jects they desired to be heard, in order that the committee might make up its program and make proper announcements. Former Senator Bristow, of Kansas, appeared for the National Association of Railway Commissioners. They desired to testify after the railways shall have presented their case. A. P. Thom, who as general counsel of the Railway Executives' Advisory Committee, has charge of the railway argument, objected to the railways coming first. They did not wish to appear as plaintiffs or contestants; but simply on the ground of public interest. He suggested that those intending to speak on the general philosophy of regulation, economists, publicists, etc., such as the committee had invited, should open the argument in a natural manner. The committee said that this was not a contest, with plaintiffs and defendants; they are simply seeking information. The committee is not prejudiced, and would not be influenced in any way by the order of the hearing. Mr. Thom said that the railways would agree in any way to the plans and wisdom of the committee.

The following then entered appearance as desiring to be heard: Advisory committee of railway executives, Frank Trumbull, chairman; F. H. Sisson, assistant chairman; B. F. Bush, A. J. Earling, Howard Elliott, W. J. Harahan, Hale Holden, L. F. Loree, R. S. Lovett, C. H. Markham, Samuel Rea, A. H. Smith, F. D. Underwood, H. Walters, Daniel Willard and A. P. Thom, general counsel; Amos, L. Hathaway, Boston Chamber of Commerce; F. D. Debrard, Merchants' Association of New York; George E. Bartol, the Philadelphia Bourse; George E. Rix, Lawrence, Mass., Chamber of Commerce; W. F. Garcelon, Boston; L. P. Boyle, Commercial Club, Kansas City; Philip Godley, Philadelphia board of trade; R. C. Marsh and Amos Pinchot, committee on real preparedness; G. A. Post, New York, president of the Railway Business Association; Judge S. H. Cowan, Fort Worth, Tex.; G. S. Maxwell, Dallas, Tex., representing traffic associations and live stock associations; C. D. Heineman, Chicago, secretary of the National Live Stock Exchange; J. H. Townsend, Memphis, Tenn., Hardware Traffic Association; W. E. Lamb, Chicago, representing Citrus Fruit Growers' Association of California; J. E. Love, chairman of the Oklahoma state railway commission; Richard Gates, Illinois; Scott J. Henderson, public service commission of Washington; Fred Lehman, former United States solicitor general, representing the American Telephone & Telegraph Co.; F. B. McKenna, representing the independent telephone companies; Albert T. Benedict, New York, representing the Western Union Telegraph Co., and Thomas B. Harrison, representing the Adams and American express companies.

No representative of the Interstate Commerce Commission or of any of the labor unions responded to the call of the chairman.

The committee then went into executive session to prepare its program. The hearings, it was subsequently announced, would be resumed Thursday morning. Most of those appearing wanted to secure dates in December, and there was an evident desire to "come after the other fellow."

Mechanical Features of the C. M. & St. P. Ry.'s Electric Locomotives

By A. F. Batchelder, Engineer Locomotive Department, General Electric Co.

Previous articles in the Railway Review have described various features of the equipment of the electrified divisions of the Chicago Milwaukee & St. Paul Ry. in Idaho and Montana. The project of electrifying 440 miles of main line for heavy passenger and freight traffic was described as a whole, Jan. 16, 1915. Illustrations and certain data concerning the electric locomotives were published Oct. 9, 1915. An account of the progress of the work and some details concerning the power equipment were published Oct. 30, 1915; and two articles, April 8, 1916, described respectively the electric switching locomotives, and the results of operation up to that time. In the present article Mr. Batchelder gives a concise statement of the most important mechanical features of the road's locomotives. He describes the make-up of the frames and superstructure and gives the arrangement of the apparatus. The article, with illustrations, is from the General Electric Review, November, 1916, and is re-printed here by permission of that publication.

