UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

FREIGHTCAR AMERICA, INC.,

Petitioner,

v.

NATIONAL STEEL CAR LIMITED,

Patent Owner

IPR2025-01046 (Patent 8,166,892)

IPR2025-01047 (Patent 8,132,515)

DECLARATION OF LAURA JEWELL

I, Laura Jewell, declare as follows:

1. I have personal knowledge of the matters set forth herein and if I am called upon to testify, I could and would testify competently thereto.

2. I am Director of Process Control for Product Engineering at National Steel Car Limited ("NSC"). As part of my duties, I maintain Product Engineering's physical and electronic storage of documents and regularly search and retrieve documents and information from the same.

3. I understand that Petitioner FreightCar America, Inc. has identified the 1946 Car Builders' Cyclopedia of America Practice (the "1946 Cyclopedia") in this proceeding. The portions of the 1946 Cyclopedia identified by Petitioner are attached hereto as Exhibits A and B.

4. NSC keeps multiple "Cyclopedias" of various editions in its Product Engineering and Marketing departments. I have conducted searches for the 1946 Cyclopedia in Product Engineering and Marketing's physical and electronic documents. I did not find the 1946 Cyclopedia in Product Engineering or Marketing's physical and electronic documents.

5. I would not expect another department (besides Product Engineering and Marketing) at NSC to have a copy of a Cyclopedia. To my knowledge, NSC did not have a copy of the 1946 Cyclopedia prior to my searches.

I declare under penalty of perjury under the laws of the United States of America that the foregoing is true and correct.

Date: October 17, 2025



Laura Jewell

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EXHIBIT A

CAR BUILDERS' CYCLOPEDIA

1946

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1946
Car Builders' Cyclopedia
Of American Practice

Definitions and Typical Illustrations of Railroad and Industrial Cars, Their Parts and Equipment; Cars Built in America for Export to Foreign Countries; Descriptions and Illustrations of Shops and Equipment Employed in Car Construction and Repair

Seventeenth Edition—1946

First Edition—"Car Builders' Dictionary"—1879

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for the
Association of American Railroads—Mechanical Division
(Formerly Master Car Builders' Association)

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1946

SIMMONS-BOARDMAN PUBLISHING CORPORATION

LIST OF EDITIONS

Car Builders' Dictionary		*Car Builders' Cyclopedia*	
First	1879	Tenth	1922
Second	1884	Eleventh	1925
Third	1895	Twelfth	1928
Fourth	1903	Thirteenth	1931
Fifth	1906	Fourteenth	1937
Sixth	1909	Fifteenth	1940
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Eighth	1916	Seventeenth	1946
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Foreword

In the tenth edition, 1922, of this work it was transformed from what might be termed an illustrated Dictionary to a Cyclopedia and the data were compiled in a manner differing radically from that of previous editions; all information relating to a specific subject was combined within a single section instead of being placed in several separate groups. In former editions each of these groups—Association of American Railroads (formerly American Railway Association, Mechanical Division, and originally Master Car Builders' Association) specifications and drawings, general illustrations, and manufacturers' descriptive pages—were in different sections of the book, necessitating considerable cross reference and inconvenience in obtaining complete information on any subject. In the tenth edition, the material was so arranged and indexed that reference to the general index, or the table of contents gave the location of each class of cars or appliances.

Other indexes—General Index to Car Parts and Products—Trade Name Index and Index to Advertisers—were given in the last pages of the book. The Association of American Railroads "Rules of Interchange" and diagrams of the "Loading Rules" were omitted as these are now obtainable in convenient booklet forms.

In this volume, the Seventeenth Edition, the same general arrangement has been followed, with the division into sections clearly defined. In a few cases the arrangement has been changed somewhat in order to make the material more readily accessible. As a further aid, the Table of Contents by sections and subdivisions on page six and the General Index to Car Parts and Products at the end of the book have been amplified and improved and in addition a summary of the contents of each section is given on the first page of the several sections.

Many new designs of cars and appliances in the field of railway car construction have been made since the publication of the previous edition. These have been included as far as possible in order that this Edition might contain the latest practices in American Car Construction and Equipment.

The work of compiling data and rearranging the book has entailed a vast amount of research and revision, in connection with which valuable assistance has been given by an Advisory Committee appointed by the Mechanical Division of the Association of American Railroads, by many other railway mechanical officers, by the railway car builders and by the manufacturers of railway supplies.

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Body Brace. An inclined member of the body side or end framing of the car.

Body Center Plate. The center plate attached to the under side of the body bolster. See CENTER PLATE.

Body Check or Safety Chain Eye. An eye bolt or clevis for fastening a truck check chain or safety chain to the car body.

Body Check or Safety Chain Hook. An iron hook on the check chain, which enters into the check chain eye.

Body Cross Tie. A metal bar extending across a hopper or other form of open-top freight car and fastened to the sides to prevent their bulging.

Body End Furring. Furring in the end of a car. See FURRING.

Body End Plate. A transverse member in the end of a car connecting the side plates. See END PLATE.

Body End Rail. See WAINSCOT RAIL.

Body Framing. The framework of that part of a car above the underframe, so called to distinguish it from the underframe. It is commonly subdivided into side, end and roof framing.

Body Post (Freight Car Bodies). An upright piece which is fastened to the sill and plate of a freight car. The body posts and corner posts form the vertical members of the side frame of a car body. See POST and SIDE POST.

Body Side Bearing. The upper one of the two side bearings, which is attached to the body bolster. See SIDE BEARINGS.

Body Transom. A name sometimes given to a Needle-beam or Crossbearer.

Body Unit. One complete part of an articulated car. See ARTICULATED CAR.

Bogie. A British term for a swiveling car truck. American eight-wheel cars are termed bogie carriages, or wagons, in Great Britain

Bogus Plate (Refrigerator Cars). A horizontal timber attached to the posts on the inside of the car, a short distance below the plate. The bogus plates support horizontal cross members, called meat racks, or hanging bars, to which hooks are attached for hanging meat. See MEAT RACK.

Bolster. A cross member on the under side of a car body and in the center of a truck, through which the weight is transmitted. The bolsters carry the body and truck center plates, the body bolster resting on the truck bolster.

Truck bolsters are either swing bolsters, admitting of lateral motion to mitigate shocks, or rigid bolsters, which permit no lateral motion. See BODY BOLSTER, SWING BOLSTER and TRUCK BOLSTER.

Bolster Anchor. An arm pivoted to the truck frame and to the truck bolster to constrain the movement of the latter in a desired manner.

Bolster Bridge (Six-Wheel Truck). See SIDE BEARING ARCH.

Bolster Center Filler. A hollow box-shaped member placed between the center sills and body bolster plates; the king bolt passes through it.

Bolster Diaphragm. See BODY BOLSTER DIAPHRAGM.

Bolster Guide Bars (Diamond Arch Bar Trucks). See COLUMN.

In modern trucks with cast steel side frames the bolster guide bars are cast integral, as part of the frame.

Bolster Hanger. See SWING HANGER.

Bolster Hanger Carrier. A Swing Hanger Pin Bearing.

Bolster Jack Screw (Wreck Cranes). A jack screw attached to the spring plank for the purpose of taking the load off the springs and making the entire truck and car body one rigid structure when the derrick of the crane is in use.

Bolster Roll Stabilizer. Comprises a split spring plank, the two separate parts of which are connected to each other and to the bolster so as to prevent the bolster from moving out of plane with the track and overloading the springs.

Bolster Spring. The main spring of a car, supporting the truck bolster, on which the weight of the car body rests.

Bolster Thimble. A small filler sometimes used between the cover plates of a bolster when the main filler or web does not extend clear to the end of the bolster.

Boom (Steam Shovel). The heavy swinging arm which carries the boom engine and ratchet beam. It is stepped at the foot of the "A" frame and held in its inclined position by boom guys.

Bottom Arch Bar. See ARCH BAR.

Bottom Connecting Rod. The brake rod connecting the bottom ends of the live and dead truck brake levers.

Bottom Rod. See BRAKE ROD and BOTTOM CONNECTING ROD.

Bottom Rod Guard or Emergency Support. Name applies to devices designed to support the bottom rod and prevent it from dropping to the track in case of failure of any part which normally supports the bottom rod. Also called safety support.

Bottom Truck Connection. See BOTTOM CONNECTING ROD.

Bow. See PLATFORM HOOD BOW.

Box. See JOURNAL BOX.

Box Car. A car with sides enclosed and having a roof; doors are placed in the sides or sides and ends. Used for general service and especially for lading which must be protected from the weather.

Box Car Door. Used on both the sides and sometimes on the ends of automobile car.

Box Cars, Framing for. See general drawings of cars. Sections 2 and 3.

Box Car End, Design and Strength. Manual, C-7.

Box Cover. See JOURNAL BOX LID.

Box Guide. See PEDESTAL.

Box Lid. See JOURNAL BOX COVER or LID.

Box Packing. See JOURNAL PACKING.

Box Section Bolster. A bolster whose cross-section is of rectangular shape.

Box Steps. A term sometimes used to distinguish platform steps made with sides, from open steps.

Brace. An inclined piece which unites two or more of the points of a frame or truss, where other members of the structure are connected together, and which prevents them from turning about their joints.

Bracket Lamp. A lamp attached to a wall by a suspension in the form of a bracket.

Bracket Steps (Hopper Cars). Steps secured to the side of the car on the inside to serve as a substitute for a running board.

Brake or **Brake Gear.** The whole combination of parts by which the motion of a car or train is retarded or arrested. The foundation brake gear includes all the parts by which the pressure of the

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the bolt. A cotter is then inserted, thus securing the nut.

Ceiling. The inside or under surface of the roof or covering of a car. This term is sometimes used to mean Sheathing. The ceiling of a passenger car is generally termed Head Lining. Deafening Ceiling is boarding under the sills of a car. See HEAD LINING.

Ceiling Furring. Strips or pieces of wood fastened to the under side of the carlines, to which the paneling or veneering of the ceiling is applied.

Ceiling Veneers. Thin boards used for covering the ceilings of passenger cars. The term is also misapplied to the thin preparations of paper maché, etc., in imitation of natural wood veneers. See VENEER.

Celestial Field. A term used in interior illumination. The celestial field of a car interior would be the upper walls and ceilings.

Cement Car. See COVERED HOPPER CAR.

Center Anchor. An arrangement of plates, which are riveted to the tank and to the center sills at the center of a tank car. These plates anchor the tank to the frame and supplant head blocks and double anchors at the ends.

Center Bearing. The place in the center of a truck where the weight of the body rests, the truck bolster center plate. A body center plate attached to the car body here rests on a truck center plate attached to the truck. The general term center bearing is used to designate the whole arrangement and the functions which it performs, in distinction from Side Bearing. See also CENTER PLATE.

Center Bearing Arch Bar. See CENTER BEARING BRIDGE.

Center Bearing Beam. See CENTER BEARING BRIDGE.

Center Bearing Bridge (Six-Wheel Trucks). A structure formed by the top and bottom center bearing arch bars to support the center plate block or center bearing beam and transmit the weight of the car to the bolsters, on which its extremities rest.

Center Bolster. A center bearing bridge made in a single unit either built up, welded or cast steel.

Center Buffer Spring. A spiral spring situated above the draft springs in some forms of passenger draft gear and intended for buffing purposes only.

Center Buffer Stem. See BUFFER STEM.

Center Door Rail. See MIDDLE DOOR RAIL.

Center Draft Drawbar. A drawbar which is connected directly with the king bolt of a truck. It is especially designed for use on very sharp curves. Sometimes termed radial drawgear.

Center Dump Car. A car which will discharge its entire load between the rails.

Center Girth. See DOOR CENTER GIRTH.

Center Pin or **King Bolt.** A large bolt which passes through the center plates on the body bolster and truck bolster. The truck turns about the bolt, but the stress is taken by the center plates. It is, therefore, a mere pin and not a bolt in the usual sense. The name king bolt is derived from the name of the corresponding part of the front wheels of a wagon. Center pin, however, is the more common term.

Center Pin Floor Plate. A plate or casting set into the floor of a passenger equipment car to cover the head of the center pin.

Center Plate. One of a pair of plates which fit one into the other and which support the car body on the trucks, allowing them to turn freely under the car. The center pin or king bolt passes through both, but does not really serve as a pivot. The body center plate or male center plate is attached to the under side of the body holster or in cast steel bolsters is made an integral part of the casting. The female or truck center plate is attached to the top side of, or cast integral with, the truck bolster. When the car is tilted, as on a curve, part of the weight is carried on the Side Bearings. See ANTI-FRICTION, BALL BEARING, and ROLLER CENTER PLATES.

Center Plate Block. The member supporting the center plate of a six-wheel truck.

Center Rod (Postal Car). A device which fits in a socket at the top of the pedestals, and to which the ends of the two rods, which support the distributing trays, etc., near the center of the car, are fastened.

Center Sill. The central longitudinal member of the underframe of a car, which forms, as it were, the backbone of the underframe and transmits most of the buffing shocks, from one end of the car to the other. In the A. A. R. standard box car the center sill is one of the units for which a required standard has been established. In freight cars with cushioned underframe a special type of floating center sill construction is followed. For passenger cars no set standard has been established and some unique designs are in use, as in the case of passenger cars built entirely of stainless steel. See CUSHIONED UNDERFRAME.

Center Sill Bottom Angle. The angle at the bottom of a center sill of the built-up type.

Center Sill Bottom Cover Plate. See CENTER SILL COVER PLATE.

Center Sill Cover Plate. A flat plate riveted or welded across steel center sills, either above or below, to give additional strength.

Center Sill Separator. A filler piece placed between the center sills at cross members.

Center Sills, Splicing of. See Manual, C-10.

Center Sill Stiffener. A filling piece riveted between the center sills to act as a brace for holding them rigid.

Center Sill Top Angle. The angle at the top of a center sill of the built-up type.

Center Sill Top Cover Plate. See CENTER SILL COVER PLATE.

Center Sill Web Plate. The plate which forms the web of a center sill of the built-up type.

Center Stop (Tip Car). A bracket or block attached to a draw member to restrain the body from moving longitudinally.

Centering Device. See COUPLER CENTERING DEVICE.

Centering Gage. A gage to fix the middle point of an axle.

Centrifugal Dirt Collector. A device connected in the branch pipe between the brake pipe and distributing valve, or triple valve, and so constructed that due to the combined action of centrifugal force and gravity, all dirt and foreign material is automatically eliminated from the air flowing through the collector chamber and by means of a plug may be removed without breaking any pipe connections whatever. When this device is used, the brake pipe air strainer is omitted.

Chafing Plate. A removable metal plate to resist wear, used on truck transoms, pedestal jaws, and other places where wear concentrates.

Chair. The usual designation for the seats of parlor cars. Ordinary chairs are used in dining cars. See RECLINING CHAIR, PARLOR CAR CHAIR.

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As its name implies, the resilience of the rubber draft gear is provided by blocks or rubber set between steel plates.

For further draft gear details see Section 10.

Draft Gear Attachments. The parts which connect the Coupler and the Draft Gear.

Draft Gear Carrier. A plate which extends underneath the draft sills and supports the draft gear.

Draft Gear Cheek Casting. See DRAFT CASTING.

Draft Gear Followers. See FOLLOWERS.

Draft Gear Pocket. The space occupied by the draft gear and followers in the center or draft sills. Manual M-901.

Draft Gear Yoke. See YOKE.

Draft Key. A key used to connect the coupler shank to the yoke. It is extended to pass through key slots in the draft sills and front draft lugs. Section 10.

Draft Key Retainer. A pin inserted at one end of the draft key to prevent it from backing out through the slot in the center sills. The pin has an elongated head to provide a larger wearing surface against the sill.

Draft Lug Angle. An angle riveted to the bottom of the center sill at the draft gear, to which the lower part of the draft lug is fastened.

Draft Plate. See DRAFT LUG.

Draft Sill. Same as CENTER SILL.

Draft Sill Tie Plate. A plate riveted to the draft sills to aid in holding them rigid.

Draft Spring. A spring attached to a coupler or drawbar to give elasticity. They are so arranged by means of follower plates at each end as to resist either tension or compression.

Drain Cock. See RESERVOIR DRAIN COCK.

Drain Cup (Air Brake). A globular receptacle under a triple valve to collect the water of condensation.

(Refrigerators and Ice Cars.) A metal cup through which the drippings from the ice pass, but which is so arranged as to prevent the entrance of air to the car.

Drain Valve (Car Heating). A valve for draining off the water condensed in the steam pipes where an automatic trap is not used.

Drapes. Heavy cloth hung at windows instead of roller curtains. They are usually supported on rods to adjust the closure. Also used in door ways to smoking and reclining rooms.

Draw Head. The head of an A. A. R. automatic coupler, exclusive of the knuckle, knuckle pin and lock.

Drawbar. A term formerly used synonymously with Coupler. It has been used indiscriminately to designate both the old link and pin drawbar and the modern automatic car coupler. There has been in the past an effort to confine the name drawbar to the old link and pin type, but in the proceedings of the M. C. B. Association, now A. A. R., in speaking of the height of drawbars, the term is applied to the standard automatic coupler. See COUPLER.

Drawbar Safety Lug. See COUPLER HORN.

Drawbar Stop. See DRAFT CASTING.

Drawing Room. A small room or compartment in a sleeping or drawing-room car. Usually fitted with double berths, a sofa or lounge and private toilet facilities. See STATEROOM.

Drinking Cup Vendor. A device for holding and supplying drinking cups.

Drip Coupling or **Basin Coupling** (Wash Basin). The connection of the waste pipe or drip pipe with the basin.

Drip Pan (Refrigerator Car). A dish or pan at one corner or end of the car for receiving the water from the melting ice, usually permitting it to escape to the roadbed through a trap.

Drop Bottom. See DROP DOOR.

Drop Bottom Car. A gondola car with a level floor or bottom, equipped with a number of drop doors, for discharging the load. See also HOPPER BOTTOM GONDOLA CAR.

Drop Brake Shaft. A brake shaft for flat cars which is normally in a vertical position, but can be dropped to a horizontal position and still remain operative should conditions of lading require this to be done.

Drop Door. A door at the bottom of a drop bottom or hopper gondola car for unloading it quickly by allowing the load to fall through the opening. Drop doors are usually in pairs, and are supported by a chain wound upon a winding shaft; or by a lever arrangement. Frequently a drop door beam extends across the car above the winding shaft to assist in supporting it and to stiffen the car.

Drop Door Chain. A chain attached to a drop door, and usually connecting it with a winding shaft, for the purpose of controlling the door. Also sometimes termed Hopper Chain.

Drop Door Chain Ring. An iron ring to which are fastened the single chain passing around the door winding shaft and the two chains which are attached to eye bolts in each of the double drop doors.

Drop Door Eye Bolt. An iron bolt with an eye in the upper end which is fastened to a drop door near the edge away from the hinge and to which is secured the drop door chain.

Drop Door Gear. See DOOR OPERATING GEAR.

Drop End. Used on many gondola cars. The entire end is arranged to swing down at right angles to its normal position, for loading long materials.

Drop End Gondola Car. A gondola car with the ends in the form of doors, which can be dropped when the car is used for shipping long material which extends over more than one car.

Drop Forging. One made by the use of dies, under a drop hammer.

Drop Suspension (Electric Lighting). A drop or bent frame attached to the truck frame. The belt or chain is adjusted by sliding the generator along on the frame and this arrangement is called the sliding-type suspension. See SUSPENSION.

Drop Table. A table hinged to the wall so as to drop against it out of the way when desired.

Drovers' Car. A car similar to a caboose except that a drovers' car is equipped with bunks for the accommodation of stockmen and drovers who accompany a train carrying a shipment of livestock. The car is attached to a stock train.

Drum. (Hoisting Gear.) The main cylinder upon which the hoisting rope winds and unwinds. The spur wheel is carried on the same shaft.

Drum Shaft (of a Derrick or Crane). The shaft on which the winding drum is carried.

Dry Closet. A closet, so called in distinction from a water closet, which is not flushed with water.

Dummy End (Passenger Equipment). See BLIND-END CAR.

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To overcome contact friction, rollers, and rockers are used in many different ways. If the portion containing the anti-friction member is fastened to the truck bolster, it is known as a truck side bearing; if fastened to the body bolster, it is considered a body side bearing.

Other types of side bearings employ springs and friction elements to maintain constant contact and control relative movement between car body and truck.

Side Bearing Arch or Bridge (Six-Wheel Truck). A truss attached to the bolsters to support the truck side bearing.

Side Bearing Brace. A filler block between the body bolster diaphragms that supports the side bearing.

Side Bearing Truck. A truck in which the weight of the car is transmitted at the side instead of the center. The term balanced side bearing truck is also used to indicate that the car body is so balanced on the truck that the weight is equally distributed to all the wheels at all times. Not commonly used.

Side Brace. Commonly designated as body brace or brace, except when the end braces are to be distinguished from them.

Side Casting. See DRAFT LUG.

Side Deck Lamp. A bracket lamp fastened above the windows and to the deck sill, or to the lower deck ceiling and the deck post.

Side Door. Designated thus to distinguish from end door on both freight and passenger equipment.

Side Door Bottom Guide. An iron bracket attached to the side of freight cars having sliding doors to guide the door while it is being opened and shut and also to prevent its swinging away from the car at the bottom.

Side Door Fixtures. See Section 3.

Side Door Hanger. See DOOR HANGER.

Side Door Protection Strip. See PROTECTION STRIP.

Side Door Top Track. See DOOR TRACK.

Side Dump Car. A car so constructed that its contents may be discharged to either side or both sides of the track through doors in the car sides, or drop doors in the floor; by means of an inclined floor and side doors; or by tipping the car body sidewise. See also DUMP CAR.

Side Eave. A term sometimes used to designate a steel plate running along the eaves or edge of the roof of a steel passenger equipment car.

Side Fascia. See FASCIA.

Side Frame. The frame which forms the side of a car body or a truck. It includes the posts, braces, plate, belt rail, etc., for the car body; and the side member of a truck frame. See TRUCK SIDE FRAME.

Side Furring. See FURRING.

Side Lamp. A lamp attached to the side of a passenger car in distinction from a center lamp, which is attached to the roof. They are usually made with brackets, by which they can be conveniently fastened.

Side Nailing Strip. A piece of wood bolted outside the side sills of steel underframe cars to which the ends of the floor planks and the bottom ends of the sheathing are nailed. See NAILING STRIP.

Side Plate. More properly, simply plate. The longitudinal member connecting the tops of the side posts of the car body. So called as distinguished from the end plate.

Side Plate Stiffening Angle (Steel Cars). An angle iron riveted to the side plate, and serving the same purpose as the stakes. Often called stake.

Side Plate Tie Rod. A rod extending across the top of the car and tying the side plates together.

Side Post. Vertical member used in the side framing of freight and passenger cars.

Side Rail. A longitudinal member extending along the top of the side frame of a coal or ore car. It rests upon posts and braces and connects with end rails, which go across the end of the car. It corresponds to the plate of a box car, but does not carry any carlines, as does a plate.

Side Seat. A longitudinal car seat, the back of which is against the side of a car.

Side Sheet. A plate used for closing in the sides of a steel car.

Side Sill. The outside longitudinal members of the underframe. In some designs of steel cars the side sills are dispensed with and the entire side of the car is designed as a deep plate girder to carry most of the load to the bolster.

Side Sill Step. See SILL STEP and Section 14.

Side Slope. That part of the floor which slopes from the side of a hopper to the hopper door. See HOPPER SLOPE SHEET.

Side Stake. See STAKE.

Side Stake Pocket. See STAKE POCKET.

Side Stem. A bar attached to the side of a three-stem coupler to transmit part of the force to springs separate from the regular draft springs. See THREE-STEM PLATFORM EQUIPMENT.

Side Straps (Wooden Gondola Car). The straps to which the end planks and sometimes also the side planks, are bolted. They are also called side plank tie straps.

Side Strut for Hopper Floor (Hopper Cars). An inclined strut or support for the hopper floor between the bolster and the end of the car, fastened to the corner of the end sill.

Siding. See SHEATHING.

Signal Branch Pipe. A pipe leading from the train air signal pipe to the car discharge valve.

Signal Cord. A rope or sash cord extending along a passenger car wall inside and attached to the air signal discharge valve; a pull on the cord releases the air in the signal pipe and blows the signal in the cab.

Signal Cord Bushing. A thimble lining a hole through a partition for a signal cord to pass through, in distinction from a signal cord guide, which is attached to the side or roof of the car or to the signal cord hanger.

Signal Cord Guide. A metal eye or ring attached to the roof or ceiling of a car, or to the end of a Signal Cord Hanger, and by which a signal cord is carried or conducted. See also SIGNAL CORD BUSHING.

Signal Cord Splice. A metal coupling with right and left hand screws for permanently splicing the ends of a broken cord. See also SIGNAL CORD COUPLING.

Signal Hose. An air hose similar to, but of smaller diameter than, an air brake hose, and used between cars to connect the train air signal lines.

Signal Lamp. See MARKER.

Signal Lamp Bracket. See MARKER BRACKET.

Signal Lamp Socket. See MARKER BRACKET.

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called the brake step, is also sometimes used. A bracket called a tank step is attached to the tanks of tank cars.

Step Box. A portable box-shaped step, for use between the bottom passenger car step and a low station platform.

Step Hanger. A vertical board or metal plate by which the steps are supported from the corner of a car and from the platform end sill.

Step Nosing. A metallic facing or molding for the tread of stair steps.

Step Riser. The vertical portion of a step in stairs.

Step Treads. See SAFETY TREAD and TREAD.

Steps, Folding. On many streamlined passenger cars the vestibule steps are hinged to fold up when closed, forming a smooth outline.

Stile. The upright pieces on the outer edge of a door or sash, as door stile, sash stile, window stile, etc.

Stirrup. A kind of ring or bent bar of iron resembling somewhat the stirrup of a saddle. A coupler carry iron is sometimes called a stirrup.

Stock Car. A car for the transportation of live stock, equipped with roof, slatted sides and side doors, single or double deck and frequently with feed and water troughs.

Stop Bar (Sleeping Car). A bar to connect the two seats on which the seat bottoms may rest when drawn down to make up a lower berth. It rests upon a stop bar plate.

Stop Bar Guide. An attachment to hold a stop bar in place laterally.

Stop Cock. A simple form of cock having a body and tapered plug which has an opening through it. When the plug is turned so that the holes in it correspond to the ports in the body the liquid flowing in the pipe can pass through the cock. When the plug is turned so that the openings do not correspond, the flow is stopped.

Stop-Key Journal Bearing. A key or wedge with a lug or projection which bears against the end of the axle to restrain lateral motion and thus dispense with a collar on the axle. Not in general use.

Storage Battery. A storage battery consists of a number of metallic plates, separated by suitable insulators, immersed in an electrolyte within a proper container. Its function is to convert electrical energy into chemical energy during the operation known as charging and the reverse when discharging. When charging, the terminals are properly connected to a source of electrical supply, usually a direct-current generator driven from the car axle or by an independent engine. Storage batteries are used to supply current for car lighting and air conditioning in passenger train cars and are carried in battery boxes suspended from the underframe.

Storage Battery Car. A motor car driven from storage batteries.

Stove Pipe Jack. A covering or bonnet for the aperture of a stove pipe on the outside of a car. Practically obsolete except on cabooses and work cars.

Strap Bolt or **Lug Bolt.** A round bolt with a flat bar of iron or steel welded to it, and usually with a hook on the end which serves the purpose of a head. The flat bar has holes in it, by which it can be fastened in place with rivets, bolts, or screws.

Strap Washer. An iron or steel strap which takes the heads of several bolts. Also called washer plate.

Streamline. The general term given to the type of construction which provides a smooth continuous outer surface on passenger cars. By rounding both ends of a train equipped with such cars, head-on air resistance and air drag are reduced.

Street Ell. An elbow pipe fitting with male thread on one end and female thread on other end.

Striker. See STRIKING PLATE.

Striker Arm. A seat arm. The terms striker arm, seat back arm and seat arm are commonly used.

Striking Horn. The stop shoulder, or horn of a coupler, arranged to touch the striking plate before the draft gear goes solid.

Striking Plate. A member placed on the ends of the center sills of freight cars against which the horn of the coupler strikes, preventing damage to the draft gear and center sills.

String Board (Passenger Car Steps). A vertical plate which supports the ends of the steps. A step hanger.

Stringer. A term sometimes applied to a floor nailing strip or a steel member which acts as a support for a nailing strip. A longitudinal floor stringer sometimes occupies a position similar to that of an intermediate sill but is not designed to perform its duties. See NAILING STRIP.

Stringer Pocket. A casting for supporting the end of a beam or stringer. In automobile and similar cars, for facilitating the use of a second or upper deck for increasing the loading capacity for small freight.

Strut (Truss). A member subjected to a strain of compression. A vertical strut is usually called a post. See also BRAKE BEAM STRUT.

Stud. A headless bolt, threaded on both ends. A standing bolt, pin, boss or protuberance designed to hold an attached object in place. Especially a headless bolt permanently screwed into a tapped hole in a casting or forging.

Sub-Carline (Refrigerator Car). A strip of wood under the main carline, supporting the sub-roof. See CARLINE.

Sub-Floor (Refrigerator Car). A layer of flooring boards under the main floor, and usually separated from it by an air space and hair felt or some other form of special insulation.

Sub-Roof (Refrigerator Car). The inside layer of boards of the roof proper, supported on sub-carlines.

Sub-Sill. A sill attached under another sill to reinforce it.

Subway Car. An electric motor car for use in subways in large cities.

Sugar Cane Car. See CANE CAR.

Supply Pipe (Air Compresser). A pipe sometimes connected to the air inlet of an air compressor by means of which the air supply is drawn from a point some distance away from the compressor.

(Lavatory Fittings.) Pipes which carry hot or cold water to the basin faucets.

Supply Valve (Steam Heating). A valve for regulating the supply of steam in the radiator pipes of a car.

Suspension (Motor Car). The method of supporting a railway motor. Except in the case of gearless motors, the suspension is designed to put as little dead weight as possible on the axle.

(Electric Lighting.) The iron work and fittings which are attached to the body or truck for supporting or suspending the axle generator and which include the belt tightening and aligning devices. The

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Trap Door Latch (Vestibule). The latch for the vestibule trap door.

Trap Door Lock. See TRAP DOOR LATCH.

Traversing Jack. A jack that can be moved horizontally on a bed or track while under its load. See JACK.

Tread (of a Step). The part on which the foot is placed. See TREAD BOARD and SAFETY TREAD.

(Of a Car Wheel.) The exterior cylindrical surface of a car wheel next to the flange which comes in contact with the rail.

Tread Board (of a Step). The horizontal part on which the foot is placed. Usually covered with rubber or metal safety treads to prevent slipping. See TREAD and SAFETY TREAD.

Triple Valve (Air Brake). A device which automatically performs three functions in operating the air brakes on older freight cars. It charges the auxiliary reservoir, applies the brakes and releases the brakes according to the varying pressures in the train line. Now being superseded by AB equipment.

Triple Valve Branch Pipe (Air Brake). A short pipe by which the triple valve is connected with the brake pipe.

Triple Valve Gasket. A gasket placed in the joint between the triple valve and the passenger brake cylinder or freight car auxiliary reservoir.

Triple Valve Piston (Air Brake). See TRIPLE VALVE.

Trolley. See PANTAGRAPH TROLLEY.

Truck. The general term covering the assembly of parts comprising the structures which support a car body at each end (or, in the case of articulated cars, the joint support of two abutting car ends) and also provide for attachment of wheels and axles.

Truck Bolster. A cross member in the center of a truck, on which the car body rests. The truck bolster is connected to the body bolster by a center pin, which passes through both.

Truck Bolster Guide. A small projection at the ends of a truck bolster that engages the vertical member of the truck frame preventing spreading of the latter.

Truck Bolster Guide Bar. See BOLSTER GUIDE BAR.

Truck Car. A car used in a wreck train for carrying spare trucks. See WRECK TRAIN EQUIPMENT.

Truck Center Plate. See CENTER PLATE.

Truck Frame. A structure made of cast steel in one piece, to which the journal boxes or pedestals, springs and other parts are attached, and which forms the skeleton of a truck. See TRUCK SIDE FRAME.

Truck Lever. That part of the foundation brake rigging which applies the power of the brake cylinder at the brake beams. On freight car trucks there is a live lever and a dead lever collectively known as truck levers. On passenger cars truck levers assume various positions according to the type of brake rigging used.

Truck Lever Connection. A rod or bar connecting the brake levers on the truck brake gear.

Truck Side Bearing. A device attached to the top of the truck bolster and having an upper bearing surface which comes in contact with a similar bearing surface fastened to the underside of the body bolster. See SIDE BEARING.

Truck Side Frame. The longitudinal portion of a truck structure, on the outside of the wheels, which extends from one axle to the other, and to which the journal boxes and bolsters or transoms are attached or form a part.

Truck Springs. The springs that carry the weight of the car body and its load to the running gear or trucks. On freight cars the truck springs are generally of the helical type placed in groups between the bolster and bottom chord of the truck frame. Helical springs are used on passenger car trucks both as equalizer springs and sometimes at the bolster. On some cars helical springs are placed directly over the journal box, the truck frame resting upon them. Elliptical springs are made in groups for use on passenger car bolsters and occasionally semi-elliptic springs are employed in different types of trucks. See SPRING, ELLIPTIC, HELICAL AND VOLUTE.

Trunnion. A cylindrical projection on the side of any part that allows a turning or oscillating movement.

Truss. An engineering term applied to certain types of built-up load-carrying structures so designed that the individual members comprising together the complete unit are subject only to compression or tension loads.

Truss Rod. A rod or set of rods usually placed beneath the sills of wooden cars to carry the tension stress of a truss.

Tufting Button. A button used in upholstery to hold the cord which passes through the upper covering of the upholstered surface, dividing it into squares or diamonds.

Tumbler (Lock). A latch engaging with a notch in a lock bolt, or otherwise opposing its motion until it is lifted or arranged by the key so as to remove the obstacle.

Tup. See HAMMER.

Turbo-Generator. A steam turbine direct-connected to a generator for furnishing electric current. The turbo-generator receives steam from the locomotive.

Turnbuckle. An elongated sleeve with a right and left hand thread at either end for the purpose of tightening two rods together.

Turn Over Seat. See REVERSIBLE CAR SEAT.

Turtle Back Roof. See ARCHED ROOF.

Twin Car Seat. A seat stand with a division arm, two cushions and two seat backs with two striker arms each, so that they may be turned to bring the occupants face to face. See RECLINING CHAIR.

U

U-Bolt. A double bolt made of a bar of steel or iron bent to the shape of the letter U, with a screw thread on each end.

U-Bolt Casting. A casting so shaped that a U-bolt can fit around it to form a bearing or carrier for a pin or bolt.

U C Brake Equipment. A standard brake equipment for general passenger train service. The principal units include a Universal Valve used with three reservoirs, Auxiliary, Service, and Emergency, also one brake cylinder for both service and emergency applications, except in the cases of very heavy cars which require the use of two cylinders.

Uncoupling Lever or **Uncoupling Rod.** A rod with a bent handle forming a lever, usually attached to the end sill, by which the lock of the automatic coupler is opened and the cars uncoupled without going between them. The lever proper is the part attached to the rod and operating the unlocking mechanism, but in the case of freight cars the lever and rod are generally made in one piece. The short lever which is directly connected to a passenger

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Vestibule Lamp. A lamp used for lighting a car vestibule.

Volt. The basic unit of electric potential, pressure, or electro-motive force. The International Volt is the potential difference required to maintain a steady current of one ampere in a circuit whose resistance is one ohm.

Voltmeter. An instrument for measuring the voltage of electric currents.

Volute Spring. A spring made of flat metal wound in a spiral scroll. Used for in certain types of friction bolster springs and for buffer springs on foreign cars.

W

Wagon. British for Freight Car.

Wainscoting. The lining for interior walls of a passenger car body. Term applies especially when paneling and relatively elaborate workmanship are employed.

Wainscot Panel (Passenger Car Interior). A panel under the windows between the two wainscot rails.

Wainscot Rails (Passenger Car Interior). Longitudinal strips extending from one end of the car to the other, used in connection with wainscoting. The wainscot end rails are the wainscot rails at the end of the car.

Walkover Seat. A term used to designate a type of car seats in which the back does not turn over when the seat is reversed. Also called GLIDEOVER, PUSHOVER and SLIDEOVER.

Wall Lamp. A lamp to fit in a recess in the wall of a car or corridor.

Wall Seat End. The seat end next to the wall or side of a car, so called in distinction from the aisle seat end.

Wardrobe (Postal Car). See POSTAL CARS.

Wards (Lock). The interior circular ridges which fit into corresponding recesses in the bit of a key (the latter also termed wards), the surrounding solid parts of the bit being called the web.

Washer. A plate of metal or other material, usually annular, which is placed under a nut or bolt head to give it a better bearing. Washers in car work generally take their name from that of the bolt or rod to which they are attached.

Washer Plate. See STRAP WASHER.

Washstand. A basin or lavatory installed as a permanent fixture for cleaning purposes. Equipped with water supply and outlet. On some types of cars the washstands are made to fold up out of the way when not in use.

Waste. Threads of wool or cotton or mixtures of these into which is incorporated mechanically curled vegetable fiber, often cocoanut fiber, to impart to the product an elasticity not possessed by wool or cotton threads. The material is saturated with lubricating oil and placed in a journal box so that it comes in contact with the lower half of the journal. Sometimes called packing or dope. Various special compositions have been developed, sometimes with springs inserted in the mass to impart greater resiliency. Manual, A-905.

Waste Cock. A cock for drawing off water from a tank or basin. (Baker Heaters.) A cock attached to the expansion drum or circulating drum of the Baker heater for drawing off or changing the water in the heater pipes.

Wastometer. A device for flushing water closets.

Water Alcove. A recess in the side of a partition of a passenger car to receive the faucet of a water cooler or water pipe and a drinking cup.

Water Circulation Heating System. See HOT WATER CIRCULATION HEATING SYSTEM.

Water Cooler. A tank or vessel for carrying drinking water, which is cooled by electric refrigeration or with ice. The sides are generally made double, and the space between filled with some non-conducting substance. See WATER ALCOVE, WATER TANK.

Water Drip. A pan or receptacle to receive the waste water from a water cooler. A drip pipe, or waste pipe, is connected to it.

A slight projection or raised seam in the roof of a passenger or baggage car over the side doors, or at the end of the car in the platform roof to divert the water so it will not fall upon persons entering the car or passing from one car to the next

Water Gage. See GLASS WATER GAGE.

Water Mixing Valve. A device for mixing hot and cold water in a lavatory.

Water Seal. See TRAP.

Water Supply. The system of water supply used in coaches and Pullman cars is under air pressure. The system provides for forcing water into the wash bowls by air pressure taken from the air brake system. Hot water is usually heated by using live steam from the locomotive.

Water Tank. A vessel or reservoir for holding water. Those used on cars for drinking water are usually made of sheet iron, and often extend to the roof. They are then usually drawn from by a water alcove, the tank usually being in the corner and concealed from the interior of the car. Water used in dining car kitchens is usually carried in overhead tanks.

For size and arrangement of water tank in postal cars, see POSTAL CARS.

Watt. The unit commonly used in measuring electric power. The International Watt represents the power expended by an electric current of one International Ampere flowing through a resistance of one International Ohm. In d. c. electrical calculations the product of voltage multiplied by amperage equals the number of watts. One watt equals $1/746$th of one horsepower or conversely, one horsepower equals 746 watts. Also see AMPERE, OHM, OHM'S LAW, and VOLT.

Wattmeter. An instrument for measuring electric power directly in watts. See WATT.

Waved Moldings. Moldings which by a special machine are made of a corrugated section longitudinally.

Way Car. See CABOOSE.

Wear Plate. A plate placed between two moving surfaces to withstand frictional wear.

Weather Strips. A strip for application around the crevices of windows or doors, for excluding the dust and wind, and for preventing water from entering around the windows.

Web. A term applied to the center portion of a beam, as an I-beam, which ties the flanges together.

Web Filler. See BODY BOLSTER FILLER.

Webbing. A strong fabric, made of hemp or other material which is not likely to stretch, used in upholstering car seats.

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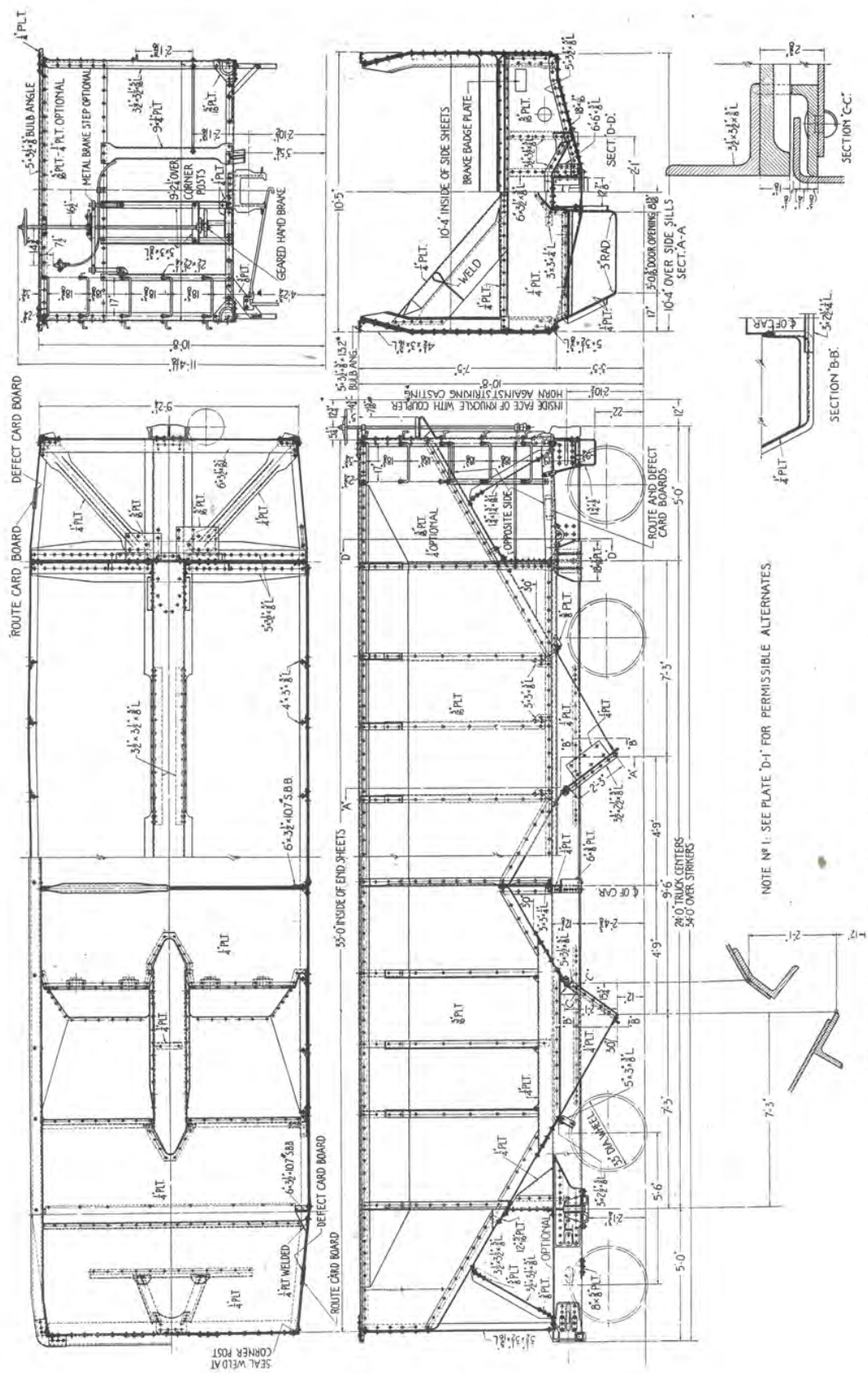


Fig. 2.601—Plan and elevation of A. A. R. Standard 50-ton hopper car (2 hoppers). Class HM.
(For A. A. R. 70-ton hopper cars see Pages 274 and 279)
(See A. A. R. Supplement to the Manual, Plate 600-C)

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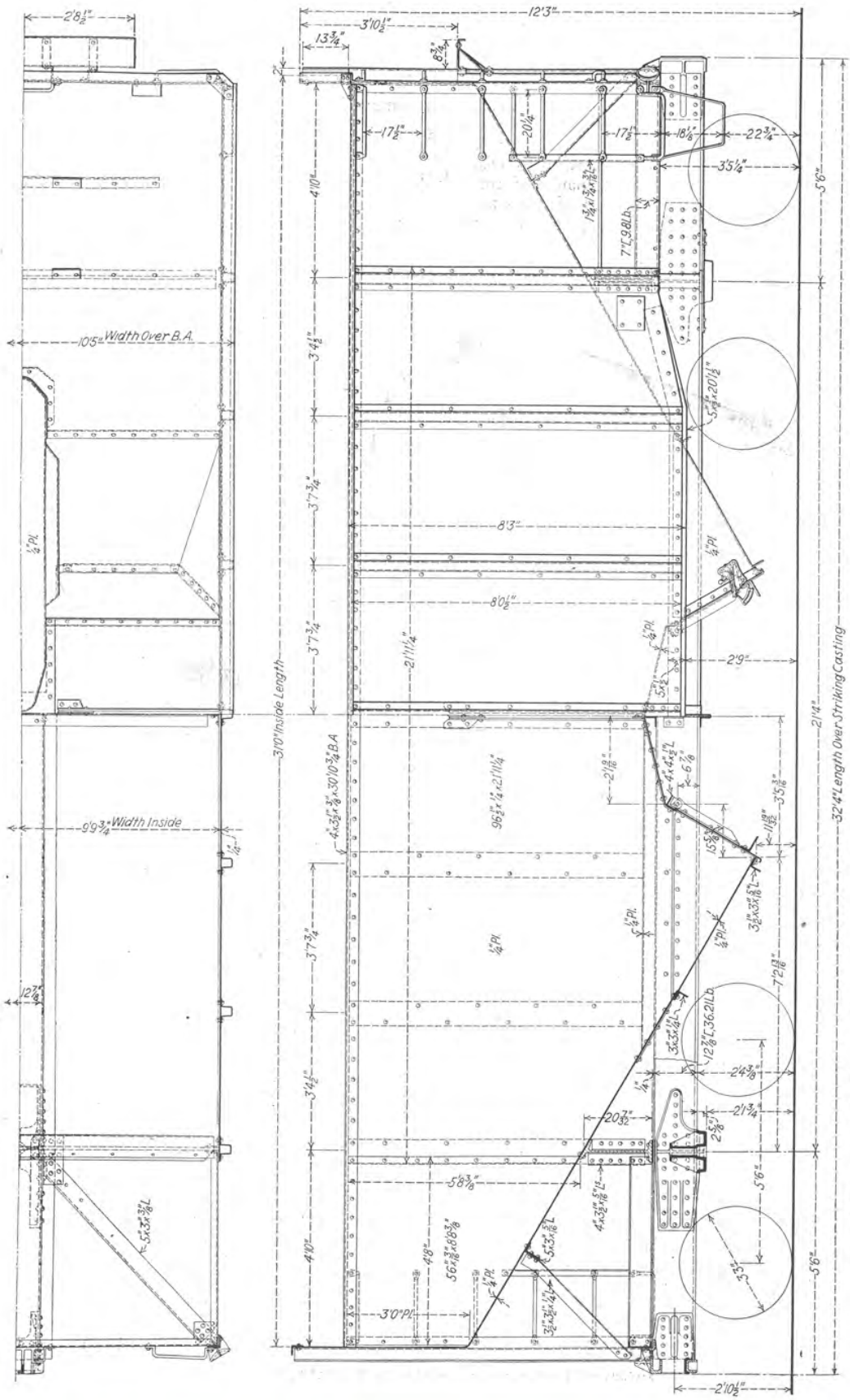


Fig. 2.604—Norfolk & Western 55-ton hopper car (2 hoppers), Road Class, HL, A. A. R. Class HM. Design characterized by the small number of parts.
(Note: Some changes, including ⅜ in. end and slope sheets have been made in last cars built)
(*See also Page* 259)

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Fig. 2.605—Norfolk & Western 55-ton hopper car, Road Class HL, A. A. R. Class HM. Road Numbers 22,000-25,999; 38,000-39,999; 56,500-59,999; 67,000-69,999
(See also Figs. 2.604-2.607)

DIMENSIONS AND WEIGHTS—N. & W. CLASS HL HOPPER CAR

Length over striking plates	32 ft. 4 in.
Coupled length	34 ft. 10 in.
Truck centers	21 ft. 4 in.
Truck wheel base	5 ft. 6 in.
Axle journals	5½ in. x 10 in.
Inside length	31 ft. 0 in.
Inside width	9 ft. 9¾ in.
Cubical capacity, level full	1,998 cu. ft.
Cubical cap., with 30 deg. heap	2,429 cu. ft.
Weight of empty car (average)	41,200 lb.
Load limit (average)	127,800 lb.
Weight of one truck	7,200 lb.
Height from rail to top car side	11 ft. 0 in.

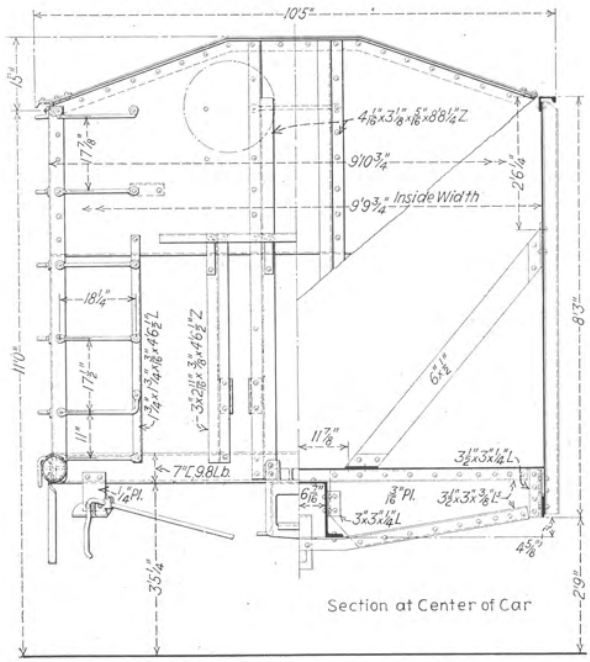


Fig. 2.606—End view and cross section of Norfolk & Western Class HL hopper car shown on Page 258.



Fig. 2.607—Norfolk & Western 55-ton hopper car, Road Class HL.

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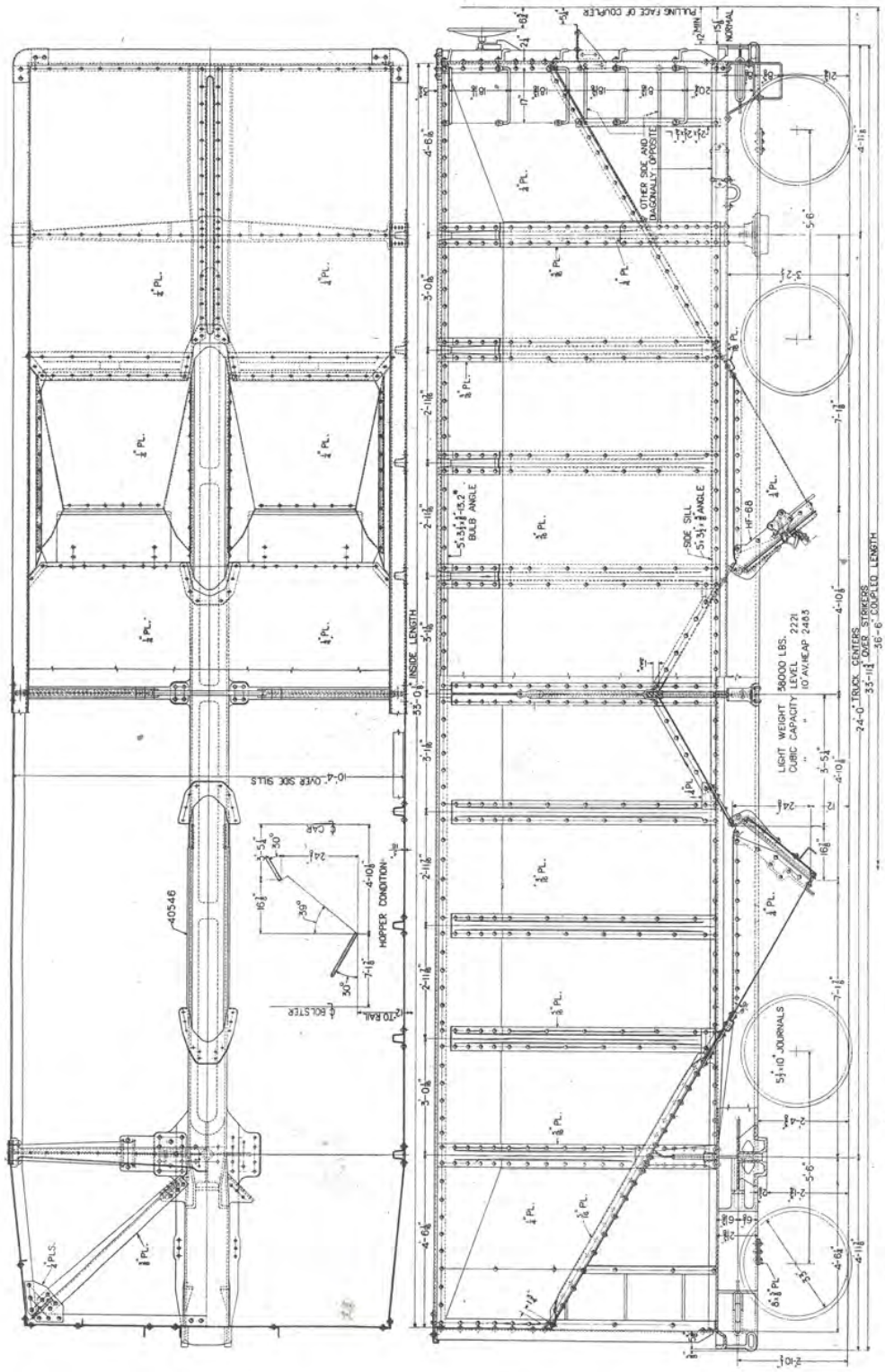


Fig. 2.608—Plan and elevation of Unitcast design, high-capacity, 60-ton twin hopper car with cast steel center sill, body bolsters, crossbearer, crossbearer arms and hopper frames

Unitcast Corporation.

(*See also Pages 261, 262, 263*)

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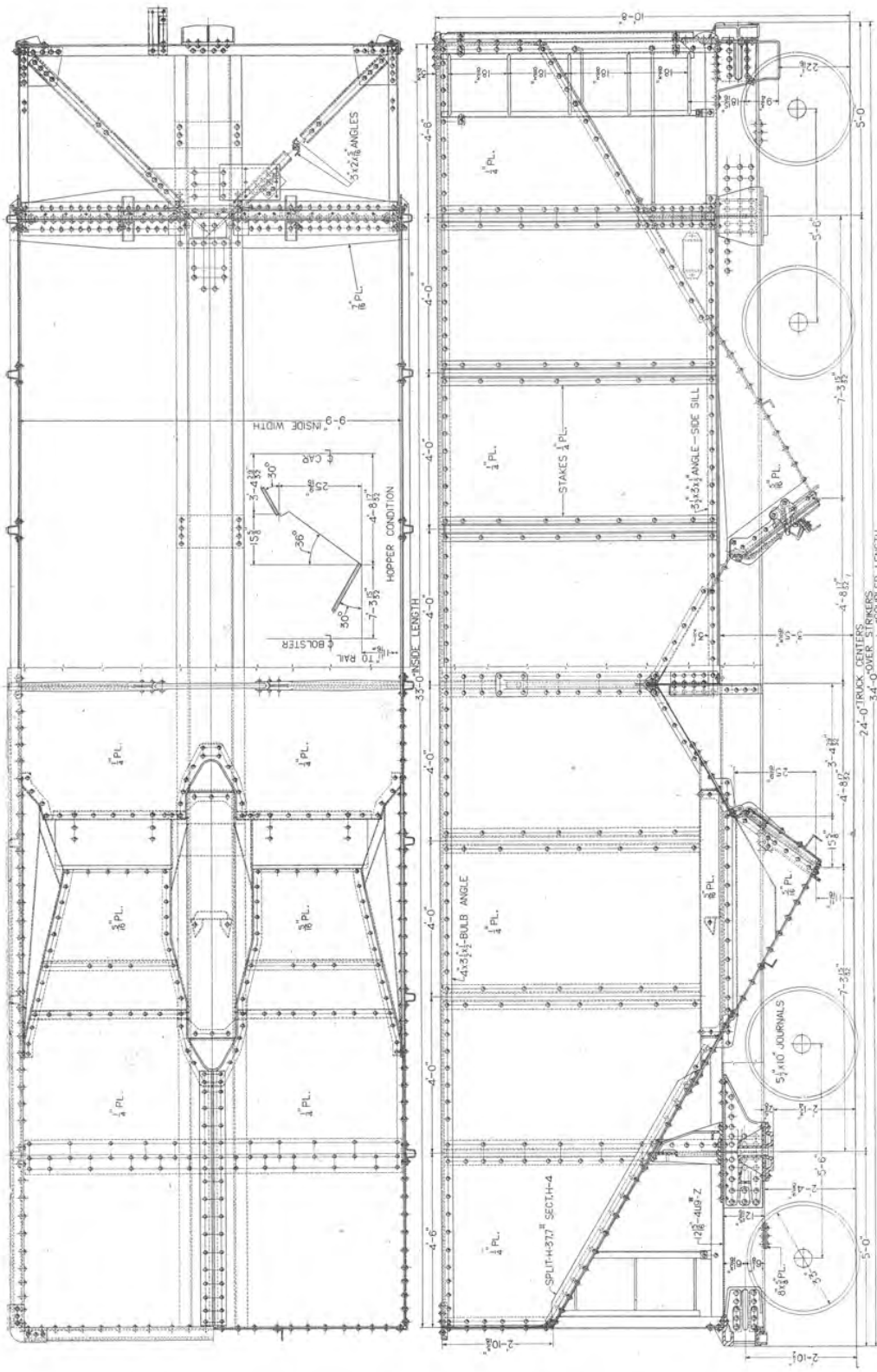


Fig. 2.609—Plan and elevation of Unitcast design, 55-ton twin hopper car with cast steel crossbearer arms, body bolster centers, center sill hood ends and hopper frames.
Unitcast Corporation.
Cubic capacity, level 2,053 cu. ft.; light weight, 42,000 lb.
(See also Pages 260, 261, 263)

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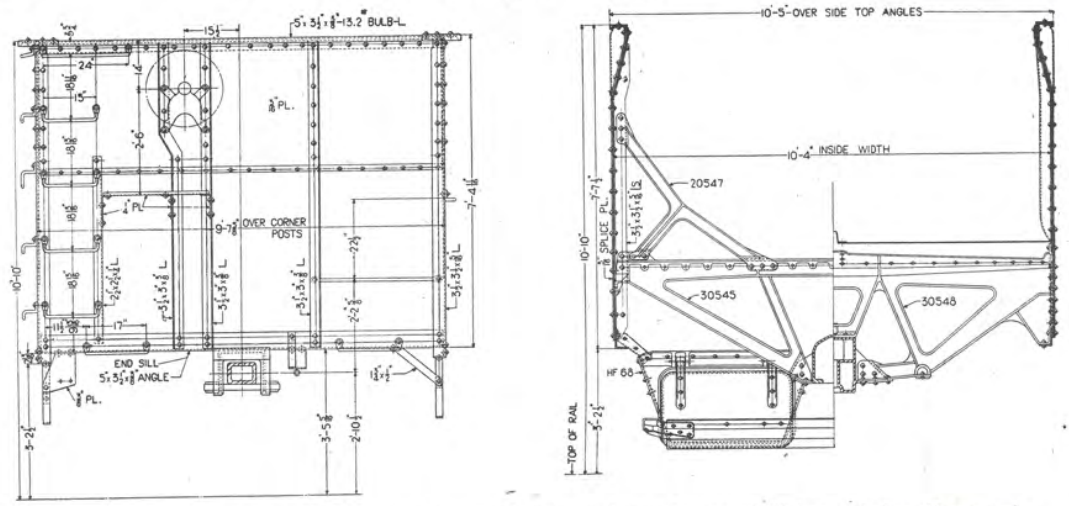


Fig. 2.610—End elevation and half cross-sections at bolster and crossbearer of Unitcast design 60-ton twin hopper car.

(*See also Page* 260)



Fig. 2.611—Side view of 70-ton hopper car using Unitcast design cast steel body bolsters, crossbearers and hopper frames.

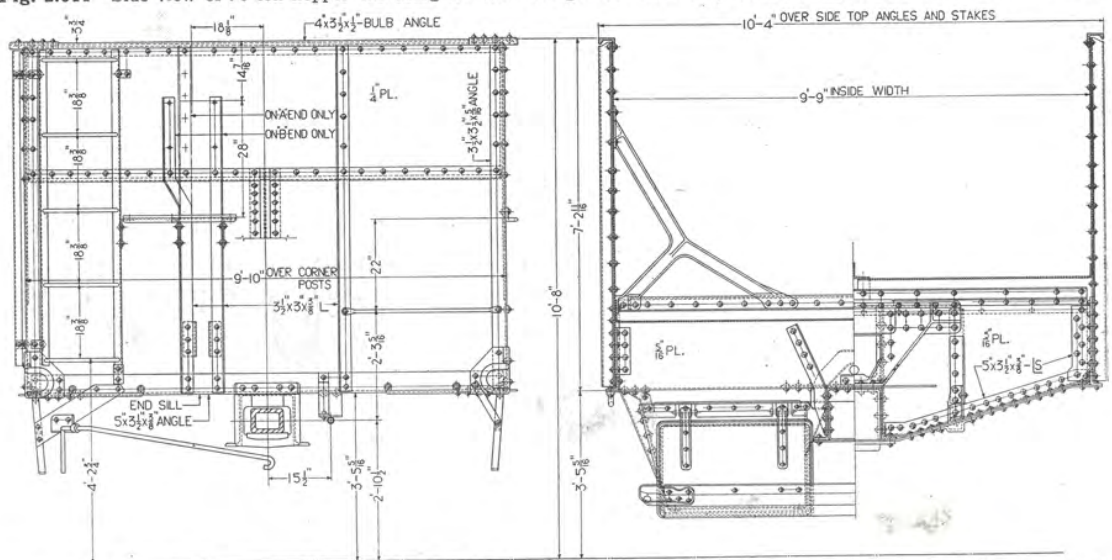


Fig. 2.612—End elevation and half cross-sections of Unitcast design. 55-ton twin hopper car incorporating cast steel crossbearer arms, body bolster center, center sill hood ends and hopper frames.

(*See also Page* 262)

Unitcast Corporation

(*See also Pages* 260, 261, 262)

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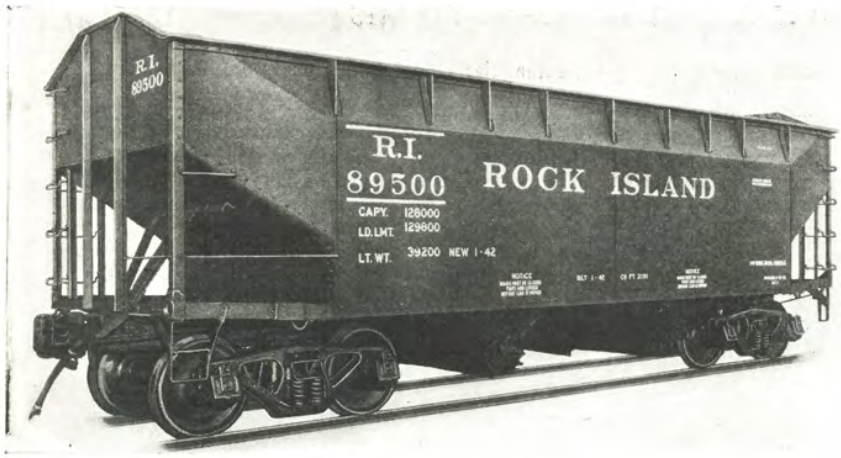


Fig. 2.613—Chicago, Rock Island & Pacific 128,000-lb. capacity twin hopper coal car. Builder, American Car and Foundry Co.

Light weight, 39,200 lb.; load limit, 129,800 lb., capacity, 2,191 cu. ft.; inside, length 33 ft. 0 in.; width 10 ft. 4 in.; height of sides 10 ft. 8 in.

