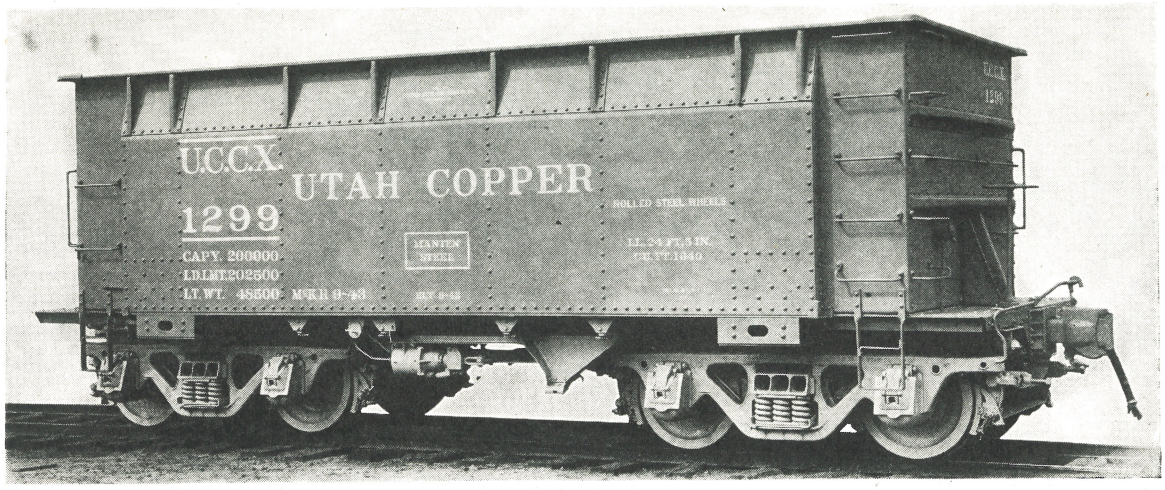


Fig. 2.671—Utah Copper Company 200,000-lb. capacity high-tensile steel, flat bottom, ore car. Unloaded by car dumper. Builder, Pressed Steel Car Company, Inc.

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

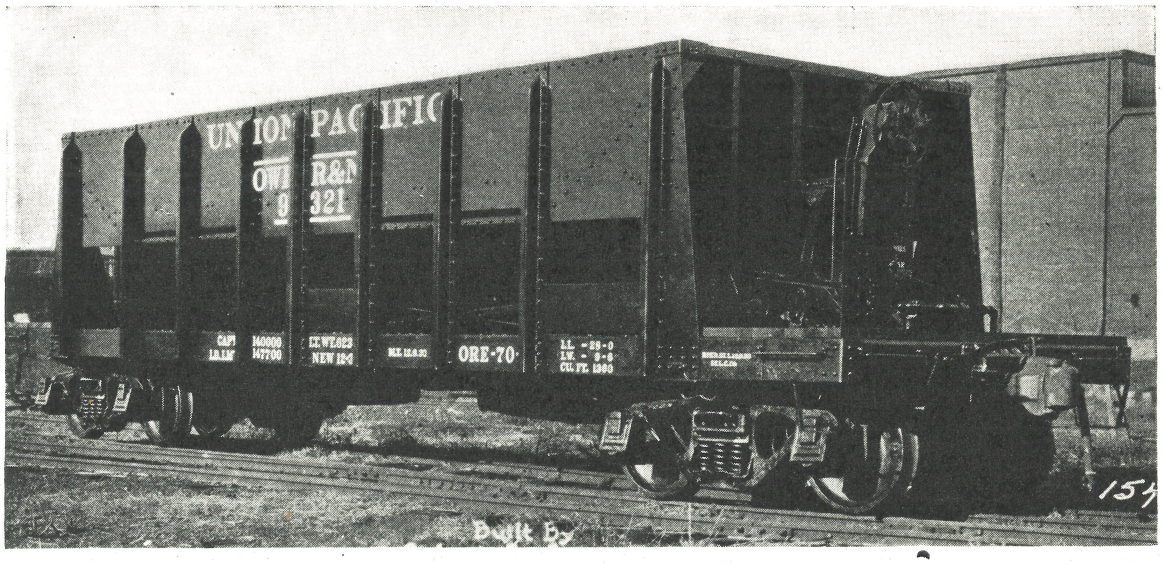


Fig. 2.672—Union Pacific (O.-W. R. & N.) 70-ton ore car, AAR Class HMA. Builder, St. Louis Car Company.