The electrified portion of the Chicago Milwaukee & St. Paul Ry. in the Rocky mountains has been in operation now approximately a year, including an extremely severe winter, when many steam-operated roads were unable to keep their trains moving regularly enough to prevent congestion at points even where the natural conditions are not considered severe. This electric division, through a most difficult section of the Rockies, with long grades both up and down and with severe cold weather and bad storms operated with its new equipment without any apparent difficulty, not only keeping the road clear of congestion, but almost universally making up time that had been lost on the adjoining steam operated portions of the road. It, therefore, seems fitting at this time to give a more detailed description of the mechanical part of the electric locomotives that are making such a remarkable record in the hauling and braking of the enormous trains that were handled up and down these mountain grades so effectively. The principal dimensions and features of these locomotives are as follows:

General Data.

Gage	4 ft. 8½ ins.
Service	Freight
Voltage	3000 volts d. c.
Wheel arrangement	4-4-4-4-4-4
Maximum tractive effort	132,500 lbs.
Continuous tractive effort	71,000 lbs.
Length over all	112 ft. 0 in.
Total wheel base	102 ft. 8 ins.
Width over all	10 ft. 0 in.
Height, trolley locked down	16 ft. 8 ins.
Rigid driving wheel base	10 ft. 6 ins.
Rigid guiding wheel base	6 ft. 0 in.
Diameter driving wheels	52 ins.
Diameter guiding truck wheels	36 ins.
Size main driving journals	8 by 14 ins.
Size guiding truck journals	6½ by 12 ins.
Total weight	576,000 lbs.
Weight on drivers	450,000 lbs.
Weight per driving axle	56,250 lbs.
Spring borne weight per driving axle	40,000 lbs.

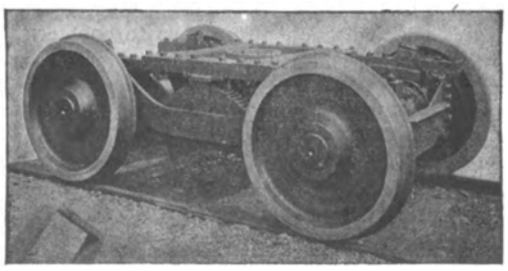


Fig. 1—Guiding Truck, Electric Locomotive of the Chicago Milwaukee & St. Paul Ry.

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Dead weight per driving axle	16,250 lbs.
Weight per guiding axle	31,500 lbs.
Spring borne weight per guiding axle	27,274 lbs.
Dead weight per guiding axle	4226 lbs
Weight on guiding truck wheels	126,000 lbs.
Maximum traction effort in per cent of weight on drivers	30 per cent
Continuous tractive effort in per cent of weight on drivers	16 per cent
Normal braking power in per cent of weight on drivers	89 per cent
Normal braking power in per cent of total weight	69 per cent

On account of the enormous tonnage to be handled and the great power of these locomotives, a total of eight traction motors are used, requiring an over-all length of locomotive of 112 ft. For the purpose of negotiating curves easily with minimum flange wear, and in order to secure a simple and effective weight equalization and foundation brake system, the running gear is made in sections or individual trucks, articulated in such a manner as to give positive guiding from one to another, and also to take up the bumping and hauling stresses directly through the running gear frames. This arrangement also gives a most convenient opportunity for supporting the motors and is advantageous for receiving forced ventilation. In order to eliminate any possibility of undue lateral strains on the track and for operating in either direction, a four-wheel bogey guiding truck, see Fig. 1, has been connected to the outer driving truck at each end of the running gear.

The complete locomotive consists of two duplicate sections, each having a cab mounted on two driving trucks, one truck being symmetrical and the other unsymmetrical with an extended frame carrying the draft rigging and center pin for the guiding truck, see Fig. 2. The guiding trucks are of the well known equalized type common to steam locomotives, having inside journal bearings, 6½-in. by 12-in., and are arranged to carry the load on the center bearing through a bolster which provides a lateral movement 4 ins. each way from the center against a constant pressure. This lateral movement of the bolster is only required in cases where the locomotive negotiates curves greater than 14 degrees, or where entering sharp curves at high speeds tending to produce lateral lurches of the locomotive.

