high puncture test. These strain insulators are made in sizes to stand strains up to 3,000 lbs. breaking strain.

—THE CREAGHEAD ENGINEERING COMPANY, CINCINNATI, OHIO.

GENERAL ELECTRIC THIRD RAIL INSULATORS. These insulators are furnished for standard or special work. Malleable iron supports are used with reconstructed granite or vitrified clay forming the insulator proper.

—GENERAL ELECTRIC COMPANY, SCHENECTADY, N. Y.

HEMINGRAY INSULATORS. These insulators are of the screw glass type with special drip petticoats.

—THE HEMINGRAY GLASS COMPANY, COVINGTON, KY.

J-M THIRD RAIL INSULATORS. Reconstructed granite consists of selected orthoclase granite pulverized, moulded into any desired form under heavy pressure, and then fused into a solid mass at a temperature approximating 3,000 deg. F. It is highly glazed, and being vitreous, does not contain or absorb moisture. It is of unlimited durability, not being affected by heat, cold or any commercial acids or alkalies. Its crushing strength is about 15,000 lbs. per cu. in., and its tensile strength 1,000 lbs. per sq. in. of cross section. After years of severe test in all sorts of climatic conditions, it has been generally adopted throughout the world for third rail insulation. (See Catalogue No. 14; also see advertisement.)

—H. W. JOHNS-MANVILLE COMPANY, NEW YORK.

"OHIO BRASS" THIRD RAIL INSULATORS. Made from semi-porcelain, which possesses great mechanical strength, best of insulating qualities, and is low in cost. The castings are all of malleable iron. A large number of types of third rail insulators are made to suit various requirements. (See pages 637 to 648, Bulletin No. 1.)

—THE OHIO BRASS COMPANY, MANSFIELD, OHIO.

RECONSTRUCTED GRANITE INSULATORS. Composed of selected orthoclase granite, pulverized, moulded into any desired form under heavy pressure, and then fused into a solid mass at a temperature approximating 3,000 deg. F. They are well vitrified, highly glazed, and possess unlimited durability, not being affected by hot or cold nor by acids. The material shows high crushing strength and high ohmic resistance. The company controls several patented types of third rail insulators, among which are the "Courtenay," "Lawrencourt" and "Crossbar" varieties, and also makes a specialty of executing orders for insulators for the owners of other types.

—RECONSTRUCTED GRANITE COMPANY, NEW YORK.

VICTOR INSULATORS. That electric current may be confined to the circuit which shall convey it, glass or porcelain in the form of shells nested and cemented together is introduced between points of high pressure. The inherent qualities of the glass or porcelain prevent puncture and design of the shells is such as to, at all times, insure dry surface between opposite sides of a high pressure circuit, thus preventing passage of current.

—LOCKE INSULATOR MANUFACTURING COMPANY, VICTOR, N. Y.

VICTOR LINE INSULATORS. Used for the support of high tension power transmission wires and almost invariably made of several shells of highly vitrified porcelain nested together and cemented in place.

—LOCKE INSULATOR MANUFACTURING COMPANY, VICTOR, N. Y.

VICTOR STRAIN INSULATORS. Designed to give maximum mechanical strength by allowing pin to be fastened at both ends with line wire about the middle.

—LOCKE INSULATOR MANUFACTURING COMPANY, VICTOR, N. Y.

VICTOR WALL ENTRANCE INSULATOR. Designed to permit entire closing of aperture about line wire and should present ample dry surface even in face of severe blowing rain. Mounted in slate or cement panel.

—LOCKE INSULATOR MANUFACTURING COMPANY, VICTOR, N. Y.

WESTERN ELECTRIC THIRD RAIL INSULATORS. In the company's catalogue of electric railway material for 1904-5 it illustrates three specific types of patented third rail insulators in which its well-known "Electrose" insulating material is employed in combination with the metal parts. The types shown provide a strong and at the same time a slightly flexible support for the conductor rail, thereby insuring a more constant and perfect contact between the collector shoe and the rail; sparking and loss of current is thereby avoided; ample scope for the expansion and contraction of the rail is also provided.

—WESTERN ELECTRIC COMPANY, NEW YORK AND CHICAGO.

JACKS

(See also "Cranes, Hoists and Lifts")

BARRETT JACKS. Made in many sizes and styles for railway track and car work, comprising track jacks, car jacks, pit jacks, journal jacks, bridge jacks, emergency jacks, etc. Single and double acting jacks are the two types—single acting jacks raising their load on the downward movement of the lever only, while double acting jacks raise on both upward and downward movement. Special pit jacks are manufactured for removing the trucks and axles of street railway cars, and journal jacks for removing the brasses. Special forms of car emergency jacks are also included in this line of Barrett jacks for the equipment of each car of an entire system.

—THE DUFF MANUFACTURING COMPANY, PITTSBURG, PA.

BARRETT GEARED RATCHET LEVER JACKS. Lever jacks for heavy lifting of 25 and 35 tons capacity. They are compounded to permit ease of operation as well as quick action. These geared jacks are essential for the rapid handling of heavy cars or heavy loads of any character, and are popular with railroads for handling either empty or loaded cars and coaches.

—THE DUFF MANUFACTURING COMPANY, PITTSBURG, PA.

BARRETT LEVER JACKS. Made in "trip" and "automatic lowering" types for all kinds of track work, car repairing, wrecking, etc. A large number of different modifications, ranging in capacity from 1 to 15 tons. A special pit jack is made for electric railroads, for use in removing motors from trucks. Lifting racks are steel, frame malleable iron, pawls forged steel.

—FAIRBANKS, MORSE & COMPANY, CHICAGO, ILL.

BARRETT SCREW JACKS. Cone bearings permit of the raising of loads from 10 tons and upward easier and much more quickly than the hydraulic. They are more dependable, always ready, strong and durable.

—FAIRBANKS, MORSE & COMPANY, CHICAGO, ILL.

BRILL "HERCULES" CAR JACK. Two wooden uprights, well braced and bracketed with iron, contain the raising mechanism consisting of a lever handle which operates a ratchet wheel clogged to a large wheel on the shaft of which is wound a chain; the chain passes over a sheave and a pair of hooks at the end engage a steel-plated plank upon which the heaviest car is easily raised by one man at each lever. The jack occupies little space, can be operated in a crowded car barn, and may be readily moved. Besides raising cars, it will serve a variety of other purposes.

—J. G. BRILL COMPANY, PHILADELPHIA, PA.

BUCKEYE TRACK JACKS. These jacks are compound lever track and automobile lowering jacks. All parts are interchangeable and broken parts are easily replaced by inexperienced track men.

—THE BUCKEYE JACK MANUFACTURING COMPANY, LOUISVILLE, OHIO.

BUDA JACKS. Ratchet, friction, ball bearing and cone bearing. In all sizes and for special and general purposes. All tested beyond rated capacity—an important feature, eliminating danger of accidents from breakage.

—BUDA FOUNDRY & MANUFACTURING COMPANY, CHICAGO, ILL.

DORNER PIT JACKS. Used in moving commutators from motors. Made of cast iron, with brass bushing and steel screw, wood rollers in cradles for handling armatures and flat top for handling motor cases. Flat or flanged wheels. Very convenient for use in car houses. (For illustration see advertisement.)

—THE DORNER MANUFACTURING COMPANY, CHICAGO, ILL.

DUFF ROLLER BEARING SCREW JACKS. Improved roller bearing screw jacks manufactured with capacities from 15 to 70 tons for every purpose and for the safe and economical handling of railway equipment or machinery. They displace hydraulic jacks and other forms of screw jacks, as they are cheaper to operate, more reliable and will give longer service. Two special roller bearings are employed in each jack, permitting these jacks to operate at least 15 per cent. easier than other screw jacks under the same load.

—THE DUFF MANUFACTURING COMPANY, PITTSBURG, PA.

KALAMAZOO JACKS. In form and weight these jacks are easily portable by one person. The shape and dimensions of bases and the heights of standards are arranged for their respective duties; the broad and long rectangular bases enable operator to reach loads inaccessible with round base; the same feature makes the jack safe against tilting with load. Two pawls are provided, one which is engaged in teeth of rack while other is traveling for load, thus obviating the chance of sudden collapse to the injury of operator. Standards are made of choice malleable iron. Lifting racks are of forged steel with machine-cut teeth to give even finish and accuracy in operation otherwise unattainable. Pawls are of drop forged steel, fulcrum pins of crucible tool steel and all bearings of hard machinery steel. Tripping jacks are intended, and are preferable for purely track work. Reversing jacks lower loads without chance of accidental precipitation and are especially recommended for electric railways.

—KALAMAZOO RAILWAY SUPPLY COMPANY, KALAMAZOO, MICH.

MERRILL-STEVENS STANDARD JACKS. These railway jacks are made to combine positive action, ease of movement, strength and durability.

—MERRILL-STEVENS MANUFACTURING COMPANY, KALAMAZOO, MICH.

SHAW JACKS. This company manufactures jacks of all types for railway work.

—SHAW ENGINEERING & MANUFACTURING COMPANY, NEW YORK.

WATSON-STILLMAN JACKS. Built in nearly three hundred styles for all classes of lifting work.

—WATSON-STILLMAN COMPANY, NEW YORK AND CHICAGO.

JOINTS, EXPANSION

(See "Pipe Fittings")

JOINTS, RAIL

ATLAS RAIL JOINTS. Made in various forms; The compromise joint is made to connect any style of rails; made suspended or supported. Joint No. 1 has a double truss; it is composed of two like sections, one on each side of the rail and made to fit any rail or rails.

—ATLAS RAILWAY SUPPLY COMPANY, CHICAGO, ILL.

CONTINUOUS RAIL JOINTS. These joints are rolled from best steel billets to any desired length and to fit any section of either "Tee" or "Girder" rail. They provide for contraction and expansion, support the rail base perfectly, maintain rail alignment, eliminate low joints, communicate the load wave uninterruptedly from rail to rail and perfectly control all vertical action between the rail ends, preventing crystallization and consequent breaking of copper bonds or terminals. This results in easy riding and economy of maintenance of both track and rolling stock. The cost is but little more than angle bars and the life of the joint is twice as long. (See illustration in advertisement.)

—THE CONTINUOUS RAIL JOINT COMPANY OF AMERICA, NEWARK, N. J.

FALK CAST-WELDED RAIL JOINTS. This rail joint makes a continuous track, saves current, rails, equipment, does away with track maintenance entirely, and makes a delightful smooth riding track. There are no copper bonds to get loose and divert the electric current, and actual tests show twenty (20%) per cent. greater conductivity at the joint than in the rail itself. Hundreds of thousands of joints are in use the world over, and many of the leading systems, both in this country and abroad, have welded all of their track. (See advertisement in this issue.)

—THE FALK COMPANY, MILWAUKEE, WIS.

HEIL RAIL WELDING. The outfit required for making cast-welded joints by this process consists of the following: A wagon-mounted cupola for casting the joints, having a capacity of ten tons of iron in six hours; a platform in the wagon for carrying iron; a box for holding the coke; a sand-blast apparatus for cleaning the rail ends, consisting of a motor-driven compressor and sand hopper; and motor-driven apparatus for filing the rail and joints. This company's work includes also the construction of self-supporting smokestacks for power houses and the manufacture of steel tanks for gasoline, oil, water and storage purposes.

—HEIL RAIL JOINT WELDING COMPANY, MILWAUKEE, WIS.

LORAIN ELECTRICALLY WELDED RAIL JOINTS. This joint consists of two rolled steel bars on each side of the web of the rail across the joint and electrically welded at three points. The area of each weld is about 3½ sq. ins. The standard size of bars used is 1 in. by 3½ ins. by 18 ins. for new rail with ends left blank for welding. For rails having bolt and bond holes the bars are made long enough to reach beyond the holes. These joints are applied by special apparatus, mounted on trolley cars which move along the track from joint to joint. Current is taken from the trolley and converted to a low voltage for welding. The joints are applied by the track welding department of the company. (See advertisement.)

—THE LORAIN STEEL COMPANY, PHILADELPHIA, PA.

THERMIT RAIL JOINTS. This joint consists of a steel shoe weighing 5 lbs. to 12 lbs., according to rail section, fused with the web and rail flange to one homogeneous mass. The steel is run into a sand mold out of a magnesia-lined crucible placed directly over the gate of the mold and tapped from the bottom. In the crucible itself takes place the chemical reaction of finely divided aluminium with iron oxide, which produces this liquid steel, at a temperature of about 5,000° F., without supply of heat or power from outside. The whole outfit consists of crucible with tripod, sand molds, mold clamps and the Thermit necessary to weld any given section. (See advertisement.)

—GOLDSCHMIDT THERMIT COMPANY, NEW YORK.

WEBER RAIL JOINT. This is a base support joint giving perfect surface and line. It preserves the rail's life by reducing excessive wear at the ends, thus making it uniform throughout. The bolts and nuts do not become loose, as the wood filler (which does not decay or otherwise fail), being under constant compression, and practically enclosed in steel, preserves a tension in the bolts which prevents any movement in the parts. (See advertisement.)

—THE WEBER RAILWAY JOINT MANUFACTURING COMPANY, NEW YORK.

JOURNAL BOXES

BRILL JOURNAL BOX. This journal box is self oiling and will run six months without re-oiling. It has a record of fourteen months without re-oiling on one of the New York lines. The box is strongly and simply constructed, readily removed and replaced, and easily inspected. It is made dust-proof by a method that is singularly effective in operation. The fault with most journal boxes is that the connection between the collar and the inside rim is too loose. In the Brill box the small amount of dust that is not trapped in a groove in the rim and gets under the collar, is deposited upon a fiber washer which in turning around drops it out again.

—J. G. BRILL COMPANY, PHILADELPHIA, PA.

—AMERICAN CAR COMPANY, ST. LOUIS, MO.

—G. C. KUEHLMAN CAR COMPANY, CLEVELAND, OHIO.

—JOHN STEPHENSON COMPANY, ELIZABETH, N. J.

SYMINGTON JOURNAL BOX. Now being applied on most of the leading high speed electric cars built during the past year. It is exclusively an M. C. B. type of box for M. C. B. trucks, having been successfully developed on the steam roads of the United States. Its points of excellence are a simple, durable, dust-proof lid with machined joint and central spring pressure; a lid spring which will not fail in long service, and an arrangement of interior ribbing that will positively prevent any settling of waste packing away from the journal. It is made of a tough resilient metal which resists abrasion at all wearing points. (For illustration see advertisement.)

—THE T. H. SYMINGTON COMPANY, BALTIMORE, MD

JOURNAL LUBRICATORS

(See "Lubricating Devices")

LABORATORIES, ELECTRICAL

LABORATORIES. To the manufacturer tests are of great benefit and are as necessary to a secure future as careful accounting; but to the intelligent purchaser, tests

are even more necessary to know whether the claims of a salesman are fulfilled by the goods or that the specifications under which the purchase was made are fully met. The goods sold will be more carefully selected if the shipper knows that they must pass certain inspections and tests before they will be accepted. It was for the purpose of helping the buyer as well as the manufacturer that these testing laboratories were instituted and their past work already has shown the value of their assistance along these lines.

—ELECTRICAL TESTING LABORATORIES, NEW YORK

LAMPS, ARC AND INCANDESCENT

(See also Headlights.)

BANNER INCANDESCENT LAMPS. These lamps are manufactured under the latest improved processes known to the business, and this, coupled with skill and knowledge acquired by extensive experience in the manufacture of high grade lamps, has resulted in the production of a lamp suited to the most exacting requirements. The lamps are subjected to the most extensive and exacting tests before they leave the factory, and only perfect lamps are permitted to bear the "Banner" label. The most critical attention is given to specifications in filling orders, and Banner lamps are guaranteed in every particular. (See advertisement.)

—BANNER ELECTRIC COMPANY, YOUNGSTOWN, OHIO.

CREAGHEAD INCANDESCENT LAMPS. Made under expert supervision and with the most approved apparatus. The selection is such as is demanded by the most careful buyers and to meet the most severe conditions. Lamps for street railway circuits are carefully selected for series burning. The spiral "Mill type" lamps are especially designed for factory use. These lamps are furnished in all voltages, candle powers and bases that are in demand. The "Creaghead Special" type lamp is made for a larger tip candle power, having a filament with one extra coil.

—THE CREAGHEAD ENGINEERING COMPANY, CINCINNATI, OHIO.

GENERAL ELECTRIC ARC LAMPS. These series of arc lamps are especially suited to railway work, and are known as the Parallel Rod Edgewise Wound Type. They operate two in series on 220 volts or five in series on 550 volts. They may also be operated on 110 volts by a simple adjustment. The number of parts is reduced to a minimum. The construction is practically indestructible. The insulation is ideal, as all insulating pieces are of porcelain and there is but one flexible cable in the lamp and it is insulated with glass beads. The regulation of the arc length is obtained by a simple mechanical device, no shunt magnets being used. These lamps will operate over a wide range of voltage. All fittings for lamps are interchangeable in all parallel rod and center type lamps.

—GENERAL ELECTRIC COMPANY, SCHENECTADY, N. Y.

GENERAL ELECTRIC INCANDESCENT LAMPS. The General Electric Company manufactures all types and varieties of incandescent lamps. The company's latest development in incandescent lighting is a high efficiency metallized carbon filament lamp known as the "G. E. M." This lamp supplies the need for an intermediate lighting unit between the ordinary incandescent light and the arc lamp. It is furnished in three sizes, each equipped with two styles of Holophane Pagoda reflectors for concentrating or distributing the light as required. The efficiency of the new units is 20 per cent. higher than ever before obtained for best incandescent lamps.

—GENERAL ELECTRIC COMPANY, MAIN LAMP SALES OFFICE, HARRISON, N. J.

SAWYER-MAN INCANDESCENT LAMPS. The incandescent lamps sold by this company are manufactured by the Sawyer-Man Electric Company of New York City. The makers of these lamps have the benefit of twenty-four years experience and continuous experiment. The desirable and valuable qualities of long life, small energy consumption, and uniformity in candle-power and voltage are secured by close attention and skill during the intricate process of manufacture, supplemented by great care and accuracy in the final testing and selection.

—WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY, PITTSBURG PA

"STERLING SPECIAL" RAILWAY LAMP. This lamp is designed especially to overcome the swinging of the filament caused by oscillation, at the same time producing an equal light from all light-giving points of the bulb. The formation of the filament being spiral, fully anchored the entire distance, prevents any drooping or swinging, thereby producing a long life and efficient lamp. Vibration cannot affect a lamp made in this manner and vibration

must be considered in railway lighting. Tested in series and fully guaranteed.

—STERLING ELECTRICAL MANUFACTURING COMPANY, WARREN, OHIO.

SUNBEAM STREET RAILWAY LAMP. This lamp has attracted a great deal of favorable attention among street railway men during the past year. Its strong feature, recommending it particularly to railway men of long experience, is strength. Both in design and quality of material the filament and connections are as near perfection as the science of the day permits, and as for uniformity, both in candle power and life performance, the Sunbeam is guaranteed to meet and even exceed the requirements of standard specifications for street railway work.

—THE SUNBEAM INCANDESCENT LAMP COMPANY, NEW YORK. WESTERN ELECTRIC COMPANY, NEW YORK AND CHICAGO, SOLE SELLING AGENT.

WESTERN ELECTRIC ARC LAMPS. Up-to-date lamps for all voltages and all classes of service. Characterized by rigidity of construction, certainty of action, interchangeability of parts and economy of operation. Recent improvements in all lines place this company's present products ahead even of its past high standard. All lamps have a narrow waist separating the globe from portion containing mechanism. Parts are accessible for adjustment. A special metal is used for casings, giving strength with lightness. Carbons can be changed without removing globes, when desired.

—WESTERN ELECTRIC COMPANY, NEW YORK AND CHICAGO.

WESTINGHOUSE ARC LAMPS. The lamp shells are made of heavy corrugated copper. Combustion of the carbon takes place in a chamber which is entirely separate from that containing the lamp mechanism, thus permitting a low operating temperature. The lamps are dust, weather and bug proof, strong and serviceable, and of high efficiency. They are made for operation on all alternating current and direct current circuits.

—WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY, PITTSBURG, PA.

LAMP PARTS

(See Clusters and Sockets")

LIFTERS, CAR STEP

MILLEN CAR STEP LIFTER. A lifting device attached to the underside of a car, and connected with both platforms of the same, so that the motorman or conductor, by lifting up a handle, can turn up the long step of an open car, fasten it up and also let it down again without leaving the platform.

—THE CONSOLIDATED CAR FENDER COMPANY, NEW YORK.

LAUNCHES AND BOATS

(See Park Attractions.)

LIFTS

(See "Cranes, Hoists and Lifts.")

LIGHTING SYSTEMS, CAR

KINSMAN AUXILIARY CAR LIGHTING SYSTEM. This auxiliary car lighting system comprises means for keeping a car illuminated even when the main current is cut off. The apparatus consists of a number of auxiliary lamps, a storage battery, a charging switch and an automatic change-over switch. When the main current is cut off the change-over switch immediately places the auxiliary lamps in circuit with a small storage battery. A flexible cord and lamp is also used in connection with the battery circuit to enable car inspection while the main power circuit is dead; also keeps marker and headlights in service during break downs.

—KINSMAN ELECTRIC & RAILWAY SUPPLY COMPANY, NEW YORK.

LIGHTNING PROTECTION

AJAX LIGHTNING ARRESTER. A protective device for direct current apparatus of 650 volts potential, or less, consisting, essentially, of a magazine of fusible lightning arresters becoming operative successively, one fuse for each lightning discharge. The fuse consists of two pieces of No. 0 B. & S. soft brass wire lapped at their inner ends to form a discharge gap which is hermetically enclosed in a small glass tube. One end of each fuse rests upon a common ground terminal, the other being connected to the line terminal through a small carbon ball which is operated by gravity.

—ALBERT & J. M. ANDERSON MANUFACTURING COMPANY, BOSTON, MASS.

GARTON-DANIELS LIGHTNING PROTECTION. The arresters made by this company are of the "circuit-breaker" type. The air-gap is fixed and the circuit is opened in an enclosed chamber. This allows the use of a small air-gap, insuring the discharge an easy path to earth. The circuit-breaker is positive, automatically reset and instantaneous in operation. A resistance is used, in series with the arrester coil to limit the current flow, and in shunt to provide a non-inductive path around the coil for the discharge. Parts so mounted on base to avoid breakdown of surface distances between parts of opposite potential.

—GARTON-DANIELS COMPANY KEOKUK, IA.

GENERAL ELECTRIC LIGHTNING ARRESTERS. This lightning arrester is suitable for all direct current systems whether railway, light or power. In railway systems it is installed in the station, on the cars or on poles carrying feeder lines. It consists of two rounded terminals, forming an adjustable spark gap, a non-inductive resistance and a magnetic blow-out coil, all enclosed in a porcelain box. Choke coils should be interposed between the point where the arrester is connected to the circuit and generator or motor to be protected. The spark gap terminals are mounted on the underside of the cover of the porcelain box, rendering them readily accessible for inspection and cleaning. For outdoor service the arrester is enclosed in a substantial wooden box.

—GENERAL ELECTRIC COMPANY, SCHENECTADY, N. Y.

SHAW NON-ARCING LIGHTNING ARRESTERS. These arresters are composed of a series of special carbonized rings placed alternately in series with mica rings on an insulating tube supported by two circular serrated metal caps on brackets secured to the insulating base. The composition and shape of the carbonized rings afford an inner as well as outer discharge circuit for the static current, but will not permit arcs to form or a dynamic current to precede or follow. The arresters have no moving parts. They are always ready for operation. They are made for all voltages.

—LORD ELECTRIC COMPANY, BOSTON, MASS.

WESTINGHOUSE LIGHTNING PROTECTION. An installation of lightning arresters, choke coils, or both, for the protection of electrical apparatus against lightning or other abnormal rises of potential. The choke coil tends to flatten out the potential wave, and the arrester offers an easy path to ground and also prevents the line current from following the discharge. For railways having high voltage transmission, the low equivalent arresters afford excellent protection. For cars or lines of 500 volts to 750 volts, the M. P. arrester is used. It is small and compact, has no moving parts, is weather and fireproof, and will operate without attention for an indefinite time.

—WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY, PITTSBURG, PA.

LINE MATERIAL

(See also Brackets and Cross-Arms, Insulators and Wires and Cables.)

ANDERSON LINE MATERIAL. This company's overhead material for electric railways includes a complete line of trolley line suspensions, of West End, Boston, cap and cone, and round top types, together with Brooklyn strains, wood strains, and many other forms of strain insulators of thoroughly tested construction, also trolley wire ears and splicing sleeves in great variety for both round and grooved wire. The Aetna insulating compound furnishes the insulation for this line material.

—ALBERT & J. M. ANDERSON MANUFACTURING COMPANY, BOSTON, MASS.

CREAGHEAD LINE MATERIAL. A complete line of material for overhead construction of electric railway and power transmission lines.

—THE CREAGHEAD ENGINEERING COMPANY, CINCINNATI, OHIO.

CREAGHEAD "ARMORED CAP-CONE" TROLLEY HANGERS. Have a spark gap of 24,000 volts, with very high surface insulation (long surface distance), and high puncture test. Their simplicity and strength recommend them. The hanger will not shake loose as is the case with many other designs.

—THE CREAGHEAD ENGINEERING COMPANY, CINCINNATI, OHIO.

ELECTRIC RAILWAY EQUIPMENT COMPANY'S LINE MATERIAL. Embraces iron and steel poles, feeder arms, cross-arm supports, iron pole tops, bands and collars, pole brackets for wood and iron poles, malleable iron fittings, etc. See also Wirelocked Swedged Joint Poles and Hercules Brackets.

—ELECTRIC RAILWAY EQUIPMENT COMPANY, CINCINNATI, O.

ELECTROSE OVERHEAD LINE MATERIAL. Electrosec overhead line material has received the approval and endorsement of the best engineers in America and Europe. After a number of years of the most severe service on some of the leading roads it has been demonstrated that it is superior electrically and mechanically to any other material now on the market. The company is constantly adding to its regular line new and improved devices. The metal parts used in these overhead line fixtures are uniformly tough and strong and of the best quality of metal obtainable. This material can also be supplied on customers' special forms.

—WESTERN ELECTRIC COMPANY, NEW YORK AND CHICAGO.

GENERAL ELECTRIC LINE MATERIAL. The company's line comprises a complete assortment. Liberal design and an ample factor of safety insure great mechanical strength and durability. The insulating material for suspension and strain parts retains its insulating properties under varying climatic conditions. All castings used are of standard composition for railway engineering. Fittings have been devised and standardized for catenary construction work, for both high speed direct and alternating current.

—GENERAL ELECTRIC COMPANY, SCHENECTADY, N. Y.

J-M LINE MATERIAL. A desirable property for an insulator for overhead work is resistance to the weather, and while mechanical strength, electrical insulation and heat resistance are essential, these properties must be combined with the weather resisting property to make an efficient insulator for all-around work. These properties are combined to the greatest extent in the well-known moulded mica line material. It was one of the very earliest insulators on the market and has the advantage of many years of service under the severest conditions. (See Catalogue No. 14; also advertisement.)

—H. W. JOHNS-MANVILLE COMPANY, NEW YORK.

MACALLEN LINE MATERIAL. Overhead line material for electric railways is the specialty of this company. This also includes materials in connection with high potential insulation.

—W. T. C. MACALLEN COMPANY, BOSTON, MASS.

MAYER & ENGLUND LINE MATERIAL. Keystone insulation for overhead line material, which was developed some years ago by this company, has proved to be very successful. The high grade material used in its manufacture and the careful process employed in making it, impart to the compound the necessary heat resisting quality, and makes it absolutely immune to the effects of moisture. Its mechanical strength is exceptionally high. It is moulded into all standard forms of overhead fittings and in many special ones.

—MAYER & ENGLUND COMPANY, PHILADELPHIA, PA.

MORRIS LINE MATERIAL.—This line covers practically everything required for overhead work, such as brackets, cross arms, poles, insulators, pull-offs, etc. Made both in standard and special types.

—ELMER P. MORRIS COMPANY, NEW YORK.

"OHIO BRASS" LINE MATERIAL. "Dirigo" insulation is used in this overhead line material. This insulation is the result of over eleven years of experience in this branch of manufacture. It has great tensile strength, resists heat and has exceptional insulating properties, combined with toughness and elasticity. This company's line of hangers, ears, strain insulators, etc., is very complete, including the most approved single phase construction material. (See Catalogue No. 6 and Bulletin No. 1; also advertisement.)

—THE OHIO BRASS COMPANY, MANSFIELD, OHIO.

PORTER & BERG'S TRUSS PIN. This pin is made of malleable iron, japanned or galvanized, and has been designed with the idea that the pin is primarily a part of the mechanical construction and should be made strong and durable; the insulator alone is depended upon for insulation. The pin top is specially designed to insure greatest possible "holding surface" for the insulator, which is fastened to the pin with cement. The base of the pin is designed with a flange to protect the cross arm from the weather and to prevent absolutely any turning of the pin. Bolted to the cross arm, it is a permanent piece of construction. Over 50,000 are now in use supporting Locke insulators. (See Catalogue No. 2.)

—PORTER & BERG, CHICAGO, ILL.

RECORDING FARE REGISTER COMPANY'S LINE MATERIAL. Consists of various styles of ears, mechanical clips, bracket arms, etc.

—THE RECORDING FARE REGISTER COMPANY, NEW HAVEN, CONN.

S-H LINE MATERIAL. This overhead line material is manufactured in either malleable iron or bronze in three distinct types complete, viz.: "Cap and Cone," "Boston" and "Gem," all of which are made for both single and double trolley systems. The insulation is of the highest grade; the metal parts are neat in design, substantial and especially well and carefully made. The entire line is made with a view to standing any excessive strain to which it may be subjected. (See advertisement.)

—STUART-HOWLAND COMPANY, BOSTON, MASS.

LOCKERS, METAL

LYON STEEL LOCKERS. A sheet steel locker for factories of all kinds. Made entirely of sheet steel with angle iron at top, bottom and sides, making it strong and durable. A locker that is not affected by hard usage. It is heavily coated with the best black varnish, with a permanent glossy black finish, absolutely insuring against rust, disease germs, bad odors, etc. Made in all sizes and combinations. Over 50,000 in use.

—LYON METALLIC MANUFACTURING COMPANY, CHICAGO, ILL.

MERRITT METAL LOCKER. Few things contribute so much to the comfort of the shop and barn employe as cleanly lockers, both for his personal effects and the storage of material. The lockers and material closets made by this company are of expanded metal and sheet steel, possessing great durability, cleanliness and safety.

—MERRITT & CO., PHILADELPHIA, PA.

MEYERS' SANITARY METAL LOCKERS. These lockers are made to have thorough ventilation, no dark corners, no accumulation of dirt and dust. They are made entirely of steel and will not absorb germs. They are perfectly secure as well as neat and attractive. These lockers are made in single or double tier.

—THE FRED. J. MEYERS MANUFACTURING COMPANY, HAMILTON, OHIO.

WRIGHT WIRE CLOTHES LOCKERS. These wire clothes lockers are largely used by street railways and manufacturing establishments all over the country. They are made of either wire or expanded metal, and can be fitted with the company's 3-point locking device, with Yale lock, or with a hasp for padlock.

—WRIGHT WIRE COMPANY, WORCESTER, MASS.

LOCK NUTS AND WASHERS

(See "Nuts and Bolts")

LOCOMOTIVES, ELECTRIC

AMERICAN LOCOMOTIVE COMPANY, NEW YORK. Builders of electric locomotives for passenger and freight railways and industrial purposes. A recent development by this company is the construction of steel motor trucks, for definition of which see "Trucks."

BALDWIN-WESTINGHOUSE ELECTRIC LOCOMOTIVES. The use of electric locomotives is becoming more extensive every year, supplanting in many cases the steam locomotives, especially in the congested terminals of large cities. Short railroad lines, tunnels, switching, shops, lumber yards and mines furnish a place where they are very useful. The union of the Baldwin Locomotive Works and this company in the manufacture of electric locomotives has resulted in the highest type of construction. While a large variety of standard designs fill all ordinary requirements, the companies are equipped for building locomotives of special construction. (See advertisement.)

—WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY, PITTSBURG, PA.

—BALDWIN LOCOMOTIVE WORKS, PHILADELPHIA, PA.

BRILL ELECTRIC LOCOMOTIVES. The company builds every type of electric locomotive for hauling freight and baggage cars and for industrial purposes, including mine locomotives. Some are built for hauling only, and are furnished with a commodious cab while others have space for carrying large loads. Locomotives are frequently designed to combine with other purposes such as freight, express, construction and snow plow service. A useful type of locomotive which has been designed for manufacturing plants includes a crane which is operated by the truck motor.

—J. G. BRILL COMPANY, PHILADELPHIA, PA.

—AMERICAN CAR COMPANY, ST. LOUIS, MO.

—G. C. KUHLMAN CAR COMPANY, CLEVELAND, OHIO.

—JOHN STEPHENSON COMPANY, ELIZABETH, N. J.

GENERAL ELECTRIC LOCOMOTIVES. These electric locomotives are manufactured for mining, freight haulage and passenger service. The latest type built in conjunction with the American Locomotive Works is the

100 ton 2,200 hp. locomotive for the New York Central & Hudson River Railroad. These locomotives have developed under test a maximum draw bar pull of 35,400 lbs., and have hauled a 551 ton train at 62 miles an hour. Electric locomotives are adaptable, convenient, safe, economical and reliable. Liberal figures give a cost of maintenance less than half cost for steam locomotive. These locomotives are particularly efficient for heavy, short distance haulage.

—GENERAL ELECTRIC COMPANY, SCHENECTADY, N. Y.

LUBRICANTS, OIL AND GREASE

DEARBORN OILS. The lubricants made by this company embrace a wide variety of greases, mineral stocks, lard, neatfoot and tallow oils (acidless and free from water), adapted for special requirements. Each oil is distinguished by being named after some fort. The large laboratories conducted by this company enable it to prepare specifications and formulae for proper oil for certain purposes.

—DEARBORN DRUG & CHEMICAL WORKS, CHICAGO, ILL.

GALENA OILS. Compounded of the highest grade of petroleum (unrefined), combined by the company's special process with whale oil and oxide of lead, forming efficient lubricants for all branches of electric and steam railway lubrication. They are the result of over thirty years' experience. The company will furnish, on application, list showing where its oils and greases are being successfully used on the largest railroad systems in the United States. The cost of lubrication with these oils and greases absolutely guaranteed. The company offers the benefit of years of experience on the subject of lubrication. (See advertisement.)

—GALENA-SIGNAL OIL COMPANY, FRANKLIN, PA.

HARRIS LUBRICANTS. As a manufacturer of lubricating oils of many years' standing, this company has bestowed special attention on the requirements of street railways and supplies a full line of high class lubricants, meeting all their needs. Harris valve oils prepared specially for simple and compound engine cylinders and Harris engine oil for external parts, furnish the most satisfactory results in the power house. Harris dynamo and machine oil is extensively used for motors and dynamos; Harris transformer oil is specially prepared for transformers; H. S. machine oil for axle and motor bearings has the lubricating properties and stability required for this purpose and is specially adapted for use in automatic car and motor lubricators; Harris signal oil burns bright, clear, steady and smokeless in signal lamps and yardmen's lanterns; Harris curve grease helps cars around curves, with least strain on wheels, boxes and axles in any weather.

—A. W. HARRIS OIL COMPANY, PROVIDENCE, R. I.

MONITOR DYNAMO AND ENGINE OILS. This company makes a specialty of oils and greases for electric railway machinery.

—THE MONITOR OIL COMPANY, CLEVELAND, O.

LUBRICATING DEVICES

ARMSTRONG JOURNAL OILER. To prevent the carbonization and hardening of the ordinary wick or pad oilers used in journal bearings, this company uses a combination of cotton and wool woven into a plush pad in which a set of buttons in the pad press against the journal, so that the "pile" of the plush brushes it but lightly. The pressure of the journal, therefore, is taken up by the buttons, the "plush" "pile" giving up its oil freely and uniformly.

—ARMSTRONG OILER COMPANY, PHILADELPHIA, PA.

ECONOMY JOURNAL LUBRICATOR AND DUST-GUARD. The lubricating device consists of a steel or fiber wheel provided with ball bearings, carried by a cradle so as to have its upper rim in contact with the lower side of the journal, and its lower portion below the surface of the oil in the bottom of the journal box. The cradle is carried at one end by a stud (having conical bearings) attached to one side of the box, and spring supported at the other end by a hook stud secured to the corresponding side of the box, the whole arranged to cause an upward pressure of the oil wheel against the journal. The contact between the wheel and the journal causes the former to revolve and carry oil to the under side of the journal, whence it is carried up to the edge of the brass and distributed throughout its entire length. The amount of oil supplied to the journal is obviously greatly in excess of that actually required for lubrication, and to prevent waste the maker has devised an oil and dust-guard which has proven most effective. (See advertisement.)

—RAILWAY JOURNAL LUBRICATING COMPANY, NEW YORK, MILWAUKEE, CHICAGO.