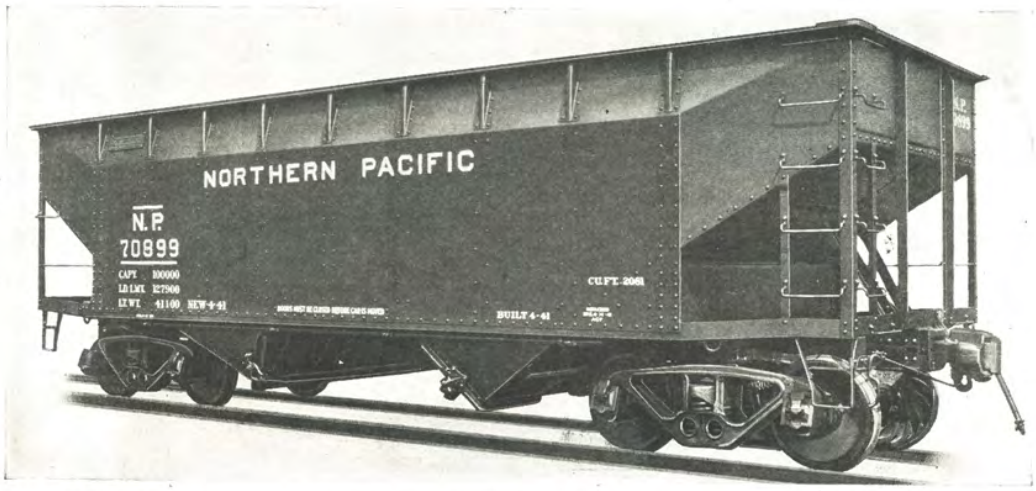


Fig. 2.614—Northern Pacific 50-ton twin hopper coal car. Builder, American Car and Foundry Co.

Light weight, 41,100 lb.; load limit, 127,900 lb.; capacity, 2,081 cu. ft.; inside, length 33 ft. 0 in.; width 10 ft. 4 in.; height of sides 10 ft. 5 in.



Fig. 2.615—C. B. & Q. 55-ton aluminum twin hopper coal car. Rebuilt on old steel frame. Built at Havelock shops.

Light weight, 36,800 lb.; load limit, 132,200 lb.; capacity, 2,075 cu. ft.; inside, length 34 ft. 3 in.; width 9 ft. 6 in.; height of sides 10 ft. 9 in.

Descriptions: *Railway Mechanical Engineer*, Sept. 1944; *Railway Age*, Sept. 9, 1944. (*See also Page* 267).

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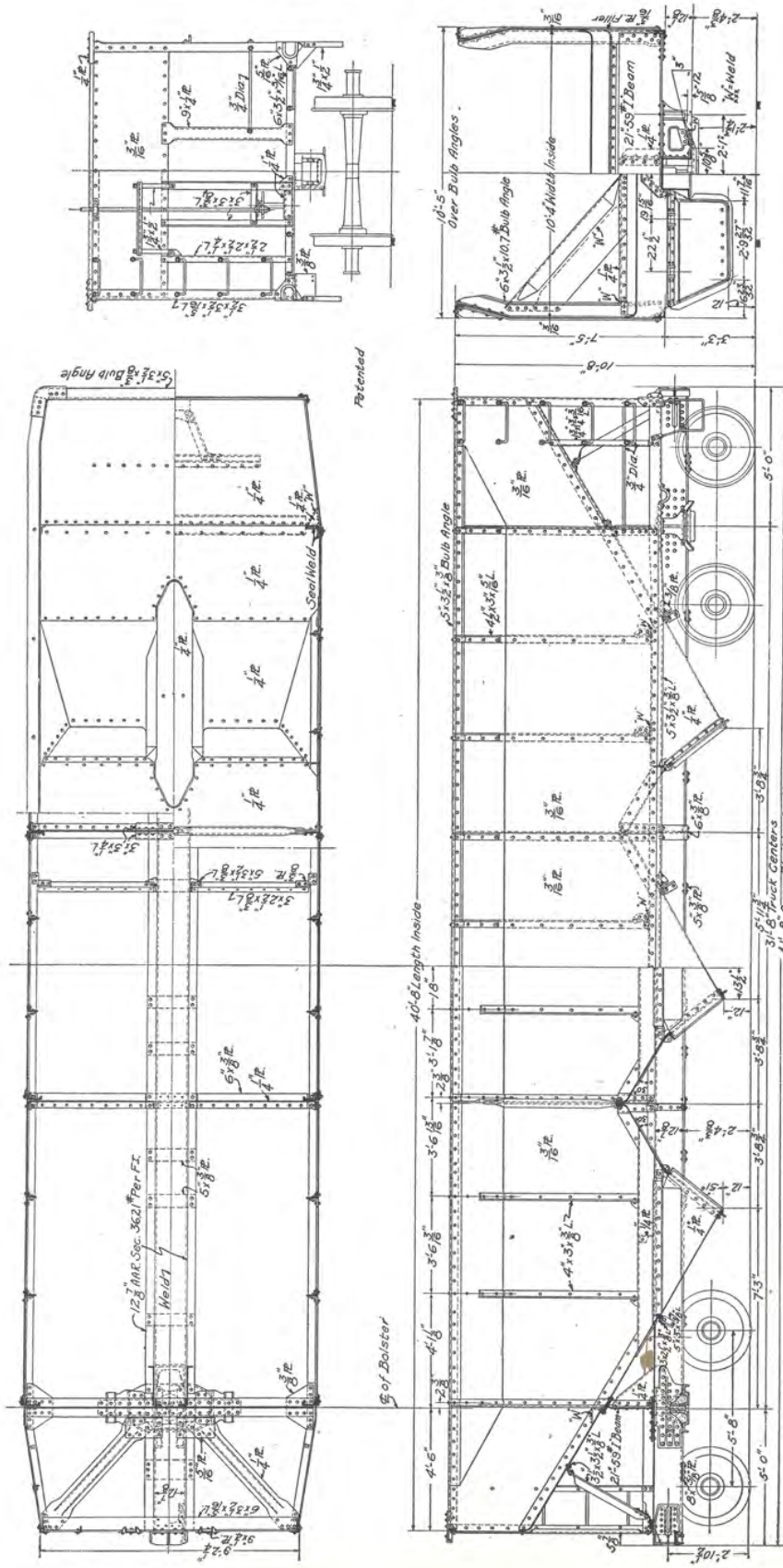


Fig. 2.636—75-Ton all-steel 6 in. by 11 in. axle load Triple Hopper Car with Enterprise hoppers and bolster construction. A. A. R. Class HT. Cubic capacity, 2,758 cu. ft. level or 3,147 cu. ft. with 12 in. average heap.

Enterprise Railway Equipment Company

(See also page 257)

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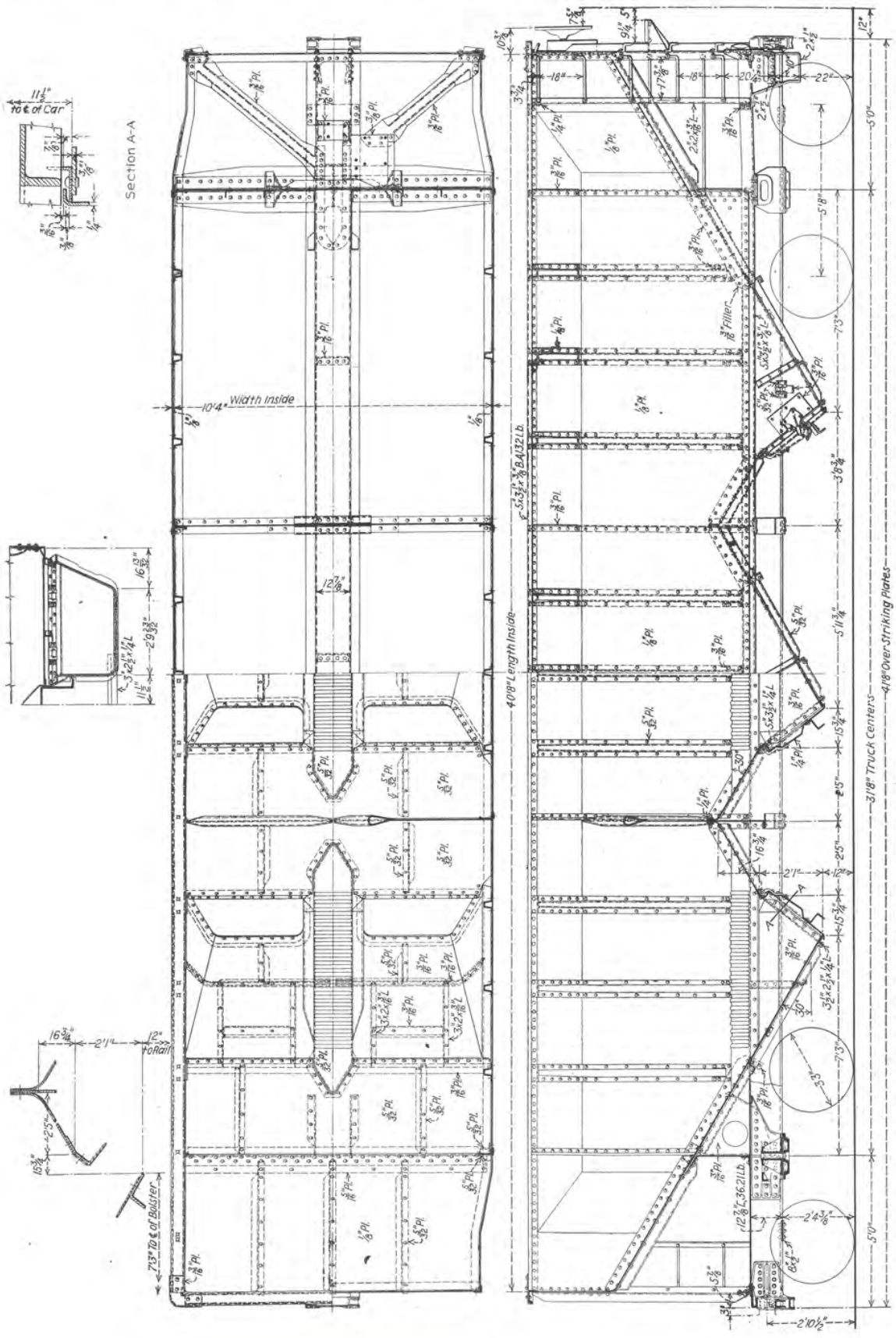


Fig. 2.637—Bessemer & Lake Erie 90-ton triple hopper car, light weight (USS Cor-Ten steel). 6½ in. x 12 in. Journal Axles. Road Class HT17.
(Note—Cars of 70 tons capacity were also built. These differed only in having trucks with 6 in. x 11 in. axles—See Fig. 2.640)
(See also Page 277)

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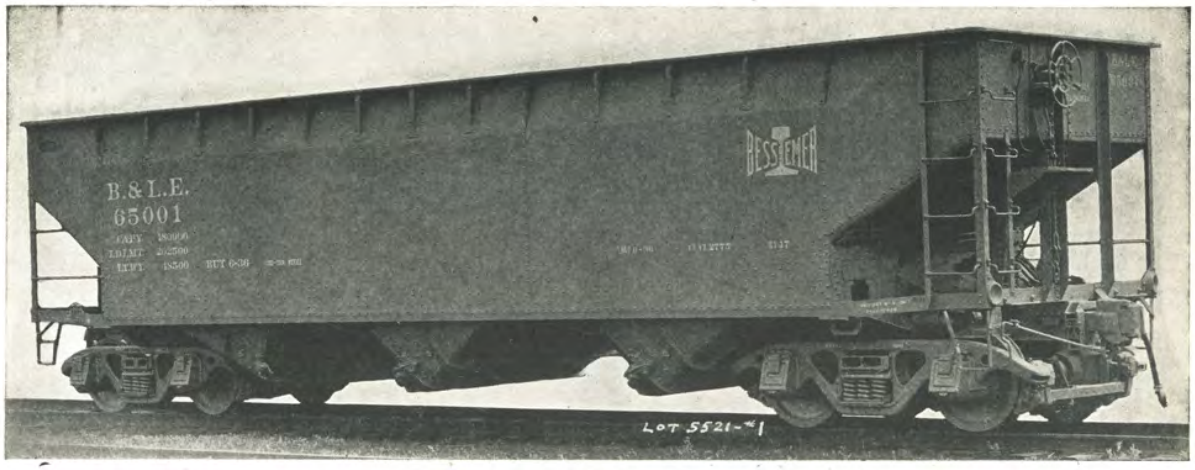


Fig. 2.638—Bessemer & Lake Erie 90-ton light weight hopper car. Built of USS Cor-Ten steel, Road Class HT17.
Light weight, 48,500 lb.; load limit, 202,500 lb.; capacity, 2,775 cu. ft.; axle journals, 6½ in. x 12 in.
Also built in 70-ton capacity with 6 in. x 11 in. journals, Road Class H16. See Fig. 2.642.
NOTE: Earlier 90-ton cars of carbon steel weighed 58,800 lb. with load limit 192,200 lb.
(*See also Page 276*)

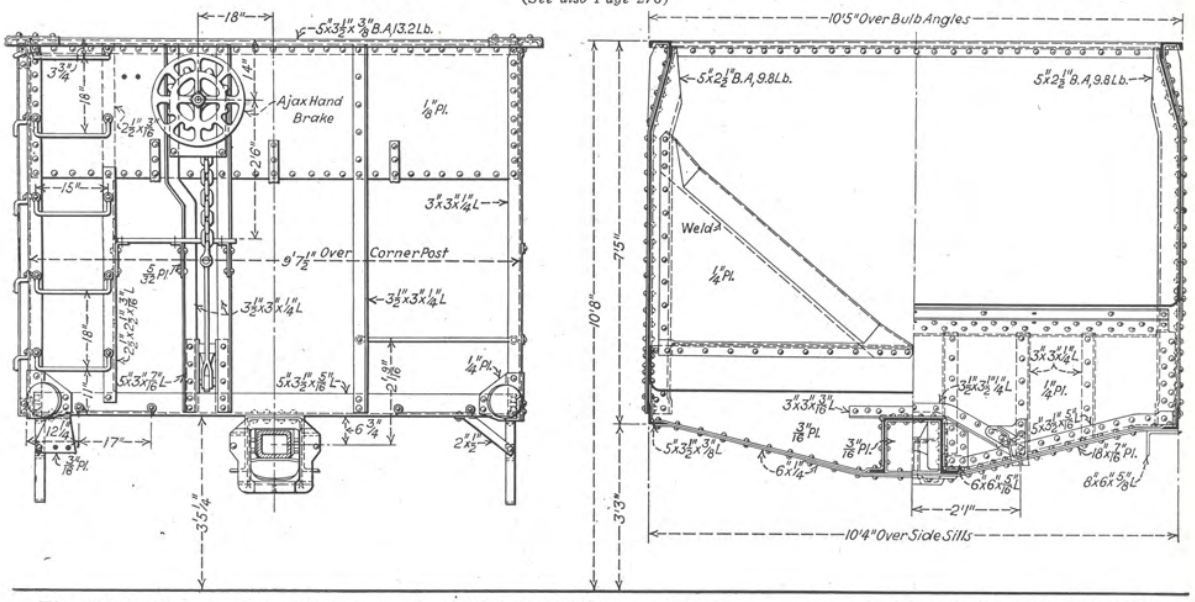


Fig. 2.639—End elevation and cross section of B. & L. E. 70-ton and 90-ton cars shown in Figs. 2.637, 2.638 and 2.640.

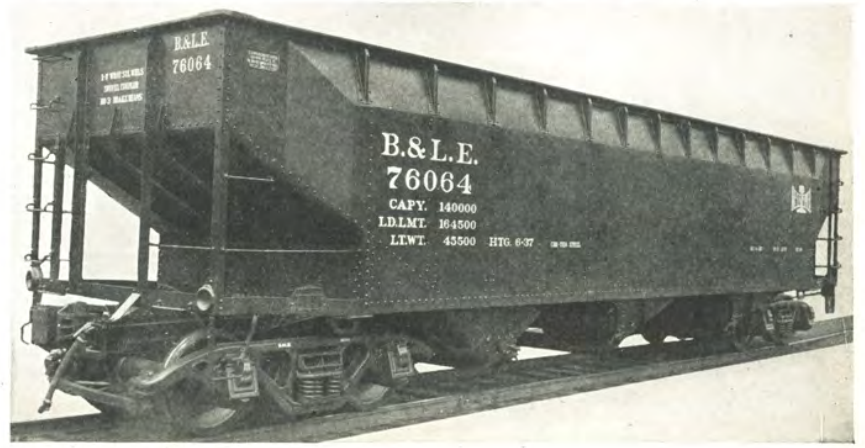


Fig. 2.640 — Bessemer & Lake Erie 70-ton light weight hopper cars of USS Cor-Ten steel. Road Class HT16.

Light weight	45,500 lb.
Load limit	164,500 lb.
Capacity	2,775 cu. ft.

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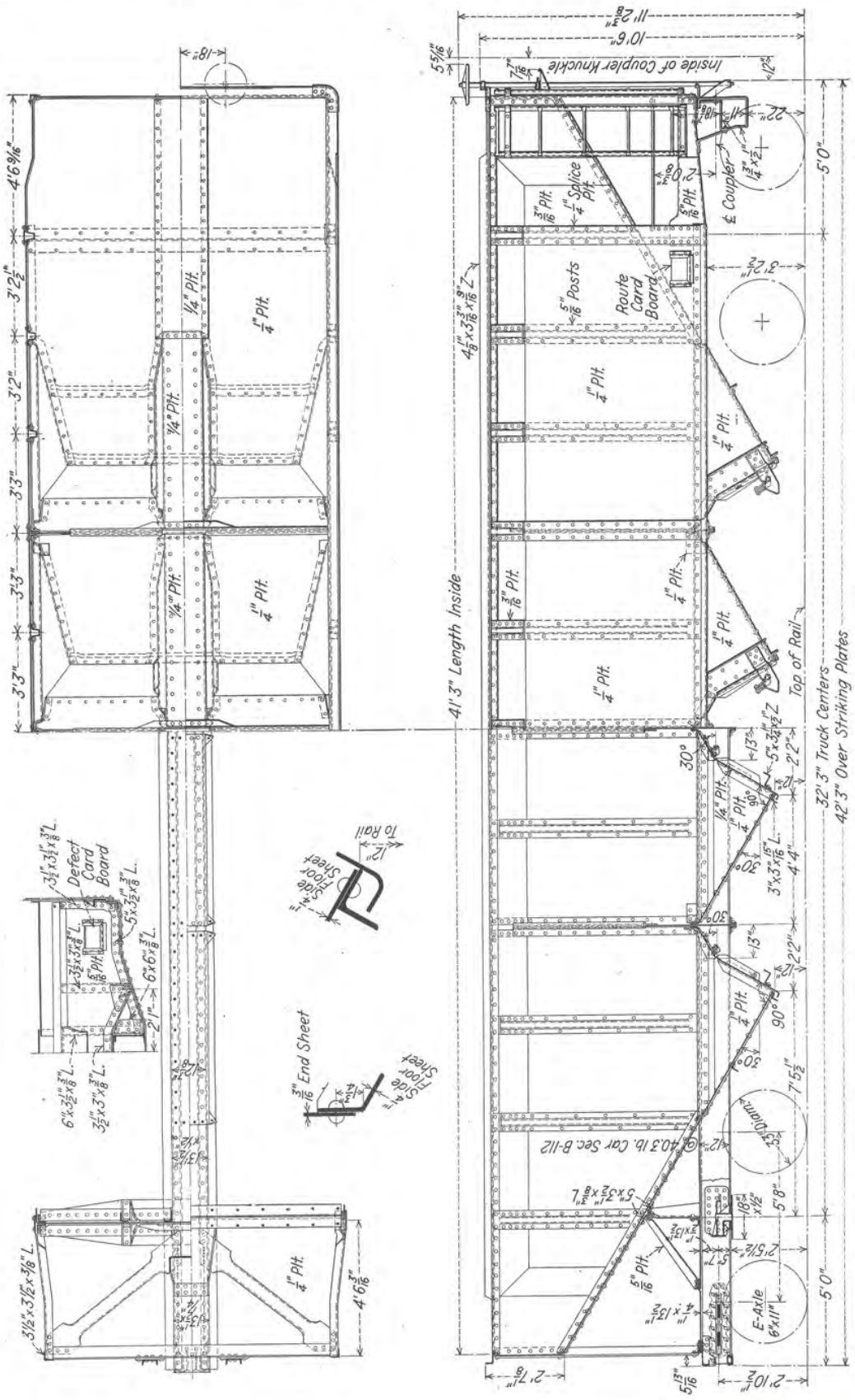


Fig. 2.646—Plan and elevation of Baltimore & Ohio 70-ton capacity quadruple hopper car. Design follows general lines of A. A. R. Recommended Practice Car, Class HT. (See also Page 281)

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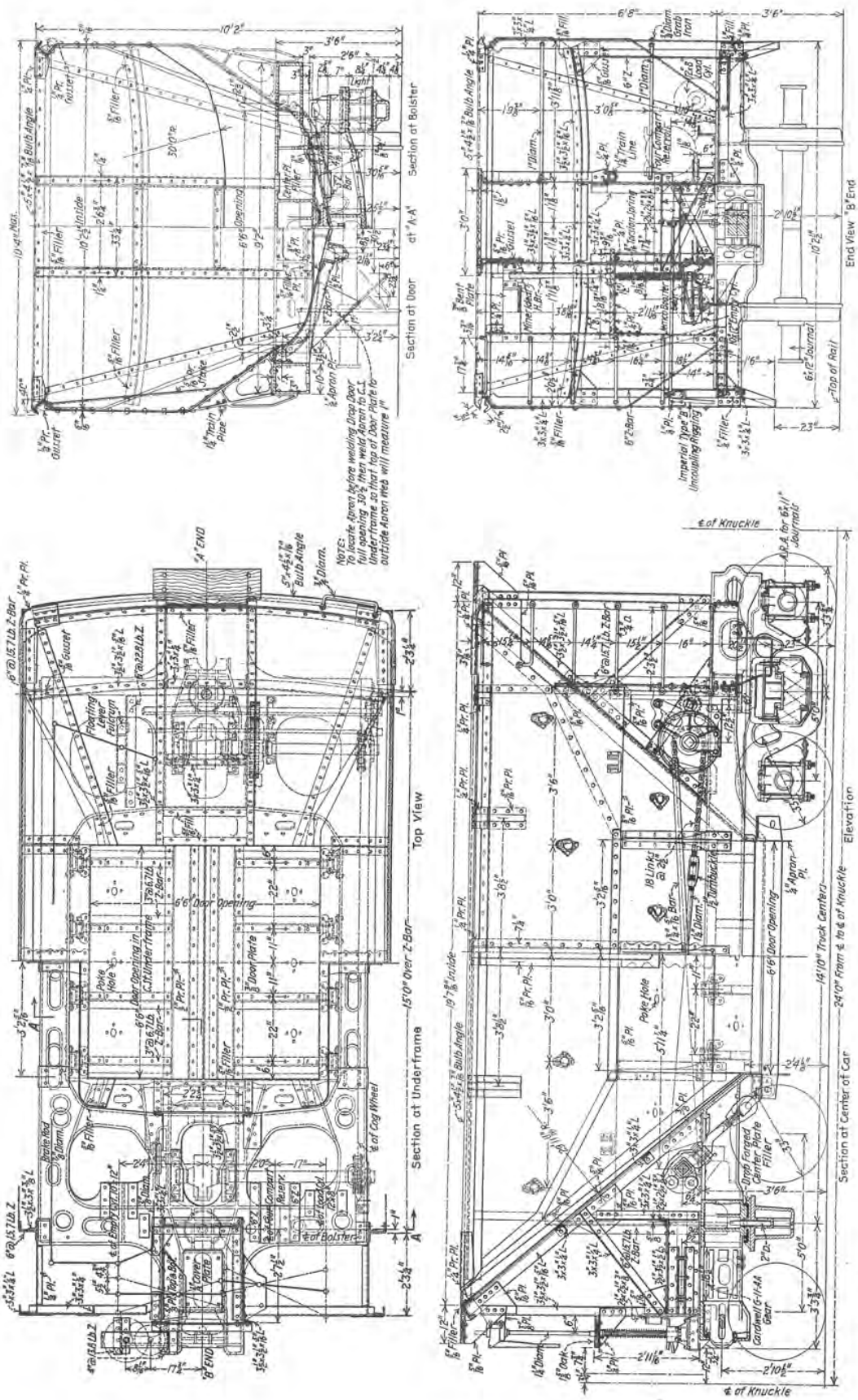


Fig. 2.665—Plan, elevation and sections of Duluth, Missable & Iron Range 80-ton capacity hopper ore car with Commonwealth cast steel underframe. Road Class U-14.
Roads Nos. 22,001-22,125; capacity, 935 cu. ft.; light weight, 47,600 lb.; load limit, 162,400 lb.
Descriptions: *Railway Age*, Feb. 8, 1928. *Railway Mechanical Engineer*, May 1928
(Later cars have been of fabricated type. See Fig. 2.667)
(For ore car door operating mechanism see Sec. 3)

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Fig. 2.666—Great Northern 75-ton capacity hopper iron ore car. Series 90,000-92,999. Builder, Bethlehem Steel Company.

A. A. R. Class	HMA	Length inside	19 ft. 10⅞ in.
Nominal capacity	150,000 lb.	Width inside	10 ft. 5½ in.
Load limit	167,500 lb.	Coupled length	24 ft. 0 in.
Cubic capacity, level	1,262 cu. ft.	Length over strikers	21 ft. 5¾ in.
Light weight	42,500 lb.	Width outside	10 ft. 6 in.
Axle journals	6 in. x 11 in.	Height of sides	10 ft. 2 in.

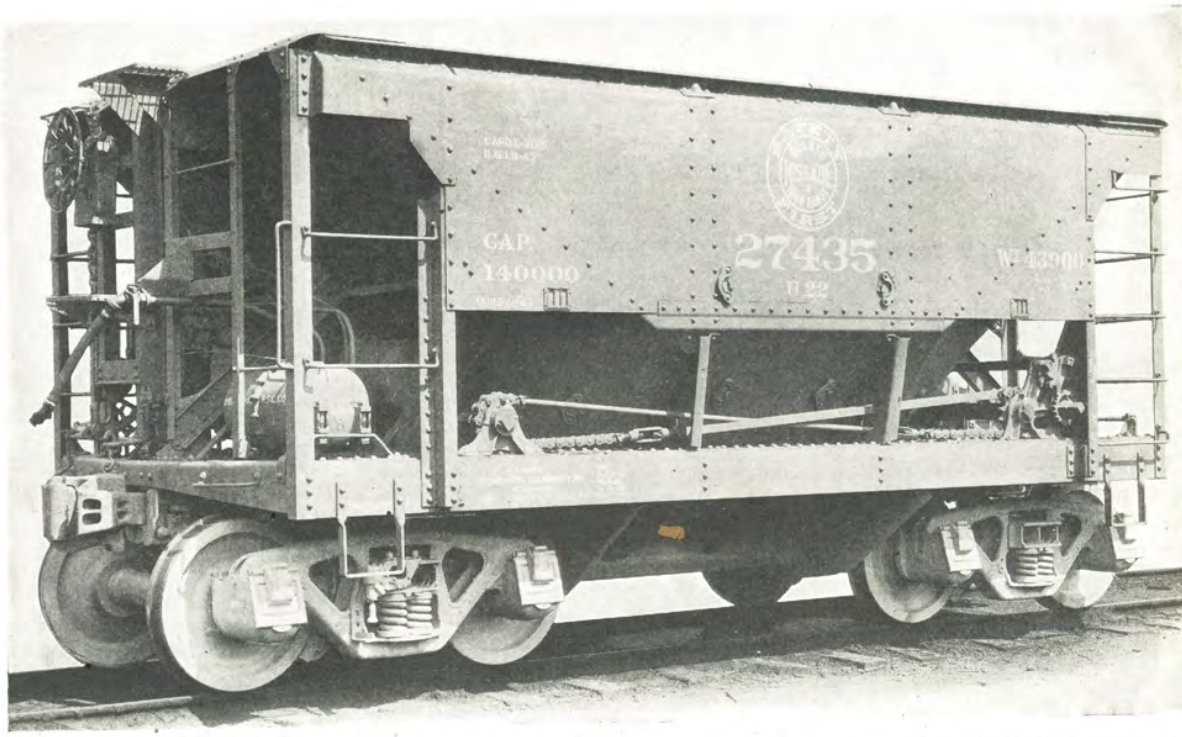


Fig. 2.667—Duluth, Missabe & Iron Range 70-ton capacity hopper iron ore car. Road Class U22. Builder, Pressed Steel Car Company, Inc.

A. A. R. Class	HMA	Axle journals	6 in. x 11 in.
Nominal capacity	140,000 lb.	Length over strikers	21 ft. 6 in.
Load limit	166,100 lb.	Length inside	19 ft. 11 in.
Cubic capacity, level	1,000 cu. ft.	Width inside	10 ft. 5½ in.
Light weight	43,900 *lb.*	Height of sides	10 ft. 2 in.

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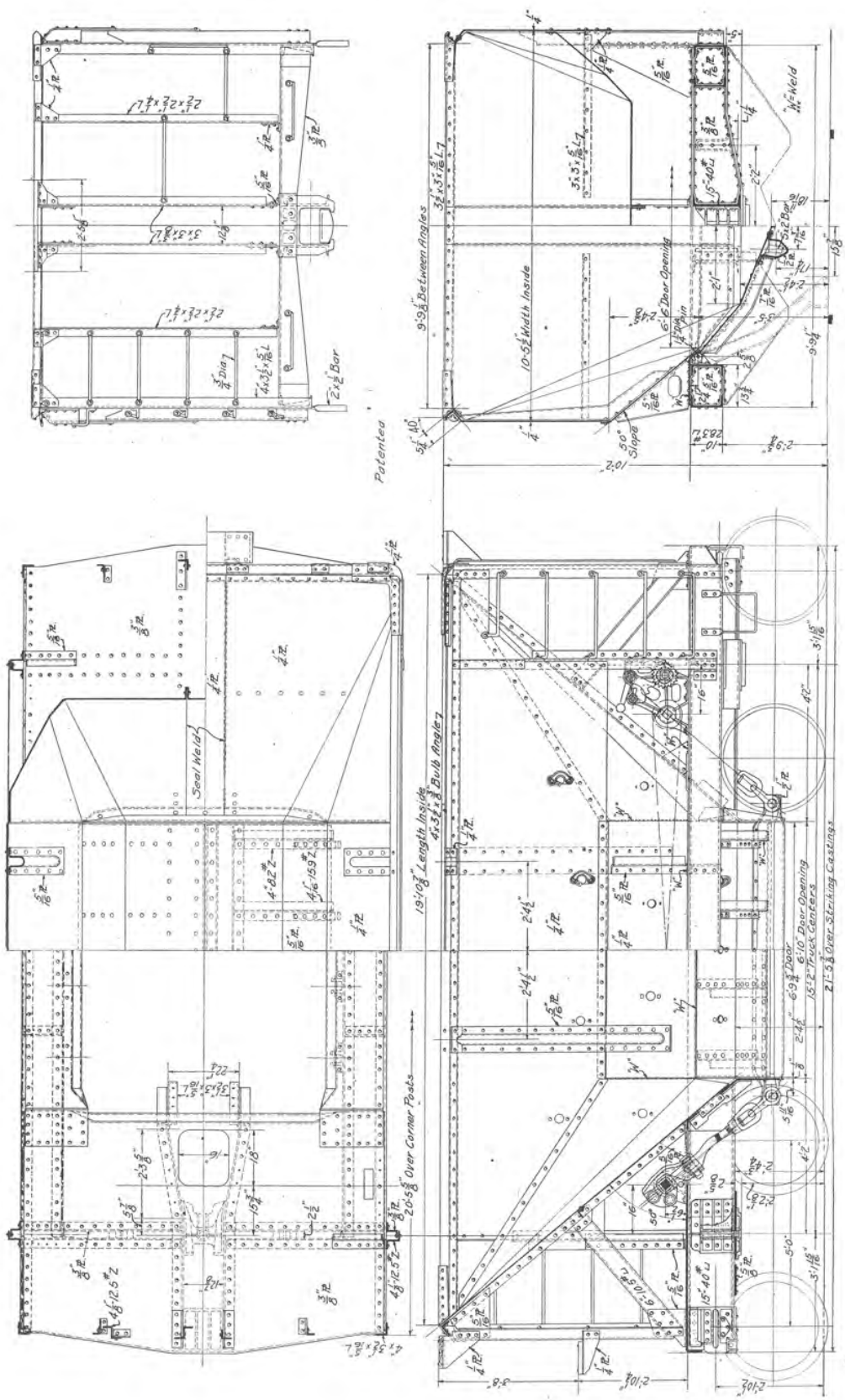


Fig. 2.668—75-Ton all-steel 6 in. by 11 in. axle load Enterprise hopper iron ore car, center discharge. Cubic capacity, 1,040 cu. ft. level or 1,244 cu. ft. with 12-in. average heap.
Enterprise Railway Equipment Company
(See also Page 299)

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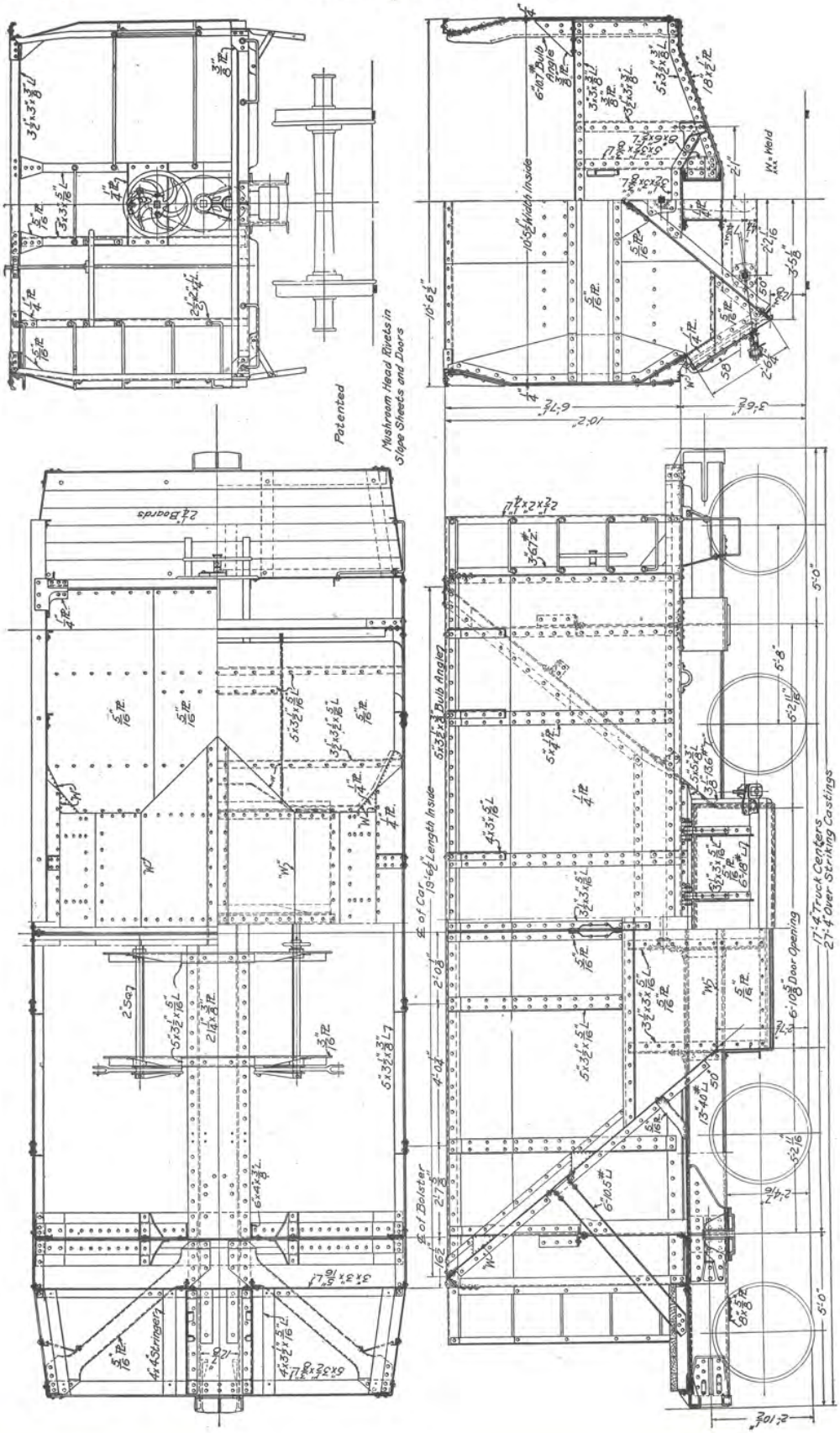


Fig. 2.669—70-Ton all-steel Enterprise hopper ore car, side discharge. Cubic capacity, 981 cu. ft. level or 1,170 cu. ft. with 12 in. average heap.

Enterprise Railway Equipment Company

(See also Page 299)

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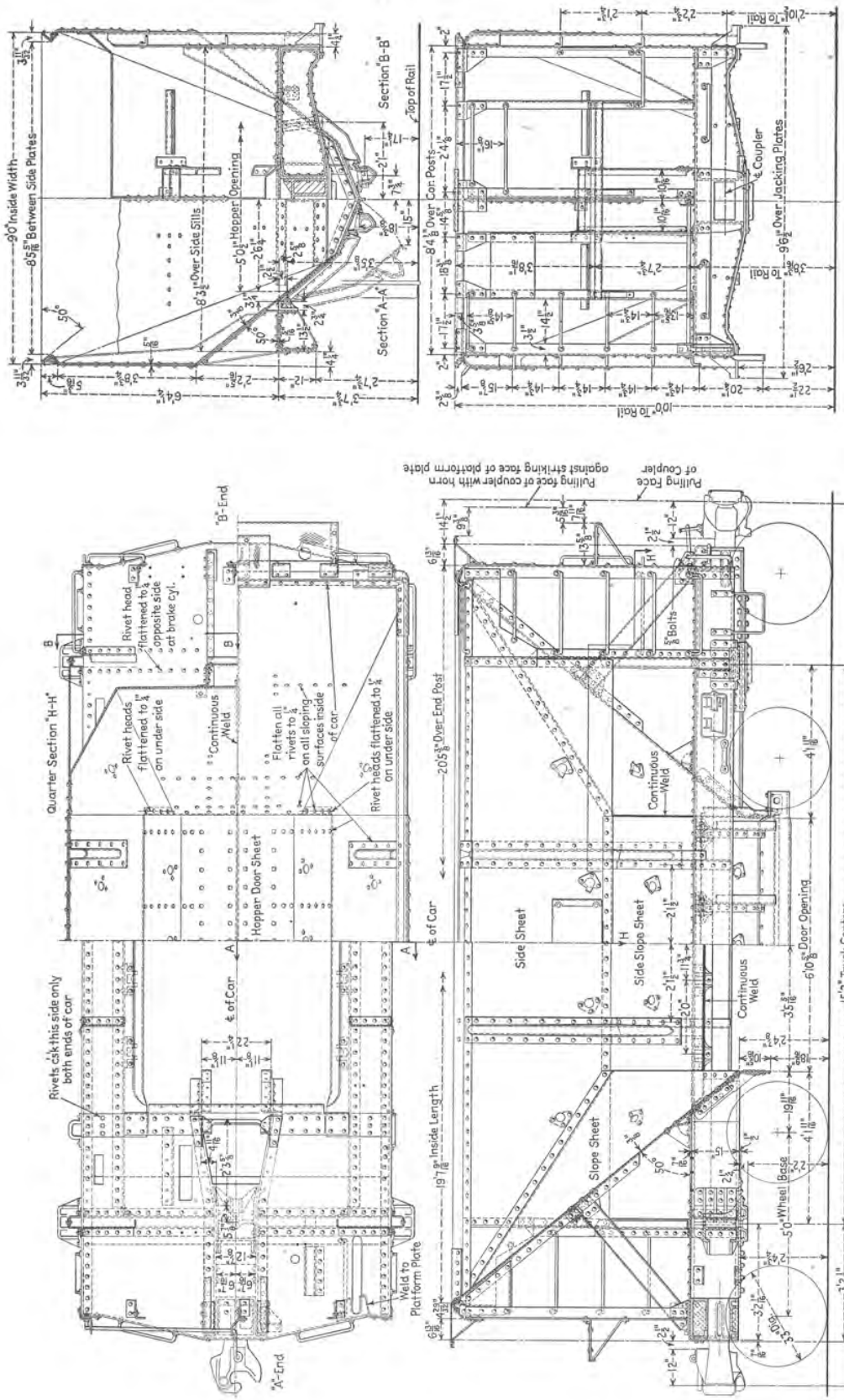


Fig. 2,670—Plan, elevation and sections of Canadian Pacific 50-Ton center discharge ore car.
Builder, National Steel Car Corporation, Ltd.
Series 114,100-114,349
(*See also Fig. 2.673*)

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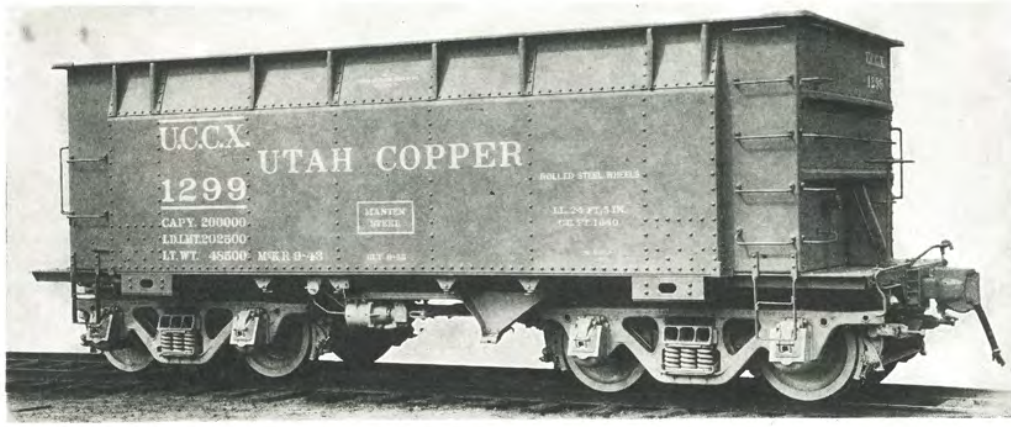


Fig. 2.671—Utah Copper Company 200,000-lb. capacity high-tensile steel, flat bottom, ore car. Unloaded by car dumper. Builder, Pressed Steel Car Company, Inc.

Light weight, 48,500 lb.; load limit, 202,500 lb.; capacity, 1,640 cu. ft.; inside, length 24 ft. 5 in.; width 10 ft. 6 in.; height 6 ft. 6⅝ in.
Description of earlier lot: Railway Age, October 30, 1937



Fig. 2.672—Union Pacific (O.-W. R. & N.) 70-ton ore car, AAR Class HMA. Builder, St. Louis Car Company.

Light weight, 62,300 lb.; load limit, 147,700 lb.; capacity, 1,360 cu. ft.; inside, length 28 ft. 0 in.; inside, width 9 ft. 6 in.



Fig. 2.673—Canadian National 50-ton center discharge ore car for use at Steep Rock mining operations. Built by National Steel Car Corporation, Ltd.

Light weight, 40,600 lb.; load limit, 128,400 lb.; capacity, 825 cu. ft.; length inside, 19 ft. 8 in.

(*See also page* 294)

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Enterprise Bulk Commodity, Ore and Ballast Cars



Fig. 2.678—70-ton Bulk Commodity Covered Hopper Car

THE Bulk Commodity Covered Hopper Car has become a standard service car for many commodities formerly hauled in sack, barrel or loosely in box cars.



Fig. 2.679—Enterprise Bulk Commodity Outlet

The Enterprise Outlet Unit illustrated in Fig. 2.679 is of cast steel, a finished machined product which provides a close, tight seal against leakage, a large opening and convenient means for operating. For general plan of Enterprise 70-ton car see Fig. 2.677, page 298 and application of outlet see Fig. 3.218, page 496.

The Enterprise has also developed a new seal tight Hatch with Door Lock for use in loading this type of car, which is illustrated and shown applied in Fig. 2.677, page 298, details, Figs. 3.221 and 3.222, page 497.

Enterprise Multi-Service Ballast Cars

The Enterprise Multi-Service Ballast Car illustrated in Fig. 2.680 is of 55 tons capacity and of Standard A.A.R. dimensions, 34 ft. 0 in. overall length and 10 ft. 8 in. height.

The car is designed to release ballast from a moving train to the sides or center of the track, free of the rails and in quantities as desired by the operator.



Fig. 2.680—55-ton Multi-Service Car

The floors of the car are steep; corner pockets are eliminated and the passageways between the floors and outlet hoppers are wide, providing for a free unrestricted flow of the ballast which is essential to prompt and clean unloading of the car. For general design, see page 288.



Fig. 2.681—70-ton Multi-Service Car



Fig. 2.682—75-ton Center Discharge Ore Car

Enterprise Ore Car—Door Mechanism

The 75-ton Hopper Ore Car shown in ig. 2.682 illustrates the Center Discharge Car commonly used in the Iron Ore Service. Steep floors, rounded corners and a large door opening are essential to quick and free discharge of the load. The door opening is closed by a pair of longitudinally hinged doors which are controlled by the Enterprise Door Mechanism which is operative from either side of the car and securely locks the doors when in closed position. A general plan of Enterprise 75-ton ore car is illustrated in Fig. 2.668, page 292. A side discharge ore or concentrate car is illustrated in Fig. 2.669, page 293.

ENTERPRISE RAILWAY EQUIPMENT COMPANY, 59 E. Van Buren St., CHICAGO 5, ILL.

Products and Branch Offices Are Listed in the Classified Indexes

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Freight Car Construction Details

THE CONSTRUCTION AND OPERATION of freight cars on American railroads has resulted in the adoption of certain fundamentals of design which general practice has shown to be most practicable. This subject has for many years been studied by the Committee on Car Construction of the Mechanical Division of the Association of American Railroads and as a result various "Standards" and "Recommended Practices" have been adopted for guidance in building such equipment.

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Fundamentals of Car Design

A.A.R. Standard—ADOPTED, 1920; REVISED, 1927, 1934 and 1938

(*Manual—Page* C-3)

1.	Height from rail to center of brake shoe face	13 in.
2.	Height from rail to brake beam hanger fulcrum	24⅞ in.
3a.	Height from rail to center plate wearing surface (empty car), old standard	26¾ in.
3b.	Height from rail to center plate wearing surface (empty car). New standard for "Z" section center sills	25¾ in.
4.	Distance from truck center plate wearing surface to top of truck side bearing	⅞ in.
5.	Distance from center to center of side bearings	50 in.
6.*	Average clearance per side bearing, per truck: Minimum ⅛ in. Maximum	¼ in.
7.	Distance between center sills	12⅞ in.
8a.	Area of center sills between rear followers (minimum). Old standard for cars not equipped with roofs	30 sq. in.
	Old standard for cars equipped with roofs	28 sq. in.
8b.	Area of center sills between rear followers, all cars (minimum). New standard for "Z" section center sills	21.3 sq. in.
9.	Distance from center of truck to end sill striking face for cars with 4-wheel trucks:	
	Hopper cars with horizontal yoke attachment	5 ft. 0½ in.
	Hopper cars with vertical yoke	5 ft. 0 in.
	Other cars with horizontal yoke attachment	5 ft. 6½ in.
	Other cars with vertical yoke	5 ft. 6 in.
10.	Coupler horn clearance (minimum)	3 in.
11.	Coupler shank side clearance, total	3½ in.
12.	Draft gear follower thickness	2¼ in.
13.	Ratio of unit stress to end load (maximum) for center sills	.05
14.	Ratio of unit stress to end load (maximum) for draft attachments	.125
	For draft attachments the area of steel in square inches equivalent to the minimum required strength value is:	
15.	Tension or compression (square inches) grade "A" steel	12
	Grade "B" steel	10½
16.	For shear (square inches), grade "A" or "B" steel	15
17.	For bearing (square inches), grade "A" steel	7½
	Grade "B" steel	6⁹⁄₁₆
18.	Length of standard draft gear pocket in the car sills (plus 0 in., minus 1/16 in.)	24⅝ in.

* See Manual C-3, for procedure in making adjustments.

Inside dimensions of A. A. R. box cars, 1932 design, were: Length 40 ft. 6 in.; width 8 ft. 9 in.; height 9 ft. 4 in.

For 1937 design, length 40 ft. 6 in.; width 9 ft. 2 in.; height 10 ft. 0 in. In 1941 an alternate height of 10 ft. 6 in. was adopted.

For large capacity box and auto-box cars, 1941 design, length 50 ft. 6 in.; width 9 ft. 2 in.; height 10 ft. 6 in.

NOTE.—Standards for some of these fundamentals had already been adopted by the former M. C. B. Association, namely:

Area of center sills, adopted in 1914 as Recommended Practice.

Side bearing clearance, adopted in 1914, as Recommended Practice, advanced to Standard in 1917.

Distance between center sills adopted in 1905 as Recommended Practice, advanced to Standard in 1907.

Coupler horn clearance, adopted in 1905 as Recommended Practice, advanced to Standard in 1907.

Coupler shank side clearance, adopted in 1899 as Standard, modified in 1896, 1899, 1905, 1907 and 1909.

Draft Gear Followers, adopted as Recommended Practice in 1905. Advanced to Standard in 1907.

Height of floors, refrigerator cars, adopted as Recommended Practice in 1911.

Inside dimensions of box cars, adopted as Recommended Practice in 1904.

Height and width of cars, adopted as Recommended Practice in 1904.

Side Bearings, spread of, adopted as Recommended Practice in 1915.

Truck center height of 25¾ in. has been used generally since 1932.

Classifications—Axles, Trucks, Cars

(*Manual—Page* C-4)

In connection with the above fundamentals a standard method of designating cars, axles, journal boxes and contained parts was adopted as standard.

Axle having 3¾x7 in. journal to be designated as A axle.

Axle having 4¼x8 in. journal to be designated as B axle.

Axle having 5x9 in. journal to be designated as C axle.

Axle having 5½x10 in. journal to be designated as D axle.

Axle having 6x11 in. journal to be designated as E axle.

Axle having 6½x12 in. journal to be designated as F axle.

Classification 2A, 2B, 2C, etc., adopted for two axle trucks, the letter designating the axle used and the figure designating the number of axles in the truck. Classification 3A, 3B, 3C, etc., adopted for three axle trucks, to be used in the same manner.

Classification 4A, 4B, 4C, etc., and 6A, 6B, 6C, etc., adopted for cars, the letters designating the axles used, and the figures designating the numbers of axles under the car.

Load Limits

(*Interchange Rule 86, Axles*)

The following load limits or total weight on rail have been adopted for cars with four-wheel trucks:

A axle	3¾ in. x 7 in.	journal	load limit	66,000 lb.
B axle	4¼ in. x 8 in.	journal	load limit	103,000 lb.
C axle	5 in. x 9 in.	journal	load limit	136,000 lb.
D axle	5½ in. x 10 in.	journal	load limit	169,000 lb.
E axle	6 in. x 11 in.	journal	load limit	210,000 lb.
F axle	6½ in. x 12 in.	journal	load limit	251,000 lb.

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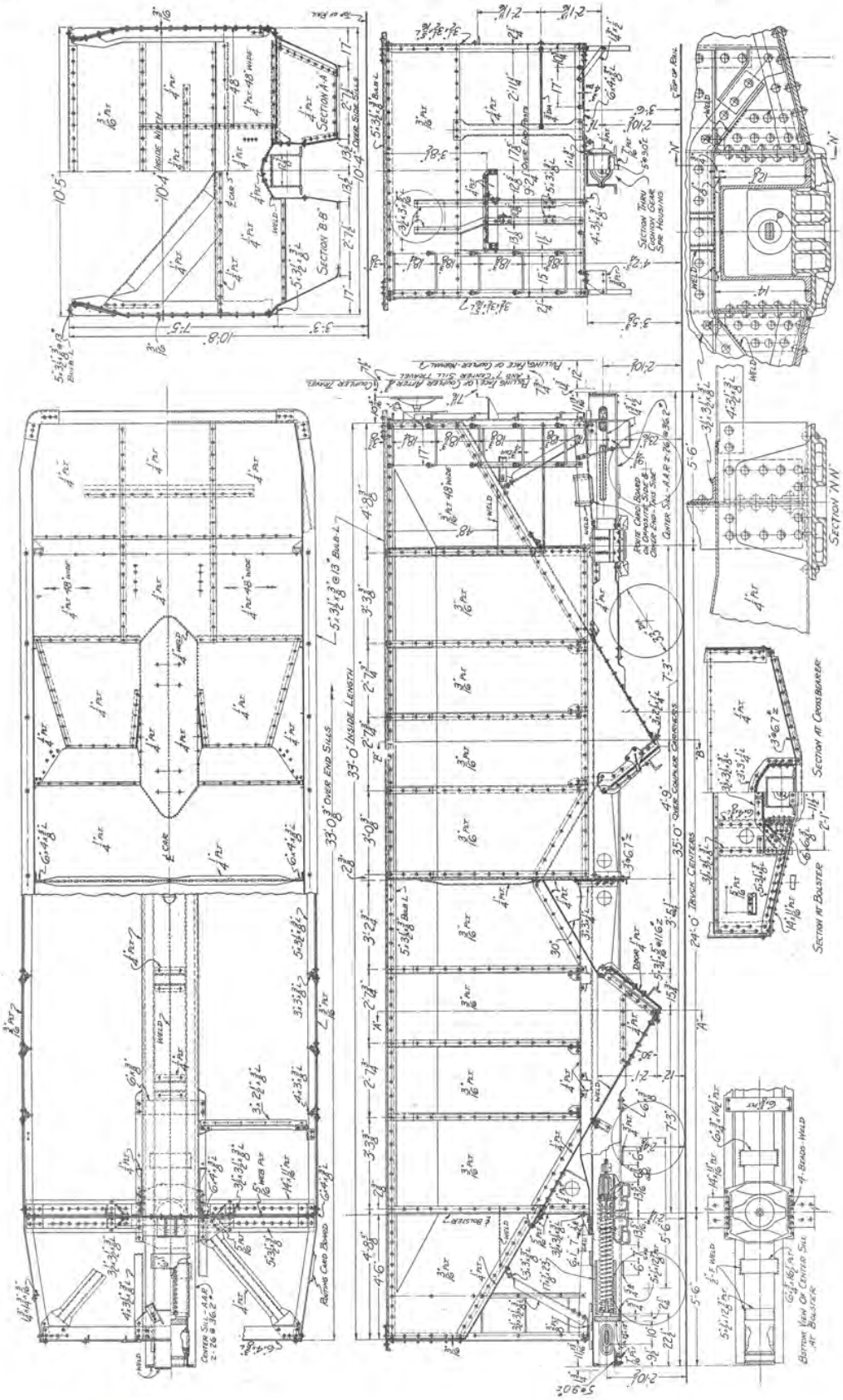


Fig. 3.29—Duryea Underframe with Long-Travel, Cushion Gear as applied to a 50-ton hopper car.
O. C. Duryea Corporation
(For description see Section 10)

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Draft Gears

DRAFT GEAR IS THE TERM used to designate the apparatus which connects the coupler or drawbar with the sills; it receives and dissipates the shocks received by the coupler, thus tending to prevent damage to equipment. Various forms of spring and friction gears have been employed.

Some older types consisted simply of heavy springs arranged in pairs—either twin springs—side by side; or tandem springs—one behind the other—and placed between follower plate contained within a coupler yoke. A special design of friction draft spring which is of such design as to increase its capacity by friction between the coils has also been used.

The form of gear now in general use is known as the Friction Draft Gear—a gear which makes use of friction for absorbing and dissipating the energy of buffing and tension shocks transmitted through the couplers. It is made in many different designs utilizing a combination of steel plates, cast blocks and springs.

The development of draft gears for railway equipment has kept pace with the constant increase in size and weight of rolling stock and the great increase in length of trains. The draft capacity required for heavy modern traffic has necessitated larger and stronger gear, and these conditions have been met successfully.

Tests and Specifications

In 1918 an extensive test of draft gears was made under the supervision of the United States Railroad Administration, and much valuable data were obtained.

Draft gear tests of an extensive character were begun in 1927 by the Mechanical Division of the American Railway Association, and in this connection a new draft gear drop test machine with falling weights of 27,000 lb. and 9,000 lb. was installed at Purdue University. A description of the machine is given in the 1927 Proceedings. A very complete report of the results of these tests, together with tentative specifications for freight car draft gears, is contained in the 1929 Proceedings. Standards since adopted include—general specifications; certificate of approval; purchase specifications.

Specifications covering "Approved Draft Gears for Freight Service" are covered by Specification M-901 in Section A of the Manual. These specifications, which were adopted in 1931, were revised in 1933, 1934 and 1936. Appendix A of this specification contains instructions regarding "certificate of approval for draft gears." The maximum permitted dimensions outside are 9 1/32 in. by 12¾ in.. with a length of 24⅝ in. for gear and follower when released. Travel to be not less than 2½ in. or more than 2¾ in. Solid height of gear and followers not less than 21⅞ in.

The Purchase Specifications for Approved Draft Gears for Freight Service is covered by Specifications M-901 and M-902.

Draft Gears have been classified under three different groups or sections as shown in Interchange Rule 101, as follows:

Section I—A.A.R. Approved Friction Draft Gears
Section II—Non-Approved Friction Draft Gears
Section III—Obsolete Types of Friction Draft Gears

According to Interchange Rule 3, cars built after January 1, 1934, and draft gears, new, applied to any car after January 1, 1935, must be of a type for which a "certificate of approval" has been issued.

Rules covering "Inspection and Maintenance of Draft Gears by Car Owners" will be found in the Manual, page L14-1.

General Requirements

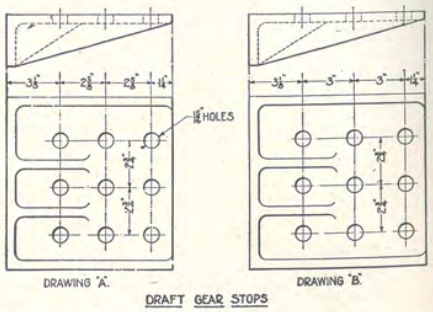
Under "Fundamentals of Car Design," Manual, page C-3, are the following requirements:

Distance between center sills, 12⅞ in.
Area of center sills between rear followers—(minimum)
For cars not equipped with roofs, 30 sq. in.
For cars equipped with roofs, 28 sq. in.
Draft gear travel—on car, 2¾ in.
Coupler horn clearance, 3 in.
Minimum draft gear capacity, 150,000 lb.
Coupler shank side clearance, total, 3 in.
Draft gear followers—thickness, 2¼ in.
Ratio of unit stress to end load—maximum—for draft attachments, .125.
For draft attachments the area of steel in square inches equivalent to the minimum required value is:
Tension or compression—sq. in.—grade "A" steel, 12.
For shear—sq. in., 15.
For bearing—sq. in., 7½.

Draft Gear Followers

A.A.R. Recommended Practice
(Manual, Page C-61)

Separate followers to be used with friction draft gears shall be made from open hearth steel of 0.40-



A.A.R. Standard Dimensions for Front and Back Draft Stops.

0.55 per cent carbon. The size of the followers shall be 12½ in. — ± ⅛ in. by 8⅞ in. — ± ⅛ in. by 2¼ in. — ± 1/32 in. Edges of followers shall be formed in such a manner that they will be free from cutting edges. Shearing will not be permitted.

Where the follower is a part of the friction surface of the draft gear, hardened followers should be used.

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Edgewater Ring Spring Draft Gear

THE Edgewater B-32-KA draft gear uses a ring spring to cushion the impact blows of freight car service in order to prevent damage to lading and car structure.

Principle of the Ring Spring

The ring spring consists of a series of solid heat-treated alloy steel rings nested into each other as shown in Figure A. The inner surfaces of the outer rings are tapered and work against the conical surfaces on the outside of the inner ring. When an

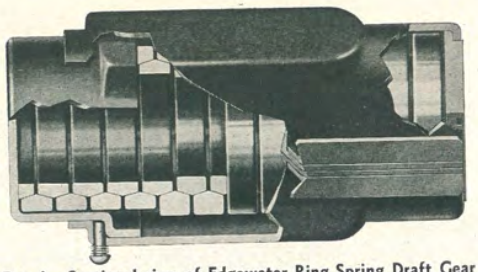


Fig. A—Sectional view of Edgewater Ring Spring Draft Gear

axial load is applied, the rings telescope into each other while the outer rings expand and the inner rings contract, giving a spring action. Friction between the conical surfaces increases the compression force and decreases the recoil force. The ring spring is so designed that it will telescope into a solid tube before the stresses become sufficiently high to cause permanent deformation of the rings. The stress in the outer rings is all tension and in the inners is all compression. This fact permits more efficient utilization of metal than is possible in any other type of spring.

Features of the Ring Spring Draft Gear

The action of the spring is positive and uniform because the contacting surfaces are lubricated for life with a heavy graphite grease. This eliminates sticking and assures the gear's expansion upon removal of the applied load, thus eliminating harmful free slack. By dissipating energy on compression and release, friction reduces impact energy from a destructive agent to the moderate force required to prevent the gear from creeping solid. The ring spring provides the friction to absorb shock and the force to return the gear promptly to full length ready for the next blow.

Figure A shows the spring installed in the rugged pressed steel housing, which protects it from dirt and retains the rings and lubricant in position. The two pins which are inserted between the movable end cup and housing reduce the length of the gear so that it can be readily installed in the pocket in the car. The first service blow compresses the spring sufficiently to eject the pins allowing the gear to become tight in the pocket. This device is necessary to permit easy installation of the gear and still prevent free play which would cause harmful slack.

Inspection of B-32-KA Draft Gears

The heat-treated rolled alloy steel rings are individually inspected and tested for size and hardness in order to insure long service life. Each gear as it comes from the assembly line after the final manufacturing operation passes under a special hydraulic press so arranged that a Force Closure Diagram is taken automatically. A sample test card is shown in Figure B. Testing of each gear before shipment assures compliance not only with the requirements of A.A.R. Specifications, but also with the much more rigid standard of Edgewater inspectors.

B-32-KA Draft Gears are A. A. R. Approved

Edgewater ring spring draft gears have been tested extensively by the Association of American Railroads, Mechanical Division. In 1933 the draft gear was submitted to the specification tests and received the A.A.R. Certificate of Approval for freight car draft gears. The certificate tests prove that the Edgewater gear exceeds the specification requirements by a large margin. They also demonstrate that the gear reaction

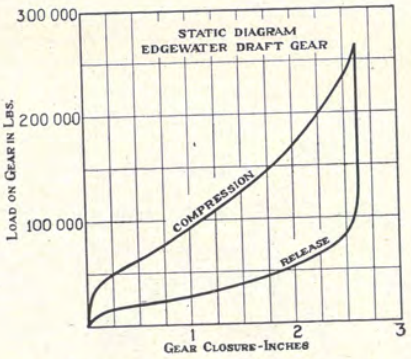


Fig. B—Typical force-closure diagram of Edgewater Ring Spring Draft Gear

(force transmitted to the car body) is exceptionally low for a given amount of energy aborbed. An analysis of the test results has been prepared and will be sent to interested persons on request.