As stated above, the extended frame of the unsymmetrical driving truck carries the bumper beam, buffer and draft gear of the Miner class 18A friction type, see Fig. 3. Also one end of the superstructure is carried on longitudinal center sills through cast steel center bearings. The center bearing for the cab

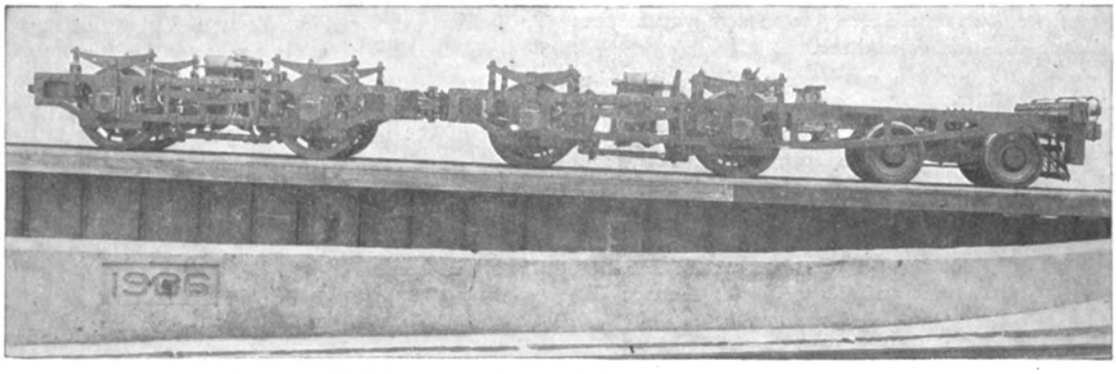


Fig. 2—Running Gear of One-Half Unit, Electric Locomotive of the Chicago Milwaukee & St. Paul Ry.

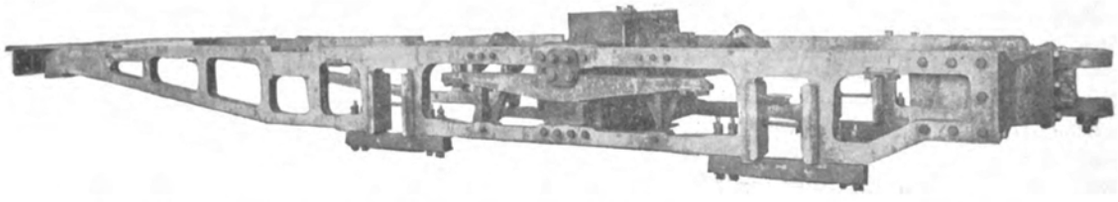


Fig. 3—Unsymmetrical Truck Partly Assembled, Electric Locomotive of the C. M. & St. P. Ry.

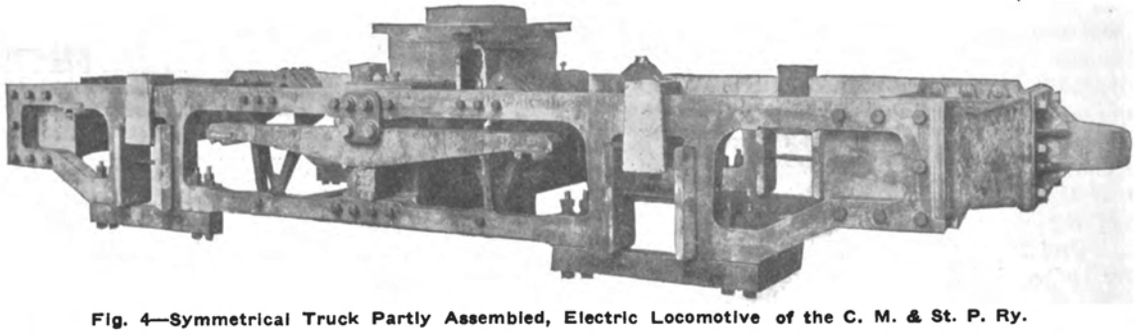


Fig. 4—Symmetrical Truck Partly Assembled, Electric Locomotive of the C. M. & St. P. Ry.

superstructure, see Fig. 4, is so located as to distribute the weight properly between the guiding truck and the driving axles. The side frames, transoms and other parts taking the bumping and hauling stresses are designed to stand 500,000 lbs. static pressure with liberal factors of safety. The side frames are of cast steel, 4½ ins. thick, placed on 80-in. centers and are bolted to the machined surfaces of the cross transoms with taper bolts.