ECONOMY OIL AND DUST-GUARD. Consists of two malleable iron plates, male and female, separated by four compression springs. The male plate is accurately milled on the exposed side to form a perfect joint against the boss in the dust-guard slot of the journal box. This boss which is on the inside of the outer wall of the dust guard slot, has an annular oil groove in the center, the face of this boss being accurately milled. The opening in the male plate is bored 1/32 in. larger than the dust-guard fit on the axle and in this opening are two annular grooves forming an oil packed joint around the axle, thereby retaining the oil and excluding all dirt. On the lower part of the inside of the female plate, a V-shaped wiper is secured in a movable holder for removing the surplus oil from the axle and returning same to box. The wearing point of the wiper is of soft brass and has a fiber insert, thus assuring long life without cutting the axle. When the exert a total pressure of about 300 lbs., thereby insuring a perfect joint at all times between the milled surfaces of the guard and boss; this pressure or tension also carries the weight of the guard so that it does not rest on the axle, thereby removing the objections to the collapsible type of guards. (For illustrations see advertisement.)

—RAILWAY JOURNAL LUBRICATING COMPANY, NEW YORK, MILWAUKEE, CHICAGO.

HANCOCK AXLE LUBRICATOR. This lubricator consists of a steel frame with parallel bars extending from the cross-bar near the bottom to the top, which act as guides for an oil well within which a disc is pivoted. In the lower portion of this well an opening is provided through which the lubricant passes into the well and after straining is taken up by the disc to the journal. The wheel within the well is adapted to bear against the shaft through the opening in the bottom of the bearing, and, as the journal revolves, the oil is conveyed by the disc to the bearing.

—AXLE LUBRICATOR COMPANY, SAVANNAH, GA.

JOLT OIL CUP. In this cup the jolting of the car operates the feed mechanism, oil being supplied only when the car is in motion. The feed valve is controlled by a spiral spring, a weight resting on the valve stem in such a way that it strikes a hammer-like blow at each jolt of the car, opening the valve to allow a small quantity of oil to escape. This lubricator may be placed inside of regular armature or axle bearing grease cups.

—THE JOLT LUBRICATOR COMPANY, PROVIDENCE, R. I.

LIBERTY GREASE CUPS. The cup for stationary bearings has an automatic spring feed which forces the grease into the bearings. The action of this can be regulated to suit the requirements. The cup for moving bearings has an automatic feed. This can be used on eccentric, crank pins, cross head, and will lubricate any bearing having a reciprocating motion. The feed of the cup is controlled by the motion of a pendulum on the cup actuated by the reciprocating motion. This action of the pendulum turns a worm attached to a plunger, which forces the grease into the bearing. (See advertisement.)

—LIBERTY MANUFACTURING COMPANY, PITTSBURG, PA.

STAR ARMATURE AND AXLE BEARING OILER. This oiler has been constructed to meet all the demands of a perfect lubricator for armature and axle bearings. It has no parts to get out of order; requires no adjusting; feeds automatically when car is in motion, and shuts the feed off when the car is at rest. It is made to fit every style of standard motor, requires no fastening to, nor any change whatever in the grease cup; can be put in and taken out of the grease cup without any trouble, and is easily cleansed when necessary.

—STANDARD AUTOMATIC LUBRICATOR COMPANY, PHILADELPHIA, PA.

LUMBER, ARTIFICIAL

ASBESTOS BUILDING LUMBER. The insulating quality of this material is very high, and it is being largely used to insulate wires and cables under cars; also for barriers, third-rail insulation, panels, oil switch compartments, circuit-breaker boxes, etc. Being composed largely of asbestos fiber, it is naturally a tough material, not only for electrical work, but for building uses as well. Nails may be driven through it, quite close to the edge, without danger of fracture. It is sufficiently elastic to allow of marked tension due to vibration, expansion and contraction of surrounding parts, wind pressure, etc., without cracking or breaking. One great and desirable feature of asbestos lumber, however, is that it can be successfully joined, fitted, etc., by ordinary mechanics. It can be used for car interiors, and painted, grained, veneered or otherwise treated to make a handsome finish.

—WENOFF & MACDUFFIE, NEW YORK.

"TRANSITE" ASBESTOS FIRE-PROOF LUMBER. Made from especially prepared asbestos and fire-

proof binding composition, formed into a hard, firm, fire-resisting sheet of great strength and toughness. This material is fire-proof, water-proof, acid proof and germ-proof. For all practical purposes it can be worked like ordinary wood, as regards nailing, chiseling, planing, etc. Capable of being oiled, grained, painted or otherwise decorated and can be made in bent or curved sheets. Transite is used extensively for fire-proofing electric cars, lining switch boxes, cut-out boxes, controller car linings, roofing, side wall construction, fire-proof doors, mouldings, controller covers, etc.

—H. W. JOHNS-MANVILLE COMPANY, NEW YORK

MACHINE TOOLS

MCCABE DOUBLE-SPINDLE LATHES. These double lathes are built for unusual strains, free and easy in their workings; although it will handle any 48-in. lathe job ever done on a 48-in. lathe, the lower-swing will also do 26-in. work with every convenience of a lathe of that size. This lathe is used in hundreds of street railway repair shops all over the country.

—J. J. MCCABE, NEW YORK.

NILES-BEMENT-POND MACHINE TOOLS. This company makes a specialty of complete machine tool installation for street railway repair shops. It manufactures everything in the line of metal working machinery. The machine tools in most of its recent installations have been driven by direct connected motors.

—NILES-BEMENT-POND COMPANY, NEW YORK.

NILES-BEMENT-POND DRILLS. These machines include vertical drills, radial drills and multiple drills. The Pond radial drill is particularly adapted for heavy work. For lighter work, the Niles universal radial drill has many desirable features.

—NILES-BEMENT-POND COMPANY, NEW YORK.

NILES HYDRAULIC WHEEL PRESSES. These wheel presses are especially designed for pressing electric car-wheels on and off their axles. They will take wheels up to 42-in. in dia. on the tread. This company also builds both larger and smaller presses than the size mentioned.

—NILES-BEMENT-POND COMPANY, NEW YORK.

NILES-BEMENT-POND LATHES. These lathes are built in sizes from 10 in. to 125 in. swing, including precision lathes for the tool-room, rapid reduction lathes for taking off large amounts of metal per minute, turret lathes for manufacturing from the bar, bolts, studs, screws and similar articles, axle lathes for turning both ends of a car axle simultaneously, and car wheel lathes for truing up steel-tired car wheels.

—NILES-BEMENT-POND COMPANY, NEW YORK.

NILES-BEMENT-POND PLANERS AND SHAPERS. These tools are built in all styles and sizes, including shapers for tool room use, crank planers for work up to 24 in. long, and standard planers for work of larger dimensions.

—NILES-BEMENT-POND COMPANY, NEW YORK.

NILES WHEEL BORERS. The 36 in. car wheel borer is especially designed for street railway work and will take wheels up to 36 in. in diameter on the tread. It may be provided with power crane and power hub facing attachment.

—NILES-BEMENT-POND COMPANY, NEW YORK.

MACHINISTS' TOOLS

PRATT & WHITNEY TOOLS. The machinists' tools in this line include taps, dies, milling cutters, reamers, drills, punches, gages and standards. The company's patent process taps, adjustable dies, high speed milling cutters, eccentric relief reamers and high speed drills have earned an enviable reputation.

—NILES-BEMENT-POND COMPANY, NEW YORK.

MECHANICAL DRAFT APPARATUS

(See also Heating and Ventilating Apparatus.)

"ABC" BLOWERS. The term "blowers" is commonly used to describe any kind of machine used for handling air, and hence covers apparatus capable of many applications. The "ABC" steel plate fans and blowers are used in connection with heating, ventilating, drying, cooling and mechanical draft plants; shavings exhausters for the removal of shavings and refuse in wood-working shops; volume blowers for supplying draft to steam boilers and forges, etc.; cast iron exhausters for gritty dust from emery wheels, tumbling barrels, etc.; pressure blowers

for furnishing draft to cupolas and forges; disc fans for cooling, removing of fumes, etc.
—AMERICAN BLOWER COMPANY, DETROIT.

"ABC" MECHANICAL DRAFT APPARATUS. As applied to boiler practice, the term "mechanical draft" is generally employed in connection with two well-known systems: Forced draft, in which the draft is increased by forcing the air beneath the grates by a blower; and induced draft, in which an exhaust fan draws the gases through the flues and smoke connections, discharging into the chimney, the effect being the same as natural draft, only stronger and always uniform. "ABC" apparatus insures uniform draft, enables the use of cheaper fuel; obviates the necessity for tall stacks; increases boiler capacity; utilizes waste gases; and prevents smoke.
—AMERICAN BLOWER COMPANY, DETROIT.

FOSTER FAN ENGINE OR BLOWER REGULATOR. Governs the speed of the fan, and maintains a practically uniform boiler pressure, with a small percentage of variation. The fan engine type is best adapted for boiler pressure of 100 lbs. or less, and is made of iron, in sizes 1½ in. and larger, while the blower valve is better adapted to the higher boiler pressures, and is fitted with composition body. In both types, provision is made for preventing engine stopping on center or "race" if boiler pressure falls below normal.
—FOSTER ENGINEERING COMPANY, NEWARK, N. J.

GENERAL ELECTRIC MOTOR BLOWERS AND EXHAUST FANS. Have a special field of usefulness in ventilating buildings. The company manufactures both direct current and alternating current motor blower sets adapted to meet given conditions. The motors are constructed with self-oiling and self-adjusting bearings, and renewable dust-proof covers, and are easily accessible for repairs. Blower sets with induction motors or direct current motors can be mounted on the ceiling, floor or wall, as desired. In special cases specifications and prices can be prepared for out-of-ordinary equipments.
—GENERAL ELECTRIC COMPANY, SCHENECTADY, N. Y.

GREEN-MATTEAWAN STEEL EXHAUSTER AND PRESSURE BLOWERS. These exhausters and blowers are provided with cast iron housings and are especially designed for high-pressure and high-speed work. The bearings of the exhausters are entirely removed from the action of the material being handled and both exhausters and blowers are of very ample proportions.
—THE GREEN FUEL ECONOMIZER COMPANY, MATTEAWAN, N. Y.

INDUCED DRAFT FANS. Made by Broomell, Schmidt & Steacy Company, New York.

STURTEVANT BLOWERS. These blowers are built in several hundred types and sizes for handling air up to 1 lb. pressure per sq. in. Steel pressure blowers deliver air at high pressure but in small volume. Monogram type blowers and exhausters operate at somewhat less pressure but discharge more air. Steel plate fans are primarily designed to handle large volumes at very moderate pressures. They are especially adapted for ventilating, heating and drying systems, mechanical draft, cooling transformers and the like, and are arranged to be driven by belt or by direct attached engine or motor. Electric propeller fans are designed for pressures under one-half ounce per square inch.
—B. F. STURTEVANT COMPANY, HYDE PARK, MASS.

STURTEVANT FANS. The term "fans" includes all classes of blowers, but particularly applies to the cased steel plate type constructed for the general purposes of ventilation, heating, drying, mechanical draft and the like. They are extensively employed for cooling transformers. Electric propeller fans, designed for light ventilating work requiring operation up to ½ oz. pressure per square inch, are equipped with Sturtevant motors. The advantage of large, slow-running fans is shown by the fact that doubling the speed increases the power required eight-fold. (See also Blowers.)
—B. F. STURTEVANT COMPANY, HYDE PARK, MASS.

GREEN-MATTEAWAN MECHANICAL-DRAFT APPARATUS. Many large power plants are now fitted with mechanical draft, which is especially favorable to the use of the Green fuel economizer, since, as the heat of the flue gases is no longer needed for draft, it may be used in heating feed water, while at the same time the economizer helps the fans, as it greatly reduces the temperature and volume of the gases to be handled.
—THE GREEN FUEL ECONOMIZER COMPANY, MATTEAWAN, N. Y.

STURTEVANT MECHANICAL DRAFT. Mechanical draft is produced by means of a fan and may be introduced either as forced draft or induced draft. It does what an ordinary chimney is incapable of doing. Its cost is from 20 to 40 per cent. of that of a chimney; its intensity permits of the burning of finely divided or low grade fuel; it makes possible the utilization of the heat of the flue gases which a chimney wastes in producing draft; it is independent of the weather; is automatically regulated to maintain constant steam pressure, decreases smoke, increases the capacity of an existing plant, and serves as an auxiliary to a chimney already overburdened; saves space and is portable.
—B. F. STURTEVANT COMPANY, HYDE PARK, MASS.

GREEN-MATTEAWAN STEEL PLATE EXHAUSTERS. Exhausters are distinguished by having only one inlet opening, which is on the side opposite from the bearings, while fans and blowers have an inlet opening upon each side. The exhausters are built with any style of discharge and with the bearings upon either the right or left hand side, as may be desired. The bearings of these exhausters are outside the casing and are not exposed to the action of the material handled, such as dust, hot air, flue gases or exhaust steam.
—THE GREEN FUEL ECONOMIZER COMPANY, MATTEAWAN, N. Y.

GREEN-MATTEAWAN STEEL PLATE FANS. The side plate and housing of these fans are made from a high grade of steel plates, carefully rolled true and flat. The angle iron frame to which the plates are riveted and bolted is so designed and braced as to give rigidity where most needed and prevent the plates from warping and buckling. Larger sized fans which it is necessary to take to pieces for shipment or for taking into buildings are specially constructed to facilitate erection.
—THE GREEN FUEL ECONOMIZER COMPANY, MATTEAWAN, N. Y.

MICA AND MICA COMPOUNDS

MICANITE. This covers a line of insulations made from exceedingly thin laminations of mica and an adhesive cement. The standard form is in flat sheets from .005 in. and upward, and in two grades: No. 1, for commutator rings, armature troughs, cylinders, tubes, etc., so that the adhesive cement softens under heat, and the plate is easily moulded; No. 2 for commutator segments and other purposes where moulding is not desirable. The company also manufactures flexible micanite, micanite cloth and paper, commutator rings and segments, armature troughs, field spools, tubes, etc. (See advertisement for other materials.)
—MICA INSULATOR COMPANY, NEW YORK.

SCHOONMAKER SOLID SHEET MICA. This mica, for electrical work, embraces white India, white domestic, green India, and Canadian amber. It can be furnished in uncut sheets, block mica or cut to any size, from 1 in. by 1 in. to 12 in. by 12 in. Segments can be furnished for any commutator, also mica washers or tubings, mica plate, flexible mica cloth or paper, insulating cloths and papers, and mica rings for any commutator can also be furnished.
—A. O. SCHOONMAKER, NEW YORK.

MOTORS, ELECTRIC

BULLOCK SMALL MOTORS AND GENERATORS. Small motors and generators, known as Type "N" and "B," are made by this company. The cast steel magnet yoke is cylindrical and the bearings carried in housings bolted to the yoke. Type "N" motors are designed especially for direct connection to machine tools. Either can be made semi-enclosed or totally enclosed by using suitable shields on the end housings. Slow speed "B" motors, open type, range in output from 1 h.p. at 1,100 r.p.m. to 25 h.p. at 775 r.p.m.; moderate speed-range from 2 h.p. at 1,800 r.p.m. to 35 h.p. at 1,175 r.p.m. Type "N" range in output from ½ h.p. at 300 r.p.m. to 100 h.p. at 900 r.p.m. Both types have laminated poles bolted to the magnet yoke.
—ALLIS-CHALMERS COMPANY, MILWAUKEE, WIS. (ELECTRICAL DEPARTMENT, BULLOCK ELECTRIC MANUFACTURING COMPANY, CINCINNATI, OHIO.)

BULLOCK BELTED TYPE DIRECT-CURRENT MOTORS AND GENERATORS. The standard belted motors and generators for direct-current, Types "H" and "HI," are made in sizes from 7.5 Kw. at 390 r.p.m., 120 volts, to 500 Kw. at 400 r.p.m., 500 volts. Machines having armatures 31 in. in diameter and over are provided with three bearings. In Type "H" machines, the brush rocker is carried on the bearing pedestal, while with Type "HI" it is carried by the magnet yoke. Both types have cast iron magnet yokes with laminated poles bolted in

place. "H" and "HI" machines are wound for standard pressures of 110, 240 and 500 volts.

—ALLIS-CHALMERS COMPANY, MILWAUKEE, WIS. (ELECTRICAL DEPARTMENT, BULLOCK ELECTRIC MANUFACTURING COMPANY, CINCINNATI, OHIO.)

BULLOCK CAR EQUIPMENTS, MOFORS, CONTROLLERS, ETC. This company makes railway motors of the usual standard sizes for operation on 500 volt direct current, and is prepared to furnish complete car equipments, including controllers, car circuit breakers, and other auxiliary devices. The motors, which are of modern design, include a number of new and desirable features. The controllers are very substantially constructed and are of the magnetic blow-out type.
—ALLIS-CHALMERS COMPANY, MILWAUKEE, WIS. (ELECTRICAL DEPARTMENT, BULLOCK ELECTRIC MANUFACTURING COMPANY, CINCINNATI, OHIO.)

CLEVELAND DYNAMOS AND MOTORS. The electrical machinery made by this company is direct current only, and ranges in capacity from eight to one hundred and fifty 16 C.P. lights and ½ h.p. to 10 h.p. The machines have cast iron frames, semi-enclosed, steel poles, toothed armature, reaction brush holders, and self oiling bearings.
—CLEVELAND ARMATURE WORKS, CLEVELAND, OHIO.

CROCKER-WHEELER MOTORS. Every power requirement in the machine or repair-shop can be readily met by one of this company's extended line of motors. During the past seventeen years it has developed a line capable of meeting the most intricate and exacting conditions. One of the most celebrated motors is the Form L, built for small power requirements. This form is described in the company's Bulletin No. 160.
—CROCKER-WHEELER COMPANY, AMPERE, N. J.

GENERAL ELECTRIC MOTORS. These motors are built for all kinds and conditions of service. The company's latest product for street railway service is known as the G.-E. 80. It is a 40 hp. motor combining all the best mechanical and electrical features of older designs, in addition to improvements of exceptional value. It has split bearings lubricated with oil and packed waste, large bearing surfaces, and wide gear and pinion faces. The gear case is suspended from three points, and extra large bolts are used throughout to insure strong and rugged construction. Cast-iron parts are eliminated.
—GENERAL ELECTRIC COMPANY, SCHENECTADY, N. Y.

INTER-POLE VARIABLE SPEED MOTOR. It appeals most strongly to electric railways as it is a variable speed motor which operates successfully on a 550 volt circuit. This enables repair shops to run their machine tools by electric drive, whether singly or in groups, as best indicated by conditions. It is claimed that the inter-pole motor is absolutely sparkless at any speed within its range, which in a 7½ hp. motor is from 300 to 1,200 r.p.m. and will not spark even under 100 per cent. overload. Its compactness, capacity and lightness are most remarkable when compared with other motors and an efficiency of from 91.5 per cent. at one-half load to 92 per cent. at three-quarter load needs no argument.
—THE ELECTRO-DYNAMIC COMPANY, BAYONNE, N. J.

STURTEVANT ELECTRIC MOTORS. Although these motors are built for independent service, a specialty is made of attaching them to fans which demand special combinations of speed and power. These motors are built in a line of bi-polar, four-pole and eight-pole types, dependent upon size and requirements. The enclosed type prevails for fan propulsion where there is considerable dust. They range in output up to 125 horse-power. The rigid specifications of the U. S. Navy Department, under which many fan motors have been constructed, have established an exceptionally high standard which is maintained in all work.
—B. F. STURTEVANT COMPANY, HYDE PARK, MASS.

WESTINGHOUSE DIRECT-CURRENT RAILWAY MOTORS. The application of electricity as a motive power on steam roads has created a demand for larger motors, so that now motors of 300 h.p. capacity and able to withstand considerable overload are being built by this company. A type of motor recently furnished the Pennsylvania, New York & Long Island R. R. has an output of 200 h.p., at 300 amps. and 550 volts. The armature alone weighs 1,980 lbs. and the motor complete 6,450 lbs. Up to the present time the Westinghouse Electric & Manufacturing Company has furnished approximately 75,000 railway motors, aggregating a total capacity of 2,500,000 h.p.
—WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY, PITTSBURG, PA.

WESTINGHOUSE INDUCTION MOTORS. Induction motors as a class are characterized by the ruggedness of their construction and the small amount of atten-

tion required in operation. The flexibility of the alternating-current system has brought these machines into great favor. This company manufactures these motors in a number of different types for both constant and variable speed work. Type CCL motors have the well-known squirrel-cage rotor, while the HN, HF and FX have secondary windings similar to those of a polyphase generator and have their speeds varied by inserting resistance in the secondary circuit.

—WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY, PITTSBURG, PA.

WESTINGHOUSE SINGLE-PHASE RAILWAY MOTORS. These motors do not differ greatly in appearance from the direct current series motors. A laminated core of steel punchings with inwardly projecting poles is held in a cylindrical frame of cast steel. The poles are wound with coils of heavy wire or copper strip, and an auxiliary compensating winding is also provided threaded through slots in the pole tips and field frame. All field and armature windings are in series. The armature differs but little in appearance from a direct current railway armature. These motors are made up to 225 h.p. and operate on line voltage as high as 6600. The controlling devices may be so arranged that a car may operate on alternating current when in the country and on direct current over city lines. (See advertisement.)

—WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY, PITTSBURG, PA.

WESTINGHOUSE STATIONARY DIRECT CURRENT MOTORS. Type S direct current motors are made from 1½ h.p. to 120 h.p. for 110, 220 or 500 volts, and with series, shunt or compound windings, for constant or variable speed, and for service on single, double or multi-voltage circuits. A wide range of speed may be obtained by shunt field control. They are used for the driving of machinery of every form. Type S motors may be either open, semi-enclosed or entirely enclosed. The three forms are convertible, which is a decided advantage where desirable to shift a motor from one place to another. These motors are easily adapted for wall or ceiling mounting. They may be arranged with back gears or vertical shafts, for direct connection or for driving by belts.

—WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY, PITTSBURG, PA.

MIRRORS FOR MOTORMEN

BROWN MIRRORS FOR MOTORMEN. These mirrors enable the motorman to see side of car to the rear platform without moving from his position or turning his head. They save money by preventing accidents caused by starting signals given by conductor while collecting fares inside of crowded cars. The mirrors are cork-cushioned and mounted on double spring hinges so as to swing clear when struck by vehicles or obstructions. (See advertisement.)

—HAROLD P. BROWN, NEW YORK.

MOVERS, CAR

(See "Pushers, Car")

MULTIPLE UNIT CONTROL

(See "Control Systems")

NUTS AND BOLTS

BLISS CROWN NUTS. The crown nut is made of very tough malleable iron, and is hexagonal in shape, having five or six prongs on the top, is tapped and threaded for standard dimensions, and faced on the underside. The nut is screwed home, and the cotter pin is then inserted through a hole in the bolt and between the prongs on either side of it, thus securely locking the nut from jarring loose. Lock washers are unnecessary with this nut. Nuts for ¾-in. and 1-in. bolts are carried in stock.

—E. W. BLISS COMPANY, BROOKLYN, N. Y.

COLUMBIA LOCK NUT. The nut consists of an inner and an outer part, which when assembled form a unit. The inner nut, which is threaded to receive the bolt, is slotted throughout its length and is tapered from above downward to fit and correspond with the taper of the outer or binding nut. The device is a combination of three mechanical powers—although only in two parts—the wedge, the screw and the lever. It is a positive lock nut which will remain indefinitely where placed; it automatically fastens both bolt and nut absolutely.

—U. S. METAL & MANUFACTURING COMPANY, NEW YORK, CHICAGO, PITTSBURG.

LORAIN TRACK BOLTS. Manufactured with button heads and oval necks and provided with either square or hexagonal nuts. (See advertisement.)

—THE LORAIN STEEL COMPANY, PHILADELPHIA, PA.

NATIONAL LOCK WASHER. This is a positive spring nut lock for use on all kinds of work. Over 310,000,000 have been used in railroad track alone. It is made for all sizes of bolts. Its use requires but one nut, and that will remain positively locked. A nut lock that does fasten a nut, not dependent on spring holding power alone.

—THE NATIONAL LOCK WASHER COMPANY, NEWARK, N. J.

SPIRAL NUT LOCK. This nut prevents the nut from screwing off the bolt. It is necessary for every bolt where it is important that the nut should stay in its proper position. It is made of special tempered steel wire of triangular shape and the spiral is made to conform to the angle of the United States standard thread, so that it grips the bolt independently of the nut; this prevents the nut from unscrewing off the bolt. This nut is guaranteed to grip the bolt.

—SPIRAL NUT LOCK COMPANY, NEW YORK

OILS

(See "Lubricants")

OILS, PAINT

SIPE'S JAPAN OIL. A self drying paint oil. Japan oil is not a substitute for linseed oil, but combines the good qualities of linseed oil with other products that add to the life of the paint. For binding and holding paints to either wood or metallic surfaces, it is claimed superior to linseed oil. On account of its elasticity and adhesive qualities, it will neither crack, blister nor peel off. Japan oil will stop and prevent rust if the surface is dry when coated. It forms a coating impervious to air and moisture.

—JAMES B. SIPE & COMPANY, ALLEGHENY, PA.

OIL AND WASTE SAVING MACHINES

OIL AND WASTE SAVING MACHINES. These machines are turbine engines with direct connected basket or waste receptacle in which the oily waste is placed to be reclaimed. The oil is separated from the waste by centrifugal force and the steam as the engine exhausts itself through the waste. The oil is then filtered, and the waste dried and used as new oil and waste. Operation requires thirty minutes and costs practically nothing as the engineer in charge of the power stations gives but a few minutes daily to the machine.

—OIL & WASTE SAVING MACHINE COMPANY, PHILADELPHIA, PA.

OIL FILTERS

(See "Filters, Oil")

OVERHEAD EQUIPMENT

(See Line Material.)

PACKING

DUVAL METALLIC PACKING. This packing is for engines using superheated steam. It is equally good for packing steel or cast iron plungers working in water or oil, and for accumulators. It has been used extensively on heavy pressures, from 500 to 1,000 lbs. per sq. in. The packing consists of fine composition wire coated with anti-friction metal, plaited into square form. Sections of proper length to form rings are cut off with hacksaw or wood chisel and after binding ends with light wire to prevent fraying are soaked in graphite and oil and laid in the stuffing box, the joints being broken. Duval packing has lasted over seven years without renewal. It is not recommended on brass rods.

—POWER SPECIALTY COMPANY, NEW YORK.

J-M PACKING. While the specialty of this company is asbestos packings, which include the well-known Kearsarge and Vulcanston materials, together with its latest production—Triplex sheet and Duplex hot water packing—it is prepared to meet the call for other packings, such as rubber, flax and cloth insertion goods. The company is always ready and willing to discuss packings for new conditions, its line of "specials" having often proved "a friend in need" to many engineers. (See advertisement.)

—H. W. JOHNS-MANVILLE COMPANY, NEW YORK.

METALLIC PACKING. This company's standard class No. 1 design of metallic packing for piston rods and valve stems of steam engines consists of two sets of packing arranged in tandem. By means of a ball and socket joint absolute flexibility is attained. This packing will give satisfaction if rod runs out of line. Friction and wear on rods are reduced to a minimum and rods are kept in perfect condition. Renewals needed only at long intervals and are easily made without disconnecting.

—THE UNITED STATES METALLIC PACKING COMPANY, PHILADELPHIA AND CHICAGO.

MORRIS FIBROUS BABBITT STEAM PACKING. This packing fits any stuffing-box regardless of size. It is as frictionless as oil and self-lubricating. This packing will not score or bind the rod and can stand any steam pressure up to 200 lbs. without fusing. It does not have to be taken out, as a little refilling in case of a leak is all that is wanted.

—ELMER P. MORRIS COMPANY, NEW YORK.

RAINBOW PACKING.

—PEARLSS RUBBER MANUFACTURING COMPANY, NEW YORK

SUPERHEATED STEAM BRONZE GASKETS.

These gaskets have been found to give excellent satisfaction in flanged joints of pipes carrying superheated steam. They are corrugated evenly with sharp ridges. The metal is well suited to high temperatures and has elastic properties tending to maintain tight joints.

—POWER SPECIALTY COMPANY, NEW YORK.

PAINTS AND VARNISHES

(See also Insulating Compounds.)

ATLAS PAINTS. These embrace I. X. L. paints for wood and iron; Atlas primer, which takes the place of oil or paste-wood fillers, and Atlas surfacers, to take the place of lead and oil surfacers for passenger cars.

—ATLAS RAILWAY SUPPLY COMPANY, CHICAGO, ILL.

ELASTIC INSULATING VARNISH. Designed especially for use on all types of armatures, field magnet and transformer coils where maximum elasticity is required. Break down about 900 volts per mil. Bakes in eight to ten hours at 190° F.

—STANDARD VARNISH WORKS—NEW YORK, CHICAGO, LONDON—OR INTERNATIONAL VARNISH CO., LTD., TORONTO, CANADA.

ELATEROID PRESERVATIVE COATING. The basic material of these preparations is obtained from natural deposits, and is a pure hydro carbon treated by new processes controlled by this company. In its physical and chemical features it closely resembles rubber, so that in the form of coatings it possesses great elasticity, ductility and durability. It contains no destructive or disintegrating element, and may be applied to or combined with any material or substance without injury or detriment thereto. Elateroid is manufactured in all degrees of hardness, ductility, pliability, melting point and cold test, and in its physical features and actions is susceptible to almost infinite variations and regulation, whereby it is readily adaptable to a great variety of uses and purposes. It also possesses great features of insulation, and by its closeness of composition and great adhesion, forms an impervious coating for the preservation of anything to which it may be applied.

—THE HYDRO CARBON MANUFACTURING COMPANY, DENVER, COLO.

ELECTRO BLACK FINISHING VARNISH. A black air-drying finishing and insulating varnish for use in the repair shops of large and small electric railways for painting over fields and armatures of railway motors and repairing slight breaks in insulation. Air dries in half an hour, has good insulating properties, is absolutely waterproof and does not become brittle or crack.

—STANDARD VARNISH WORKS—NEW YORK, CHICAGO, LONDON—OR INTERNATIONAL VARNISH CO., LTD., TORONTO, CANADA.

FLEXITE METAL PRESERVATIVE PAINTS.

These paints are for protecting metal and other surfaces exposed to the weather, dampness, salt air, water and corrosive gases. They are made from inert pigments, and the vehicle contains pure refined linseed oil in combination with one of the most refractory materials known. This is a natural substance, and it alone has shown itself to be an exceptional resistant to the conditions mentioned. Linseed oil alone dries to an absorbent film comparable in a sense to a sponge; its micro-structure is entirely altered when used in conjunction with the material employed. The dried films in these paints present a compact, homogeneous mass, which ensures the exclusion of moisture and destructive gases. These paints impart a highly lustrous coating, and will retain their gloss under long exposure. A hard coat will form within twelve hours under ordinary conditions.

—THE STANDARD PAINT COMPANY, NEW YORK.

GUTTA-PERCHA MICA STICKING VARNISH. Designed for use in making up flexible mica plate, etc. Air dries or may be baked at a low heat.

—STANDARD VARNISH WORKS—NEW YORK, CHICAGO, LONDON—OR INTERNATIONAL VARNISH CO., LTD., TORONTO, CANADA.

(CONTINUED ON PAGE XXXIII.)

PAINTS AND VARNISHES— Continued.

GUTTA-PERCHA BLACK FINISHING VARNISH. A black spirit varnish for use as a finishing coat on armatures and fields. Dries in the air in half an hour. Has good insulating properties and gives a glossy finish which will not fade. Is oil and water proof. Invaluable for use in brightening up fields and armatures of generators in central station lighting and power plants, because it can be applied to the fields and armatures of a dynamo and the machine may be started up in half an hour.

—STANDARD VARNISH WORKS—NEW YORK, CHICAGO, LONDON—OR INTERNATIONAL VARNISH CO., LTD., TORONTO, CANADA.

GUTTA-PERCHA COIL STICKING VARNISH. Designed especially for sticking varnished paper and cloth which is used for insulation on armature and field coils. Sets quickly and has excellent sticking qualities. Is not soluble in water and possesses good insulating properties.

—STANDARD VARNISH WORKS—NEW YORK, CHICAGO, LONDON—OR INTERNATIONAL VARNISH CO., LTD., TORONTO, CANADA.

GUTTA-PERCHA CLOTH VARNISH. An extremely elastic and durable varnish for coating cloth and paper for electrical work. Can be applied either by machine or by hand dipping. Break down 825 volts per mil.

—STANDARD VARNISH WORKS—NEW YORK, CHICAGO, LONDON—OR INTERNATIONAL VARNISH CO., LTD., TORONTO, CANADA.

GUTTA-PERCHA INSULATING VARNISH. A clear baking varnish used as a dipping varnish for armature coils, field coils, transformer coils, both air and oil cooked, magnet coils, etc. Break-down about 850 volts per mil. Requires from eight to twelve hours to dry under a temperature of 190 F., depending on depth of wire in coil.

—STANDARD VARNISH WORKS—NEW YORK, CHICAGO, LONDON—OR INTERNATIONAL VARNISH CO., LTD., TORONTO, CANADA.

GUTTA-PERCHA LIGHT FINISHING VARNISH. A spirit varnish designed for use on armatures and fields of rotary converters and generators when the windings are insulated in light varnish. It brightens up fields and armatures and greatly improves the appearance of all machines to which it is applied, besides reinsulating and providing an oil and weather proof coating. Dries in half an hour.

—STANDARD VARNISH WORKS—NEW YORK, CHICAGO, LONDON—OR INTERNATIONAL VARNISH CO., LTD., TORONTO, CANADA.

GUTTA-PERCHA QUICK DRYING VARNISH. A combined baking and air drying clear varnish of great elasticity for use on all classes of coil work where quick drying is required. Break down about 880 volts per mil. of thickness. Bakes in four to six hours at 190 F. Will air dry over night. Specially adapted for use by manufacturers who have limited baking facilities and for small electric railways and repair shops where baking ovens are not used.

—STANDARD VARNISH WORKS—NEW YORK, CHICAGO, LONDON—OR INTERNATIONAL VARNISH CO., LTD., TORONTO, CANADA.

HEAT RADIATING VARNISH. A varnish combining high insulation with superior heat conducting and radiating properties. Has high power of penetration and may be used as a dipping varnish for field, magnet spools and other windings. Reduces working temperature of windings through ability to conduct and radiate heat.

—STANDARD VARNISH WORKS—NEW YORK, CHICAGO, LONDON—OR INTERNATIONAL VARNISH CO., LTD., TORONTO, CANADA.

LUCAS PAINTS AND VARNISHES. These comprise a complete line of standard goods for the electric railway field as well as for general use. The company's coach and car colors, signal colors, station paints, enamels, car varnishes and Mirac varnish and paint remover are among the more prominent, but any of their products will be found equally satisfactory. This firm is one of the largest in the country, with a modern, well-equipped plant, whose output reaches every part of the world.

—JOHN LUCAS & COMPANY, NEW YORK, PHILADELPHIA, CHICAGO.

MACON LIGHT COLORED INSULATING VARNISH. A baking varnish possessing all requirements for perfect insulation. It is designed for use on armature coils, field coils, transformer coils, magnet coils, and wherever else a baking varnish should be used. It is a high insulator, very elastic and is not affected by the action of moisture or lubricating oils. It should be baked for eight

or ten hours at a temperature of from 175 deg. to 195 deg. (80 deg. to 90 deg. C.)

—MACON-EVANS VARNISH COMPANY, PITTSBURG, PA.

MIRAC VARNISH AND PAINT REMOVER. Almost instantly removes old varnish, shellac, enamel and paint from wood, iron and glass, leaving the surface clean and ready for finishing. Harmless to hands and not irritating to the eyes. It has no unpleasant odor. It is also an excellent brush cleanser; will not raise the grain or stain wood or injure hair or bristles of brushes. This material contains no ammonia, no alkali, water or acids, and is said to go much further and not evaporate like alcohol. Recommended for removing old paint, varnish, enamel, etc., from floors, furniture, front doors, store fronts, carriages, car blinds, inside shutters and exterior and interior wood, glass and iron work of all kinds. One gallon will remove from 250 sq. ft. to 300 sq. ft. of old finish.

—JOHN LUCAS & COMPANY, PHILADELPHIA, PA.

MORRIS INSULATING PAINT. Made for armatures, fields, switchboards, conduits, iron and wood poles, connections, mouldings, wires, cut-out boxes, lamp hoods, and all other kinds of electrical appliances where high insulation is desired. It contains no crude asphalts, tar, or other deleterious substances. It contains quick drying natural oils. It makes a lasting gloss equal to varnish; does not crack, blister or peel off; not affected by any extremes of climates, and loses none of its properties under 550 deg. to 600 deg. F. It is also a wood preservative. It will stand the action of any acids, alkalies, oils or salines, and is absolutely water repellant, thus preventing the absorption of oils and moisture and consequent lowering of insulation.

—ELMER P. MORRIS COMPANY, NEW YORK.

OHMLAC. A black insulating compound for dipping armatures and armature and field coils, possessing the remarkable property of being unaffected by continued high temperatures and consequently invaluable for the insulation of motors subject to heavy overloads. Contains no linseed oil and there is "no rotting" of the cotton covering of wires under continued high temperature. Quick drying, high insulation and great elasticity. (See advertisement.)

—EMIL CALMAN & COMPANY, NEW YORK.

SHERWIN-WILLIAMS SYSTEM OF CAR FINISHING. This consists of S-W primer and surfacer (foundation coats), S-W standard car body (for color coats), and S-W railway varnishes (roof or protecting coats), each made with special reference to its use with the other two. The logical result is a perfectly homogeneous and well-knit body of coats. This finishing insures maximum durability and a uniformly clear and smooth finish. Paints are also furnished for all parts of cars, buildings, poles, bridges, targets and machinery.