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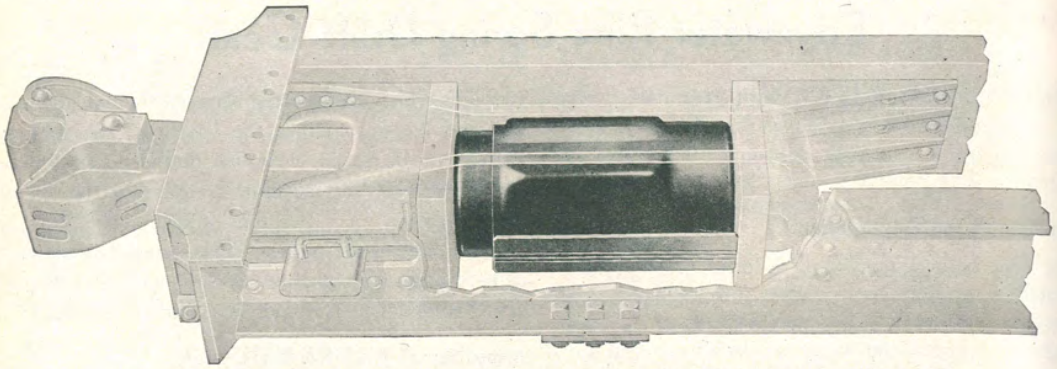
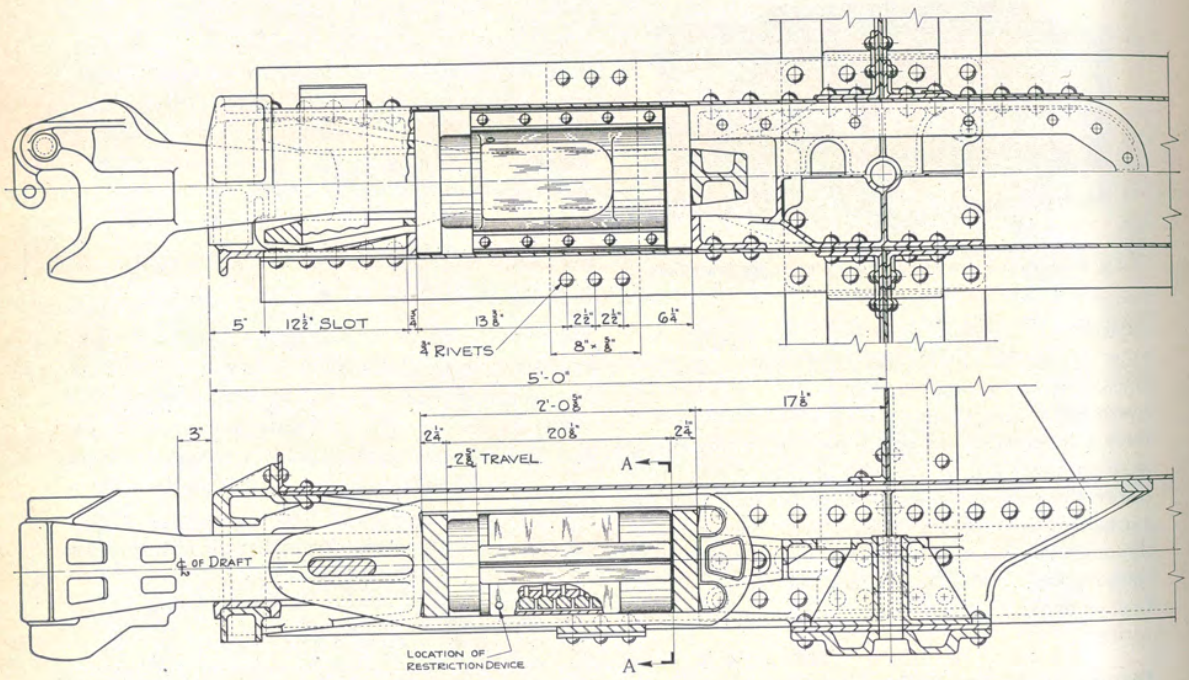
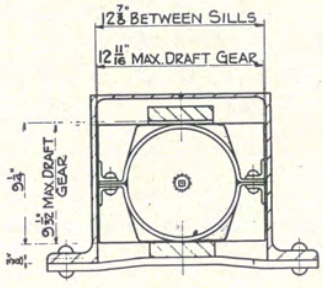


Fig. 10.43—Edgewater Ring Spring Draft Gear as applied with A.A.R. standard vertical yoke.





SECTION A-A

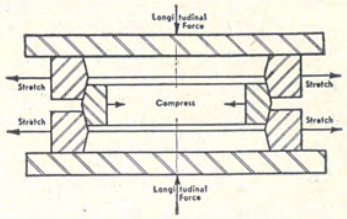


Diagram of Ring Spring Action.

Fig. 10.44—Edgewater B-32-KA Draft gear as applied to A.A.R. cars with standard vertical yoke attachment.

Edgewater Steel Company

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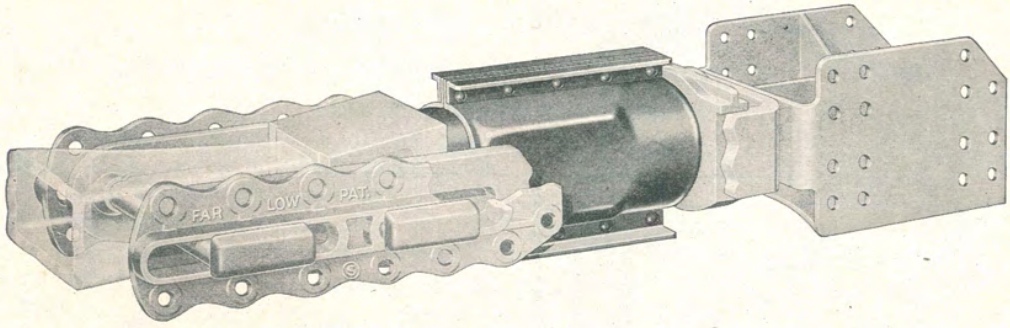


Fig. 10.45—Edgewater Ring Spring Draft Gear as applied with Farlow attachments.

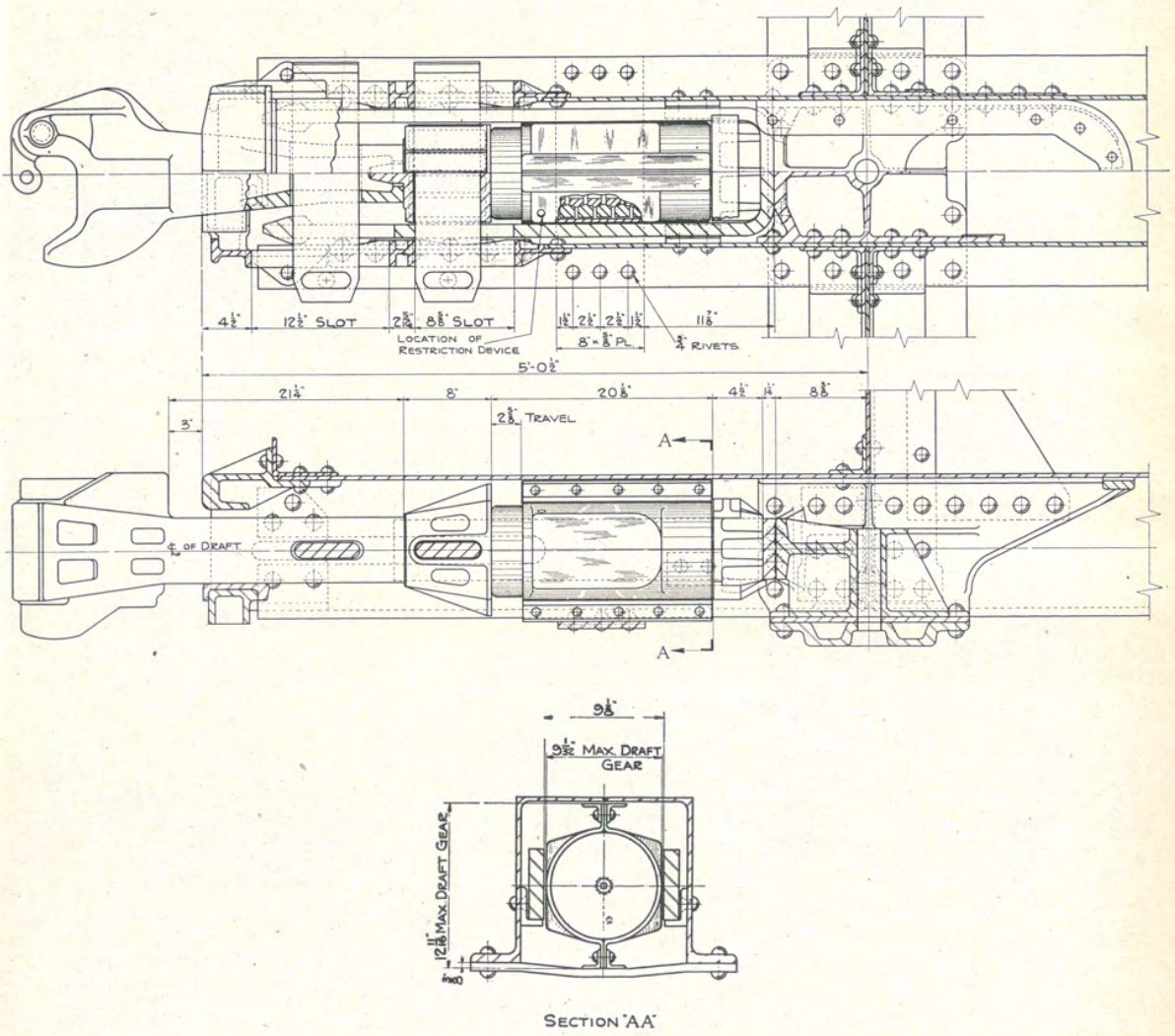


Fig. 10.46—Edgewater B-32-KA Draft Gear as applied to A.A.R. car with standard horizontal yoke attachment.

Edgewater Steel Company

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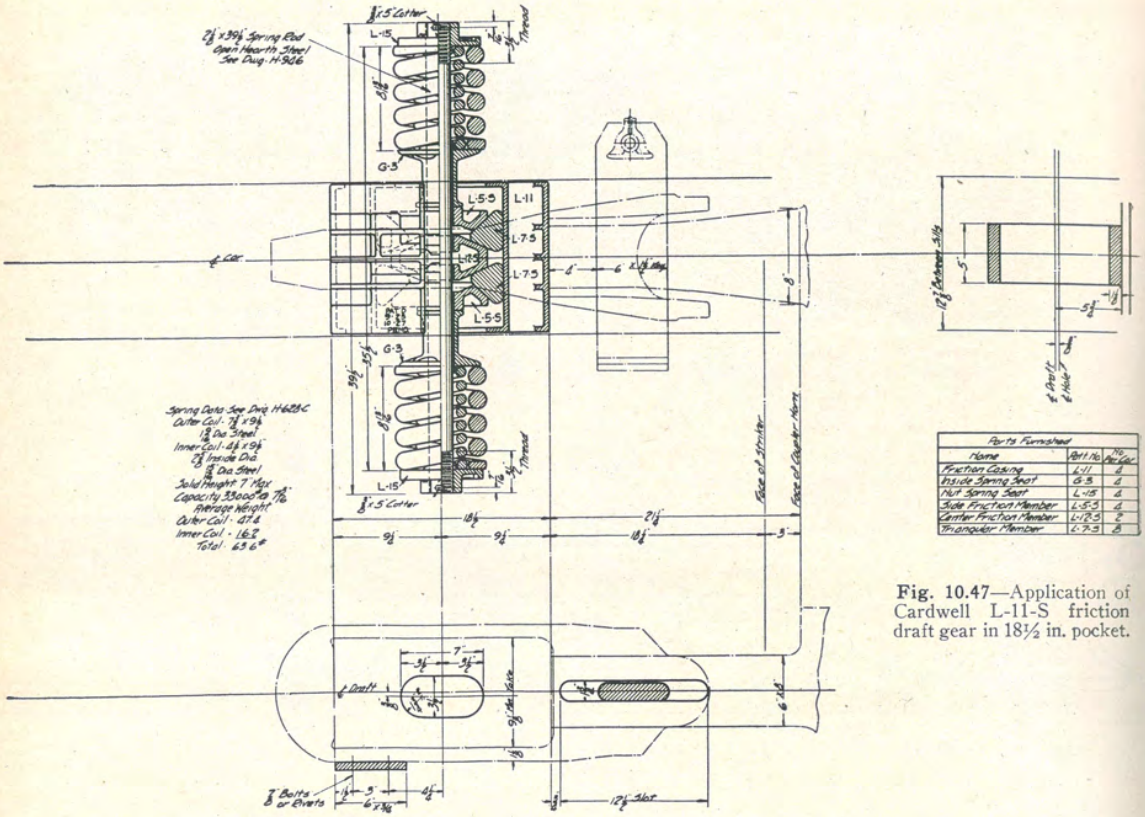


Fig. 10.47—Application of Cardwell L-11-S friction draft gear in 18½ in. pocket.

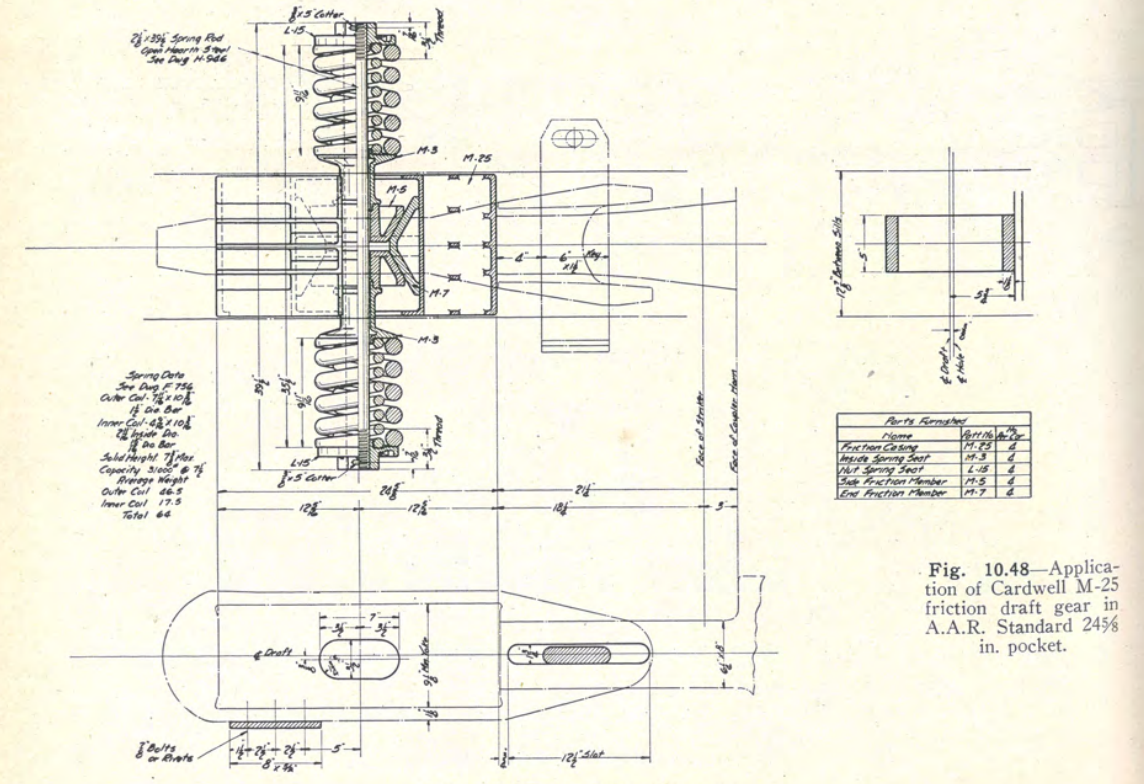


Fig. 10.48—Application of Cardwell M-25 friction draft gear in A.A.R. Standard 24⅝ in. pocket.

Cardwell Westinghouse Company

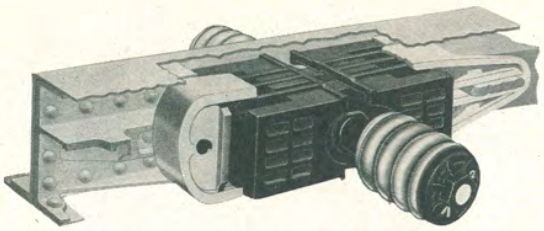
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The Cardwell Friction Draft Gear

Features include invariable high capacity, rugged construction, ease of inspection and repairs

INCREASES in weights of railway rolling stock, and in speed of operation, were long ago recognized by this company as normal progress which would continue into the future. Consequently, the capacity of Cardwell Friction Draft Gears has always been kept well in advance of current requirements. Cardwell Draft Gears provide a degree of protection to cars and lading which is not only ample for the present, but for a considerable future increase in the severity of service. To determine the condition of a Cardwell Friction Draft Gear, it is only necessary to inspect the spring and spring rod; and this is done with the gear on the car and without disassembling. Friction parts are easily replaced to restore the gear to its high initial efficiency.



Cardwell M-25 draft gear, certified A.A.R.

The Cardwell Friction Draft Gear

The manufacturers of this gear were among the first to adopt the friction principle as a means of dissipating the energy of moving cars. This principle is now followed in practically all draft gears. The design of the Cardwell Friction Draft Gear itself, however, is radically different from others. It can be easily restored to high efficiency, after years of service, resulting in considerable economy.

Improvements Give Greater Protection

Incorporated in the Cardwell series of gears, are the results of investigations and tests which are being carried on continuously.

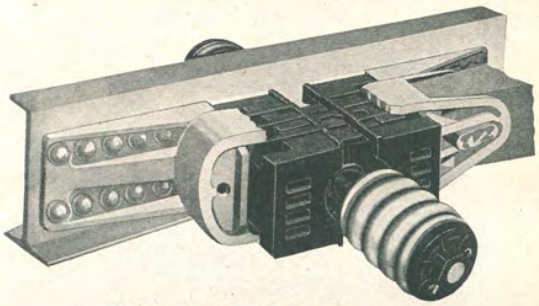
While the basic design remains unchanged, additional capacity and sturdiness make this gear, with standard attachments, capable of withstanding as great final forces as any other known combination.

Design Details

The friction members of this gear are encased in two housings. The spring rod supports coil springs which hold the friction members under compression. The coupler yoke encircles the two housings.

Cardwell Friction Draft Gear Is Distinctive in Design

The feature which distinguishes the Cardwell Friction Draft Gear is the arrangement of its springs which are crosswise of the sills. Its working mechanism is so disposed that its condition may be determined in an instant, by an inspection from the outside. This arrangement of springs allows the gear to be made longitudinally compact, which is a decided advantage in nearly all cases and particularly so in short cars.



The Cardwell type L-11-S draft gear

Summarizing, the distinguishing features of the Cardwell Draft Gears are high work capacity, simplicity, long efficient life, positive release and ability to restore its capacity. This gear can be repaired by regular car repair men.

The Cardwell M-25 Draft Gear is designed for the A. A. R. Standard 24⅝-in. pocket.

The Cardwell L-11-S Draft Gear has the same capacity as the M-25 but is designed for an 18½-in. pocket.

Important instructions for inspecting Cardwell Friction Draft Gears and keeping these gears working at their full capacity are contained in the Cardwell Draft Gear Chart which will be sent to interested railroad men upon request.

CARDWELL WESTINGHOUSE COMPANY, CHICAGO, ILL.
CANADIAN CARDWELL CO., LTD., MONTREAL

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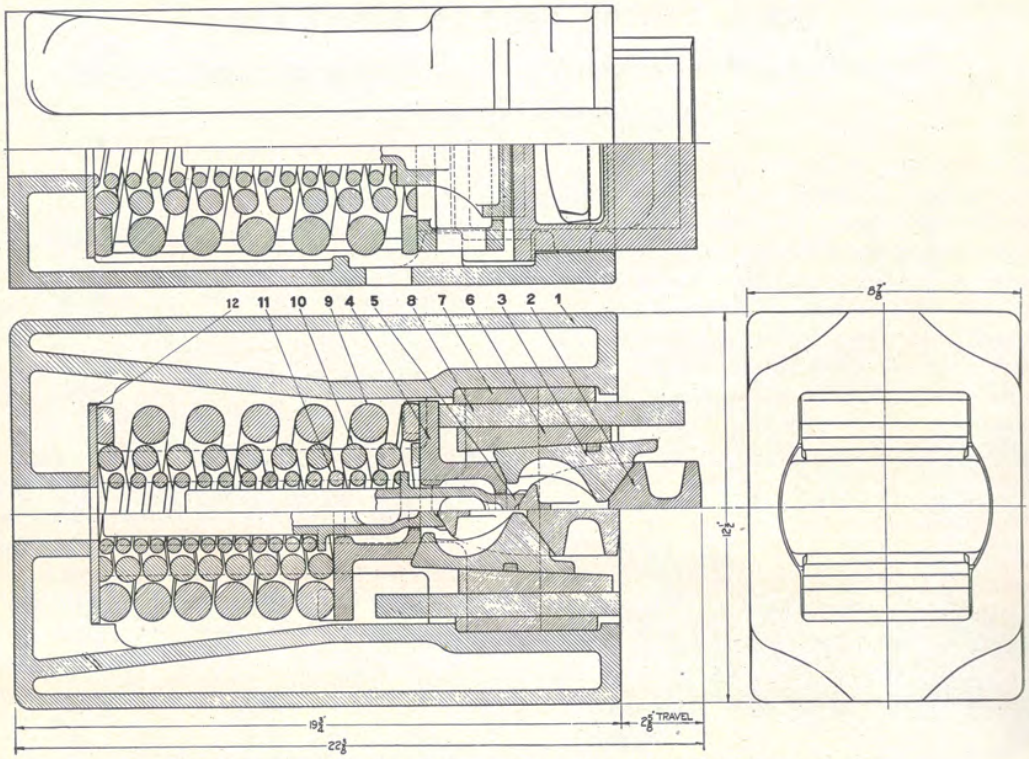


Fig. 10.49—Cross sections of Westinghouse Type NY-11-F friction draft gear.

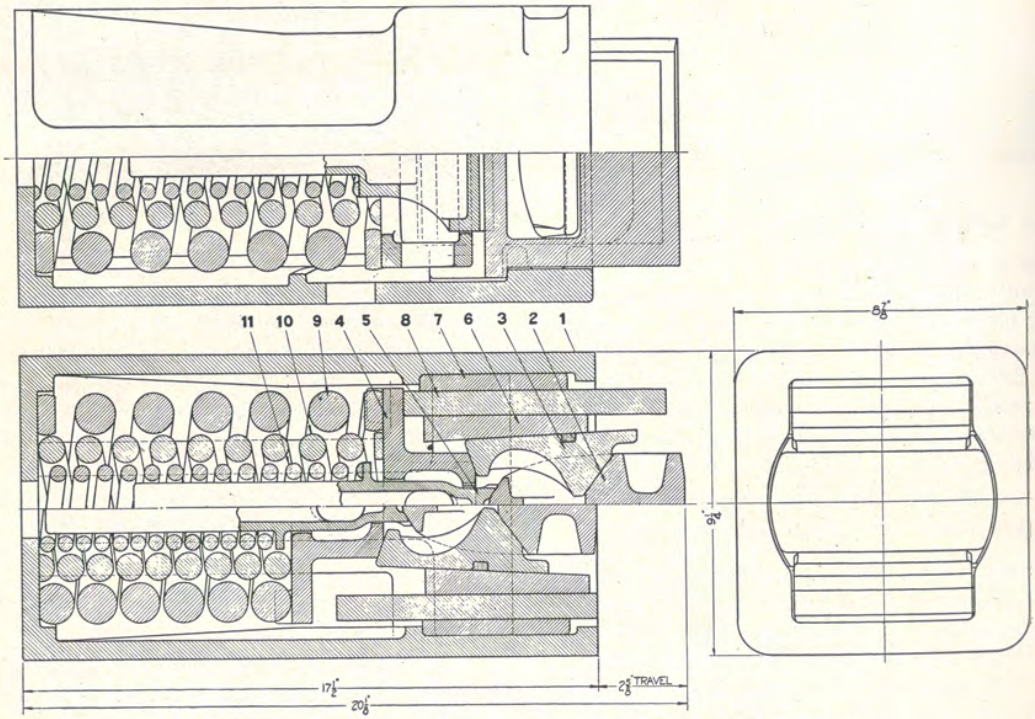


Fig. 10.50—Cross sections of Westinghouse Type NZ-11-F friction draft gear.

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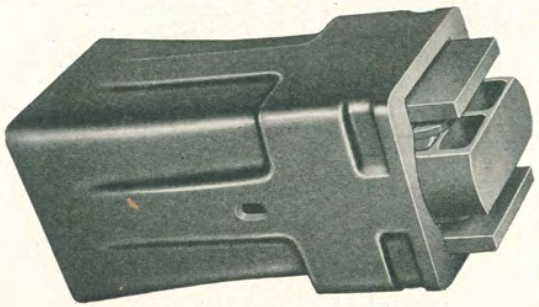
Westinghouse Friction Draft Gears

Feature strength and shock-absorbing capacity

THE Westinghouse Type NY-11-F and Type NZ-11-F Draft Gears give the increased car protection necessitated by the heavy loads and high speeds of present-day traffic. The gears are designed to give ample capacity, strength and durability for the shocks encountered in hump-yard or other switching, or in the severe service to which they are subjected in high-speed trains, with a minimum maintenance. The friction members are made of a metal especially suited to the stresses and wear to which they are subjected.

Westinghouse Type NY-11-F and NZ-11-F Draft Gears

The Type "N" Westinghouse Draft Gears are unusually rugged, with special high-duty characteristics which lower maintenance costs and give an unusual degree of protection to attachments, car structure and lading.



Westinghouse type NZ-11-F draft gear, certified A.A.R.

The gear consists essentially of a multiple arrangement of friction members, in combination with springs, which furnish the elastic resistance and the means for releasing the gear. Its movable parts are encased in a housing of rectangular cross-section, and held together under initial compression by a self-locking arrangement.

The construction throughout is substantial and of the best materials. The housing is a heat-treated steel casting of highest quality. The friction members are of hardened alloy steel, a combination which offers high resistance with minimum wear.

Low Initial Resistance

The operating advantages include a low initial resistance to provide the necessary movement for starting long trains.

Positive Release

These gears are so designed and constructed as to insure prompt and certain return to normal position in readiness for subsequent duty up to full capacity.

Minimum Recoil

One of the desirable features of this Gear—minimum recoil—is effected by the proper design, proportioning and arrangement of the frictional and spring elements.

Installation

These gears can be applied with proper follower plates to any standard 24⅝-in. pocket using either vertical or horizontal Yoke attachments.

Gear Travel

The soft starting action and ultimate high capacity are obtained with a travel of 2⅝ in.

The Gear Is Self-Contained

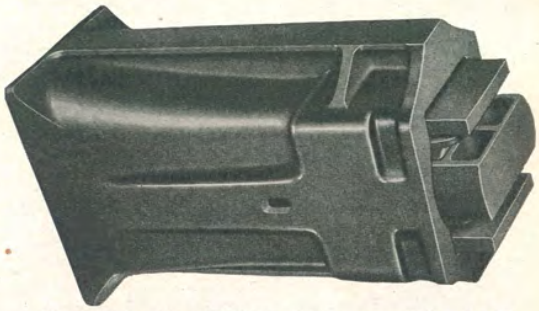
The fact that the various members of the gear are held together under initial compression insures, first, that all parts are always in their proper relation; and second, that the gear can be handled as a single unit.

No Friction Wear on Housing

There is no wear on the housing—the most expensive single part to replace—which insures that no repairs will be required from this source. This is achieved by so designing the gear that the wear affects the removable elements only. Exceptionally large frictional surfaces are provided, which distribute the work over a large area, consequently the rate of wear is low. The housing is strong enough to withstand, safely, blows far in excess of the capacity of the coupler.

Two Types of Gears

Within these two classes of gears, details are similar, and operate to produce the same excellent performance.



Westinghouse type NY-11-F draft gear, certified A.A.R.

The NY-11-F has a capacity and ruggedness which make it adequate for the great majority of applications. The NZ-11-F has equal capacity and both are designed for cars and locomotives subjected to severe service.

Both gears meet all A.A.R. requirements. If further information is desired, the Cardwell Westinghouse Company will be pleased to have one of their experienced draft gear men call and discuss specific draft gear requirements to suit any individual case.

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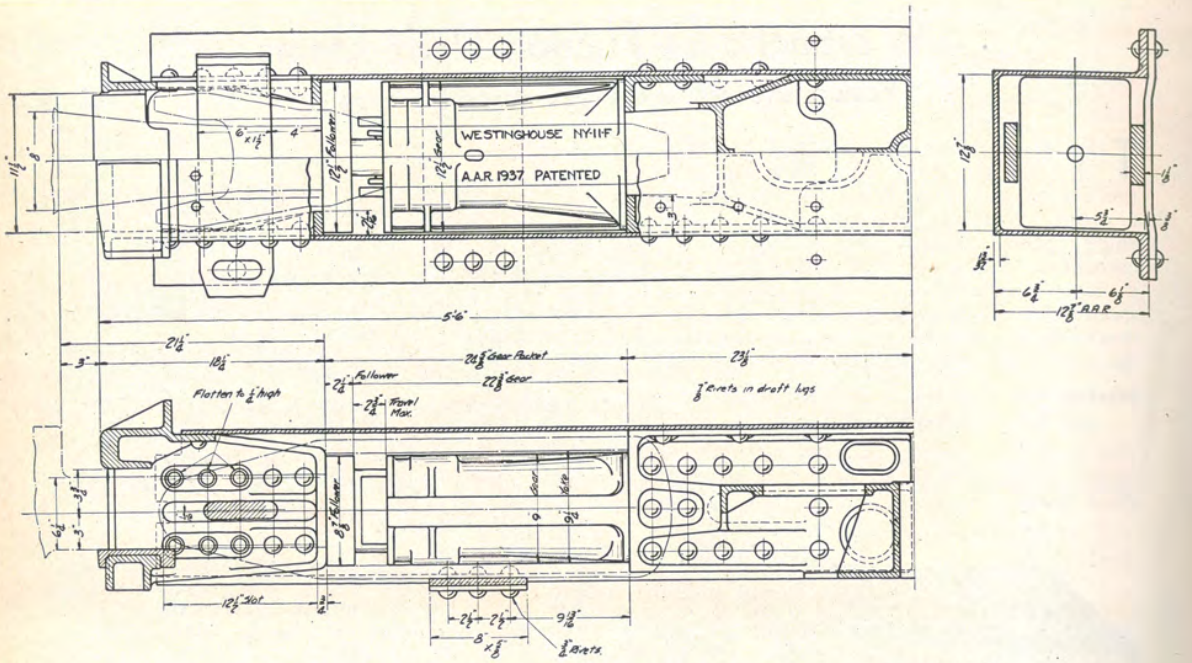


Fig. 10.51—Application of Westinghouse Type NY-11-F friction draft gear with vertical yoke.

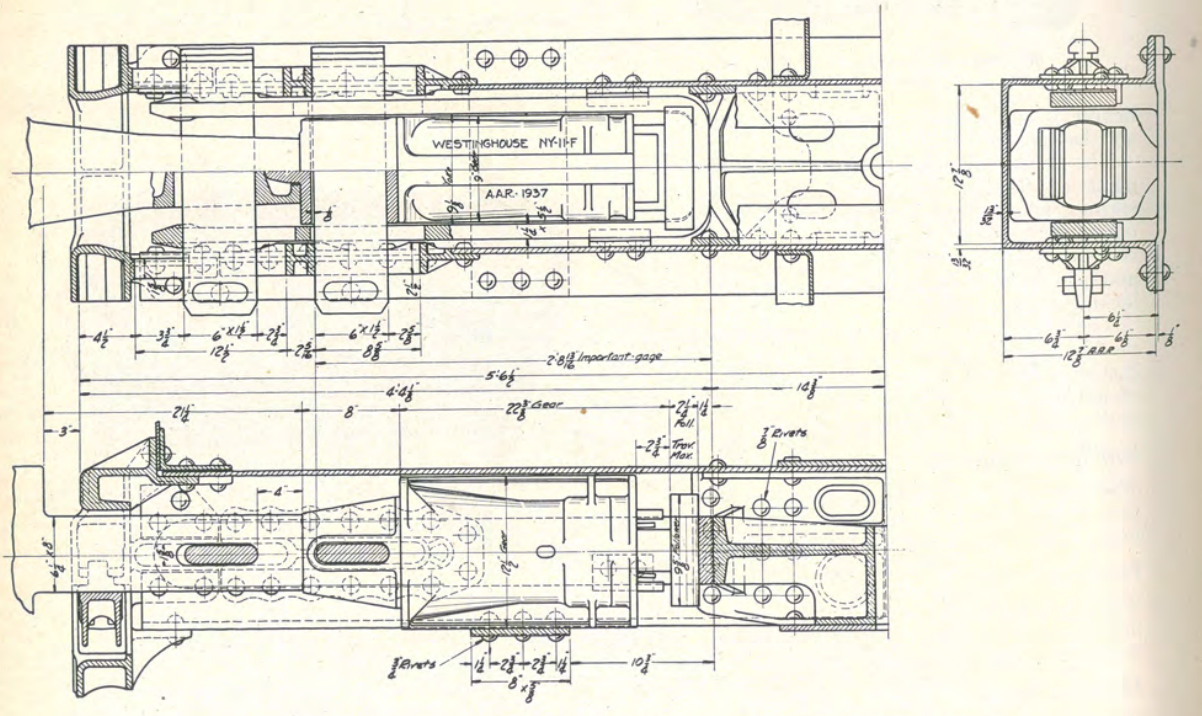


Fig. 10.52—Application of Westinghouse Type NY-11-F friction draft gear with horizontal yoke.

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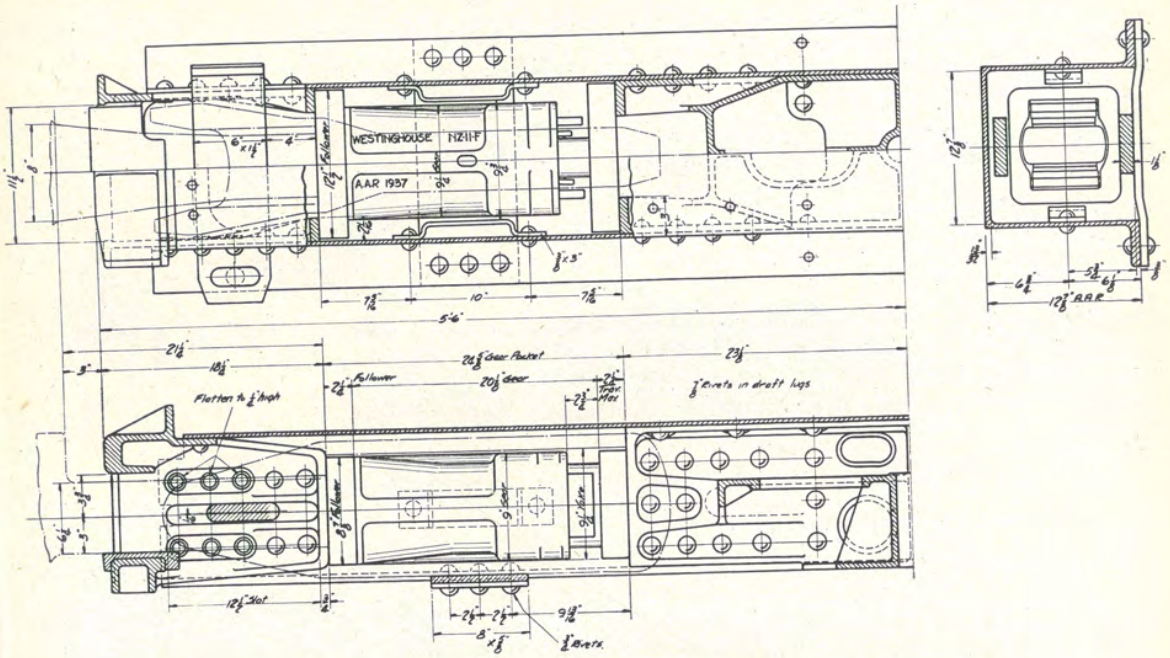


Fig. 10.53—Application of Westinghouse Type NZ-11-F friction draft gear with vertical yoke.

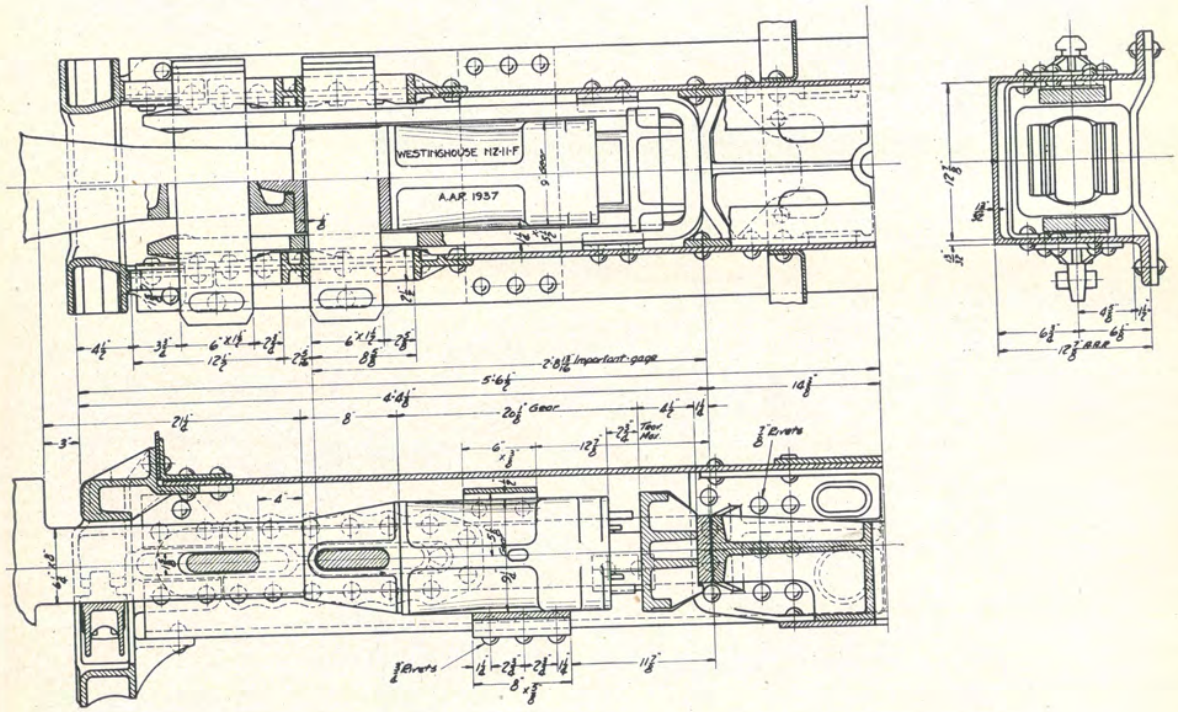


Fig. 10.54—Application of Westinghouse Type NZ-11-F friction draft gear with horizontal yoke.

Cardwell Westinghouse Company

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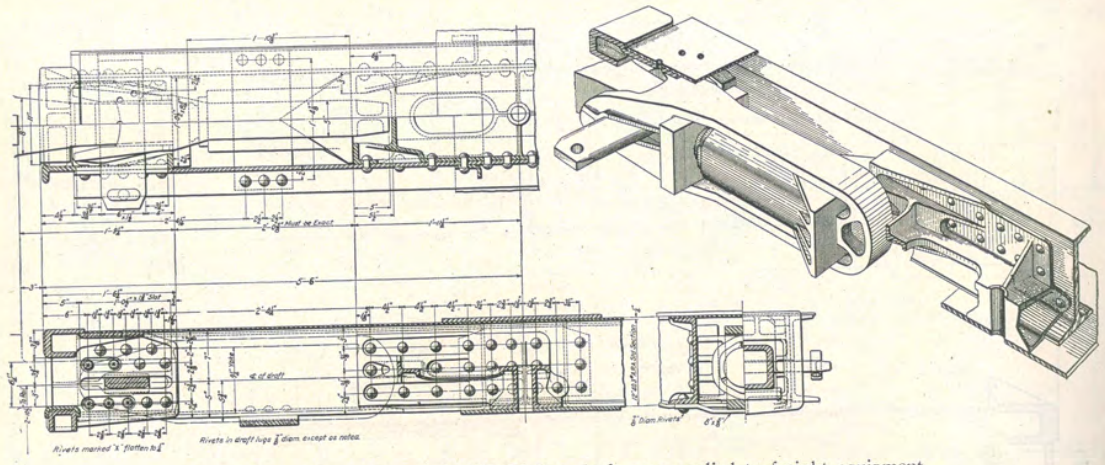


Fig. 10.55—Miner Class A-22-XB friction draft gear applied to freight equipment.

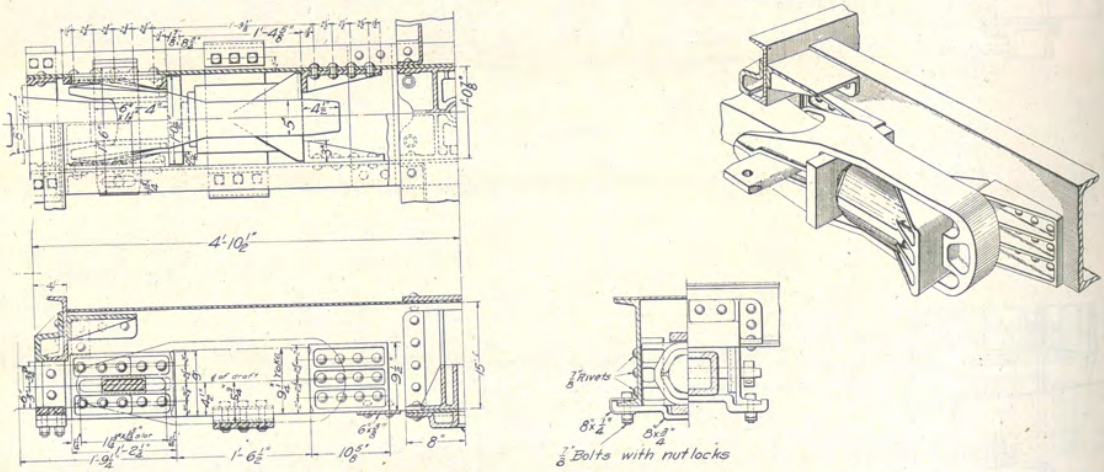


Fig. 10.56—Miner Class A-69-XB friction draft gear applied to freight equipment.

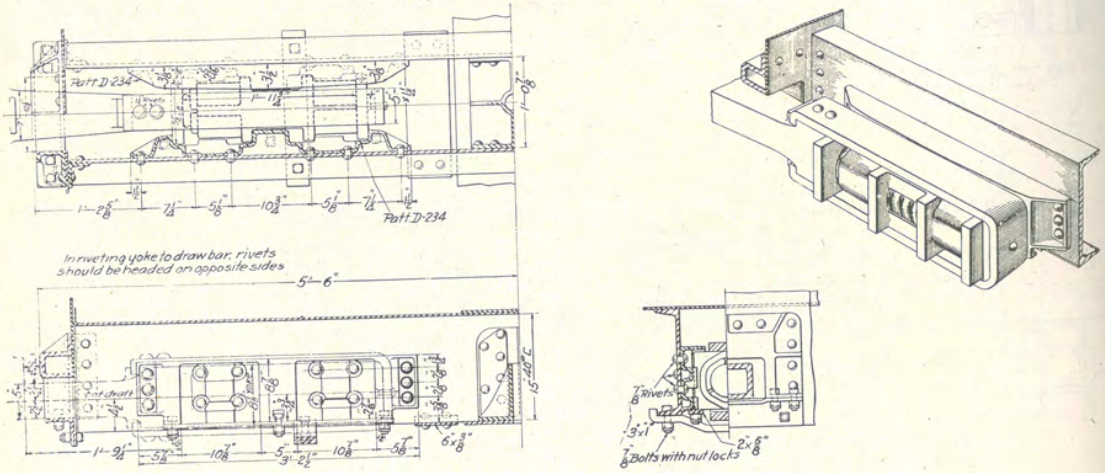


Fig. 10.57—Miner Class A-19-XB friction draft gear applied to freight equipment having Miner tandem draft attachments.

W. H. Miner, Inc.

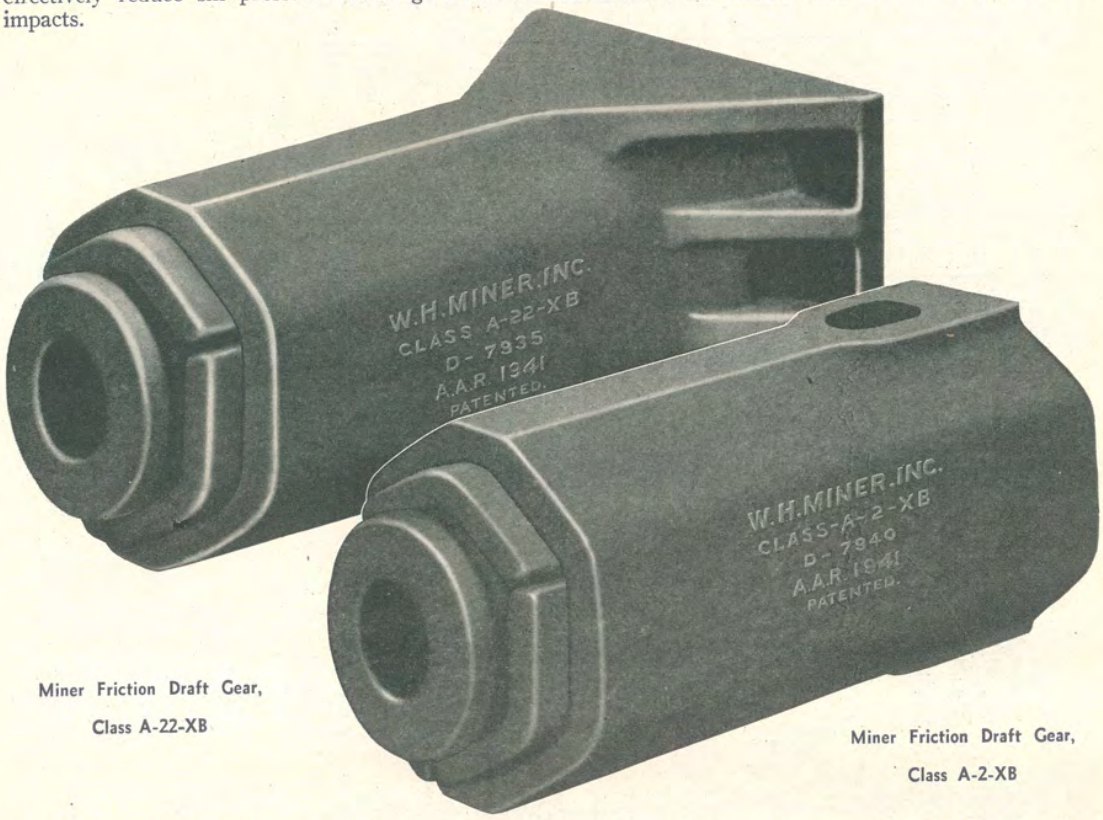
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Miner Friction Draft Gears

For Freight Equipment

MINER Friction Draft Gears perform a vital service in the economic operation of high-speed freight trains. These devices have thoroughly demonstrated their ability to protect car structure and lading under the most severe operating conditions. Miner gears are powerful shock absorbers which effectively reduce sill pressure resulting from car impacts.



Miner Friction Draft Gear, Class A-22-XB

Miner Friction Draft Gear, Class A-2-XB

The Miner method of manufacturing the materials of which these devices are made and the subsequent steps in the fabrication and heat-treatment of the component parts positively ensure the high quality necessary to satisfy the exacting demands of shock-prevention service. The friction elements are made of drop-forged steel, thoroughly heat-treated and inspected. The springs are wound to exact specifications in accordance with the latest scientific practice. Each device is individually inspected and tested under a 27,000-pound drop hammer, thereby definitely ensuring correct action and capacity. Extensive service experience has positively demonstrated the ability of Miner gears to withstand shock and to protect car and lading from damage.

Miner A-22-XB Gear

The Miner Class A-22-XB Gear is certified by the Association of American Railroads and meets fully every requirement for heavy freight train protection. This device provides great column strength, and the extraordinary resistance to wear ensures that high capacity with low sill pressure is maintained for many years of service. For typical application, see Figure 10.55.

Miner A-2-XB Gear

The Miner Class A-2-XB Gear is also certified by the Association of American Railroads. This device has a high degree of mechanical efficiency, resulting in the reduction of lading and equipment damage. The gear is applied to the standard pocket in combination with two follower plates. See Figure 10.58 for typical application.

Miner A-69-XB Gear

The Miner Class A-69-XB Gear is similar in construction and performance to the Class A-22-XB gear except that it is especially designed to fit the 18½-in. pocket. Application to car conditions is shown in Figure 10.56.

Miner Class A-28-XB Gear

This device was designed for caboose cars. It provides an initial resilient spring action of 1½ in., ensuring comfort for the trainmen, and an additional 1-in. travel of frictional resistance so vitally necessary to protect the car when it is used in pusher service. Figure 10.60 shows typical application.

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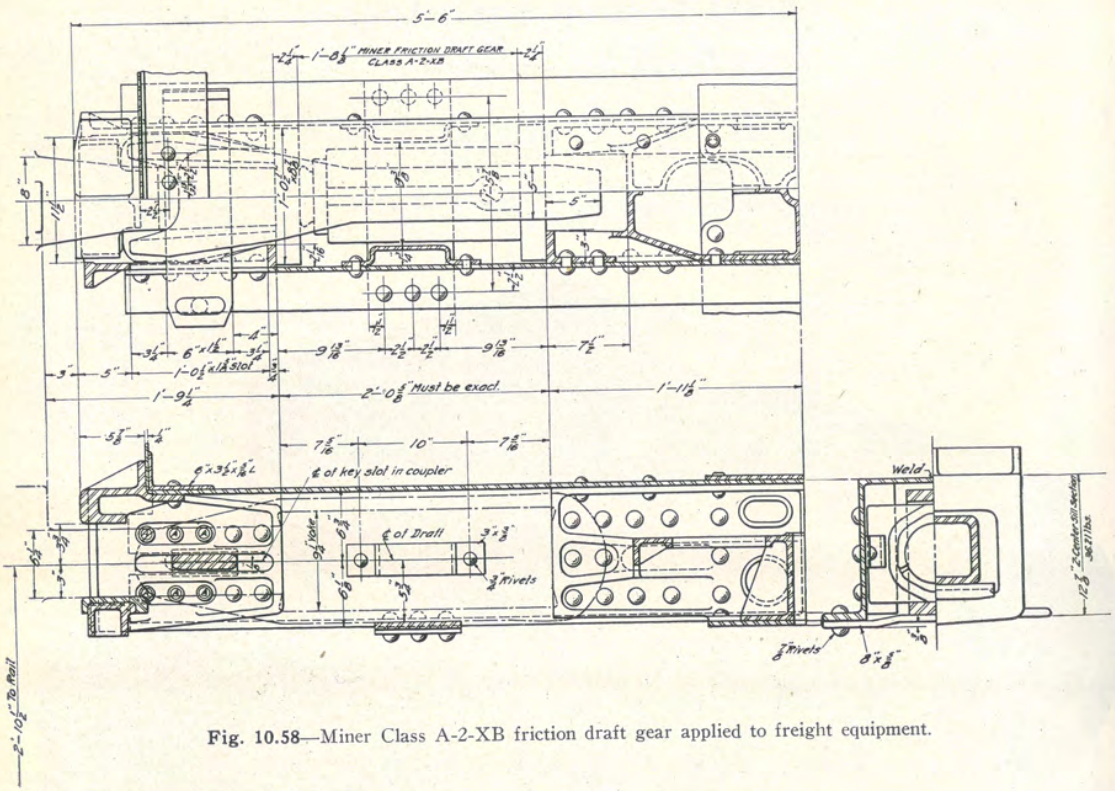


Fig. 10.58—Miner Class A-2-XB friction draft gear applied to freight equipment.

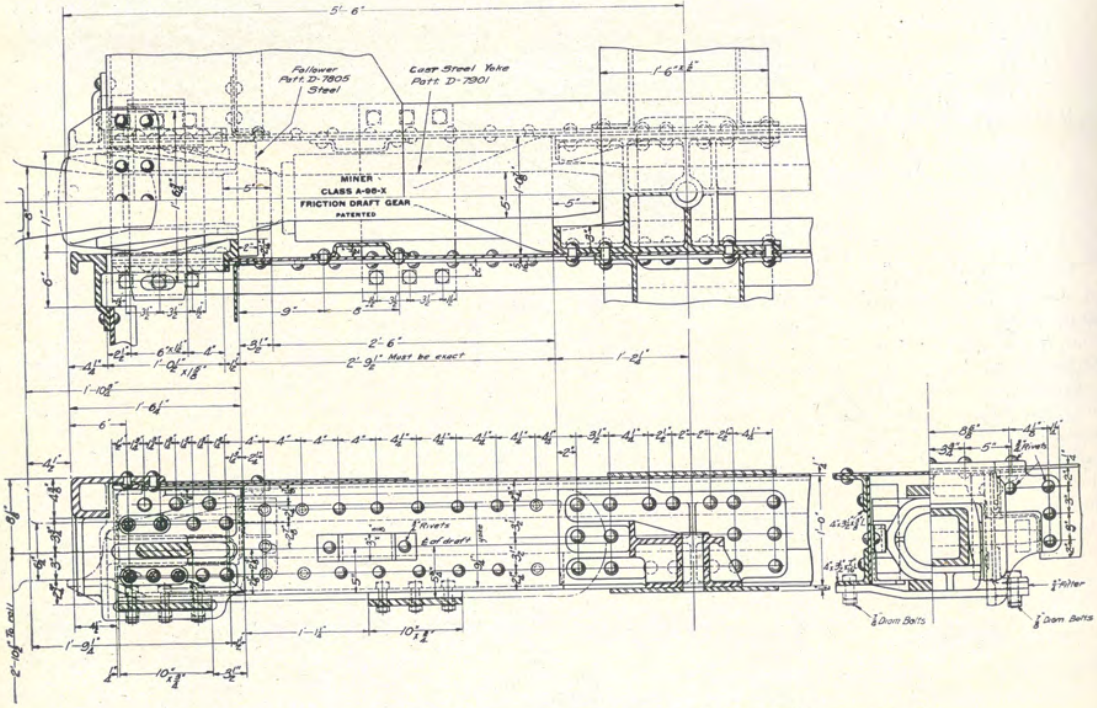


Fig. 10.59—Miner Class A-98-X friction draft gear applied to freight equipment.

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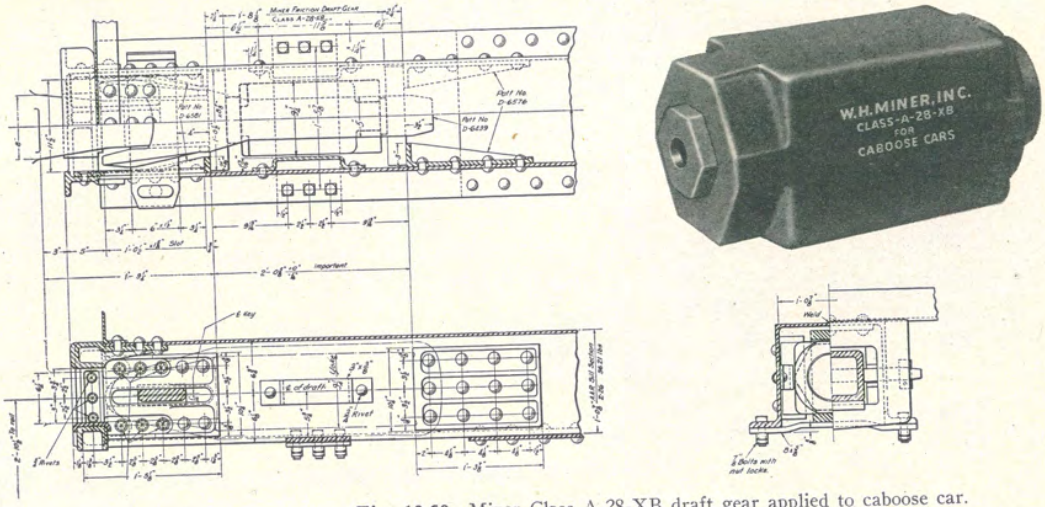


Fig. 10.60—Miner Class A-28-XB draft gear applied to caboose car.

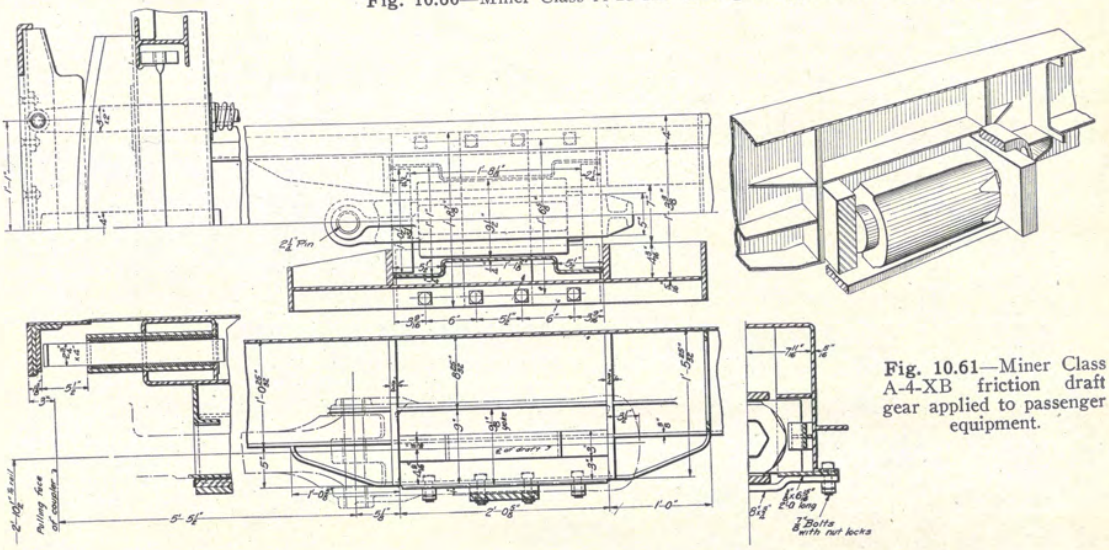


Fig. 10.61—Miner Class A-4-XB friction draft gear applied to passenger equipment.

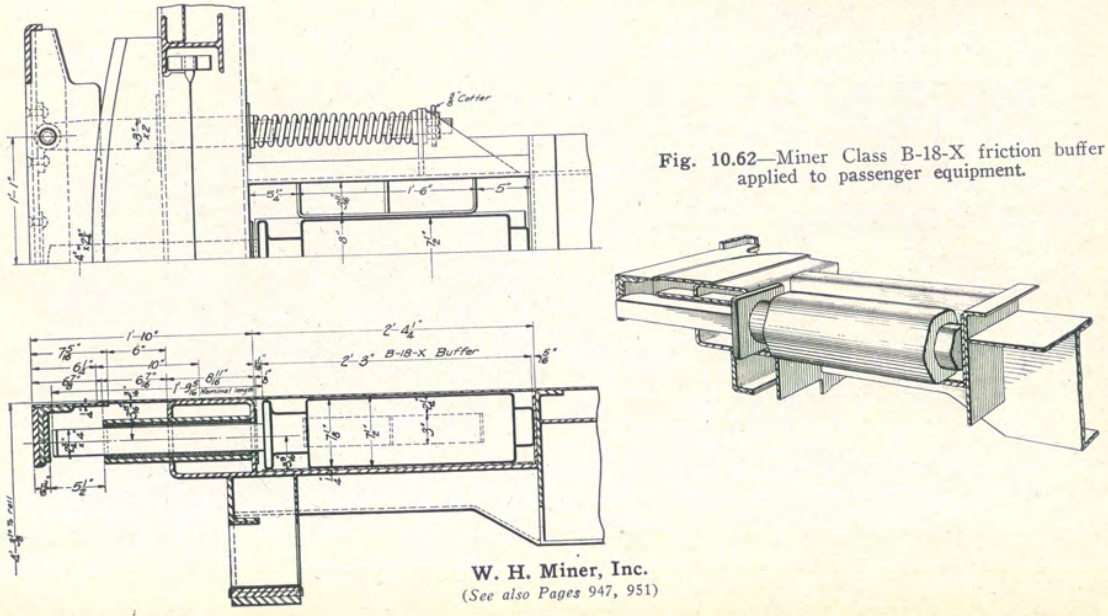


Fig. 10.62—Miner Class B-18-X friction buffer applied to passenger equipment.

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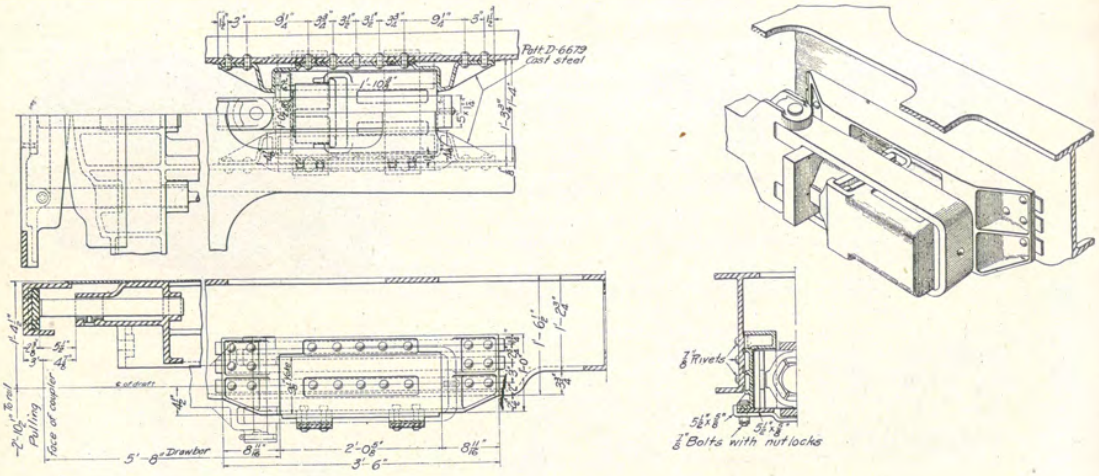


Fig. 10.63—Miner Class A-5-XB friction draft gear applied to passenger equipment.

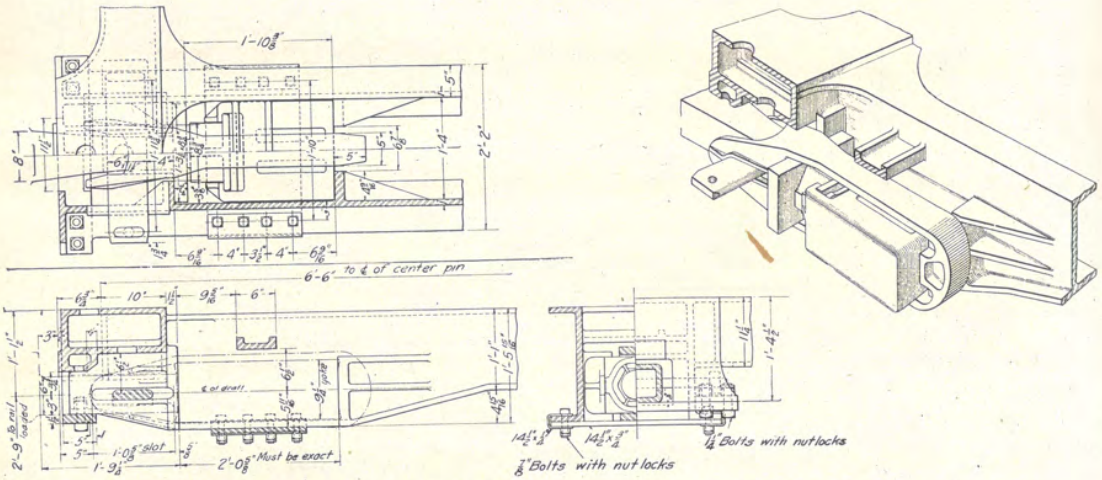


Fig. 10.64—Miner Class A-94-XB friction draft gear applied to passenger equipment.

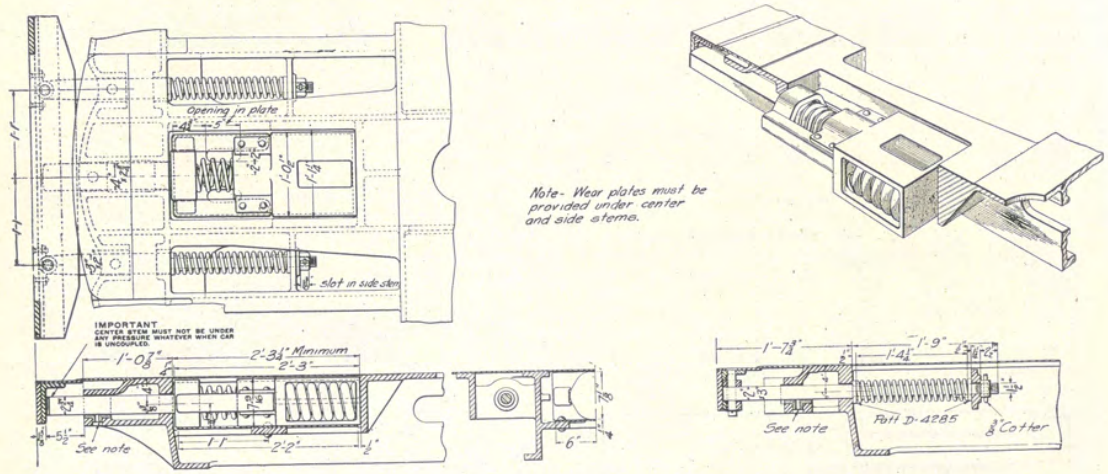


Fig. 10.65—Miner Class B-10-X friction buffer applied to passenger equipment.

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Miner Friction Draft Gears and Buffers

For Passenger Equipment

IT is imperative that correctly designed cushioning devices be selected for passenger equipment in order to ensure a maximum of comfort for the traveling public. Miner Velvet-Action Draft Gears and Buffers successfully fulfill every requirement of modern passenger train operation, not only protecting equipment from rough handling but facilitating smooth starting and stopping of cars. They also provide proper blending of the differences in speed between the motive power and the individual cars while the train is in motion.

Miner A-4-XB Gear

The Miner Class A-4-XB Gear (Figures A and 10.61) is made of high-strength steel, ensuring extraordinary durability. This device, which fits the standard draft gear pocket, provides the necessary live spring action for the smooth and noiseless starting of trains. High frictional resistance is developed in the final portion of the travel to protect equipment against rough handling.