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)

FreightCar America, Ex. 1054
IPR2025-01046, -01047

Enterprise Bulk Commodity, Ore and Ballast Cars

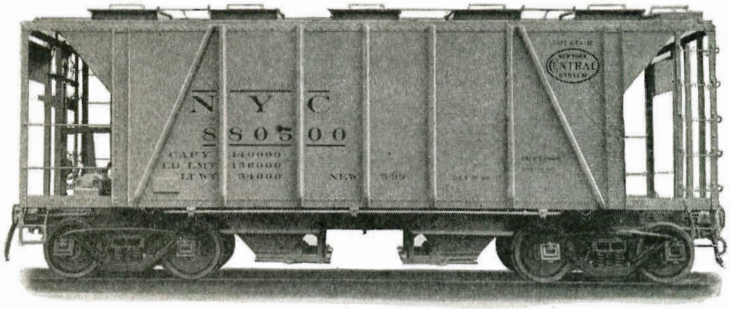


Fig. 2.678—70-ton Bulk Commodity Covered Hopper Car

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.

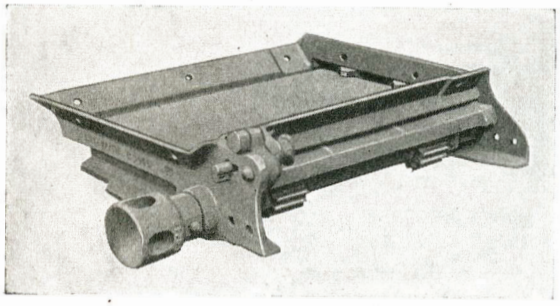


Fig. 2.679—Enterprise Bulk Commodity Outlet

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.

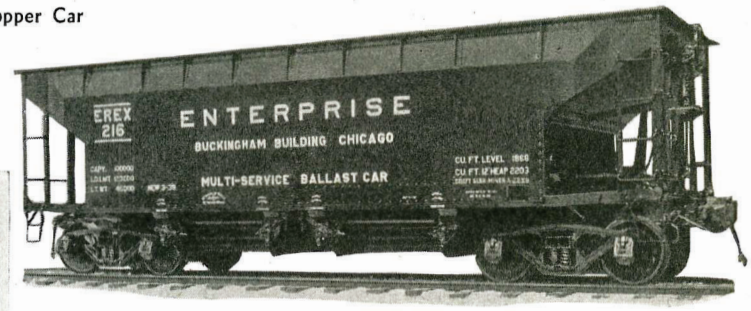


Fig. 2.680—55-ton Multi-Service Car

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.

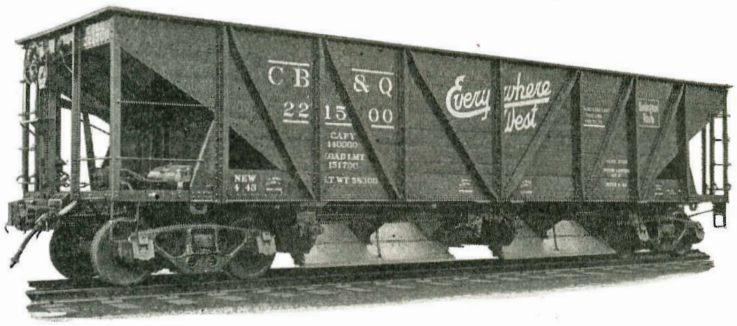


Fig. 2.681—70-ton Multi-Service Car



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.

FreightCar America, Ex. 1054
IPR2025-01046, -01047

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.

CONTENTS OF SECTION 3

	Page
A.A.R. Standards; Lettering, Marking	367
Bibliography	376
Materials, Parts	378
Underframes, Bolsters, Center Plates	390
Box Car Ends and Sides	405, 442
Floor Protectors	410
Ladders, Grab Irons	412
Loaders, Box and Auto.	412, 414
Roofs	418
Running Boards; Brake Steps	423
Box Car Doors; Side and End	430, 456
Containers (see also Sec. 2)	451
Ventilators; Lumber Doors	461
Refrigerator Car Details	462
Gondola and Hopper Car Details	486
Tank Car Details	502

Couplers; Draft Gears ..... Section 10
Trucks; Bearings .... Sections 14 & 15

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	6 9/16
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.