—THE SHERWIN-WILLIAMS COMPANY, CLEVELAND, OHIO.

S. P. C. ARMATURE AND FIELD COIL VARNISH. Made for armature and dynamo work. It gives a hard, glossy surface, and will not soften at a temperature up to 300 deg. It is absolutely moisture proof; a perfect insulator, and has elastic properties which will not allow it to crack or flake off.

—THE STANDARD PAINT COMPANY, NEW YORK.

S. P. C. FLEXIBLE IRON PAINT. A paint for bridges, water-tanks and all metal or woodwork exposed to the weather. For coating metal roofs and for the running gear of cars. It is weather-proof, elastic and resists acids and alkalies. It will not blister or peel.

—THE STANDARD PAINT COMPANY, NEW YORK.

STERLING PAINTS AND VARNISHES. Sterling black iron enamel and Sterling elastic iron finish black are especially adapted for use on iron and steel bridges, steel cars, buildings, roofs, signal towers, tanks, water and gas pipes, etc. Sterling black hull varnish is intended for the protection of metal work exposed to an unusual quantity of water, such as vessel hulls, pen stocks, etc. Sterling hot iron black is for use on flues, boiler fronts, smoke stacks, locomotive front ends, etc. The company's claim of merit for these materials is based upon the use of Sterling raw refined linseed oil in these paints. This oil is pure commercial raw linseed oil from which all those substances have been removed which cause linseed oil when spread on a surface to dry to a porous film. This linseed oil spread on a surface and dried is not porous. The pigments used in the above coatings are of the most durable nature.

—THE STERLING VARNISH COMPANY, PITTSBURG, PA.

THE STERLING VARNISH COMPANY, PITTSBURG, PA. In their recent treatise on "The Insulation of Electric Machines," (Whittaker & Company, 1905),

Turner & Hobart say: "One of the earliest firms" (The Sterling Varnish Company), "to enter this field brought out Sterling varnish, which enjoys a wide use. It would appear that the materials now supplied under that name are considerable improvements upon the original varnish placed on the market." This space is too limited to furnish a list of the company's products, much less to indicate their individual application. The company maintains a well equipped laboratory and a corps of specialists who are continuously engaged on insulating problems for the benefit of its customers as well as its own. (See advertisement.)

SUPERIOR GRAPHITE PAINT. A protection for metal surfaces against rust. Basis is an inert amorphous graphite which, being ground to exceeding fineness, insures an absolute protection for the elastic oil coating. A notable feature is its power to absorb rust or moisture on the metal, thereby arresting corrosion, which is otherwise liable to start under the paint skin. It is adapted for electric railways, especially upon bridges, structural steel in buildings, corrugated iron, poles, stacks, trucks, etc. It is also used extensively upon brick, stone, wood and canvas.

—DETROIT GRAPHITE MANUFACTURING COMPANY, DETROIT, MICH.

VOLTALAC AIR-DRYING VARNISH. A black plastic varnish of extreme durability, especially adapted for use on street railway motor armatures and field coils. Sets to handle in half an hour and coils insulated with it air dry sufficiently to assemble in two to four hours. It may also be baked in one-half the time in case of hurried work. Is a neutral product and may be used as a first coat next to copper on windings of high tension machines, without danger of corrosion. Remains plastic and withstands heat for an indefinite period. Is absolutely waterproof. Break down about 900 volts per mil.

—STANDARD VARNISH WORKS—NEW YORK, CHICAGO, LONDON—OR INTERNATIONAL VARNISH CO., LTD., TORONTO, CANADA.

VOLTALAC ELASTIC VARNISH. A black baking varnish of high and uniform insulation. Break down averages from 1,000 to 1,100 volts per 1-1,000 in. of thickness. Requires nine to twelve hours to bake, at a temperature of 200°F. Is strong and elastic, yet yielding and plastic, thus enabling coils to be assembled in armatures with a minimum of labor and without danger of breaking the insulating film of varnish. Resists long continued heat without becoming brittle, withstands the action of water, moisture and lubricating oil. Has high power of penetration, thus ensuring best results from heat conduction and radiation.

—STANDARD VARNISH WORKS—NEW YORK, CHICAGO, LONDON—OR INTERNATIONAL VARNISH CO., LTD., TORONTO, CANADA.

PANELS, SEAT END

BRILL OPEN CAR SEAT-END PANELS. Metal round-corner seat-end panels for open cars give more entrance space, and as there are no sharp projecting corners to strike the knees against and catch in dresses, passengers may get in and out more safely and quickly than with the old style. They enable the conductor to move more freely and safely along the running-board, and give him more space to stand while collecting fares. The double curvature of the panels makes them very strong, so that they aid materially in stiffening the posts and supporting the seats. Curtain grooves are cast in the panels, allowing the curtains to be drawn to the floor. (Advertisements in last pages.)

—J. G. BRILL COMPANY, PHILADELPHIA, PA.

—AMERICAN CAR COMPANY, ST. LOUIS, MO.

—G. C. KUHLMAN CAR COMPANY, CLEVELAND, OHIO.

—JOHN STEPHENSON COMPANY, ELIZABETH, N. J.

PARK ATTRACTIONS

THE AEROSTAT. A safe and sane circle swing. Consists of a six-leg steel tower, gusset plate bridge construction, over which is telescoped a solid steel cantilever crown truss with six or more radiating arms. The crown truss rests upon 153 1-in. steel balls each held by a special ball retainer, traveling in its own path between two case hardened plates. The cars are suspended from the crown truss arms and the safety of the passengers is in no way dependent upon any part of the machinery. A thirty-six passenger swing requires 6½ hp. to operate. No brakes are used, yet by the use of the controlling device, the swing can be brought to a dead stop without a jar in thirty seconds. The structure is an ornament to any park, and when lighted presents a magnificent spectacle.

—FEDERAL CONSTRUCTION COMPANY, CHICAGO, ILL.

AMERICAN BOX BALL VALLEY. This is an automatic bowling alley well suited for parks, aside from

its value as an indoor entertainment. No helper is required to set pins and return balls, as the pins are set by a touch of a lever and the balls return by gravity. The game is scientific, as one pin is not depended on to knock down another. Easily installed and portable. Strongly built of oak, and handsomely finished in the natural color. Regular lengths, 30, 36, 42 and 48 ft. always kept in stock.—AMERICAN BOX BALL COMPANY, INDIANAPOLIS, IND.

ARMITAGE-HERSCHELL MINIATURE RAILWAYS. The No. 1 miniature railway train made by this company draws twenty-four adults and is furnished with air brakes throughout; the No. 2 train is lighter and has air brakes only on the locomotive. These brakes are capable of stopping a loaded train at 15 m.p.h. in less than its own length. The locomotives usually employed for these trains develop 7.5 hp., at 15 miles per hour.

—ARMITAGE-HERSCHELL COMPANY, NORTH TONAWANDA, N. Y.

ARMITAGE-HERSCHELL RIDING GALLERIES. The merry-go-rounds made by this company are produced in great variety of forms at costs ranging from a few hundreds to thousands of dollars, the more expensive styles having elaborate carvings, organs and other attractive accessories.

—ARMITAGE-HERSCHELL COMPANY, NORTH TONAWANDA, N. Y.

AUTOMOBILE CYCLE SKATE. Among the improved skates made by this company, the automobile cycle skate deserves special mention. It has ball bearings, 5-in. rubber-tired wheels, metal parts of sheet steel and is finely nickel-plated. It appeals to both young and old, being adapted for use in skating rinks or on smooth sidewalks.

—CYCLE SKATE AND SPORTING GOODS COMPANY, NEW YORK.

AUTOMATIC GUM VENDING AND WEIGHING MACHINES. This company furnishes both the confection and weighing machines free of charge. In the case of the confection machine, the only obligation is to purchase and keep it filled with Huyler's chocolate and St. Nicholas gum, which is supplied by the company. In the case of the weighing scale, a liberal commission is allowed for the small space which it occupies. Both machines are entirely automatic, require no attention whatever, and may be placed nearly anywhere in parks and pleasure resorts, stations, waiting rooms, etc.

—THE AUTOMATIC VENDING COMPANY, NEW YORK.

BAYONNE ELECTRIC LAUNCHES. Pleasure grounds fortunate enough to contain a lake or to be located on a waterway will find a good source of profit in the hiring of electric launches. This company has built a great many motor boats for pleasure purposes, and believes that only an electrically operated boat can afford the safety so essential where most of the passengers are children.

—THE ELECTRIC LAUNCH COMPANY, BAYONNE, N. J.

BETHLEHEM PARK BENCHES AND TABLES. This company is one of the largest manufacturers in the country of outdoor benches, cafe tables, iron work for parks, lawns, gardens, waiting rooms, etc. The settees or benches and tables are made so as to be shipped complete in knocked-down shape and can be set up and finished by an ordinary workman at little cost. When not otherwise specified, all woodwork is of ash, oil finish, and iron painted dull black.

—BETHLEHEM FOUNDRY & MACHINE COMPANY, SOUTH BETHLEHEM, PA.

BIOGRAPH MOTION PICTURES. Originators of "The Horse Thief," "River Pirates," "Personal," "The Lost Child," "The Escaped Lunatic," "The Moonshiners," "The Chicken Thieves," "The Nihilists," and other great hits. This company furnishes its own and all other makes, and can offer either a complete service of machine, operator and films, or of films alone, and are also the sole manufacturers of the well-known penny-operated moving picture machine, the motoscope.

—AMERICAN MOTOSCOPE & BIOGRAPH COMPANY, NEW YORK.

EDWARD C. BOYCE, NEW YORK. Designs, erects and operates amusement resorts and individual devices; furnishes plans and specifications and superintends erection; or, builds under contract. Mr. Boyce is prepared to organize amusement corporations; furnish all or a portion of the necessary capital; or build for the company and base his charges upon the cost of construction, either estimated or actual. This service includes expert advice and the benefit of exceptional resources in matters of purchase of material, machinery, renting concessions, institution of operating systems, advertising and general

management. Many of the devices are patented and under his exclusive control. These are sold either outright or on royalty, granting exclusive territory. Mr. Boyce will submit a proposed arrangement with a suitable selection of devices, and give detailed estimates as to cost. Among Mr. Boyce's accomplishments are the erection of "The White City," Chicago, Dreamland, Coney Island, N. Y., and "The White City," New Haven, Conn.

BOYCE CANALS OF VENICE. This is considered one of the finest attractions in Dreamland, Coney Island. There are running through the interior of the building a quarter mile of canals which wind and encircle all of the most beautiful portions of this romantic city. Passengers are transported in gondolas by a swiftly moving current. The great plaza of St. Mark, the palace of the Doges, Rialto Bridge, Church of Santa Maria Della Salute, palace in which Desdemona lived, Bridge of Sighs and the open sea leading into the Adriatic are some of the many picturesque features of a trip through this beautiful attraction.

—EDWARD C. BOYCE, NEW YORK.

BOYCE FIGURE EIGHT ROLLER COASTER. As a five cent attraction, the figure eight or roller coaster has no equal in popularity and earning power. It is inexpensive in installation and its operating expenses are nominal. Can be planned to suit any shape of ground.

—EDWARD C. BOYCE, NEW YORK.

BOYCE SCENIC RAILWAY. A trip on the scenic railway consists of a ride in cars through 2,500 ft. of bewilderment. The cars in starting move slowly down a slight incline, where a cable run by electricity pulls them up to the highest point—about 40 ft., from which they run by gravity to the starting point. The passengers find themselves being dashed along down sharp inclines and up again, around corners, through caves of darkness and tunnels containing beautiful scenery, and lighted by many colored electric lights, until the passenger finds himself again at the starting point, with even a greater desire to patronize this always popular and attractive amusement.

—EDWARD C. BOYCE, NEW YORK.

BOYCE SHOOTING THE CHUTES. Few amusements of either modern or past times have enjoyed such widespread popularity as this well-known attraction. The fascination lies in a wild ride down the steep incline and the sensation of striking the water at full speed. Unlike the majority, this chute is equipped with a modern moving stairway which carries the passengers from the bottom to the waiting platform at the top.

—EDWARD C. BOYCE, NEW YORK.

BOYCE "THE BUMPS." The bumps is a merry-maker for spectators and participants alike. It consists of a slippery hard wood incline with various depressions and elevations. It can be installed at a very moderate expense.

—EDWARD C. BOYCE, NEW YORK.

BOYCE "THE GREAT COAL MINE." A visitor at the mine receives a ride of over one thousand five hundred feet in real coal cars. Starting on the street level a cable automatically picks up the cars and carries them up an incline, from the summit of which they run by gravity in a sinuous course through the mine, returning to the starting point. Descending into the mine, one sees all the typical sights of this great industry in full operation. It is extremely picturesque, intensely exciting and interesting.

—EDWARD C. BOYCE, NEW YORK.

BOYLESS BOWLING ALLEY. This is a five-pin bowling alley made in standard lengths of 40 ft. Its great advantage lies in the fact that no pin-boys are needed, as the pins are reset by pulling a lever near the bowler and the balls return by gravity.

—MATTHEWS-FAHL MANUFACTURING COMPANY, ST. LOUIS, MO.

CAGNEY MINIATURE RAILWAYS. This company has long been prominently identified in the construction of miniature railways. Its installation at last year's Louisiana Purchase Exposition proved one of the most profitable attractions. The locomotives and cars used are substantially built and are capable of being successfully operated on any length of straight or curved track.

—MINIATURE RAILROAD COMPANY, (CAGNEY BROTHERS), NEW YORK.

CIRCLE SWING. This device consists of a central pole around which torpedo shaped boats are arranged to swing. These boats are made of steel plates. In general, the whole structure is substantially built and will remain in absolute equilibrium even if the load is all on one side.

—EDWARD C. BOYCE, NEW YORK.

DOREMUS CIGAR AND CANDY VENDING MACHINES. An inexpensive, efficient and clean salesman, especially where it is not wise to carry a large stock. The machine is 8½ ins. long, 7 ins. wide by 13 ins. high, and is handsomely finished in oxidized copper or heavy nickel plate. The cigars are visible through plate glass and are obtainable only upon insertion of the proper coin. A valuable feature is the combination cigar cutter and match-box. A modification of this machine is adapted for selling candy and chewing gum.

—NEW YORK VENDING COMPANY, NEW YORK.

EAGLE LAWN SWINGS. Constructed entirely of high carbon steel, with the exception of the slats in the seats and platform, and can be easily and compactly folded. The chairs or seats can be quickly adjusted for any desired angle to suit the comfort of the occupants. The swing is built extra heavy for public use, and can be furnished in all cases with table or steel lead rests.

—A. BUCH'S SONS & COMPANY, ELIZABETHTOWN, PA.

FEDERAL CONSTRUCTION COMPANY, CHICAGO. Designs and installs novel amusements in street railway parks. Among its popular devices are the Velvet Coaster, Aerostat, Katzenjammer Castle, Mystic Rill, water chutes, roller coasters and helter-skelters.

HERSCHELL-SPILLMAN ENGINES FOR LAUNCHES. This company furnishes gas and gasoline engines for auto and marine use in sizes from 10 to 60 hp., four-cylinder. These engines are well adapted for pleasure launches.

—HERSCHELL-SPILLMAN COMPANY, NORTH TONAWANDA, N. Y.

HERSCHELL-SPILLMAN MERRY-GO-ROUNDS AND OCEAN WAVE GALLERIES. The products of this firm are so well known and so varied in style and character that it is unnecessary to attempt any detailed descriptions. The company has enjoyed a long experience in this field and is prepared to build any type of riding gallery suitable for the conditions given.

—HERSCHELL-SPILLMAN COMPANY, NORTH TONAWANDA, N. Y.

THE INGERSOLL COMPANY, PITTSBURG, PA. This company is prepared to build parks for electric railway companies and install the most suitable and profitable attractions. The Ingersoll Luna Parks at Pittsburg and Cleveland earned \$100,000 for the street railway companies in each of those cities this year. The company also builds for railway parks, or builds and operates "Figure 8" coasters, old mills, carousels, scenic railways and all other amusements.

INGERSOLL ROLLER COASTER AND LAUGHING GALLERY. The "Figure 8" roller coaster has made the name of this company known far and wide. Ever since its introduction the roller coaster has proved a splendid attraction, with the result that no modern pleasure ground can be said to be complete without one. The Ingersoll laughing mirrors form another one of this company's money-makers.

—INGERSOLL CONSTRUCTION COMPANY, PITTSBURG, PA.

KATZENJAMMER CASTLE. Fourteen structures of this type were built this season and every one is reported to have proved profitable. Reports from several Eastern resorts show the Katzenjammer Castle to be earning more money than many amusements costing much more.

—FEDERAL CONSTRUCTION COMPANY, CHICAGO, ILL.

KINETOGRAPH MOVING PICTURE MACHINE. This machine can be installed anywhere at a nominal cost, no advance outlay being required. The company can furnish a kinetograph outfit, an operator and a weekly change of film, or can sell the machine and supply a weekly change of film upon an attractive rental basis. These machines can be operated by any park employe of average intelligence. This company is agent for machines and films made by the Edison Manufacturing Company, now used in many parks.

—THE KINETOGRAPH COMPANY, NEW YORK.

KINGERY POPPING AND ROASTING MACHINES AND CREAM ACCESSORIES. This company manufactures peanut roasters, corn poppers, roasters and poppers combined, operated by steam, electric, spring and hand power. It also manufactures ice cream freezers, tubs, cans, cabinets, dishers, ice breakers, shavers, flavoring extracts, etc.

—KINGERY MANUFACTURING COMPANY, CINCINNATI, O.

KINODROME MOVING PICTURE EXHIBITION. This exhibition has already been used in electric

railway parks with satisfactory results. The Kinodrome is the apparatus used by the Western Association of Vaudeville Managers in the leading vaudeville theatres in the Central and Western States. It is an economical and popular attraction.
—GEORGE K. SPOOR COMPANY, CHICAGO, ILL.

KLEINE MOTION PICTURES. These pictures form a most popular and economical amusement for summer parks. The catalogue No. 2D published by the company contains an extended description of a great many interesting subjects besides detailed references to the apparatus used in connection therewith.
—KLEINE OPTICAL COMPANY, CHICAGO, ILL.

MELVILLE'S THEATRICAL BOOKING AGENCY. Electric railway companies owning parks have found it profitable to place the business of furnishing theatrical attractions in the hands of an experienced booking agent who has at command a wide range of theatrical talent. Mr. Melville is very prominent in this field as is shown by the fact that over fifty parks were in his circuit last year, enjoying the best summer attractions at minimum expense.
—FRANK MELVILLE, NEW YORK.

MILES MOVING PICTURES AND SONG SLIDES. The location of this company's New York office, together with its London and Paris connections, and San Francisco studio, places it in close touch with the largest manufacturers and best novelties in this field. Moving pictures to be permanently profitable must not only cover novel situations, but also be changed from time to time so that the public will not tire of them. The organization by this company of a moving picture circuit meets this demand very effectively.
—MILES BROTHERS, NEW YORK AND SAN FRANCISCO.

MILLS SLOT MACHINES. To enumerate the slot machines made by this company would mean to cover practically everything that has been found popular in this line. An idea of the company's manufactures may be obtained, however, by stating that these machines include the following: Illustrated song machines, auto-stereoscopes, phonographs, bag punchers, weighing machines, hat blowers and Cupid post office. The company is prepared to equip complete arcades.
—MILLS NOVELTY COMPANY, CHICAGO, ILL.

MORRIS FIGURE 8 TOBOGGANS AND MERRY-GO-ROUNDS. This builder has enjoyed long experience in the design and construction of up-to-date amusement contrivances. Among these are "Figure 8" toboggans and merry-go-rounds which he has built for many picnic grounds throughout the United States.
—E. JOY MORRIS, PHILADELPHIA, PA.

MULLINS STEEL BOATS. The obvious advantage of a non-sinkable boat is embodied in the steel boats made by this company. Thousands of this company's stamped steel boats are in use wherever boating is in favor because of their lightness, durability and safety.
—THE W. H. MULLINS COMPANY, SALEM, OHIO.

MUTOSCOPE. This is a standard slot machine showing moving pictures. The Mutoscope is exceedingly simple of operation and requires no expert attendance. All parts are interchangeable; it is mounted in a handsome iron cabinet. It has the safest device known for the care of money, and is supplied with register attachment when desired. The average equipment for a summer park is thirty machines, which will readily take in a dollar per day per machine.
—AMERICAN MUTOSCOPE AND BIOGRAPH COMPANY, NEW YORK.

NAUGHTON'S HOUSE OF TROUBLE AND LAUGHING GALLERIES. The specialties of this company as indicated by the above title are the "House of Trouble" and metal laughing galleries. Construction plans are sold by the company to enable park managers to install the necessary structures at minimum expense.
—J. M. NAUGHTON AMUSEMENT CONSTRUCTION COMPANY, COLUMBUS, OHIO.

THE PHILADELPHIA TOBOGGAN COMPANY, PHILADELPHIA, PA. This company has installed a large number of forest coasters, toboggan slides and riding galleries in prominent amusement resorts throughout the country. Its carousels are exceptionally popular on account of the well-carved figures and artistic decorations furnished.

QUAKER CITY TARGETS. Shooting galleries are an ever-popular attraction in picnic parks, but they can be made even more so by equipping them with attractive

targets. This company has made a specialty of this work and can furnish all kinds of amusing subjects, such as Punch and Judy, prize fighters, running rabbits, flying birds, etc.
—QUAKER CITY ARMS & TARGET WORKS, PHILADELPHIA, PA.

TRAVELER CIRCLE SWING FLYING MACHINE. This popular device is made up of a central steel shaft, to the hub of which projecting arms are attached. Cables for carrying small cars are suspended from these arms. The entire structure is revolved by an electric motor within the tower, the acceleration being so rapid that in less than a minute the passengers enjoy the exhilarating sensation of sailing through the air at high speed but with absolute safety.
—TRAVELER CIRCLE SWING COMPANY, NEW YORK.

UNION ROLLER SKATES. This company has been making roller skates ever since their introduction and is prepared to furnish them for park skating rinks in any desired quantity. The skates are made either in plain or ball-bearing models, but the latter are preferable for rink use as they run so easily.
—UNION HARDWARE COMPANY, TORRINGTON, CONN.

VELVET COASTER. This is a departure in pleasure railways. It has all the sensations of a scenic railway, without any noise or danger. No cast iron is used in the construction of the cars. All running parts are of phosphor bronze and hammered steel, cars are of handsome design upholstered in best wool plush. The Velvet Coaster has been pronounced by many who have ridden it as the most delightful ride ever invented. It is absolutely noiseless and runs as smooth as a cutter on new snow.
—FEDERAL CONSTRUCTION COMPANY, CHICAGO, ILL.

WINSLOW ROLLER SKATES. The renewed popularity of roller skating should prove a valuable source of income in parks equipped with a well-built skating rink. This company makes a very extensive line of skates both plain and ball bearing, with stationary and adjustable foot-plates. A popular style for rink use is the "Vineyard," No. 13, which has ball bearing web steel rolls.
—THE SAMUEL WINSLOW SKATE MANUFACTURING COMPANY, WORCESTER, MASS.

PAVING MATERIALS

ARTHUR'S "HUMP" RAIL BLOCK. This company manufactures rail blocks of all shapes for all kinds of track, and has for sale large quantities of paving blocks and bricks.
—MACK MANUFACTURING COMPANY, PHILADELPHIA, PA.

MARGINAL PROTECTING STRIPS. Toothed strips of cast iron for laying on inside edges of street railway track rails to prevent injury to asphalt pavement from movement of rails; strips are toothed to interlock with pavement and provided with toe checks to prevent slipping of horses.
—AMERICAN BRAKE SHOE & FOUNDRY COMPANY, MAHWAH, N. J.

U. S. WOOD BLOCKS. These blocks are of all-heart long leaf pine treated throughout with 22 lbs. of preservative mixture to the cubic foot instead of 10 or 12 lbs., as is the general practice. Especially suitable for street railroad work, because they are not injured like asphalt by oil drippings from cars, are not damaged by vibration of rails and are very easily removed for repairs to track. Will outwear granite block. Smooth, noiseless and sanitary. Booklets furnished on application.
—U. S. WOOD PRESERVING COMPANY, NEW YORK.

PHOSPHOR BRONZE

(See "Alloys")

PINIONS

(See "Gears and Pinions")

PIPE COVERINGS

(See "Coverings, Pipe")

PIPE FITTINGS

"BALLWOOD" WELDED PIPE FLANGES. This flange consists of a forged flange or collar placed on the end of a piece of wrought pipe, and the pipe and flange welded together. Then flanges are faced, back and edge turned off, and bolt holes drilled. By this method the flange is made an integral part of the pipe. Leaks between flange and pipe are thus eliminated. This joint is ideal for high pressures, and for air and gas. The flanges can be furnished on special lengths of pipe to blue print, and with any style of faces and of any thickness and diameter. Pipe bent to

special shapes and radii also furnished with this type of flange.

—THE BALL & WOOD COMPANY, NEW YORK.

CRANE PIPE FITTINGS.

—CRANE COMPANY, CHICAGO.

WAINWRIGHT EXPANSION JOINTS. A deeply corrugated copper tube which yields readily to compression. An expansion joint which never leaks. Used for vacuum, exhaust and high pressure lines.
—ALBERGER CONDENSER COMPANY, NEW YORK.

WALMANCO PIPE JOINT. This joint does not weep under the highest pressures. It has no threads or rivets; the flanges swivel.

—THE WALWORTH MANUFACTURING COMPANY, BOSTON AND NEW YORK.

PLANERS

(See Machine Tools and Woodworking Machinery.)

PLOWS, SNOW

(See Snow Plows and Sweepers.)

PNEUMATIC TOOLS

CHICAGO PNEUMATIC TOOLS. Pneumatic tools and appliances, of the Boyer, "Little Giant" and Keller types are used extensively in connection with street railway work and are of the latest and best types yet devised. They are extensively used throughout the civilized world. They are powerful, durable and efficient. Use air economically. They have so many unique features space will not permit enumerating them. (See advertisement.)
—CHICAGO PNEUMATIC TOOL COMPANY, CHICAGO, ILL.

POLES, TIES AND LUMBER

ABELES & TAUSSIG, ST. LOUIS, MO. Distributors of cross ties, switch ties, crossing plank, bridge and car timbers, white oak and cypress piling, cedar and cypress poles, and everything in heavy timbers for steam and electric railways or industrial plants. White oak 5 x 7 x 7 sawed ties carried in stock. The company owns 40,000 acres of virgin white oak timber, controls the output of good oak mills, and can furnish anything in its line. Heavy lumber and timbers a specialty.

THE F. BISSELL COMPANY, TOLEDO, O. Dealers in Michigan and Idaho cedar poles.

CHURCHILL CEDAR COMPANY, HERON, MONT. Producers and dealers in western cedar poles, posts, ties and piling.

JOHN H. FOWLER & COMPANY, CHICAGO, ILL. This company is prepared to furnish poles, ties, posts and piling in any desired quantity.

FRANCIS BEIDLER & COMPANY, CHICAGO, ILL. Specialists in the production and sale of live peeled white cedar poles.

GLENN-KLINE LUMBER COMPANY, PITTSBURG, PA. Chestnut, oak or cedar are used for the poles, ties, piling and posts made by this company.

GRAY TIE COMPANY, EVANSVILLE, IND. Manufacturer of oak cross ties for steam and electric railways.

LINDSLEY BROS. COMPANY, CHICAGO, ILL. The officers of the company are: President, G. L. Lindsley; Vice-President, C. P. Lindsley; Secretary and Treasurer, E. A. Lindsley. Wholesalers of cedar poles, cedar posts, cedar and oak ties. Also representing The Lindsley Bros. Company, Spokane, Wash., the officers of which are: President, C. P. Lindsley; vice-president, G. L. Lindsley; secretary and treasurer, E. A. Lindsley. Wholesale dealers in Western cedar poles, ties and piling; also fir piling.

H. H. MAUS & COMPANY, PHILADELPHIA, PA. Producers of ties, poles, cross-arms, brackets and pins for use in electric installations.

THE MORSE CEDAR COMPANY, SAGINAW, MICH. Dealers in cedar poles, ties, posts, flag poles, station yard posts and paving blocks.

T. J. MOSS TIE COMPANY, ST. LOUIS, MO. This firm carries on a large business in railway lumber, such as white oak, red oak, cypress and chestnut railroad ties, bridge ties, switch ties and piling.

WILLIAM MUELLER COMPANY, CHICAGO, ILL. Producers and dealers in cedar ties, posts and poles.

D. W. PHELAN, NEW YORK. Dealer in wooden cross-arms, pins and braces; octagonal or round yellow pine poles, chestnut or southern cedar poles, and yellow pine, oak or chestnut ties.

RABER & WATSON, CHICAGO, ILL. Dealers in Michigan cedar poles and posts, and ties of cedar, oak or chestnut.

SOUTHERN LONG LEAF PINE OCTAGONAL POLES. These poles are manufactured from long leaf yellow pine, sawed eight equal sides; base measurement from 8 ins. to 20 ins., with gradual taper, in any length from 20 feet to 65 feet. Painted, butts treated, tops coned. —SOUTHERN EXCHANGE COMPANY, NEW YORK.

SOUTHERN WHITE CEDAR POLES. These poles are furnished peeled of the bark, knots closely shaved, topped and butted with a saw. They have a large base measurement, grow very straight, with a gradual taper, and are entirely free from butt rot. —SOUTHERN EXCHANGE COMPANY, NEW YORK.

STANDARD TIE COMPANY, DETROIT, MICH. This company deals entirely in oak, cedar, cypress, chestnut and pine railway ties, telegraph poles, posts, shingles and switch ties. The main offices are at Detroit, but there are branches in New York, N. Y.; Paducah, Ky.; Au Train, Mich.; Duluth, Minn.; Ewart, Mich., and Chicago, Ill.

THE VALENTINE-CLARK COMPANY, CHICAGO, ILL. Cedar as well as steel poles are supplied by this company in any desired quantity for traction, light and other power purposes.

C. H. WORCESTER COMPANY, CHICAGO, ILL. This firm is a large producer and wholesaler in Michigan white cedar for telegraph and railway poles, piling, fence posts, railroad ties, shingles, etc. The company has worked out an excellent code as a means of enabling buyers to send telegraphic orders at minimum cost.

POLES, TROLLEY

COLUMBIA TROLLEY POLES AND WHEELS. The trolley poles are made of steel tubing and as light in weight as is consistent with strength. They also have almost a spring temper and therefore do not bend easily. The wheels are made of phosphor bronze, and some of them are recorded as having made eight thousand miles. —COLUMBIA MACHINE WORKS AND MALLEABLE IRON COMPANY, BROOKLYN, N. Y.

RECORDING FARE REGISTER COMPANY'S TROLLEY POLES. Corrugated, seamless, taper drawn steel poles. The principal feature of advantage is great strength combined with little weight, a 12-ft. pole weighing only 16 lbs. Also poles of standard types. —THE RECORDING FARE REGISTER COMPANY, NEW HAVEN, CONN.

SHELBY TROLLEY POLES. Made from cold-drawn seamless tubing. Each pole is tested by suspending 12 ft. from butt end, a weight of 40 lbs., which must not produce a deflection in pole greater than 12 in. After removal of weight, if pole does not return to its original shape, it is rejected. —THE GARFORD COMPANY, ELYRIA, OHIO.

POLES, METAL (STREET)

AMERICAN METAL POLES. Metal poles for electric railway service are furnished by this company. —AMERICAN BRIDGE COMPANY OF NEW YORK, NEW YORK.

CREAGHEAD POLES AND POLE FITTINGS. A complete line of fittings for iron or wooden poles designed to meet the requirements on either telephone, electric light, railway or high tension power transmission work, consisting of the following principal items: Malleable iron cross arms and insulator pins; pole tops, pole collars, pole bases; ornamental arc lamp poles and brackets; malleable iron high tension insulator pins, brackets and break arms. The high tension insulator pins are made of malleable iron and steel with threaded wooden thimble for insulator or with top to cement into insulators. All sizes for insulators from 500 to 50,000 volts. —THE CREAGHEAD ENGINEERING COMPANY, CINCINNATI, OHIO.

VOYNOW RE-INFORCING AND PROTECTIVE SLEEVE FOR METAL POLES. A simple, common-

sense, and very effective means for overcoming the weakened condition of metal poles caused by corrosion at the ground level. It doubles the strength and prevents such corrosion when applied to new poles. Such corrosion of poles has only lately been seriously recognized; investigation indicates that practically all metal poles which have been in use for ten years or more are fast approaching, in their present condition, the end of their usefulness. The Voynow sleeve, at a small cost, makes the pole as good as new without removing it from service. (Pole equipped with this sleeve illustrated in advertisement.) —WILLIAM D. GHERKY, PHILADELPHIA, PA.]

WIRE-LOCKED SWEDGED JOINT POLES. These iron and steel tubular poles have special wire-locked swedged joints. Pole joints so made they cannot be telescoped by overloading by the drop test, or in any other way. They caliper the same all over the joint, which is as smooth on the outside as the tubes of which the pole is composed, showing that the swedging is perfect. As the metal of the outer tubes is laid down on the inner tube it is upset and thickened the whole length of the joint, and not stretched out and thinned, as in the ordinary manner of swedging under the hammer. The edge of the outer tube at all joints is chamfered, so that water cannot rust and corrode the pole at these points. —ELECTRIC RAILWAY EQUIPMENT COMPANY, CINCINNATI, OHIO.

POLISHES, METAL

U. S. METAL POLISH. This material is well adapted for easily and effectively polishing all kinds of metal car trimmings. —GEO. W. HOFFMAN, INDIANAPOLIS, IND.

PRESSES, HYDRAULIC WHEEL

(See Machine Tools.)

PULLEYS, NON-METAL

ROCKWOOD PAPER PULLEYS. The chief merits of paper pulleys are stated to be as follows: Improved belt adhesion over iron and wood pulleys, economy resulting from absence of belt slipping and reduction in wear of shafting; superior strength and durability resulting from absence of shrinkage strains; no belt tightener required; perfect balance due to uniform density; better appearance, and cheaper and safer to transport as they are non-breakable and light. —THE ROCKWOOD MANUFACTURING COMPANY, INDIANAPOLIS, IND.

XYLOTITE PULLEYS AND FRICTIONS. Made of a tough, fibrous material to which a belt will cling. No slipping as with iron, wood or steel. The solid pulleys are especially adapted for dynamos and motors and are made in any size from two to sixty ins. in dia. with any width of face. The split pulleys have no equal for general shop use. The wear and tear on belts, shafting and hangers is reduced to a minimum, as all the necessary power can be transmitted with a slack belt. The frictions give a uniform drive without slippage and stand the most severe service. (See illustration in advertisement.) —THE XYLOTITE PRODUCT COMPANY, CINCINNATI, OHIO.

PRESSURE REGULATORS

FOSTER PRESSURE REGULATORS, CLASS W. The "Class W" pressure regulator is a "standard" device for obtaining a constant, uniform delivery pressure of steam, water, gas or air, irrespective of variations in the initial pressure or volume of delivery. The special features claimed for this valve are a compensating spring movement, insuring positive delivery; no small parts liable to clog, or pistons to stick; simple construction; easily adjusted; and reliable. Made screwed or flanged, for standard or extra heavy working pressures, in sizes ½ in. to 20 ins. —FOSTER ENGINEERING COMPANY, NEWARK, N. J.

FOSTER LOW PRESSURE REGULATORS, "CLASS Q," "CLASS QV" AND "CLASS QH" VALVES. Designed expressly for steam heating service, especially for vacuum systems. Will deliver as low as atmosphere but are not intended for service on steam exceeding 15 lbs. or on air above 25 lbs. In the "QH Class," the outlet connection is double the size of inlet, to permit use of larger distributing pipes on reduced pressure. —FOSTER ENGINEERING COMPANY, NEWARK, N. J.

FOSTER AUXILIARY PRESSURE REGULATORS. Reduce the initial pressure and maintain a constant, uniform delivery of steam, water or air. The "Class G" regulator can be adjusted to deliver from zero to within a small fraction of the initial pressure or will close off and hold tight where no steam, etc., is required. Operates

horizontally, vertically, inverted or at any angle; made in composition only, in sizes half-inch to ten inches. Specially designed for very exacting work and recommended where price is secondary consideration. —FOSTER ENGINEERING COMPANY, NEWARK, N. J.

PUMPS

(See also Condensers)

ALBERGER TWO-STAGE DRY VACUUM PUMPS. The result of experience in building condensing machinery for producing the high vacuums required in connection with steam turbines, vacuum pans, etc. With a two-stage pump 29 in. vacuum is maintained when the temperature of the water will permit. Air cylinders fitted with positive type equalizing suction valve which cuts out the voluntary discharge valve from vacuum at end of stroke, thereby causing easy seating and quiet running. Steam cylinders of smaller pumps fitted with plain slide valve gear, of larger pumps with Corliss gear. —ALBERGER CONDENSER COMPANY, NEW YORK.