At the inner end of this truck is bolted a cast steel end frame, see Fig. 8, to which is fastened the hinge joint which is also designed to stand 500,000 lbs. static pressure. The middle transom, see Fig. 9, is of steel, cast hollow, with supporting lugs for the nose of the traction motor and with provision for taking air from the blower duct in the superstructure through a telescoping duct directly into the motors. This gives a very simple

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and effective method of conducting the air from the blower to the motors.

The symmetrical driving truck has a transom at each end identical to the inner end transom of the unsymmetrical truck, with hinge joint bolted to each of them. This truck has a middle transom, also identical, which carries the motor supports in the same manner as on the other truck and also serves as a support for the superstructure, the air duct being through the center bearing. This center bearing, see Fig. 10, is made to provide for any change in distance between bearings, due to the curving of the trucks, allowing longitudinal motion besides swiveling, but preventing all transverse movement of the superstructure.

The weight of the locomotive is distributed to the wheels by an equalizing system consisting of main elliptic springs, side equalizers, and double coil springs. The unsymmetrical trucks are so equalized as to effect a three-point bearing which is accomplished by side equalizers between the driving wheels on each side, making an effective transverse axis one-half way between the driving axles, the third point being the center bearing of the guiding truck. This unsymmetrical truck being supported in equilibrium, serves through its hinged joint as the steadying agent for the symmetrical truck, which is also provided with side equalizers having its transverse axis one-half way between the axles. With this arrangement the end of the symmetrical truck which is attached to the unsymmetrical truck follows the same vertical movement as the latter, the hinge allowing no vertical play. This necessitates allowing vertical play in the hinged joint between the two symmetrical trucks.

Each of the driving trucks is equipped with inside hung brakes of the simple push rod type supported by specially designed brackets, each side being operated by its own individual 12-in. by 10-in. cylinder. There are no brakes furnished for the guiding trucks.

The wheel centers are of steel castings with twelve spokes and provided with hub extensions to receive the motor gear.

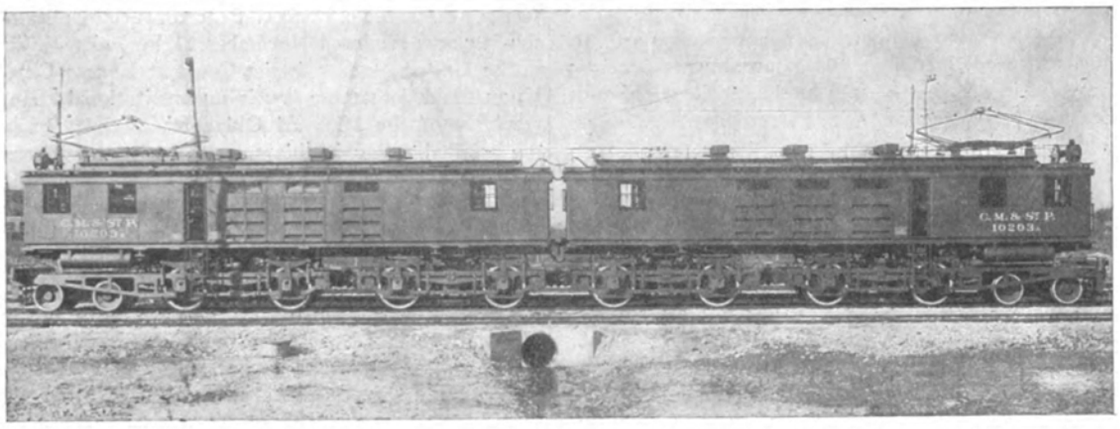


Fig. 5—Electric Freight Locomotive, C. M. & St. P. Ry.