FreightCar America, Ex. 1054
IPR2025-01046, -01047

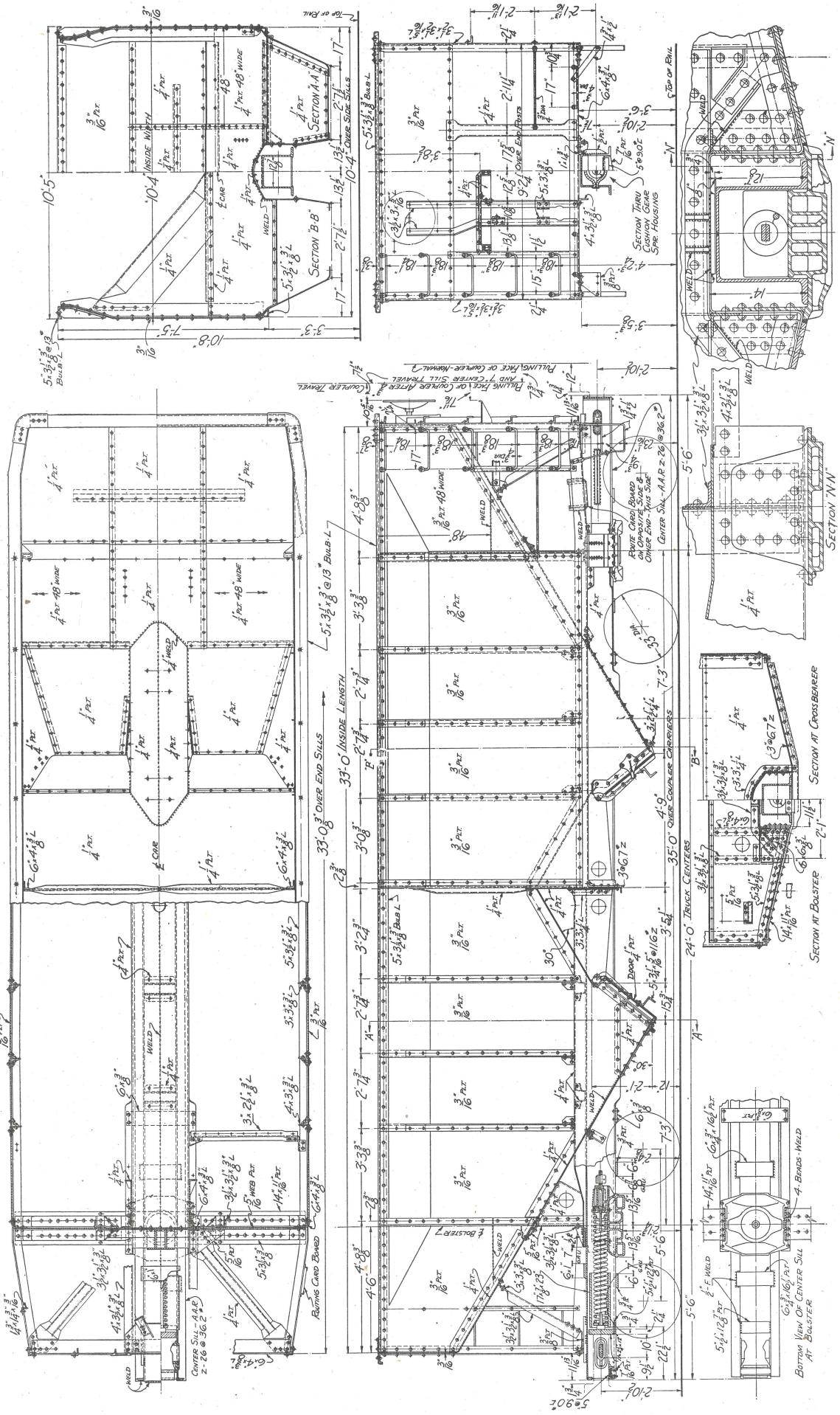


Fig. 3.29—Duryea Underframe with Long-Travel, Cushion Gear as applied to a 50-ton hopper car.
O. C. Duryea Corporation
(For description see Section 10)