ALLIS-CHALMERS SINGLE-STAGE CENTRIFUGAL PUMP. Fluids are elevated by means of the velocity imparted to them in passing through a rotating impeller. Impellers are made with curved vanes enclosed on either side and the material used is cast iron, bronze or acid resisting metal. Best adapted to low heads and large capacities, such as low service pumping in municipal water supply, sewerage and draining, pumping and irrigation. Impellers are arranged to take suction on one or both sides; the double suction impeller being in hydraulic balance requires no thrust bearing. All sizes have removable flanged covers permitting removal of impeller. —ALLIS-CHALMERS COMPANY, MILWAUKEE, WIS.

ALLIS-CHALMERS CENTRIFUGAL PUMPS, MULTI-STAGE. Same general construction as single-stage described herein. Casings made of cast iron in one piece; only the larger pieces being split. Including the single-stage pump, the capacities of a centrifugal pump range from 600 gal. to 150,000 gal. per minute. Designed for heads from 500 to 2,500 feet. Driven by direct connection, gearing, belting or ropes. Multi-stage pumps specially adapted to high heads with moderate and small capacities, where low first cost or compactness is of more importance than high economy under continuous operation, and are used for fire protecting service, etc. —ALLIS-CHALMERS COMPANY, MILWAUKEE, WIS.

W. H. BLAKE PUMPS. Absolute certainty of action is insured in these pumps, for the valve mechanism is actuated solely by direct boiler pressure, and is not dependent upon an adjustable arrangement of levers and rods connected to the piston. With the latter arrangement there are certain points in the stroke where the valves are not directly controlled but momentum is relied upon to reverse the valve gear. With the special steam actuated valve motion a full, even stroke is maintained under all conditions of duty. The waste room of an uncompleted stroke is reduced to the least possible amount for proper cushioning. These pumps are composition fitted throughout, both the water and air cylinders are lined and a Tobin bronze piston rod is used. They equal in economy the best engine construction. —W. H. BLAKE STEAM PUMP COMPANY, BOSTON, MASS.

CONOVER COMBINED AIR AND CIRCULATING PUMP. The air pump is large enough to do its work when the circulating pump is running at its lowest speed. If desired to increase the speed of the circulating pump, the air pump takes less water at each stroke on account of running faster, that is, reduces the mean effective pressure in direct proportion to the speed. By simply running the apparatus at the proper speed for the circulating pump, the air pump will take care of the air automatically. —WATSON MACHINE COMPANY, PATERSON, N. J.

DEMING PUMPS. The pumping machinery of this type is adapted for operation by any power. Styles manufactured embrace single and double-acting triplex pumps for various services, power deep well working heads, artesian well cylinders, as well as rotary and centrifugal pumps. —THE DEMING COMPANY, SALEM, OHIO.

GENERAL ELECTRIC PUMPING SETS. Are supplied in both piston and turbine types. The direct current current motors on piston pumps are wound for low speed so that they can be belted without interposition of noisy gearing. Induction motors can also be used to drive this type of pump. The turbine pump is direct connected to the motor, thus making a neat, self contained apparatus. Alternating current equipments can also be supplied. When used in connection with storage tanks, the General Electric

Company is prepared to furnish an automatic device for starting and stopping motors.
—GENERAL ELECTRIC COMPANY, SCHENECTADY, N. Y.

STEAM PUMPS.

- HENRY R. WORTHINGTON, NEW YORK.
- THE GEORGE F. BLAKE MANUFACTURING COMPANY, NEW YORK.
- KNOWLES STEAM PUMP WORKS, NEW YORK.
- DEANE STEAM PUMP COMPANY (OF HOLYOKE), NEW YORK.
- SNOW STEAM PUMP COMPANY, NEW YORK.
- LAIDLAW-DUNN-GORDON COMPANY, NEW YORK.

SMITH-VAILE BOILER FEED PUMPS. These are duplex pumps provided with removable water cylinders and adjustable packed water plungers, permitting compensation for wear. At a small additional cost brass-lined water cylinders are furnished, with brass or brass covered piston rods and composition plungers. The water valves are made of rubber, composition rubber or brass, as the service requires. For pressures below 125 lbs. internally packed pumps may be used, but for pressure above that the outside packed plunger type is recommended.
—PLATT IRON WORKS COMPANY, DAYTON, OHIO.

SMITH-VAILE SINGLE-ACTING TRIPLEX PUMPS. When power from shafting or electric motors is conveniently available, these pumps will show a great saving in cost of operation over direct-acting steam pumps. When used for boiler feeding an automatic by-pass may be applied to regulate the supply of water. The plungers are outside packed, rendering leakage at once visible and easily remedied.
—PLATT IRON WORKS COMPANY, DAYTON, OHIO.

WHEELER PUMPS. Pumps for moving water and producing a vacuum in connection with condensing systems are of many types and kinds. Different manufacturers have brought out special lines of pumps to suit different requirements. In connection with its condenser practice, this company has had a long experience with water pumps, of both the plunger and centrifugal types, and for vacuum purposes. A line of improved vacuum pumps has also been produced. These are manufactured in many sizes, either for steam-driven or motor-driven units, and careful attention is given to adapting the kind best suited for the work proposed.
—WHEELER CONDENSER & ENGINEERING COMPANY, NEW YORK.

PUMP GOVERNORS

FOSTER PUMP GOVERNORS. This piston actuated pump governor is controlled wholly by the discharge pressure from the pump. The water acting on a piston tends to close the steam valve against the tension of a spring. The points claimed for this governor are durability, close and reliable regulation. Made in sizes from ½ in. to 5 ins. Sizes up to and including 2 ins. are made wholly of steam metal, larger sizes have iron bodies and composition interiors. Renewable seats.
—FOSTER ENGINEERING COMPANY, NEWARK, N. J.

WILLIAMS PUMP GOVERNOR. In the building of this governor absolute simplicity was the aim, consequently there is an entire absence of weights, cups or pistons. The spring used is tempered to permit wide ranges of tension without loss of resiliency. The adjustment is simple; to resist steam pressure and raise water pressure two nuts are taken up under the spring rider and to obtain the opposite condition the operation is reversed.
—THE WILLIAMS GAUGE COMPANY, PITTSBURG, PA.

PUNCHES, TICKET

AMERICAN TICKET PUNCHES. The styles of punches made by this company embrace a large variety for practically every case where punches are needed. The conductors' ticket punch made by this company is called the "Hoole" and enjoys wide use on American railway systems.
—AMERICAN RAILWAY SUPPLY COMPANY, NEW YORK.

MEYERS' TICKET PUNCHES. In offering this punch to railways, the manufacturer does so with the conviction that when its various practical advantages are once known it will become the favorite punch in use. The best materials are used in this punch; but no matter how good a spring may be, the chances are that it will break some time. This punch solves the problem. The spring can be removed or replaced by a new one, by merely springing it into place. No rivets, screws or other devices for holding spring in place. It is only necessary to pass the short end through

the eye, then insert in small hole, and spring the other end in place.

—THE FRED. J. MEYERS MANUFACTURING COMPANY, HAMILTON, OHIO.

SAYRE PUNCHES. The styles numbered 420 to 438 are the "Open Sight" class that are especially adapted for street railways. They are all steel tools. The manufacturers have a list of 1,065 different dies. The "Duplex" punch is meeting with great success where commutation tickets are used. It punches a die in any part of the ticket, or cuts a piece from the edge. The Reservoir punch is claimed the strongest and neatest in the market. All of these tools are made of the finest material and best workmanship.
—L. A. SAYRE & COMPANY, NEWARK, N. J.

TICKET PUNCHES. Twenty-two styles made with 1000 different designs of dies.
—THE RECORDING FARE REGISTER COMPANY, NEW HAVEN, CONN.

WOODMAN PUNCHES. These punches are made in a wide variety of forms and dies for conductors' work and all other purposes where a convenient cancelling device is needed. They are made of cast steel for more than 500 dies.
—THE R. WOODMAN MANUFACTURING & SUPPLY COMPANY, BOSTON, MASS.

PURIFIERS, FEED WATER

(See "Heaters and Purifiers")

PUSHERS, CAR

THE EASY CAR PUSHER. This device consists of a steel bar, a malleable iron shoe, a tool steel bit and a fine steel spring. The total weight is 20 lbs. and the length 5½ ft. The heel has lugs extending downward on both sides of the rail so as to hold it firmly in position and prevent its slipping sideways. The triangular bit or steel cuts into the rail when pressure is applied and prevents slipping backward, even though the rail is icy, greasy or wet. This bit can be inverted. Each one has three sharpened edges. When the pressure is released, the steel spring lifts the steel bit from the rail, thus preventing it from being dulled by sliding over the rail when following the wheel.
—THE R. WOODMAN MANUFACTURING & SUPPLY COMPANY, BOSTON, MASS.

RACKS, BASKET

"REX" BASKET RACKS. This company has patterns for manufacturing one hundred and ninety-eight different styles of racks, all made with a view of being ornamental as well as strong and durable to withstand the uses to which they are subjected. Its recent efforts in making a continuous rack, which style is now very much used, have resulted in one known as the "Rex" rack. This is so constructed that it can be secured in place and each section independent of any other section can be removed without disturbing the brackets or connecting rods, which feature commends itself very strongly when replacing broken sections, or when desiring to refinish same. This rack is made with either bronze rod or wire cord bottoms.
—THE DAYTON MANUFACTURING COMPANY, DAYTON, O.

RAILS

(See "Trackwork")

RAIL BENDERS

(See "Benders, Rail")

RAIL BONDS

(See "Bonds, Rail")

RAIL JOINTS

(See "Joints, Rail")

RAIL WELDING

(See "Joints, Rail")

RATTAN

"AMERICAN" SWEEPER RATTAN. This is a natural growth rattan of suitable diameters, furnished in natural long straight bundles of about 67 lbs.; also cut to any desired length and put up in bundles of about 50 lbs. each. Owing to the severe usage which the sweeper rattan receives, the best quality only should be used, so as to pro-

vide the desired service. Practical experience has evidenced that cheap rattan is utterly unfit for sweeper purposes. This company makes a specialty of furnishing a high grade select quality for sweeper purposes.

—AMERICAN RATTAN & REED MANUFACTURING COMPANY, BROOKLYN, N. Y.

BRILL RATTAN FOR SWEEPERS. An ample supply of rattan in all lengths is kept in stock ready for prompt shipment. Complete sets of segments for Brill brooms, or single segments, made and filled at short notice.

- J. G. BRILL COMPANY, PHILADELPHIA, PA.
- AMERICAN CAR COMPANY, ST. LOUIS, MO.
- G. C. KUHLMAN CAR COMPANY, CLEVELAND, OHIO.
- JOHN STEPHENSON COMPANY, ELIZABETH, N. J.

BRILL WOVEN RATTAN FOR CAR SEATS.

These companies manufacture lined and unlined woven rattan in all widths and lengths. Their improved processes insure a closely woven and durable seating material. Only the best selected hard cane is used.

- J. G. BRILL COMPANY, PHILADELPHIA, PA.
- AMERICAN CAR COMPANY, ST. LOUIS, MO.
- G. C. KUHLMAN CAR COMPANY, CLEVELAND, O.
- JOHN STEPHENSON COMPANY, ELIZABETH, N. J.

HALE & KILBURN RATTAN COVERING. A clean, sanitary and durable seat covering for upholstered car seats. This material consists of high grade enameled rattan, reinforced with heavy canvas lining, cemented to the underside of the rattan by the Hale & Kilburn special waterproof cement. This popular material was the invention of this company, and the manufacturers and headquarters for its supply. The twill weave hard enameled rattan is the most generally used and best adapted for electric railway service, the silicate surface having a tendency to shed the dirt rather than absorb it, as in the case of soft chair cane, sometimes used.

—THE HALE & KILBURN MANUFACTURING COMPANY, PHILADELPHIA, PA.

MORRIS RATTAN FOR SWEEPERS. This brand of sweeper rattan is imported direct from India.
—ELMER P. MORRIS COMPANY, NEW YORK.

REGISTERS AND REGISTER FITTINGS

INTERNATIONAL REGISTERS. Distinctive features are: Seamless drawn case fitting bed plate rim and locked by a signature seal, preventing access to the mechanism without destroying the seal. Red blind covering trip figures during both registration and cancellation, thus clearly showing incomplete operations. Totalizer self contained and riveted up, so reading cannot be changed when register is open. Separate bell and mechanism chambers, one open to let sound out, the other closed to keep dust out. Secure and convenient fastening of register to back, preventing accidents and facilitating handling. Interchangeable parts that must pass limit gages before assembling, thus greatly facilitating repair. Parts made of cold rolled steel, hardened where necessary, resulting in unusual durability. (See advertisement.)
—THE INTERNATIONAL REGISTER COMPANY, CHICAGO, ILL.

INTERNATIONAL AND NEW HAVEN REGISTER FITTINGS. Cord and rod fittings for register operation made in a great variety of styles and shapes, of a very strong and durable bronze, having a larger percentage of copper and tin than is usually put into car fittings, and finished, polished or dipped, as desired. The cord fittings include the usual pulleys, guides, anchors, etc., and the rod fittings are divided into three classes: New Haven, designed for use with the flat sided round steel rod; International Round, for the ordinary round rods, and International Square, for square steel rods. The first two classes are interchangeable but the last can be used only on the square rods, and is the most substantial of the three, though costing a little more. (See advertisement.)

—THE INTERNATIONAL REGISTER COMPANY CHICAGO, ILL.

MORRIS REGISTER FITTINGS. Castings and fittings made for fare registers.
—ELMER P. MORRIS COMPANY, NEW YORK.

NEW HAVEN REGISTERS. Made in many types, single, double, triple and either round or square. The square types have ornamental solid bronze cases and the round types spun brass cases, both finished in antique copper. All have aluminum face dials, ten sided lithographed trip wheels, and simple, durable mechanism similar in design in the various types. Trip counters show number of trips made. A conspicuous red shutter covers the trip figures during registration and calls attention to

any failure to complete the operation. Trip figures read to 999. Operation is by either cords or rods from the same back from one or both sides of the car. (See advertisement.)

—THE INTERNATIONAL REGISTER COMPANY, CHICAGO, ILL.

OHMER FARE REGISTERS. These registers are made for registering and indicating separately, different classes of fares as collected, and printing a record of each class at the end of each half trip or trip (just as desired) together with the register number, trip number, day and date, and the badge number of the conductor. Four new types of two-fare recording registers have just been completed. They are especially strong machines, easy to operate, and have many new features.

—OHMER FARE REGISTER COMPANY, DAYTON, OHIO.

RECORDING FARE REGISTERS AND REGISTER FITTINGS. Recording registers made in three styles and with practically unlimited recording capacity. Automatically records the direction of the trip, the number of trips made during the day, the number of the register, and the number of fares registered on each half trip. This machine prints a reading of the face of the register so the register can be checked instantly with the conductor's report, absolutely without any calculations. Plain register, same general design as the recording registers, but without the recording feature. Fittings for round or square rods.

—THE RECORDING FARE REGISTER COMPANY, NEW HAVEN, CONN.

RIDLON REGISTER FITTINGS AND CAR TRIMMINGS. This company manufactures a full line of standard register fittings, carrying the same in stock. Special fittings or trimmings made from specifications drawings or models.

—FRANK RIDLON COMPANY, BOSTON, MASS.

SECURITY RECORDING FARE REGISTERS. These registers take out of the hands of employees the making of a single register record, and besides saving this expense an absolute report is obtained of every fare rung up, without requiring further verification. The machines, while operated exactly like an ordinary register, print a full statement of the fares rung up, the number of the conductor who rang them, the number of the register, the half-trip records and the number of fares for which each conductor who was on the car is responsible. Every register is so arranged that the motorman and inspector can register their presence on the car. Not a single fare can be registered on this register without the identity of the man ringing it being given.

—THE SECURITY REGISTER COMPANY, ST. LOUIS.

—GILES S. ALLISON, NEW YORK.

STERLING FARE REGISTERS. The single registers made by this company, are Nos. 1, 3, 5, 7; the double registers, Nos. 2, 4, 6; and the printing registers, Nos. 8, 9, 10, 11. Portable registers and register fittings, including patent detachable handles, are also made. Sterling registers embody the greatest ingenuity, simplicity, accuracy and durability, with latest and original improvements.

—STERLING-MAKER COMPANY, NEWARK, N. J.

WOODMAN HAND TALLY REGISTER. This is a hand register held by passing one of the fingers through a ring on the back and operated by depressing a pusher with the thumb. These little registers are positive in their action, and can be set to zero at will. They are simple in construction, can be carried in the pocket, are about the size of an ordinary watch, and weigh about 4 oz. They are used by railroad men for checking or tallying ties, telegraph poles and passengers, all kinds of freight, etc. In fact they can be used for any purpose where a correct count is desired.

—THE R. WOODMAN MANUFACTURING & SUPPLY COMPANY, BOSTON, MASS.

REGULATORS, CONTROLLER

(See "Controller Regulators")

REPAIR WORK

(See also Armature and Field Coils.)

CHATTAHOOGA ARMATURE WORKS, CHATTANOOGA, TENN. These Works repair anything from an old brush arc to a modern turbine generator. Can handle anything up to six tons in their shop, and have competent and expert men to send out on larger work. Also build switchboards in accordance with the Underwriters' requirements.

CLEVELAND ARMATURE WORKS, CLEVELAND, OHIO. At these works everything in connection

with an electric motor, dynamos or generator is repaired, armatures rewound, reshafed, coils rebuilt, new shafts, end plates and collars for armatures furnished, armature coils of all kinds made, commutators new, refilled and assembled. Field work a specialty.

COLUMBIA MACHINE WORKS AND MALLEABLE IRON COMPANY, Brooklyn, N. Y. Manufacturer of armature coils, field coils, journal bearings, bells, gongs, brakes, castings, commutators, trolley poles and wheels; also carry on hand all kinds of electric railway repair work.

CHAS. E. DUSTIN COMPANY, NEW YORK. See item under Second Hand Equipment.

FORD ELECTRIC & MANUFACTURING COMPANY, ST. LOUIS MO. This company has installed coil winding and other machinery of a kind enabling it to carry out the best class of rewinding and other repair work. It also has facilities for handling heavy machinery.

DITTRICK & JORDAN ELECTRIC COMPANY, CLEVELAND, OHIO. This company specializes in the manufacture of armature coils and field coils; it also rewinds armatures, reshafes commutators, repairs commutators and does all sorts of electrical repair work. The company has recently increased its facilities and is in shape to send experienced men to distant points to repair large machines, if desired.

JORDAN BROS., NEW YORK. This firm does general electrical and mechanical work, including dynamos, motor and lamp repairs, and keeps a large stock of electrical supplies on hand such as carbon and wire brushes. Among its specialties described in the dictionary are the commutator truing device and signal system. A large stock is kept of new and second hand dynamos and motors.

MORRIS REPAIR WORK. All classes of electrical repair work handled by this company.

—ELMER P. MORRIS COMPANY, NEW YORK.

REPAIR WORK. These companies have patterns and facilities for duplicating parts of all cars and trucks of their manufacture at short notice. It is only necessary to have the name of the original purchaser, date of purchase and name of part, to enable the companies to supply it without further information. For parts of cars or trucks of other makes, a sketch, blueprint or sample of the part will be necessary. Everything is made that cars and trucks are built with, from the smallest piece to an entire roof, a journal box lid to a side-frame.

—J. G. BRILL COMPANY, PHILADELPHIA, PA.

—AMERICAN CAR COMPANY, ST. LOUIS, MO.

—G. C. KUHLMAN CAR COMPANY, CLEVELAND, OHIO.

—JOHN STEPHENSON COMPANY, ELIZABETH, N. J.

FRANK RIDLON COMPANY, BOSTON, MASS. This company has a large and well equipped repair shop with facilities for handling all classes of electric machinery from the largest generators to the smallest motors. Armatures and fields rewound, and commutators refilled.

ROSSITER-MacGOVERN REPAIR WORK. In addition to making all classes of armature and field coils, commutators, etc., this company also has the best facilities for carrying out repair work of every description.

—ROSSITER, MacGOVERN & COMPANY, BOSTON, NEW YORK, ST. LOUIS.

VAN DORN-ELLIOTT REPAIR WORK. This company has a thoroughly equipped repair shop for handling repair work. Its armature repairing department is equipped to rewind, repair, reshaf and rebuild armatures, from the smallest to the largest. The commutator department is equipped with the latest devices for refilling and repairing commutators quickly and satisfactorily. (See advertisement in this issue.)

—THE VAN DORN-ELLIOTT ELECTRIC COMPANY, CLEVELAND, OHIO.

WOOD REPAIR WORK. This company makes a specialty of high-class repair work for electric railway work, such as rewinding armature and field coils, repairing commutators, etc.

—CHARLES N. WOOD ELECTRIC COMPANY, BOSTON, MASS.

REPLACERS, CAR

BUDA CAR REPLACERS. These replacers are made in two sizes for rail 100 lbs. and under and 60 lbs. and under. Are arranged for easy and gradual ascent doing away with injury to equipment. No abrupt arches

on ends of replacers. Deflection to rail absolutely certain. A groove to receive flange of wheel allows tread to engage replacer, avoiding damage to flange, and the sloughing of replacers.

—BUDA FOUNDRY & MANUFACTURING COMPANY, CHICAGO, ILL.

KALAMAZOO LOCOMOTIVE AND CAR REPLACERS. Made from 9.16 in. pressed steel and guaranteed to re-rail the heaviest locomotives. Easily handled by one man. The No. 1 replacer, weighing 160 lbs. per pair, is for 6 in. rail; the No. 2 replacer, weighing 150 lbs. per pair, is for rail from 4½ to 5½ ins. high, and the No. 3 replacer, weighing 50 lbs. per pair, is for any rail under 4½ ins. high.

—KALAMAZOO RAILWAY SUPPLY COMPANY, KALAMAZOO, MICH.

SNOW CAR REPLACERS. These replacers require no clamps, and frogs will not turn over or push away from rails. They clear brake hangers, brake levers and sand pipes, and can be placed parallel or at angle to rails, according to position of derailed trucks, and they will not break wheel flanges. They are reversed by simply moving the tongue in one frog; and being wedge-shaped they can be placed well underneath the derailed wheels. Size No. 1 A, made of basic open hearth steel, weighing 235 lbs. per pair, is for wreck cars and 90 to 100 lb. rails; No. 1, the standard replacer, weighing 210 lbs. per pair, is for general use with heavy engines and cars; No. 2, same exactly as No. 1, but made of air furnace malleable iron instead of steel, weighing 160 lbs. per pair, and suitable for light engines, caboose equipment, etc.; No. 3, made of air furnace malleable iron, weighing 120 lbs. per pair, for traction companies.

—WENDELL & MacDUFFIE, NEW YORK.

VICTOR CAST STEEL CAR REPLACER. Made in various types to suit different service conditions. No. 1, weighing 110 lbs. per set, for elevated railroads and where grade rails are used; No. 2, weighing 185 lbs. per set, for standard steam railroads and for use on 100 lb. rails and under; No. 3, weighing 38 lbs. per set, for paved streets and conduit lines; No. 4, weighing 136 lbs. per set, for electric and steam railways using rails 5 ins. high or under.

—U. S. METAL AND MANUFACTURING COMPANY, NEW YORK, CHICAGO, PITTSBURG.

RESISTANCES, WIRE AND TUBE

GENERAL ELECTRIC RAILWAY RESISTANCES. In general these are of two types: "C G" and "T." Type "C G" rheostats are made up of 18 to 24 cast iron grids assembled on insulating rods between end frames which are provided with feet. All insulation used is of mica and creeping surfaces are made as wide as possible. Cast grid rheostats are used in the main or motor circuit. Type "T" rheostats are made of resistance tubes supported between end frames. The tubes are composed of galvanized steel insulated with mica upon which a non-corrosive resistance is wound. There are no soldered joints, all connections being clamped. The wound tubes are treated with an enamel varnish. Covers completely encasing the tubes are provided where required. These rheostats are used in the control circuit of the train control system.

—GENERAL ELECTRIC COMPANY, SCHENECTADY, N. Y.

SIMPLEX CAST GRID RESISTANCES. These resistances are mounted so as to form rigid and thoroughly insulated units for street railway or power purposes.

—SIMPLEX ELECTRIC HEATING COMPANY, CAMBRIDGEPORT, MASS.

SIMPLEX ENAMELED METAL TUBES. These tubes are made for headlights, electro-magnets, and all uses requiring a high resistance in a small, compact and durable form. These units are made by imbedding resistance in enamel fused to cast iron or drawn steel tubes.

—SIMPLEX ELECTRIC HEATING COMPANY, CAMBRIDGEPORT, MASS.

SPIRAL RESISTANCES. These are made up of a series of spiral units. The elasticity of the spirals imparts great strength to the metal and makes the resistance very durable. Perfect ventilation is also effected by this type. The current passing around the convolutions of the spirals produces an inductive effect in the resistance which checks sudden rushes of current at any time when the motorman steps up too fast on his controller. Standards have been adopted for the motors now generally used. These rheostats have stood some severe tests and have proved their worth.

—TRACTION EQUIPMENT COMPANY, BROOKLYN, N. Y.

WESTINGHOUSE RAILWAY RESISTANCES. For street railway equipments this company offers two types of resistance, the ventilated cell type of diverter adapted for use where large ohmic resistance and small capacity are required, and the grid type for low ohmic resistance and large capacity. Good contact is made between adjacent grids, insuring the absence of heating due to poor connections. A broken grid may easily be removed from the frame or connections made, all connecting terminals being in view and conveniently located.

—WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY, PITTSBURGH, PA.

RESEATING MACHINES

(See also Boiler Cleaners, Mechanical.)

LAGONDA RESEATING MACHINE. This is a device for cleaning header faces, nuts and caps of water tube boilers. It does the work in much less time than it can possibly be done by hand, and is more reliable, as when these parts have been cleaned with the machine, it is perfectly done, and taking down and recleaning is never necessary. It can be driven either by water or electric motor.

—THE LAGONDA MANUFACTURING COMPANY, SPRINGFIELD, OHIO.

RETRIEVERS, TROLLEY

(See "Catchers and Retrievers, Trolley")

ROOFING

J-M ASBESTOS ROOFING. Composed of asbestos felts and water-proofing compounds, put together in alternate laminations and compressed into one flexible sheet, all ready to apply. Present to both the sheathing boards and the weather a pure white fire-resistant asbestos sheet insuring protection against sulphur, acids and gases. Meets all the peculiar conditions to which power houses and similar structures are subject. Are adapted to buildings of all descriptions, both flat and steep. Is an excellent insulator, reducing the temperature materially in buildings on which it is used. (See advertisement.)

—H. W. JOHNS-MANVILLE COMPANY, NEW YORK.

RUBEROID CAR ROOFING. Made of felt with Ruberoid compound. The toughest and most elastic car roofing on the market. Will not break or tear from racking of cars in motion. Ruberoid compound makes it absolutely water-proof and temperature-proof. It contains no tar, is always pliable. It is put up in rolls 60 ins. wide, each roll containing sufficient material to cover a car roof; is easy to apply, clean to handle and is without odor. It does not require tar or pitch at seams.

—THE STANDARD PAINT COMPANY, NEW YORK.

SAND BOXES

(Including Pneumatic Sanders.)

BRILL "DUMPIT" SAND-BOX. The unique feature of this box is a double hopper which successfully prevents moisture, that creeps up the hose, from getting into the sand box. It is impossible to keep the sand-wick from forming in the hose, but it is possible to prevent the wick from having any connection with the sand in the box—that is the principle on which the "Dumpit" is designed. The flow is continuous, the operation by foot-pedal or hand-lever is easy, and the construction simple and compact.

—J. G. BRILL COMPANY, PHILADELPHIA, PA.

—AMERICAN CAR COMPANY, ST. LOUIS, MO.

—G. C. KUHLMAN CAR COMPANY, CLEVELAND, OHIO.

—JOHN STEPHENSON COMPANY, ELIZABETH, N. J.

COMMON SENSE SAND BOX. The construction of this sand box is such that it will never rust together, no matter how long the car may be in a damp place, because the valve slides on two narrow steel runners, and the bottom of the casting does not touch the slide and is therefore always ready to work. It is claimed that this is the only box that has worked twelve years without any refusal or repairs. (For illustration see advertisement.)

—DEWITT SAND BOX COMPANY, TROY, N. Y.

HAM SANDBOX, No. 10. This sandbox differs in operation from other sanders, inasmuch as it is not fastened to the floor of the car, but is suspended to permit the entire sandbox to swing. The forward motion is suddenly arrested, thus forcing the sand from the hopper, no matter what the condition of the sand may be—wet or dry. No matter how hard the sand may become packed or caked in the box, the operation is such that the sand is broken up and forced from the box.

—HAM SAND BOX COMPANY, TROY, N. Y.

HAMMOND SANDER. A sanding machine operated either by foot or by hand. It consists of a screw

conveyor operated by a lever and for each movement of the lever the screw turns a certain part of a revolution, thereby forcing the sand out of the hopper, whether wet or dry. The sand does not need to be dried or put through a screen before using. The machine is built to sand both rails simultaneously. It is durably constructed, has few parts to get out of order and is easily applied and operated.

—TRACTION EQUIPMENT COMPANY, BROOKLYN, N. Y.

KILBOURNE TRACK SANDER. This sander is now manufactured by this company in malleable iron throughout, thereby reducing to a minimum the chances for breakage. The spout is made from a spiral steel spring and the same spout may be used either on single or double truck cars. The sander will handle anything from fine sand to gravel or crushed stone, either wet or dry, and in just the amount required.

—FRANK RIDLON COMPANY, BOSTON, MASS.

NICHOLS-LINTERN AIR SANDERS. This sander consists of a supplementary valve, operated in unison with the engineer's air-brake valve, and a sand trap of special design. It doubles the efficiency of the air brakes. It prevents skidding, does not waste sand, is always under instantaneous control, makes possible fast schedule time where frequent stops are necessary, and is an invaluable aid in starting and hill climbing. (See pages 627 to 636, Bulletin No. 1; see also advertisement.)

—THE OHIO BRASS COMPANY, MANSFIELD, OHIO.

PNEUMATIC SANDERS. The track sander made by this company is designed for operation by compressed air.

—JEWETT CAR COMPANY, NEWARK, O.

PNEUMATIC TRACK SANDERS. This sander insures the placing of a small quantity of sand instantaneously exactly where needed at point of contact of wheel and rail, of the greatest value in emergencies, as by one movement of motorman's hand sander is started and remains in operation without further attention until shut off, the warning port in the valve giving constant notice that sander is working so that it cannot be forgotten and all sand run out of box.

—AMERICAN LOCOMOTIVE SANDER COMPANY, PHILADELPHIA AND CHICAGO.

ST. LOUIS SAND BOXES. No. 1 has galvanized iron hopper, with ball and socket valve and agitator combined, operated by bell crank connecting rod, with either pedal or lever. No. 21 is the same as No. 1, with these exceptions: Instead of ball and socket valve and agitator, a slide valve is used. No. 3 has cast iron hopper and is absolutely water proof. Rotary agitator prevents sand from packing, and prevents clogging. Can be operated with bell crank and pedal attachment, or by lever inside of dash. It is absolutely positive in its operation. Tube leading to rail can be set in practically any position desired, one of the strong points in favor of No. 3.

—ST. LOUIS CAR COMPANY, ST. LOUIS, MO.

STERLING SAND BOX. This box emits sand, coarse or fine, vertically by gravity, through large or small aperture, as desired. Sand kept always in flowing condition. Perfect design, great strength of parts, absolute certainty of operation. It is now in use on thousands of cars.

—STERLING-MEAKER COMPANY, NEWARK, N. J.

SASH FIXTURES

(See also Curtains.)

NATIONAL SASH BALANCE. This device as its name implies, balances the weight of sash. It is a spring roller held in brackets at the highest part of the sash slide. This roller is held to the sash by two belts, one at each end of roller. These belts are connected with roller by brass straps locked in groove of roller, and the lower ends connected to sash by hooks secured to the belting by brass straps. These hooks fit into eyes which screw into top of sash, thus making it easy to take out sash when necessary. The screw eyes can also be raised or lowered one or more turns to equalize belt on each side. This device operating with the National Sash Lock, automatically locks windows at any height.

—THE NATIONAL LOCK WASHER COMPANY, NEWARK, N. J.

NATIONAL SASH LOCK. This will positively lock sash at any height, and prevents rattle when sash is made loose enough to be easily raised or lowered. It is operated by simply compressing and releasing levers. The window cannot possibly fall as the jar, instead of loosening it, more securely locks it. By a novel arrangement of levers, if bottom lever is lifted, top lever unlocks itself, but if top lever is pulled down it will not unlock bottom lever, so that

to lower window, bottom lever must be used. If the spring by any chance should break, the bottom lever is free and will hold window by gravity.

—THE NATIONAL LOCK WASHER COMPANY, NEWARK, N. J.

SAWS, RAIL

Q AND C PORTABLE RAIL SAW. Furnishes the best and most economical means for cutting rails in track work for they cut clean, thus saving both ends of the rails which is not possible with any other means for cutting in use. It affords a great saving in track labor and saves its cost in less than a year. This saw is made in two styles of two sizes each, and has a capacity for cutting up to 9 ins. girder rail and at an angle up to 45 degs. Furnished complete with saw grinder, two saw blades and the necessary wrenches.

—RAILWAY APPLIANCES COMPANY, CHICAGO AND NEW YORK.

SCRAPERS, TRACK

(See "Cleaners, Track")

SEATING MATERIALS

(See "Curtains and Curtain Materials")

SEATS, CAR

BRILL CAR SEATS. This company manufactures seats of every form for closed, open and convertible cars. The step-over seats, besides having a simple mechanism, few parts and easy operation, are the most comfortable, durable and sightly. The rattan is smoother and more closely woven by an improved process. Frames, springs, padding, covering and all parts are the best in construction, material and workmanship—the proof of which is the enormous increase of business necessitating a recent addition to the department of 12,500 sq. ft., not counting galleries, all used for manufacturing.

—J. G. BRILL COMPANY, PHILADELPHIA, PA.

—AMERICAN CAR COMPANY, ST. LOUIS, MO.

—G. C. KUHLMAN CAR COMPANY, CLEVELAND, OHIO.

—JOHN STEPHENSON COMPANY, ELIZABETH, N. J.

HALE & KILBURN CAR SEATS. All the most modern types of walkover and reversible car seats, in rattan and other coverings, adapted to suit construction of side of car, and giving greatest seating room for actual space occupied; also securing greatest strength, while affording highest degree of comfort to occupant, by providing cushions and backs with steel top reinforced spring construction, the most perfect shapes and angles of cushion and back, together with automatic foot rest, corner grab handle, etc. Designer and sole maker of all-steel car seating of fire-proofed construction. Every description of stationary and longitudinal seating for cars and every other form of passenger vehicle.

—THE HALE & KILBURN MANUFACTURING COMPANY, PHILADELPHIA, PA.

HEYWOOD BROTHERS & WAKEFIELD CAR SEATS. The particular feature which distinguishes these seats from others is the simplicity of the Wheeler mechanism of the walkover type, which automatically tilts and moves the cushion forward with the reversal of the back. This mechanism is also made with automatic foot rest which tilts with the reversal of the back. This seat has very few parts. The rocker which carries the seat cushion is operated by cams and there are no ratchets, cogs, or other complicated mechanism to bind and cause breakage. The spring cushions are made with practically indestructible flexible steel tops. Besides the Wheeler reversible seat the company manufactures the turnover and double revolving types, as well as longitudinal spring seating, non-reversible, cross seats, motormen's seats, reed parlor car chairs and reclining car seats.

—HEYWOOD BROTHERS & WAKEFIELD COMPANY, WAKEFIELD, MASS.

ST. LOUIS SEATS. These seats are designed to meet the exacting conditions of city and interurban service. The very best twill weave rattan, canvas lined, is used on the cushions, furnished with spring or stiff edge, as may be desired. Seats in plush, leather, etc. The operating mechanism is made of the very best malleable iron, carefully fitted, and combines great strength with ease of operation. The cost of maintenance is slight. The rattan is woven and castings made in the company's shops.

—ST. LOUIS CAR COMPANY, ST. LOUIS, MO.

SEPARATORS, OIL AND STEAM

COCHRANE OIL SEPARATORS. These appliances which are already protecting over 4,000,000 hp. of boilers from oil, are very efficient for removing oil from exhaust steam and rendering the condensation of the steam suitable

for use in boilers. These oil separators are used in street railway power plants on the exhaust line leading to closed feed water heaters, though in many cases it has been found more economical to discard the closed heaters and install Cochrane Open Heaters. (See advertisement.) The Cochrane Vacuum Oil Separators are designed for removing oil from exhaust steam under a vacuum and are placed between the engine and condenser.

—HARRISON SAFETY BOILER WORKS, PHILADELPHIA, PA.

COCHRANE STEAM SEPARATORS. These separators, besides protecting engines from large flushes of water, are most efficient in removing smaller quantities of water or moisture from the steam, thus insuring dry steam for the engines, with the consequent advantages of steam economy, better cylinder lubrication and economy of lubricating oil. The Cochrane Receiver Separators are particularly adapted for service at the end of long or exposed lines of piping. In addition to having the same efficiency as the ordinary Cochrane Steam Separators in removing large or small quantities of water from steam, they are provided with extra large wells which act as receivers for storing steam under full boiler pressure, close to the engine, upon which the engine may draw instantly when the load is suddenly increased. They are very effective in preventing hammering and vibration in the piping.

—HARRISON SAFETY BOILER WORKS, PHILADELPHIA, PA.