The tires with Master Mechanics' tread and flange, are 5½ ins. wide and 3 ins. thick and are held on by shrinkage.

The journal boxes are steel castings machined to receive the bearing brasses and the frame pedestal shoes. The pedestal shoes and journal boxe flanges are so designed that when the shoes are dropped the journal box can be removed from its place without lifting the frame, making it convenient to renew the thrust plates which are provided at the back of the boxes.

The motors are supported in the usual way directly on the axle on one side, and by a nose bracket through double acting springs to the bolster on the other side. The motors drive through yielding gears mounted directly on the axle, one at each end of the motor.

The superstructure of each section is made up with two 12-in. longitudinal center sills spaced 31 ins. apart, with a plate bolted to the bottom and a ⅜-in. floor, extending over the entire structure, bolted to the top, forming a box girder and providing the

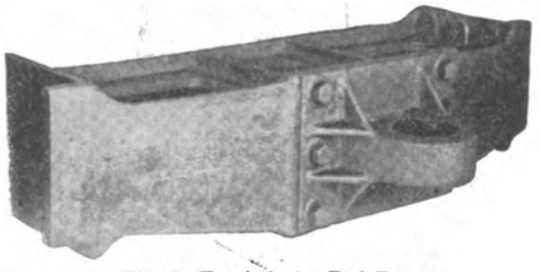


Fig. 8—Truck Inner End Frame.

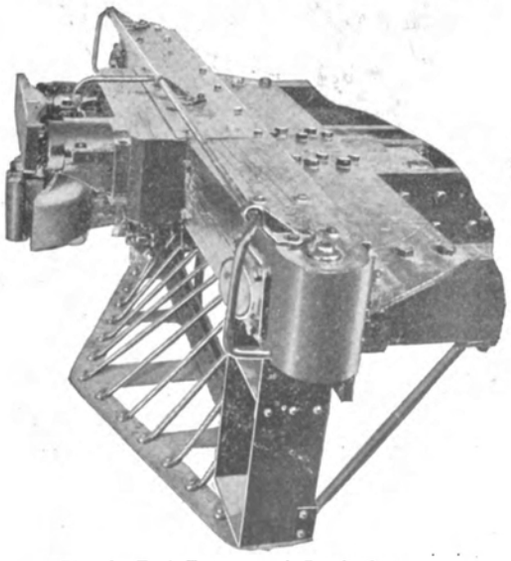


Fig. 6—End Frame and Draft Gear.

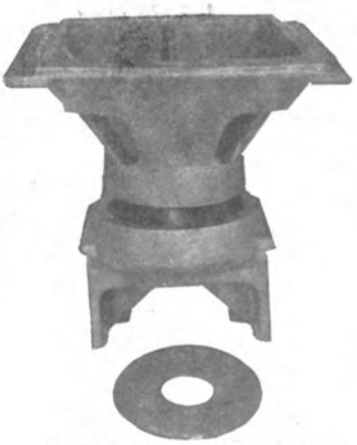


Fig. 7—Forward Cab Center Plate.

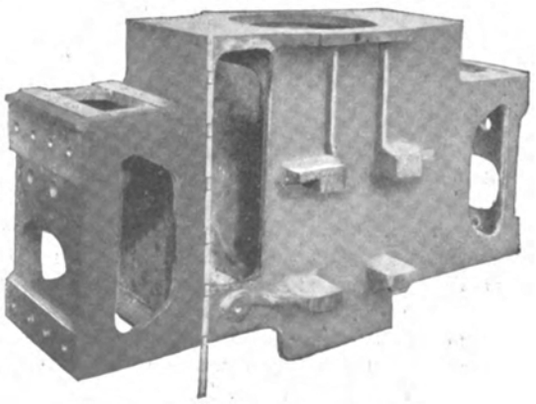


Fig. 9—Main Transom of Driving Truck.