FreightCar America, Ex. 1054
IPR2025-01046, -01047

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

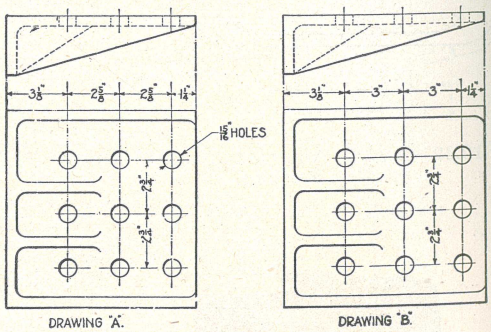
Under "Fundamentals of Car Design," Manual, page C-3, are the following requirements:

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.

FreightCar America, Ex. 1054
IPR2025-01046, -01047

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

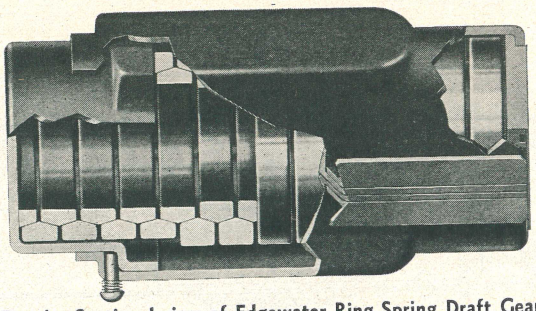


Fig. A—Sectional view of Edgewater Ring Spring Draft Gear

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

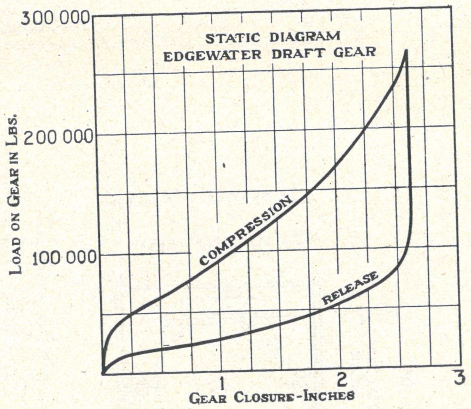


Fig. B—Typical force-closure diagram of Edgewater Ring Spring Draft Gear

(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.