MURRAY STEAM SEPARATORS. These steam separators are of two types—of steel boiler plate construction and cast iron. They are effective, durable and economical and prevent accidents due to charges of water in the engine cylinders.

—THE MURRAY IRON WORKS COMPANY, BURLINGTON, IA.

STRATTON STEAM SEPARATOR. This separator delivers dry steam to engines even under unfavorable conditions. It permits the use of long lines of pipe, as it will remove all condensation that may take place. It permits the forcing of boilers to their limit, and yet eliminates all entrained water which such practice would ordinarily produce. It is able to handle large amounts of water, arresting it, and thereby preventing possible engine wrecks.

—GOUBERT MANUFACTURING COMPANY, NEW YORK.

SETTEES AND BENCHES

BETHLEHEM PARK SETTEES AND BENCHES. Outdoor benches, cafe tables, iron work for parks, lawns, gardens, waiting rooms, etc. The settees or benches and tables are made to be shipped complete, in knocked-down shape, and can be easily set up and finished.

—BETHLEHEM FOUNDRY & MACHINE COMPANY, SOUTH BETHLEHEM, PA.

SHIELDS, THIRD-RAIL

BUCKEYE THIRD-RAIL SHIELD. This shield insures perfect safety to persons or stock and forms an absolute protection from sleet and snow. It is furnished with an enclosed rack for carrying feed, telephone or signal wires. The top of this shield is also removable at any point along the line.

—BUCKEYE THIRD-RAIL SHIELD COMPANY, COLUMBUS, OHIO.

SHOES, BRAKE

(See "Brake Shoes")

SHOVELS, POWER

VULCAN STEAM AND ELECTRIC SHOVELS. These shovels are built in ten standard sizes. Volumes of material ranging from 300 cu. yds. up, can be handled, according to the size of shovel. This construction consists of an all steel car, built to withstand severe strains, upon which are mounted improved engines and correctly proportioned machinery of the best mechanical construction. Ample power is provided for successful operation.

—THE VULCAN IRON WORKS COMPANY, TOLEDO, OHIO.

SHUTTERS, STEEL ROLLING

(See "Doors, Steel Rolling")

SIGNAL SYSTEMS

BLAKE SIGNAL SYSTEM. A railway semaphore signal for use in connection with telephones. Enables a dispatcher to set a semaphore arm and red light at any telephone point, thus signifying to an approaching car that the dispatcher desires to communicate with the car crew. Requires but a single bare iron line wire for each 15 signals. The signals are perfect in mechanical and electrical detail. The mechanism is simple, the action positive, and there is a positive "answer back" to central office when semaphore arm and red light are set.

—BLAKE SIGNAL & MANUFACTURING COMPANY, BOSTON, MASS.

EUREKA AUTOMATIC ELECTRIC SIGNALS. Two systems of Eureka signals are manufactured, both adapted to the several types of electric railways, and constructed to operate from the track or by overhead contact-makers. Both systems may employ lamps or semaphores. The two-wire system counts cars. The single-wire system is the acme of simplicity. Both systems are modified to ring bells on bridges and at road crossings, as well as to operate semaphores, normally at danger, to show danger or safety of steam tracks crossed at grade. All Eureka apparatus is designed and constructed for long, continuous, heavy service, the controllers being models of mechanical excellence.

—EUREKA AUTOMATIC ELECTRIC SIGNAL COMPANY, LANSFORD, PA.

JORDAN AUTOMATIC SIGNAL. Contains only three moving parts—the actuating magnet plunger, the color target for changing the light colors and the semaphore target and its shaft. A cast iron box is provided, the upper part containing the signal lights and the lamps in the protection circuit, together with a relay in connection with them. The lower part of the box contains two actuating magnets of the solenoid type. A single core is acted on by these magnets, the clear magnet pulling the core to the right and the danger magnet to the left. Gears on the core cause the proper working of the semaphore and targets. Adapted to third rail, overhead or underground systems.

—JORDAN AUTOMATIC ELECTRIC SIGNAL COMPANY, NEW YORK.

KINSMAN BLOCK SYSTEM. A system for preventing one train entering the block of another by automatically cutting off the power and applying the air brakes when a danger signal is disobeyed. Each track section forms part of a continuous electrical circuit. The presence of a train, or other obstruction producing a similar effect, results in disrupting the circuit controlling the apparatus in the next section, thereby operating emergency braking devices on the following train. This is obtained by the action of an increased current upon the train apparatus when the track conditions of the intermediate section become abnormal. This system is employed in the New York Subway.

—KINSMAN ELECTRIC & RAILWAY SUPPLY COMPANY, NEW YORK.

UNITED STATES BLOCK SIGNAL SYSTEM. At each end of a block are placed a signal box and automatic trolley switch, the former being about 100 ft. beyond the switch so as to be easily seen by the motorman as his car passes under switch. A car about to enter a block passes under the trolley switch, lighting a white signal in the box in front and red signal at the distant end of block. These signals are extinguished when the car operates switch on leaving the block. Red signal shows approaching car, white signal receding one. Block is clear only when signal box shows white as car passes under switch. This system does not depend upon the continuity of the lamp circuit, for if lamps burn out after being lighted, it would be impossible to get a "clear" signal. Semaphores may be used in connection with the lights.

—UNITED STATES ELECTRIC SIGNAL COMPANY, WEST NEWTON, MASS.

UNITED STATES REAR-END PROTECTION SIGNALS. To lessen the danger of rear end collisions upon sharp, hidden curves and steep hills, this company has designed a signal that operates for cars going in one direction only. It uses but one line wire and requires each car to clear the signal in its rear before leaving the block. It can be furnished with or without semaphores, the same as the company's regular block system.

—UNITED STATES ELECTRIC SIGNAL COMPANY, WEST NEWTON, MASS.

UNITED STATES TERMINAL AND CROSSING SIGNALS. The terminal signal announces the approach of a car and can be set to act at any desired distance. The highway crossing signal is equipped with an 8 in. gong, which gives an audible, as well as visible, signal that a car is approaching the crossing. The gong and signal usually are set to give the alarm when the car reaches a point about 1,500 ft. from the crossing.

—UNITED STATES ELECTRIC SIGNAL COMPANY, WEST NEWTON, MASS.

SIGNS, CAR AND TRACK

BUDA TRACK SIGNS. These are nowadays considered a permanent part of the right of way, and more substantially constructed than formerly. Cast iron face with raised letters is growing in use. Made to go with

wood and steel posts and with concrete bases. Numerous styles.

—BUDA FOUNDRY & MANUFACTURING COMPANY, CHICAGO, ILL.

THE CREAHEAD ILLUMINATED CAR SIGN (INDICATING). Any number of route changes may be carried in the sign, on a continuous sign curtain, the same being reversible through the operating mechanism of a spring roller at the top of the frame, and a plain roller at the bottom. Additional routes can be added to both the sign and indicator, without taking them off the car, as both can be readily taken apart and readjusted. In connection with the sign there is an indicator accurately indicating the changes on the sign on the hood of the car and enabling any changes of route to be made while the car is in motion or stationary, without cementing to the roof of the car or resorting to any other tedious means. The spring winding device obviates any necessity to take the frame apart to tighten the spring if it should become lax through use. Attention is particularly directed to the feature enabling one to switch cars to any route at a moment's notice.

—THE CREAHEAD ENGINEERING COMPANY, CINCINNATI, OHIO.

HENDERSON CAR SIGN ILLUMINATOR.

—UNITED STATES ELECTRIC SIGNAL COMPANY, WEST NEWTON, MASS.

MILLEN ILLUMINATED CAR SIGN. This sign is used on the lines of the New York City Railway Company and other important systems.

—COLUMBIA MACHINE WORKS AND MALLEABLE COMPANY, BROOKLYN, N. Y.

MORRIS CAR SIGNS. This company is a manufacturer of enameled signs for street and interurban cars.

—ELMER P. MORRIS COMPANY, NEW YORK.

THE ONE LIGHT SIGN. The frames are made of metal. The names are cut out of zinc, painted black and placed in front of white glass. They can also be furnished on colored glass with etched white letters. Either way a very distinct letter is shown during the day and at night the sign is illuminated by 1-16 cp. incandescent lamp producing a uniform and very strong light. If colored markers are required they can be furnished with the sign and both illuminated at night. In this case 2-16 cp. lamps are used. For any electric railways using fixed signs or making few changes in them they are very desirable.

—TRACTION EQUIPMENT COMPANY, BROOKLYN, N. Y.

SLEET CUTTERS

PORTER & BERG'S "O. K." SLEET CUTTER. This device is made of malleable iron, angle shape, with a soft copper contact lug inserted in the end of the upper arm. The lower arm is furnished with nut and washer to hold the sleet cutter firmly in place between the harp and the under side of the wheel. This construction makes the device a part of the harp for all practical purposes, and yet enables the motorman to attach or detach it in an instant. This sleet cutter has been giving universal satisfaction for the past five years and is extensively adopted as the standard device for removing sleet from the trolley wire. (See Catalogue No. 2.)

—PORTER & BERG, CHICAGO, ILL.

SMOKE STACKS

(See "Chimneys")

SLEEVES FOR POLES

(See Poles, Metal.)

SLEEVING

(See Tapes and Cloths.)

SOAPS

(See "Cleaning Powders and Washes")

SOLDER

BRADY SOLDER. This company manufactures the following grades of solder for electric railways: Warranted $\frac{1}{2}$ and $\frac{1}{4}$; strictly $\frac{1}{2}$ and $\frac{3}{4}$; commercial $\frac{1}{2}$ and $\frac{3}{4}$; No. 1 refined; wiping solder; and wire solder of every gage.

—BRADY BRASS COMPANY, NEW YORK.

HALF-ROUND BAR SOLDER. This special form of bar is the most economical form of solder that can be used on small joints, such as armature leads, etc. It is cast in 5-16 in. half round bars about 15 in. long, weighing about $\frac{1}{4}$ lb. each, and made up in three grades.

—LUMEN BEARING COMPANY, BUFFALO, N. Y.

(CONTINUED ON PAGE XLI.)

SNOW PLOWS AND SWEEPERS

BRILL SNOW-PLOWS. These nose and shear plows have $\frac{3}{8}$ in. steel plow-plates, curved at upper and lower edges and strongly backed. The plows are raised and lowered by means of chains and worm gear operated by horizontal band-wheels. The posts on which the plows are adjusted are composed of T-rails and are braced by 3 in. by $3\frac{1}{2}$ in. iron bars, which extend along each side from post to post and give enormous resisting power. For interurban service the companies build a double-truck baggage car equipped with removable plows, and design plows to meet conditions of all kinds. (Advertisements in last pages.)

—J. G. BRILL COMPANY, PHILADELPHIA, PA.
—AMERICAN CAR COMPANY, ST. LOUIS, MO.
—G. C. KUHLMAN CAR COMPANY, CLEVELAND, OHIO.
—JOHN STEPHENSON COMPANY, ELIZABETH, N. J.

BRILL STANDARD SNOW SWEEPER. Short brooms are used with this sweeper as they can be set at an angle necessary to throw the snow clear of the rails. They also work and wear more evenly than long brooms, are easier to handle, and are capable of independent adjustment to conform to the curvature of the pavement. With one end set a little lower than the other, the rattan digs into the hollow of the rails and cleans them out thoroughly. Three motors are used, two for propulsion and one for the brooms. The sweeper is powerfully constructed in every particular and intended for heavy service. (Advertisements in last pages.)

—J. G. BRILL COMPANY, PHILADELPHIA, PA.
—AMERICAN CAR COMPANY, ST. LOUIS, MO.
—G. C. KUHLMAN CAR COMPANY, CLEVELAND, OHIO.
—JOHN STEPHENSON COMPANY, ELIZABETH, N. J.

CAMPBELL SNOW BROOM. This broom is made in two sections, of any length, and can be applied or removed from the shaft of a car in a few minutes by simply screwing or unscrewing some neatly fitted bolts. Malleable iron adjustable beads make this broom practically indestructible, as the heads will not break or wear out.

—THE CONSOLIDATED CAR FENDER COMPANY, NEW YORK.

DORNER SNOW SWEEPERS. These sweepers are in use on a number of electric railways; the brooms are operated by motor independent of car. Brooms each end, cars built to suit road, single or double trucks.

—THE DORNER MANUFACTURING COMPANY, CHICAGO, ILL.

RUGGLES ELECTRIC ROTARY SNOW PLOW. Designed for the severest service. Constructed like rotaries used on steam railroads but adapted for operation by electric motors, and will move in either direction. The snow is removed from track by revolving steel blades operated from a motor-driven fan shaft running through the cab. The snow-removing blades are protected by steel scoops. Snow is received on the revolving blades and expelled laterally through chutes. The plow also has scrapers and ice diggers.

—THE PECKHAM MANUFACTURING COMPANY, KINGSTON, N. Y.

SPEED INDICATORS

WOODMAN-HUDSON SPEED INDICATORS. These indicators are adapted to pointed or hollow centers, and have a raised sight on dial so as to count by touch which is of great importance, especially in dark places, as it is only necessary to look at the watch and count the number of revolutions the dial makes, which, with the fractions, will be the exact speed of the machine. It is accurate, reliable, of convenient size, neatly finished, and suited to carry in the pocket. The spindle is made of best tool steel. The double speed indicator indicates up to 5,000 revolutions, either right or left hand. The index point can be adjusted to zero with the finger. An extra hardened point, 6 ins. long, can be furnished for dynamos.

—THE R. WOODMAN MANUFACTURING & SUPPLY COMPANY, BOSTON, MASS.

SPLICING SLEEVES

(See "Clamps and Connectors for Wires and Cables")

SPRINKLERS, FIRE

(See "Fire Extinguishers")

SPRINKLERS, TRACK AND ROAD

BRILL CENTRIFUGAL SPRINKLER. A centrifugal pump operated by a direct-connected motor, both on platform at one end of car, supplies pressure for distributing water uniformly for fifty feet on each side of track. Same pump will fill tank from lake or stream fifteen feet below track, or tank may be filled in usual

manner. The shaft of the centrifugal pump is the only wearing surface. No check or inlet valves. No crank shafts nor pistons to become heated. No need for expensively riveted tanks to withstand air pressure. Amount and direction of water always under perfect control by a patented sprinkling head.

—J. G. BRILL COMPANY, PHILADELPHIA, PA.
—AMERICAN CAR COMPANY, ST. LOUIS, MO.
—G. C. KUHLMAN CAR COMPANY, CLEVELAND, OHIO.
—JOHN STEPHENSON COMPANY, ELIZABETH, N. J.

BRILL GRAVITY SPRINKLER. This apparatus is suitable wherever it is unnecessary to sprinkle more than twelve feet on either side of track. The standard sizes of tanks are as follows: $6\frac{1}{2}$ x 10 ft. — 2,480 gals.; $6\frac{1}{2}$ x 13 ft. — 3,225 gals.; $5\frac{1}{2}$ x 24 ft. — 4,000 gals. Under ordinary conditions, a 2,480-gal. tank will sprinkle four to six miles of roadway. The sides of the tank are composed of $\frac{1}{2}$ -in. and the ends of 5-16 in. steel. The ends are strengthened with inner stays and swash plates prevent surging of water. The sprinklers are built with enclosed tanks, if desired, and the appearance made similar to an ordinary car.

—J. G. BRILL COMPANY, PHILADELPHIA, PA.
—AMERICAN CAR COMPANY, ST. LOUIS, MO.
—G. C. KUHLMAN CAR COMPANY, CLEVELAND, OHIO.
—JOHN STEPHENSON COMPANY, ELIZABETH, N. J.

SPRINGS, CAR AND TRUCK

BRILL SPRINGS. These companies make every kind of spring used on electric and steam railways, from the diminutive box-lid coil to the heaviest locomotive driving spring. The grade of steel used is that known as the Pennsylvania Railroad Standard Analysis and Test. The companies' enlarged spring-manufacturing plant is equipped with the finest types of machinery and oil-burning furnaces, and operated with the best skilled labor obtainable.

—J. G. BRILL COMPANY, PHILADELPHIA, PA.
—AMERICAN CAR COMPANY, ST. LOUIS, MO.
—JOHN STEPHENSON COMPANY, ELIZABETH, N. J.

FORT PITT CAR SPRINGS. Car springs manufactured from the finest grade of spring steel, oil tempered; these comprise bolster springs, equalizer springs, truck springs, heavy draft springs, light draft springs, etc. In fact every style of coil steel springs used for passenger, freight and electric railway service.

—FORT PITT SPRING & MANUFACTURING COMPANY, PITTSBURG, PA.

RAILWAY STEEL SPRINGS. Helical and elliptical springs for all types of electric railway trucks.

—RAILWAY STEEL SPRING COMPANY, NEW YORK.

STANDARD SPRINGS. These works manufacture elliptic, double elliptic, coil and other springs suitable for electric traction equipment.

—THE STANDARD STEEL WORKS, PHILADELPHIA, PA.

PITTSBURGH SPRINGS. This company makes springs for high-speed cars, locomotives, passenger cars, freight, coal, dump and traction cars; also governor, valve and machinery springs. All springs are oil tempered.

—PITTSBURGH SPRING & STEEL COMPANY, PITTSBURGH, PA.

TAYLOR ELLIPTIC SPRINGS. These springs are made of crucible spring steel of the regular standard railroad spring steel analysis. All springs are accurately made of the proper dimensions to allow ample spring action under various loads, and are tested to carry successfully the weight of car for which they are intended.

—TAYLOR ELECTRIC TRUCK COMPANY, TROY, N. Y.

UNION SPRINGS. The springs made by this company are furnished in helical and elliptical form for all classes of interurban and street railway service.

—UNION SPRING & MANUFACTURING COMPANY, NEW KENSINGTON, PA.

STEPS, CAR

BRILL CAR STEP. The platform step made by this company is composed of malleable iron hangers and a wooden tread. Two $\frac{3}{8}$ in. tie rods pass under the tread and are let into it. The toe piece, or fender, is bolted at three points to the platform knee and screwed to the back of the tread; it is also malleable iron with an open design free from points on which clothing might be caught. The hangers are secured to the crown-piece and the end sub-sill with two $\frac{3}{8}$ in. bolts to each.

—J. G. BRILL COMPANY, PHILADELPHIA, PA.
—AMERICAN CAR COMPANY, ST. LOUIS, MO.
—G. C. KUHLMAN CAR COMPANY, CLEVELAND, OHIO.
—JOHN STEPHENSON COMPANY, ELIZABETH, N. J.

Q AND C STANWOOD CAR STEPS. This car step is made of thin strips of Bessemer steel square sheared, bent so as to form corrugations across the step. Rods pass through the frame and steel re-inforcing strips which prevent the step from sagging. The step is handsome in appearance, always looks the same and never requires repairing. It gives a perfectly non-slipping surface and is safe in all kinds of weather. The open form of construction admits of the free passage of dirt, mud and snow and prevents any accumulation of dirt on the step.

—RAILWAY APPLIANCES COMPANY, CHICAGO AND NEW YORK.

STEP TREADS

(See "Treads, Step")

STOCK GUARDS

AMERICAN CATTLE GUARDS. This company is prepared to furnish stock guards for railways.

—AMERICAN BRIDGE COMPANY OF NEW YORK, NEW YORK.

CLIMAX CATTLE GUARDS. These guards have a smooth surface with inverted V-shaped ridges. They are manufactured from shale clay burned hard, vitrified and glazed. They will not burn, warp, rust or decay, and barring accident, will last indefinitely. The replacing of a few broken blocks maintains and renews the guards perpetually at small expense. The blocks are 24 in. long, $8\frac{1}{2}$ in. wide and 4 in. high—just long enough to span the ties center to center. Any combination of blocks can be used to meet requirements.

—THE CLIMAX STOCK GUARD COMPANY, CHICAGO, ILL.

KALAMAZOO "PERFECT" STEEL SURFACE CATTLE GUARD. There are many types of cattle guards which keep off trespassing cattle by presenting a bristling front of jagged points. This guard is a departure as it renders crossings physically impossible without hurting the animals. At the initial step they slide toe first against a slot at the base and cannot advance, but are free to withdraw without slightest injury. The "Perfect" turns the most recalcitrant steers and bronchos at troublesome crossings. Made in three sections only, ready-to-place, saves much expense; offers no catching points for dragging chains; is readily removable during track overhauling; chokes weed growth; has a solid anchorage in track and cannot rattle to pieces; after assembling guards are dipped in an asphaltum bath to fill all crevices and cover all surfaces with a thick, tenacious coat; is proof against corrosion; is self-cleansing of snow and rubbish by draught, and does not emit jingling sounds from passing trains. Other styles of cattle guards, both steel and wood, are also made by this company.

—KALAMAZOO RAILWAY SUPPLY COMPANY, KALAMAZOO, MICH.

SHEFFIELD CATTLE GUARD. Made from soft sheet steel with triangular points punched up so thickly all over them that no animal can secure a comfortable footing thereon. These sheets are 26 ins. wide and 8 ft. or 9 ft. long, as desired. A set consists of four of these sheets, or enough for one side of a single track crossing, two of the sections being placed between the rails and one on each side. No special preparation of track is necessary to put them in place. All guards are coated with asphalt before shipping.

—FAIRBANKS, MORSE & COMPANY, CHICAGO, ILL.

STOKERS, MECHANICAL

AMERICAN STOKER. Coal is supplied to the stoker through the hopper outside of the furnace. Immediately under the coal hopper, and communicating with it, is the conveyor pipe. A screw conveyor or worm is located in the conveyor pipe and conveys the coal into the magazine or retort inside of the furnace. Under the conveyor pipe and retort is located the wind-box, with its opening to the front for connection to the piping for the air supply furnished at low pressure by a blower. The upper edge of the retort is surrounded by detachable tuyeres, or air blocks, communicating with the wind-box below, the blocks being furnished with openings for discharging the air into the coal. The distribution of air to each stoker is regulated by a wind gate located at the mouth of the wind chamber.

—THE AMERICAN STOKER COMPANY, ERIE, PA.

BABCOCK & WILCOX MECHANICAL STOKER. This stoker is of the traveling chain grate type, consisting of an endless chain of short cast-iron bars linked together, passing over sprockets at the front and rear, the front sprockets being revolved by a worm and worm wheel. The depth of the fuel and speed of grate can be adjusted to suit conditions.

—THE BABCOCK & WILCOX COMPANY, NEW YORK.

THE GREEN TRAVELING LINK GRATE. An automatic traveling chain grate designed for burning low grade bituminous coals. It consists of an endless chain, the coal being fed into a hopper passing under a grate into the fire, where it is consumed, and is passed over the tail of the grate into the ash pit in the form of ash. The coal is never disturbed from the time it enters until it leaves the stoker in the form of ash, thus obviating all slicing, cleaning or firing. This style of chain grate is adapted for any type of boiler.

—GREEN ENGINEERING COMPANY, CHICAGO, ILL.

RONEY MECHANICAL STOKERS. Built in all sizes, automatic feed eliminating to a great degree the expense and general inefficiency of hand firing boiler furnaces; particularly adapted to steam generating plants of large capacity. Constructed upon the inclined rocking grate principle with special coking fire arch where bituminous fuel is used. Its essential features are (a) simplicity of operation; (b) responsiveness to steam demand; (c) adaptability to any type of boiler; (d) adaptability to usual kinds of coal, especially the cheaper grades, which may be burned to better advantage than is possible by hand firing.

—THE WESTINGHOUSE MACHINE COMPANY, PITTSBURGH, PA.

STOPS, EMERGENCY

(See "Emergency Stops")

STORAGE BATTERIES

(See "Batteries")

STOVES

(See also "Heaters, Car")

MURRAY STOVES. These are cast iron stoves and designed for stations, car barns and work shops. They are not ornamental, but exceedingly useful.

—THE MURRAY IRON WORKS COMPANY, BURLINGTON, IA.

SUPERHEATERS

BABCOCK & WILCOX STEAM SUPERHEATER. This device for superheating steam is placed in the space above the tube sections and below the drums in a Babcock & Wilcox boiler. It consists of seamless drawn steel tubes bent into U form and expanded into wrought steel boxes or manifolds. The steam from the boiler enters the upper manifold box, divides among the U tubes and becomes superheated during its passage through them, the pressure remaining unaltered. The superheated steam outlets are taken from the lower manifold box.

—THE BABCOCK & WILCOX COMPANY, NEW YORK.

FOSTER SUPER HEATER. For superheating steam or heating air. All pressure parts of steel. All joints expanded. Only cast iron exposed to hot gases. Large mass of metal in the construction prevents fluctuations in superheat and obviates necessity for dangerous flooding devices with their complicated piping and valves, requiring skilled attendance. Contains no bent tubes. Made entirely of straight cold drawn seamless steel tubes with corrugated cast iron covering shrunk on. Easily inspected inside and out. Can be installed in independent setting with furnace for coal, wood, oil or gas. Superheat may be regulated from 0° to maximum amount for which installation is designed.

—POWER SPECIALTY COMPANY, NEW YORK.

PARKER SUPERHEATERS. Consist of cast steel headers and small cold-drawn seamless steel tubes. They are located just above the bottom row of evaporating tubes and the degree of superheat can be varied by making the openings through the baffles larger or smaller. The device is flooded while getting up steam but takes care of itself at all other times. Combined with the Parker boiler, which delivers steam of uniform dryness, this superheater gives a very unusual uniformity to the superheat, due to the fact that the flow through it is arranged to vary in proportion to the fire.

—PARKER BOILER COMPANY, PHILADELPHIA, PA.

STRIPS, PROTECTING

(See "Paving Materials")

STRUCTURAL IRON WORK

(See "Bridges and Buildings")

SWEEPERS, SNOW

(See "Snow Plows and Sweepers")

STRAINERS, WATER

LIBERTY TWIN STRAINER. Claimed to be the only strainer made which can be cleaned successfully without shutting off or checking the water supply. It consists of two chambers, each containing a straining apparatus, one of which is a duplicate of the other. Two valves operated under pressure change the flow of water from the dirty chamber to the clean one. It can be placed in the suction line in the power plant, where it is accessible for cleaning. (See advertisement.)

—LIBERTY MANUFACTURING COMPANY, PITTSBURGH, PA.

SWITCHES, ELECTRIC TRACK

(See also "Track Work")

CHEATHAM AUTOMATIC ELECTRIC SWITCHING DEVICE. This consists of three parts: First—a trolley pan attached to the overhead wire, with which the trolley wheel connects when switch is to be thrown; second a track attachment consisting of an iron box containing a cylinder inside of which are two solenoid magnets which operate a single core armature connecting with the switch tongue; and third—a circuit changing box placed on a pole at curb of sidewalk; this normally connects with one track magnet until a motorman uses power through the trolley pan on bracket attached to overhead wire, which causes it to change the connection to the other track magnet. In operating the switching device the motorman simply turns off the current when desiring to set switch for straight track, and when desiring to set it for the curve he turns on power to second notch. No alteration or attachment to car is necessary.

—SAMUEL BOWMAN, ST. LOUIS, MO.

SWITCHES AND SWITCHBOARDS

ANDERSON SWITCHES AND SWITCHBOARDS. Special attention has been given to developing switches and switchboards of large capacity, and much time devoted to the production of high conductivity copper castings for this purpose, also to mechanical construction, good contacts and workmanship. This line includes knife and quick break switches; switchboards for electric railway; light and power plants; section cut-out switches for electric railways; cab and car heater switches; service switches; distant control, end cell and voltmeter switches; automatic time switches, also various other special switches designed for unusual conditions.

—ALBERT & J. M. ANDERSON MANUFACTURING COMPANY, BOSTON, MASS.

CONDIT SWITCHES AND SWITCHBOARDS. All types of switches are manufactured and switchboards erected by this company.

—CONDIT ELECTRICAL MANUFACTURING COMPANY, BOSTON, MASS.

CONSOLIDATED SWITCHES AND SWITCHBOARDS. Double quick-break knife switch, No. 204, consisting of two quick-break knife switches and two fuses mounted on a slate base. Cover and frame are of iron finished in black japan. Double snap switch, No. 164, and three-intensity regulating switch, No. 158, also snap switch, No. 151. Special switchboards made for elevated and surface cars.

—CONSOLIDATED CAR HEATING COMPANY, ALBANY, NEW YORK, CHICAGO.

CROUSE-HINDS, SWITCHES AND SWITCHBOARDS.

—CROUSE-HINDS COMPANY, SYRACUSE, N. Y.

CUTTER ELECTRICAL AND MANUFACTURING COMPANY, PHILADELPHIA.

(See item under "Circuit Breakers")

"OHIO BRASS" SWITCHES. The line section switch is furnished with wooden cover for mounting on pole, for use as a section cut-out switch. It is made single pole, capacity from 100 to 1,000 amp., and for circuits of 110-600 volts. Front connections only. The standard quick break switch is mounted on a slate base, capacity from 400 to 1,000 amp., 110-600 volts. Makes a quick, wide break and may be relied upon to open circuits up to and over its rated capacity. Front connection only. (See Bulletin No. 1, page 649.)

—THE OHIO BRASS COMPANY, MANSFIELD, OHIO.

SWITCHES AND SWITCHBOARDS. The General Electric Company has designed a complete line of standard switchboards for every class of service, but is prepared to fill promptly and satisfactorily specifications of a special nature. The instruments, meters and appliances furnished with these boards represent the latest

and best engineering practice. Standard lines of lever switches, toggle brush switches, oil switches and circuit breakers have been perfected for all voltage and ampere capacity ranging from 1 to 10,000 amperes and 10 to 60,000 volts.

—GENERAL ELECTRIC COMPANY, SCHENECTADY, N. Y.

WESTERN ELECTRIC KNIFE SWITCHES. Particularly designed for first class work. Rated on 50 amp. per sq. in. for sliding and 100 amp. for bolted contact surfaces. Blades are of best grade cold rolled copper. Jaws and studs are of hard drawn copper. Handles and cross bars have a polished ebony finish and are of well seasoned maple, which is superior to fiber compounds because far less brittle. Nuts are galvanized copper plated and oxidized to prevent rusting. "Draw file" and "polished and lacquered" finishes. These switches conform to all requirements of the National Board of Fire Underwriters.

—WESTERN ELECTRIC COMPANY, NEW YORK AND CHICAGO.

WESTINGHOUSE SWITCHBOARDS. This company builds anything in the way of switchboards from the smallest motor-panels to the largest electrically operated boards. Many different types of boards have been standardized, and it is advisable that such a board be selected when possible, although any kind of marble or slate with a choice from instruments and apparatus of many types and finishes can be furnished if desired.

—WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY, PITTSBURGH, PA.

WESTINGHOUSE SWITCHES. The output of this company includes knife switches, hook switches, field discharge switches, fused switches, plug switches, plunger switches, oil switches, electrically as well as hand operated switches. The best drawn lake copper is used for current carrying parts, and the sectional areas and contact faces of all parts have been calculated in accordance with the best practice and a liberal allowance for overload. In knife switches blades of certain definite capacities are selected as units, and switches of capacities which are multiples of the unit are built by combining in parallel the required number of unit blades.

—WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY, PITTSBURGH, PA.

SWITCHES, TRACK

(See "Track Work")

SUB-STATION, PORTABLE

(See "Cars, Portable Sub-Station")

SUB-STRUCTURES, TRACK

(See "Track Work")

TANKS, METAL

METAL TANKS. Made by Broomell, Schmidt & Steacy Company, York, Pa.

PHOENIX TANKS. Metal tanks for storage purposes are constructed by this company.

—PHOENIX IRON WORKS COMPANY, MEADVILLE, PA.

TAPES AND CLOTHS

(See also "Insulating Tapes")

ASBESTOS "LISTING" OR WOVEN TAPE. Asbestos "Listing" is a fire-proof, flexible, woven cloth tape, suitable for wrapping all forms of electrical wires, cables, as well as for other uses. It is made in widths from 1/2 in. to 4 ins. and 1-16 in. to 1/4 in. thick. It is supplied in lengths of 50, 100 and 150 ft. (See advertisement.)

—H. W. JOHNS-MANVILLE COMPANY, NEW YORK.

HOPE TAPE. Special grades and qualities required in the building and repair of dynamos, motors and other electrical apparatus. Every detail of manufacture (quality of stock, uniformity of width and thickness, evenness of finish, etc.) has been carefully worked out under the advice of the best electrical engineers, and special machinery constructed to produce material as nearly perfect as may be for each special purpose. A complete line, including a large variety of widths, qualities, and thicknesses from .003 upward.

—HOPE WEBBING COMPANY, PROVIDENCE, R. I.

MAGNETO ASBESTOS-GAUZE TAPE. An asbestos tape or ribbon having a gauze backing. This tape is 1-100 in. thick, very tough and strong, with evenly cut edges. It is put up in coils 8 in. in dia. and 1/2 in. to 3 ins. in width; other widths up to 36 ins. made to order. This material was gotten out primarily for winding armature,

but is extensively used for other purposes, where a strong fire-proof wrapping tape is desired. (See advertisement.)
—H. W. JOHNS-MANVILLE COMPANY, NEW YORK.

MORGAN & WRIGHT TAPE. A rubber tape prepared especially for electrical purposes.
—MORGAN & WRIGHT, CHICAGO, ILL.

TELEPHONES

MAYER & ENGLUND TELEPHONES. This railway telephone has no miniature parts to cause vexation and delay. The Mayer & Englund Company has two types of railway telephones. One is of the portable variety with standard sized parts arranged compactly and enclosed in a neat, strong oak box, provided with a long cord for plugging into a jack box erected on the pole. The other is of the stationary type enclosed in a malleable iron box for installing directly on the pole.
—MAYER & ENGLUND COMPANY, PHILADELPHIA, PA.

WESCO PORTABLE RAILWAY TELEPHONES. These telephones are supplied with short poles, by which connection may be made from the car with connecting boxes placed upon the line poles at convenient intervals. Should a car stop too far from the connecting box, the connecting pole may be carried to the nearest connecting box. These, as well as the company's regular exchange and bridging telephones, are made throughout of the best materials, and equipped with long distance solid back transmitters, bi-polar receivers, with concealed cord connections and permanently adjusted diaphragm and hard rubber receiver shell.
—WESCO SUPPLY COMPANY, ST. LOUIS, MO.

TESTING INSTRUMENTS

(See "Instruments, Electric Measuring," and "Bond Testers")

THIRD RAIL, TYPES OF

KINSMAN INDUSTRIAL THIRD RAIL. Designed for service where the requirements are comparatively light or temporary. Is composed of timbers mounted upon posts screwed into standard glass insulators which are firmly embedded in the wood, making a well insulated, substantial device which can be taken up in sections. The contact for the shoe is of sectional iron or copper firmly locked at the joints as well as to the stringer, forming the body of the structure, the whole making a light, compact and durable substitute for the ordinary steel third rail. Particularly adapted for contractors and others where the trolley and its supports are unavailable or inconvenient.
—KINSMAN ELECTRIC & RAILWAY SUPPLY COMPANY, NEW YORK.

FARNHAM INVERTED PROTECTED THIRD RAIL. A Tee rail or other form, special or standard, for contact on the underside by the current collector shoe. Protected against the elements, and also prevents persons from coming into accidental contact with the energized rail. This rail is capable of reinforcement to any capacity up to 4,000 hp., and forms a standard construction of maximum stability and safety assuring minimum cost of maintenance. (See also advertisement.)
—THE FARNHAM COMPANY, CHICAGO, ILL.

THIRD RAIL INSULATORS

(See "Insulators, Third Rail")

THIRD-RAIL PROTECTION

(See "Shields, Third-Rail")

TICKETS AND TRANSFERS

(Also Ticket Boxes and Cases.)

AMERICAN TICKET CASES AND BOXES. To satisfy the demand of railway ticket auditors for durable, neat and convenient ticket receptacles, this company makes several types, such as adjustable tube local ticket cases, combination ticket cases and coupon ticket cases, with folder rack. Two coupon hooks are used in connection with these cases, the Bacon style for wooden bars and the Blades for metal bars.
—AMERICAN RAILWAY SUPPLY COMPANY, NEW YORK.

GLOBE TICKETS AND TRANSFERS. These tickets and transfers are made on special machinery, built by the company. All issues and numbering are guaranteed correct and only the best grade card-board, paper and ink are used. The company controls many patent tickets and transfers and gets up special styles to meet particular requirements. (For illustration, see advertisement.)
—GLOBE TICKET COMPANY, PHILADELPHIA, CHICAGO, SAN FRANCISCO.

MACDONALD TICKET BOX. A drum shaped device made to contain one hundred or more cash receipts which are numbered in consecutive order and locked in the holder by a seal bolt arrangement. The fares and station names are arranged in two parallel columns in such a way as to engage beneath pointers, the object being to provide a cash receipt for use on electric railways that can be handled rapidly enough to meet heavy traffic, and at the same time insure a high degree of protection to the company, the conductor and the traveling public.
—THE MACDONALD TICKET & TICKET BOX COMPANY, CLEVELAND, OHIO.

NATIONAL TICKETS AND TICKET CASES. This company designs and print, in any desired quantity all classes of tickets suitable for railway use. It also manufactures ticket cases.
—NATIONAL TICKET COMPANY, CLEVELAND, OHIO.

"OHMERGRAPH" TRANSFER ISSUING MACHINE.
(See item under Transfer-Issuing Machines.)