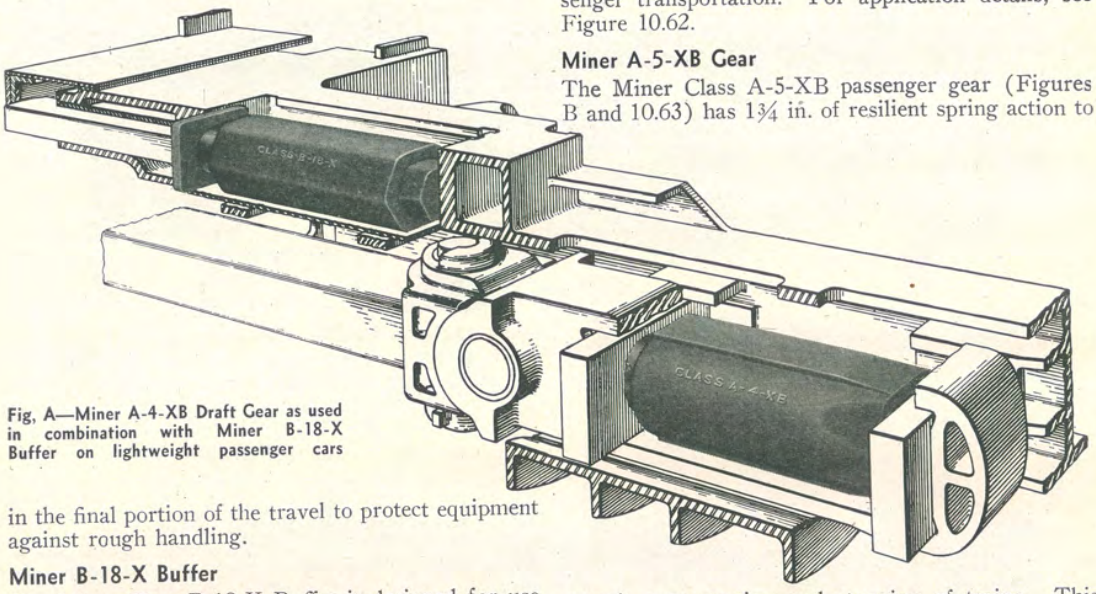


Fig. A—Miner A-4-XB Draft Gear as used in combination with Miner B-18-X Buffer on lightweight passenger cars

Miner B-18-X Buffer

The Miner Class B-18-X Buffer is designed for use in combination with the Class A-4-XB gear on modern passenger cars. Several years of service on leading high-speed trains testify to their success in meeting the exacting requirements of present-day passenger transportation. For application details, see Figure 10.62.

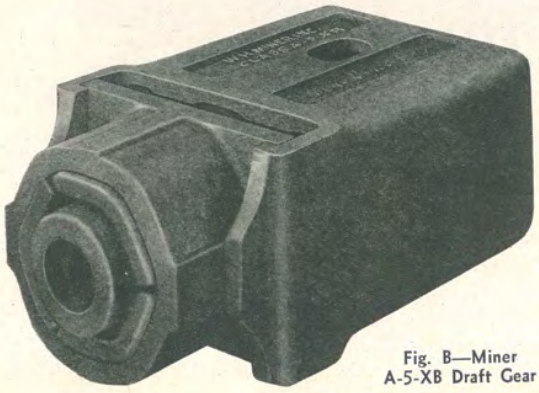


Fig. B—Miner A-5-XB Draft Gear

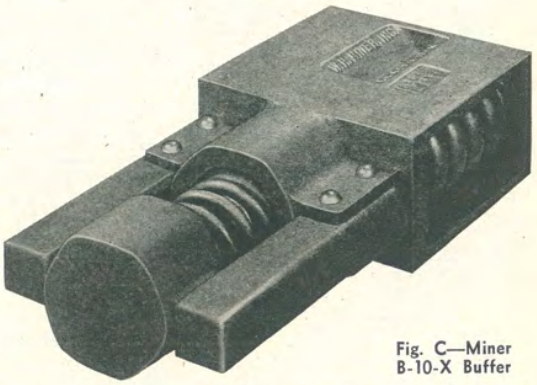


Fig. C—Miner B-10-X Buffer

Miner A-5-XB Gear

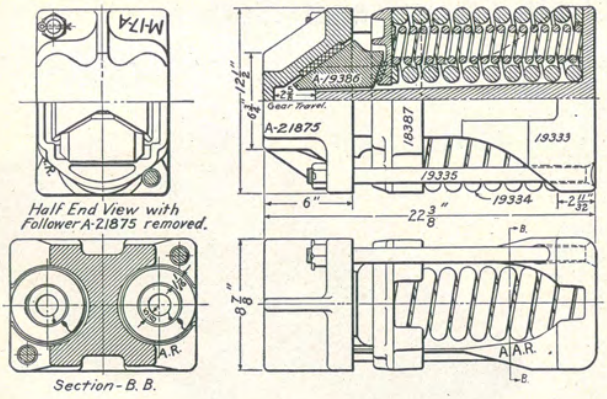
The Miner Class A-5-XB passenger gear (Figures B and 10.63) has 1¾ in. of resilient spring action to permit easy starting and stopping of trains. This spring resilience also responds to the pulsing development of the drawbar pull and, by synchronizing with this surging, transmits uniform traction to the train. This action blends into heavy frictional capacity at the end of the stroke to protect car structure against overload shocks.

Miner B-10-X Buffer

The Miner Friction Buffer (Figures C and 10.65) provides live spring resistance for precoupling action, during which the buffer works in conjunction with the side stem springs to maintain positive contact between vestibule plates. The final travel augments the draft gear capacity.

Miner passenger appliances are correctly designed and made of the finest quality steel, thoroughly heat-treated. Each device is carefully and rigidly inspected and tested before shipment.

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List of Parts of Fig. 10.66

Number	Name	No. per Gear
18387	Friction Segment Seat	1
A-21875	Follower Wedge	1
19333	Friction Member	1
19334	Draft Spring	2
19335	Retaining Rod and Nut	2
A-19386	Friction Segment	2

Travel of Gear.....Min., 2½ in.; Max, 2¾ in.
Weight of Gear.....Average 370 lb.

Fig. 10.66—National friction draft gear, Type M-17-A, A.A.R. approved—Certificate No. 2.

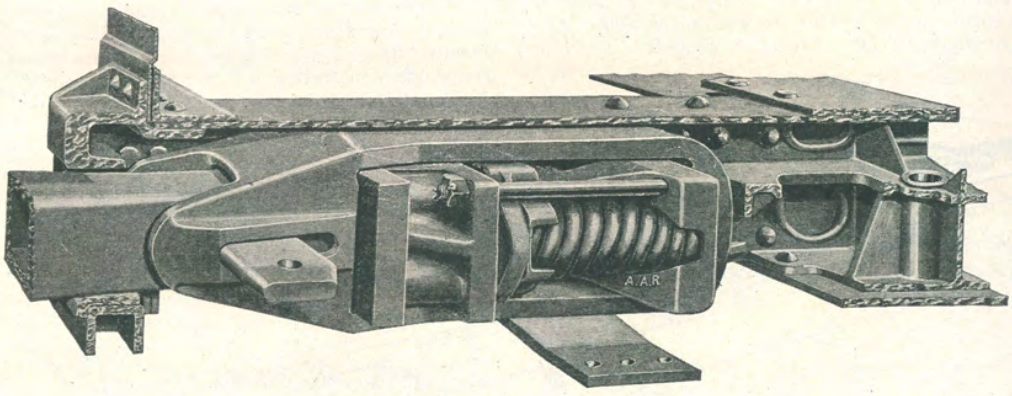


Fig. 10.67—National friction draft gear, Type M-17-A, A.A.R. approved. Applied to car in combination with A.A.R. Standard E Coupler and vertical cast steel yoke.

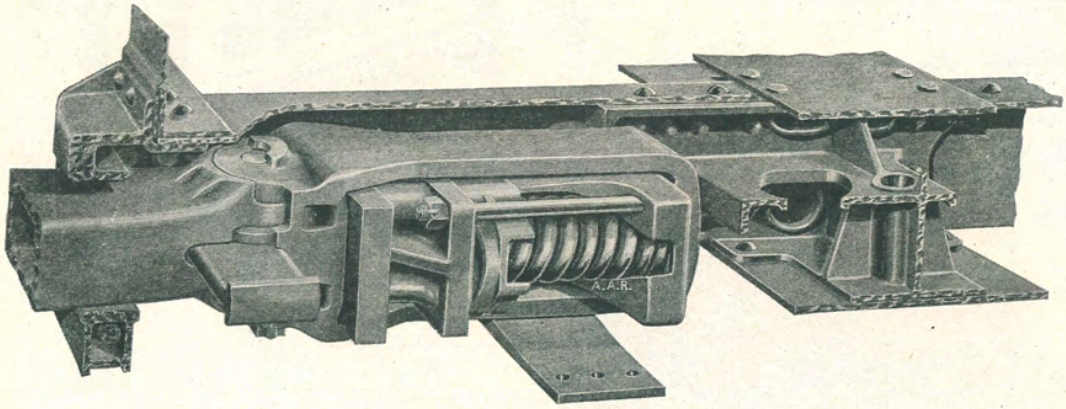


Fig. 10.68—National friction draft gear, Type M-17-A, A.A.R. approved. Applied to car in combination with A.A.R. Alternate Standard E Coupler and vertical cast steel swivel yoke.

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National Friction Draft Gears

THE present National Friction Draft Gears are the result of many years of service, investigation and development work to obtain a gear of simple design and with the fewest number of parts possible, consistent with a ruggedness and capacity that would insure a long life of the gear in service and afford the maximum protection to the cars against the extremely heavy shocks and blows of present day train operation. To attain this object the material used in the construction of National Friction Draft Gears is of special high quality. Each vital part of these gears is separately treated to obtain the exact physical properties necessary to best enable it to perform its individual function.

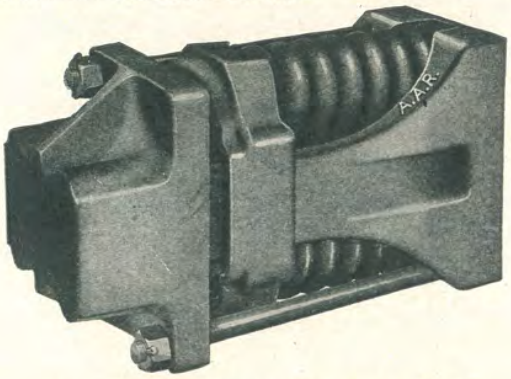


Fig. A—National Friction Draft Gear Type M-17-A
A. A. R. Approved, Cert. No. 2

Important and Distinctive Features

National Friction Draft Gears embody several important and distinctive features:

First: National gears are built upon the principle of inwardly acting wedge pressure and a centrally located friction member. The friction segments are wedged inwardly against the central member, with the result that this member is subjected only to compressive stresses. Any wear that may develop on this member, therefore, does not weaken it or lessen its ability to withstand these stresses.

Second: All castings entering into the construction of these gears are made of alloy steels, heat-treated to secure a hardness and strength best suited for the service each part must perform. The central friction member is specially hardened, providing a ductile, shock-resisting body with surfaces of extreme hardness. The friction segments are of a special alloy steel, heat-treated to secure a degree of hardness somewhat less than that of the surfaces of the central friction member but still very hard. The follower wedge and segment seat are made of Naco Steel on account of its proven strength and toughness.

Third: National Gears in types M-17-A and M-50-B are provided with central friction members of sufficient area and strength to carry the over-solid blows as well as the normal friction stresses and are of ample strength to meet the most rigid requirements.

The draft springs are never compressed solid, even when the gear is fully closed, which protects the frictional parts as well as the springs themselves from excessive stresses.

Fourth: National gears are so designed that when they are assembled and locked to the correct length for application to the car, the draft spring is under considerable initial compression. On account of this initial compression the frictional elements are always held in close contact with one another, ready to respond instantly to any applied force. This initial spring compression automatically compensates for any frictional wear that may take place during the life of the gear. The gears are locked to the proper length by retaining rods with nuts and cotters. These rods are not removed in applying the gears to equipment. The gears do not have to be boxed or crated for shipment as they cannot get out of adjustment or come apart through rough handling. The vital parts are so protected that they are not liable to injury.

Fifth: All friction and wedging surfaces are accurately machined or ground, and when assembled, each gear is given a series of factory tests in a specially designed machine equipped with an automatic recording pressure gage. Each gear is thoroughly inspected and when tested must show a minimum required capacity before it is accepted for shipment.

Sixth: As there is no case or barrel surrounding the gear, all parts are exposed to view for inspection, yet they are so protected that injury to any part is impossible.

The M-17-A gears require one follower and

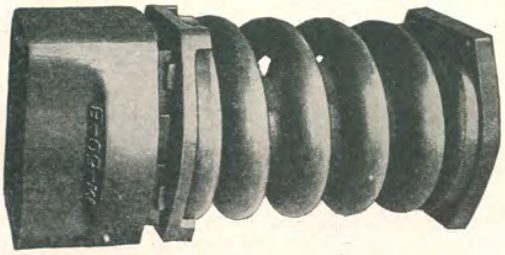


Fig. B—National Friction Draft Gear, Type M-50-B
A. A. R. Approved, Cert. No. 10

the M-50-B gears require two followers, when used in the standard draft lug spacing of 24⅝ in.

Seventh: Prior to shipment, National gears are temporarily shortened about ½ in. to facilitate their application to the cars. The small studs used for this purpose drop out during the first compression of the gears after application to a car and thus the gear is released to its normal length.

Eighth: The National M-17-A and M-50-B Draft Gears have been subjected to the tests required by the A.A.R. Standard Specifications for Approval of Draft Gears for Freight Car Service, and have passed all these requirements with an excellent margin. These gears therefore are approved as standard by the Association of American Railroads and are sold under their approval certificates.

NATIONAL MALLEABLE AND STEEL CASTINGS CO., CLEVELAND 6, O.

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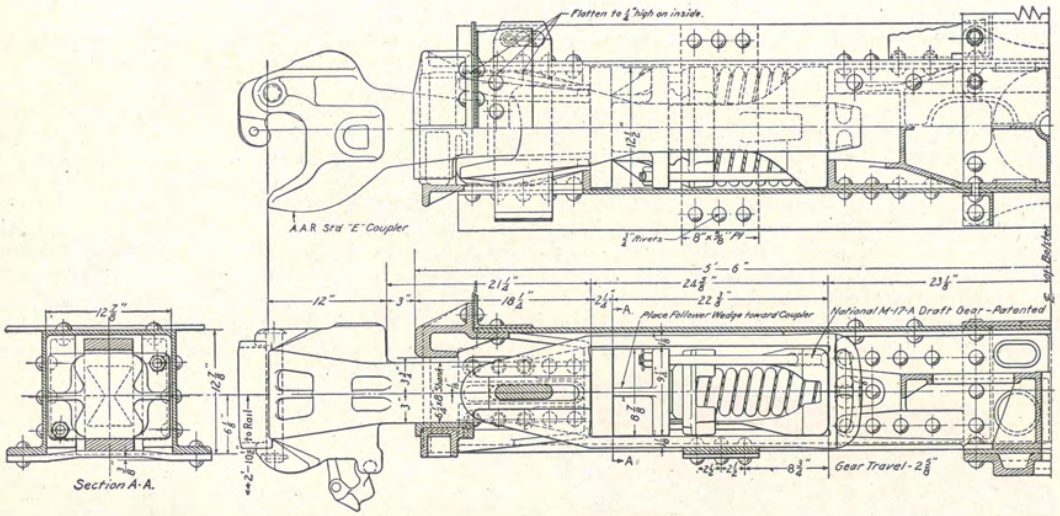


Fig. 10.69—National friction draft gear, Type M-17-A, applied to A.A.R. Type car in combination with A.A.R. Standard E Coupler and vertical cast steel yoke.

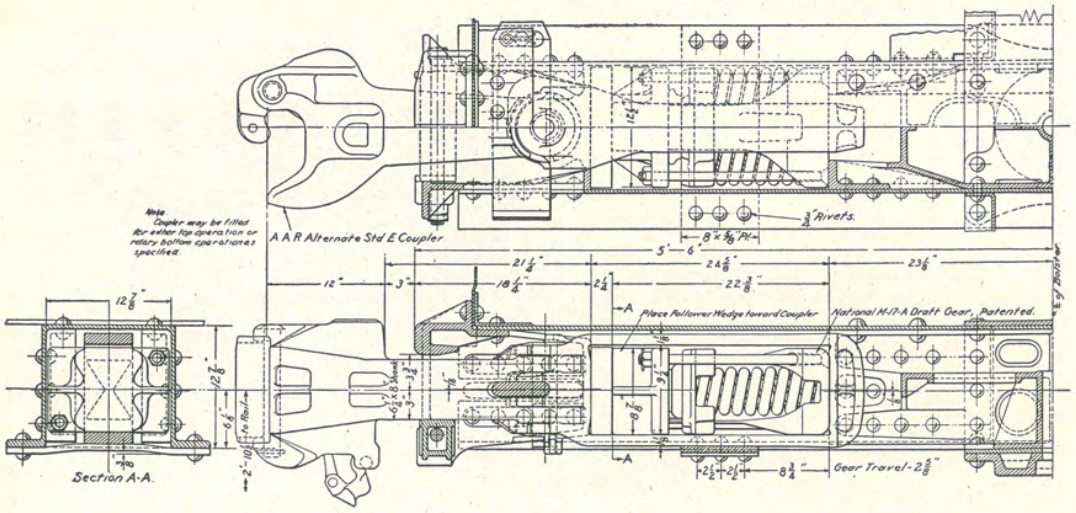


Fig. 10.70—National friction draft gear, Type M-17-A, applied to A.A.R. Type car in combination with Alternate Standard E Coupler and vertical cast steel swivel yoke.

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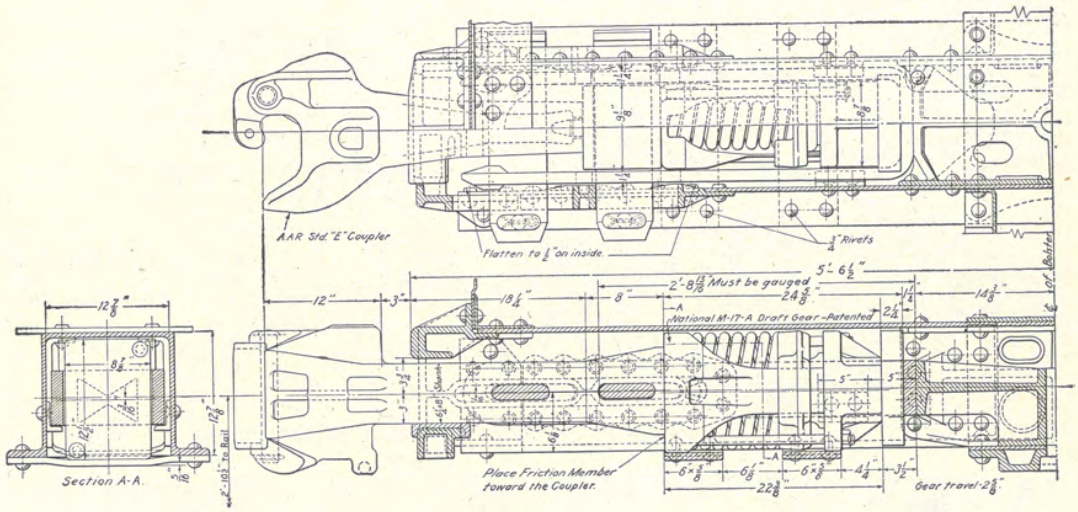


Fig. 10.71—National friction draft gear, Type M-17-A, applied to A.A.R. type car in combination with A.A.R. Standard E Coupler and horizontal cast steel yoke.

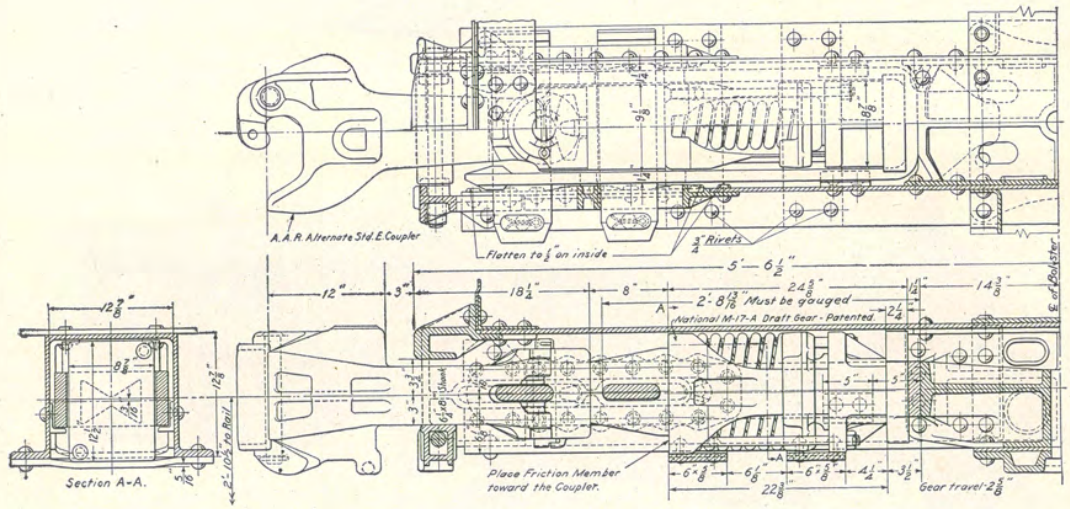
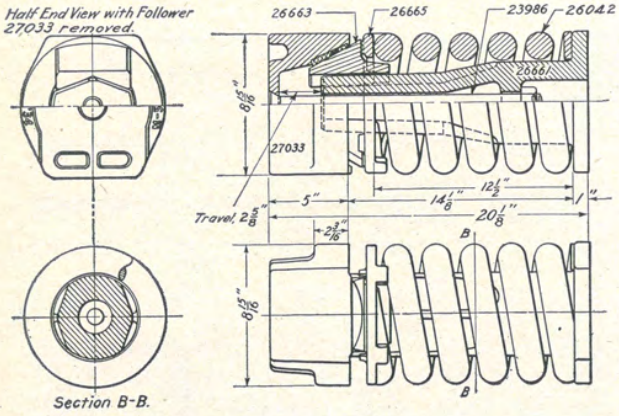


Fig. 10.72—National friction draft gear, Type M-17-A, applied to A.A.R. type car in combination with Alternate Standard E Coupler, swivel butt casting and horizontal cast steel yoke.

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List of Parts of Fig. 10.73

Number	Name	No. per Gear
26665	Friction Segment Seat	1
27033	Follower Wedge	1
26661	Friction Member	1
26042	Draft Spring	1
23986	Retaining Rod and Nut	1
26663	Friction Segment	2

Travel of Gear.....Min., 2½ in.; Max., 2¾ in.
Weight of Gear.....Average 245 lb.

Fig. 10.73—National friction draft gear, Type M-50-B. A.A.R. approved, certificate No. 10.

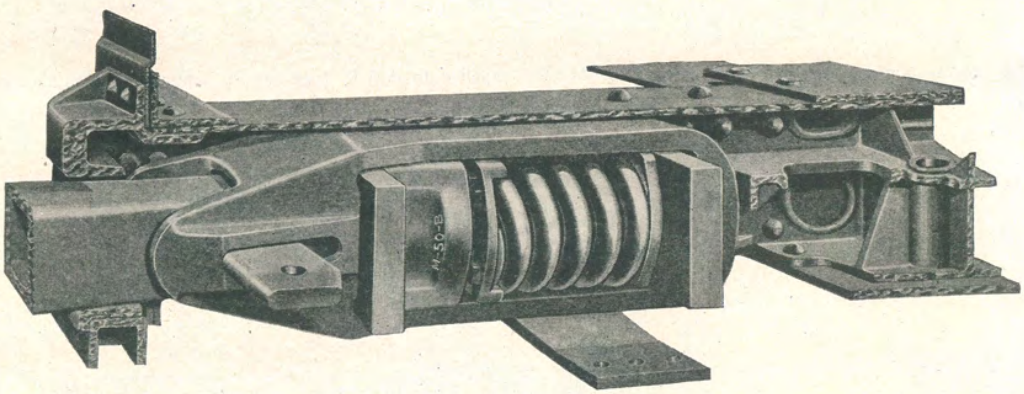


Fig. 10.74—National friction draft gear, Type M-50-B, A.A.R. approved, applied to car in combination with A.A.R. Standard E Coupler and vertical cast steel yoke.

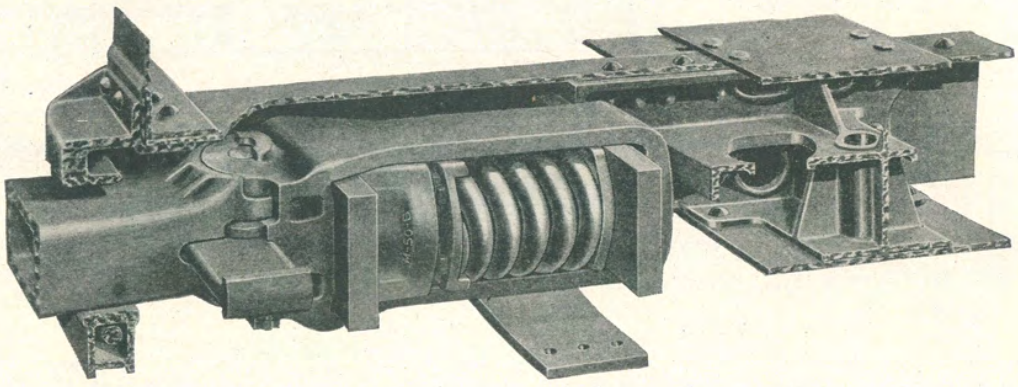


Fig. 10.75—National friction draft gear, Type M-50-B, A.A.R. approved, applied to car in combination with A.A.R. Alternate Standard E Coupler with vertical cast steel swivel yoke.

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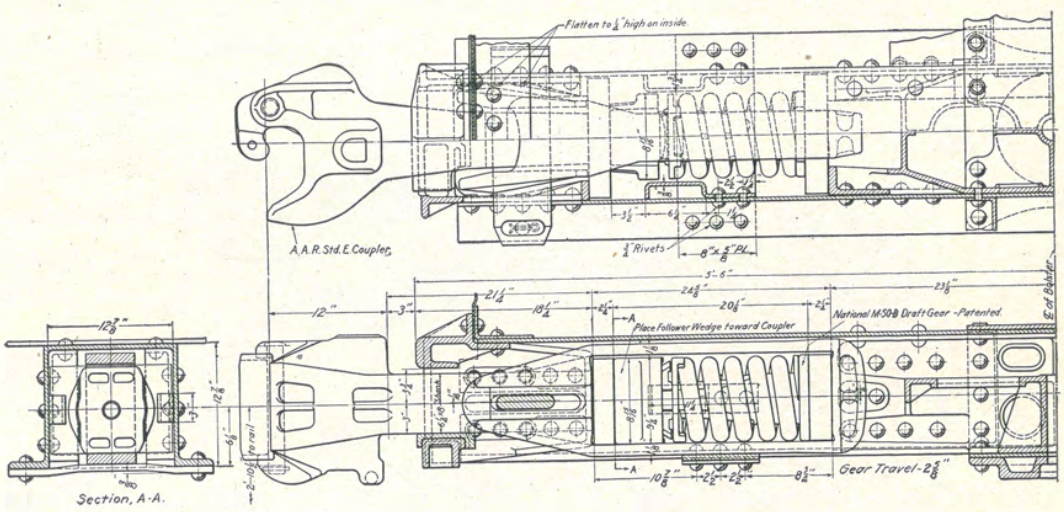


Fig. 10.76—National friction draft gear, Type M-50-B, applied to A.A.R. Type car in combination with A.A.R. Standard E Coupler and vertical cast steel yoke.

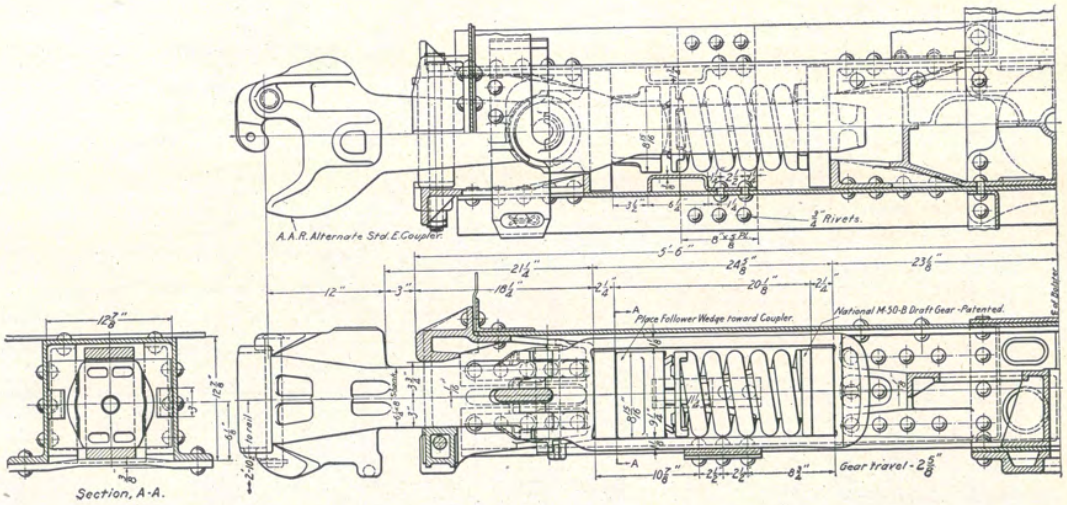


Fig. 10.77—National friction draft gear, Type M-50-B, applied to A.A.R. Type car in combination with A.A.R. Alternate Standard E Coupler and vertical cast steel swivel yoke.

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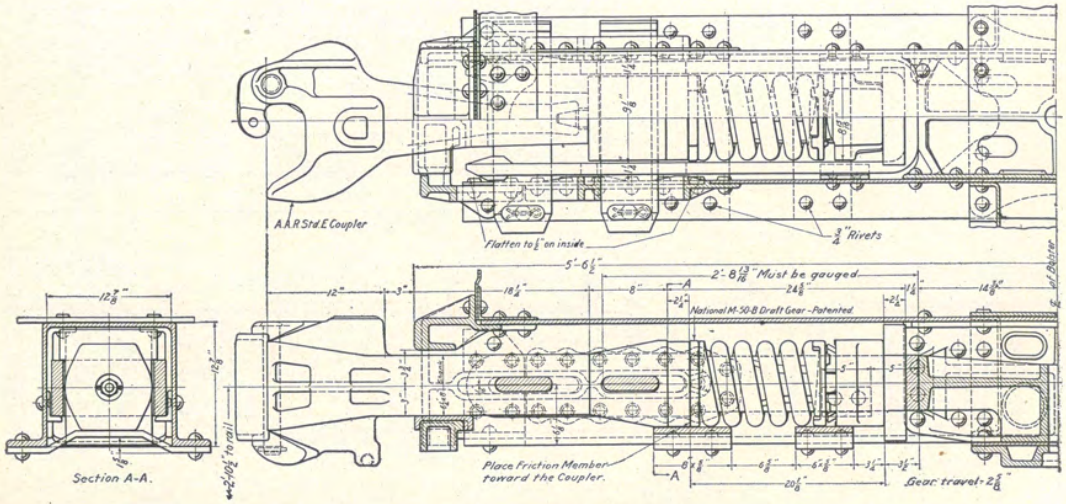


Fig. 10.78—National friction draft gear, Type M-50-B, applied to A.A.R. Type car in combination with A.A.R. Standard E Coupler and horizontal yoke.

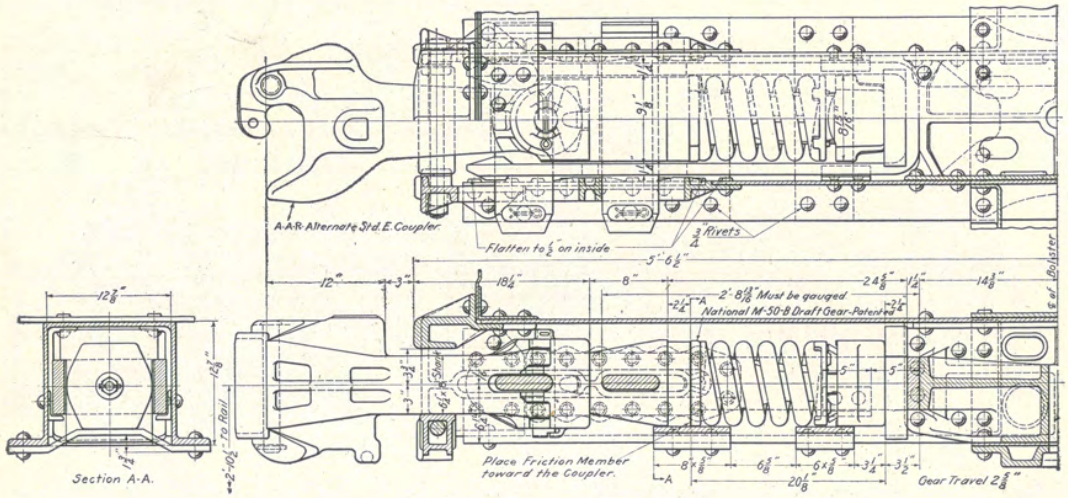


Fig. 10.79—National friction draft gear, Type M-50-B, applied to A.A.R. Type car in combination with A.A.R. Alternate Standard E coupler, swivel-butt castings and horizontal yoke.

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National Draft Gear, Type K-4

Designed to meet the exacting requirements of passenger and caboose equipment service

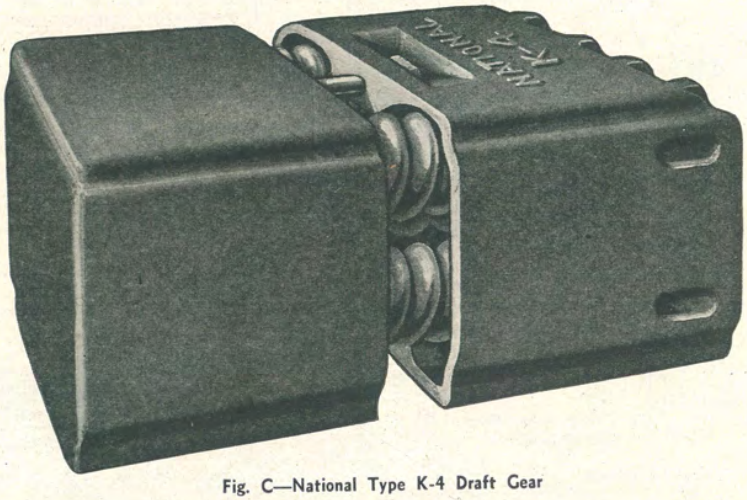


Fig. C—National Type K-4 Draft Gear

THE National Type K-4 Passenger and caboose Draft Gear embodies a combination of spring and friction resistance, the first one and one-half inches of travel in buff or draft being resisted by spring action, while for the remainder of the travel the spring action is augmented by frictional resistance to cushion the occasional heavier shocks incident to coupling, slack run-in, etc. This gear is of standard dimensions, 8⅞ in. by 12½ in. by 22⅜ in., and requires one follower. The total nominal travel is 2½ in.

Figure D shows a typical closure curve for this gear. The initial spring compression is approximately 3,000 pounds. This spring resistance increases as the gear closes, until at 1½ inches compression it is 45,000 pounds. After this the resistance increases more rapidly as the friction system comes into action.

The internal construction of this gear is such that as the gear releases, the friction system releases first, followed by release of the spring system. This means that the frictional cushioning capacity of the gear is always available, even in the case of a rapid succession of blows. The spring resistance and frictional resistance are so proportioned that pulsations in locomotive tractive effort are absorbed by the gear, thus insulating the cars from such disturbances.

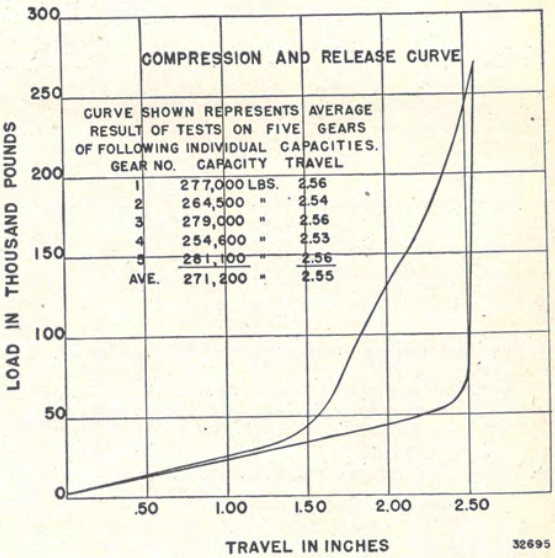


Fig. D—Closure Chart for Type K-4 Gears

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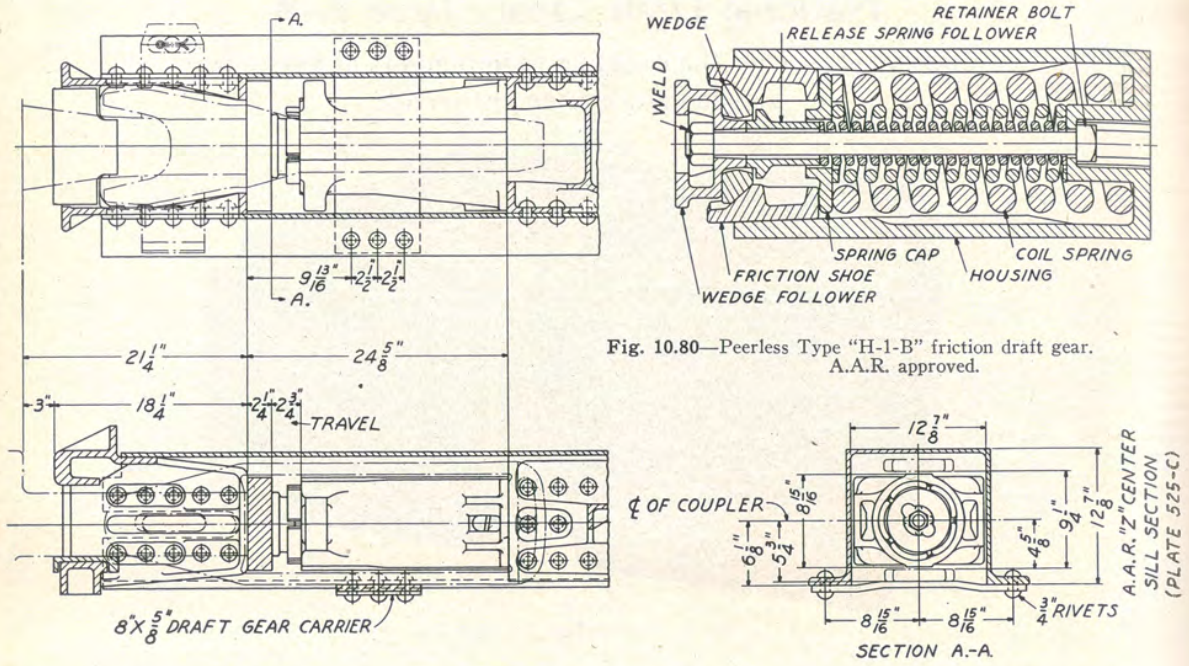


Fig. 10.80—Peerless Type "H-1-B" friction draft gear. A.A.R. approved.

Fig. 10.81—Application of Peerless Type "H-1-B" friction draft gear with A.A.R. standard vertical yoke.

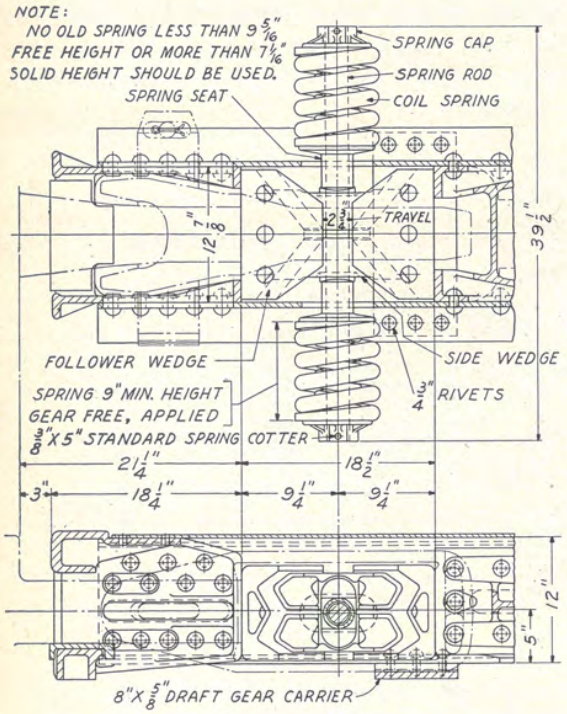


Fig. 10.82—Peerless Type "KC" friction draft gear.

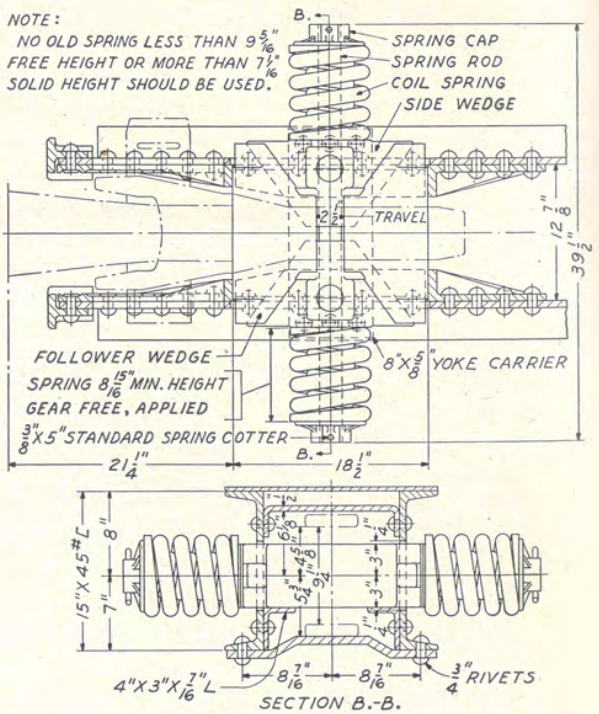


Fig. 10.83—Peerless Type "C" friction draft gear.

Peerless Equipment Company.

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Peerless Type H-1-B Friction Draft Gear

Clever design, careful selection of materials, and skilled workmanship Provide light weight, maximum protection, heavier pay load and long service life

THE Peerless Type H-1-B A.A.R. Approved Friction Draft Gear was particularly designed to meet the requirements imposed upon draft appliances under the most severe conditions.

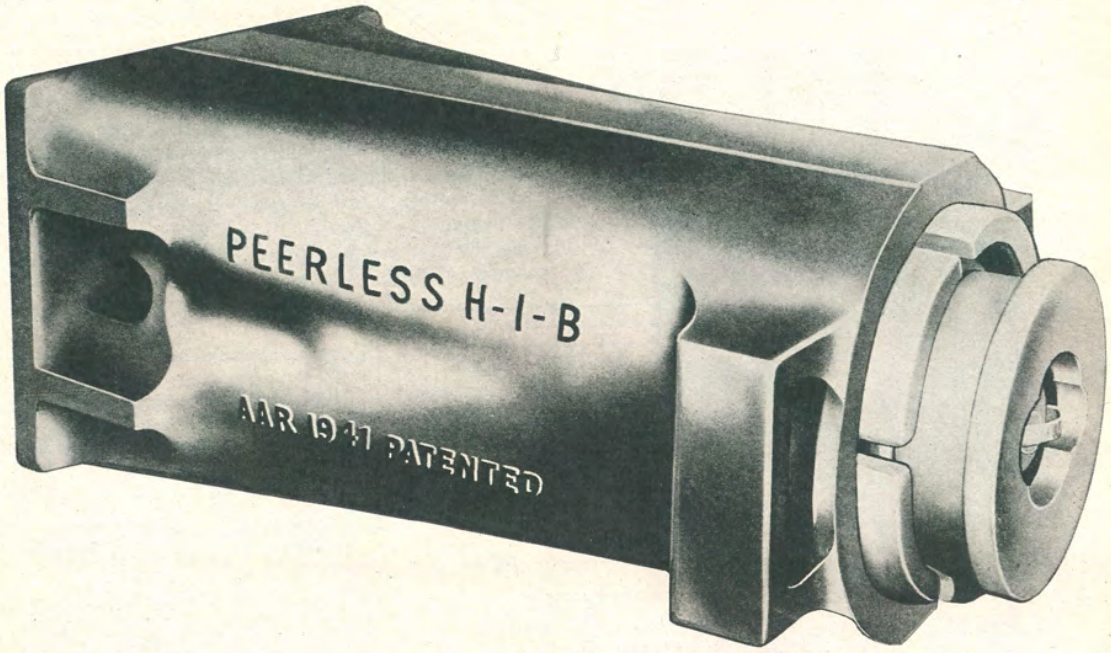
This gear is designed for uniformity, smoothness of action and high absorption qualities, with low recoil, resulting in a highly efficient mechanism adapted to effectively absorb the violent impacts incidental to present day traffic requirements.

shipped from the plant. This tup is a duplicate of the machine under which draft gears are tested for certification by the Association of American Railroads.

Other Interesting Features

The following features about the Peerless Type H-1-B Friction Draft Gear are worthy of note from the standpoint of operation and construction:—

1. In tests conducted at the A. A. R. Draft Gear Laboratory, Purdue University, and upon the results of which Certificate of Approval No. 8 was issued, this gear exceeded by a wide margin every requirement of the A. A. R. Specifications for Approved Friction Draft Gears.
2. Self-contained, easily assembled and easily applied.
3. Light in weight.
4. Positive release insured by an independent releasing mechanism. In the entire A. A. R. tests there was never a stuck blow.
5. Uniform and soft in action, high absorption, low recoil.



Peerless Type H-1-B Hylastic Vanadium Steel Friction Draft Gear.
A. A. R. Certificate of Approval No. 8

Care in Manufacture

Great care is exercised in the selection of materials, and the best physical properties suited for each part of the gear are determined by exhaustive tests. Each unit as assembled is "worked-in" to insure uniformity. The final result is a completely heat-treated product, each part being required to pass rigid physical and chemical requirements.

Inspection

Peerless H-1-B Draft Gears are tested for capacity, travel and action under a 27,000-lb. tup before being

PEERLESS EQUIPMENT COMPANY, CHICAGO, ILL.

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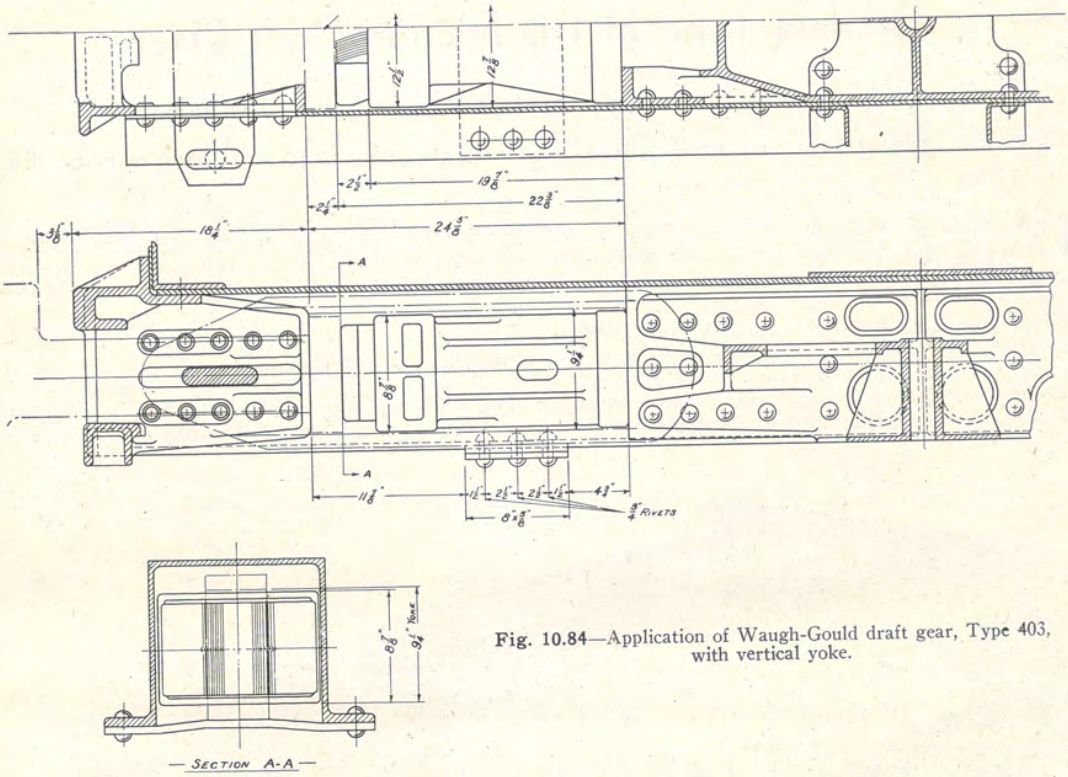


Fig. 10.84—Application of Waugh-Gould draft gear, Type 403, with vertical yoke.

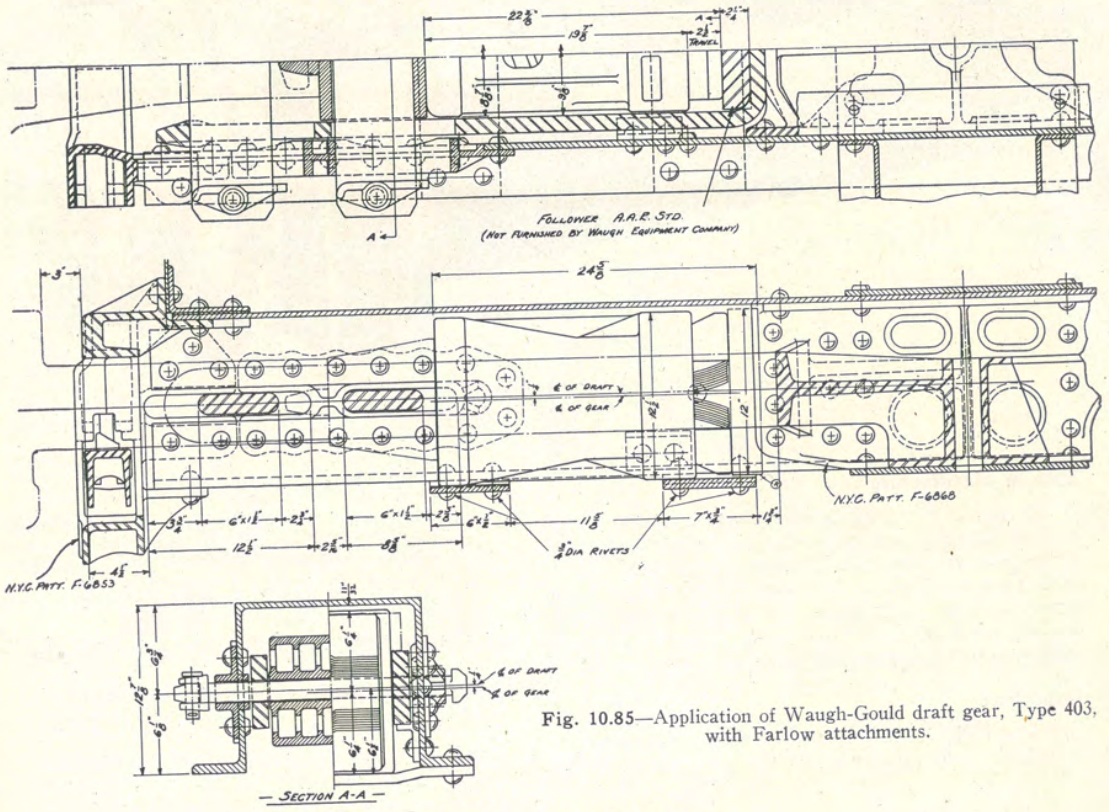


Fig. 10.85—Application of Waugh-Gould draft gear, Type 403, with Farlow attachments.

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Waugh-Gould Type 403 Friction Draft Gear

THE Waugh-Gould Type 403 Friction Draft Gear was awarded the first draft gear certificate of approval issued by the Association of American Railroads. Sturdy construction insures ample strength to withstand the severest impacts received in service. The resilience of the housing structure reduces to a minimum the forces resulting from oversolid blows. This gear will protect equipment and lading over a long period of time and will resist the heaviest shocks impressed upon it without damage to any of its parts.

Space Requirements

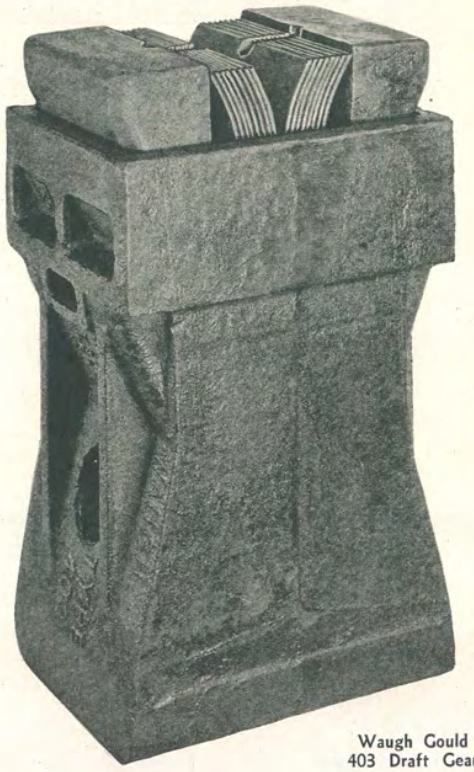
The normal external dimensions are 8⅞ in. by 12½ in. by 22⅜ in. requiring one follower for application to standard draft gear pockets. It is furnished with means for temporarily restricting the overall length to facilitate installation. The normal travel is 2½ in.

Construction

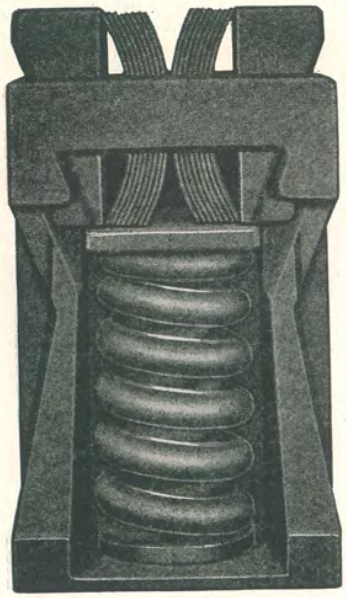
The Waugh-Gould Type 403 Draft Gear is comprised of a cast steel heat-treated housing having integral friction surfaces against which casehardened wedges operate under the pressure of leaf springs. These leaf springs are held both in alignment and in position between the wedges by means of end-nibs. The gear is held assembled by means of a lug at the bottom of each wedge, which is locked into the housing.

Operation

As the gear is compressed, the leaf spring pressure gradually increases on the wedges to a maximum at the point of full closure. This uniformly increasing pressure of the leaf springs against the wedges as the gear is closed, brings about exceptional smoothness of operation. The use of leaf springs for developing working pressures of the friction system eliminates slippage and minimizes loss of gear capacity due to rust or other etching elements. Under no circumstances will the gear creep or become closed under continued surges in heavy draft. Soft metal inserts in the wedges stabilize the coefficient of friction and maintain smooth friction surfaces, practically eliminating wear both on the wedges and housing.



Waugh Gould
403 Draft Gear



Cross-section of the 403 Gear showing spring arrangement

All parts are interchangeable. No special tools or appliances are required to assemble or disassemble the gears. They can be readily taken apart for inspection and easily reassembled.

Adaptable for Light Cars Used in Foreign Service

The Waugh-Gould 403 Friction draft gear, designed primarily for American freight service, can be readily converted to provide a gear suitable for lighter weight cars by making one small change. Six leaf springs are removed and a spacer is substituted. This provides a gear of lower capacity but one retaining the characteristic smoothness of the Type 403 Draft Gear.

WAUGH EQUIPMENT COMPANY, NEW YORK 17, N. Y.

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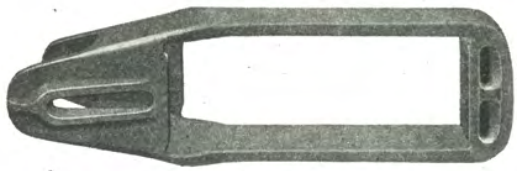


Fig. 10.99—Buckeye A.A.R. vertical-plane draft yoke for 24⅝ in. friction gears.



Fig. 10.100—Buckeye A.A.R. vertical-plane draft yoke of high-tensile steel.

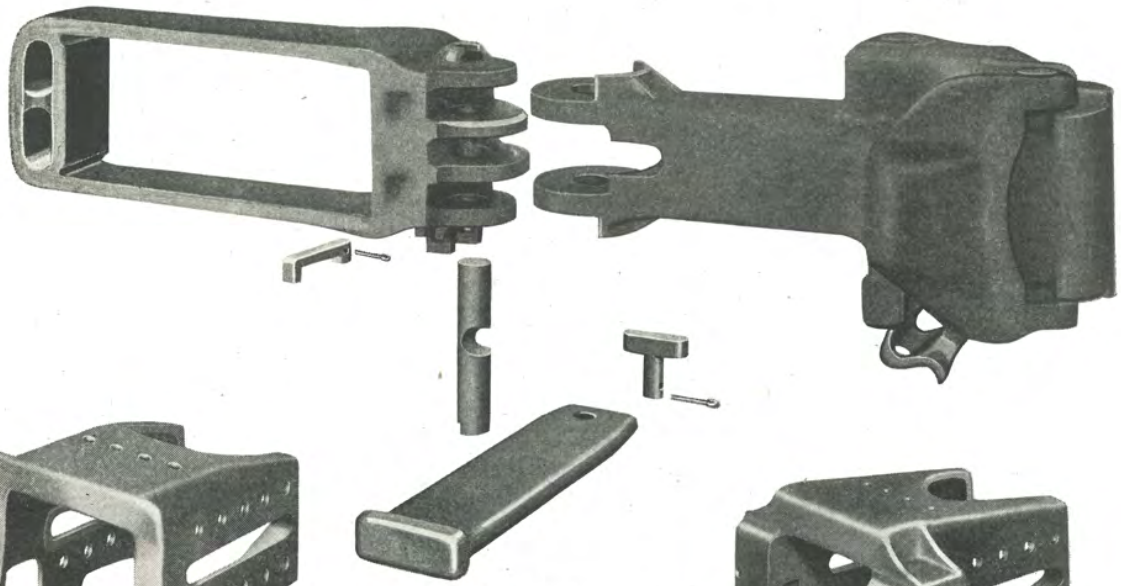


Fig. 10.101—Swivel shank coupler, swivel yoke, and attachments.

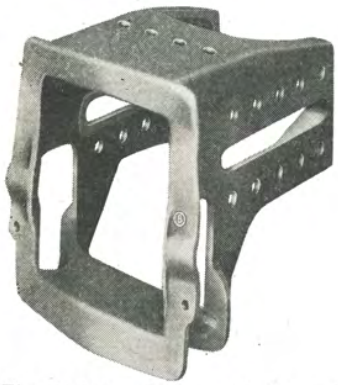


Fig. 10.102 — Striker with Integral Front Lugs and Swing Coupler Carrier.

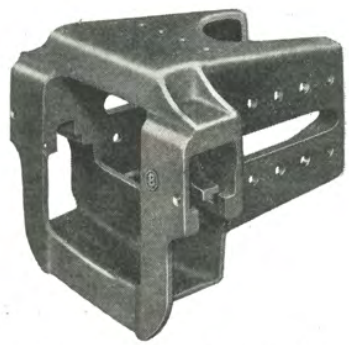


Fig. 10.103—Swing Motion Striker with Integral Front Lugs.

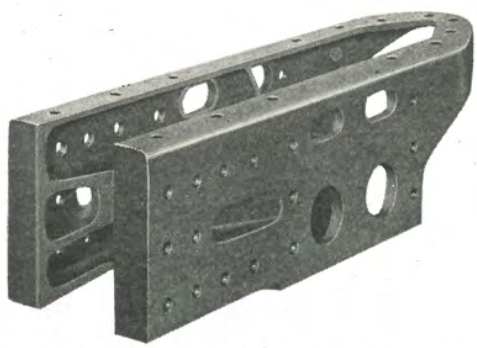


Fig. 10.104—Bolster Center Filler and Rear Draft Gear Lugs for box car.

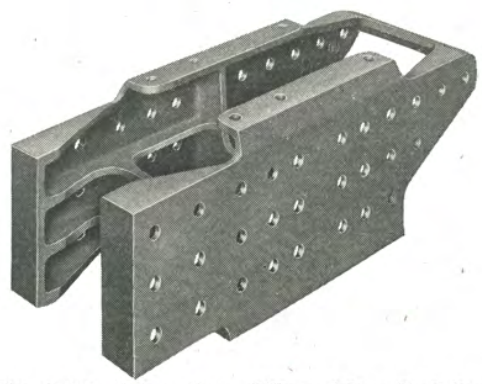


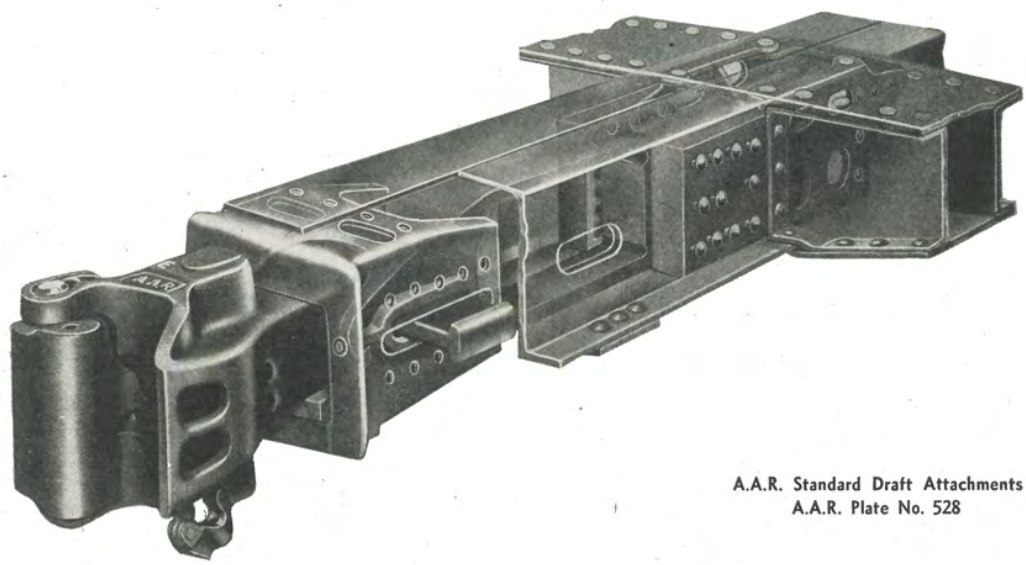
Fig. 10.105—Bolster Center Filler and Rear Draft Lugs for hopper car.