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air duct to conduct the ventilating air from the blower to the motors. These sills also serve as struts for the bolster girders A second floor carried by the first floor through 6-in. channels forming ducts for the wiring conduit is provided as the floor for the apparatus cab.

The cab is made of steel and structural shapes built up in the usual way with ventilating louvres in the sides. Doors are located at each end and one on each side. The windows are conveniently located to provide light for the inspection of all apparatus. Each cab is divided into two compartments consisting of the main apparatus cab 47 ft. long by 10 ft. wide, and the motorman's cab, 5 ft. long by 10 ft. wide. The motorman's cab is arranged in the usual way with a front door, and two doors leading into the apparatus cab. The apparatus cab is arranged with an aisle 23 ins. wide and extending the entire length of each side with the control and other apparatus compartments arranged in the middle, and with hatches in the roof for the placing of all apparatus. The motor-generator set for regenerative braking, the blower, and air compressor, are carried directly through their supports, on the main box girder forming the air duct.

The compartment for the rheostats, switches, etc., is arranged with the rheostats supported near the floor, and above them, a floor between, are mounted the contactors, switches, etc. Ventilating flues leading from the rheostat compartment through the roof provide excellent natural ventilation. Ventilation by this method is obtained by air being taken through openings in the floor, passing over the rheostats and up the flues to the top. Doors are arranged to be easily removed to get at the connections of the rheostats and the back of the contactors. The front of the contactors and switches is accessible from a center aisle.

The arc chutes of all contactors face into this aisle which provides liberal arcing space. The arrangement of these rheostat and contactor compartments has been found particularly desirable on account of the ease of inspection and removing of parts for replacement. Also by this means all the high tension apparatus which might be a source of danger is safely enclosed.

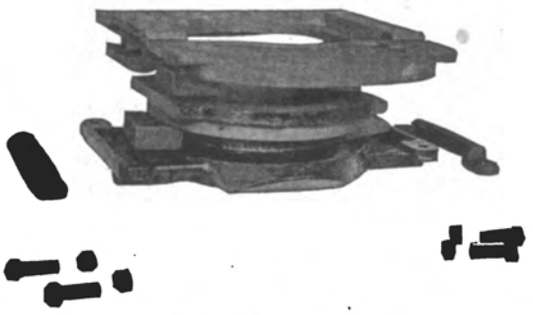


Fig. 10—Sliding Center Plate.

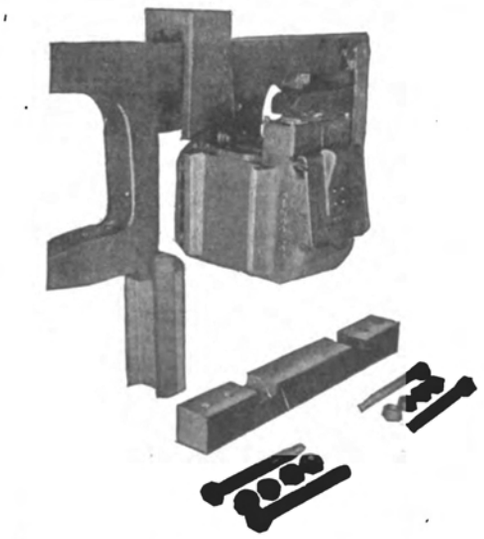


Fig. 12—Journal Box Assembly.

Developments Regarding the Adamson Law.

The first court decision under the host of suits brought in all sections of the country to test the constitutionality of the Adamson law was rendered November 22, by Judge William C. Hook, in the United States District Court at Kansas City, Mo. Judge Hook decided that the law is unconstitutional. He directed the receivers of the Missouri Oklahoma & Gulf Ry., who brought the original action in this case, to assist the government in expediting the case to the Supreme Court of the United States for final decision and instructed them through their attorneys to invite the representatives of every railroad in this country to participate in the hearings before the Supreme Court. The latter request was made in the government's motion to dismiss the injunction petition of the railroad, the government desiring to avoid prolonged, unnecessary and scattered litigation, through the hearing of countless similar suits filed by every railway system in every federal district in the United States through which their lines run.