STROMBERG-ALLEN TICKETS AND TICKET CASES. Aside from a full line of railway tickets this company also manufactures ticket punches, ticket cases, daters, blank books, stationery, etc.
—STROMBERG, ALLEN & COMPANY, CHICAGO, ILL.

TICKET CHOPPERS AND DESTROYERS

GLOBE TICKET CHOPPER. This chopper is a ticket collecting box of neat and strong construction. It is arranged, by a series of plate glass guides, to convey the tickets to a pair of cancelling rolls, where they rest in a position favorable for examination by the gateman, then are passed between the steel rolls by a turn of the wheel, and cancelled by punching slots in them. While the tickets are unmistakably cancelled they still can be audited if desired. Net weight, 151 lbs. Floor space, 17 in. by 17 in. (For illustration see advertisement.)
—GLOBE TICKET COMPANY, PHILADELPHIA, CHICAGO, SAN FRANCISCO.

PATTEN TICKET DESTROYER. This machine destroys used tickets and transfers, so as to leave no chance for fraud, the old method of burning being slow and undesirable. It can be set up in the auditor's department and all tickets destroyed under his supervision. The cuttings can be sold for paper stock or otherwise disposed of. The machine is strongly built and durable, having a cast iron frame, babbitted bearings, cutting cylinder and bearings crucible steel. The machine is fitted to run by hand or power, but a 1 h.p. motor is recommended. Price \$100 application.
—PAUL B. PATTEN, SALEM, MASS.

GLOBE POWER TICKET DESTROYER. This destroys the daily returns of tickets and transfers. It is a simple, inexpensive machine, easily operated and with ordinary intelligence and care will last for years, thoroughly destroying any paper or card-board fed through it. It will mutilate from 50,000 to 100,000 tickets or transfers per hour. Floor space 17x17 in., weight 150 lbs., speed 400 revolutions per minute, 1½ h.p. A large number of these machines are in use with gratifying results. (For illustrations see advertisements.)
—GLOBE TICKET COMPANY, PHILADELPHIA, CHICAGO, SAN FRANCISCO.

TICKET PUNCHES

(See "Punches, Ticket")

TIES

(See "Poles and Ties")

TIE PLATES AND BRACES

(See "Track Work")

TIMBER PRESERVING MACHINERY

ALLIS-CHALMERS TIMBER-PRESERVING MACHINERY. Stationary retorts are frequently 6 ft. in diameter and 125 ft. long. By means of a narrow track running the length of the cylinder, cars loaded with timber can be easily run in. Closed with an air tight fitting door at the open end, the air is pumped out. The cylinder is then filled with creosote or other preservative. For railroads the best type is the portable retort, mounted on railroad trucks. The boilers, pumps and solution tanks are also mounted on trucks. Timber along various lines of

the railroad can be treated successively with little delay and no cost for special foundations.

—ALLIS-CHALMERS COMPANY, MILWAUKEE, WIS.

TOILET APPARATUS

DAYTON DRY CLOSETS. The hopper is made of porcelain, with ivory white finish; has patent seat raising device, which lifts the seat when the lid is raised and holds it until in a perpendicular position, thus preventing the seat being fouled if used as a urinal. The seat, however, when it reaches a perpendicular position becomes automatically disengaged and can be returned to its place, the lid following the seat unless held in position; this insures the lid being closed after an operation, so that the next person desiring to use the closet will not find the lid up and seat down and soiled.
—THE DAYTON MANUFACTURING COMPANY, DAYTON, O.

DAYTON NICKELINE WASHSTANDS. Lavatories made of nickeline have of recent years taken the place of marble. These are manufactured in all shapes and sizes to fit any space provided for same in railway cars. Special attention is called to the folding lavatories for state or toilet rooms to be used where space is limited. These stands are preferable to marble as they eliminate the constant breakage and reduce repairs to a minimum. The folding lavatory cabinets are made of mahogany, cherry, quartered oak, or any other kind of wood that may be specified.
—THE DAYTON MANUFACTURING COMPANY, DAYTON, O.

DAYTON WATER CLOSETS FOR PASSENGER CARS. A toilet that can be satisfactorily introduced in a railway car must possess many requirements not found in ordinary closets. The company's experience of years has enabled it to perfect various types which are now being used on many important steam and electric railways. These closets are made so that when in use there is no water below level of seat, obviating all danger of freezing while the body of the car is warm.
—THE DAYTON MANUFACTURING COMPANY, DAYTON, O.

TOOLS, MACHINE

(See "Machine Tools")

TOOLS, TRACK AND MISCELLANEOUS

(See also "Grinders.")

BETHLEHEM FOUNDRY & MACHINE COMPANY, SOUTH BETHLEHEM, PA. This company makes a number of special devices for construction work, among them being the following: Single drum inclined winches; Bethlehem winches; dandy winches; buggies; bogie rollers; grapples; screw punches; hydraulic beam punches; flange punches; horizontal hydraulic jacks; ground lift hydraulic jacks, and jack screws.

BROWN BONDING TOOLS. Hand power grinders, flexible shafts, emery wheels, arbors drills, etc, for applying rail bonds. (See advertisement.)
—HAROLD P. BROWN, NEW YORK.

BROWN FLEXIBLE SHAFTS. For use with emery wheels, portable hand power grinders, etc., on track and shop work. Strong, cheap, simple and compact. Designed after ten years' experience with the ordinary expensive and delicate flexible shafts; will stand rough handling by the ordinary track labor. (See advertisement.)
—HAROLD P. BROWN, NEW YORK.

FAIRBANKS-MORSE CLAW BAR. The claw is made separately and secured to bar by means of bolt. The claw is the part of the bar that receives the hardest wear and gives out first. In this bar the claw is made of special crucible steel, securing the greatest durability, and when worn out the claw only needs to be renewed, the bar lasting almost indefinitely. It will go under heads of spikes that other bars will not take and pulls the spike straight.
—FAIRBANKS, MORSE & COMPANY, CHICAGO, ILL.

"OHIO BRASS" TRACK TOOLS. Track bonding tools are made by this company for installation of "All Wire" soldered bonds. These tools are especially designed for bonding work and make it possible to install "All Wire" bonds quickly and at the same time insure perfect joints.
—THE OHIO BRASS COMPANY, MANSFIELD, OHIO.

SECURITY DRILL CLAMP. This device grips the base of any rail, and holds on until desired to let it go.

There is no bend or spring to it, and it always stays in alignment. The total weight of this clamp is 34 lbs.
—THE F. BISSELL COMPANY, TOLEDO, O.

WATSON-STILLMAN TRACK TOOLS. These include street car motor lifts, rail benders, car wheel presses and many other hydraulic tools specially adapted to street railway service.
—WATSON-STILLMAN COMPANY, NEW YORK AND CHICAGO.

TOWER WAGONS

(See "Wagons, Tower")

TOWERS, COOLING

(See also "Condensers")

ALBERGER COOLING TOWERS. Representing the most modern and improved apparatus for cooling water for re-use in steam and ammonia condensers, rolling mills, gas engines and compressor jackets, chemical works and all places where a continual supply of cold water is required and is not available from a natural source. Built in two distinct types, forced draft and natural draft, and provided with the greatest amount of effective and practically indestructible cooling surface geometrically arranged to insure the least resistance to the air. Absolutely even distribution of water over the surface, effected by means of the Alberger automatic rotary distributor.
—ALBERGER CONDENSER COMPANY, NEW YORK.

WHEELER COOLING TOWERS. Where cooling water for condensing purposes cannot be obtained from a natural source, a cooling tower is installed, through which cooling water, after being heated in condensers, is passed and cooled with the aid of a blast of air produced by fans, thus carrying away the heat put into the water from the exhaust steam and allowing the cooling water, which is being used continuously, to be returned to the condenser. These are made in various types and sizes, and can be adapted to the varying conditions found in engineering practice.
—WHEELER CONDENSER & ENGINEERING COMPANY, NEW YORK.

WHEELER-PRATT WATER COOLING APPARATUS. See item under Condensers.
—C. H. WHEELER CONDENSER AND PUMP COMPANY, PHILADELPHIA, NEW YORK, CHICAGO AND SAN FRANCISCO.

WORTHINGTON COOLING TOWER. Consists of a vertical steel shell provided with fans which deliver air over a filling of tile or galvanized pipe. The hot water passes through a vertical central discharge column into a revolving distributor, which lays it evenly upon the filling, over which it trickles while being cooled by the upward blast of air, and then falls to the cold water tank in the tower base. The tower may be arranged for ground foundation or roof, or for natural draught service. Two hundred and fifty towers have been installed since 1893 for miscellaneous service, mostly for cooling condensing water.
—HENRY R. WORTHINGTON, NEW YORK.

TRACK WORK

ALABAMA FROG & SWITCH COMPANY, AN-NISTON, ALA. This company has excellent facilities for manufacturing railroad crossings, frogs, switches, switch stands, as well as special work of every description for steam and electric railways.

AMERICAN BRIDGE COMPANY OF NEW YORK NEW YORK. Among the other railway manufactures of this company may be named transfers and turntables.

THE AMERICAN FROG & SWITCH COMPANY, HAMILTON, OHIO. This company, which is prepared to supply all varieties of track work for electric railways, has designed, in connection therewith, a number of special devices, such as the American spring frog Nos. 1 and 3, the American split switch No. 3 and the American re-enforced split switch with two adjustable head rods, No. 34.

ATLAS TRACK SPECIALTIES. These include not only the well-known Atlas rail-joint in various forms, but also girder braces, rail braces, etc.
—ATLAS RAILWAY SUPPLY Co., CHICAGO, ILL.

BARBOUR-STOCKWELL COMPANY, CAM-BRIDGEPORT, MASS. This company manufactures a variety of track work for electric railway purposes, including switches, mates and frogs, and crossings with hard steel centers.

BEAVERDAM TIE PLATES AND RAIL BRACES These plates and braces are made of malleable iron only, the manufacturer having found them to be lighter, stronger and more durable than those made of rolled steel.
—BEAVER DAM MALLEABLE IRON COMPANY, BEAVER DAM, WIS.

BUDA SEMAPHORE SWITCH STANDS. These stands have all the advantages of ordinary stands of the color and shape order, but have additional points in favor. They may be seen at a quarter distance and position of the semaphore arm is a more positive and natural indication of the position of the switch points. Interurban roads find them a safe and desirable stand, and their use tends toward unification of signal standards and to the avoidance of confusion in interpretation.
—JUDA FOUNDRY & MANUFACTURING COMPANY, CHICAGO, ILL.

BUDA SPECIAL WORK. Such as frogs, crossings, switches, hard centers, crossings, complicated street intersections, etc. Much depends upon accuracy and only the best construction is desirable.
—PAIGE IRON WORKS, A DEPARTMENT OF THE BUDA FOUNDRY & MANUFACTURING COMPANY, CHICAGO, ILL.

THE CLEVELAND FROG AND CROSSING COM-PANY, CLEVELAND, OHIO. This company is a large manufacturer of Lucas' steel rail frogs and crossings, spring rail frogs, split switches, switch stands, tie bars, and track supplies in general. One of the company's specialties is the Porter self-cleaning derailing switch.

DUFF STEEL RAILWAY SUBSTRUCTURE. A method of track construction, consisting of a continuous steel arch support under each rail, and tie pieces of channel shape binding girders together across the track. Rails are fastened to girders by pressed steel clips without bolts or any parts that can get loose or broken. Rail joints are fully supported without interfering with the standard splice bars or rail bonds. Specially adapted for railway track in paved streets, as pavement is not broken up by removal of cross ties, and track does not require frequent renewal. (See advertisement.)
—AMERICAN RAILWAY TIE & GIRDER COMPANY, PITTS-BURG, PA.

ELLIOT FROG & SWITCH COMPANY, EAST ST. LOUIS, ILL. Maker of all types of electric railway track work, including frogs, switches, crossings, etc.

FALK SPECIAL TRACK WORK. Hardened center-cast-steel track work is integral with all principal wearing surfaces specially treated to combine toughness with hardness. Steel bound track work dispenses with bolts, angle plates or knees, and, being thoroughly welded together by heavy steel castings, is integral in its nature. It is a compromise between the built-up and higher price hardened-center-work. The '04 frog (built up) is made up with heavy open-hearth steel knees and corner filler blocks, provided with guards and riser protection for points. (See advertisement.)
—THE FALK COMPANY, MILWAUKEE, WIS

INDIANAPOLIS SWITCH STANDS. This company furnishes all types of stands, such as main line high stands, pony stands and parallel throw automatic target stands, as well as plain ground throw, for yard and switch use, all of which are designed to meet the requirements of steam and interurban railways—also for mine track and industrial railways.
—THE INDIANAPOLIS SWITCH AND FROG COMPANY, SPRINGFIELD, O.

THE INDIANAPOLIS SWITCH & FROG COM-PANY, SPRINGFIELD, OHIO. This company manufactures special work for steam, electric and interurban railways, also mine and industrial tracks; all construction especially adapted to meet the requirements of high speed heavy traffic railways. The self-contained easer crossing and improved tongue switches and mates for turnouts and car barn layouts possess features of exceptional merit. Special attention is given to equipping interurban railways with crossings, frogs, switches and stands of all designs equal in every respect to standard steam railway specifications. Surveys are made when desired.
—THE INDIANAPOLIS SWITCH & FROG COMPANY, SPRING-FIELD, OHIO.

"JOHNSTOWN" SWITCH STAND. This stand has a throw parallel with the track and is used with either rigid or spring split switches. It is suitable for steam or interurban railroads or yard use. It is furnished with either a low or high target or without target as required.

The target rod is provided with a bayonet to fit lamp socket. It is supplied with an automatic latch and lever rest. The latch is released by the foot and can be locked with an ordinary switch lock. (See advertisement.)
—THE LORAIN STEEL COMPANY, PHILADELPHIA, PA.

LORAIN CAST STEEL "GUARANTEE" CROSS-INGS. Made of cast steel and have renewable hardened steel plates at points of maximum wear. The outside arms are provided with forged or cast steel combination joints, or are made to conform to connecting sections. (See advertisement.)
—THE LORAIN STEEL COMPANY, PHILADELPHIA, PA.

LORAIN GIRDER RAIL FROGS AND CURVE CROSSES. "Guarantee" frogs are made to accom-modate any section of girder rail with hardened renewable centers at points of intersection. According to the special requirements of the case, the frogs may be made of cast steel with arms of same material, or arms of rolled steel, held in position by cast iron. Cast steel frogs are made of open hearth cast steel as durable as rail steel; this type being made in one solid casting there are no parts to become loose. Solid cast filler frogs: In this construction the point rails are held together independently of the bolts by the solid cast filler, which is poured hot after all the rails are assembled. Cast-in frogs: In this type rails are firmly held at intersection without bolts or brackets. Unbroken main line frogs are for the purpose described in title. Are made of cast steel and are recommended for use where crossing track is infrequently used; floor of groove in crossing track is gradually raised to a level with the head of main line rail. (See advertisement.)
—THE LORAIN STEEL COMPANY, PHILADELPHIA, PA.

LORAIN MATES. Mates for tongue switches are provided in either girder or tee rail, conforming to any con-struction indicated in the foregoing for tongue switches. (See advertisement.)
—THE LORAIN STEEL COMPANY, PHILADELPHIA, PA.

LORAIN RAILS. Steel rails of various types rolled to suit conditions of paving, etc., including girder rails, guard rails for curved track, full groove rails, half groove rails, "Trilby" rails, deep tee rails, slot rails, stringer bridge rails and shaped guard for tee rails. (See advertisement.)
—THE LORAIN STEEL COMPANY, PHILADELPHIA, PA.

LORAIN SLOT CROSSINGS. Track with slot cross-ing track, with or without slot, are made of cast steel, excepting the slot rails, which are of rolled steel—the cast steel rails being fitted to the rolled slot rail. Hardened steel renewable centers are provided at points of maximum wear. Variations in this type permit the slot rail to be made also of cast steel and an integral part of the crossing casting, and crossings of this description are sometimes made without the hardened renewable plates at points of maximum wear. (See advertisement.)
—THE LORAIN STEEL COMPANY, PHILADELPHIA, PA.

LORAIN SPLIT SWITCHES. Split switches are manufactured in every weight of tee rail and to any tee rail section; types varying according to wish of individual buyers. Among others, being cast manganese point split switches, reinforced split switches, rigid split switches, spring split switches, housed point split switches, spring switches with rigid ground throw, and spring switches with spring ground throw. (See advertisement.)
—THE LORAIN STEEL COMPANY, PHILADELPHIA, PA.

LORAIN STANDARD TRANSFER TABLE. De-signed in such a way that no pit is necessary. The axes revolve in steel anti-friction bearings. The table is con-structed entirely of steel and is made for rough usage. It can be made to accommodate any length of car desired. The transfer table rails are framed level with the rails in the car house. (See advertisement.)
—THE LORAIN STEEL COMPANY, PHILADELPHIA, PA.

LORAIN STEAM RAILROAD CROSSINGS. Made with or without the third or lift rails and with or without hardened steel renewable centers at points of intersection, both tracks guarded with same section of rail and are se-curely bottled together, having necessary fillers. There is a wide variation in the types of steam railroad crossings, such variations being made in order to conform to the local conditions and the individual ideas of steam and street railroad companies, by whom the same are used. (See advertisement.)
—THE LORAIN STEEL COMPANY, PHILADELPHIA, PA.

LORAIN STREET CROSSINGS, REGULAR CON-STRUCTION. One street track crossing another street track. Crossing to be built of any guard, girder or tee rail section. Rails in crossing are rigidly held in place by means

of corner plates or brackets, securely bolted, or by cast iron poured around the rail intersections. "Guarantee" construction rails are held rigidly in place by cast iron poured around the rail intersections and having renewable hardened steel plates inserted at points of maximum wear; such crossings can be made having the outside arms of the same section of rail as rail sections abutting, thus obviating the use of combination joints. (See advertisement.)

—THE LORAIN STEEL COMPANY, PHILADELPHIA, PA.

LORAIN TEE RAIL FROGS. "Guarantee" frogs. Solid cast filler frogs and cast in frogs are made also in tee rail and of the same general construction indicated above for girder rail frogs. Rolled steel filler frogs are extra strong, being provided with rolled steel fillers. Riveted plate frogs are riveted down to bed plate of size varying with angle of frogs. Spring frogs are made with either one or both wings movable, to provide unbroken main line in either one or both tracks, as may be required. (See advertisement.)

—THE LORAIN STEEL COMPANY, PHILADELPHIA, PA.

LORAIN TONGUE SWITCHES. Tongue switches of the "Guarantee" type are made with hardened renewable centers after the manner described for this type of construction in crossings and frogs. Armored heel tongue switches are provided with renewable plates, protecting and covering heel of tongue, designed to protect the heel from wear and obviate the possibility of excessive movement of worn tongues. Cast steel tongue switches are made of solid cast steel with tongues of hard forged steel. Connected tongue switches (tongue switch and tongue mate), tongue connection being an adjustable rod enclosed in a cast iron box. Tee rail tongue switches of "Guarantee" construction and of the "built up" type. Spring tongue switches in either tee or girder rail, action of tongue being made automatic by means of spring adjustment. (See advertisement.)

—THE LORAIN STEEL COMPANY, PHILADELPHIA, PA.

LORAIN TRACK WORK embraces every variety of girder and tee rail, special work including ordinary surface work of girder or tee rail, with switch pieces either of hardened renewable center construction or of built-up type, and curves spiralized or plain as may be required; also electric conduit and cable work of every kind and variety.

—THE LORAIN STEEL COMPANY, PHILADELPHIA, PA.

NEW YORK SWITCH AND CROSSING COMPANY, HOBOKEN, N. J. This company manufactures special track of all kinds, such as switches, frogs, crossings, stands, transfer and turn tables for steam and industrial railways. Girder rails, hard center construction for electric and steam roads a specialty.

PENNSYLVANIA STEEL COMPANY'S TRACK WORK. This company manufactures steel rails of all sections and weights, frogs, switches, crossings and special track work for electric railways.

—PENNSYLVANIA STEEL COMPANY, PHILADELPHIA, PA.

WEIR FROG COMPANY, CINCINNATI, OHIO. This company has about thirty different designs of crossings adapted for the crossing of electric railways over steam roads. They are built in accordance with the latest specifications and plans. It can furnish split switches of any design, but has over one hundred of its own, with and without adjustable head rods, or spring head rods, or springs. Point rails re-enforced, or plain. Frogs can be furnished either rigid or spring rail, bolted-up construction in about ninety designs. Switch stands can be furnished from plain ground throw without target, to a ladder stand with a 20 ft. target, either rigid or automatic stands. The company also makes guard rails, rail braces, derailers, etc.

WHARTON MANGANESE STEEL SPECIAL TRACK WORK. Crossings, frogs and switches made with specially strong cast iron or cast steel bodies, with girder rails, of section to be joined, cast into the ends and centers of Manganese Steel, inserted at points of greatest wear. In T-rail work, frogs, etc., cast solidly of Manganese Steel. The Manganese Steel centers outwear the adjoining rail. Special attention is given to accuracy and finish, to insure smooth riding. The company has the sole right in America for the use of genuine Manganese Steel in track work.

—WM. WHARTON, JR. & COMPANY, INCORPORATED, PHILADELPHIA, PA.

TRANSFERS

(See "Tickets and Transfers")

TRANSFER-ISSUING MACHINES

"OHMERGRAPH" TRANSFER-ISSUING MACHINE. The Ohmergraph is a light machine carried on the side or chest of the conductor. It perforates the month, day, direction, hour and fractions of hours. It is encased in aluminum and contains transfers put up in rolls of 200 to 300. It is impossible to punch and issue transfers without recording them in this machine. An audible bell ring accompanies each transfer issued.

—OHMER FARE REGISTER COMPANY, DAYTON, OHIO.

TRANSFORMERS

AMERICAN TRANSFORMERS. Durable and safe apparatus of the oil-cooled type, made for all voltages. Large spacings are allowed and generous quantities of iron and copper are used, giving cool operation. Coils are thoroughly baked and impregnated with insulating varnish. Only a slight increase in temperature is caused by several hours under one and one-quarter load. At three-quarters load the efficiency varies between 93.17 per cent. and 97.90 per cent., according to size. Each transformer is tested before leaving factory by running at double potential and applying 15,000 volts immediately after running on full load.

—WESTERN ELECTRIC COMPANY, NEW YORK AND CHICAGO.

BULLOCK TRANSFORMERS. Oil-filled transformers are made for a wide range from 50 Kw. up, for all the standard voltages used in transmission work. They are made in two types—oil filled self-cooled and oil-filled water-cooled. Self-cooled transformers are provided with corrugated sheet iron cases, depending on radiation from the case to get rid of the heat; they are not made for outputs above 250 Kw. Water-cooled transformers are provided with boiler-plate cases, and the heat is carried off by water circulating through a coil of seamless copper pipe. Water-cooled transformers can be supplied for any desired output.

—ALLIS-CHALMERS COMPANY, MILWAUKEE, WIS. (ELECTRICAL DEPARTMENT, BULLOCK ELECTRIC MANUFACTURING COMPANY, CINCINNATI, OHIO.)

GENERAL ELECTRIC TRANSFORMERS. These transformers are manufactured in all sizes ranging from the small 6 kw. lighting transformers up to the monster 7,500 kw. units, which are now under way at the Schenectady works. This range in size includes oil cooled, air-blast, and water-cooled types. The first type is preferable when first cost is of less importance than minimum attendance, and the units are comparatively small. For large units either air-blast or water-cooled types must be used, the selection depending upon line voltage and local conditions. The Company's engineers are prepared to decide these questions for the customer.

—GENERAL ELECTRIC COMPANY, SCHENECTADY, N. Y.

WESTINGHOUSE TRANSFORMERS. In addition to the several lines of smaller transformers for lighting and power service, such as types N, OD and C, this company has met the demand for larger units, and now 70,000 volt transformers of 3,000 kw. capacity are designed with the same accuracy as 5,000 volt transformers of ten years ago. These large transformers are of the oil-insulated water-cooled type. The Interborough Rapid Transit Company of New York operates 198,000 kw. of Westinghouse air-blast transformers in New York City alone.

—WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY, PITTSBURG, PA.

TRAPS, STEAM

ALBANY RETURN STEAM TRAPS. Return steam traps will not only remove the condensed water from steam-jacketed cylinders and from steam separators using high pressure steam, but will also return the same water into the boiler direct without the aid of a pump or the steam loop; and will do this from systems working under varying pressures, from 100 to 200 lbs., returning the water at temperatures from 212 deg. to over 350 deg. Thousands of these have been made and sold during the past 32 years.

—THE ALBANY STEAM TRAP COMPANY, ALBANY, N. Y.

ALBANY NON-RETURN STEAM TRAPS. This trap is styled the "Class C" non-return trap and is best adapted for working on steam pressures of from one up to 100 lbs.; in construction it is similar to the old pot, or bucket trap, that has been in use over fifty years, and perhaps at the present time there are more traps of this one kind than of all the other kinds put together. The improvement in construction of this trap is providing for the renewing of the valve and its seat, when necessary, and this can be accomplished in a few minutes,

without removing the top of the trap. The joints are all scraped and fitted metal to metal, and all the parts are interchangeable.

—THE ALBANY STEAM TRAP COMPANY, ALBANY, N. Y.

GOLDEN TILTING STEAM TRAP. The proper amount of condensation entering through a feed trunion, passing into the receiver, will cause the same to "tilt." As it does so it opens the auxiliary valve, allowing the pressure to act on the piston, which in turn opens the main valve, allowing water in receiver to discharge through the outlet in trunion. The balance weight on lever causes the receiver to "tilt" back to its filling position, which releases the auxiliary valve, allowing the main valve to close. There are no floats, valves or buckets inside of traps; all working parts are outside.

—GOLDEN-ANDERSON VALVE SPECIALTY COMPANY, PITTSBURG, PA.

MOREHEAD RETURN TRAP. This automatic steam trap takes the condensation from steam heating apparatus and returns it direct to the boiler without waste. The heating surface is rendered more effective by the quick removal of the condensation and the heat from same is utilized in the boiler. The trap consumes less than 10 lbs. of steam per h.p. hour, whereas an ordinary duplex boiler-feed pump requires from 90 lbs. to 120 lbs. The construction of this trap is such that it requires no attention or repairs. It will not race or stick, is noiseless, requires little room and no foundation.

—AMERICAN BLOWER COMPANY, DETROIT.

STURTEVANT STEAM TRAPS. Especially designed for use with the Sturtevant heaters, although equally well fitted for operation with steam heaters or radiators of any other construction. The body of the trap contains a pot, which floats and closes the connection between the interior and exterior until sufficient water accumulates in this space to overflow into the pot and sink it. Free passage for the water is thus afforded from the pot up to the outer air, which continues until the levity of the pot becomes sufficient to cause it to rise and close the outlet. The periodic delivery continues as long as there is water to discharge or sufficient steam pressure to cause the trap to act.

—B. F. STURTEVANT COMPANY, HYDE PARK, MASS.

WILLIAMS STEAM TRAP. The discharge of this trap resembles a gun, and its construction obviates all possibility of steam waste. There is no duty that it will not perform, its capacity being practically unlimited. The maker cites an instance where one 2 in. trap is doing the work of seven 1½ in. traps of other manufacture. These traps are very compactly built to permit their installation in places where little head room is obtainable.

—THE WILLIAMS GAUGE COMPANY, PITTSBURG, PA.

TREADS, STEP

EMPIRE CARBORUNDUM SAFETY TREAD

A top-piece for stairs and car steps, employed for the double purpose of preventing pedestrians from slipping and the steps from wearing out. This type of tread is composed of hard grains of carborundum grit set in the channels of a rolled metal plate. As the grains offer varying resistance to wear, this tread combines the advantages of a permanently rough surface and long life.

—EMPIRE SAFETY TREAD COMPANY, BROOKLYN, N. Y.

MASON SAFETY TREAD. Consists of a steel plate ¼ in. thick, the upper surface cut with longitudinal alternating grooves; one set of grooves V-shaped, the other set dovetailed and filled with lead. The purpose of the lead is to prevent slipping. The open grooves permit all dirt deposited upon the tread to be readily swept out. This form of tread is claimed to be superior to any other from the fact that the steel supporting ribs are continuous, giving longer wear and preventing the possibility of the lead being pressed over into the open grooves. The treads are curved when required to fit any form of step. (See illustrated advertisement.)

—AMERICAN MASON SAFETY TREAD COMPANY, BOSTON, MASS.

UNIVERSAL SAFETY TREAD. A lead tread for car steps, platforms and floors. Clean, safe, durable.

—UNIVERSAL SAFETY TREAD COMPANY, NEW YORK.

TROLLEY BASES, POLES, HARPS AND WHEELS

(See "Bases," "Poles," "Harps" and "Wheels, Trolley")

TROLLEY WAGONS

(See "Wagons, Tower.")

TRUCKS, CAR

AMERICAN CAR COMPANY'S "M. C. B." TRUCK. A simply and powerfully constructed truck adaptable to a large variety of conditions. The center trusses of the frame are brought under castings to which the transoms are secured and the ends bolted through the pedestals and frame. Ends of the frame are depressed for clearance and are trussed by extending the tie bars to meet them. End crossings are secured to the side bars with heavy gusset plates, forming a square and substantial frame. The bolster is of the swing type and is mounted on double, triple and quadruple elliptics, according to the weight of load and carrying capacity required.

—AMERICAN CAR COMPANY, ST. LOUIS, MO.

AMERICAN CAR & FOUNDRY COMPANY.
(See item under "Cars.")

AMERICAN STEEL MOTOR TRUCK. This truck will safely carry an 85,000 lb. car at a speed of 70 miles an hour. M. C. B. construction is followed throughout, using equalizers and swing link bolsters. Dust-proof side bearings oiled from the center are employed. In general, the design insures easy riding and low maintenance cost.

—AMERICAN LOCOMOTIVE COMPANY, NEW YORK.

BALDWIN MOTOR AND TRAILER TRUCKS. These are of the M. C. B. type or in accordance with customer's specifications, of best material and workmanship, guaranteed forever against inherent defects; all joints are machined and bolt holes taper reamed in accordance with best locomotive practice. Strains due to motor are carefully calculated and allowed for as well as strains from weight of car and roadbed. Special designs for fast interurban and heavy street railway service. Trucks are built to operate with any motor customer may specify. On account of good design and first class construction, these trucks save repairs, keeping maintenance charges to the minimum.

—BALDWIN LOCOMOTIVE WORKS, PHILADELPHIA, PA.

BRILL "EUREKA" MAXIMUM-TRACTION TRUCK. The truck for low and narrow city cars. Seventy-five per cent. of the load is on the drivers, giving traction that enables it to start rapidly and climb heavy grades. When taking curves, a spring-post between the pony wheels is compressed by an inclined plate attached under the car transferring for the time more of the load to these wheels. The brake system includes differential levers which proportion the amount of pressure on each pair of wheels according to the load which they carry. Having no bolster, there is ample space for a large motor and free access to it. Solid forged side frames. (Advertisements in last pages.)

—J. G. BRILL CAR COMPANY, PHILADELPHIA, PA.

—AMERICAN CAR COMPANY, ST. LOUIS, MO.

—JOHN STEPHENSON COMPANY, ELIZABETH, N. J.

BRILL NO. 21-E TRUCK. Cars mounted on this truck are carried two inches lower than on any other single-truck. Another distinctive feature is the diagonal cross-bracing at the center of the frame. Each side frame is solid forged in a single piece. No rivets, no built-up work, no possibility of getting out of square, no sagging at the ends. The spring arrangement gives complete support and steady cushion—no bounding motion. Self-oiling journal boxes run six months without re-oiling and are absolutely dust-proof. (Advertisements in last pages.)

—J. G. BRILL COMPANY, PHILADELPHIA, PA.

—AMERICAN CAR COMPANY, ST. LOUIS, MO.

—JOHN STEPHENSON COMPANY, ELIZABETH, N. J.

BRILL NO. 27-E TRUCK. A perfectly equalized truck for high-speed service. The spring system comprises three sets of springs working in series, each set having to do with the equalization. Not only is the load perfectly equalized on the wheels, but is also equalized on the frames. The only high-speed truck that has a cushioned side swing. No lurch or jar in taking curves. Load carried on the frame at wide-apart points, which, together with a spring base for the frame as long as the wheel base, absolutely prevents frame tilting under violent brake action. Solid forged frames, always safe and sound. (Advertisements in last pages.)

—J. G. BRILL COMPANY, PHILADELPHIA, PA.

—AMERICAN CAR COMPANY, ST. LOUIS, MO.

—JOHN STEPHENSON COMPANY, ELIZABETH, N. J.

BRILL NO. 27-F TRUCK. This truck is a modification of the Brill No. 27-E high speed truck, to adapt it to a short wheel-base and outside-hung motors. The spring system is equal in elasticity to that of the No. 27-G type, three sets of springs being used in both, and the method of equalization is the same in principle and result. The side frames are solid forged, and the transoms are secured

to them with forged single and double corner brackets. In this truck the brakes are usually hung on the end cross-ings. (Advertisements in last pages.)

—J. G. BRILL CAR COMPANY, PHILADELPHIA, PA.

—AMERICAN CAR COMPANY, ST. LOUIS, MO.

—JOHN STEPHENSON COMPANY, ELIZABETH, N. J.

BRILL NO. 27-G TRUCK. An easy riding short base double-truck for fast and heavy city and suburban service. Semi-elliptical springs take the place of equalizing bars. Spring links cushion the side swing, amplify the action of the semi-elliptical springs, and cushion the load upon the frames. The elastic side swing prevents jarring of the car at the entrance of curves, and gives soft contact of wheel flanges with rail heads. The truck can be used under narrow and low cars. The brake shoes are usually hung inside the wheels to simplify rods and levers. Solid forged side frames. (Advertisements in last pages.)

—J. G. BRILL COMPANY, PHILADELPHIA, PA.

—AMERICAN CAR COMPANY, ST. LOUIS, MO.

—JOHN STEPHENSON COMPANY, ELIZABETH, N. J.

BRILL "M. C. B." TRUCK. The frame is solid forged in one piece, lessening the number of bolts, doing away with trussing at the ends and only requiring gusset plates at the transoms. The pedestals, the spools between the ends of the pedestals, and the tie bars which connect and brace each pair of pedestals are also solid forged. The equalizing bars are double, each forged in a single piece without welding. The side trusses are secured between the tie bars and transom castings and brought over the equalizing springs. All parts are machined to templates and put together with turned bolts in reamed holes.

—J. G. BRILL COMPANY, PHILADELPHIA, PA.

—AMERICAN CAR COMPANY, ST. LOUIS, MO.

—JOHN STEPHENSON COMPANY, ELIZABETH, N. J.

BRILL SOLID FORGED SIDE FRAMES. Brill trucks are the only ones built with side frames—side bar, yokes and extensions—solid forged in a single piece. Riveted and built-up frames are at best an uncertain quantity, and although flanged to obtain transverse strength, are dependent upon a multitude of joints, each one of which is undergoing constant deterioration caused by side strains, shocks and vibrations. Cast-steel side frames are equal to strains from every direction and will keep the truck square, but are not proof against crystallization, and sooner or later break. Only six out of the many thousands of solid forged frames made have broken or needed repairs. (Advertisements in last pages.)

—J. G. BRILL COMPANY, PHILADELPHIA, PA.

—AMERICAN CAR COMPANY, ST. LOUIS, MO.

—JOHN STEPHENSON COMPANY, ELIZABETH, N. J.

DORNER M. C. B. TRUCK. Is extra strong, with heavy patented top frame. All parts are machine fitted. There is no lost motion. Very powerful brakes are used and the boxes and castings are of steel. It is especially adapted for high speed interurban and elevated railway service, as well as for electric locomotives. A large number of these trucks are now in satisfactory service. (See illustrated advertisement.)

—THE DORNER MANUFACTURING COMPANY, CHICAGO, ILL.

LACONIA HIGH SPEED DOUBLE TRUCKS. These are adapted for both interurban and city service; have cushioned swing holsters, which prevent cars from receiving shock while rounding curves; arranged for any style motor either inside or outside hung; brakes inside hung of extra strong construction and on steam car lines; wheels of Laconia make either spoke or double plate. Trucks furnished with either 4 ft. 0 in., 4 ft. 4 in., 5 ft. 0 in., 5 ft. 4 in. or 5 ft. 7 in. wheel base.

—THE LACONIA CAR COMPANY WORKS, BOSTON, MASS.

LORD BALTIMORE TRUCKS. A line of high grade electric car trucks comprising M. C. B. type for heaviest high speed service; short wheel-base centre bearing trucks; maximum traction trucks with bolster and king pin, giving all the stability of a centre bearing truck; and single four wheel-trucks. All are fitted with oil and dust tight boxes, and a perfect brake mechanism, giving maximum power with minimum movement of levers, and having all pivotal points fitted with hardened finished steel pins and bushings; constructed to permit changing of wheels and brakeshoes with greatest facility.

—THE BALTIMORE CAR WHEEL COMPANY, BALTIMORE, MD.

PECKHAM ELECTRIC CAR TRUCKS. These trucks comprise the following styles: "Standard" and "Extra Long" single trucks designed for 20 ft. to 22 ft. electric cars, "Maximum Traction" truck designed for city and suburban service, under cars operating with but one motor per truck; a "Center Bearing" truck carrying the motor outside of the driving axle;

"Short Wheel Base" MCB No. 25 truck, designed for service under double truck cars operating through short radius curves, practically an M-C-B construction without equalizing bars, MCB Nos. 36, 40 and 46 trucks are constructed for heavy high speed passenger service, following the same general line of construction so long successful under steam railroad cars, and the "Diamond Frame" No. 100 double truck for freight car service. (For illustrations of the above trucks see regular advertisements.)