The Buckeye Steel Castings Company

(See also Page 973)

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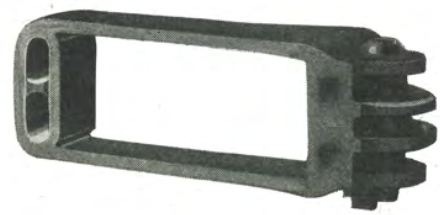
Buckeye Yokes and Draft Attachments



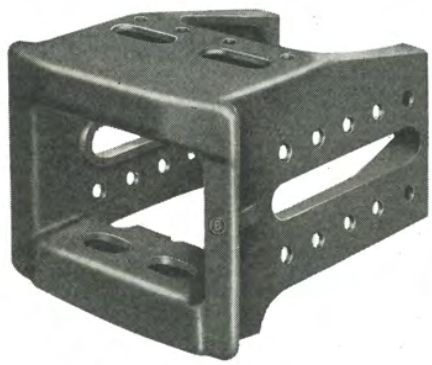
A.A.R. Standard Draft Attachments
A.A.R. Plate No. 528



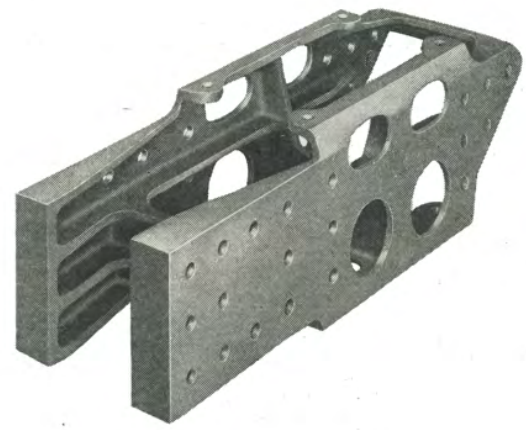
A.A.R. Standard
Vertical-Plane Draft Yoke



A.A.R. Alternate Standard
Vertical-Plane Draft Yoke



Striker with Integral Carrier
and Front Draft Lugs
A.A.R. Plate No. 532



Combined Bolster Center Filler
and Rear Draft Lugs
A.A.R. Plate No. 534

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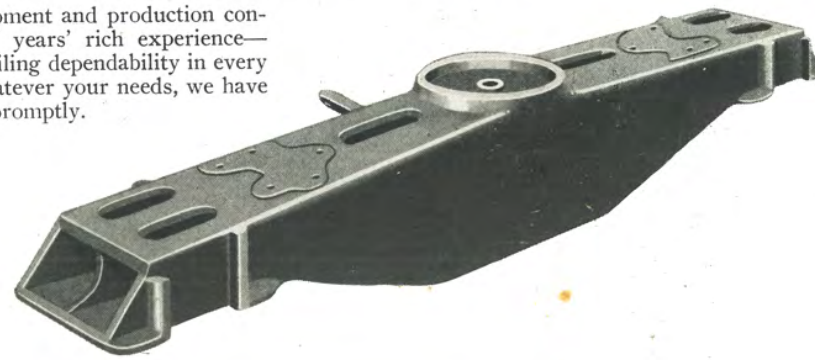
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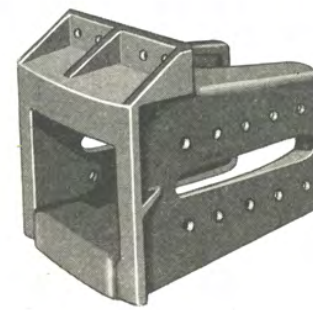
Truck Bolster



Integral-Journal-Box Side Frame



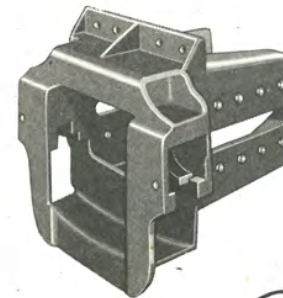
A.A.R. Vertical Plane Cast Yoke for Friction Gear



Striker with Integral Carrier and Front Lugs



Bolster Center Filler and Rear Draft Lugs



Swing Motion Striker with Integral Front Lugs

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EXHIBIT B

CAR BUILDERS' CYCLOPEDIA

1946

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1946
Car Builders' Cyclopedia
Of American Practice

Definitions and Typical Illustrations of Railroad and Industrial Cars, Their Parts and Equipment; Cars Built in America for Export to Foreign Countries; Descriptions and Illustrations of Shops and Equipment Employed in Car Construction and Repair

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Foreword

In the tenth edition, 1922, of this work it was transformed from what might be termed an illustrated Dictionary to a Cyclopedia and the data were compiled in a manner differing radically from that of previous editions; all information relating to a specific subject was combined within a single section instead of being placed in several separate groups. In former editions each of these groups—Association of American Railroads (formerly American Railway Association, Mechanical Division, and originally Master Car Builders' Association) specifications and drawings, general illustrations, and manufacturers' descriptive pages—were in different sections of the book, necessitating considerable cross reference and inconvenience in obtaining complete information on any subject. In the tenth edition, the material was so arranged and indexed that reference to the general index, or the table of contents gave the location of each class of cars or appliances.

Other indexes—General Index to Car Parts and Products—Trade Name Index and Index to Advertisers—were given in the last pages of the book. The Association of American Railroads "Rules of Interchange" and diagrams of the "Loading Rules" were omitted as these are now obtainable in convenient booklet forms.

In this volume, the Seventeenth Edition, the same general arrangement has been followed, with the division into sections clearly defined. In a few cases the arrangement has been changed somewhat in order to make the material more readily accessible. As a further aid, the Table of Contents by sections and subdivisions on page six and the General Index to Car Parts and Products at the end of the book have been amplified and improved and in addition a summary of the contents of each section is given on the first page of the several sections.

Many new designs of cars and appliances in the field of railway car construction have been made since the publication of the previous edition. These have been included as far as possible in order that this Edition might contain the latest practices in American Car Construction and Equipment.

The work of compiling data and rearranging the book has entailed a vast amount of research and revision, in connection with which valuable assistance has been given by an Advisory Committee appointed by the Mechanical Division of the Association of American Railroads, by many other railway mechanical officers, by the railway car builders and by the manufacturers of railway supplies.

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Body Brace. An inclined member of the body side or end framing of the car.

Body Center Plate. The center plate attached to the under side of the body bolster. See CENTER PLATE.

Body Check or Safety Chain Eye. An eye bolt or clevis for fastening a truck check chain or safety chain to the car body.

Body Check or Safety Chain Hook. An iron hook on the check chain, which enters into the check chain eye.

Body Cross Tie. A metal bar extending across a hopper or other form of open-top freight car and fastened to the sides to prevent their bulging.

Body End Furring. Furring in the end of a car. See FURRING.

Body End Plate. A transverse member in the end of a car connecting the side plates. See END PLATE.

Body End Rail. See WAINSCOT RAIL.

Body Framing. The framework of that part of a car above the underframe, so called to distinguish it from the underframe. It is commonly subdivided into side, end and roof framing.

Body Post (Freight Car Bodies). An upright piece which is fastened to the sill and plate of a freight car. The body posts and corner posts form the vertical members of the side frame of a car body. See POST and SIDE POST.

Body Side Bearing. The upper one of the two side bearings, which is attached to the body bolster. See SIDE BEARINGS.

Body Transom. A name sometimes given to a Needle-beam or Crossbearer.

Body Unit. One complete part of an articulated car. See ARTICULATED CAR.

Bogie. A British term for a swiveling car truck. American eight-wheel cars are termed bogie carriages, or wagons, in Great Britain

Bogus Plate (Refrigerator Cars). A horizontal timber attached to the posts on the inside of the car, a short distance below the plate. The bogus plates support horizontal cross members, called meat racks, or hanging bars, to which hooks are attached for hanging meat. See MEAT RACK.

Bolster. A cross member on the under side of a car body and in the center of a truck, through which the weight is transmitted. The bolsters carry the body and truck center plates, the body bolster resting on the truck bolster.

Truck bolsters are either swing bolsters, admitting of lateral motion to mitigate shocks, or rigid bolsters, which permit no lateral motion. See BODY BOLSTER, SWING BOLSTER and TRUCK BOLSTER.

Bolster Anchor. An arm pivoted to the truck frame and to the truck bolster to constrain the movement of the latter in a desired manner.

Bolster Bridge (Six-Wheel Truck). See SIDE BEARING ARCH.

Bolster Center Filler. A hollow box-shaped member placed between the center sills and body bolster plates; the king bolt passes through it.

Bolster Diaphragm. See BODY BOLSTER DIAPHRAGM.

Bolster Guide Bars (Diamond Arch Bar Trucks). See COLUMN.

In modern trucks with cast steel side frames the bolster guide bars are cast integral, as part of the frame.

Bolster Hanger. See SWING HANGER.

Bolster Hanger Carrier. A Swing Hanger Pin Bearing.

Bolster Jack Screw (Wreck Cranes). A jack screw attached to the spring plank for the purpose of taking the load off the springs and making the entire truck and car body one rigid structure when the derrick of the crane is in use.

Bolster Roll Stabilizer. Comprises a split spring plank, the two separate parts of which are connected to each other and to the bolster so as to prevent the bolster from moving out of plane with the track and overloading the springs.

Bolster Spring. The main spring of a car, supporting the truck bolster, on which the weight of the car body rests.

Bolster Thimble. A small filler sometimes used between the cover plates of a bolster when the main filler or web does not extend clear to the end of the bolster.

Boom (Steam Shovel). The heavy swinging arm which carries the boom engine and ratchet beam. It is stepped at the foot of the "A" frame and held in its inclined position by boom guys.

Bottom Arch Bar. See ARCH BAR.

Bottom Connecting Rod. The brake rod connecting the bottom ends of the live and dead truck brake levers.

Bottom Rod. See BRAKE ROD and BOTTOM CONNECTING ROD.

Bottom Rod Guard or Emergency Support. Name applies to devices designed to support the bottom rod and prevent it from dropping to the track in case of failure of any part which normally supports the bottom rod. Also called safety support.

Bottom Truck Connection. See BOTTOM CONNECTING ROD.

Bow. See PLATFORM HOOD BOW.

Box. See JOURNAL BOX.

Box Car. A car with sides enclosed and having a roof; doors are placed in the sides or sides and ends. Used for general service and especially for lading which must be protected from the weather.

Box Car Door. Used on both the sides and sometimes on the ends of automobile car.

Box Cars, Framing for. See general drawings of cars. Sections 2 and 3.

Box Car End, Design and Strength. Manual, C-7.

Box Cover. See JOURNAL BOX LID.

Box Guide. See PEDESTAL.

Box Lid. See JOURNAL BOX COVER or LID.

Box Packing. See JOURNAL PACKING.

Box Section Bolster. A bolster whose cross-section is of rectangular shape.

Box Steps. A term sometimes used to distinguish platform steps made with sides, from open steps.

Brace. An inclined piece which unites two or more of the points of a frame or truss, where other members of the structure are connected together, and which prevents them from turning about their joints.

Bracket Lamp. A lamp attached to a wall by a suspension in the form of a bracket.

Bracket Steps (Hopper Cars). Steps secured to the side of the car on the inside to serve as a substitute for a running board.

Brake or **Brake Gear.** The whole combination of parts by which the motion of a car or train is retarded or arrested. The foundation brake gear includes all the parts by which the pressure of the

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the bolt. A cotter is then inserted, thus securing the nut.

Ceiling. The inside or under surface of the roof or covering of a car. This term is sometimes used to mean Sheathing. The ceiling of a passenger car is generally termed Head Lining. Deafening Ceiling is boarding under the sills of a car. See HEAD LINING.

Ceiling Furring. Strips or pieces of wood fastened to the under side of the carlines, to which the paneling or veneering of the ceiling is applied.

Ceiling Veneers. Thin boards used for covering the ceilings of passenger cars. The term is also misapplied to the thin preparations of paper maché, etc., in imitation of natural wood veneers. See VENEER.

Celestial Field. A term used in interior illumination. The celestial field of a car interior would be the upper walls and ceilings.

Cement Car. See COVERED HOPPER CAR.

Center Anchor. An arrangement of plates, which are riveted to the tank and to the center sills at the center of a tank car. These plates anchor the tank to the frame and supplant head blocks and double anchors at the ends.

Center Bearing. The place in the center of a truck where the weight of the body rests, the truck bolster center plate. A body center plate attached to the car body here rests on a truck center plate attached to the truck. The general term center bearing is used to designate the whole arrangement and the functions which it performs, in distinction from Side Bearing. See also CENTER PLATE.

Center Bearing Arch Bar. See CENTER BEARING BRIDGE.

Center Bearing Beam. See CENTER BEARING BRIDGE.

Center Bearing Bridge (Six-Wheel Trucks). A structure formed by the top and bottom center bearing arch bars to support the center plate block or center bearing beam and transmit the weight of the car to the bolsters, on which its extremities rest.

Center Bolster. A center bearing bridge made in a single unit either built up, welded or cast steel.

Center Buffer Spring. A spiral spring situated above the draft springs in some forms of passenger draft gear and intended for buffing purposes only.

Center Buffer Stem. See BUFFER STEM.

Center Door Rail. See MIDDLE DOOR RAIL.

Center Draft Drawbar. A drawbar which is connected directly with the king bolt of a truck. It is especially designed for use on very sharp curves. Sometimes termed radial drawgear.

Center Dump Car. A car which will discharge its entire load between the rails.

Center Girth. See DOOR CENTER GIRTH.

Center Pin or **King Bolt.** A large bolt which passes through the center plates on the body bolster and truck bolster. The truck turns about the bolt, but the stress is taken by the center plates. It is, therefore, a mere pin and not a bolt in the usual sense. The name king bolt is derived from the name of the corresponding part of the front wheels of a wagon. Center pin, however, is the more common term.

Center Pin Floor Plate. A plate or casting set into the floor of a passenger equipment car to cover the head of the center pin.

Center Plate. One of a pair of plates which fit one into the other and which support the car body on the trucks, allowing them to turn freely under the car. The center pin or king bolt passes through both, but does not really serve as a pivot. The body center plate or male center plate is attached to the under side of the body holster or in cast steel bolsters is made an integral part of the casting. The female or truck center plate is attached to the top side of, or cast integral with, the truck bolster. When the car is tilted, as on a curve, part of the weight is carried on the Side Bearings. See ANTI-FRICTION, BALL BEARING, and ROLLER CENTER PLATES.

Center Plate Block. The member supporting the center plate of a six-wheel truck.

Center Rod (Postal Car). A device which fits in a socket at the top of the pedestals, and to which the ends of the two rods, which support the distributing trays, etc., near the center of the car, are fastened.

Center Sill. The central longitudinal member of the underframe of a car, which forms, as it were, the backbone of the underframe and transmits most of the buffing shocks, from one end of the car to the other. In the A. A. R. standard box car the center sill is one of the units for which a required standard has been established. In freight cars with cushioned underframe a special type of floating center sill construction is followed. For passenger cars no set standard has been established and some unique designs are in use, as in the case of passenger cars built entirely of stainless steel. See CUSHIONED UNDERFRAME.

Center Sill Bottom Angle. The angle at the bottom of a center sill of the built-up type.

Center Sill Bottom Cover Plate. See CENTER SILL COVER PLATE.

Center Sill Cover Plate. A flat plate riveted or welded across steel center sills, either above or below, to give additional strength.

Center Sill Separator. A filler piece placed between the center sills at cross members.

Center Sills, Splicing of. See Manual, C-10.

Center Sill Stiffener. A filling piece riveted between the center sills to act as a brace for holding them rigid.

Center Sill Top Angle. The angle at the top of a center sill of the built-up type.

Center Sill Top Cover Plate. See CENTER SILL COVER PLATE.

Center Sill Web Plate. The plate which forms the web of a center sill of the built-up type.

Center Stop (Tip Car). A bracket or block attached to a draw member to restrain the body from moving longitudinally.

Centering Device. See COUPLER CENTERING DEVICE.

Centering Gage. A gage to fix the middle point of an axle.

Centrifugal Dirt Collector. A device connected in the branch pipe between the brake pipe and distributing valve, or triple valve, and so constructed that due to the combined action of centrifugal force and gravity, all dirt and foreign material is automatically eliminated from the air flowing through the collector chamber and by means of a plug may be removed without breaking any pipe connections whatever. When this device is used, the brake pipe air strainer is omitted.

Chafing Plate. A removable metal plate to resist wear, used on truck transoms, pedestal jaws, and other places where wear concentrates.

Chair. The usual designation for the seats of parlor cars. Ordinary chairs are used in dining cars. See RECLINING CHAIR, PARLOR CAR CHAIR.

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As its name implies, the resilience of the rubber draft gear is provided by blocks or rubber set between steel plates.

For further draft gear details see Section 10.

Draft Gear Attachments. The parts which connect the Coupler and the Draft Gear.

Draft Gear Carrier. A plate which extends underneath the draft sills and supports the draft gear.

Draft Gear Cheek Casting. See DRAFT CASTING.

Draft Gear Followers. See FOLLOWERS.

Draft Gear Pocket. The space occupied by the draft gear and followers in the center or draft sills. Manual M-901.

Draft Gear Yoke. See YOKE.

Draft Key. A key used to connect the coupler shank to the yoke. It is extended to pass through key slots in the draft sills and front draft lugs. Section 10.

Draft Key Retainer. A pin inserted at one end of the draft key to prevent it from backing out through the slot in the center sills. The pin has an elongated head to provide a larger wearing surface against the sill.

Draft Lug Angle. An angle riveted to the bottom of the center sill at the draft gear, to which the lower part of the draft lug is fastened.

Draft Plate. See DRAFT LUG.

Draft Sill. Same as CENTER SILL.

Draft Sill Tie Plate. A plate riveted to the draft sills to aid in holding them rigid.

Draft Spring. A spring attached to a coupler or drawbar to give elasticity. They are so arranged by means of follower plates at each end as to resist either tension or compression.

Drain Cock. See RESERVOIR DRAIN COCK.

Drain Cup (Air Brake). A globular receptacle under a triple valve to collect the water of condensation.

(Refrigerators and Ice Cars.) A metal cup through which the drippings from the ice pass, but which is so arranged as to prevent the entrance of air to the car.

Drain Valve (Car Heating). A valve for draining off the water condensed in the steam pipes where an automatic trap is not used.

Drapes. Heavy cloth hung at windows instead of roller curtains. They are usually supported on rods to adjust the closure. Also used in door ways to smoking and reclining rooms.

Draw Head. The head of an A. A. R. automatic coupler, exclusive of the knuckle, knuckle pin and lock.

Drawbar. A term formerly used synonymously with Coupler. It has been used indiscriminately to designate both the old link and pin drawbar and the modern automatic car coupler. There has been in the past an effort to confine the name drawbar to the old link and pin type, but in the proceedings of the M. C. B. Association, now A. A. R., in speaking of the height of drawbars, the term is applied to the standard automatic coupler. See COUPLER.

Drawbar Safety Lug. See COUPLER HORN.

Drawbar Stop. See DRAFT CASTING.

Drawing Room. A small room or compartment in a sleeping or drawing-room car. Usually fitted with double berths, a sofa or lounge and private toilet facilities. See STATEROOM.

Drinking Cup Vendor. A device for holding and supplying drinking cups.

Drip Coupling or **Basin Coupling** (Wash Basin). The connection of the waste pipe or drip pipe with the basin.

Drip Pan (Refrigerator Car). A dish or pan at one corner or end of the car for receiving the water from the melting ice, usually permitting it to escape to the roadbed through a trap.

Drop Bottom. See DROP DOOR.

Drop Bottom Car. A gondola car with a level floor or bottom, equipped with a number of drop doors, for discharging the load. See also HOPPER BOTTOM GONDOLA CAR.

Drop Brake Shaft. A brake shaft for flat cars which is normally in a vertical position, but can be dropped to a horizontal position and still remain operative should conditions of lading require this to be done.

Drop Door. A door at the bottom of a drop bottom or hopper gondola car for unloading it quickly by allowing the load to fall through the opening. Drop doors are usually in pairs, and are supported by a chain wound upon a winding shaft; or by a lever arrangement. Frequently a drop door beam extends across the car above the winding shaft to assist in supporting it and to stiffen the car.

Drop Door Chain. A chain attached to a drop door, and usually connecting it with a winding shaft, for the purpose of controlling the door. Also sometimes termed Hopper Chain.

Drop Door Chain Ring. An iron ring to which are fastened the single chain passing around the door winding shaft and the two chains which are attached to eye bolts in each of the double drop doors.

Drop Door Eye Bolt. An iron bolt with an eye in the upper end which is fastened to a drop door near the edge away from the hinge and to which is secured the drop door chain.

Drop Door Gear. See DOOR OPERATING GEAR.

Drop End. Used on many gondola cars. The entire end is arranged to swing down at right angles to its normal position, for loading long materials.

Drop End Gondola Car. A gondola car with the ends in the form of doors, which can be dropped when the car is used for shipping long material which extends over more than one car.

Drop Forging. One made by the use of dies, under a drop hammer.

Drop Suspension (Electric Lighting). A drop or bent frame attached to the truck frame. The belt or chain is adjusted by sliding the generator along on the frame and this arrangement is called the sliding-type suspension. See SUSPENSION.

Drop Table. A table hinged to the wall so as to drop against it out of the way when desired.

Drovers' Car. A car similar to a caboose except that a drovers' car is equipped with bunks for the accommodation of stockmen and drovers who accompany a train carrying a shipment of livestock. The car is attached to a stock train.

Drum. (Hoisting Gear.) The main cylinder upon which the hoisting rope winds and unwinds. The spur wheel is carried on the same shaft.

Drum Shaft (of a Derrick or Crane). The shaft on which the winding drum is carried.

Dry Closet. A closet, so called in distinction from a water closet, which is not flushed with water.

Dummy End (Passenger Equipment). See BLIND-END CAR.

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To overcome contact friction, rollers, and rockers are used in many different ways. If the portion containing the anti-friction member is fastened to the truck bolster, it is known as a truck side bearing; if fastened to the body bolster, it is considered a body side bearing.

Other types of side bearings employ springs and friction elements to maintain constant contact and control relative movement between car body and truck.

Side Bearing Arch or Bridge (Six-Wheel Truck). A truss attached to the bolsters to support the truck side bearing.

Side Bearing Brace. A filler block between the body bolster diaphragms that supports the side bearing.

Side Bearing Truck. A truck in which the weight of the car is transmitted at the side instead of the center. The term balanced side bearing truck is also used to indicate that the car body is so balanced on the truck that the weight is equally distributed to all the wheels at all times. Not commonly used.

Side Brace. Commonly designated as body brace or brace, except when the end braces are to be distinguished from them.

Side Casting. See DRAFT LUG.

Side Deck Lamp. A bracket lamp fastened above the windows and to the deck sill, or to the lower deck ceiling and the deck post.

Side Door. Designated thus to distinguish from end door on both freight and passenger equipment.

Side Door Bottom Guide. An iron bracket attached to the side of freight cars having sliding doors to guide the door while it is being opened and shut and also to prevent its swinging away from the car at the bottom.

Side Door Fixtures. See Section 3.

Side Door Hanger. See DOOR HANGER.

Side Door Protection Strip. See PROTECTION STRIP.

Side Door Top Track. See DOOR TRACK.

Side Dump Car. A car so constructed that its contents may be discharged to either side or both sides of the track through doors in the car sides, or drop doors in the floor; by means of an inclined floor and side doors; or by tipping the car body sidewise. See also DUMP CAR.

Side Eave. A term sometimes used to designate a steel plate running along the eaves or edge of the roof of a steel passenger equipment car.

Side Fascia. See FASCIA.

Side Frame. The frame which forms the side of a car body or a truck. It includes the posts, braces, plate, belt rail, etc., for the car body; and the side member of a truck frame. See TRUCK SIDE FRAME.

Side Furring. See FURRING.

Side Lamp. A lamp attached to the side of a passenger car in distinction from a center lamp, which is attached to the roof. They are usually made with brackets, by which they can be conveniently fastened.

Side Nailing Strip. A piece of wood bolted outside the side sills of steel underframe cars to which the ends of the floor planks and the bottom ends of the sheathing are nailed. See NAILING STRIP.

Side Plate. More properly, simply plate. The longitudinal member connecting the tops of the side posts of the car body. So called as distinguished from the end plate.

Side Plate Stiffening Angle (Steel Cars). An angle iron riveted to the side plate, and serving the same purpose as the stakes. Often called stake.

Side Plate Tie Rod. A rod extending across the top of the car and tying the side plates together.

Side Post. Vertical member used in the side framing of freight and passenger cars.

Side Rail. A longitudinal member extending along the top of the side frame of a coal or ore car. It rests upon posts and braces and connects with end rails, which go across the end of the car. It corresponds to the plate of a box car, but does not carry any carlines, as does a plate.

Side Seat. A longitudinal car seat, the back of which is against the side of a car.

Side Sheet. A plate used for closing in the sides of a steel car.

Side Sill. The outside longitudinal members of the underframe. In some designs of steel cars the side sills are dispensed with and the entire side of the car is designed as a deep plate girder to carry most of the load to the bolster.

Side Sill Step. See SILL STEP and Section 14.

Side Slope. That part of the floor which slopes from the side of a hopper to the hopper door. See HOPPER SLOPE SHEET.

Side Stake. See STAKE.

Side Stake Pocket. See STAKE POCKET.

Side Stem. A bar attached to the side of a three-stem coupler to transmit part of the force to springs separate from the regular draft springs. See THREE-STEM PLATFORM EQUIPMENT.

Side Straps (Wooden Gondola Car). The straps to which the end planks and sometimes also the side planks, are bolted. They are also called side plank tie straps.

Side Strut for Hopper Floor (Hopper Cars). An inclined strut or support for the hopper floor between the bolster and the end of the car, fastened to the corner of the end sill.

Siding. See SHEATHING.

Signal Branch Pipe. A pipe leading from the train air signal pipe to the car discharge valve.

Signal Cord. A rope or sash cord extending along a passenger car wall inside and attached to the air signal discharge valve; a pull on the cord releases the air in the signal pipe and blows the signal in the cab.

Signal Cord Bushing. A thimble lining a hole through a partition for a signal cord to pass through, in distinction from a signal cord guide, which is attached to the side or roof of the car or to the signal cord hanger.

Signal Cord Guide. A metal eye or ring attached to the roof or ceiling of a car, or to the end of a Signal Cord Hanger, and by which a signal cord is carried or conducted. See also SIGNAL CORD BUSHING.

Signal Cord Splice. A metal coupling with right and left hand screws for permanently splicing the ends of a broken cord. See also SIGNAL CORD COUPLING.

Signal Hose. An air hose similar to, but of smaller diameter than, an air brake hose, and used between cars to connect the train air signal lines.

Signal Lamp. See MARKER.

Signal Lamp Bracket. See MARKER BRACKET.

Signal Lamp Socket. See MARKER BRACKET.

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called the brake step, is also sometimes used. A bracket called a tank step is attached to the tanks of tank cars.

Step Box. A portable box-shaped step, for use between the bottom passenger car step and a low station platform.

Step Hanger. A vertical board or metal plate by which the steps are supported from the corner of a car and from the platform end sill.

Step Nosing. A metallic facing or molding for the tread of stair steps.

Step Riser. The vertical portion of a step in stairs.

Step Treads. See SAFETY TREAD and TREAD.

Steps, Folding. On many streamlined passenger cars the vestibule steps are hinged to fold up when closed, forming a smooth outline.

Stile. The upright pieces on the outer edge of a door or sash, as door stile, sash stile, window stile, etc.

Stirrup. A kind of ring or bent bar of iron resembling somewhat the stirrup of a saddle. A coupler carry iron is sometimes called a stirrup.

Stock Car. A car for the transportation of live stock, equipped with roof, slatted sides and side doors, single or double deck and frequently with feed and water troughs.

Stop Bar (Sleeping Car). A bar to connect the two seats on which the seat bottoms may rest when drawn down to make up a lower berth. It rests upon a stop bar plate.

Stop Bar Guide. An attachment to hold a stop bar in place laterally.

Stop Cock. A simple form of cock having a body and tapered plug which has an opening through it. When the plug is turned so that the holes in it correspond to the ports in the body the liquid flowing in the pipe can pass through the cock. When the plug is turned so that the openings do not correspond, the flow is stopped.

Stop-Key Journal Bearing. A key or wedge with a lug or projection which bears against the end of the axle to restrain lateral motion and thus dispense with a collar on the axle. Not in general use.

Storage Battery. A storage battery consists of a number of metallic plates, separated by suitable insulators, immersed in an electrolyte within a proper container. Its function is to convert electrical energy into chemical energy during the operation known as charging and the reverse when discharging. When charging, the terminals are properly connected to a source of electrical supply, usually a direct-current generator driven from the car axle or by an independent engine. Storage batteries are used to supply current for car lighting and air conditioning in passenger train cars and are carried in battery boxes suspended from the underframe.

Storage Battery Car. A motor car driven from storage batteries.

Stove Pipe Jack. A covering or bonnet for the aperture of a stove pipe on the outside of a car. Practically obsolete except on cabooses and work cars.

Strap Bolt or **Lug Bolt.** A round bolt with a flat bar of iron or steel welded to it, and usually with a hook on the end which serves the purpose of a head. The flat bar has holes in it, by which it can be fastened in place with rivets, bolts, or screws.

Strap Washer. An iron or steel strap which takes the heads of several bolts. Also called washer plate.

Streamline. The general term given to the type of construction which provides a smooth continuous outer surface on passenger cars. By rounding both ends of a train equipped with such cars, head-on air resistance and air drag are reduced.

Street Ell. An elbow pipe fitting with male thread on one end and female thread on other end.

Striker. See STRIKING PLATE.

Striker Arm. A seat arm. The terms striker arm, seat back arm and seat arm are commonly used.

Striking Horn. The stop shoulder, or horn of a coupler, arranged to touch the striking plate before the draft gear goes solid.

Striking Plate. A member placed on the ends of the center sills of freight cars against which the horn of the coupler strikes, preventing damage to the draft gear and center sills.

String Board (Passenger Car Steps). A vertical plate which supports the ends of the steps. A step hanger.

Stringer. A term sometimes applied to a floor nailing strip or a steel member which acts as a support for a nailing strip. A longitudinal floor stringer sometimes occupies a position similar to that of an intermediate sill but is not designed to perform its duties. See NAILING STRIP.

Stringer Pocket. A casting for supporting the end of a beam or stringer. In automobile and similar cars, for facilitating the use of a second or upper deck for increasing the loading capacity for small freight.

Strut (Truss). A member subjected to a strain of compression. A vertical strut is usually called a post. See also BRAKE BEAM STRUT.

Stud. A headless bolt, threaded on both ends. A standing bolt, pin, boss or protuberance designed to hold an attached object in place. Especially a headless bolt permanently screwed into a tapped hole in a casting or forging.

Sub-Carline (Refrigerator Car). A strip of wood under the main carline, supporting the sub-roof. See CARLINE.

Sub-Floor (Refrigerator Car). A layer of flooring boards under the main floor, and usually separated from it by an air space and hair felt or some other form of special insulation.

Sub-Roof (Refrigerator Car). The inside layer of boards of the roof proper, supported on sub-carlines.

Sub-Sill. A sill attached under another sill to reinforce it.

Subway Car. An electric motor car for use in subways in large cities.

Sugar Cane Car. See CANE CAR.

Supply Pipe (Air Compresser). A pipe sometimes connected to the air inlet of an air compressor by means of which the air supply is drawn from a point some distance away from the compressor.

(Lavatory Fittings.) Pipes which carry hot or cold water to the basin faucets.

Supply Valve (Steam Heating). A valve for regulating the supply of steam in the radiator pipes of a car.

Suspension (Motor Car). The method of supporting a railway motor. Except in the case of gearless motors, the suspension is designed to put as little dead weight as possible on the axle.

(Electric Lighting.) The iron work and fittings which are attached to the body or truck for supporting or suspending the axle generator and which include the belt tightening and aligning devices. The

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Trap Door Latch (Vestibule). The latch for the vestibule trap door.

Trap Door Lock. See TRAP DOOR LATCH.

Traversing Jack. A jack that can be moved horizontally on a bed or track while under its load. See JACK.

Tread (of a Step). The part on which the foot is placed. See TREAD BOARD and SAFETY TREAD.

(Of a Car Wheel.) The exterior cylindrical surface of a car wheel next to the flange which comes in contact with the rail.

Tread Board (of a Step). The horizontal part on which the foot is placed. Usually covered with rubber or metal safety treads to prevent slipping. See TREAD and SAFETY TREAD.

Triple Valve (Air Brake). A device which automatically performs three functions in operating the air brakes on older freight cars. It charges the auxiliary reservoir, applies the brakes and releases the brakes according to the varying pressures in the train line. Now being superseded by AB equipment.

Triple Valve Branch Pipe (Air Brake). A short pipe by which the triple valve is connected with the brake pipe.

Triple Valve Gasket. A gasket placed in the joint between the triple valve and the passenger brake cylinder or freight car auxiliary reservoir.

Triple Valve Piston (Air Brake). See TRIPLE VALVE.

Trolley. See PANTAGRAPH TROLLEY.

Truck. The general term covering the assembly of parts comprising the structures which support a car body at each end (or, in the case of articulated cars, the joint support of two abutting car ends) and also provide for attachment of wheels and axles.

Truck Bolster. A cross member in the center of a truck, on which the car body rests. The truck bolster is connected to the body bolster by a center pin, which passes through both.

Truck Bolster Guide. A small projection at the ends of a truck bolster that engages the vertical member of the truck frame preventing spreading of the latter.

Truck Bolster Guide Bar. See BOLSTER GUIDE BAR.

Truck Car. A car used in a wreck train for carrying spare trucks. See WRECK TRAIN EQUIPMENT.

Truck Center Plate. See CENTER PLATE.

Truck Frame. A structure made of cast steel in one piece, to which the journal boxes or pedestals, springs and other parts are attached, and which forms the skeleton of a truck. See TRUCK SIDE FRAME.

Truck Lever. That part of the foundation brake rigging which applies the power of the brake cylinder at the brake beams. On freight car trucks there is a live lever and a dead lever collectively known as truck levers. On passenger cars truck levers assume various positions according to the type of brake rigging used.

Truck Lever Connection. A rod or bar connecting the brake levers on the truck brake gear.

Truck Side Bearing. A device attached to the top of the truck bolster and having an upper bearing surface which comes in contact with a similar bearing surface fastened to the underside of the body bolster. See SIDE BEARING.

Truck Side Frame. The longitudinal portion of a truck structure, on the outside of the wheels, which extends from one axle to the other, and to which the journal boxes and bolsters or transoms are attached or form a part.

Truck Springs. The springs that carry the weight of the car body and its load to the running gear or trucks. On freight cars the truck springs are generally of the helical type placed in groups between the bolster and bottom chord of the truck frame. Helical springs are used on passenger car trucks both as equalizer springs and sometimes at the bolster. On some cars helical springs are placed directly over the journal box, the truck frame resting upon them. Elliptical springs are made in groups for use on passenger car bolsters and occasionally semi-elliptic springs are employed in different types of trucks. See SPRING, ELLIPTIC, HELICAL AND VOLUTE.

Trunnion. A cylindrical projection on the side of any part that allows a turning or oscillating movement.

Truss. An engineering term applied to certain types of built-up load-carrying structures so designed that the individual members comprising together the complete unit are subject only to compression or tension loads.

Truss Rod. A rod or set of rods usually placed beneath the sills of wooden cars to carry the tension stress of a truss.

Tufting Button. A button used in upholstery to hold the cord which passes through the upper covering of the upholstered surface, dividing it into squares or diamonds.

Tumbler (Lock). A latch engaging with a notch in a lock bolt, or otherwise opposing its motion until it is lifted or arranged by the key so as to remove the obstacle.

Tup. See HAMMER.

Turbo-Generator. A steam turbine direct-connected to a generator for furnishing electric current. The turbo-generator receives steam from the locomotive.

Turnbuckle. An elongated sleeve with a right and left hand thread at either end for the purpose of tightening two rods together.

Turn Over Seat. See REVERSIBLE CAR SEAT.

Turtle Back Roof. See ARCHED ROOF.

Twin Car Seat. A seat stand with a division arm, two cushions and two seat backs with two striker arms each, so that they may be turned to bring the occupants face to face. See RECLINING CHAIR.

U

U-Bolt. A double bolt made of a bar of steel or iron bent to the shape of the letter U, with a screw thread on each end.

U-Bolt Casting. A casting so shaped that a U-bolt can fit around it to form a bearing or carrier for a pin or bolt.

U C Brake Equipment. A standard brake equipment for general passenger train service. The principal units include a Universal Valve used with three reservoirs, Auxiliary, Service, and Emergency, also one brake cylinder for both service and emergency applications, except in the cases of very heavy cars which require the use of two cylinders.

Uncoupling Lever or **Uncoupling Rod.** A rod with a bent handle forming a lever, usually attached to the end sill, by which the lock of the automatic coupler is opened and the cars uncoupled without going between them. The lever proper is the part attached to the rod and operating the unlocking mechanism, but in the case of freight cars the lever and rod are generally made in one piece. The short lever which is directly connected to a passenger

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Vestibule Lamp. A lamp used for lighting a car vestibule.

Volt. The basic unit of electric potential, pressure, or electro-motive force. The International Volt is the potential difference required to maintain a steady current of one ampere in a circuit whose resistance is one ohm.

Voltmeter. An instrument for measuring the voltage of electric currents.

Volute Spring. A spring made of flat metal wound in a spiral scroll. Used for in certain types of friction bolster springs and for buffer springs on foreign cars.

W

Wagon. British for Freight Car.

Wainscoting. The lining for interior walls of a passenger car body. Term applies especially when paneling and relatively elaborate workmanship are employed.

Wainscot Panel (Passenger Car Interior). A panel under the windows between the two wainscot rails.

Wainscot Rails (Passenger Car Interior). Longitudinal strips extending from one end of the car to the other, used in connection with wainscoting. The wainscot end rails are the wainscot rails at the end of the car.

Walkover Seat. A term used to designate a type of car seats in which the back does not turn over when the seat is reversed. Also called GLIDEOVER, PUSHOVER and SLIDEOVER.

Wall Lamp. A lamp to fit in a recess in the wall of a car or corridor.

Wall Seat End. The seat end next to the wall or side of a car, so called in distinction from the aisle seat end.

Wardrobe (Postal Car). See POSTAL CARS.

Wards (Lock). The interior circular ridges which fit into corresponding recesses in the bit of a key (the latter also termed wards), the surrounding solid parts of the bit being called the web.

Washer. A plate of metal or other material, usually annular, which is placed under a nut or bolt head to give it a better bearing. Washers in car work generally take their name from that of the bolt or rod to which they are attached.

Washer Plate. See STRAP WASHER.

Washstand. A basin or lavatory installed as a permanent fixture for cleaning purposes. Equipped with water supply and outlet. On some types of cars the washstands are made to fold up out of the way when not in use.

Waste. Threads of wool or cotton or mixtures of these into which is incorporated mechanically curled vegetable fiber, often cocoanut fiber, to impart to the product an elasticity not possessed by wool or cotton threads. The material is saturated with lubricating oil and placed in a journal box so that it comes in contact with the lower half of the journal. Sometimes called packing or dope. Various special compositions have been developed, sometimes with springs inserted in the mass to impart greater resiliency. Manual, A-905.

Waste Cock. A cock for drawing off water from a tank or basin. (Baker Heaters.) A cock attached to the expansion drum or circulating drum of the Baker heater for drawing off or changing the water in the heater pipes.

Wastometer. A device for flushing water closets.

Water Alcove. A recess in the side of a partition of a passenger car to receive the faucet of a water cooler or water pipe and a drinking cup.

Water Circulation Heating System. See HOT WATER CIRCULATION HEATING SYSTEM.

Water Cooler. A tank or vessel for carrying drinking water, which is cooled by electric refrigeration or with ice. The sides are generally made double, and the space between filled with some non-conducting substance. See WATER ALCOVE, WATER TANK.

Water Drip. A pan or receptacle to receive the waste water from a water cooler. A drip pipe, or waste pipe, is connected to it.

A slight projection or raised seam in the roof of a passenger or baggage car over the side doors, or at the end of the car in the platform roof to divert the water so it will not fall upon persons entering the car or passing from one car to the next

Water Gage. See GLASS WATER GAGE.

Water Mixing Valve. A device for mixing hot and cold water in a lavatory.

Water Seal. See TRAP.

Water Supply. The system of water supply used in coaches and Pullman cars is under air pressure. The system provides for forcing water into the wash bowls by air pressure taken from the air brake system. Hot water is usually heated by using live steam from the locomotive.

Water Tank. A vessel or reservoir for holding water. Those used on cars for drinking water are usually made of sheet iron, and often extend to the roof. They are then usually drawn from by a water alcove, the tank usually being in the corner and concealed from the interior of the car. Water used in dining car kitchens is usually carried in overhead tanks.

For size and arrangement of water tank in postal cars, see POSTAL CARS.

Watt. The unit commonly used in measuring electric power. The International Watt represents the power expended by an electric current of one International Ampere flowing through a resistance of one International Ohm. In d. c. electrical calculations the product of voltage multiplied by amperage equals the number of watts. One watt equals $1/746$th of one horsepower or conversely, one horsepower equals 746 watts. Also see AMPERE, OHM, OHM'S LAW, and VOLT.

Wattmeter. An instrument for measuring electric power directly in watts. See WATT.

Waved Moldings. Moldings which by a special machine are made of a corrugated section longitudinally.

Way Car. See CABOOSE.

Wear Plate. A plate placed between two moving surfaces to withstand frictional wear.

Weather Strips. A strip for application around the crevices of windows or doors, for excluding the dust and wind, and for preventing water from entering around the windows.

Web. A term applied to the center portion of a beam, as an I-beam, which ties the flanges together.

Web Filler. See BODY BOLSTER FILLER.

Webbing. A strong fabric, made of hemp or other material which is not likely to stretch, used in upholstering car seats.

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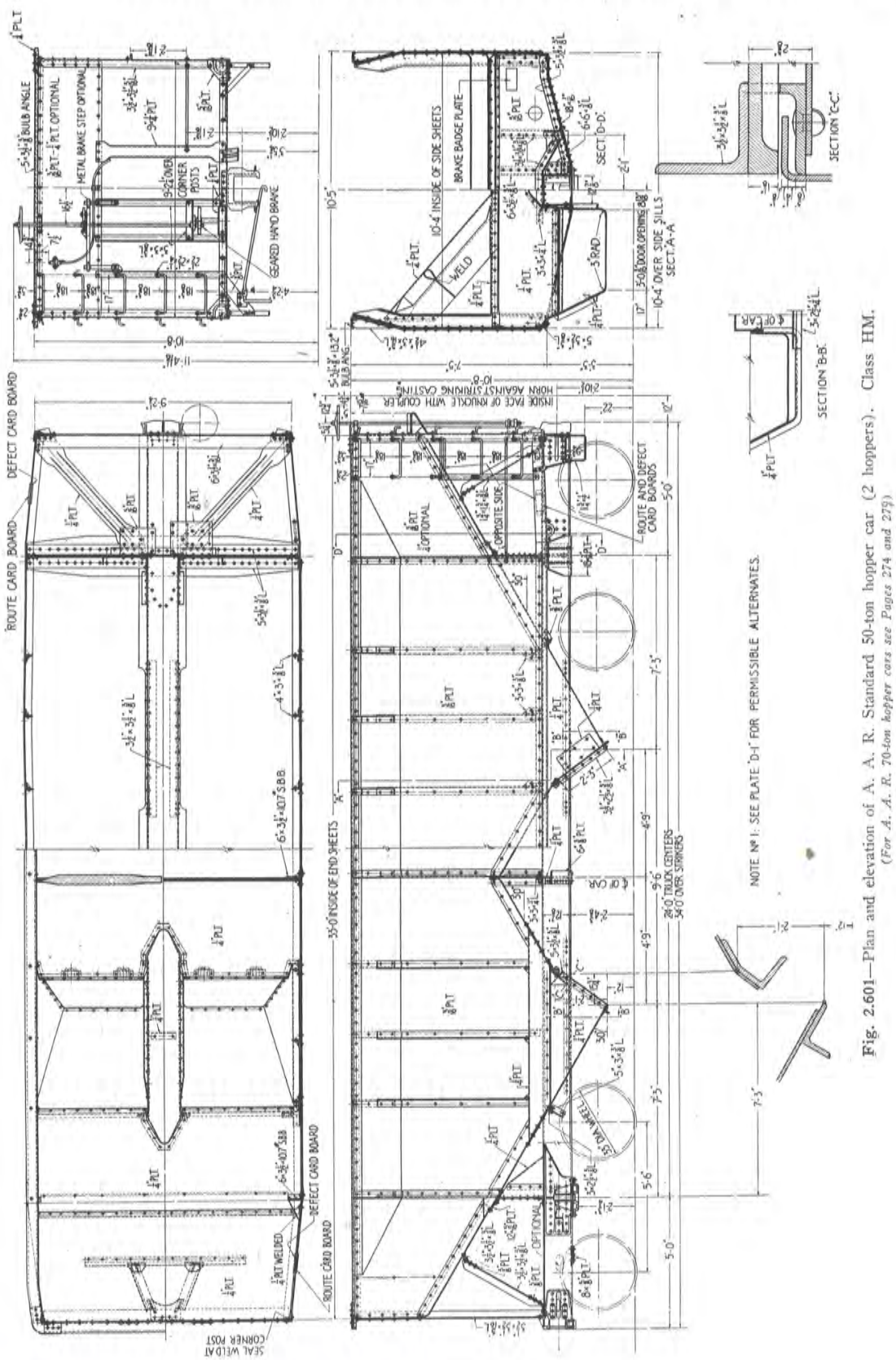


Fig. 2.601—Plan and elevation of A. A. R. Standard 50-ton hopper car (2 hoppers). Class HM.
(For A. A. R. 70-ton hopper cars see Pages 274 and 279)
(See A. A. R. Supplement to the Manual, Plate 600-C)

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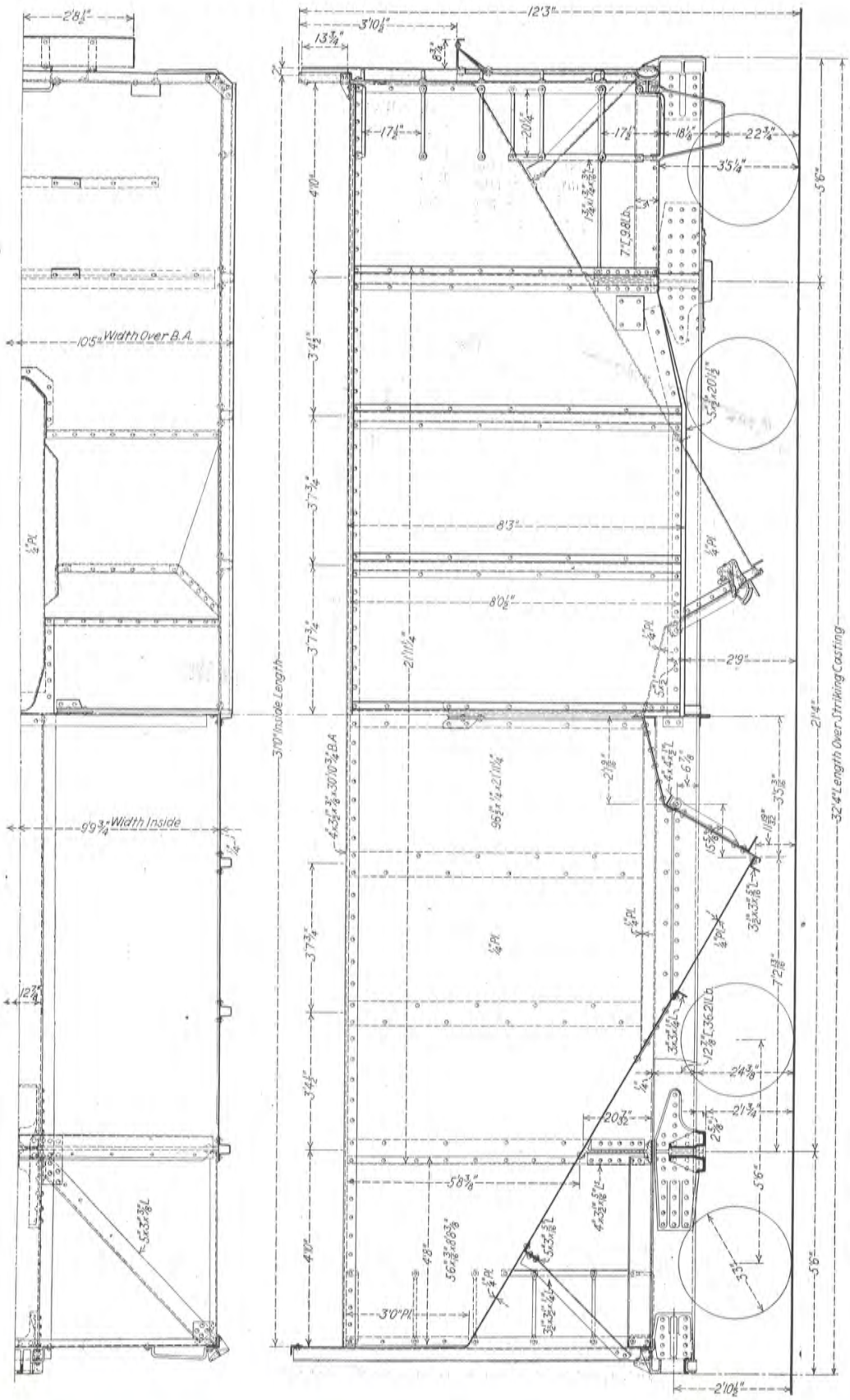


Fig. 2.604—Norfolk & Western 55-ton hopper car (2 hoppers), Road Class, HL, A. A. R. Class HM. Design characterized by the small number of parts.
(Note: Some changes, including ⅜ in. end and slope sheets have been made in last cars built)
(See also Page 259)

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Fig. 2.605—Norfolk & Western 55-ton hopper car, Road Class HL, A. A. R. Class HM. Road Numbers 22,000-25,999; 38,000-39,999; 56,500-59,999; 67,000-69,999
(See also Figs. 2.604-2.607)

Dimensions and Weights—N. & W. Class HL Hopper Car

Length over striking plates	32 ft. 4 in.
Coupled length	34 ft. 10 in.
Truck centers	21 ft. 4 in.
Truck wheel base	5 ft. 6 in.
Axle journals	5½ in. x 10 in.
Inside length	31 ft. 0 in.
Inside width	9 ft. 9¾ in.
Cubical capacity, level full	1,998 cu. ft.
Cubical cap., with 30 deg. heap	2,429 cu. ft.
Weight of empty car (average)	41,200 lb.
Load limit (average)	127,800 lb.
Weight of one truck	7,200 lb.
Height from rail to top car side	11 ft. 0 in.

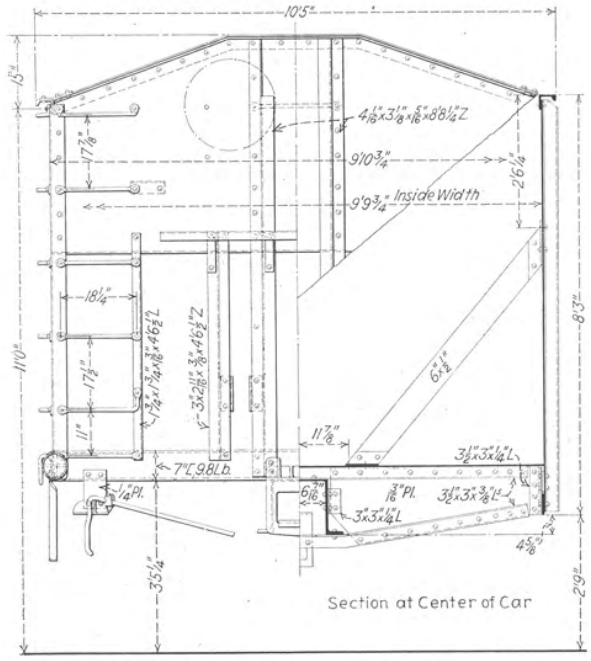


Fig. 2.606—End view and cross section of Norfolk & Western Class HL hopper car shown on Page 258.



Fig. 2.607—Norfolk & Western 55-ton hopper car, Road Class HL.

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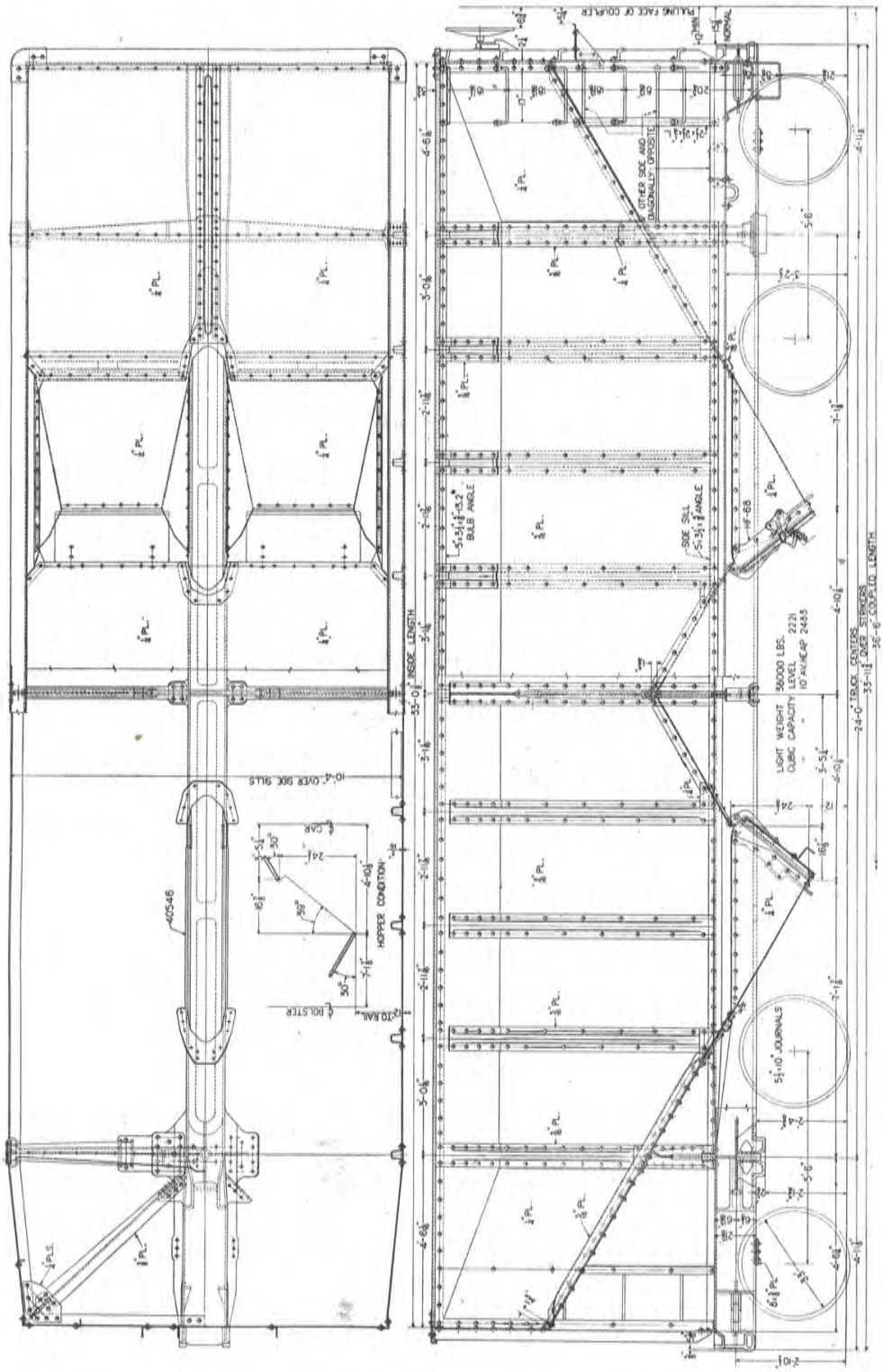


Fig. 2.608—Plan and elevation of Unitcast design, high-capacity, 60-ton twin hopper car with cast steel center sill, body bolsters, crossbearer, crossbearer arms and hopper frames

Unitcast Corporation.

(*See also Pages 261, 262, 263*)

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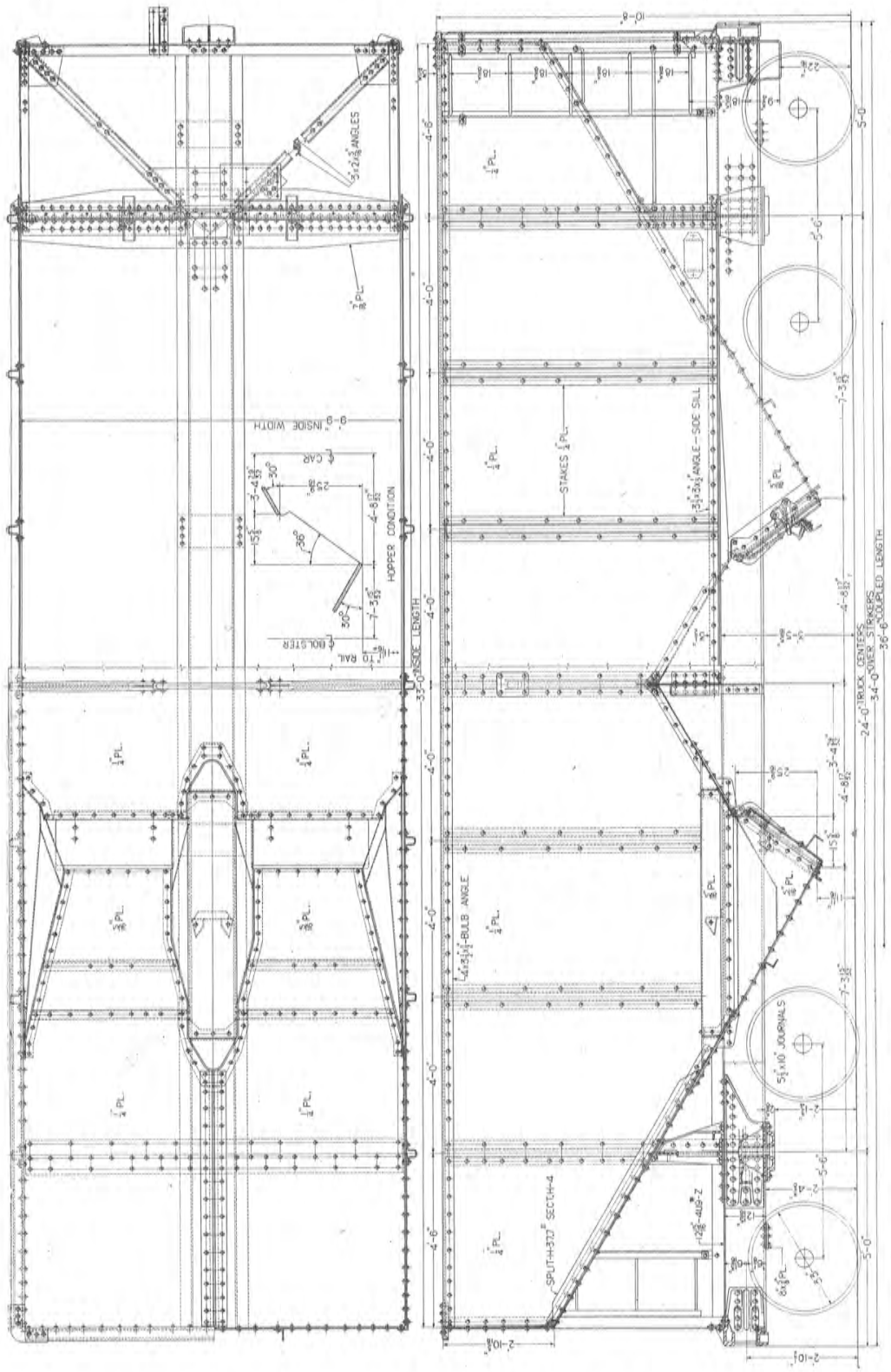


Fig. 2.609—Plan and elevation of Unitcast design, 55-ton twin hopper car with cast steel crossbearer arms, body holster centers, center sill hood ends and hopper frames. **Unitcast Corporation.** Cubic capacity, level 2,053 cu. ft.; light weight, 42,000 lb. *(See also Pages 260, 261, 263)*

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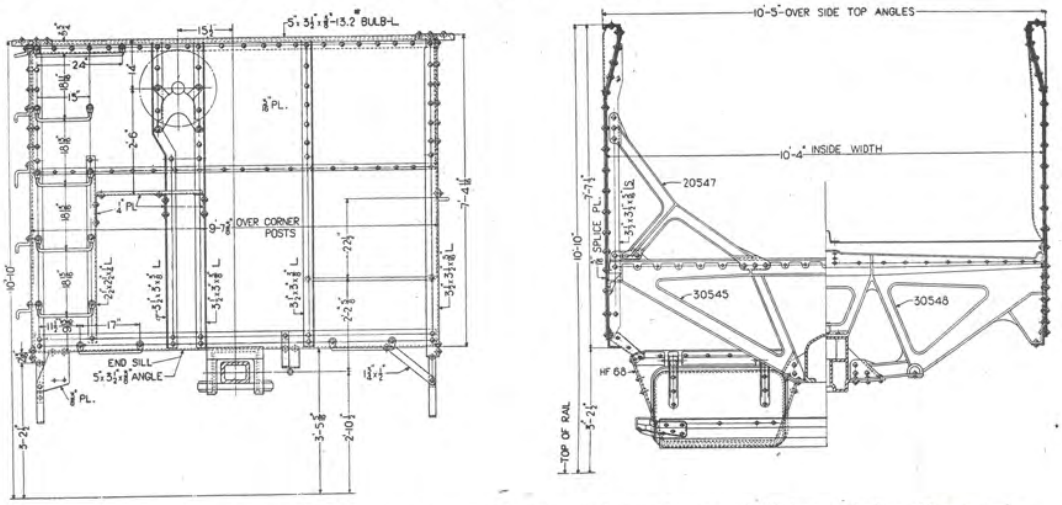


Fig. 2.610—End elevation and half cross-sections at bolster and crossbearer of Unitcast design 60-ton twin hopper car.

(*See also Page* 260)



Fig. 2.611—Side view of 70-ton hopper car using Unitcast design cast steel body bolsters, crossbearers and hopper frames.

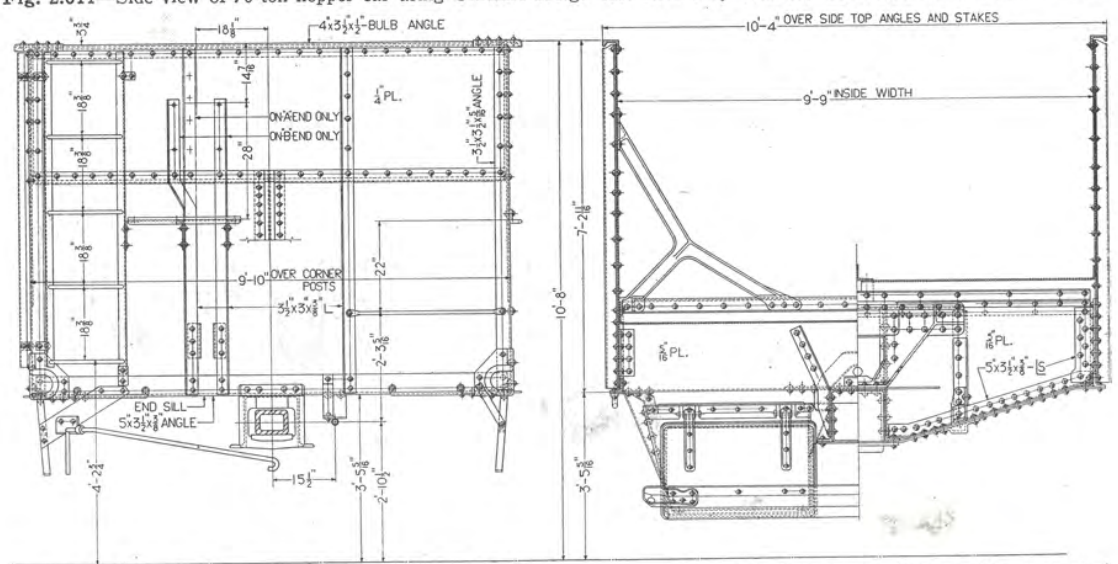


Fig. 2.612—End elevation and half cross-sections of Unitcast design. 55-ton twin hopper car incorporating cast steel crossbearer arms, body bolster center, center sill hood ends and hopper frames.

(*See also Page* 262)

Unitcast Corporation

(*See also Pages* 260, 261, 262)

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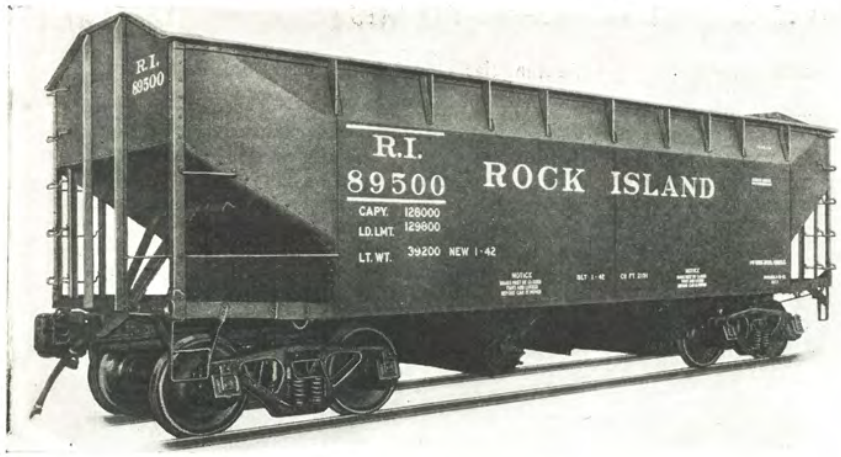


Fig. 2.613—Chicago, Rock Island & Pacific 128,000-lb. capacity twin hopper coal car. Builder, American Car and Foundry Co.

Light weight, 39,200 lb.; load limit, 129,800 lb., capacity, 2,191 cu. ft.; inside, length 33 ft. 0 in.; width 10 ft. 4 in.; height of sides 10 ft. 8 in.