FreightCar America, Ex. 1054
IPR2025-01046, -01047

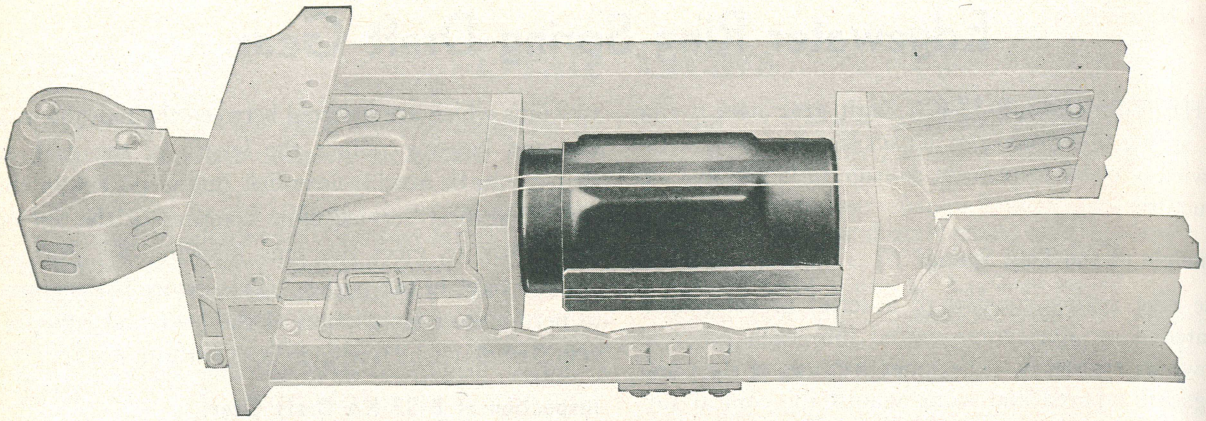
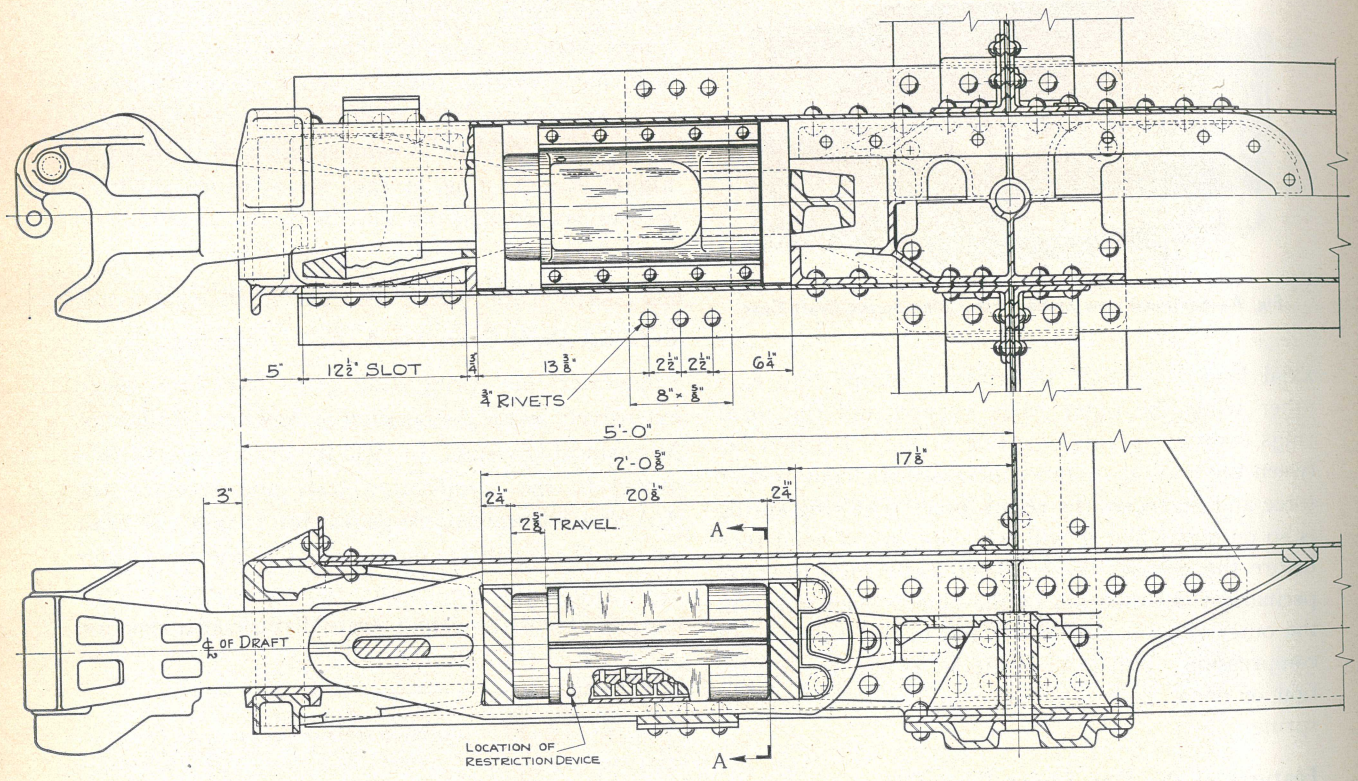
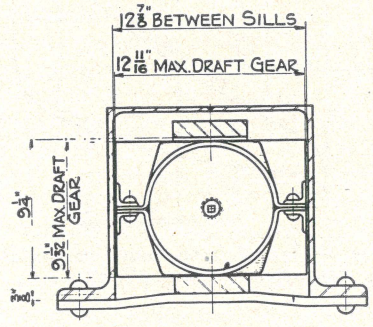


Fig. 10.43—Edgewater Ring Spring Draft Gear as applied with A.A.R. standard vertical yoke.





SECTION A-A

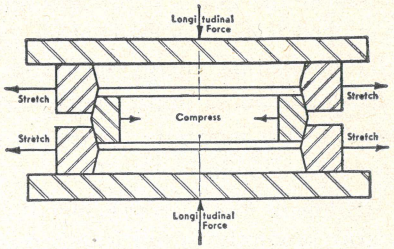


Diagram of Ring Spring Action.

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)

FreightCar America, Ex. 1054
IPR2025-01046, -01047