—THE PECKHAM MANUFACTURING COMPANY, KINGSTON, N. Y.

ST. LOUIS TRUCKS. For city service the No. 47 short wheel base truck is best adapted. Solid steel frames, machine fitted to angle iron end cross bars, making a rigid frame. Machine fitted pedestals. Swing bolster of wrought steel, consisting of top and bottom plates, trussed with cast iron separators. Bolster supported by two double elliptical springs, and cushioned by coil spring for side thrust. One coil spring over each journal box. Inside hung brakes with slack adjusting device at each end of brake hangers. Arranged for outside motor suspension. The short wheel base enables the hauler to lower the distance at which car body is carried above the rail and is adapted to short radius curves. The wheel base is 4 ft. 6 in. and the weight 5,700 lbs.

—ST. LOUIS CAR COMPANY, ST. LOUIS, MO.

STANDARD STEEL CAR TRUCKS. This company manufactures trucks for all types of electric cars, long wheel base, short wheel base and maximum traction, each of the M. C. B. equalizer bar type, and also trucks for single truck cars. They are solid forged of open hearth steel without welds. The brakes and motors are carried on the equalizer bars instead of the truck frame. The brake shoes are automatically adjusted so that they require no attention until worn out. The swing of the bolster is retarded by a friction device which makes the riding much smoother than with other designs.

—THE STANDARD STEEL CAR COMPANY, PITTSBURG, PA.

STEPHENSON "M. C. B." TRUCK. An inexpensive, durable and easy-riding truck. The frame is trussed above and below the pedestals and provided with cast steel pedestals. Gusset plates at the center are of malleable iron and are lipped over the frame to which they are securely bolted. Besides connecting the upper flange of the channel transoms to the side frames they serve as guides to the bolster and also carry the bolster hangers and the hangers of inside brakes. The frame is forged in a single piece and to obtain extra clearance is curved at the corners besides being depressed.

—JOHN STEPHENSON COMPANY, ELIZABETH, N. J.

TAYLOR TRUCKS. These trucks embrace thirty types, both single and double for passenger, freight and locomotive service. All wrought metals used are steel, and the cast parts malleable. All of these trucks are built on the Standard Master Car Builders' lines, and incorporate the best principles known in railway truck construction. The springs used in these trucks are made by the truck builders and are accurately tested. Trucks made to suit the specific requirements of railway companies.

—TAYLOR ELECTRIC TRUCK COMPANY, TROY, N. Y.

TRUING DEVICES, COMMUTATOR

(See Commutator Compounds and Truing Devices.)

TURBINES, HYDRAULIC

(See Hydraulic Machinery.)

TURBINES, STEAM

ALLIS-CHALMERS STEAM TURBINES. A horizontal turbine of the multiple expansion parallel flow type. Cylinder consists of several transverse sections permanently secured together. Rotor built of steel. Channel shaped shrouds riveted to ends of blades, giving great stiffness and eliminating danger of stripping. Balance pistons of special design, small in diameter, thus reducing distortion of cylinders under varying temperatures. Bearing and cylinder covers easily removed for inspection. Arrangement of bedplates such as to leave space between foundations open to floor line for condensers. Fluctuating loads handled automatically.

—ALLIS-CHALMERS COMPANY, MILWAUKEE, WIS.

CURTIS STEAM TURBINES. This turbine is manufactured by the General Electric Company and is especially adapted to railway work. Its advantages may be thus summarized: High steam economy at all loads. High steam economy with rapidly fluctuating loads. Small space per K. W. capacity. Uniform angular ve-

locity. Simplicity in operation, and low expense for attendance. Freedom from vibration. Steam economy not impaired by wear in long service. Adapted to high steam pressure and high superheat. Condensed water is kept entirely free from oil and may be returned to the boilers. Built in sizes from 15 K.W.-8,000 K.W. Also made in horizontal form from 15 K.W.-300 K.W. for direct current work. Self contained and automatic. A special line is offered for operation on exhaust steam from reciprocating non-condensing engines.
—GENERAL ELECTRIC COMPANY, SCHENECTADY, N. Y.

HAMILTON-HOLZWARTH STEAM TURBINE. This turbine is of the horizontal type. It has a large number of stationary disks and running wheels, but expands only in the stationary blades. The radial height of the vanes in these blades is gradually increased from high to low pressure, corresponding to the volume to which the steam expands in its course. The hub of the running wheel runs, with minimum practical clearance, in the bore of the stationary disks, thus restricting the leakage losses to the lowest figure. The stationary disks are located in grooves in the turbine casings.
—HOOVEN-OWENS-RENTSCHLER COMPANY, HAMILTON, O.

RATEAU-BALLWOOD STEAM TURBINE. This turbine is of the action type, as the energy of the steam is transformed into velocity by expanding in a series of fixed distributors. To each distributor there is one moving wheel, the two forming a group or element. The moving wheels turn between the distributors which are in the form of vanes projecting radially almost to the shaft which carries the moving wheels so that between succeeding vanes is formed a cell giving rise to the term multi-cellular as applied to this type. Between succeeding cells the fall in pressure is slight and as the only leakage is that through the clearance between the fixed distributor vanes and the shaft, the nature of the design makes this very slight. Considerable play can be allowed therefore between the fixed and moving parts—a very important matter in the operation of any turbine when it can be obtained along with the highest efficiencies, as is the case with this turbine.
—THE BALL & WOOD COMPANY, NEW YORK.

WESTINGHOUSE-PARSONS STEAM TURBINE. The essential features of this turbine are (a) simplicity—utilizes simple rotary motion and consists of only two main parts, rotor and stator, or casing. By lifting the cover of the latter the entire machine interior is exposed; (b) compactness—space occupied from one-half to one-fifth that occupied by Corliss engines; (c) high economy throughout wide ranges of load; (d) large overload capacity in machines; (e) rotation absolutely uniform; (f) continuous oiling system, under low static head no pressure employed; (g) condensation pure and free from oil; (h) steam expansion complete, i. e., to condenser pressure; (i) especially suited to the use of superheated steam.
—THE WESTINGHOUSE MACHINE COMPANY, PITTSBURG, PA.

VACUUM IMPREGNATING APPARATUS

DEVINE VACUUM AND IMPREGNATING APPARATUS FOR COILS. This comprises a line of special apparatus which has been designed to enable electric railway shops to carry out successfully the vacuum-drying and impregnating methods so valuable in securing the thorough insulation of field and armature coils.
—JOSEPH P. DEVINE, BUFFALO, N. Y.

VALVES AND GATES

ALBANY GATE VALVE. These valves are made extra heavy. The seats of the valve are annular rings, threaded on the outside to screw into the body of the valve from the inside. On the interior of these rings, or seats, are projections not unlike the teeth of an internal gear. A small wrench fits over these projections and after removing the cap and withdrawing the stem and wedge, the wrench can be inserted and the seats removed and new ones substituted, or the old ones repaired. These qualities and the facility with which the parts can be replaced make these valves very desirable.
—THE ALBANY STEAM TRAP COMPANY, ALBANY, N. Y.

ALBANY GLOBE VALVES. These valves embody the principle of removing and renewing the wearing parts without disturbing the bodies of the valves from their position in a line of pipes. It is a fact well known to engineers and steam users generally that any improvement in steam valves, whereby they could be renewed or made tight without removing the body of the valve from the pipe, and at the same time be simple, durable and cheap, would be appreciated. With high pressure steam, a valve seat will only last for a limited time, even when made of the best

steam metal; and once leaking, the only remedy is refitting, or a new valve, with the consequent expense, trouble and delay. These valves are made specially heavy, and adapted for use in fitting up electric light and power stations.
—THE ALBANY STEAM TRAP COMPANY, ALBANY, N. Y.

ANDERSON FLOAT VALVE. This valve is used to maintain a uniform stage of water in the tank or reservoir.
—GOLDEN-ANDERSON VALVE SPECIALTY COMPANY, PITTSBURG, PA.

ANDERSON CUSHIONED NON-RETURN VALVE (ANGLE OR GLOBE). These valves supply a very vital part of the general piping system of power plants. The valve, when placed between the boiler and header, will equalize the pressure between the different units of a battery of boilers as they remain closed as long as the boiler pressure is lower than that of the header. When the boiler pressure equals that of the head pressure, they open and will remain in that position without chattering or hammering. They will automatically cut off a boiler in case of accident to the boiler and also act as a safety stop to prevent steam being turned into a cold boiler, while men are working inside.
—GOLDEN-ANDERSON VALVE SPECIALTY COMPANY, PITTSBURG, PA.

ANDERSON CUSHIONED TRIPLE-ACTING NON-RETURN VALVE. The use of high steam pressures with many branched pipes has necessitated the employment of a valve to act as a safeguard in emergencies, such as the bursting of a pipe or fitting, or other accident. This cushioned triple-acting non-return valve is designed to avert absolutely this constant danger. The pilot valve can be located at any desirable place, thus having perfect control from distant points. This valve is a non-return valve, an automatic emergency stop valve, and a hand stop valve.
—GOLDEN-ANDERSON VALVE SPECIALTY COMPANY, PITTSBURG, PA.

ANDERSON PATENT ALTITUDE VALVE. This valve is used to maintain a uniform stage of water in tank or reservoir, doing away with the annoyance of tank fixtures. It is especially adapted for large buildings.
—GOLDEN-ANDERSON VALVE SPECIALTY COMPANY, PITTSBURG, PA.

CRANE VALVES AND GATES. This company has been manufacturing steam supplies for over half a century, such as stationary, marine and locomotive pop safety valves, drainage fittings; extra heavy brass and iron valves and fittings, hydraulic valves and fittings; Ferrostee flanged fittings and valves; steam traps; steam and oil separators; malleable and Ferrostee companion flanges, and electrically and hydraulically operated and steam actuated valves. In addition the company is prepared to turn out complete piping equipments for power plants, and has facilities for making all kinds of piping.
—CRANE COMPANY, CHICAGO, ILL

FABER SELF-CLEANING BLOW-OFF VALVE. A jet of steam, at full boiler pressure, blows across the faces of both seat and disc after the water is shut off, but before final closing, thus insuring a clean tight joint. It can be opened and closed as often as a steam valve without leaking. The workmanship and material are in accordance with the best steam valve practice. (See advertisement.)
—LIBERTY MANUFACTURING COMPANY, PITTSBURG, PA.

FOSTER RELIEF OR FREE EXHAUST VALVE. On condensing engines, where the engineer is not always in attendance, instant relief to the exhaust is afforded by this relief or free exhaust valve, in case of failure of the condenser and loss of vacuum. The simplicity of this construction and ingenious mechanism makes it a perfect valve and one in which the working parts will not become corroded or affected by scale or grit. It is self-contained and when thrown open remains so until closed by hand. Made of the best grade of iron, and internal working parts of composition.
—FOSTER ENGINEERING COMPANY, NEWARK, N. J.

FOSTER AUTOMATIC NON-RETURN STOP VALVE. Takes the place of the ordinary stop valve on boilers and is a safeguard where two or more boilers are connected to a single steam pipe or header. In case of an accident, such as the bursting of a tube, occurring in a battery of boilers carrying different pressures, the valve closes automatically, cutting out the disabled boiler. It also shuts off steam pressure from other boilers to cold boilers undergoing repairs, or in which steam is being raised. Made in 2½ in. to 10 in. sizes, bodies of gray iron, semi-steel or cast steel as desired. Internal parts are made of govern-

ment composition for ordinary service or special metal for superheated steam.
—FOSTER ENGINEERING COMPANY, NEWARK, N. J.

FOSTER AUTOMATIC NON-RETURN EMERGENCY STOP VALVE. Embodies all the valuable features of the Foster non-return valve, with important additional features. This valve closes automatically in case of any break or rupture in main steam pipe and may also be closed from a distance by means of small globe valves on emergency pipes leading to the main valve, through pilot valve. Pilot valve can be arranged in large plants to cut out one, two or three boilers, or any section, or close all sections from a central point.
—FOSTER ENGINEERING COMPANY, NEWARK, N. J.

FOSTER BACK PRESSURE VALVE. This valve is self contained, without direct-acting springs or weighted levers. Direct-acting springs, owing to the variation of their tension with the degree of compression, cannot furnish uniform back pressure; weighted lever valves are apt to chatter and pound themselves loose. The compensating spring movement in Foster regulator valves makes the action of this valve very sensitive and positive; a dash-pot, within the valve, ensures its noiselessness. The valve has drainage relief for condensation and can be thrown out of commission by the turn of a screw, when hack pressure is not required.
—FOSTER ENGINEERING COMPANY, NEWARK, N. J.

FOSTER FLOAT VALVE. Quick and sensitive in action, simple and compact in form. It can be placed anywhere in the supply pipe to a tank, and connected by cord or wire to a small operating float in the tank. It will not leak and is invaluable for application on steam pipe to pump returning water of condensation from enclosed tanks. Sizes ¾ in. to 8 ins., above 2 ins. with iron bodies. Cumbersome floats unnecessary. Renewable seats.
—FOSTER ENGINEERING COMPANY, NEWARK, N. J.

FREEPORT VALVES. A modified form of globe valve body with poppet or rising valve spindle, allowing a free flow of the steam or water fully equal to gate valves, made with either rising or telescoping spindles, solid or removable seats and valve discs, and all are of the regrinding type.
—THE WM. T. BONNER COMPANY, BOSTON AND NEW YORK.

NATIONAL BLOW-OFF VALVE. This valve has a renewable disk and seat.
—GOLDEN-ANDERSON VALVE SPECIALTY COMPANY, PITTSBURG, PA.

WALWORTH GATE VALVES. These are furnished with bronze seats and are designed especially for high pressure work.
—THE WALWORTH MANUFACTURING COMPANY, BOSTON AND NEW YORK.

WILTBOC CUSHION PRESSURE SEATED CONTROL COCKS AND BLOWOFF VALVES. A new type of control cock, wherein the pressure of steam or water is utilized to hold the plug to its seat. Being otherwise free of all mechanical resistance, very little force is required for operating the valve. Awarded gold medal at Louisiana Purchase Exposition, St. Louis, 1904.
—THE WM. T. BONNER COMPANY, BOSTON AND NEW YORK.

VARIABLE SPEED MOTORS

(See Motors, Electric.)

VARNISHES

(See "Paints and Varnishes")

VENTILATING APPARATUS

(See "Heating and Ventilating Apparatus")

VESTIBULES, PORTABLE

BRILL PORTABLE VESTIBULE. Where closed or open-sided vestibules are not used, this portable vestibule will be found a valuable accessory, increasing the efficiency of the motorman by protecting him from storm and wind, shielding passengers entering or leaving the car, and aiding to keep the car warm in winter by reducing draughts when the doors are open. It is substantially though lightly constructed, hears directly on the dasher railing, is held upright by straps around the hood supports, and is connected with the hood by a narrow canvas bellows. The central sash is arranged to slide to one side; the side sashes are stationary.
—J. G. BRILL COMPANY, PHILADELPHIA, PA.
—AMERICAN CAR COMPANY, ST. LOUIS, MO.
—G. C. KUHLMAN CAR COMPANY, CLEVELAND, OHIO.
—JOHN STEPHENSON COMPANY, ELIZABETH, N. J.

SJOBERG CAR VESTIBULES. The portable vestibules of this type are furnished with either three or five lights. The center light is fastened into a sliding frame suspended on a curved or angular overhead track by adjustable swivel sheaves. Suitable guides at the bottom are provided with springs or rollers to keep the sash from rattling when opened or closed. The vestibules are connected to the iron dash rail and to the bonnet overhead, and usually made to project far enough over the dash to allow the free operation of the controller handle. This company also builds stationary vestibules and all other kinds of car wood work.

—J. P. SJOBERG & COMPANY, NEW YORK.

VOLTMETERS

(See "Instruments, Electrical Measuring")

WAGONS, TOWER

LEONHARDT TOWER WAGONS. Owing to the complaints of railway men about tower wagons with over one-half of the tower always projecting above the wagon bed or overhanging in the rear, this company began to build its improved wagons, of which no part of the tower raises above the driver's seat, nor does any portion project over the rear nor extend under the bed. The tower folds up like a penknife, and is easily and quickly raised and lowered. All lumber is aired seasoned. All iron work of the best forged refined iron. The wagons are built in three sizes. (See illustrated advertisement.)

—LEONHARDT WAGON MANUFACTURING COMPANY, BALTIMORE, MD., U. S. A.

TRENTON TROLLEY WAGON. A light, durable and easily operated tower vehicle built for one or two horses; may also be used with facility for pole painting and tree trimming. The two-horse wagon is built with platform gear to fit any gage from 4 ft. 8 in. out. The body is 11 ft. long (not including steps or footboard) by 4 ft. 3 in. wide; frame-work white oak; locker and large body space front and two large lockers at rear of tower. The tower is firmly set in sills, thoroughly braced angle iron slides bolted to posts on outside corners of upper and inside corners of lower tower, elevated by steel cables running over revolving sheaves set on sliding bearings; height extended, 19 ft. 4 in.; lowered, less than 11 ft. The revolving platform revolves on large wrought-iron circle, bolted securely to the top of the tower. Platform 9 ft. long by 4 ft. wide, strongly trussed, and provided with a positive clutch to hold it firmly in any position; folding guard rails, with hand-forged hinges. An adjustable scaling ladder 21 ft. long is also furnished.

—J. R. MCCARDLELL & COMPANY, TRENTON, N. J.

WAYBILLING

EGRY WAY BILLING. This system is recognized to be as complete and thoroughly practical as it is economical, accurate and convenient. Avoids unnecessary rewriting, eliminates constant handling of carbon and stationery, prevents errors and discrepancies, provides clear, legible copies and saves money and time. Traffic departments of interurban lines will find it to their advantage to look into the details of this method.

—THE EGRY AUTOGRAPHIC REGISTER COMPANY, DAYTON, OHIO, DEPT. W. B.

WASTE-SAVING MACHINES

(See "Oil and Waste-Saving Machines")

WATER-SOFTENING APPARATUS

(See "Boiler Cleaning Compounds")

WATER WHEELS AND GOVERNORS

(See "Hydraulic Machinery")

WATTMETERS

(See "Instruments, Electrical Measuring")

WHEEL GRINDERS

(See "Wheel Truing Brake Shoe," under Brake Shoes; also Machine Tools.)

WHEEL GUARDS

(See "Fenders and Wheel Guards")

WHEELS AND AXLES

AMERICAN CAR AND FOUNDRY WHEELS AND AXLES. This company is the largest manufacturer of chilled cast iron wheels in the world, the approximate annual capacity being 1,500,000 wheels. The wheel foundries are located at Detroit, Mich.; Berwick, Pa.; St. Louis, Mo.; Madison, Ill.; Chicago, Ill.; Huntington,

W. Va.; St. Charles, Mo.; Terre Haute, Ind.; Jeffersonville, Ind.; Buffalo, N. Y.; Milton, Pa.; Indianapolis, Ind.; Memphis, Tenn.

—AMERICAN CAR AND FOUNDRY COMPANY, ST. LOUIS, AND NEW YORK.

BALTIMORE CHILLED CAST IRON WHEELS.

These wheels are made for every service. Manufactured of the highest grade charcoal irons, and furnished with or without axles.

—THE BALTIMORE CAR WHEEL COMPANY, BALTIMORE, MD.

BRILL WHEELS AND AXLES. These companies furnish all styles of wheels, separate or on axles. Their facilities for grinding wheels and turning axles are unsurpassed, insuring accuracy and enabling them to fill orders promptly.

—J. G. BRILL COMPANY, PHILADELPHIA, PA.

—AMERICAN CAR COMPANY, ST. LOUIS, MO.

—JOHN STEPHENSON COMPANY, ELIZABETH, N. J.

GRIFFIN WHEELS. The street railway department of this company offers special channel spoke and double plate wheels for city and interurban service.

—GRIFFIN WHEEL COMPANY, CHICAGO, ILL.

LACONIA WHEELS. Made either 30 ins. or 33 ins. diameter, with flange and tread to suit purchaser, either spoke or double plate. Nothing used in their manufacture but new pig iron and old wheels of Northern manufacture, each lot of pig iron being carefully analyzed by company's chemist to insure getting the right mixture of materials, and a record is kept of each lot of wheels for future reference.

—THE LACONIA CAR COMPANY WORKS, BOSTON, MASS.

NATIONAL CAR WHEELS. This company manufactures steel tired and all kinds of chilled cast iron street car wheels for city and interurban service.

—NATIONAL CAR WHEEL COMPANY, NEW YORK.

RAILWAY STEEL SPRING COMPANY'S STEEL TIRED WHEELS. For city and suburban electric railway electric equipment.

—RAILWAY STEEL SPRING COMPANY, NEW YORK.

SCHOEN SOLID PRESSED AND ROLLED STEEL WHEELS. These wheels are intended for city and interurban traction service, making an absolutely safe wheel for exacting conditions under heavy high speed cars. The wheel having over five times the strength of cast iron prevents chipped or broken flanges, insuring safety and preventing the housing of cars for wheel troubles. Service tests prove an economy in operating expenses as compared with cast iron wheels.

—THE SCHOEN STEEL WHEEL COMPANY, PHILADELPHIA, PA.

STANDARD WHEELS AND AXLES. These works manufacture both wheels and axles and furnish same ready for application. The whole wheel is forged as thoroughly as a tire bloom and subsequently rolled to the required form and size, thus so increasing the strength of the hub and web that a much lighter design is permissible, reducing largely the weight in comparison with steel tired wheels. The method of manufacture appears to give a wheel embodying three important requisites for the heavy equipment and fast running in suburban service, i. e., lightness, strength and durability.

—THE STANDARD STEEL WORKS, PHILADELPHIA.

TAYLOR FUSED STEEL-TIRED WHEEL. This is a solid or integral wheel without bolts or retaining rings to loosen in service, the application of which necessitates the cutting away of both tire and center for their insertion. The tire is of rolled steel, the center of cast iron, poured into the tire under proper conditions for the effecting of a perfect weld or fusion, adding to the strength of the tire the strength of the iron, which supports the tire across its entire width. This wheel has been manufactured by the company for more than thirty years.

—TAYLOR IRON & STEEL COMPANY, HIGH BRIDGE, N. J.

TWENTIETH CENTURY WHEEL. This is a channel spoke wheel, especially designed for long life, and results obtained from wheels of this design, of which this company is the original manufacturer, show stronger spokes and flanges, more uniform chill and greater mileage. It is a wheel well adapted for heavy high-speed interurban service. (See advertisement and illustration.)

—ST. LOUIS CAR WHEEL COMPANY, ST. LOUIS, MO.

WOODWORTH-ENGERT COMBINATION WHEEL. Consists of a cast steel spoked or plate center having a projecting shoulder on its inner side and a corre-

sponding bevel on the outside. The tire has corresponding shoulder and bevel to match those on the center. The space between bevel and shoulder has a sufficient drop to prevent tire from shifting after same has been shrunk onto center. To prevent longitudinal displacement a $\frac{1}{2}$ in. bolt with eccentric head flush with the inside of wheel is placed opposite each spoke. Bolts are staggered, 11-16 being in the tire and 5-16 in the center and vice-versa, thus forming a series of keys. By reason of the manner in which the tire is shrunk onto the center there is no strain on any of the bolts. In case of broken tire, bolts prevent same from leaving center. Can be renewed with little labor and slight expense. (See advertisement.)

—THE WOODWORTH-ENGERT COMPANY, CLEVELAND, OHIO.

WOODWORTH-ENGERT SHRUNKEN TIRED WHEEL. This wheel consists of a cast steel center having on its periphery a shoulder which fits into a corresponding groove in the tire, thus making it impossible in the tire to shift on the center. No special equipment is necessary for re-tiring the wheels. It has given the best satisfaction on a number of prominent interurban railways and is guaranteed to stand up under the most severe service. It is fully guaranteed in material and workmanship. (See advertisement.)

—THE WOODWORTH-ENGERT COMPANY, CLEVELAND, OHIO.

WHEEL PRESSES

(See "Machine Tools")

WHEELS, TROLLEY

BRADY TROLLEY WHEELS. Having specially studied the service requirements of a trolley wheel on modern electric railways and installed special machinery for their manufacture, this company is able to offer trolley wheels made of the best material and of the most improved design at greatly decreased costs.

—BRADY BRASS COMPANY, NEW YORK.

IDEAL TROLLEY WHEEL. This is a composite wheel made with cold-rolled steel flanges and a copper contact ring held together by a lumen bronze hub. The contact ring is a machined casting of lake copper with a little alloy to give it the requisite hardness without destroying its conductivity. The ring and flanges are placed in a metal form which holds them central, while the lumen bronze hub is cast around the flanges and against the ring, assuring rigid construction and positive electrical contact between ring and hub, independent of the flanges. These wheels have graphite bushings. Two sizes are made. The small wheel is 4 $\frac{1}{2}$ in. dia., weighing less than 2 lbs. complete with bushing; larger is 6 in. dia., weighing about 3 lbs.

—LUMEN BEARING COMPANY, BUFFALO, N. Y.

J-M TROLLEY WHEELS. This company's solid copper wheels are made by an entirely new process and are demonstrating every day in actual service their superiority over other types of trolley wheels heretofore used on electric railways. (See advertisement.)

—H. W. JOHNS-MANVILLE COMPANY, NEW YORK.

KALAMAZOO TROLLEY WHEELS. These wheels are made of pure lake copper especially treated for this purpose only. The result is a wheel that is soft but tough, and while it has the long life of a wheel made of hard metal, it is in itself soft and guaranteed not to injure the wire. There are a great variety of styles, thus making it possible to fit any overhead construction. (See advertisement.)

—THE STAR BRASS WORKS, KALAMAZOO, MICH.

RECORDING FARE REGISTER COMPANY'S TROLLEY WHEELS. Furnished in all sizes. They are made without bushings, a bearing being made in the wheel itself, and requiring no oil. Also multi-ampere trolley wheels in three sizes, 5 in., 6 in. and 7 in., consists of a trolley made wheel with very large area of contact, having a three-inch flange on each side. Made either with a bearing or a bushing which requires no oil. Also sleet wheels of all sizes. Trolley wheel bushings, made from solid castings, machined (not cored), being free from all sand, grit and scale; rifled grooves running entire length of the bushing and filled with special "don't oil" graphite compound. Self-oiling trolley wheels axles; no bushings required where these axles are used. Consists of a steel axle filled with lubricant, same being fed to the wheel by wooden plugs. Requires re-filling only at the end of 5,000 miles.

—THE RECORDING FARE REGISTER COMPANY, NEW HAVEN CONN.

(CONTINUED ON PAGE XLIX.)

WHEELS, TROLLEY—Continued.

UNION STANDARD TROLLEY WHEELS. Twenty-five types are now manufactured and new forms are being added as necessity demands. All wheels are fitted with special composition bushings filled with graphite. The grooves are of various forms, including compound curve, deep or U-shaped and square styles. The diameters range from 4-7 in.; length through hubs, 1½ in. to 3 in., and bores ½ in. to ¾ in. The Union Standard line of wheels is most complete and no trouble will be found in selecting a wheel to fill any specification, either ordinary or special.
—R. D. NUTTALL COMPANY, PITTSBURG, PA.

WESCO TROLLEY WHEELS. These wheels are made of pure Lake Superior bar copper, treated by a special process in moulding, which gives the same carrying capacity as hard drawn copper wire, and toughens the material to give the greatest mileage possible. They are fitted with an oil chamber in addition to a graphite bushing, which prolongs the life of the bushing to equal that of the wheel. Made in the standard models found on the various street and interurban electric railways. They fit the standard harps. They do not wear out the trolley wires.
—WESCO SUPPLY COMPANY, ST. LOUIS, MO.

WINDING MACHINES

(See "Armatures and Field Coils")

WIRES AND CABLES

ALUMINUM ELECTRICAL CONDUCTORS. An electrical conductor made of pure aluminum, having a conductivity of 62 in the Mathiessen scale, a tensile strength of 23,000 lbs. per sq. in., and a very high efficiency. Aluminum conductors are especially adapted to railway feeders and transmission lines. The popularity of aluminum conductors is due to their high efficiency, combined with their low cost. The purchase price is less than copper and the cost of erection and maintenance is also less, the weight of an aluminum conductor being only 47 per cent. that of a copper conductor of same capacity.
—PITTSBURG REDUCTION COMPANY, PITTSBURG, PA.

AMERICAN ELECTRICAL WORKS, PROVIDENCE, R. I. Manufacturers of all kinds of bare and insulated wires and cables for electrical work, including the following: Railway feeder and trolley wire; electric light line wire; incandescent and flexible cords; Americanite, magnet, office and annunciator wires, and cables for aerial and underground use.

AMERICAN STEEL & WIRE COMPANY'S HARD DRAWN COPPER WIRE. This wire is known and in use in every country on the globe where electric railways are in existence. Its wearing qualities are well known in cities where the roads have an almost continuous traffic and it is recognized as standard wherever maximum conductivity, strength and superior finish are sought for. Although odd shapes are little called for, this company is prepared to furnish all varieties: Figure 8, grooved and round.
—AMERICAN STEEL & WIRE COMPANY, NEW YORK.

BISHOP SUBMARINE CABLES. This company is the only one in America using gutta-percha insulation. Gutta-percha is claimed to be more uniform, longer-lived and more easily repaired than any other insulation.
—BISHOP GUTTA-PERCHA COMPANY, NEW YORK.

DELTABESTON MAGNET WIRE. This wire is insulated with practically pure asbestos, which has been treated so that its insulating qualities are exceptionally good. At the same time its wonderful resistance to heat renders it absolutely indestructible as far as any temperature rise to which it may be subjected in ordinary service is concerned. At the present this wire is supplied in any size from No. 4 to No. 18 B. & S. gage.
—D. & W. FUSE COMPANY, PROVIDENCE, R. I.

EASTERN INSULATED WIRES AND CABLES. This company manufactures insulated wires and cables for railway, lighting and power transmission systems. "Clark" wire a specialty.
—EASTERN ELECTRIC CABLE & WIRE COMPANY, BOSTON, MASS.

GENERAL ELECTRIC WIRE AND CABLES. Some years ago the General Electric Company introduced the grooved trolley wire. Since then the success attained in general railway work had led to its use in all classes of service. In addition to ease of installation, smooth operation, and positive grip of ears on the wire, the readiness with which the line may be moved has led to its adoption in mines for coal haulage, and industrial plants. The

General Electric Company manufactures at Schenectady all classes of magnet wires, insulated cables and National Electric Code wires.

—GENERAL ELECTRIC COMPANY, SCHENECTADY, N. Y.

MAGNET WIRE. This wire requires more care in its manufacture than any other type of wire. The copper must be of high electrical conductivity, the annealing must be just right and the size of great uniformity. Moreover there is room for a wide choice in the cotton used and our selection of combed sea island cotton, free from all the grease and oil that ordinary cotton is heir to, is a most successful one. The success of field and armature coils is largely dependent upon magnet wire, and specialization in these lines is productive of a reliability and endurance which is appreciated by all electric railway managers who consider their first duty to their company and the public to be that of giving uninterrupted service and whose motto is: "A car on the road is worth two in the barn."
—THE MAGNET WIRE COMPANY, NEW YORK.

MONTREAL WIRES AND CABLES. The Wire & Cable Company, Montreal, has been giving considerable attention lately to the manufacture of wires and cables for electric railway purposes. It has manufactured a considerable amount of hard drawn copper power transmission cable with hemp centers, and has also executed several contracts for trolley and feeder wire in connection with the recent developments in Canada. In order to take care of the constantly increasing demand, the company is enlarging its floor area from 113,844 to 152,666 sq. ft. These extensions are mainly additions to the bare wire mill and the lead covered cable department. It expects to have to continue building operations still further in the spring. The plant has been built entirely on American methods, one of its characteristics being the application of the direct electrical drive, and the consequent absence of belting and shafting.
—THE WIRE & CABLE COMPANY, MONTREAL, CAN.

NATIONAL WIRES AND CABLES. This company is a large manufacturer of bare copper wire and cable, weather-proof wire and cable, as well as paper insulated cables for all classes of railway, lighting, power, telegraph and telephone work.
—THE NATIONAL CONDUIT CABLE COMPANY, NEW YORK.

OKONITE INSULATED WIRES AND CABLES. The wires and cables manufactured by this company are all insulated with the well-known Okonite rubber insulation, mentioned elsewhere in this dictionary under "Insulations and Insulating Compounds."
—THE OKONITE COMPANY, NEW YORK.

"PHONO-ELECTRIC" WIRE. This is an exceptionally tough wire for trolley purposes, its great strength assuring a permanent and reliable overhead construction.
—BRIDGEPORT BRASS COMPANY, NEW YORK.

ROEBLING WIRES AND CABLES. This company makes paper insulated, lead incased cables from 2,000,000 cm. to 4-0 dia. for 600 volts and 250,000 cm. to 0 for 15,000 volts. All sizes and constructions of rubber insulated, lead incased cables; also magnet wire, weather proof wire, copper trolley wire and other bare and insulated wires and cables of all kinds.
—JOHN A. ROEBLING'S SONS COMPANY, TRENTON, N. J.

STANDARD WIRES AND CABLES. Made from copper of highest known conductivity and depending upon service requirements; furnished either plain or tinned conductor in round or special shapes or insulated with the following, either singly or in combination, namely: Silk, cotton, weatherproof, dry or saturated fiber, dry or saturated paper, rubber and special varnished cloth. Conductors insulated with these various insulations are furnished in single or multiple form and finished outside, according to requirements, with tape, braid, lead sheath, supplemented where necessary by saturated fibrous cover, steel wire armor or flat, steel tape armor.
—STANDARD UNDERGROUND CABLE COMPANY, PITTSBURG, PA.

WATERBURY WIRES AND CABLES. This company manufactures seamless rubber insulated wire and underground cables; signal, telephone, telegraph and fixture wires; and paper insulated lead encased cables for power, lighting, telegraph and telephone circuits.
—WATERBURY & COMPANY, NEW YORK.

WRIGHT WIRES AND CABLES. This company manufactures wires and cables of all descriptions, including the following: Annealed, bright, coppered, tinned and galvanized wire; straightened and cut, round and flat wire; iron, tinned, galvanized, brass, copper, wire cloth; galvan-

ized poultry netting; wire clothes lines and wire lathing; riddles, coal and sand screens, and steel sparks netting, staples. See also definitions under "Fences" and "Lockers."

—WRIGHT WIRE COMPANY, WORCESTER, MASS.

WIRE CONNECTORS

(See "Clamps and Connectors")

WOODWORK, CAR

(See "Vestibules," "Doors," etc.)

WOODWORKING MACHINERY

AMERICAN NO. 2 VERTICAL BORER. This is a substantial, well-built machine. The bit is 18 in. from the post and has a throw of 12 in. Stops are provided to regulate the depth of hole. The table has a universal movement and may be tilted forward and to either side. The table is adjusted vertically by hand wheel and when at its lowest point the distance from the bit socket to the table is 26½ in., and when raised to its highest point the distance from the table to the bit socket is 17½ in. The distance from front of table to guide is 30 in. The table is 24 in. wide. The boring bit may be run at two different speeds. (See advertisement).

—AMERICAN WOODWORKING MACHINERY COMPANY, NEW YORK.

AMERICAN NO. 200 AUTOMATIC KNIFE GRINDER. A transverse reciprocating movement of the knife bar regulated in extent from 2 ins. to full length of machine (30 ins., 36 ins., 42 ins. and 50 ins.). Movement of the wheel toward the work can be regulated to grind from 1-3,000 in. to 1-200 in. to each back and forth movement of the knife bar frame. Will cease grinding at any point for which it may be set. Thus there is no danger that cutters will be overground through inadvertence or inattention of the operator. Supplied with hood and water tank, adapting machine to wet or dry grinding. (See advertisement).

—AMERICAN WOODWORKING MACHINERY COMPANY, NEW YORK.

AMERICAN HOLLOW CHISEL MORTISING MACHINE. Useful for mortising in hard woods. Fitted with a hollow chisel, through which projects a boring bit, and when brought up to the timber it bores the hole, and the chisel following it simultaneously squares out the four corners and sides, with no jarring to the machine. A finished mortise of any length, and from ½ in. to 1½ ins. square and free from chips, is thus made. The stroke is variable from ½ in. to 4½ ins. in depth. The table is counterbalanced and is adjusted vertically by worm and worm wheel, provided with vertical and horizontal stops, by which one or more mortises can be made. The table is 3 ft. 6 ins. long, 10 ins. wide, and travels 6 ins. each way from center of chisel, making a mortise 12 ins. long with one clamping. (See advertisement).

—AMERICAN WOODWORKING MACHINERY COMPANY, NEW YORK.

AMERICAN NO. 1 POWER MORTISER. Designed to do heavy hard wood mortising, such as hard wood doors, as well as lighter work. The conical brass boxes used are split and fitted into conical bearings. The larger or quill box is threaded on lower end with nut to take up wear, and the smaller or spindle box is provided with clamp or jamb nuts to take up wear. The reverse is also conical, with nut on small end to take up wear. It will mortise to the centre of material 5 in. wide with clamp table, and with plain table to the center of material 6 in. wide. The table tilts to an angle, is provided with clamping device, hold-downs and rack and pinion feed. (See advertisement).