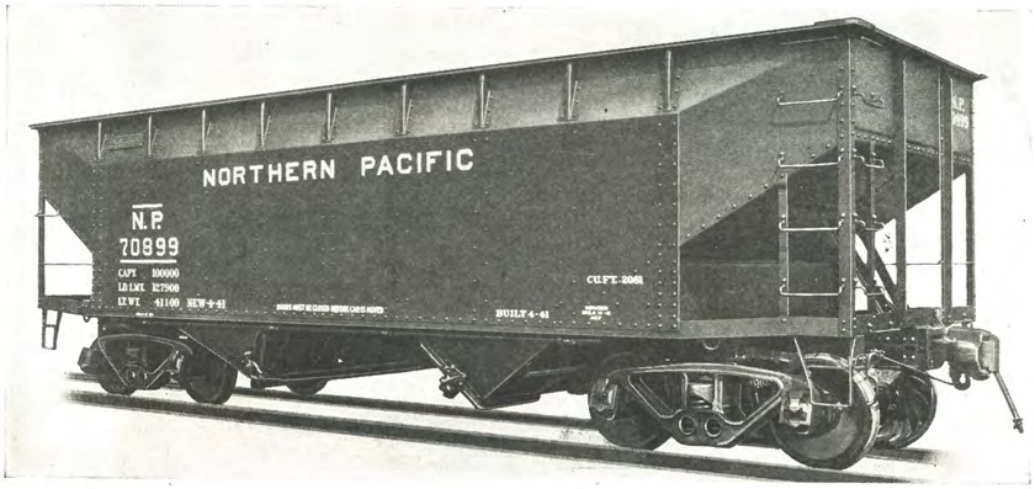


Fig. 2.614—Northern Pacific 50-ton twin hopper coal car. Builder, American Car and Foundry Co.

Light weight, 41,100 lb.; load limit, 127,900 lb.; capacity, 2,081 cu. ft.; inside, length 33 ft. 0 in.; width 10 ft. 4 in.; height of sides 10 ft. 5 in.



Fig. 2.615—C. B. & Q. 55-ton aluminum twin hopper coal car. Rebuilt on old steel frame. Built at Havelock shops.

Light weight, 36,800 lb.; load limit, 132,200 lb.; capacity, 2,075 cu. ft.; inside, length 34 ft. 3 in.; width 9 ft. 6 in.; height of sides 10 ft. 9 in.

Descriptions: *Railway Mechanical Engineer*, Sept. 1944; *Railway Age*, Sept. 9, 1944. (*See also Page 267*).

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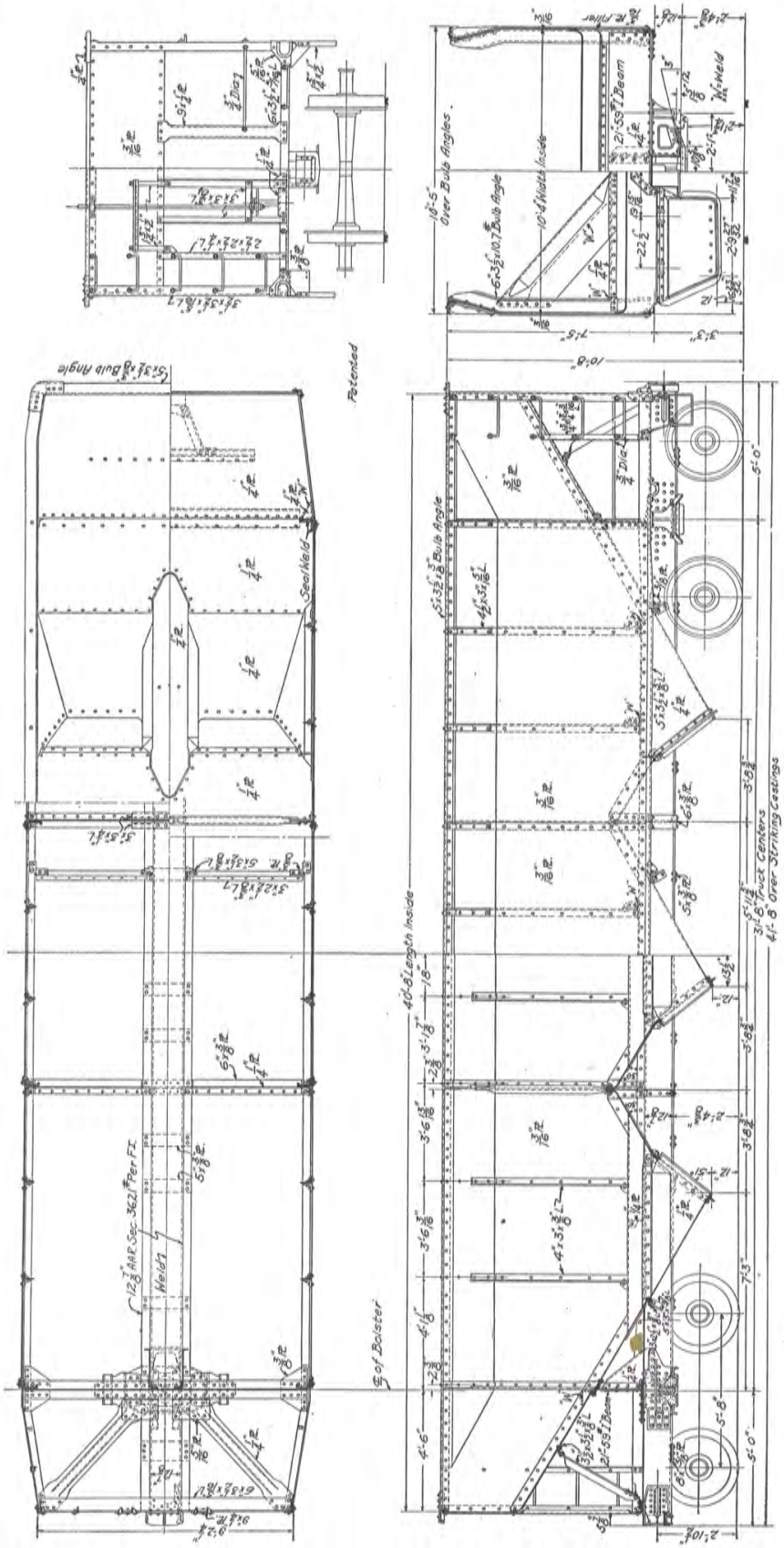


Fig. 2.636—75-Ton all-steel 6 in. by 11 in. axle load Triple Hopper Car with Enterprise hoppers and bolster construction. A. A. R. Class HT. Cubic capacity, 2,758 cu. ft. level or 3,147 cu. ft. with 12 in. average heap.

Enterprise Railway Equipment Company

(See also page 257)

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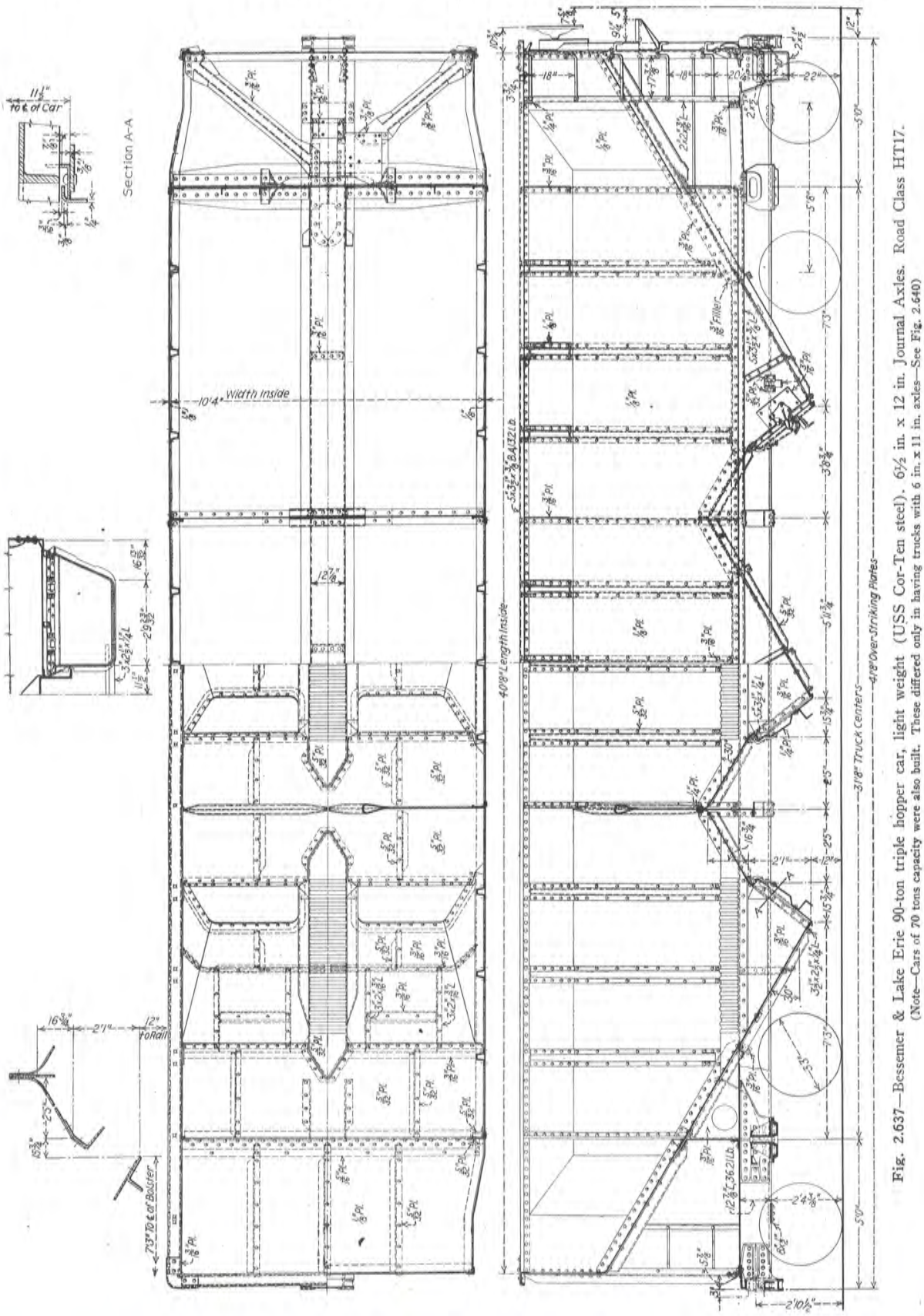


Fig. 2.637—Bessemer & Lake Erie 90-ton triple hopper car, light weight (USS Cor-Ten steel). 6½ in. x 12 in. Journal Axles. Road Class HT17.
(Note—Cars of 70 tons capacity were also built. These differed only in having trucks with 6 in. x 11 in. axles—See Fig. 2.640)
(See also Page 277)

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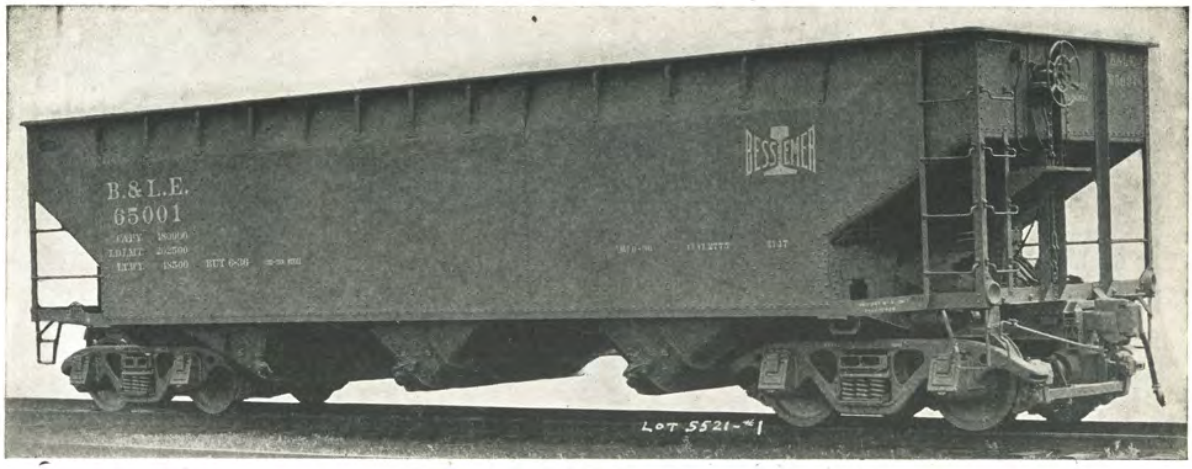


Fig. 2.638—Bessemer & Lake Erie 90-ton light weight hopper car. Built of USS Cor-Ten steel, Road Class HT17.
Light weight, 48,500 lb.; load limit, 202,500 lb.; capacity, 2,775 cu. ft.; axle journals, 6½ in. x 12 in.
Also built in 70-ton capacity with 6 in. x 11 in. journals, Road Class H16. See Fig. 2.642.
NOTE: Earlier 90-ton cars of carbon steel weighed 58,800 lb. with load limit 192,200 lb.
(*See also Page 276*)

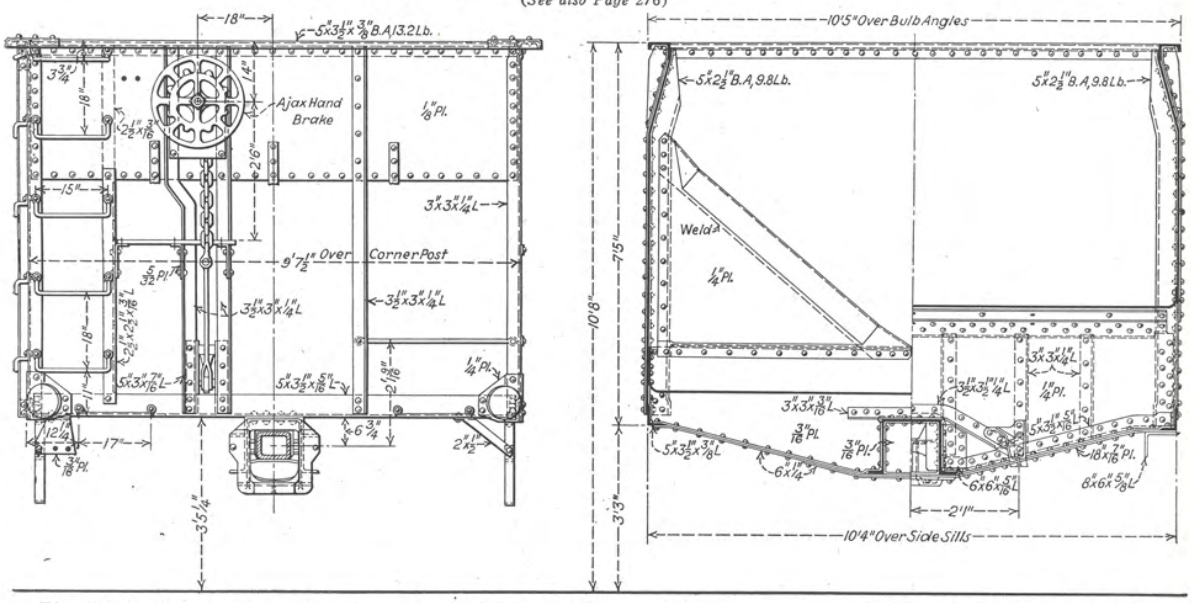


Fig. 2.639—End elevation and cross section of B. & L. E. 70-ton and 90-ton cars shown in Figs. 2.637, 2.638 and 2.640.

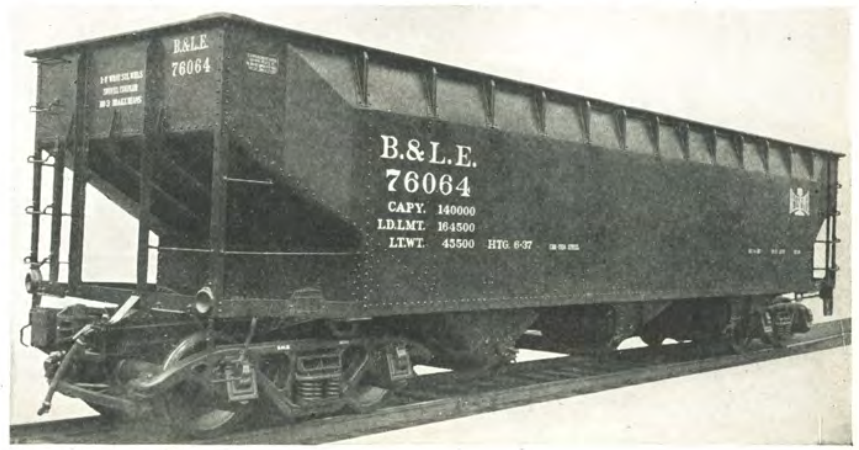


Fig. 2.640 — Bessemer & Lake Erie 70-ton light weight hopper cars of USS Cor-Ten steel. Road Class HT16.

Light weight	45,500 lb.
Load limit	164,500 lb.
Capacity	2,775 cu. ft.

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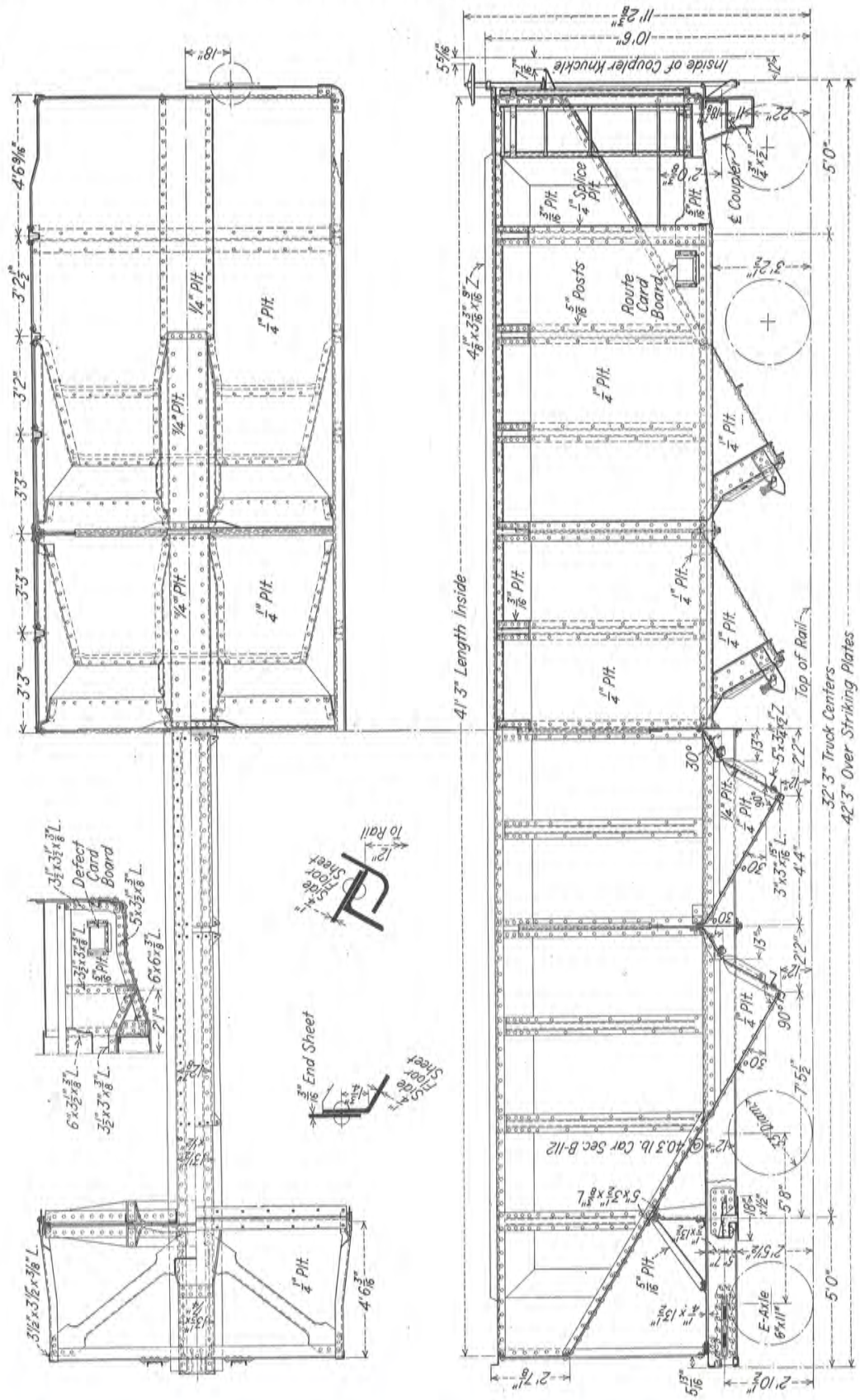


Fig. 2.646—Plan and elevation of Baltimore & Ohio 70-ton capacity quadruple hopper car. Design follows general lines of A. A. R. Recommended Practice Car, Class HT. (See also Page 281)

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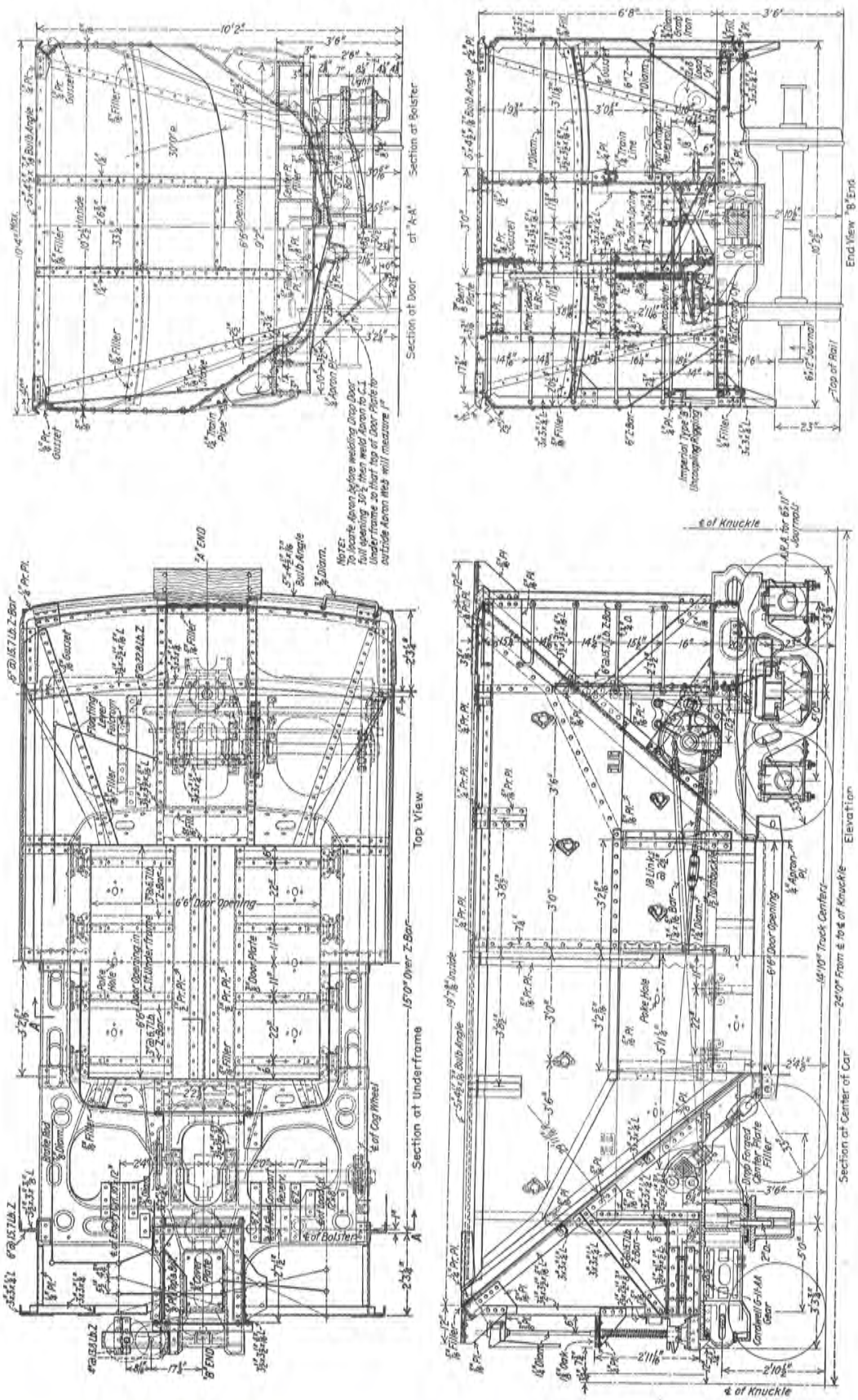


Fig. 2.665—Plan, elevation and sections of Duluth, Missable & Iron Range 80-ton capacity hopper ore car with Commonwealth cast steel underframe. Road Class U-14.
Roads Nos. 22,001-22,125; capacity, 935 cu. ft.; light weight, 47,600 lb.; load limit, 162,400 lb.
Descriptions: *Railway Age*, Feb. 8, 1928. *Railway Mechanical Engineer*, May 1928.
(Later cars have been of fabricated type. See Fig. 2.667)
(For ore car door operating mechanism see Sec. 3)

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Fig. 2.666—Great Northern 75-ton capacity hopper iron ore car. Series 90,000-92,999. Builder, Bethlehem Steel Company.

A. A. R. Class	HMA	Length inside	19 ft. 10⅞ in.
Nominal capacity	150,000 lb.	Width inside	10 ft. 5½ in.
Load limit	167,500 lb.	Coupled length	24 ft. 0 in.
Cubic capacity, level	1,262 cu. ft.	Length over strikers	21 ft. 5¾ in.
Light weight	42,500 lb.	Width outside	10 ft. 6 in.
Axle journals	6 in. x 11 in.	Height of sides	10 ft. 2 in.

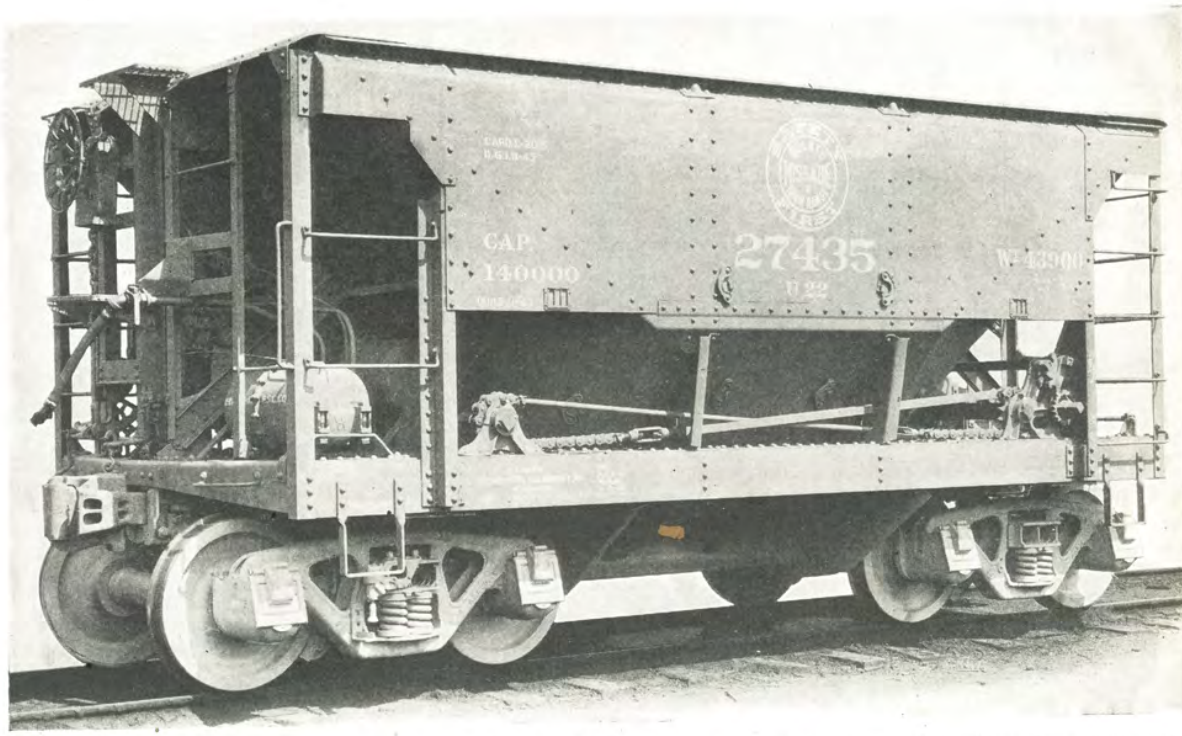


Fig. 2.667—Duluth, Missabe & Iron Range 70-ton capacity hopper iron ore car. Road Class U22. Builder, Pressed Steel Car Company, Inc.

A. A. R. Class	HMA	Axle journals	6 in. x 11 in.
Nominal capacity	140,000 lb.	Length over strikers	21 ft. 6 in.
Load limit	166,100 lb.	Length inside	19 ft. 11 in.
Cubic capacity, level	1,000 cu. ft.	Width inside	10 ft. 5½ in.
Light weight	43,900 *lb.*	Height of sides	10 ft. 2 in.

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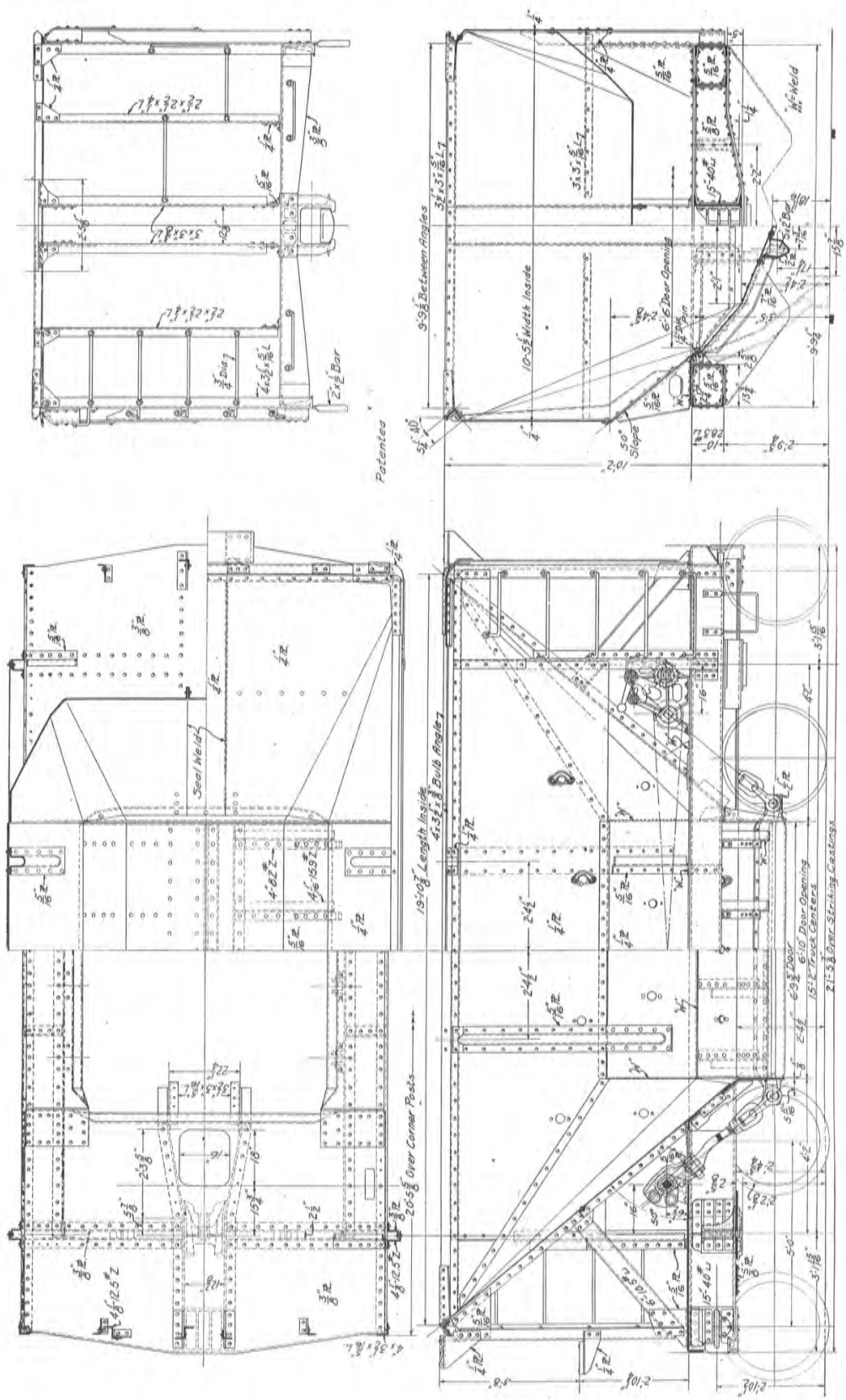


Fig. 2.668—75-Ton all-steel 6 in. by 11 in. axle load Enterprise hopper iron ore car, center discharge. Cubic capacity, 1,040 cu. ft. level or 1,244 cu. ft. with 12-in. average heap.
Enterprise Railway Equipment Company
(See also Page 299)

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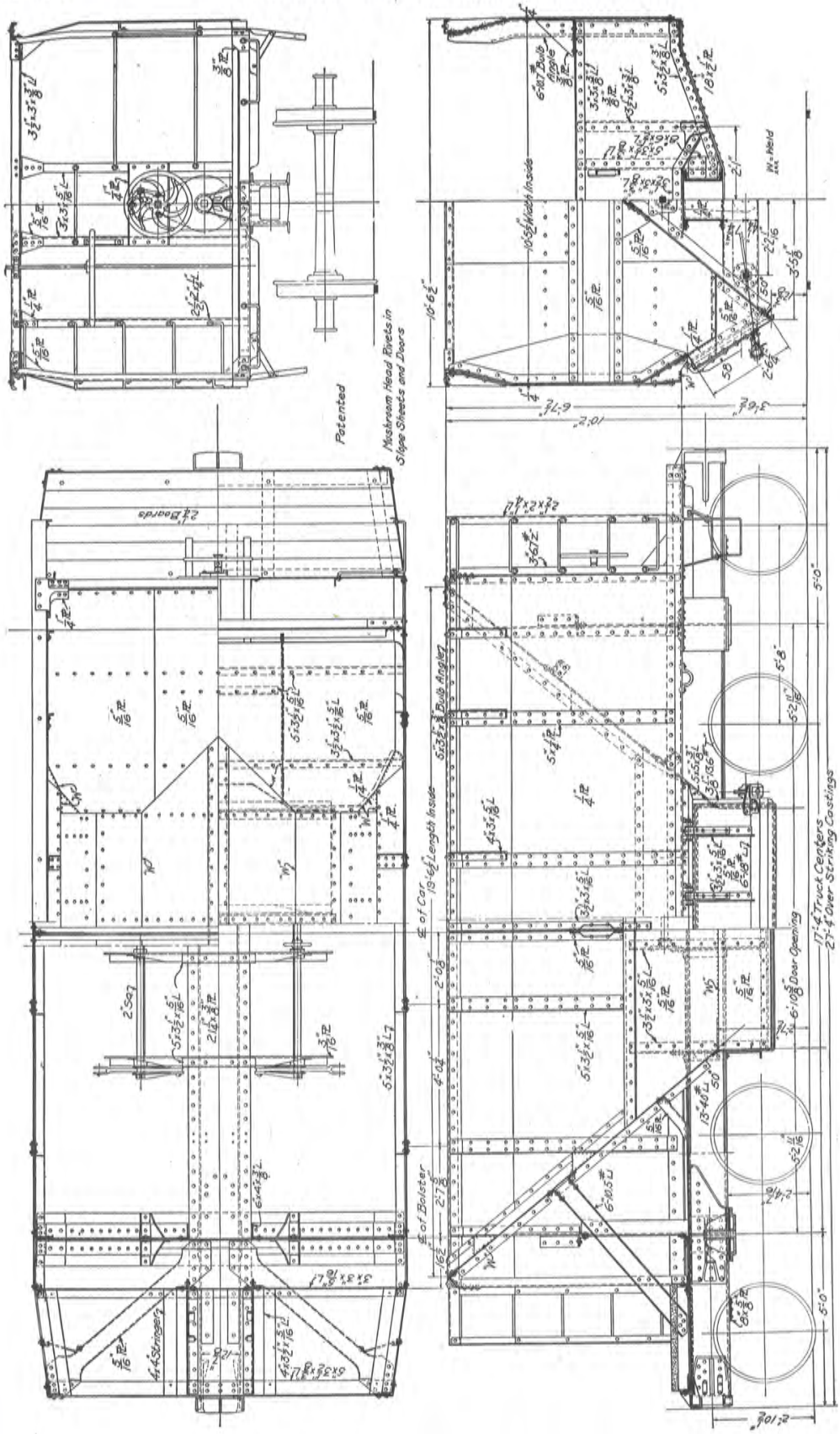


Fig. 2.669—70-Ton all-steel Enterprise hopper ore car, side discharge. Cubic capacity, 981 cu. ft. level or 1,170 cu. ft. with 12 in. average heap.

Enterprise Railway Equipment Company

(See also Page 299)

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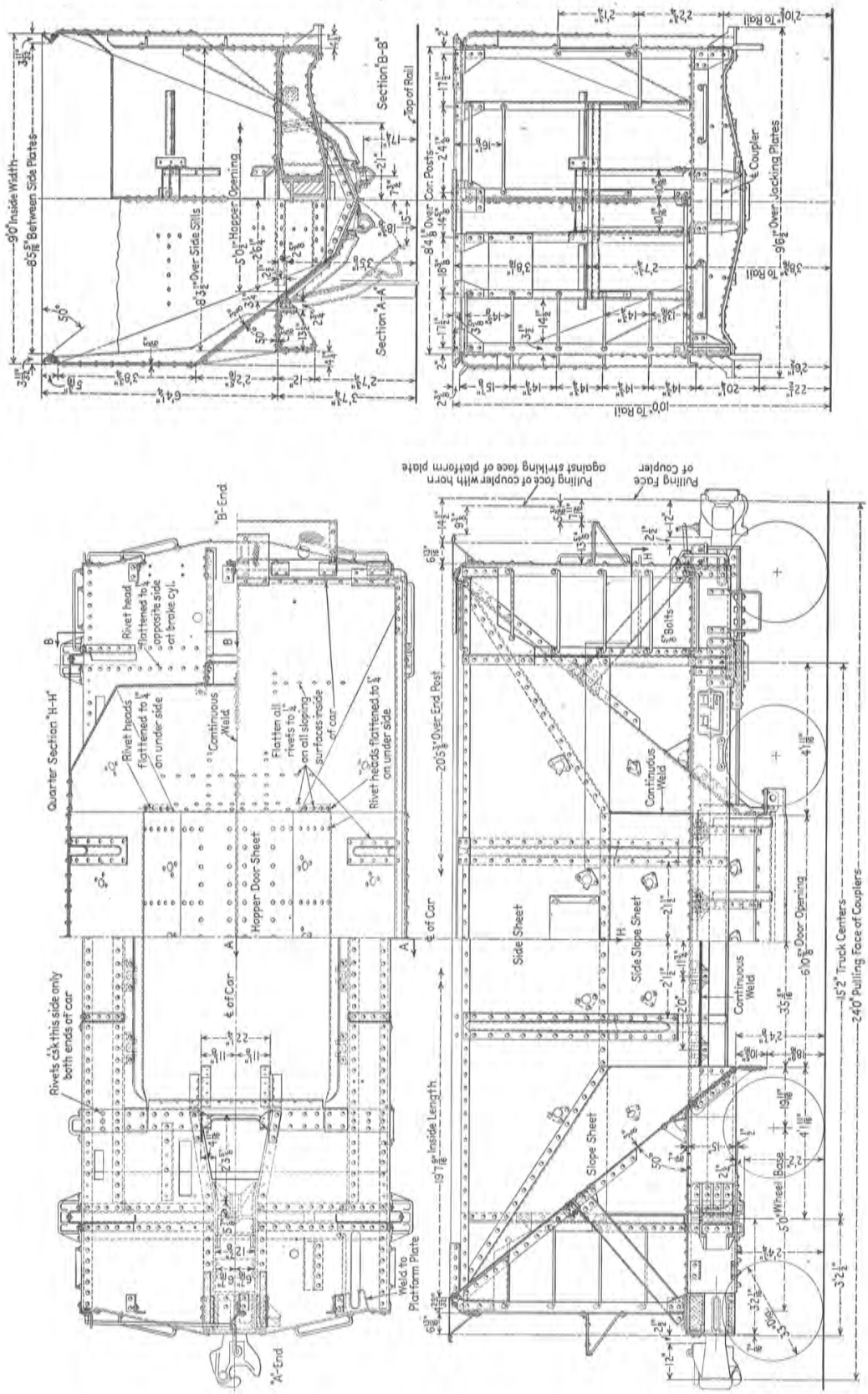


Fig. 2,670—Plan, elevation and sections of Canadian Pacific 50-Ton center discharge ore car.
Builder, National Steel Car Corporation, Ltd.
Series 114,100-114,349
(See also Fig. 2,673)

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Fig. 2.671—Utah Copper Company 200,000-lb. capacity high-tensile steel, flat bottom, ore car. Unloaded by car dumper. Builder, Pressed Steel Car Company, Inc.
Light weight, 48,500 lb.; load limit, 202,500 lb.; capacity, 1,640 cu. ft.; inside, length 24 ft. 5 in.; width 10 ft. 6 in.; height 6 ft. 6⅝ in.
Description of earlier lot: Railway Age, October 30, 1937



Fig. 2.672—Union Pacific (O.-W. R. & N.) 70-ton ore car, AAR Class HMA. Builder, St. Louis Car Company.
Light weight, 62,300 lb.; load limit, 147,700 lb.; capacity, 1,360 cu. ft.; inside, length 28 ft. 0 in.; inside, width 9 ft. 6 in.



Fig. 2.673—Canadian National 50-ton center discharge ore car for use at Steep Rock mining operations. Built by National Steel Car Corporation, Ltd.
Light weight, 40,600 lb.; load limit, 128,400 lb.; capacity, 825 cu. ft.; length inside, 19 ft. 8 in.
(*See also page* 294)

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Enterprise Bulk Commodity, Ore and Ballast Cars



Fig. 2.678—70-ton Bulk Commodity Covered Hopper Car

THE Bulk Commodity Covered Hopper Car has become a standard service car for many commodities formerly hauled in sack, barrel or loosely in box cars.



Fig. 2.679—Enterprise Bulk Commodity Outlet

The Enterprise Outlet Unit illustrated in Fig. 2.679 is of cast steel, a finished machined product which provides a close, tight seal against leakage, a large opening and convenient means for operating. For general plan of Enterprise 70-ton car see Fig. 2.677, page 298 and application of outlet see Fig. 3.218, page 496.

The Enterprise has also developed a new seal tight Hatch with Door Lock for use in loading this type of car, which is illustrated and shown applied in Fig. 2.677, page 298, details, Figs. 3.221 and 3.222, page 497.

Enterprise Multi-Service Ballast Cars

The Enterprise Multi-Service Ballast Car illustrated in Fig. 2.680 is of 55 tons capacity and of Standard A.A.R. dimensions, 34 ft. 0 in. overall length and 10 ft. 8 in. height.

The car is designed to release ballast from a moving train to the sides or center of the track, free of the rails and in quantities as desired by the operator.



Fig. 2.680—55-ton Multi-Service Car

The floors of the car are steep; corner pockets are eliminated and the passageways between the floors and outlet hoppers are wide, providing for a free unrestricted flow of the ballast which is essential to prompt and clean unloading of the car. For general design, see page 288.



Fig. 2.681—70-ton Multi-Service Car



Fig. 2.682—75-ton Center Discharge Ore Car

Enterprise Ore Car—Door Mechanism

The 75-ton Hopper Ore Car shown in ig. 2.682 illustrates the Center Discharge Car commonly used in the Iron Ore Service. Steep floors, rounded corners and a large door opening are essential to quick and free discharge of the load. The door opening is closed by a pair of longitudinally hinged doors which are controlled by the Enterprise Door Mechanism which is operative from either side of the car and securely locks the doors when in closed position. A general plan of Enterprise 75-ton ore car is illustrated in Fig. 2.668, page 292. A side discharge ore or concentrate car is illustrated in Fig. 2.669, page 293.

ENTERPRISE RAILWAY EQUIPMENT COMPANY, 59 E. Van Buren St., CHICAGO 5, ILL.

Products and Branch Offices Are Listed in the Classified Indexes

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Freight Car Construction Details

THE CONSTRUCTION AND OPERATION of freight cars on American railroads has resulted in the adoption of certain fundamentals of design which general practice has shown to be most practicable. This subject has for many years been studied by the Committee on Car Construction of the Mechanical Division of the Association of American Railroads and as a result various "Standards" and "Recommended Practices" have been adopted for guidance in building such equipment.

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Fundamentals of Car Design

A.A.R. Standard—ADOPTED, 1920; REVISED, 1927, 1934 and 1938

(*Manual—Page* C-3)

1.	Height from rail to center of brake shoe face	13 in.
2.	Height from rail to brake beam hanger fulcrum	24⅞ in.
3a.	Height from rail to center plate wearing surface (empty car), old standard	26¾ in.
3b.	Height from rail to center plate wearing surface (empty car). New standard for "Z" section center sills	25¾ in.
4.	Distance from truck center plate wearing surface to top of truck side bearing	⅞ in.
5.	Distance from center to center of side bearings	50 in.
6.*	Average clearance per side bearing, per truck: Minimum ⅛ in. Maximum	¼ in.
7.	Distance between center sills	12⅞ in.
8a.	Area of center sills between rear followers (minimum). Old standard for cars not equipped with roofs	30 sq. in.
	Old standard for cars equipped with roofs	28 sq. in.
8b.	Area of center sills between rear followers, all cars (minimum). New standard for "Z" section center sills	21.3 sq. in.
9.	Distance from center of truck to end sill striking face for cars with 4-wheel trucks:	
	Hopper cars with horizontal yoke attachment	5 ft. 0½ in.
	Hopper cars with vertical yoke	5 ft. 0 in.
	Other cars with horizontal yoke attachment	5 ft. 6½ in.
	Other cars with vertical yoke	5 ft. 6 in.
10.	Coupler horn clearance (minimum)	3 in.
11.	Coupler shank side clearance, total	3½ in.
12.	Draft gear follower thickness	2¼ in.
13.	Ratio of unit stress to end load (maximum) for center sills	.05
14.	Ratio of unit stress to end load (maximum) for draft attachments	.125
	For draft attachments the area of steel in square inches equivalent to the minimum required strength value is:	
15.	Tension or compression (square inches) grade "A" steel	12
	Grade "B" steel	10½
16.	For shear (square inches), grade "A" or "B" steel	15
17.	For bearing (square inches), grade "A" steel	7½
	Grade "B" steel	6⁹⁄₁₆
18.	Length of standard draft gear pocket in the car sills (plus 0 in., minus 1/16 in.)	24⅝ in.

* See Manual C-3, for procedure in making adjustments.

Inside dimensions of A. A. R. box cars, 1932 design, were: Length 40 ft. 6 in.; width 8 ft. 9 in.; height 9 ft. 4 in.

For 1937 design, length 40 ft. 6 in.; width 9 ft. 2 in.; height 10 ft. 0 in. In 1941 an alternate height of 10 ft. 6 in. was adopted.

For large capacity box and auto-box cars, 1941 design, length 50 ft. 6 in.; width 9 ft. 2 in.; height 10 ft. 6 in.

NOTE.—Standards for some of these fundamentals had already been adopted by the former M. C. B. Association, namely:

Area of center sills, adopted in 1914 as Recommended Practice.

Side bearing clearance, adopted in 1914, as Recommended Practice, advanced to Standard in 1917.

Distance between center sills adopted in 1905 as Recommended Practice, advanced to Standard in 1907.

Coupler horn clearance, adopted in 1905 as Recommended Practice, advanced to Standard in 1907.

Coupler shank side clearance, adopted in 1899 as Standard, modified in 1896, 1899, 1905, 1907 and 1909.

Draft Gear Followers, adopted as Recommended Practice in 1905. Advanced to Standard in 1907.

Height of floors, refrigerator cars, adopted as Recommended Practice in 1911.

Inside dimensions of box cars, adopted as Recommended Practice in 1904.

Height and width of cars, adopted as Recommended Practice in 1904.

Side Bearings, spread of, adopted as Recommended Practice in 1915.

Truck center height of 25¾ in. has been used generally since 1932.

Classifications—Axles, Trucks, Cars

(*Manual—Page* C-4)

In connection with the above fundamentals a standard method of designating cars, axles, journal boxes and contained parts was adopted as standard.

Axle having 3¾x7 in. journal to be designated as A axle.

Axle having 4¼x8 in. journal to be designated as B axle.

Axle having 5x9 in. journal to be designated as C axle.

Axle having 5½x10 in. journal to be designated as D axle.

Axle having 6x11 in. journal to be designated as E axle.

Axle having 6½x12 in. journal to be designated as F axle.

Classification 2A, 2B, 2C, etc., adopted for two axle trucks, the letter designating the axle used and the figure designating the number of axles in the truck. Classification 3A, 3B, 3C, etc., adopted for three axle trucks, to be used in the same manner.

Classification 4A, 4B, 4C, etc., and 6A, 6B, 6C, etc., adopted for cars, the letters designating the axles used, and the figures designating the numbers of axles under the car.

Load Limits

(*Interchange Rule 86, Axles*)

The following load limits or total weight on rail have been adopted for cars with four-wheel trucks:

A axle	3¾ in.	x 7 in.	journal	load limit 66,000 lb.
B axle	4¼ in.	x 8 in.	journal	load limit 103,000 lb.
C axle	5 in.	x 9 in.	journal	load limit 136,000 lb.
D axle	5½ in.	x 10 in.	journal	load limit 169,000 lb.
E axle	6 in.	x 11 in.	journal	load limit 210,000 lb.
F axle	6½ in.	x 12 in.	journal	load limit 251,000 lb.

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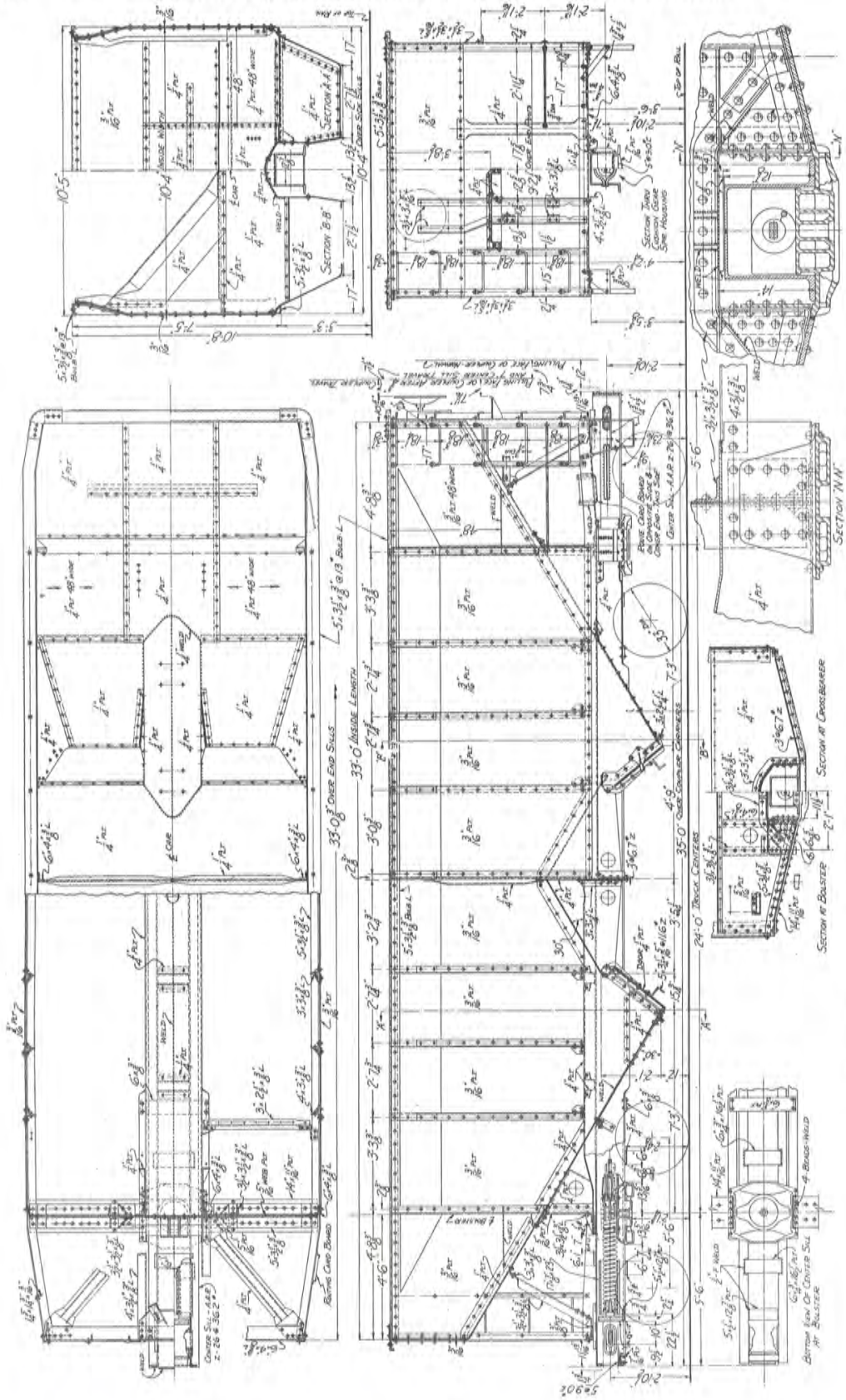


Fig. 3.29—Duryea Underframe with Long-Travel, Cushion Gear as applied to a 50-ton hopper car.
O. C. Duryea Corporation
(For description see Section 10)

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Draft Gears

DRAFT GEAR IS THE TERM used to designate the apparatus which connects the coupler or drawbar with the sills; it receives and dissipates the shocks received by the coupler, thus tending to prevent damage to equipment. Various forms of spring and friction gears have been employed.

Some older types consisted simply of heavy springs arranged in pairs—either twin springs—side by side; or tandem springs—one behind the other—and placed between follower plate contained within a coupler yoke. A special design of friction draft spring which is of such design as to increase its capacity by friction between the coils has also been used.

The form of gear now in general use is known as the Friction Draft Gear—a gear which makes use of friction for absorbing and dissipating the energy of buffing and tension shocks transmitted through the couplers. It is made in many different designs utilizing a combination of steel plates, cast blocks and springs.

The development of draft gears for railway equipment has kept pace with the constant increase in size and weight of rolling stock and the great increase in length of trains. The draft capacity required for heavy modern traffic has necessitated larger and stronger gear, and these conditions have been met successfully.

Tests and Specifications

In 1918 an extensive test of draft gears was made under the supervision of the United States Railroad Administration, and much valuable data were obtained.

Draft gear tests of an extensive character were begun in 1927 by the Mechanical Division of the American Railway Association, and in this connection a new draft gear drop test machine with falling weights of 27,000 lb. and 9,000 lb. was installed at Purdue University. A description of the machine is given in the 1927 Proceedings. A very complete report of the results of these tests, together with tentative specifications for freight car draft gears, is contained in the 1929 Proceedings. Standards since adopted include—general specifications; certificate of approval; purchase specifications.

Specifications covering "Approved Draft Gears for Freight Service" are covered by Specification M-901 in Section A of the Manual. These specifications, which were adopted in 1931, were revised in 1933, 1934 and 1936. Appendix A of this specification contains instructions regarding "certificate of approval for draft gears." The maximum permitted dimensions outside are 9 1/32 in. by 12¾ in.. with a length of 24⅝ in. for gear and follower when released. Travel to be not less than 2½ in. or more than 2¾ in. Solid height of gear and followers not less than 21⅞ in.

The Purchase Specifications for Approved Draft Gears for Freight Service is covered by Specifications M-901 and M-902.

Draft Gears have been classified under three different groups or sections as shown in Interchange Rule 101, as follows:

Section I—A.A.R. Approved Friction Draft Gears
Section II—Non-Approved Friction Draft Gears
Section III—Obsolete Types of Friction Draft Gears

According to Interchange Rule 3, cars built after January 1, 1934, and draft gears, new, applied to any car after January 1, 1935, must be of a type for which a "certificate of approval" has been issued.

Rules covering "Inspection and Maintenance of Draft Gears by Car Owners" will be found in the Manual, page L14-1.

General Requirements

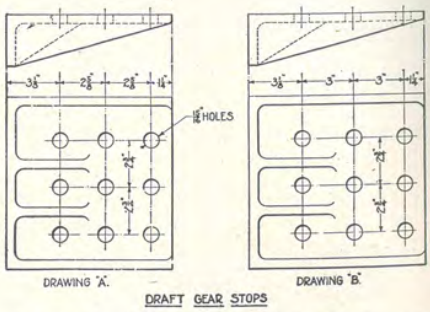
Under "Fundamentals of Car Design," Manual, page C-3, are the following requirements:

Distance between center sills, 12⅞ in.
Area of center sills between rear followers—(minimum)
For cars not equipped with roofs, 30 sq. in.
For cars equipped with roofs, 28 sq. in.
Draft gear travel—on car, 2¾ in.
Coupler horn clearance, 3 in.
Minimum draft gear capacity, 150,000 lb.
Coupler shank side clearance, total, 3 in.
Draft gear followers—thickness, 2¼ in.
Ratio of unit stress to end load—maximum—for draft attachments, .125.
For draft attachments the area of steel in square inches equivalent to the minimum required value is:
Tension or compression—sq. in.—grade "A" steel, 12.
For shear—sq. in., 15.
For bearing—sq. in., 7½.

Draft Gear Followers

A.A.R. Recommended Practice
(Manual, Page C-61)

Separate followers to be used with friction draft gears shall be made from open hearth steel of 0.40-



DRAFT GEAR STOPS

A.A.R. Standard Dimensions for Front and Back Draft Stops.

0.55 per cent carbon. The size of the followers shall be 12½ in. — ± ⅛ in. by 8⅞ in. — ± ⅛ in. by 2¼ in. — ± 1/32 in. Edges of followers shall be formed in such a manner that they will be free from cutting edges. Shearing will not be permitted.

Where the follower is a part of the friction surface of the draft gear, hardened followers should be used.

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Edgewater Ring Spring Draft Gear

THE Edgewater B-32-KA draft gear uses a ring spring to cushion the impact blows of freight car service in order to prevent damage to lading and car structure.

Principle of the Ring Spring

The ring spring consists of a series of solid heat-treated alloy steel rings nested into each other as shown in Figure A. The inner surfaces of the outer rings are tapered and work against the conical surfaces on the outside of the inner ring. When an

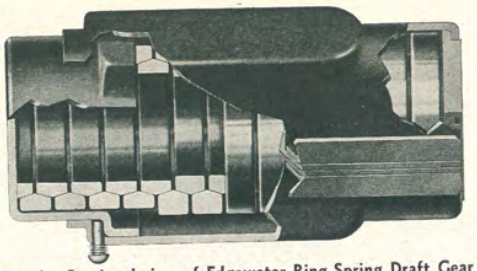


Fig. A—Sectional view of Edgewater Ring Spring Draft Gear

axial load is applied, the rings telescope into each other while the outer rings expand and the inner rings contract, giving a spring action. Friction between the conical surfaces increases the compression force and decreases the recoil force. The ring spring is so designed that it will telescope into a solid tube before the stresses become sufficiently high to cause permanent deformation of the rings. The stress in the outer rings is all tension and in the inners is all compression. This fact permits more efficient utilization of metal than is possible in any other type of spring.

Features of the Ring Spring Draft Gear

The action of the spring is positive and uniform because the contacting surfaces are lubricated for life with a heavy graphite grease. This eliminates sticking and assures the gear's expansion upon removal of the applied load, thus eliminating harmful free slack. By dissipating energy on compression and release, friction reduces impact energy from a destructive agent to the moderate force required to prevent the gear from creeping solid. The ring spring provides the friction to absorb shock and the force to return the gear promptly to full length ready for the next blow.

Figure A shows the spring installed in the rugged pressed steel housing, which protects it from dirt and retains the rings and lubricant in position. The two pins which are inserted between the movable end cup and housing reduce the length of the gear so that it can be readily installed in the pocket in the car. The first service blow compresses the spring sufficiently to eject the pins allowing the gear to become tight in the pocket. This device is necessary to permit easy installation of the gear and still prevent free play which would cause harmful slack.

Inspection of B-32-KA Draft Gears

The heat-treated rolled alloy steel rings are individually inspected and tested for size and hardness in order to insure long service life. Each gear as it comes from the assembly line after the final manufacturing operation passes under a special hydraulic press so arranged that a Force Closure Diagram is taken automatically. A sample test card is shown in Figure B. Testing of each gear before shipment assures compliance not only with the requirements of A.A.R. Specifications, but also with the much more rigid standard of Edgewater inspectors.

B-32-KA Draft Gears are A. A. R. Approved

Edgewater ring spring draft gears have been tested extensively by the Association of American Railroads, Mechanical Division. In 1933 the draft gear was submitted to the specification tests and received the A.A.R. Certificate of Approval for freight car draft gears. The certificate tests prove that the Edgewater gear exceeds the specification requirements by a large margin. They also demonstrate that the gear reaction

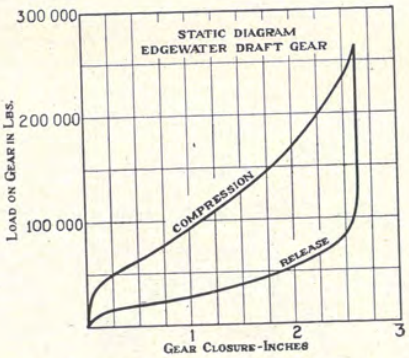


Fig. B—Typical force-closure diagram of Edgewater Ring Spring Draft Gear

(force transmitted to the car body) is exceptionally low for a given amount of energy aborbed. An analysis of the test results has been prepared and will be sent to interested persons on request.

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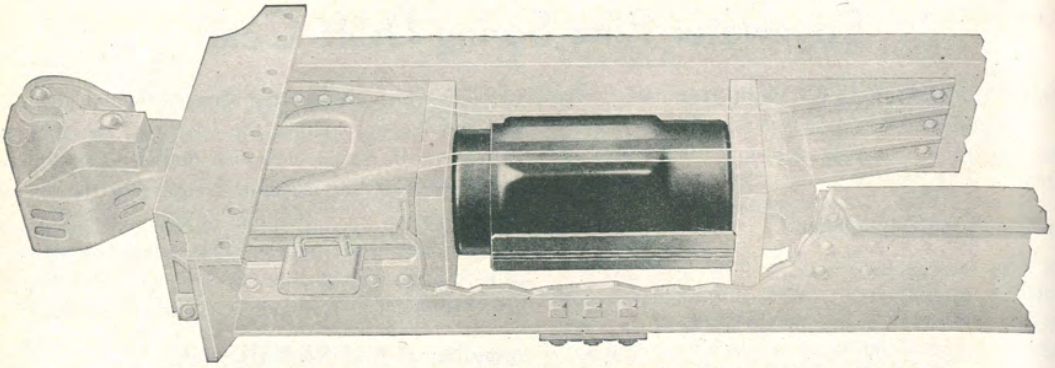
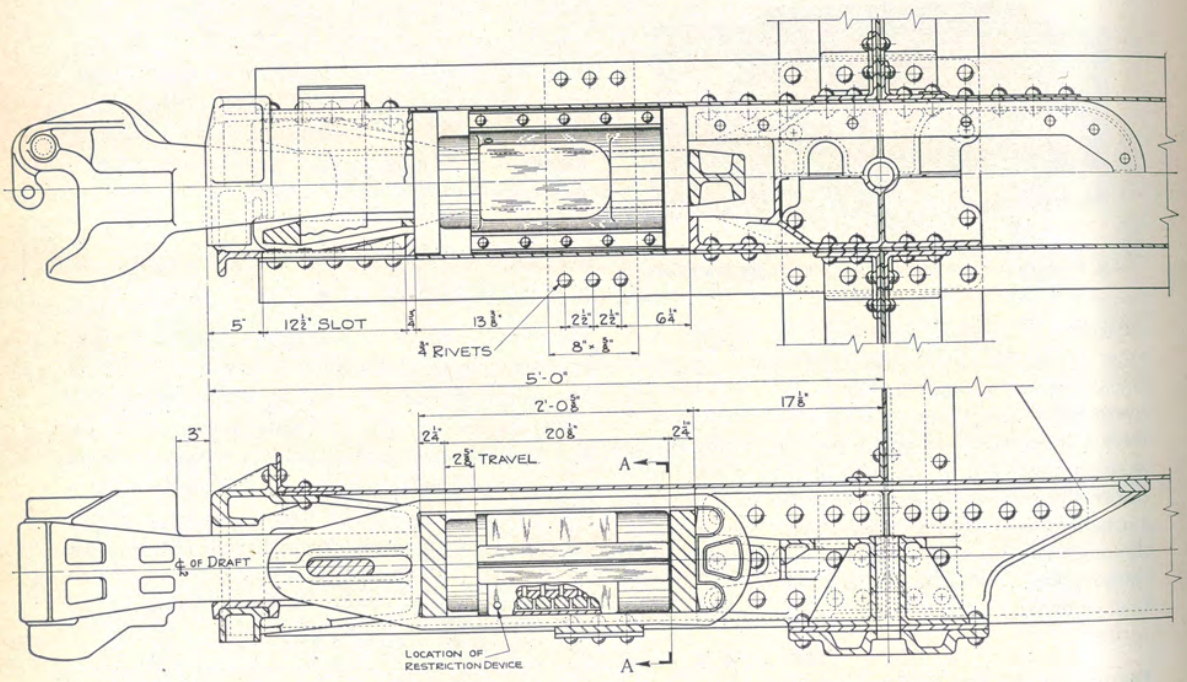
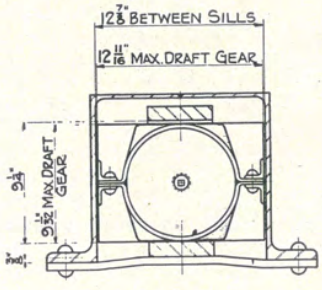


Fig. 10.43—Edgewater Ring Spring Draft Gear as applied with A.A.R. standard vertical yoke.