—AMERICAN WOODWORKING MACHINERY COMPANY, NEW YORK.

AMERICAN 54 IN. BAND RE-SAW. Adapted for general work in hard or soft wood. Lower wheel has solid web, and the strain line of the blade lies within the bearings on both wheels. Main shaft is of hammered crucible steel, 3½ ins. dia., and the boxes are self-oiling with positive circulation. All six feed rolls are geared, and the teeth of the blade run within 1 in. of the center line of the last rolls. They can be tilted to saw clapboards, and set to self-center or to slab off, as required. Speed is adjustable as 8 is to 1, and may be as high as 120 feet per minute. Guides have hardened rear safety rolls and bronze side plates all adjustable. Capacity, 30 ins. vertically, and from ½ in. to 20 ins. horizontally; 16 ins. can be split in the center and a veneer cut from 12 ins. wide. (See advertisement).

—AMERICAN WOODWORKING MACHINERY COMPANY, NEW YORK.

AMERICAN 36 IN. BAND SAW. The most popular size made, and is well adapted to general scroll sawing in hard or soft wood. Frame is cast hollow in one piece. Table, 32 ins. by 32 ins., of wood or iron; tilts to an angle of 45 deg. for bevel sawing; shafts are of steel; lower wheel is of iron, and upper one has hard wood rim glued up of kiln dried veneers. "Mohawk Dutchman" guide is used. Upper shaft runs in a double box, and all boxes are divided to take up wear, and are adjustable for alignment. Elastic weighing strain lever is provided, as in all the company's scroll hand saws. Capacity, 14 ins. vertically and 36 ins. horizontally. (See advertisement).

—AMERICAN WOODWORKING MACHINERY COMPANY, NEW YORK.

COLUMBIA SANDERS. Built with three, two or one drum on the same general design, all working up to 6 in. thick, 30 ins. to 84 ins. wide. It is suitable for every kind of work, from the heavy cuts required in a planing mill to the highest finish of the pinao factory. The cylinders are provided with a device for taking up the slack of the sandpaper automatically while the machine is running. To keep the sandpaper constantly snug around the drum is the first requisite for smooth sanding, and the automatic part of it obviates frequent stops. Also preserves the life of the sandpaper and enables it to do much more work than if used in any other way. The cylinders produce a straight flat surface and leave no dips or round edges and ends. (See advertisement.)

—AMERICAN WOODWORKING MACHINERY COMPANY, NEW YORK.

AMERICAN NO. 7½ COMBINATION SAW AND DADO MACHINE. Adapted for cutting off, ripping, miter and bevel sawing, dadoing, etc. The travel of the saw produces only a very slight movement of the tightener frame. Saw may be brought forward 23 in. by a foot treadle; carriage carrying saw runs on ball bearings. Table is 3 in. by 4 in. The right hand table is pivoted to the frame and may be swung upward, while the left hand table is arranged to slide outward and so constructed as to always keep the table parallel. Ripping gage may be set at any angle. The cross-cut gages are instantly clamped to the table, and can be changed from stationary to sliding gages, and may be set at any angle to 45 deg. The gages can be reversed so that the saw will force the board against the face of the gage if desired. Will cut 4 in. thick, and will cut through a 1 in. board 21 in. wide. Arbor has 3 in. vertical adjustment. (See advertisement.)

—AMERICAN WOODWORKING MACHINERY COMPANY, NEW YORK.

AMERICAN SELF-FEED RIP SAW TABLE. The No. 2 table is designed for ripping all kinds of stock up to 25 in. wide and 6 in. thick. The table is 40 in. wide by 55½ in. long, provided with two adjustable idler rolls and an iron throat plate so arranged that two or more saws can be used at the same time, 6½ in. apart or less. The table has a locking gage and index plate. The feed consists of a corrugated and spur feed roll in front, and a corrugated feed roll with spreader in rear of saw, all 5 in. in diameter. There rolls can be set up close to a 10 in. saw, or can expand to take in a 20 in. saw. The feed rolls can be adjusted for ripping 6 in. thick and are driven by chain sprocket wheel and expansion gearing. There are three changes of feed—60, 120 and 180 linear ft. per minute. The arbor is 1½ in. in diameter and runs in three self-oiling boxes 5½ in. long. Pulley on arbor is 7 in. by 7½ in.; speed, 2,500. Table No. 1 has a capacity up to 20 in. by 6 in., and No. 0 up to 16 in. by 6 in. (See advertisement.)

—AMERICAN WOODWORKING MACHINERY COMPANY, NEW YORK.

AMERICAN NO. 2½ TWO-SPINDLE SHAPER. Adapted to general work in all wood shops; frame is cast in one piece and contains tool closet; spindles are of cast steel, 1½ in. in diameter, with ground journals and self-oiling boxes set 24 in. apart; top sections are usually 1½ in. in diameter and may be made separable when so ordered; box slides are scraped to bearings with take-up gibs and clamp handles; table is usually of iron, 38 in. by 54 in., with removable plates for collars; two sets (8) of steel slotted collars, four filling collars, one set (4) of blank knives and

pedal belt shifter are furnished; belt guide stands supplied on order. (See advertisement.)

—AMERICAN WOODWORKING MACHINERY COMPANY, NEW YORK.

AMERICAN BOSS TIMBER SIZER. A heavy, powerful, simple and easily handled machine, working 20 ins., or 30 ins. wide, 12 ins., 14 ins., 16 ins., 18 ins., or 20 ins. thick. All of the adjustments are easily and quickly made, and those necessary for a change from one class of work to another are all made from the operator's positions at the side or end of the machine, and so quickly and easily as to make this machine capable of covering a very large range of work, from surfacing four sides (full capacity of machine) to car sills, flooring, decking, or any similar work. Made with six and eight feed rolls. Standard machines include regular heads and straight knives and necessary wrenches.

—AMERICAN WOODWORKING MACHINERY COMPANY, NEW YORK.

AMERICAN NO. 50 DOUBLE SURFACER. This standard double surfacer works 26 ins. and 30 ins. wide by 8 ins. thick; built from new designs, with table as short as practicable for length of belts, to allow short pieces to be handled easily. The feed consists of four rolls, operated by improved expansion gearing attached to shafts working in self-oiling boxes. The top feeding-in roll is divided. The sections of the divided roll rise perfectly true, and each roll is operated by one screw, doing away with all bevel gearing and leaving all parts easily accessible. The divided roll permits the feeding of unevenly sawed lumber or two boards of different thicknesses at one time. (See advertisement.)

—AMERICAN WOODWORKING MACHINERY COMPANY, NEW YORK.

AMERICAN "PEACEMAKER" DOUBLE AND SINGLE SURFACERS. Built as double or single surfacer, with solid or divided infeeding roll. A heavy, strong and compact machine for smooth and rapid work. Will plane 26 ins. wide and from ½ in. to 8 in. thick. Top and bottom heads solid steel forgings tapped on two sides. Top head bolted at both ends. The bed is held very rigidly. Chip breakers and pressure bar are carefully fitted. There are four feed rolls, strongly geared. Pressure bar over the under head raises and lowers by hand wheel. There are two rates of feed, 45 ft. and 64 ft. (See advertisement.)

—AMERICAN WOODWORKING MACHINERY COMPANY, NEW YORK.

AMERICAN NO. 1 TENONING MACHINE. For door, sash and other work. Will cut a tenon 7 ins. long at one operation and 9½ ins. long by twice passing through the machine. Any thickness of tenon can be cut up to 5½ ins. thick by 15 ins. wide. Both head stocks are adjustable vertically, while the top head stock has also an independent vertical adjustment. The cope head stocks are attached to the main head stocks and adjust with them. They have also independent vertical and horizontal adjustment. The carriage has a combined roller movement, which greatly facilitates the work both in ease of operation and the quantity turned out. The hold-down is convenient, and the fence is adjustable to any required angle. The cut-off saw attachment works by a lever and has a graduated scale. It can be regulated to cut different lengths of tenon while the machine is in operation. The cutter head spindles are 1½ ins. in dia. Cope spindles are 1 in. dia. in the boxes and ¾ in. dia. where the heads go on. (See advertisement.)

—AMERICAN WOODWORKING MACHINERY COMPANY, NEW YORK.

J. A. FAY & EGAN COMPANY, CINCINNATI, OHIO. The history of wood working machinery for use in car shops is largely the history of this company. Its experience dates back over a period of 75 years, when the steam railroad was little more than a dream and the electric car was unthought of. This company has kept constantly alive to the needs of car manufacturers, and at the present time it can supply anything wanted in the line of car wood-working machinery.

FAY & EGAN AUTOMATIC BAND RIP SAW NO. 109. This saw takes 30 ins. between saw and fence and 14 ins. under the guide. Five 8 in. power-geared feeding rolls. Special straining device.

J. A. FAY & EGAN COMPANY, CINCINNATI, OHIO.

FAY & EGAN AUTOMATIC DOUBLE TENONER. Designed with a base or foundation plate, which supports the working parts in a very superior manner. Made in two sizes: No. 9 to tenon from 6 ins. up to 54 ins. in length. No. 10 to tenon from 6 ins. up to 78 ins. in length. Takes material up to 20 ins. wide or 7 ins. thick.

—J. A. FAY & EGAN COMPANY, CINCINNATI, OHIO.

FAY & EGAN BAND RESAW NO. 104. A resaw for heavy and light work. Resaws 24 ins. wide, receives 20 ins. between rolls, will saw to the center of 16 ins. Improved arrangement of feed rolls. Extra heavy shafts. New sensitive straining device. Improved guides. 60 in. wheels, 8 in. blade. Solid lower wheel. Wheels running between bearings.

—J. A. FAY & EGAN COMPANY, CINCINNATI, OHIO.

FAY & EGAN DOUBLE-CYLINDER TIMBER DRESSERS. Dresser No. 111 is an exceptionally fine and powerful timber dresser in every respect. Made in two sizes to plane material on four sides, 20 or 30 ins. wide, and 20 ins. thick. The company also makes a smaller size of this machine to plane up to 20 or 30 ins. wide and 16 ins. thick, calling it No. 125.

—J. A. FAY & EGAN COMPANY, CINCINNATI, OHIO.

FAY & EGAN EXTRA HEAVY DOUBLE-SPINDLE SHAPER NO. 87. This machine is designed for extra heavy work, such as wagon and carriage work, railroad work, etc.; for shaping gearing, wagon tongues, plow beams, and all kinds of heavy, hardwood cutting. The table is of iron or wood, and is 61x48 ins., amply large for any kind of work.

—J. A. FAY & EGAN COMPANY, CINCINNATI, OHIO.

FAY & EGAN HEAVY DOUBLE-CYLINDER PLANER NO. 140. Planes 24, 27 or 30 ins. wide and 8 ins. thick, with center-geared, divided or sectional rolls. Both cylinders slotted on all four sides. All gears mounted on shaft, eliminating all studs.

—J. A. FAY & EGAN COMPANY, CINCINNATI, OHIO.

FAY & EGAN INSIDE MOLDER NO. 133. This is an excellent machine for making light or heavy molding, casing, drop siding, etc. Is constructed with four feed rolls, 7 ins. in dia. Interchangeable rollers. Sectional chip breaker before cut of top lead, to provide for the irregularities of the knives. Made in two sizes to work from ¾ to 12 or 15 ins. in width.

—J. A. FAY & EGAN COMPANY, CINCINNATI, OHIO.

FAY & EGAN "LIGHTNING" FLOORING MACHINES. The No. 106 is made in two sizes to work material 9 and 15 ins. wide and up to 6 ins. thick. Six or eight rolls, 9 ins. in dia. A very rapid, powerful and efficient flooring machine. The company also makes this machine with lower cylinder placed before the upper, calling it No. 107; and with one upper and two lower cylinders calling it No. 108.

—J. A. FAY & EGAN COMPANY, CINCINNATI, OHIO.

FAY & EGAN SIX-ROLL, DOUBLE-CYLINDER PLANER AND MATCHER NO. 129. An excellent machine for general and special purposes to plane and match 10, 16, 20, 24, 27 or 30 ins. wide and 8 ins. thick. Cylinders four sided, slotted and double belted. Six 6 in. feed rolls. Tight and loose pulleys for feed belt. Two speeds of feed.

—J. A. FAY & EGAN COMPANY, CINCINNATI, OHIO.

FAY & EGAN VERTICAL HOLLOW CHISEL CAR MORTISING MACHINE NO. 4. A powerful and reliable machine. Boring attachment. The vertical movement of the ram is 16 ins., and the extreme lateral motion, with the housing, is 14 ins.

—J. A. FAY & EGAN COMPANY, CINCINNATI, OHIO.

DEALERS IN ELECTRIC RAILWAY SUPPLIES

MANUFACTURERS' AGENTS

GILES S. ALLISON, NEW YORK. Dealer in all classes of railway supplies. Direct representative of the Security Register Company's self-recording and other types of fare registers; the Skinner station indicator and car sign; Valentine & Company, varnishes and colors; the Orient adjustable register rod handle; the Armstrong oiler. Makes a specialty of second-hand rolling stock for steam and electric railways. Acts also as purchasing and selling agent for railroads.

F. BISSELL CO., TOLEDO, OHIO. Dealers in electric railway supplies of all kinds.

THE W. R. GARTON COMPANY, CHICAGO, ILL. Manufacturers, manufacturers' agents and dealers in electric railway and mine supplies. The lines covered comprise such articles as are used for the construction and maintenance of electric railway high tension circuits and trolley lines, including wire, insulators, hangers, cross arms, pins, braces, lag screws, bolts, trolley hangers, pull offs, cross overs, section insulators, section switches, aside from a general line of diverse materials, many of which are specialties, such as circuit breakers, lightning arresters, poles, bonds, trolley wheels, bushings and harps. The company is pushing the following specialties: Thomas soldered rail bonds, Lima porcelain insulators; Armalac, an insulating compound; Shaw non-arcing lightning arresters for high A.C. circuits; Garton lightning arresters, etc.

GENERAL RAILWAY SUPPLY COMPANY, PITTSBURG, PA. Manufacturers' agent and dealer in electric railway and lighting supplies. This company carries a large assortment in its warehouse and is fully equipped to furnish materials and supplies for the equipment and maintenance of electric railway, mine and industrial haulage plants. Has selling arrangements for Westinghouse and General Electric repair parts and represents the following well known manufacturers: R. D. Nuttall Company, gears, pinions and trolleys; General Electric Company, line material and rail bonds; International Register Company, registers; the Heil Rail Joint Welding Company, cast welded joints, and the Wilson Trolley Catcher Company, trolley catchers and retrievers.

J. A. HANNA COMPANY, CLEVELAND, OHIO. Sole sales agent for Niles cars and Western sales agent for Peckham trucks. Is prepared to supply promptly electric, gasoline and steam cars, either complete with trucks or car bodies and trucks separately. Its specialties are the complete rolling stock equipment of interurban electric railways, passenger coaches, parlor cars, express-freight cars, portable sub-stations, cars, etc., complete with various types of Peckham trucks.

W. R. KERSCHNER, ALLENTOWN, PA. Manufacturers' agent for the companies, as follows: The Columbia Machine Works & Malleable Iron Company, Brooklyn, N. Y., electric railway supplies; The Catskill Foundry & Machine Works, Catskill, N. Y., steel gears and pinions; The Traction Equipment Company, Brooklyn, N. Y., grid resistances for cars.

KINSMAN ELECTRIC & RAILWAY SUPPLY COMPANY, NEW YORK. The railway supplies furnished by this company embrace almost everything required in the construction and maintenance of railways, buildings and office supplies.

ERVIN G. LONG, NEW YORK. Eastern representative of the Union Spring & Manufacturing Company, Van Dorn & Dutton Company, Van Dorn-Elliott Electric Company, and export agent of the Sterling-Meaker Company and the W. T. Van Dorn Company. He gives special attention to export business in all kinds of electric traction equipment and supplies, recent orders having been executed by him for Japan, Siam, India, England, Italy, South Africa, Australasia, Argentina, Brazil and Peru. Mr. Long has had fourteen years' experience handling electrical materials, and has an extensive acquaintance with the operators of electric tramways abroad.

THE MAYER & ENGLUND COMPANY, PHILADELPHIA, PA. This company devotes its entire attention and energy to designing, manufacturing and jobbing electrical and mechanical supplies for street and interurban railways and electrically operated industrial plants, and is recognized to-day as a leader in its line. One of the main specialties handled by this company is the protected rail bond, which was adopted by the Interborough Rapid

Transit Company, of New York, after a most elaborate series of competitive tests. Keystone compound, of which this company makes its overhead trolley wire insulating devices, has earned an enviable reputation for the company in this line. The company is the Eastern sales agent for many leading manufacturers, including the International Register Company; is district representative for the R. D. Nuttall Company's gears and pinions; acts as agents for the Crouse-Hinds Imperial headlight and also for the Brady Brass Company's motor and axle bearings. A large stock of standard railway material is kept in the company's eight story building in Philadelphia.

ELMER P. MORRIS COMPANY, NEW YORK. Dealer in overhead line material, trolley wire grooving machines, trolley poles, wheels and harps; armature and field coils; incandescent lamps; headlights; drills; grinders; track construction tools; electrical instruments, etc.

PORTER & BERG, CHICAGO, ILL. President and treasurer, J. W. Porter; vice-president, E. R. Mason; secretary, Max A. Berg. After several years as sales agents for the leading manufacturers of electric railway supplies and specialties, and exclusive territorial agents for many articles of approved design and construction, they have become widely known in the railway supply field. The present sales and general office is augmented by a splendid sample room where the purchaser is enabled to examine and judge advantageously materials and apparatus set up or in operation. Apart from the general office is a handsomely furnished private office for street railway men who desire headquarters while in the city.

FRANK RIDLON CO., BOSTON, MASS. Manufacturers' agents for electric railway equipment and supplies.

STUART-HOWLAND COMPANY, BOSTON, MASS. Besides this company's line material (including bracket arms) described elsewhere in this dictionary, the company also makes standard head lights, "spiral" trolley cord, trolley wheels, steel wheels, a complete line of ears, and several other specialties. It is exclusive territorial selling agent for Garton-Daniels lightning arresters, visible die punches, Helios arc lamps, Sterling incandescent lamps, Chase-Shawmut rail bonds and enclosed fuses, "Amesbury" trolley wheels, case hardened axles, insulating tapes and compounds, switches, and cut-outs, live wire pick-ups, Ham trolley catchers, boxes and sanders, Dale clusters, and a variety of wiring devices. The company is also a jobber in all kinds of railway, telephone and lighting supplies, and carries in stock practically everything required in the equipment and maintenance of street railways. (See advertisement.)

—STUART-HOWLAND COMPANY, BOSTON, MASS.

SHAW ENGINEERING & MANUFACTURING COMPANY, NEW YORK. General sales agent for the American Ventilating Company, manufacturer of ventilators for railroad cars, buildings and window ventilation; Eastern sales agent for Moloney Electric Company, St. Louis, Mo., on transformers, and Dornier Manufacturing Company, of Chicago, Ill., on bearings, brake shoes, fenders and guards, motor lifts, snow plows, snow sweepers, spring trucks, wheels and axles; also conducts a general business in all kinds of electric railway and lighting supplies, under the management of H. M. Shaw.

JOHN B. WATSON, PHILADELPHIA, PA. In almost every trade, the broker is a recognized factor, employed by both buyer and seller. In one form or another he is an essential feature in the financing of electric propositions; but when it comes to his employment for the purchase of material entering into the construction of these projects, there is an opposition which is incomprehensible. Like all professional men, the broker is selling ideas or knowledge of conditions, rather than merchandise, and it is his concentration of effort in this direction, his ability to command and to judge system, details and extended markets that makes his services valuable. The possession of this kind of knowledge enables Mr. Watson to conduct a large brokerage business in the electric railway field.

WENDELL & MACDUFFIE, NEW YORK. Dealers in electric railway supplies; exporters and handlers of McCardell tower wagons; fire, police and telegraph alarms; asbestos building materials; steel castings; gears and pinions; rails; car replacers; babbit metal; metallic weather strips, etc.

WESCO SUPPLY COMPANY, ST. LOUIS, MO.

Within the compass of a paragraph it is not possible to give an adequate idea of the immense range covered by this company's electric railway supply business. Examination of its general catalogue, however, will show that the company handles practically everything that enters into the construction of the track, overhead and operating equipment (except power generation) of an electric railway.

WESTERN ELECTRIC COMPANY, NEW YORK AND CHICAGO. This company's line of overhead railway material and general railway supplies is complete in every detail. A few of its specialties ready for shipment are: Galvanized line material, crossarms, high potential insulators, poles, tape, insulating compounds, arc lamps, armature and field coils, Perkins 500 volt switches, Stombaugh guy anchors, Hipwood car fenders, galvanized strand, street hoods and fixtures, incandescent lamps, lightning arresters and weather-proof wire. A full line of construction tools always in stock. The company is a large manufacturer of electrical material, including Electro-se insulation, American transformers, arc lamps, knife switches, third rail insulators, which are described elsewhere in this dictionary.

CHARLES N. WOOD ELECTRIC COMPANY, BOSTON, MASS. Manufacturers' agents for electric railway supplies.

SECOND-HAND MATERIAL

GILES S. ALLISON, NEW YORK. Makes a specialty of second-hand rolling stock and car equipments.

THE CHICAGO HOUSE WRECKING COMPANY, OF CHICAGO, ILL. Purchases general stocks of merchandise of every kind at sheriffs' and other sales, and carries a full line of everything in the way of mill supplies, including belting, shafting, hangers and the like. Is also engaged in general construction and dismantling business, and consequently has all kinds of boilers, engines and machinery of electrical material, building supplies and general material of every kind for sale.

DALLETT & COMPANY, PHILADELPHIA, PA. This firm has been established thirty years and with some of the best practical experience at their command, has been successful throughout. Dealers in railway and trolley supplies and contractors' equipment of all kinds, locomotives, cars, rails, steam shovels, etc., etc., carrying a large stock on hand at all times.

CHARLES E. DUSTIN COMPANY, NEW YORK. The sale of second-hand equipment has become a valuable and recognized branch of the electrical and steam machinery business. By reason of consolidations, enlargements and radical changes in systems, much material of standard makes, attractive sizes and of the highest grades is being constantly released and made available for smaller installations or additions to existing plants. It is not worn out or obsolete apparatus, but in service is equally as good as though just out of the shop, and at a very much less cost, with the additional advantage of prompt delivery. In most cases after purchase, this company takes such material into its works at Jersey City and puts it in the best condition. The company buys everything from central stations to individual pieces, and, consequently, is able to constantly carry a large stock of direct-connected units, belted generators, engines, boilers, cars, railway motors and equipments; in fact, every variety of material that is used in street railway systems or central stations.

ELECTRIC RAILWAY EQUIPMENT COMPANY, PHILADELPHIA, PA. This company confines its efforts to the sale of second-hand cars, trucks and electric motor equipments. It acts as purchasing or selling agent for railway companies that do not have the advantages or knowledge of the business that it has or for those companies that cannot give the time to it. It is its purpose to handle only the very best materials and to be in position at all times to furnish desirable material in first-class condition and very promptly.

HENRY A. HITNER'S SONS, PHILADELPHIA, PA. This company is not only a large dealer in second-hand machinery, but also buys and sells all kinds of structural work for elevated railways, bridges and buildings.

HYDE BROS. & COMPANY, PITTSBURG, PA. Relaying and new rails are among the principal specialties of this company. Tee rails of all sizes are kept in stock.

IRON CITY STEEL COMPANY, PITTSBURG, PA. This company makes a specialty of both new and relaying rails, spikes, bolts and all track equipment, and is always in the market to either buy or sell any of this material.

CHAS. F. JOHNSON, BUFFALO, N. Y. Buys and sells all kinds of electric railway track work, ties, poles, rolling stock, generating machinery, motors, engines, boilers, etc.

W. R. KERSCHNER, ALLENTOWN, PA. Dealer in second-hand apparatus. All railway motors are thoroughly overhauled and put into first-class condition, being practically equal to new motors. New gears and pinions are furnished with all motors sold. Controllers are likewise overhauled the same as railway motors. Second hand cars and generators also sold.

HENRY LEVIS & COMPANY, PHILADELPHIA, PA. Dealers in all classes of rails and track work.

THE MALES COMPANY, NEW YORK AND CINCINNATI. Dealers in second-hand material for electric railways, including rolling stock and construction apparatus.

ELMER P. MORRIS COMPANY, NEW YORK. Dealers in all kinds of electrical and other material and apparatus suitable for the construction and operation of electric railways.

OWEGO BRIDGE COMPANY, PHILADELPHIA, PA. While not regular dealers in second-hand material, the Owego Bridge Company has often been able to save money for its customers by supplying bridges released from steam railroads. Using this material in connection with new work from its shops, several electric railways have been supplied throughout at considerable saving in cost; at the same time a greater capacity is obtained. The company repairs and erects these spans in any section of the country.

FRANK RIDLON COMPANY, BOSTON, MASS. This company conducts a large second-hand business, making a specialty of generators and motors. Its excellent repair facilities enable it to place such apparatus on sale in first-class operating condition.

ROSSITER, MacGOVERN & COMPANY, NEW YORK. This company makes a specialty of standardizing street railway and lighting companies, power house apparatus and railway motor equipments, taking in part payment station apparatus and motor equipments for which there is no further use, and supplying in cases of stations machinery best adapted to the purpose. In case of equipments the type of motor best adapted to local conditions, making it possible for its clients to reduce their stock of extra supply parts. And also accomplishes the greatest result of all, viz.: Standardizing the motor equipments, making all parts interchangeable. This company makes it possible for street railway, power transmission and lighting companies to extend their service, thus increasing their earning capacity where it might not be possible, on account of the important first cost of absolutely new apparatus, by reason of the fact that it first of all furnishes standard high grade machinery, such as General Electric and Westinghouse, that has been used, but is nevertheless guaranteed to be similar in all respects to new

apparatus, at a substantial reduction below the cost of new, and in addition to this the company makes a liberal allowance for any apparatus that its clients might have on hand the use of which they desire to discontinue.

THOMPSON-BONNEY COMPANY, BROOKLYN, N. Y. This firm manufactures and deals extensively in the following: Armatures and field coils, journal bearings; center, side bearings and armature bearings; car brakes; packing, rattan for sweepers, car steps; trucks, ventilators; trolley bases, also a general line of second-hand material, such as generators, railway motors, trucks, cars, sweepers and other appurtenances used in the operation and maintenance of railways.

—THOMPSON-BONNEY COMPANY, BROOKLYN, N. Y.

BENJAMIN WATSON, NEW YORK. Dealer in second-hand rolling stock for interurban and street railway service. Rolling stock also overhauled.

JOHN H. WATSON, PHILADELPHIA, PA. Second-hand or released material is material that has been in service and is fitted to go into use again, either as it is, or after overhauling. Naturally coming out in every form and condition it varies from what should go into the scrap heap to what is practically as good as new, and the prices vary accordingly. Under these conditions, a good technical knowledge, combined with keen commercial sense is required, and that Mr. Watson can employ them is evidenced by the successful installation of some ten electric railways during the past year alone with second-hand apparatus.

CHARLES N. WOOD ELECTRIC COMPANY, BOSTON, MASS. Dealer in second-hand electric railway material, such as generators and motors for railway service.

FINANCIAL, ENGINEERING, ETC.

ACCOUNTANTS AND AUDITORS

THE AUDIT COMPANY OF ILLINOIS, CHICAGO, ILL. This firm is a public accountant and auditing firm prepared to examine and report on the books and bookkeeping methods of railway, lighting and power companies.

ADVERTISING, STREET CAR

AMBROSE PETRY COMPANY, DETROIT, MICH. A few years ago advertising privileges were ceased to street car advertising men indiscriminately, and in a great many instances to local parties. Within the past three or four years there has been considerable tendency toward concentration, and it is now the general rule to lease the privilege in the cars to some company controlling large numbers of cars throughout the different cities. The reason for this is obvious. A general street car advertising concern is able to supply good, clean advertising cards which are really attractive, and a car fitted up and cared for as it should be is an improvement on the bare racking or plain printed cards. The Ambrose Petry Company has enjoyed valuable experience in this line and is prepared to give detailed information on this subject. It operates extensively throughout the United States and Canada. The executive office of the company is at Detroit, its Eastern office at New York and its Western office at Chicago. Other offices are at Toledo, Dayton, Youngstown, Indianapolis, Grand Rapids, Bay City, Tacoma, Spokane, Los Angeles, San Francisco, Seattle and Vancouver, B. C.

BARRON G. COLLIER, INCORPORATED, NEW YORK. Controls the street car advertising privileges in something over seventy towns and cities throughout the United States. These privileges are secured from the traction companies by lease, and the space thus obtained and controlled is sublet to individual local and national advertisers through a corps of solicitors, operating from the central and branch offices. The central office is located

in New York city, the branches at New Orleans, Atlanta, Baltimore and Washington. The company is one of the pioneers in this field of work.

GEORGE KISSAM & COMPANY, NEW YORK. This company makes a specialty of street and interurban railway advertising and is prepared to negotiate for long time leases with first-class roads in any part of the United States.

"STREET CAR ADVERTISING." A monthly publication issued for railway companies; subscription price 50 cents per year in advance.

—ELECTRIC RAILROAD ADVERTISING COMPANY, ROCHESTER, N. Y.

BANKERS AND BROKERS

BROWN BROTHERS & COMPANY, NEW YORK, PHILADELPHIA AND BOSTON. Dealers in high-class railway stocks, bonds and other investment securities. Travelers and commercial letters of credit issued. Cable transfers and bills of exchange bought and sold.

DUMEE, SON & COMPANY, PHILADELPHIA, PA. This company buys and sells street railway franchises in the United States and Canada, and negotiates railroad securities.

W. E. FARLOW & COMPANY, NEW YORK. This company finances electric railways and other projects after proper reorganization and when the engineering details are perfected. The company is also prepared to organize properly and take care of all engineering features, including construction, detail and management.

FARSON, LEACH & COMPANY, NEW YORK AND CHICAGO. This firm specializes in the purchase and sale of railway and municipal bonds.

W. J. HAYES & SONS, CLEVELAND, OHIO, AND BOSTON, MASS. This firm buys total issues of street railway bonds on properties issued in the larger cities.

N. W. HALSEY & COMPANY, NEW YORK. Investment securities are sold by this company and a general banking business carried on. This firm also acts as fiscal agent for corporations and negotiates entire new or refunding issues of railway, lighting and power company's bonds.

N. W. HARRIS & COMPANY, NEW YORK, CHICAGO AND BOSTON. Buy and sell entire issues of municipal, railroad, street railway, gas, electric light and power company bonds, in addition to engaging in a general banking business, acting as fiscal agents for municipalities and corporations, issuing letters of credit, etc.

R. H. GODELL & COMPANY, NEW YORK AND CHICAGO. This banking firm is prepared, after proper investigation, to loan money to corporations for construction and extension purposes in anticipation of permanent funding operations.

KEAN, VAN CORTLANDT & COMPANY, NEW YORK. This firm transacts a general domestic and foreign banking business, and deals in high class investment securities.

PERRY, COFFIN & BURR, BOSTON, MASS. This firm is prepared to purchase total issues of street railway and electric lighting bonds.

SPENCER TRASK & CO., BANKERS, NEW YORK. This firm transacts a general banking business; acts as fiscal agent for corporations; negotiates security issues of railroads and other companies; issues monthly investment circulars describing long-term and short-term high-grade bonds, and executes commission orders upon the New York Stock Exchange and in all of the markets of the principal cities.

BOOKS, TECHNICAL

ELECTRICAL BOOKS. The publishers of the STREET RAILWAY JOURNAL are also the largest publishers in the world of electrical books for the engineer, the student and the practical electrician. The list includes the works of Dr. Louis Bell, Chas. P. Steinmetz, Prof. Edwin J. Houston, Dr. A. E. Kennelly, B. A. Behrend, A. V. Abbott, Kempster B. Miller, Lamar Lyndon and scores of other well-known writers of electrical books. A complete catalogue may be had upon request.
—MCGRAW PUBLISHING COMPANY, NEW YORK.

ENGINEERING BOOKS. There is no engineering book published that this company cannot supply either from stock or to order on short notice. Quotations will be made on any list submitted for libraries for street railway and electric companies. Special lists of books recommended will be submitted on request.
—MCGRAW PUBLISHING COMPANY, NEW YORK.

PRACTICAL ELECTRICITY. Makes the study of electricity a pleasure. The most valuable feature in connection with this book is its questions, which are found at the end of each of the twenty chapters. These questions bring out all the valuable points, thus assisting the reader in mastering a subject before leaving it. Every one of the 441 questions is answered in the back of the book, where is also found a dictionary defining 1,500 electrical words, terms and phrases. 471 pages, price \$2.00, delivered.
—CLEVELAND ARMATURE WORKS, CLEVELAND, OHIO.

STREET RAILWAY BOOKS. The publishers of the STREET RAILWAY JOURNAL have for sale the best books on every branch of street railway engineering. Gotshall's "Electric Railway Economics;" Herrick's "Practical Electric Railway Handbook," new edition; Hanchett's "Modern Electric Railway Motors," and Meyer's "Steam Power Plants" are examples of leading books which they publish. A full catalogue will be sent on request.
—MCGRAW PUBLISHING COMPANY, NEW YORK.

DETECTIVE SERVICE

DRUMMOND EMPLOYEE'S CHECKING SYSTEM. The thorough inspection by trained men of employees and equipment of railroad companies, especially of operating crews and cars, the handling of fares and the carefulness or carelessness of employees while operating cars. This work requires a thorough knowledge of city and interurban practice in methods of collection and registration of fares and of the different kinds of registers in use.
—DRUMMOND'S DETECTIVE AGENCY, NEW YORK.

BENJAMIN FRANKLIN'S DETECTIVE AGENCY, PHILADELPHIA. Established in 1854. Branch office in New York. Malcolm Franklin, the principal of the home office, is the son of the founder of the business, Benjamin Franklin, and has been engaged in the profession for some twenty-four years. This agency has correspondents throughout the United States and foreign countries. While it conducts all detective investigations of a strictly legitimate character for individuals and corporations, attorneys, etc., for the past ten years it has made a specialty of conducting investigations for electric railway lines, and can furnish the best of references from some of the leading street car companies, for which it has operated, in checking conductors, accident cases, etc.

MOONEY & BOLAND DETECTIVE AGENCY, NEW YORK AND CHICAGO. Street railway work in all branches a specialty.

RAILWAYS PROTECTIVE ASSOCIATION. An association of steam and electric railroads, steamship companies, express companies and accident insurance companies for the purpose of defeating accident fakirs. Members of the association pay a small annual fee, and report all claims of every kind made against them to a separate bureau, where these records are kept. If previous records of claimant are found, also of accident witnesses on file, copies are immediately forwarded to the member reporting a claim against it.
—DRUMMOND'S DETECTIVE AGENCY, NEW YORK.

ENGINEERS,

Consulting, Contracting and Operating.

AMERICAN RAILWAY CONSTRUCTION COMPANY, NEW YORK. This firm is engaged in the business of financing, constructing and equipping electric and steam railways, water power plants and other public works. It was organized January 9, 1905, and is prepared to handle large contracts, and if of unquestioned

merit will assist, through its financial connections, in placing securities of roads, contracts for building which are entered into with it.

THE ARNOLD COMPANY, CHICAGO, ILL. This firm has successfully completed, and is prepared to construct, a large variety of installations requiring the use of a high standard of civil, mechanical and electrical engineering.

ATLAS CONTRACT & SUPPLY COMPANY, SAN FRANCISCO, CAL. This company builds and equips steam railroads, electric railways, power and lighting plants, etc. Securities are taken in high-class enterprises.

W. E. BAKER & COMPANY, NEW YORK. This firm, which is composed of W. E. Baker and H. R. Bishop, conducts a general consulting engineering business. It has also designed and completed a number of electric railway and power plants.

PUTNAM A. BATES, NEW YORK. Plans, specifications and supervision of electrical installations. Examinations and tests of existing electrical equipments—Special investigations of existing or proposed electrical equipments and engineering enterprises for those interested. Reports as to possible betterments, from a commercial as well as from an engineering point of view, in existing establishments. Complete reports based on special investigations of electrical properties with respect to their dividend paying possibilities. Recommendations concerning alterations, substitutions and extensions to conform with new conditions and to improve the commercial success of the undertakings.

CHARLES EDWIN VAN BIBBER, BOSTON, NEW YORK AND TOLEDO. Consulting and constructing engineer for steam and electric railways, power plants and all classes of civil, electrical and mechanical engineering.

BLOOD & HALE, BOSTON, MASS. Consulting and designing engineers, particularly for elevated and heavy electric traction. Complete designs prepared for electrical and mechanical apparatus. Plans and specifications furnished for power plants.

EDWARD P. BURCH, MINNEAPOLIS, MINN. Consulting engineer for electrical work and specialist in heavy electric traction.

H. M. BYLLESBY & COMPANY, INC., CHICAGO, ILL. Designers, constructors and operators of railway, power and hydraulic plants. Examinations and reports made, and specifications furnished.

CASON & BARRETT, KANSAS CITY, MO. Consulting engineers for electric railways and power plants. Plans, reports and specifications furnished.

CHARLES A. CHAPMAN, CHICAGO, ILL. Consulting engineer for electric railway, power and lighting plants.

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