SECTION A-A

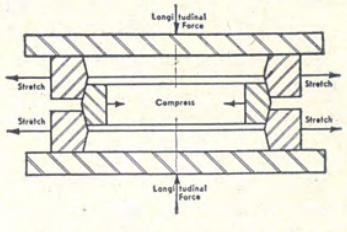


Diagram of Ring Spring Action.

Fig. 10.44—Edgewater B-32-KA Draft gear as applied to A.A.R. cars with standard vertical yoke attachment.

Edgewater Steel Company

(*See also Page 937*)

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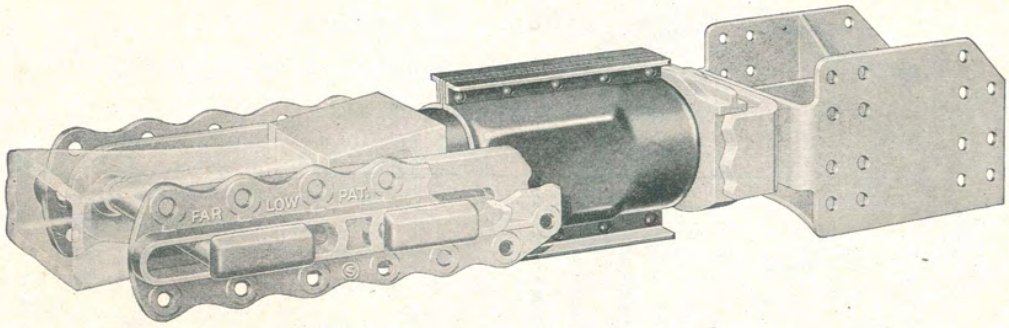


Fig. 10.45—Edgewater Ring Spring Draft Gear as applied with Farlow attachments.

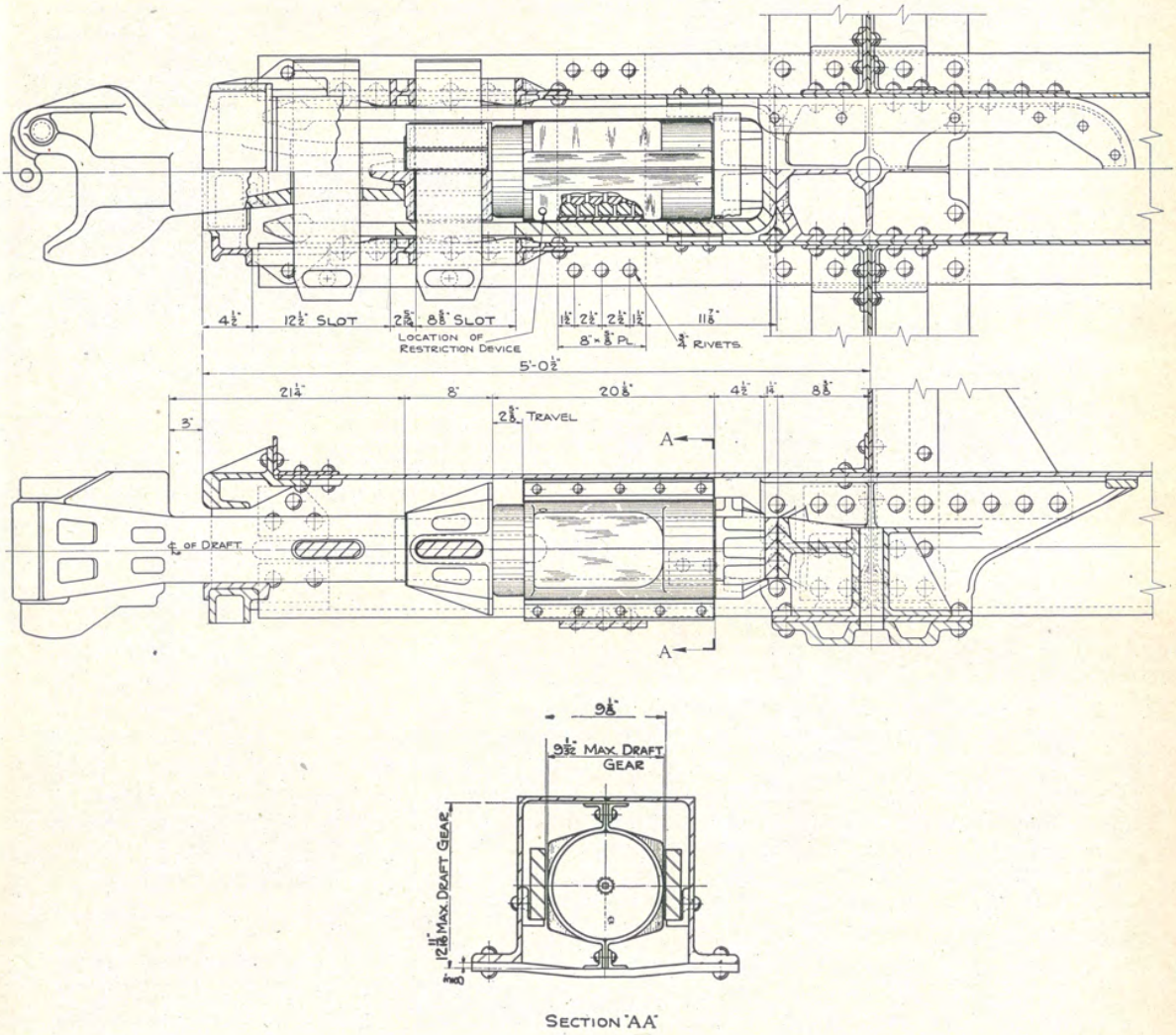


Fig. 10.46—Edgewater B-32-KA Draft Gear as applied to A.A.R. car with standard horizontal yoke attachment.

Edgewater Steel Company

(*See also Page 937*)

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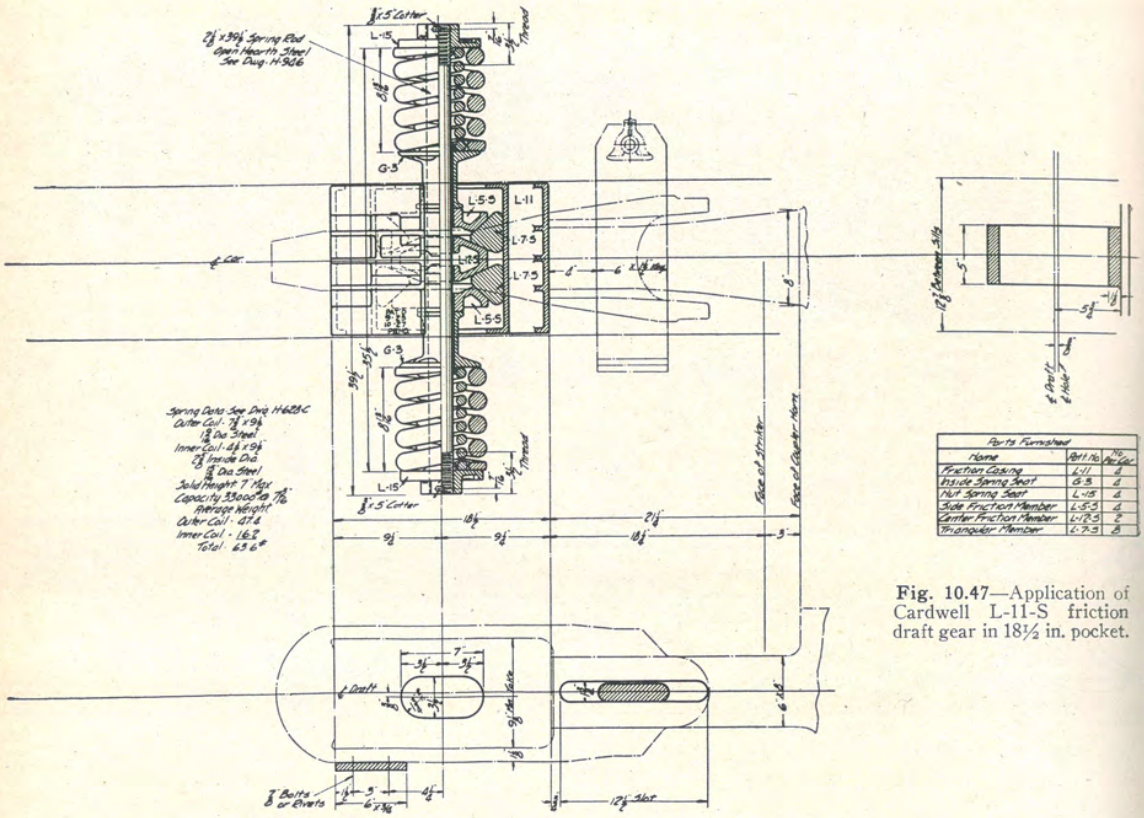


Fig. 10.47—Application of Cardwell L-11-S friction draft gear in 18½ in. pocket.

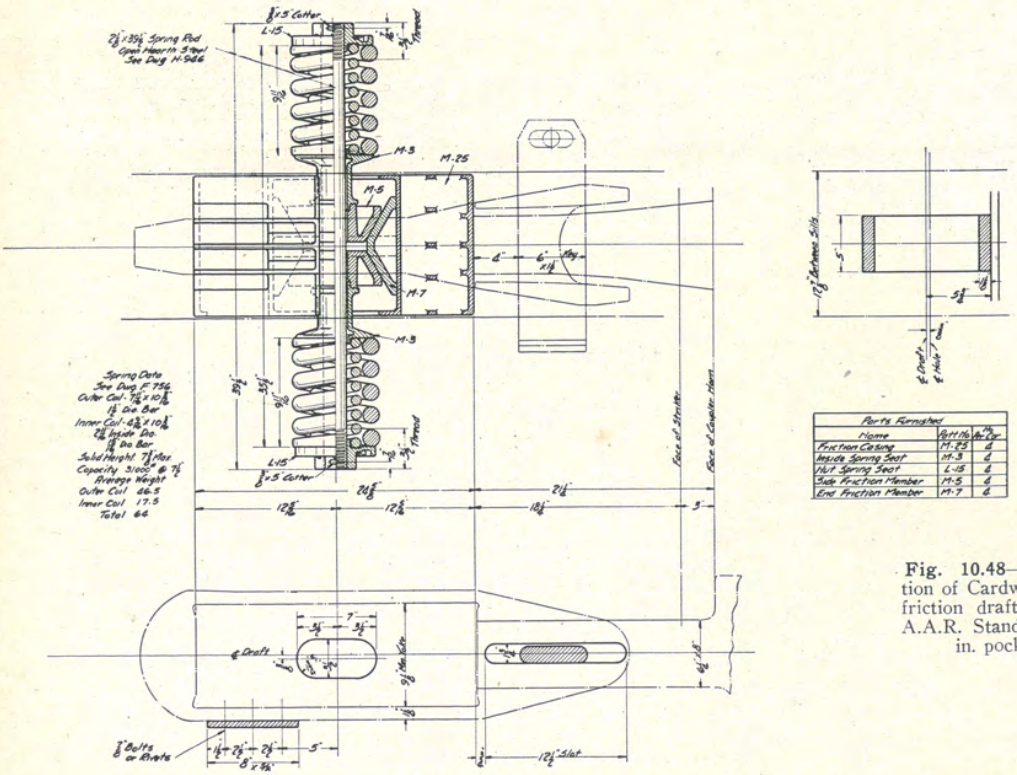


Fig. 10.48—Application of Cardwell M-25 friction draft gear in A.A.R. Standard 24⅝ in. pocket.

Cardwell Westinghouse Company

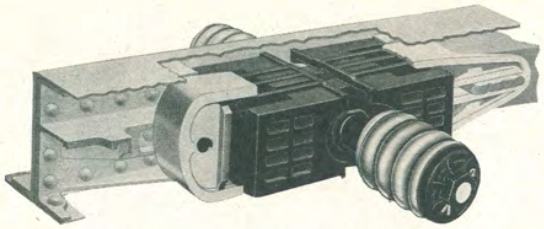
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The Cardwell Friction Draft Gear

Features include invariable high capacity, rugged construction, ease of inspection and repairs

INCREASES in weights of railway rolling stock, and in speed of operation, were long ago recognized by this company as normal progress which would continue into the future. Consequently, the capacity of Cardwell Friction Draft Gears has always been kept well in advance of current requirements. Cardwell Draft Gears provide a degree of protection to cars and lading which is not only ample for the present, but for a considerable future increase in the severity of service. To determine the condition of a Cardwell Friction Draft Gear, it is only necessary to inspect the spring and spring rod; and this is done with the gear on the car and without disassembling. Friction parts are easily replaced to restore the gear to its high initial efficiency.



Cardwell M-25 draft gear, certified A.A.R.

The Cardwell Friction Draft Gear

The manufacturers of this gear were among the first to adopt the friction principle as a means of dissipating the energy of moving cars. This principle is now followed in practically all draft gears. The design of the Cardwell Friction Draft Gear itself, however, is radically different from others. It can be easily restored to high efficiency, after years of service, resulting in considerable economy.

Improvements Give Greater Protection

Incorporated in the Cardwell series of gears, are the results of investigations and tests which are being carried on continuously.

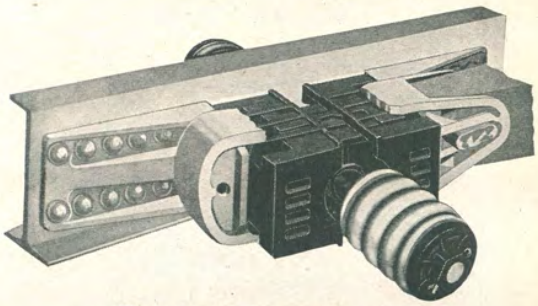
While the basic design remains unchanged, additional capacity and sturdiness make this gear, with standard attachments, capable of withstanding as great final forces as any other known combination.

Design Details

The friction members of this gear are encased in two housings. The spring rod supports coil springs which hold the friction members under compression. The coupler yoke encircles the two housings.

Cardwell Friction Draft Gear Is Distinctive in Design

The feature which distinguishes the Cardwell Friction Draft Gear is the arrangement of its springs which are crosswise of the sills. Its working mechanism is so disposed that its condition may be determined in an instant, by an inspection from the outside. This arrangement of springs allows the gear to be made longitudinally compact, which is a decided advantage in nearly all cases and particularly so in short cars.



The Cardwell type L-11-S draft gear

Summarizing, the distinguishing features of the Cardwell Draft Gears are high work capacity, simplicity, long efficient life, positive release and ability to restore its capacity. This gear can be repaired by regular car repair men.

The Cardwell M-25 Draft Gear is designed for the A. A. R. Standard 24⅝-in. pocket.

The Cardwell L-11-S Draft Gear has the same capacity as the M-25 but is designed for an 18½-in. pocket.

Important instructions for inspecting Cardwell Friction Draft Gears and keeping these gears working at their full capacity are contained in the Cardwell Draft Gear Chart which will be sent to interested railroad men upon request.

CARDWELL WESTINGHOUSE COMPANY, CHICAGO, ILL.
CANADIAN CARDWELL CO., LTD., MONTREAL

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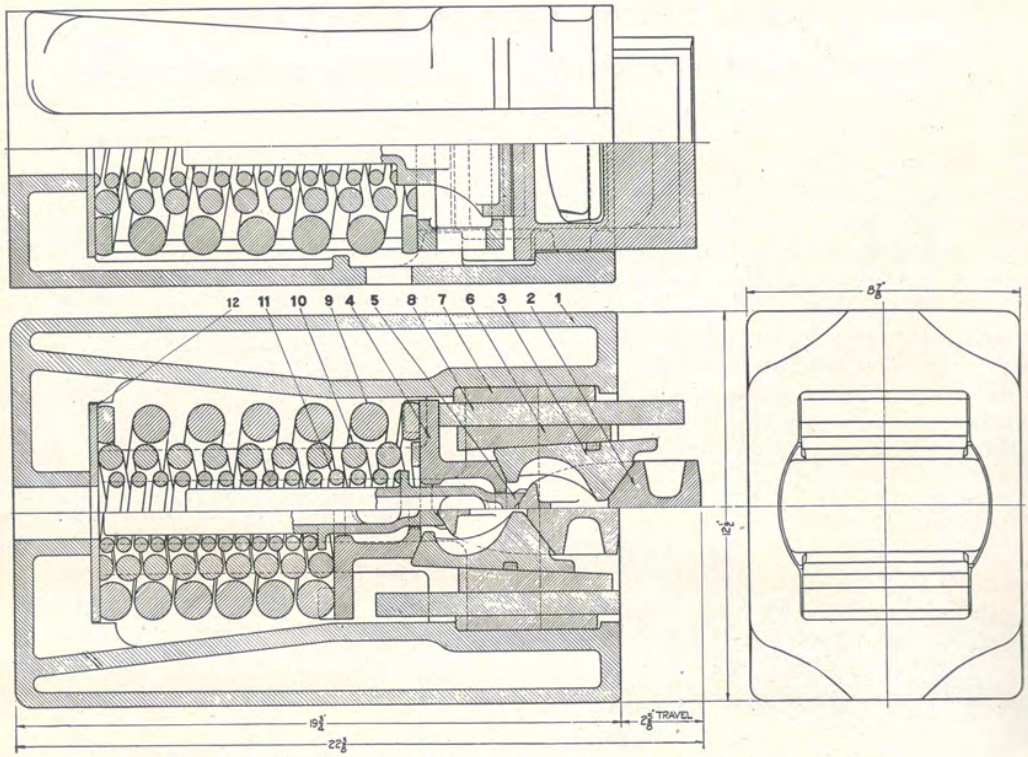


Fig. 10.49—Cross sections of Westinghouse Type NY-11-F friction draft gear.

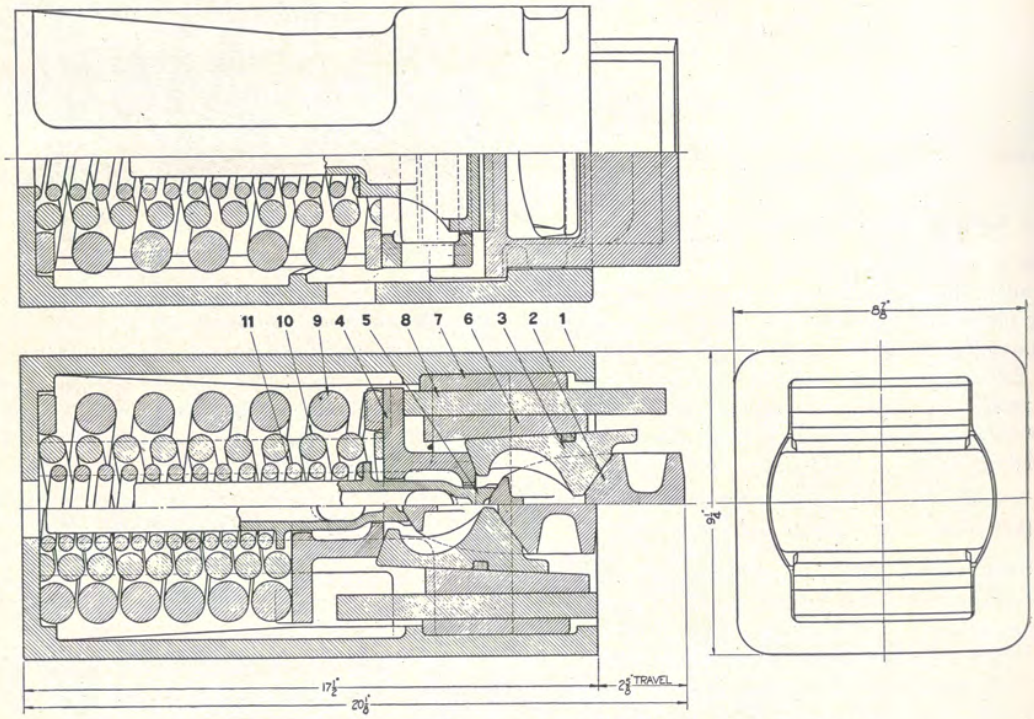


Fig. 10.50—Cross sections of Westinghouse Type NZ-11-F friction draft gear.

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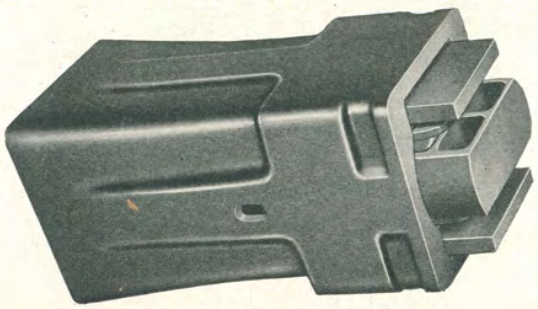
Westinghouse Friction Draft Gears

Feature strength and shock-absorbing capacity

THE Westinghouse Type NY-11-F and Type NZ-11-F Draft Gears give the increased car protection necessitated by the heavy loads and high speeds of present-day traffic. The gears are designed to give ample capacity, strength and durability for the shocks encountered in hump-yard or other switching, or in the severe service to which they are subjected in high-speed trains, with a minimum maintenance. The friction members are made of a metal especially suited to the stresses and wear to which they are subjected.

Westinghouse Type NY-11-F and NZ-11-F Draft Gears

The Type "N" Westinghouse Draft Gears are unusually rugged, with special high-duty characteristics which lower maintenance costs and give an unusual degree of protection to attachments, car structure and lading.



Westinghouse type NZ-11-F draft gear, certified A.A.R.

The gear consists essentially of a multiple arrangement of friction members, in combination with springs, which furnish the elastic resistance and the means for releasing the gear. Its movable parts are encased in a housing of rectangular cross-section, and held together under initial compression by a self-locking arrangement.

The construction throughout is substantial and of the best materials. The housing is a heat-treated steel casting of highest quality. The friction members are of hardened alloy steel, a combination which offers high resistance with minimum wear.

Low Initial Resistance

The operating advantages include a low initial resistance to provide the necessary movement for starting long trains.

Positive Release

These gears are so designed and constructed as to insure prompt and certain return to normal position in readiness for subsequent duty up to full capacity.

Minimum Recoil

One of the desirable features of this Gear—minimum recoil—is effected by the proper design, proportioning and arrangement of the frictional and spring elements.

Installation

These gears can be applied with proper follower plates to any standard 24⅝-in. pocket using either vertical or horizontal Yoke attachments.

Gear Travel

The soft starting action and ultimate high capacity are obtained with a travel of 2⅝ in.

The Gear Is Self-Contained

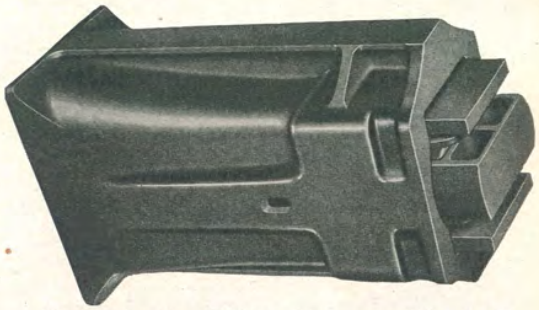
The fact that the various members of the gear are held together under initial compression insures, first, that all parts are always in their proper relation; and second, that the gear can be handled as a single unit.

No Friction Wear on Housing

There is no wear on the housing—the most expensive single part to replace—which insures that no repairs will be required from this source. This is achieved by so designing the gear that the wear affects the removable elements only. Exceptionally large frictional surfaces are provided, which distribute the work over a large area, consequently the rate of wear is low. The housing is strong enough to withstand, safely, blows far in excess of the capacity of the coupler.

Two Types of Gears

Within these two classes of gears, details are similar, and operate to produce the same excellent performance.



Westinghouse type NY-11-F draft gear, certified A.A.R.

The NY-11-F has a capacity and ruggedness which make it adequate for the great majority of applications. The NZ-11-F has equal capacity and both are designed for cars and locomotives subjected to severe service.

Both gears meet all A.A.R. requirements. If further information is desired, the Cardwell Westinghouse Company will be pleased to have one of their experienced draft gear men call and discuss specific draft gear requirements to suit any individual case.

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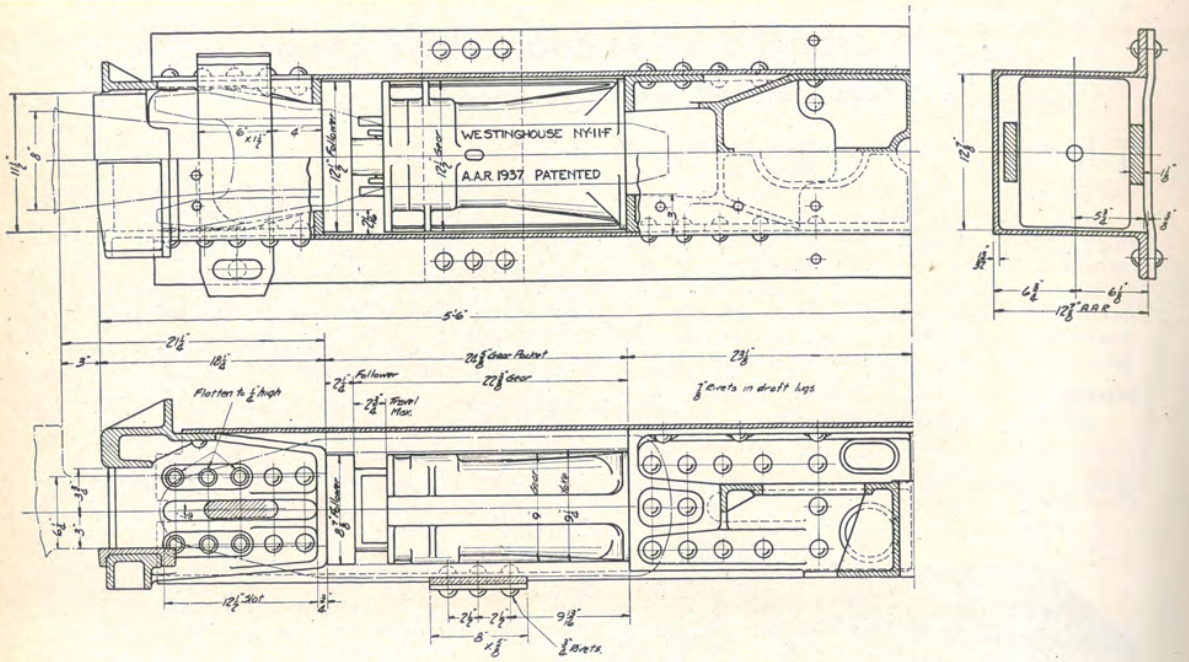


Fig. 10.51—Application of Westinghouse Type NY-11-F friction draft gear with vertical yoke.

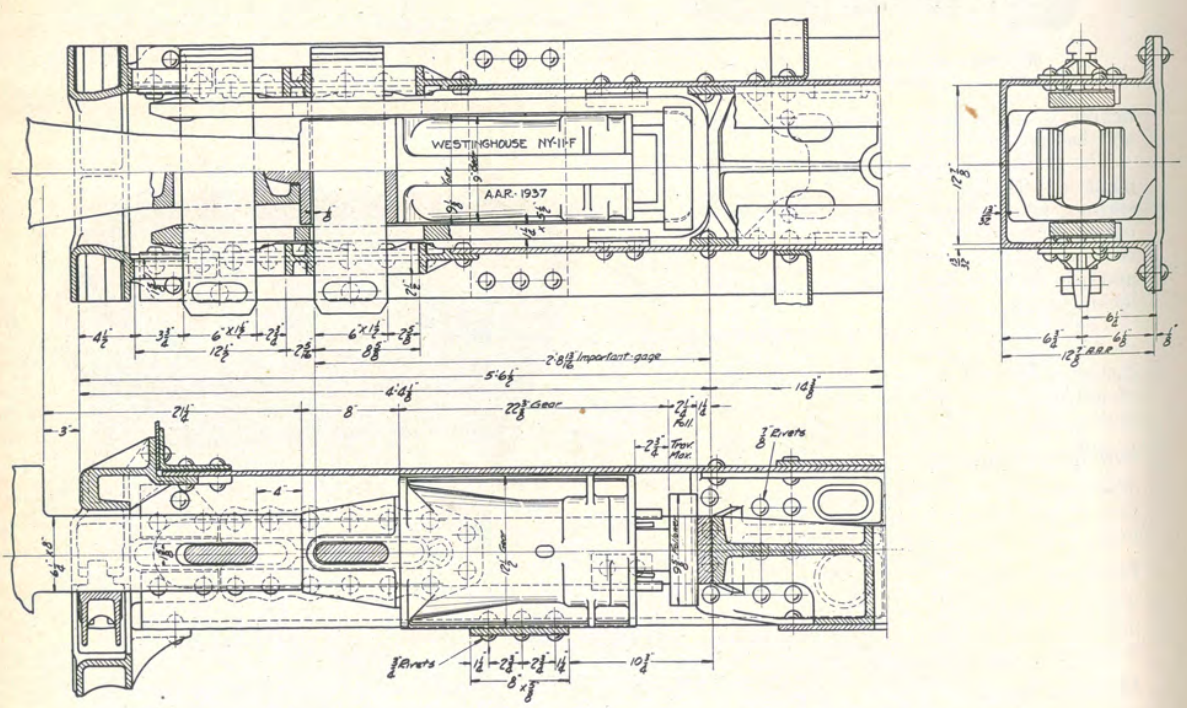


Fig. 10.52—Application of Westinghouse Type NY-11-F friction draft gear with horizontal yoke.

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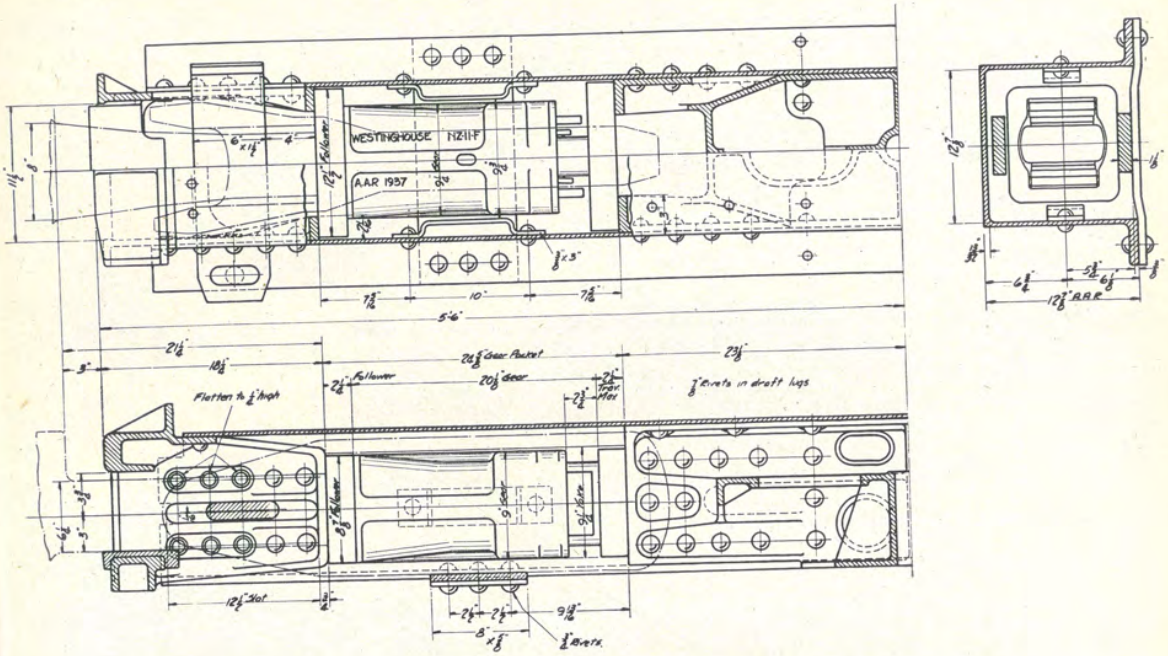


Fig. 10.53—Application of Westinghouse Type NZ-11-F friction draft gear with vertical yoke.

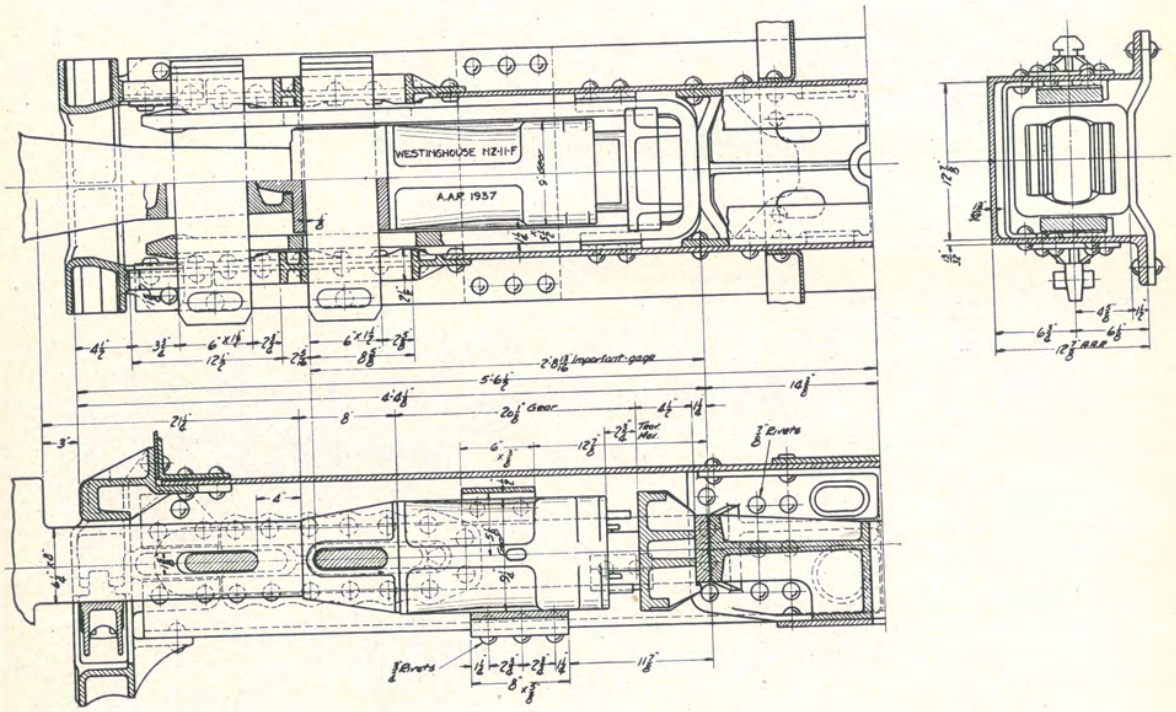


Fig. 10.54—Application of Westinghouse Type NZ-11-F friction draft gear with horizontal yoke.

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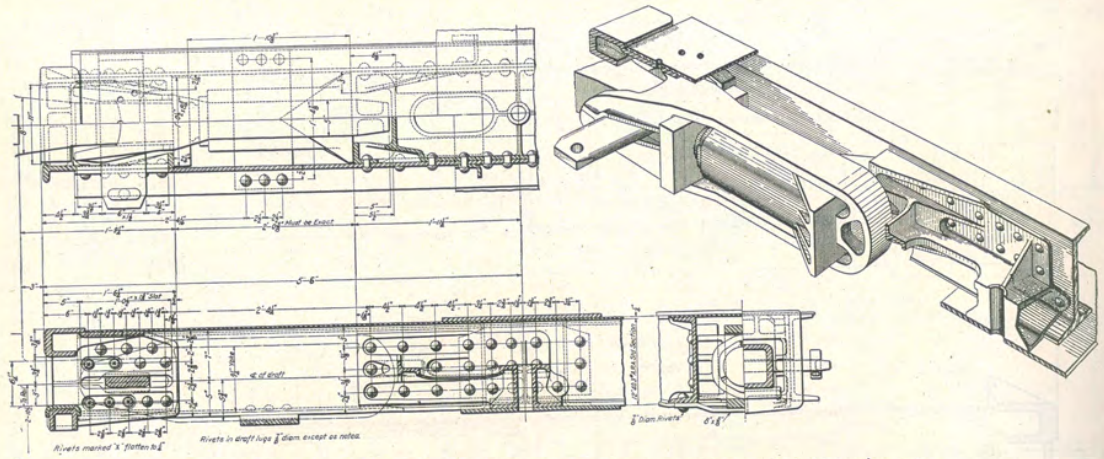


Fig. 10.55—Miner Class A-22-XB friction draft gear applied to freight equipment.

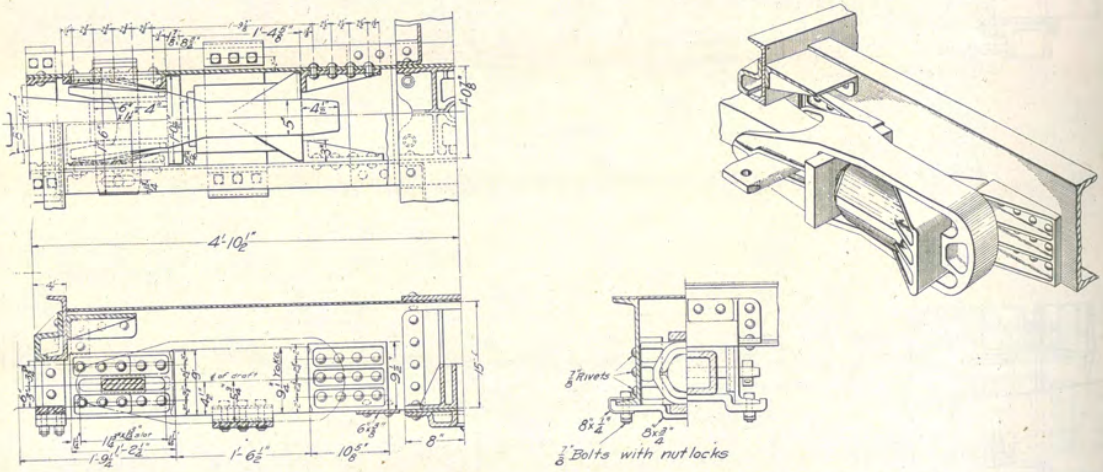


Fig. 10.56—Miner Class A-69-XB friction draft gear applied to freight equipment.

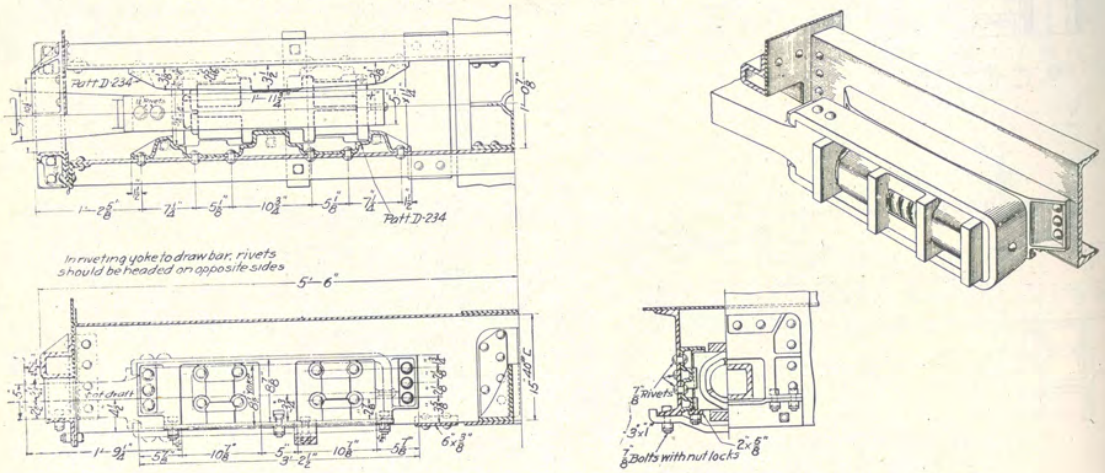


Fig. 10.57—Miner Class A-19-XB friction draft gear applied to freight equipment having Miner tandem draft attachments.

W. H. Miner, Inc.

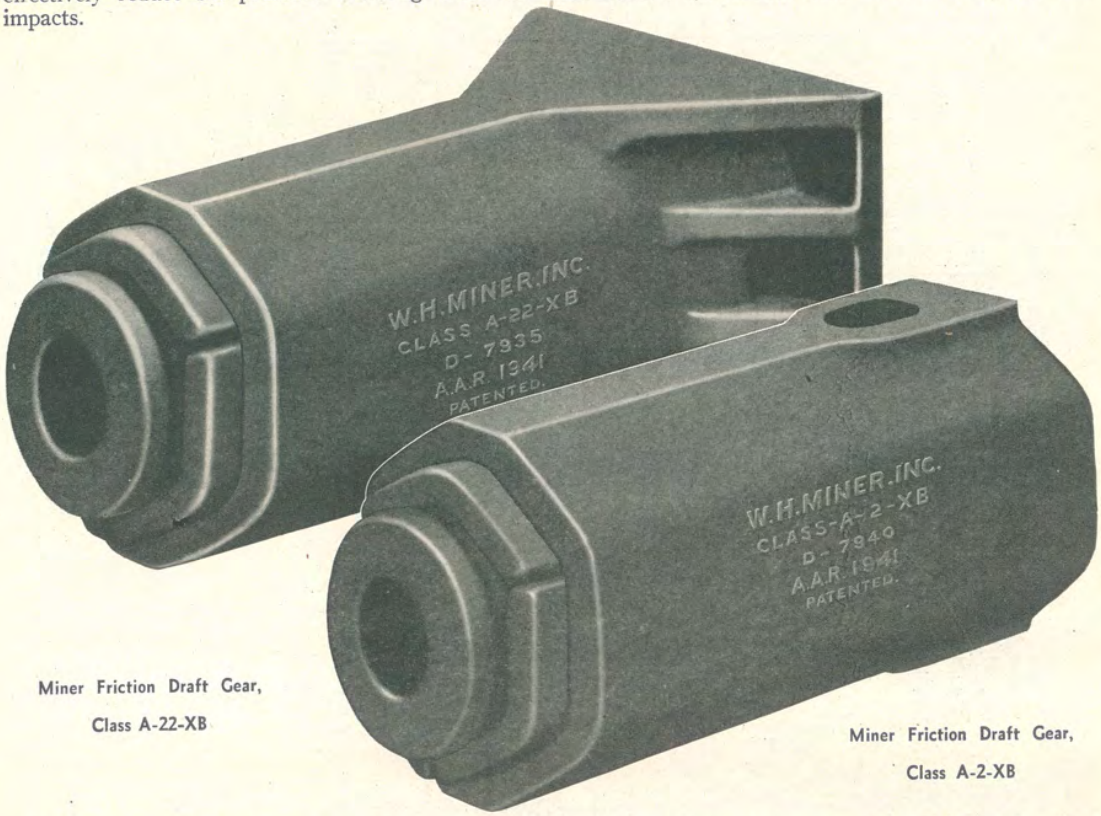
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Miner Friction Draft Gears

For Freight Equipment

MINER Friction Draft Gears perform a vital service in the economic operation of high-speed freight trains. These devices have thoroughly demonstrated their ability to protect car structure and lading under the most severe operating conditions. Miner gears are powerful shock absorbers which effectively reduce sill pressure resulting from car impacts.



Miner Friction Draft Gear, Class A-22-XB

Miner Friction Draft Gear, Class A-2-XB

The Miner method of manufacturing the materials of which these devices are made and the subsequent steps in the fabrication and heat-treatment of the component parts positively ensure the high quality necessary to satisfy the exacting demands of shock-prevention service. The friction elements are made of drop-forged steel, thoroughly heat-treated and inspected. The springs are wound to exact specifications in accordance with the latest scientific practice. Each device is individually inspected and tested under a 27,000-pound drop hammer, thereby definitely ensuring correct action and capacity. Extensive service experience has positively demonstrated the ability of Miner gears to withstand shock and to protect car and lading from damage.

Miner A-22-XB Gear

The Miner Class A-22-XB Gear is certified by the Association of American Railroads and meets fully every requirement for heavy freight train protection. This device provides great column strength, and the extraordinary resistance to wear ensures that high capacity with low sill pressure is maintained for many years of service. For typical application, see Figure 10.55.

Miner A-2-XB Gear

The Miner Class A-2-XB Gear is also certified by the Association of American Railroads. This device has a high degree of mechanical efficiency, resulting in the reduction of lading and equipment damage. The gear is applied to the standard pocket in combination with two follower plates. See Figure 10.58 for typical application.

Miner A-69-XB Gear

The Miner Class A-69-XB Gear is similar in construction and performance to the Class A-22-XB gear except that it is especially designed to fit the 18½-in. pocket. Application to car conditions is shown in Figure 10.56.

Miner Class A-28-XB Gear

This device was designed for caboose cars. It provides an initial resilient spring action of 1½ in., ensuring comfort for the trainmen, and an additional 1-in. travel of frictional resistance so vitally necessary to protect the car when it is used in pusher service. Figure 10.60 shows typical application.

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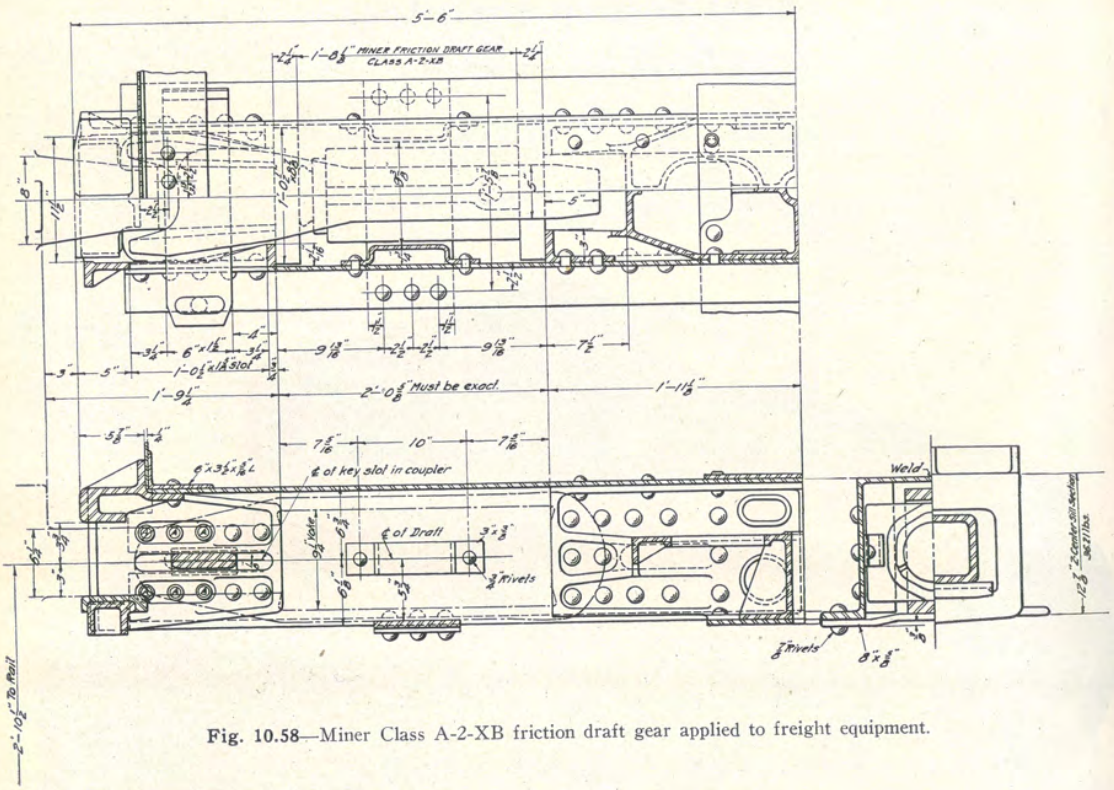


Fig. 10.58—Miner Class A-2-XB friction draft gear applied to freight equipment.

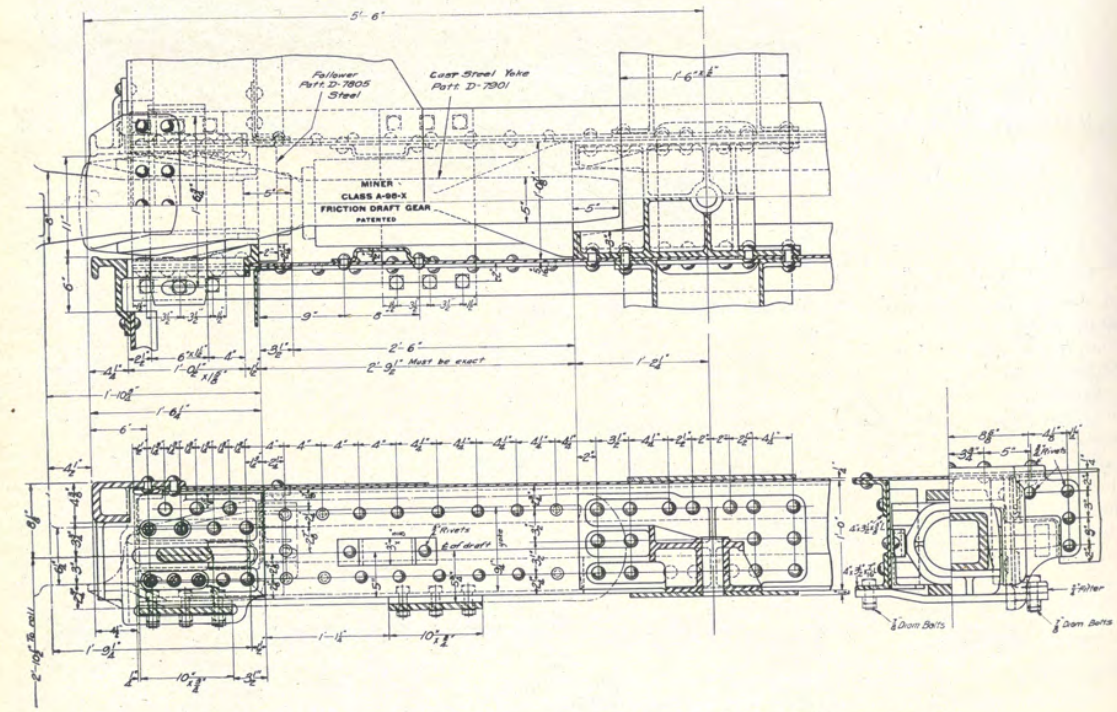


Fig. 10.59—Miner Class A-98-X friction draft gear applied to freight equipment.

W. H. Miner, Inc.

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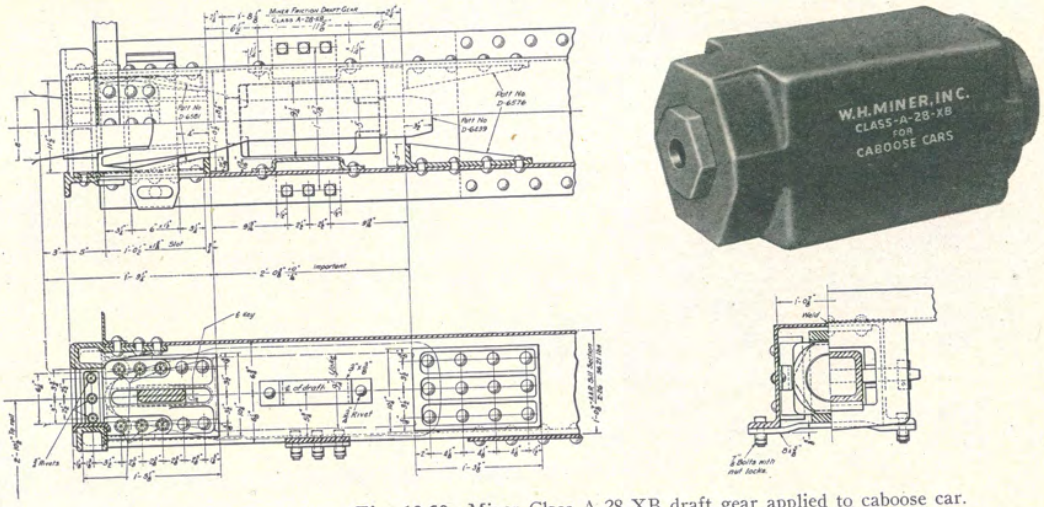


Fig. 10.60—Miner Class A-28-XB draft gear applied to caboose car.

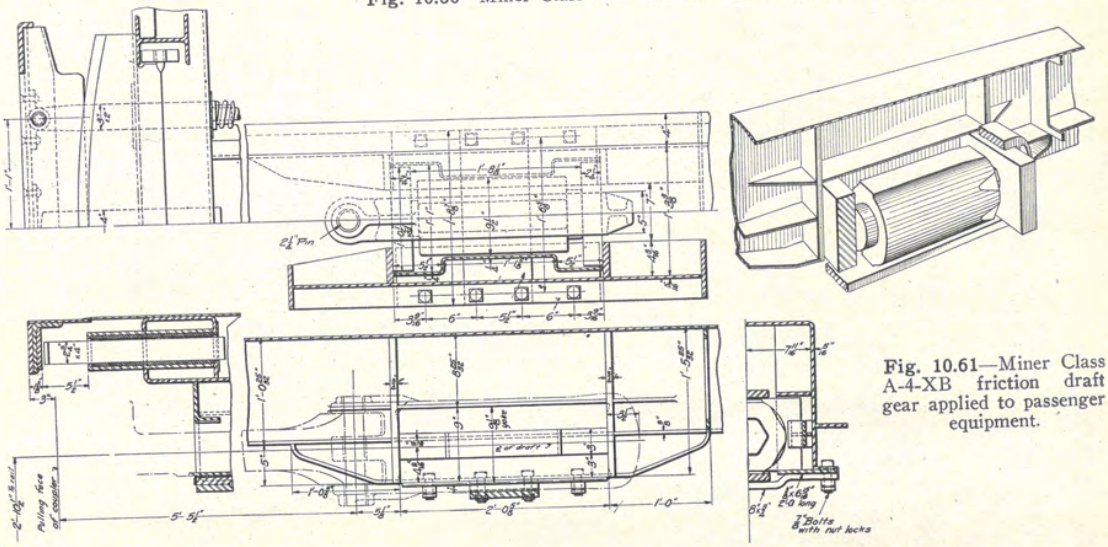


Fig. 10.61—Miner Class A-4-XB friction draft gear applied to passenger equipment.

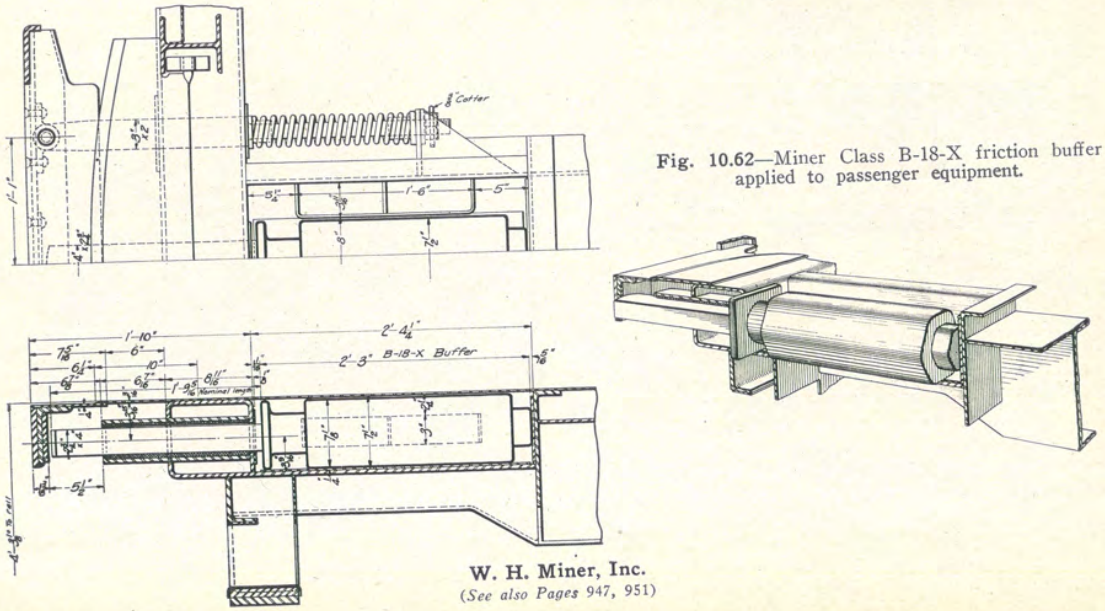


Fig. 10.62—Miner Class B-18-X friction buffer applied to passenger equipment.

W. H. Miner, Inc.

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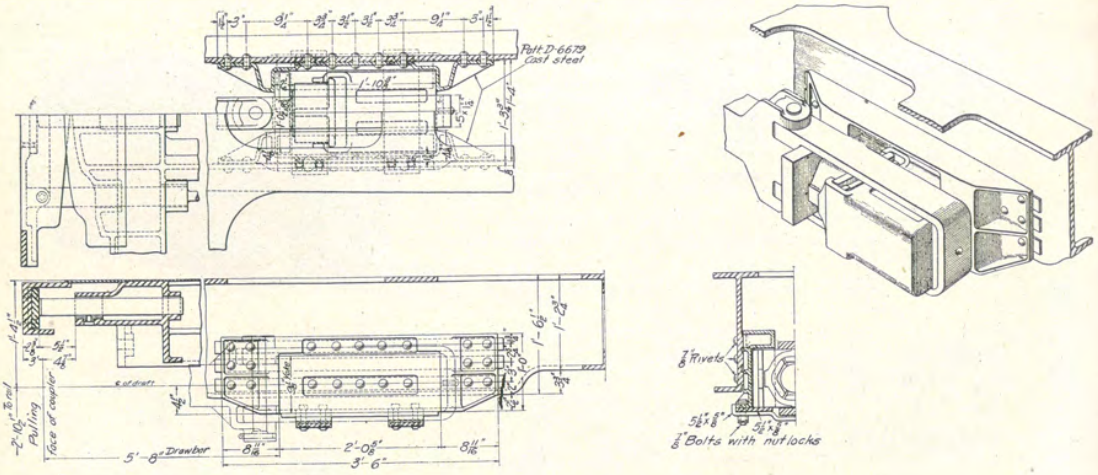


Fig. 10.63—Miner Class A-5-XB friction draft gear applied to passenger equipment.

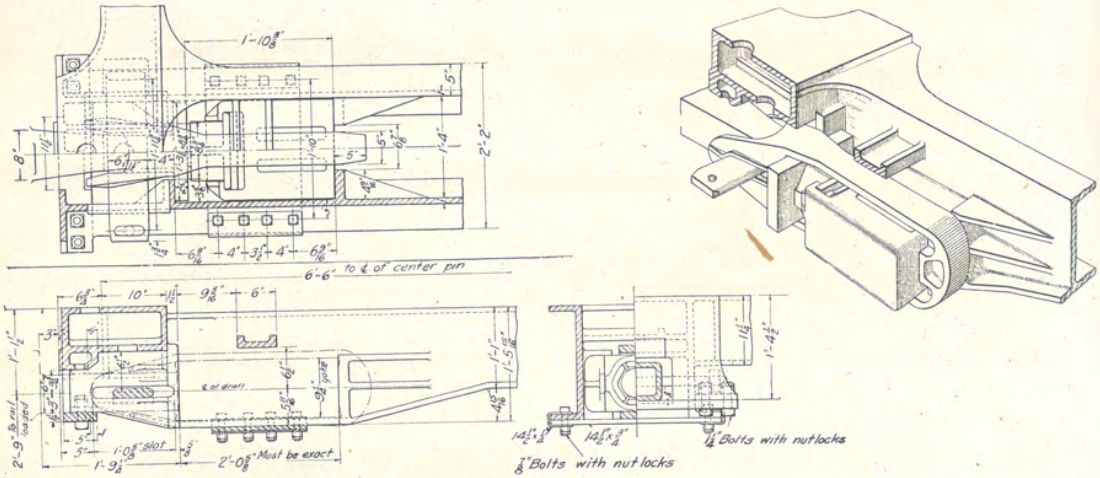


Fig. 10.64—Miner Class A-94-XB friction draft gear applied to passenger equipment.

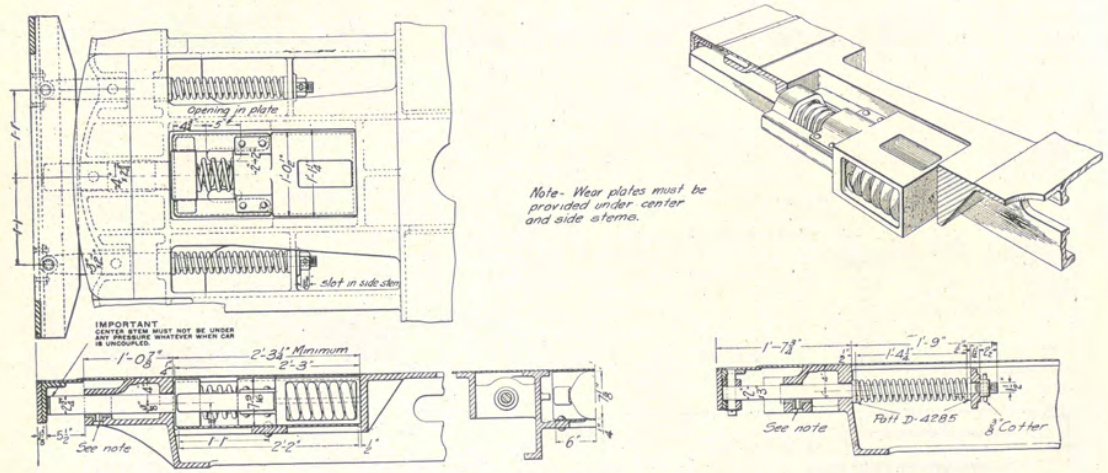


Fig. 10.65—Miner Class B-10-X friction buffer applied to passenger equipment.

W. H. Miner, Inc.

(See also Page 951)

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Miner Friction Draft Gears and Buffers

For Passenger Equipment

IT is imperative that correctly designed cushioning devices be selected for passenger equipment in order to ensure a maximum of comfort for the traveling public. Miner Velvet-Action Draft Gears and Buffers successfully fulfill every requirement of modern passenger train operation, not only protecting equipment from rough handling but facilitating smooth starting and stopping of cars. They also provide proper blending of the differences in speed between the motive power and the individual cars while the train is in motion.

Miner A-4-XB Gear

The Miner Class A-4-XB Gear (Figures A and 10.61) is made of high-strength steel, ensuring extraordinary durability. This device, which fits the standard draft gear pocket, provides the necessary live spring action for the smooth and noiseless starting of trains. High frictional resistance is developed in the final portion of the travel to protect equipment against rough handling.

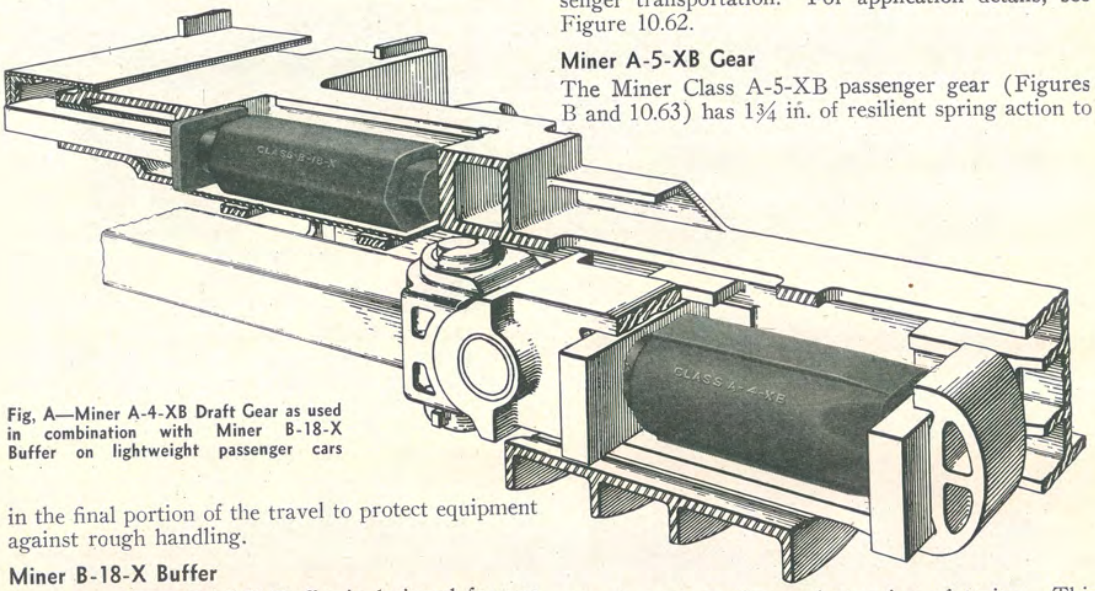


Fig. A—Miner A-4-XB Draft Gear as used in combination with Miner B-18-X Buffer on lightweight passenger cars

Miner B-18-X Buffer

The Miner Class B-18-X Buffer is designed for use in combination with the Class A-4-XB gear on modern passenger cars. Several years of service on leading high-speed trains testify to their success in meeting the exacting requirements of present-day passenger transportation. For application details, see Figure 10.62.

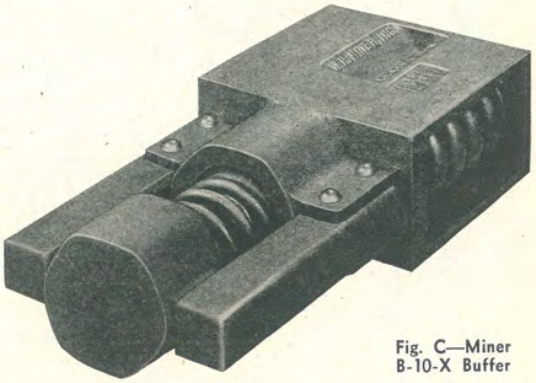


Fig. C—Miner B-10-X Buffer

Miner A-5-XB Gear

The Miner Class A-5-XB passenger gear (Figures B and 10.63) has 1¾ in. of resilient spring action to permit easy starting and stopping of trains. This spring resilience also responds to the pulsing development of the drawbar pull and, by synchronizing with this surging, transmits uniform traction to the train. This action blends into heavy frictional capacity at the end of the stroke to protect car structure against overload shocks.

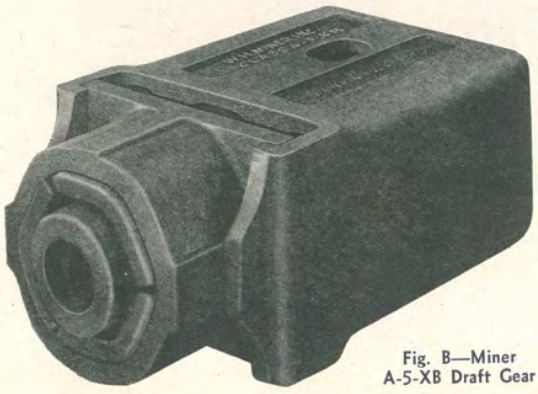


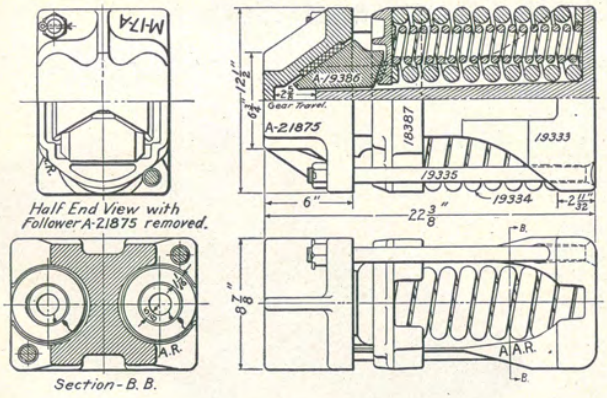
Fig. B—Miner A-5-XB Draft Gear

Miner B-10-X Buffer

The Miner Friction Buffer (Figures C and 10.65) provides live spring resistance for precoupling action, during which the buffer works in conjunction with the side stem springs to maintain positive contact between vestibule plates. The final travel augments the draft gear capacity.

Miner passenger appliances are correctly designed and made of the finest quality steel, thoroughly heat-treated. Each device is carefully and rigidly inspected and tested before shipment.

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List of Parts of Fig. 10.66

Number	Name	No. per Gear
18387	Friction Segment Seat	1
A-21875	Follower Wedge	1
19333	Friction Member	1
19334	Draft Spring	2
19335	Retaining Rod and Nut	2
A-19386	Friction Segment	2

Travel of Gear.....Min., 2½ in.; Max, 2¾ in.
Weight of Gear.....Average 370 lb.

Fig. 10.66—National friction draft gear, Type M-17-A, A.A.R. approved—Certificate No. 2.

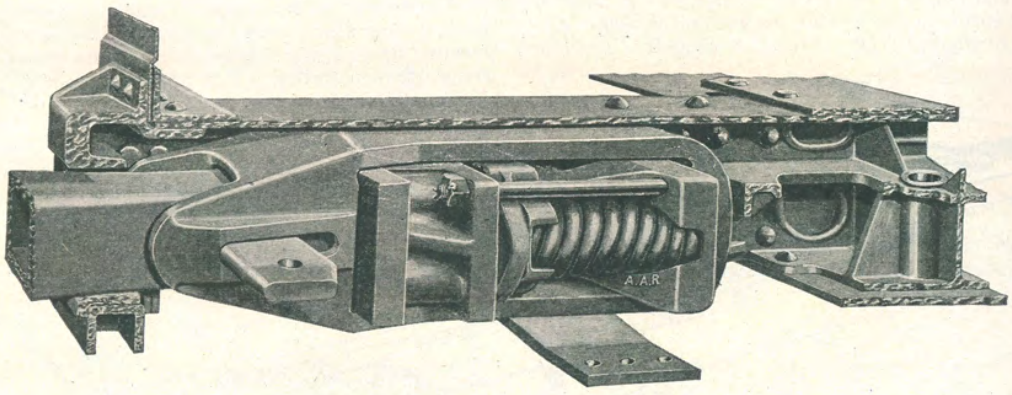


Fig. 10.67—National friction draft gear, Type M-17-A, A.A.R. approved. Applied to car in combination with A.A.R. Standard E Coupler and vertical cast steel yoke.

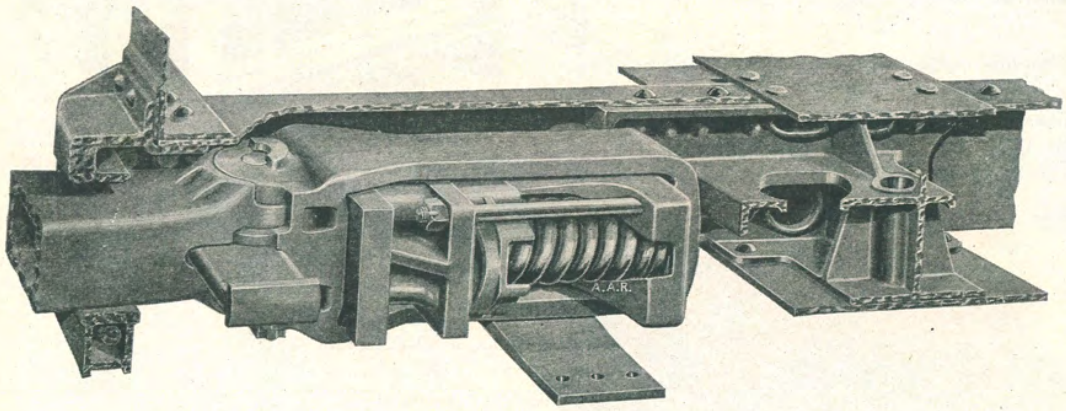


Fig. 10.68—National friction draft gear, Type M-17-A, A.A.R. approved. Applied to car in combination with A.A.R. Alternate Standard E Coupler and vertical cast steel swivel yoke.

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National Friction Draft Gears

THE present National Friction Draft Gears are the result of many years of service, investigation and development work to obtain a gear of simple design and with the fewest number of parts possible, consistent with a ruggedness and capacity that would insure a long life of the gear in service and afford the maximum protection to the cars against the extremely heavy shocks and blows of present day train operation. To attain this object the material used in the construction of National Friction Draft Gears is of special high quality. Each vital part of these gears is separately treated to obtain the exact physical properties necessary to best enable it to perform its individual function.

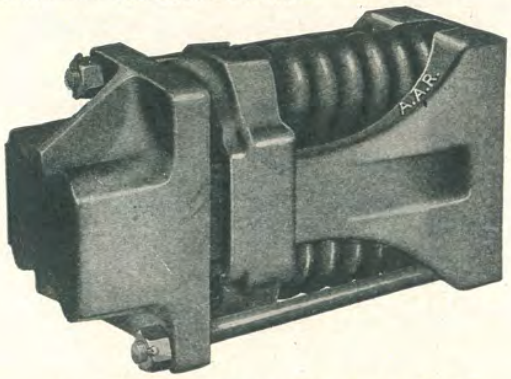


Fig. A—National Friction Draft Gear Type M-17-A
A. A. R. Approved, Cert. No. 2

Important and Distinctive Features

National Friction Draft Gears embody several important and distinctive features:

First: National gears are built upon the principle of inwardly acting wedge pressure and a centrally located friction member. The friction segments are wedged inwardly against the central member, with the result that this member is subjected only to compressive stresses. Any wear that may develop on this member, therefore, does not weaken it or lessen its ability to withstand these stresses.

Second: All castings entering into the construction of these gears are made of alloy steels, heat-treated to secure a hardness and strength best suited for the service each part must perform. The central friction member is specially hardened, providing a ductile, shock-resisting body with surfaces of extreme hardness. The friction segments are of a special alloy steel, heat-treated to secure a degree of hardness somewhat less than that of the surfaces of the central friction member but still very hard. The follower wedge and segment seat are made of Naco Steel on account of its proven strength and toughness.

Third: National Gears in types M-17-A and M-50-B are provided with central friction members of sufficient area and strength to carry the over-solid blows as well as the normal friction stresses and are of ample strength to meet the most rigid requirements.

The draft springs are never compressed solid, even when the gear is fully closed, which protects the frictional parts as well as the springs themselves from excessive stresses.

Fourth: National gears are so designed that when they are assembled and locked to the correct length for application to the car, the draft spring is under considerable initial compression. On account of this initial compression the frictional elements are always held in close contact with one another, ready to respond instantly to any applied force. This initial spring compression automatically compensates for any frictional wear that may take place during the life of the gear. The gears are locked to the proper length by retaining rods with nuts and cotters. These rods are not removed in applying the gears to equipment. The gears do not have to be boxed or crated for shipment as they cannot get out of adjustment or come apart through rough handling. The vital parts are so protected that they are not liable to injury.

Fifth: All friction and wedging surfaces are accurately machined or ground, and when assembled, each gear is given a series of factory tests in a specially designed machine equipped with an automatic recording pressure gage. Each gear is thoroughly inspected and when tested must show a minimum required capacity before it is accepted for shipment.

Sixth: As there is no case or barrel surrounding the gear, all parts are exposed to view for inspection, yet they are so protected that injury to any part is impossible.

The M-17-A gears require one follower and

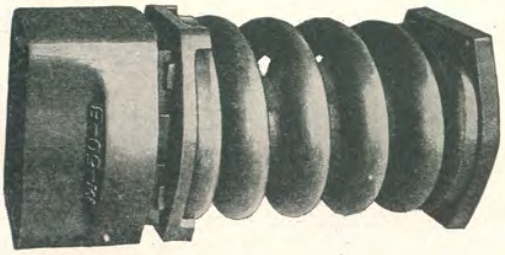


Fig. B—National Friction Draft Gear, Type M-50-B
A. A. R. Approved, Cert. No. 10

the M-50-B gears require two followers, when used in the standard draft lug spacing of 24⅝ in.

Seventh: Prior to shipment, National gears are temporarily shortened about ½ in. to facilitate their application to the cars. The small studs used for this purpose drop out during the first compression of the gears after application to a car and thus the gear is released to its normal length.

Eighth: The National M-17-A and M-50-B Draft Gears have been subjected to the tests required by the A.A.R. Standard Specifications for Approval of Draft Gears for Freight Car Service, and have passed all these requirements with an excellent margin. These gears therefore are approved as standard by the Association of American Railroads and are sold under their approval certificates.

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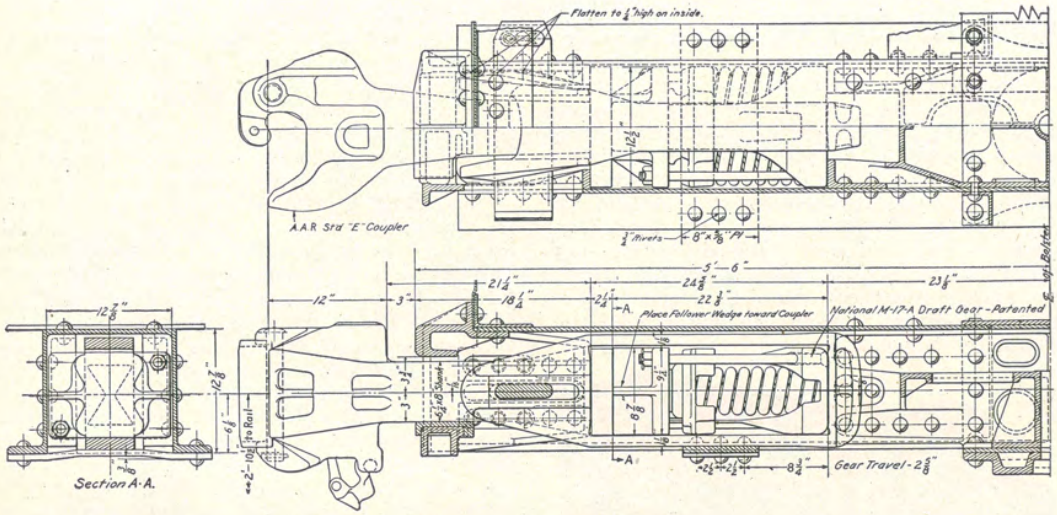


Fig. 10.69—National friction draft gear, Type M-17-A, applied to A.A.R. Type car in combination with A.A.R. Standard E Coupler and vertical cast steel yoke.

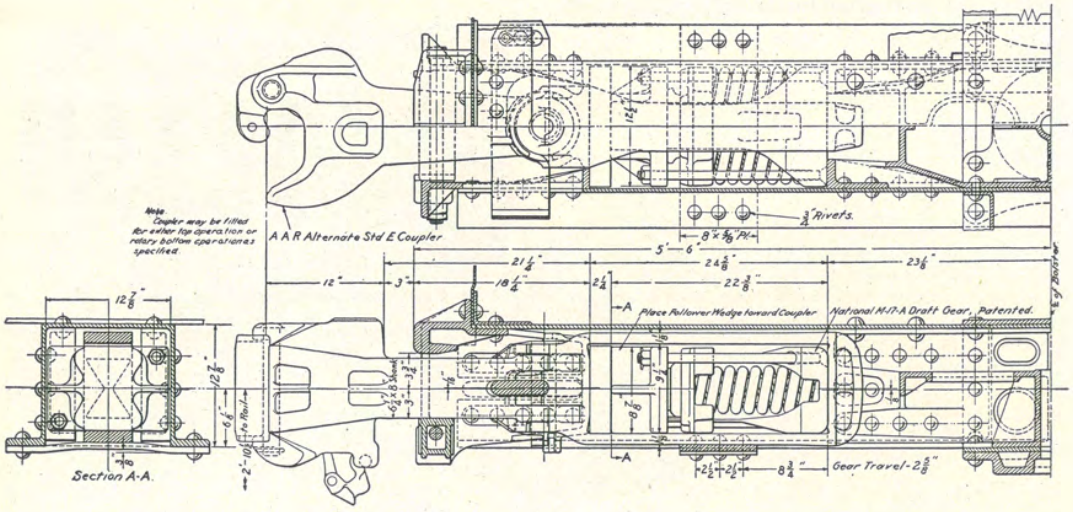


Fig. 10.70—National friction draft gear, Type M-17-A, applied to A.A.R. Type car in combination with Alternate Standard E Coupler and vertical cast steel swivel yoke.

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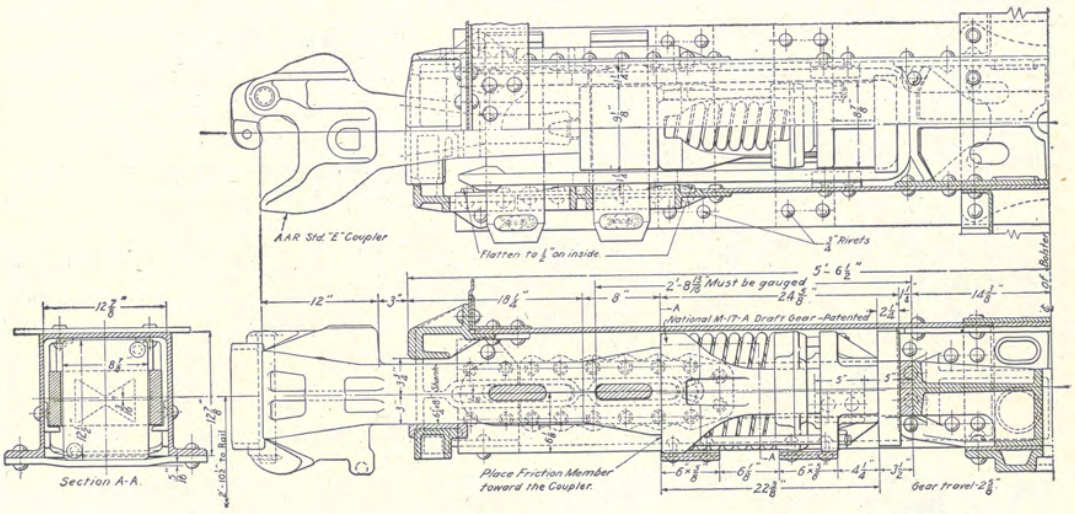


Fig. 10.71—National friction draft gear, Type M-17-A, applied to A.A.R. type car in combination with A.A.R. Standard E Coupler and horizontal cast steel yoke.

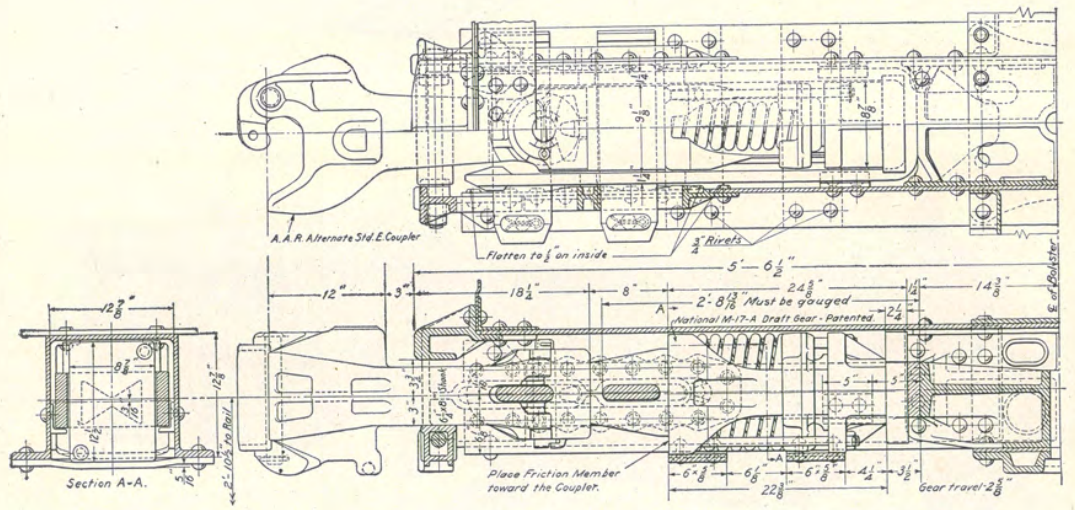
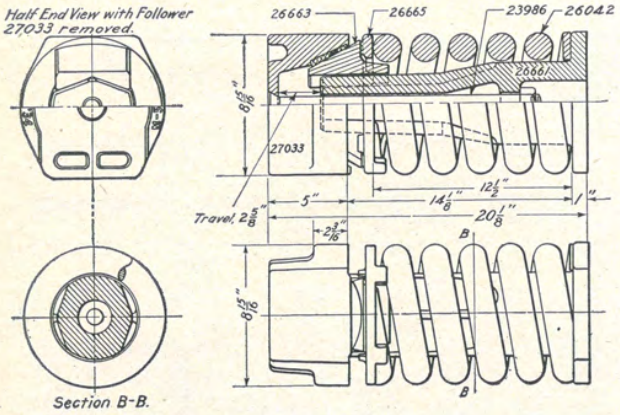


Fig. 10.72—National friction draft gear, Type M-17-A, applied to A.A.R. type car in combination with Alternate Standard E Coupler, swivel butt casting and horizontal cast steel yoke.

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List of Parts of Fig. 10.73

Number	Name	No. per Gear
26665	Friction Segment Seat	1
27033	Follower Wedge	1
26661	Friction Member	1
26042	Draft Spring	1
23986	Retaining Rod and Nut	1
26663	Friction Segment	2

Travel of Gear.....Min., 2½ in.; Max., 2¾ in.
Weight of Gear.....Average 245 lb.

Fig. 10.73—National friction draft gear, Type M-50-B. A.A.R. approved, certificate No. 10.

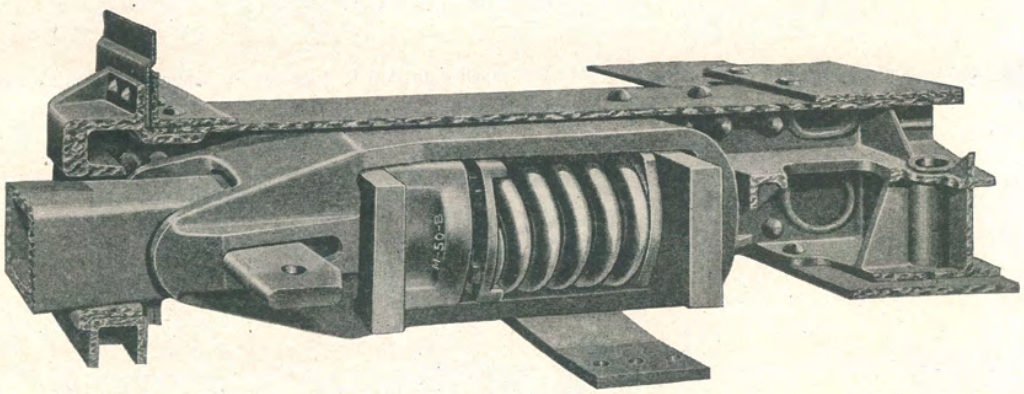


Fig. 10.74—National friction draft gear, Type M-50-B, A.A.R. approved, applied to car in combination with A.A.R. Standard E Coupler and vertical cast steel yoke.

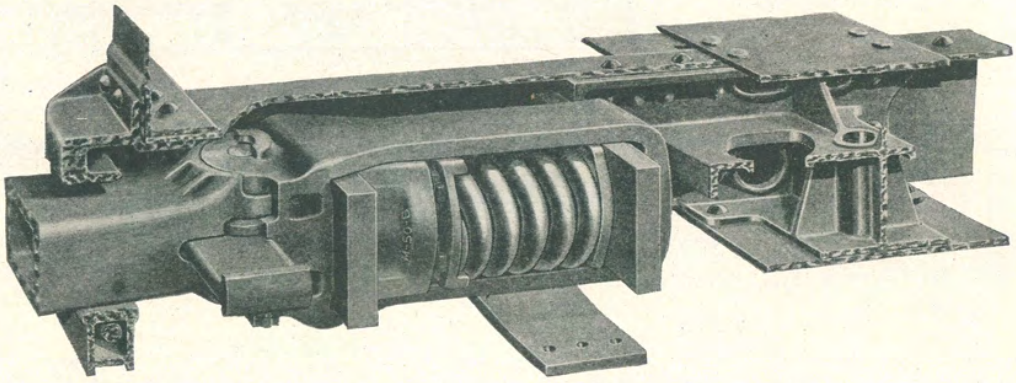


Fig. 10.75—National friction draft gear, Type M-50-B, A.A.R. approved, applied to car in combination with A.A.R. Alternate Standard E Coupler with vertical cast steel swivel yoke.

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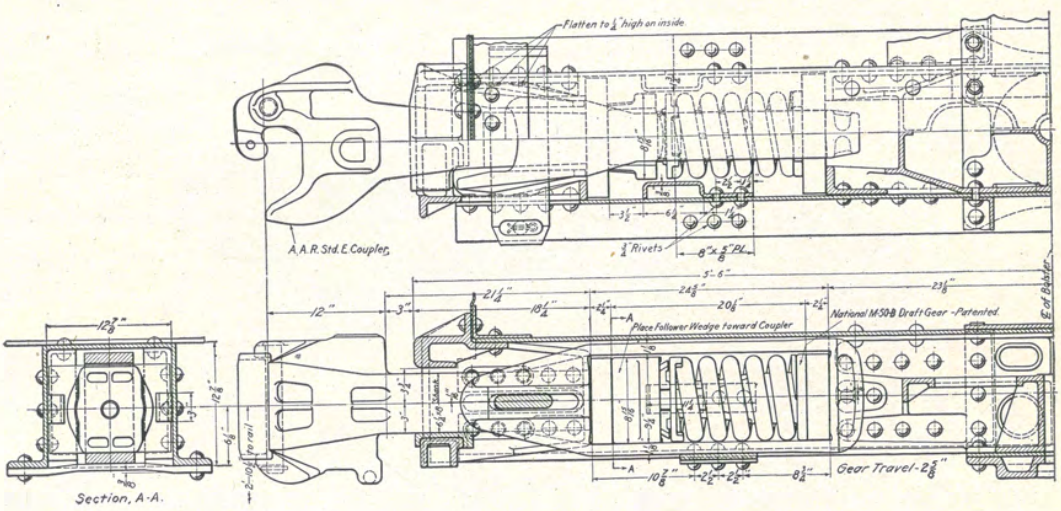


Fig. 10.76—National friction draft gear, Type M-50-B, applied to A.A.R. Type car in combination with A.A.R. Standard E Coupler and vertical cast steel yoke.

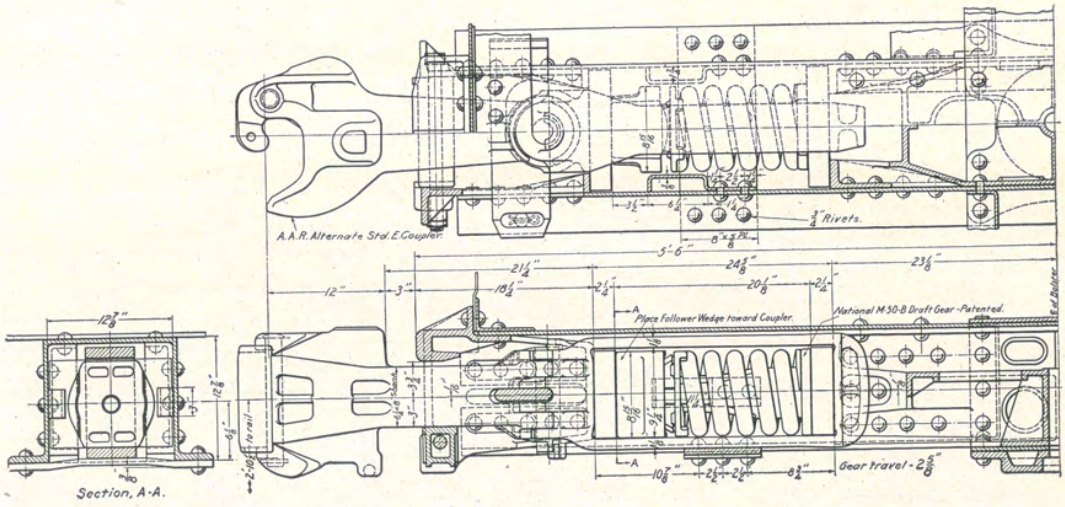


Fig. 10.77—National friction draft gear, Type M-50-B, applied to A.A.R. Type car in combination with A.A.R. Alternate Standard E Coupler and vertical cast steel swivel yoke.

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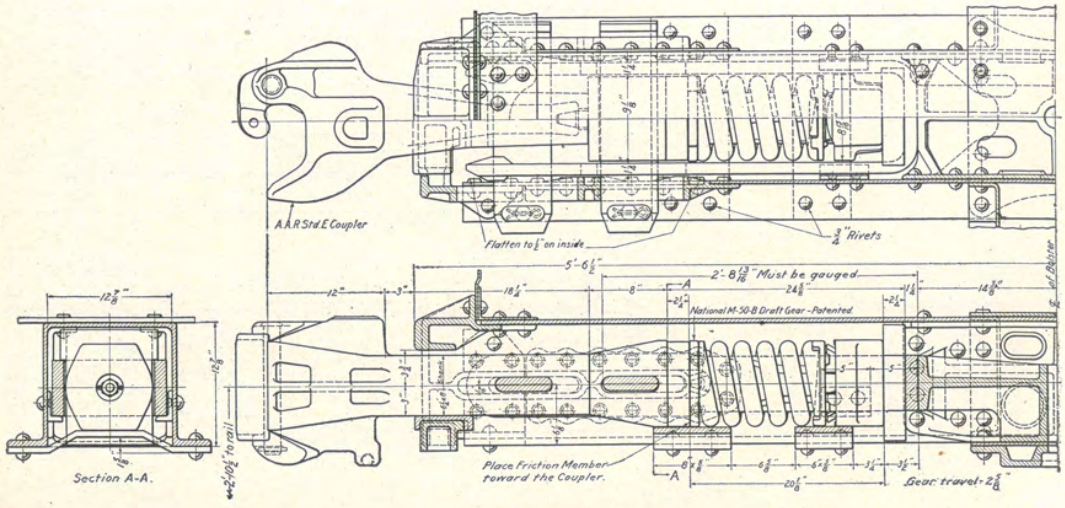


Fig. 10.78—National friction draft gear, Type M-50-B, applied to A.A.R. Type car in combination with A.A.R. Standard E Coupler and horizontal yoke.

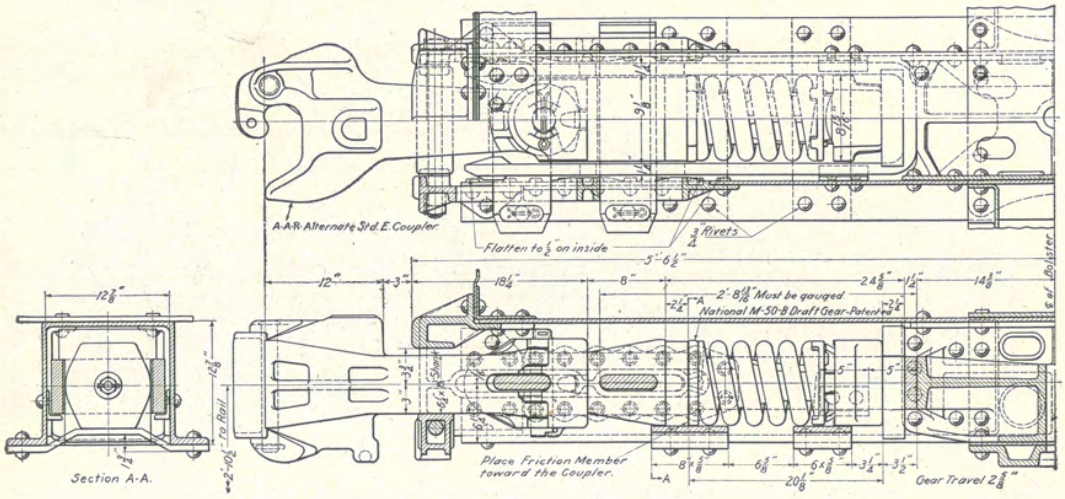


Fig. 10.79—National friction draft gear, Type M-50-B, applied to A.A.R. Type car in combination with A.A.R. Alternate Standard E coupler, swivel-butt castings and horizontal yoke.

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National Draft Gear, Type K-4

Designed to meet the exacting requirements of passenger and caboose equipment service

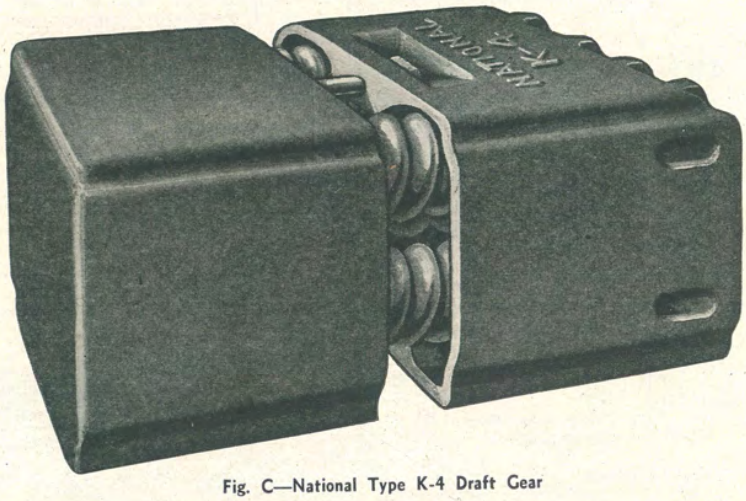


Fig. C—National Type K-4 Draft Gear

THE National Type K-4 Passenger and caboose Draft Gear embodies a combination of spring and friction resistance, the first one and one-half inches of travel in buff or draft being resisted by spring action, while for the remainder of the travel the spring action is augmented by frictional resistance to cushion the occasional heavier shocks incident to coupling, slack run-in, etc. This gear is of standard dimensions, 8⅞ in. by 12½ in. by 22⅜ in., and requires one follower. The total nominal travel is 2½ in.

Figure D shows a typical closure curve for this gear. The initial spring compression is approximately 3,000 pounds. This spring resistance increases as the gear closes, until at 1½ inches compression it is 45,000 pounds. After this the resistance increases more rapidly as the friction system comes into action.

The internal construction of this gear is such that as the gear releases, the friction system releases first, followed by release of the spring system. This means that the frictional cushioning capacity of the gear is always available, even in the case of a rapid succession of blows. The spring resistance and frictional resistance are so proportioned that pulsations in locomotive tractive effort are absorbed by the gear, thus insulating the cars from such disturbances.

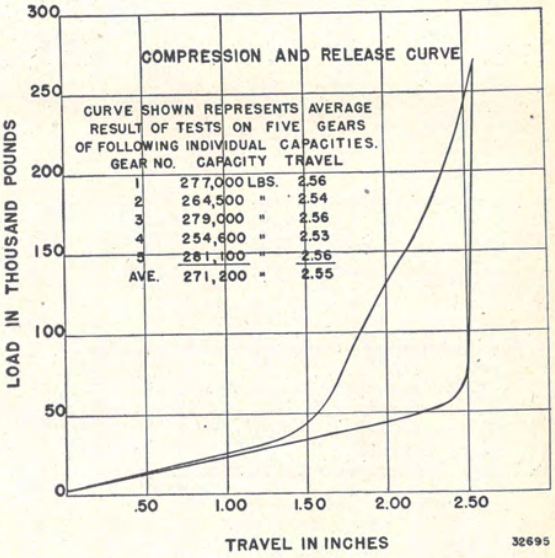


Fig. D—Closure Chart for Type K-4 Gears

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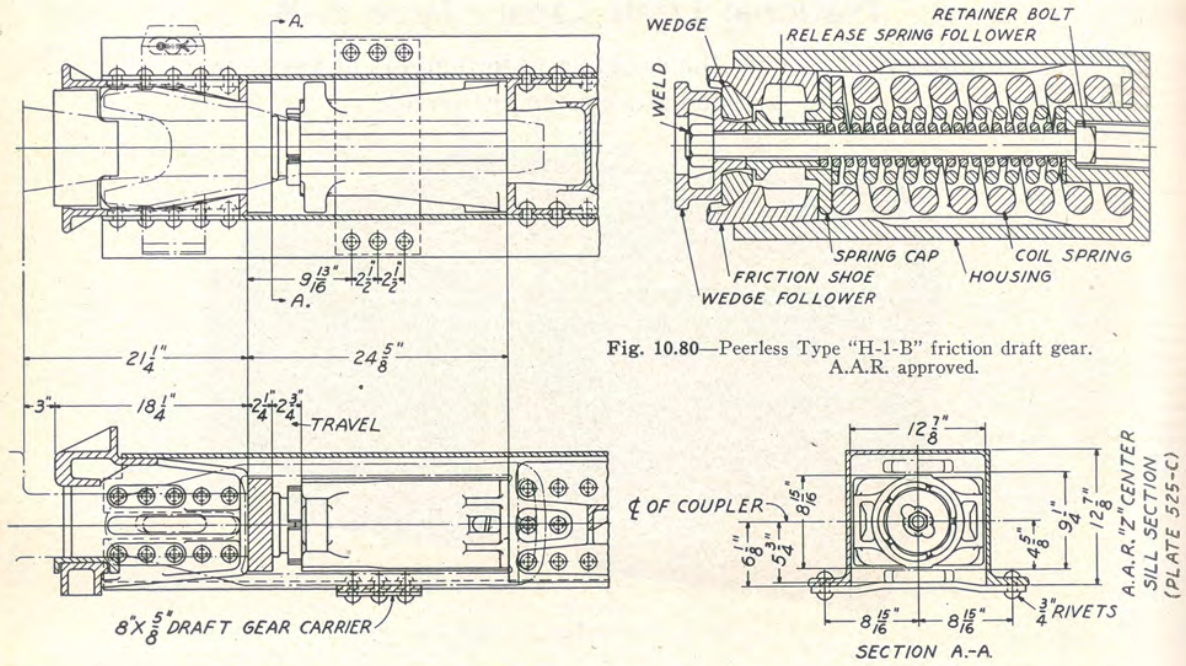


Fig. 10.80—Peerless Type "H-1-B" friction draft gear. A.A.R. approved.

Fig. 10.81—Application of Peerless Type "H-1-B" friction draft gear with A.A.R. standard vertical yoke.

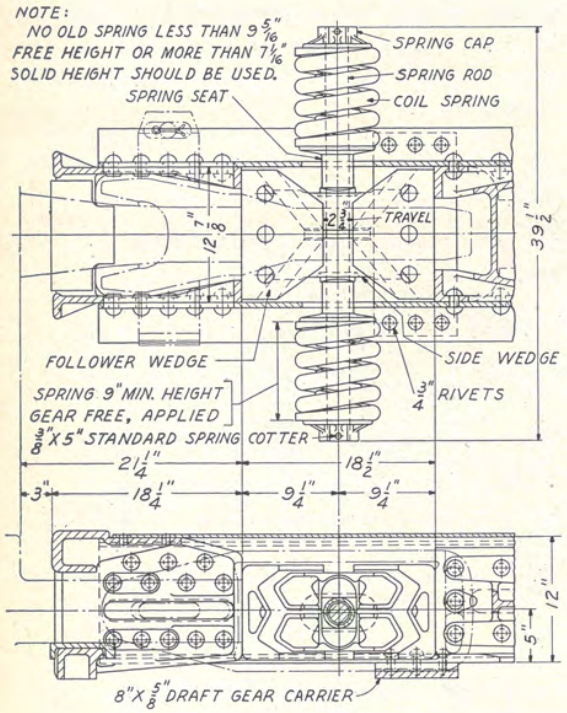


Fig. 10.82—Peerless Type "KC" friction draft gear.

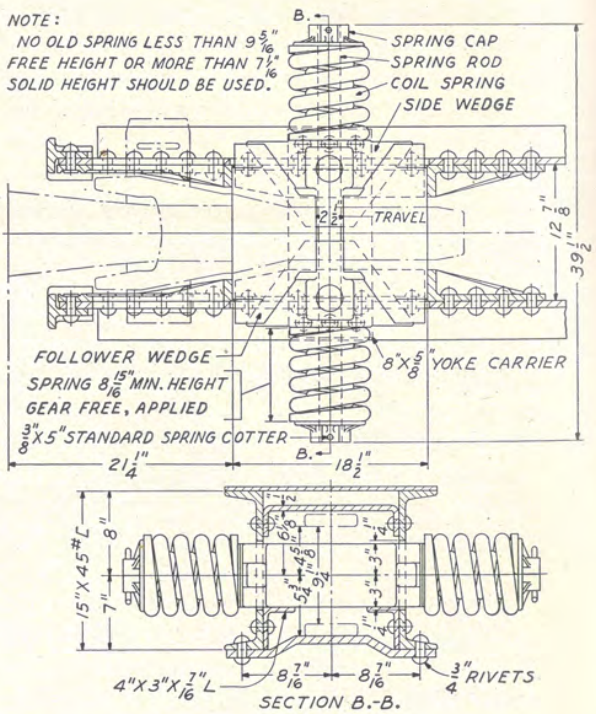


Fig. 10.83—Peerless Type "C" friction draft gear.

Peerless Equipment Company.

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Peerless Type H-1-B Friction Draft Gear

Clever design, careful selection of materials, and skilled workmanship Provide light weight, maximum protection, heavier pay load and long service life

THE Peerless Type H-1-B A.A.R. Approved Friction Draft Gear was particularly designed to meet the requirements imposed upon draft appliances under the most severe conditions.

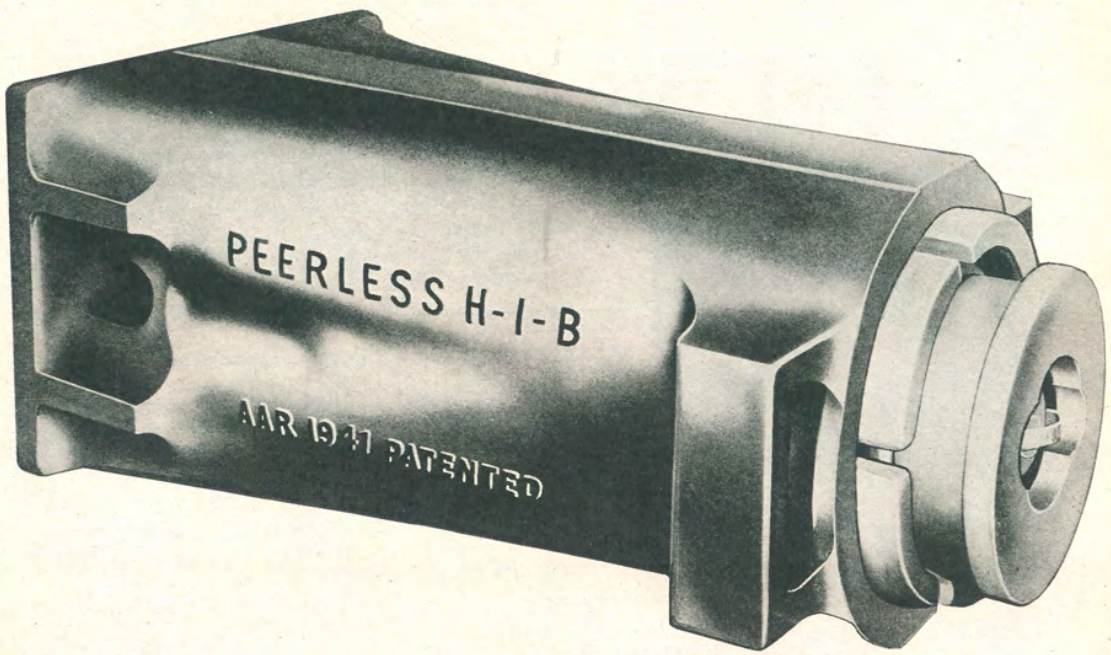
This gear is designed for uniformity, smoothness of action and high absorption qualities, with low recoil, resulting in a highly efficient mechanism adapted to effectively absorb the violent impacts incidental to present day traffic requirements.

shipped from the plant. This tup is a duplicate of the machine under which draft gears are tested for certification by the Association of American Railroads.

Other Interesting Features

The following features about the Peerless Type H-1-B Friction Draft Gear are worthy of note from the standpoint of operation and construction:—

1. In tests conducted at the A. A. R. Draft Gear Laboratory, Purdue University, and upon the results of which Certificate of Approval No. 8 was issued, this gear exceeded by a wide margin every requirement of the A. A. R. Specifications for Approved Friction Draft Gears.
2. Self-contained, easily assembled and easily applied.
3. Light in weight.
4. Positive release insured by an independent releasing mechanism. In the entire A. A. R. tests there was never a stuck blow.
5. Uniform and soft in action, high absorption, low recoil.



Peerless Type H-1-B Hylastic Vanadium Steel Friction Draft Gear.
A. A. R. Certificate of Approval No. 8

Care in Manufacture

Great care is exercised in the selection of materials, and the best physical properties suited for each part of the gear are determined by exhaustive tests. Each unit as assembled is "worked-in" to insure uniformity. The final result is a completely heat-treated product, each part being required to pass rigid physical and chemical requirements.

Inspection

Peerless H-1-B Draft Gears are tested for capacity, travel and action under a 27,000-lb. tup before being

PEERLESS EQUIPMENT COMPANY, CHICAGO, ILL.

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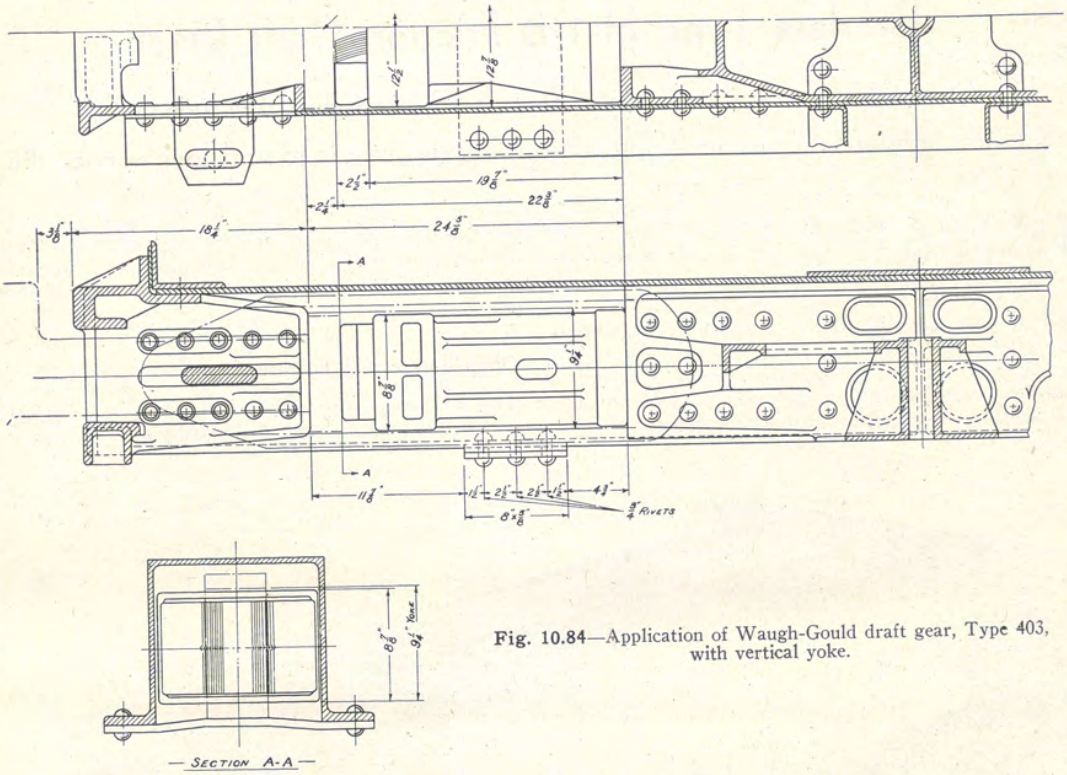


Fig. 10.84—Application of Waugh-Gould draft gear, Type 403, with vertical yoke.

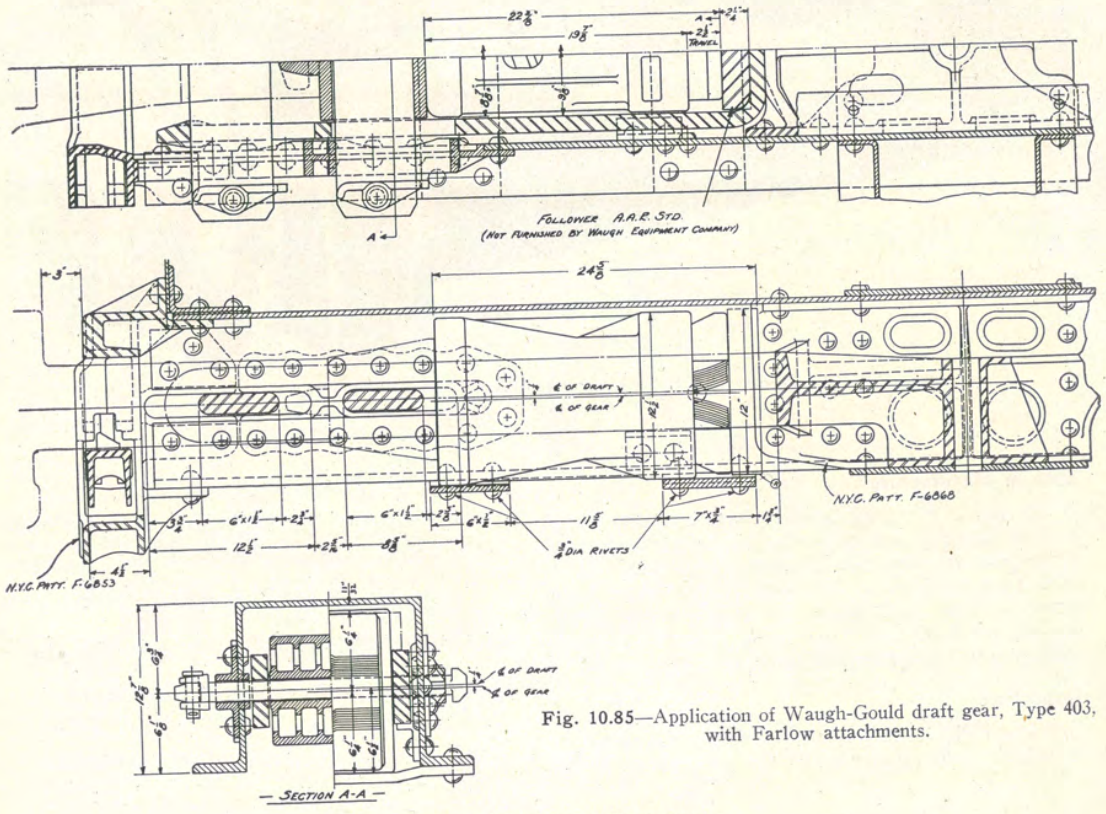


Fig. 10.85—Application of Waugh-Gould draft gear, Type 403, with Farlow attachments.

Waugh Equipment Company

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Waugh-Gould Type 403 Friction Draft Gear

THE Waugh-Gould Type 403 Friction Draft Gear was awarded the first draft gear certificate of approval issued by the Association of American Railroads. Sturdy construction insures ample strength to withstand the severest impacts received in service. The resilience of the housing structure reduces to a minimum the forces resulting from oversolid blows. This gear will protect equipment and lading over a long period of time and will resist the heaviest shocks impressed upon it without damage to any of its parts.

Space Requirements

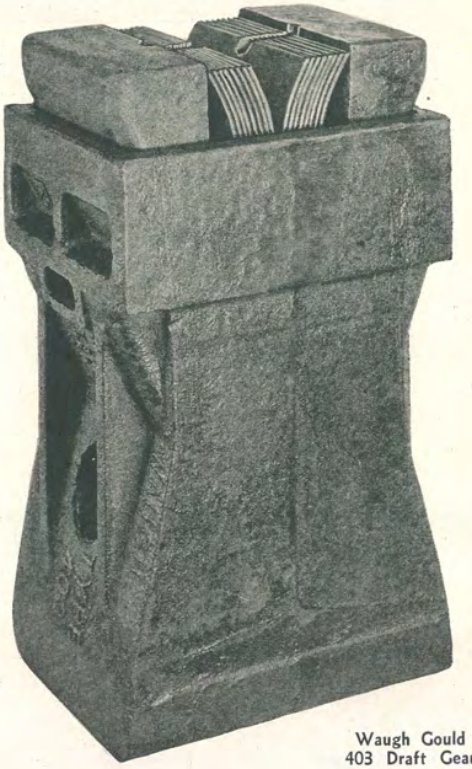
The normal external dimensions are 8⅞ in. by 12½ in. by 22⅜ in. requiring one follower for application to standard draft gear pockets. It is furnished with means for temporarily restricting the overall length to facilitate installation. The normal travel is 2½ in.

Construction

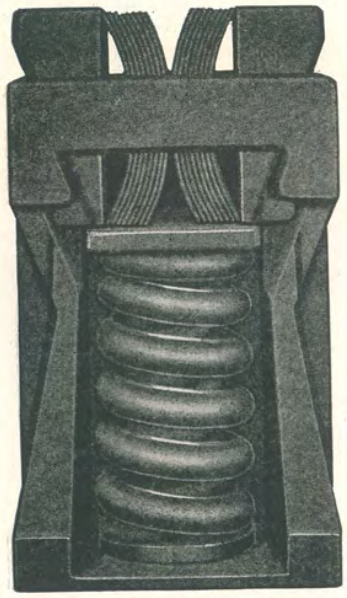
The Waugh-Gould Type 403 Draft Gear is comprised of a cast steel heat-treated housing having integral friction surfaces against which casehardened wedges operate under the pressure of leaf springs. These leaf springs are held both in alignment and in position between the wedges by means of end-nibs. The gear is held assembled by means of a lug at the bottom of each wedge, which is locked into the housing.

Operation

As the gear is compressed, the leaf spring pressure gradually increases on the wedges to a maximum at the point of full closure. This uniformly increasing pressure of the leaf springs against the wedges as the gear is closed, brings about exceptional smoothness of operation. The use of leaf springs for developing working pressures of the friction system eliminates slippage and minimizes loss of gear capacity due to rust or other etching elements. Under no circumstances will the gear creep or become closed under continued surges in heavy draft. Soft metal inserts in the wedges stabilize the coefficient of friction and maintain smooth friction surfaces, practically eliminating wear both on the wedges and housing.



Waugh Gould
403 Draft Gear



Cross-section of the 403 Gear showing spring arrangement

All parts are interchangeable. No special tools or appliances are required to assemble or disassemble the gears. They can be readily taken apart for inspection and easily reassembled.

Adaptable for Light Cars Used in Foreign Service

The Waugh-Gould 403 Friction draft gear, designed primarily for American freight service, can be readily converted to provide a gear suitable for lighter weight cars by making one small change. Six leaf springs are removed and a spacer is substituted. This provides a gear of lower capacity but one retaining the characteristic smoothness of the Type 403 Draft Gear.

WAUGH EQUIPMENT COMPANY, NEW YORK 17, N. Y.

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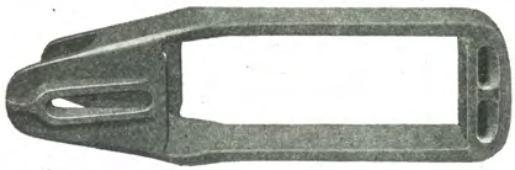


Fig. 10.99—Buckeye A.A.R. vertical-plane draft yoke for 24⅝ in. friction gears.



Fig. 10.100—Buckeye A.A.R. vertical-plane draft yoke of high-tensile steel.

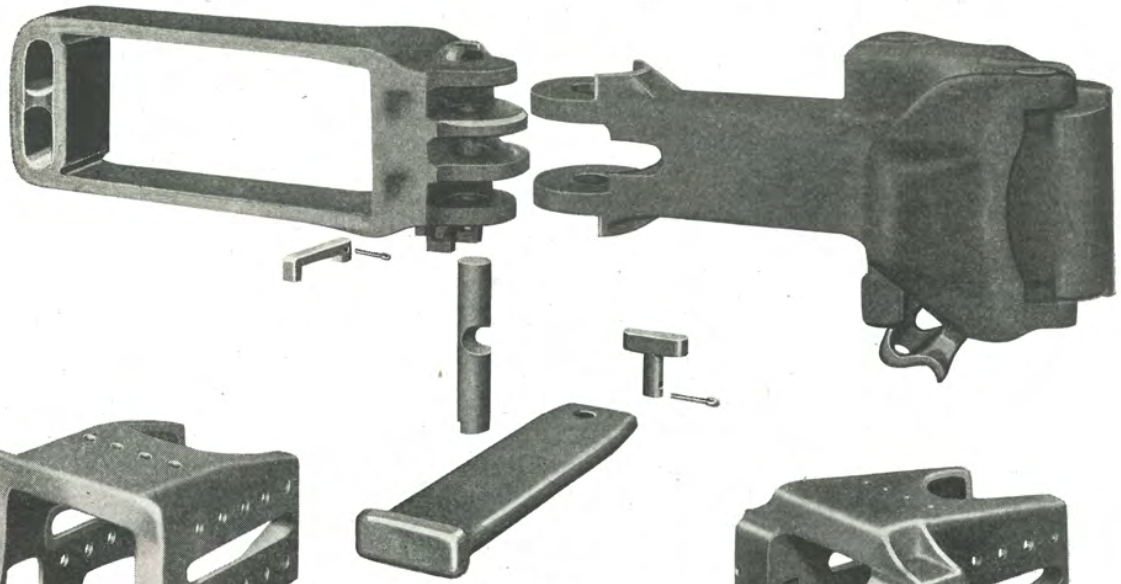


Fig. 10.101—Swivel shank coupler, swivel yoke, and attachments.

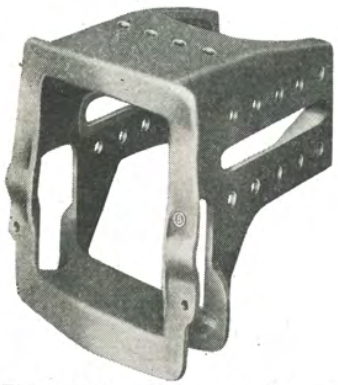


Fig. 10.102 — Striker with Integral Front Lugs and Swing Coupler Carrier.

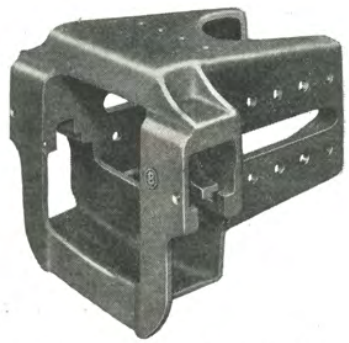


Fig. 10.103—Swing Motion Striker with Integral Front Lugs.

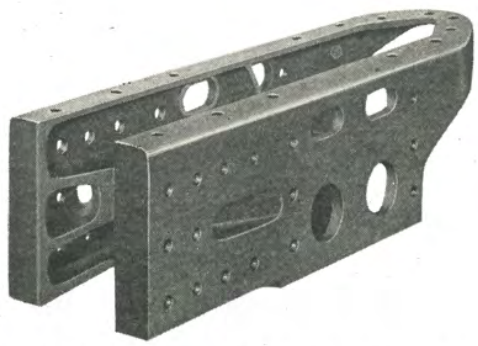


Fig. 10.104—Bolster Center Filler and Rear Draft Gear Lugs for box car.

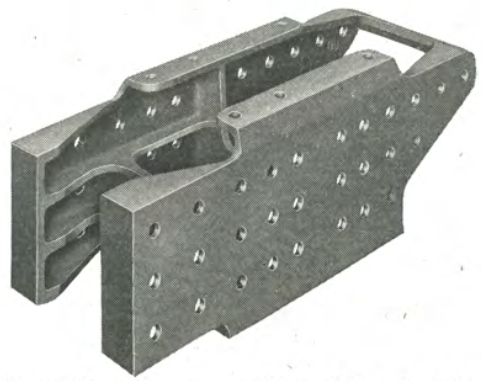


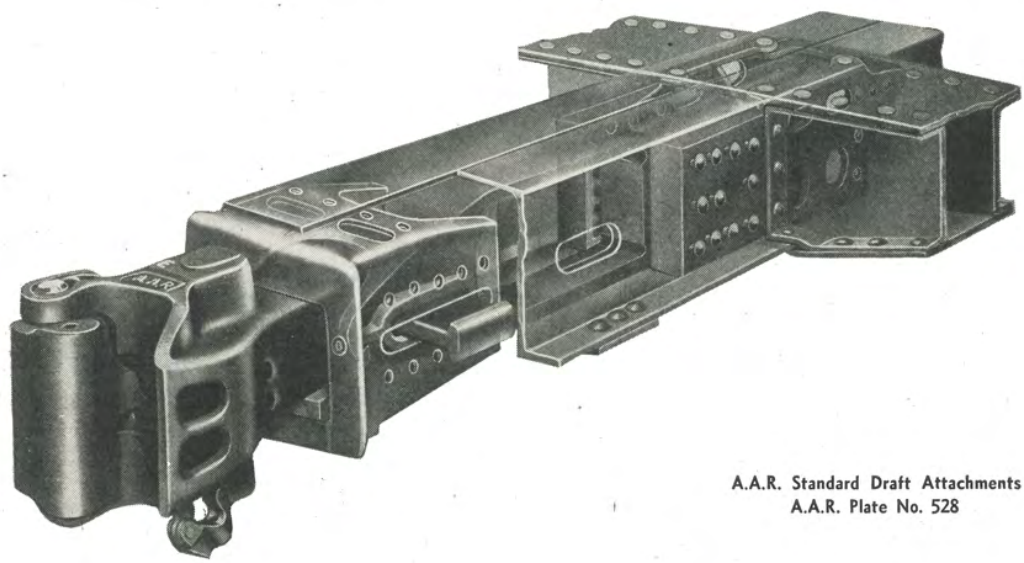
Fig. 10.105—Bolster Center Filler and Rear Draft Lugs for hopper car.

The Buckeye Steel Castings Company

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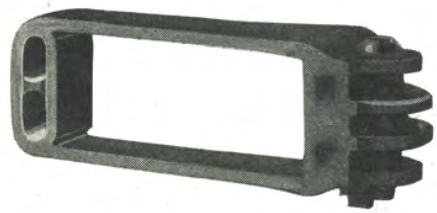
Buckeye Yokes and Draft Attachments



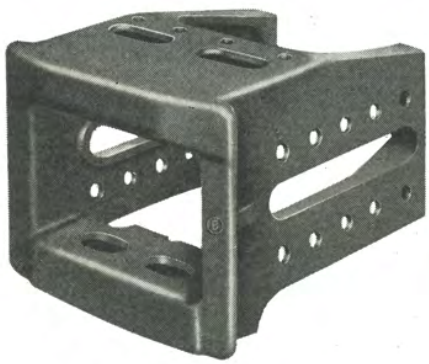
A.A.R. Standard Draft Attachments
A.A.R. Plate No. 528



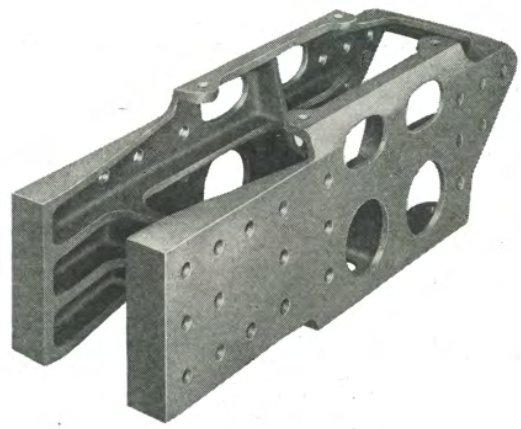
A.A.R. Standard
Vertical-Plane Draft Yoke



A.A.R. Alternate Standard
Vertical-Plane Draft Yoke



Striker with Integral Carrier
and Front Draft Lugs
A.A.R. Plate No. 532



Combined Bolster Center Filler
and Rear Draft Lugs
A.A.R. Plate No. 534

THE BUCKEYE STEEL CASTINGS COMPANY, COLUMBUS, OHIO

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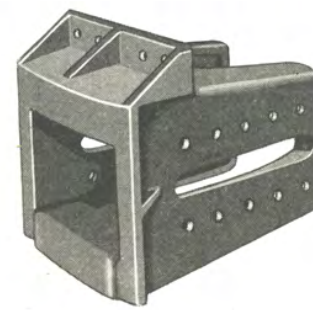
Truck Bolster



Integral-Journal-Box Side Frame



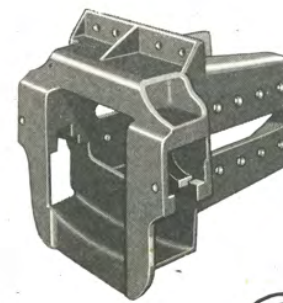
A.A.R. Vertical Plane Cast Yoke for Friction Gear



Striker with Integral Carrier and Front Lugs



Bolster Center Filler and Rear Draft Lugs



Swing Motion Striker with Integral Front Lugs

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