In rendering his decision, Judge Hook took notice of the fact that the government's motion, which precipitated action in the injunction proceedings, was filed only the day previous and that a decision was desired at once. While declaring it "far from agreeable" for a judge to render a decision without the deliberation necessary for a decision which he would stand to "in every circumstance," the judge, in order to expedite the case, entered a decree for the plaintiff railroad. The text of Judge Hook's decree follows:

"This is an independent suit to enjoin the enforcement of a recent act of congress, commonly called the Adamson law, upon the ground that it is contrary to the constitution. In the



Fig. 13—Spring Gear, Electric Locomotives of the C. M. & St. P. Ry.

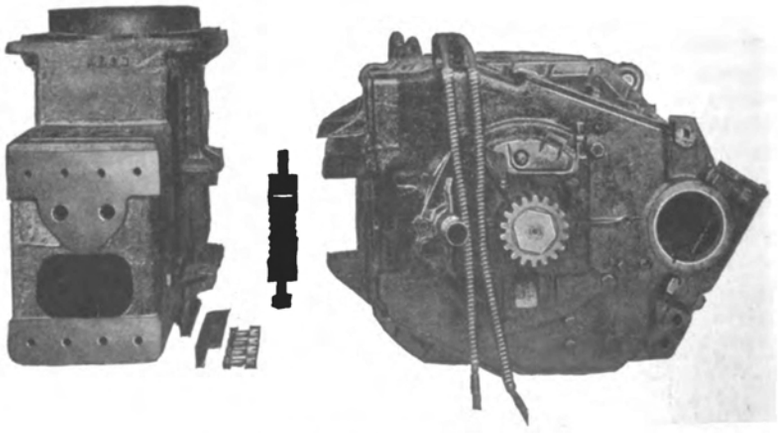


Fig. 11—Motor Nose Suspension.

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character of the averments the plaintiff's bill of complaint is stated to be typical of a number recently filed by railroad companies in various district courts of the United States. A motion to dismiss has been presented on behalf of the defendant by the United State's attorney. The sole question raised by it is that of the constitutionality of the law. The court is informed that the other cases stand on applications for temporary injunctions.

"An appeal from an order granting or refusing a temporary injunction goes to the Circuit Court of Appeals and not further by ordinary procedure, while an appeal from a final order or decree in such a case would go directly to the Supreme Court of the United States. In the former a decision would be inconclusive; in the latter a decision would definitely settle the question for the whole country. The motion to dismiss the case here, however, it is decided, will promptly result in a final decree, from which an appeal will be taken to the Supreme Court.

"The assistance of this court has been invoked to facilitate a final and authoritative determination of the constitutional question. The case was presented but yesterday and a decision is expected today. It is far from being an agreeable duty for a judge to record a judicial conclusion without the care and deliberation essential to a conviction that he would stand to in every circumstance. Upon the merits of a case the government neither asks nor receives from a court greater consideration than is required by the settled rules and presumptions of law, but a request by the department of justice to aid the progress of a case consistently with the rights of every one cannot be declined, certainly not for personal consideration.

"Upon a consideration of the Adamson law and of what is said of its practical effect and what was intended to be accomplished by it, the judgment is that as the court construes the terms of the law, it cannot be sustained. Since both parties have said they would not plead further whatever the decision might be, a decree will be entered for the plaintiff, reciting that the defendant prays and is allowed an appeal in an open court. The case in which the plaintiffs were appointed receivers is in charge of the judge who is acting here.

"An order will be entered, in that case, directing plaintiffs and their counsel to co-operate with the department of justice in lodging the appeal in the Supreme Court by December 4 next and in then moving for the advancement thereof for such early hearing as that court may find it consistent to grant; also to invite counsel for all railroad companies and others similarly interested in the question involved to participate in the presentation of the motion to advance and in the arguments on the merits as fully as though their clients were parties to this litigation.

"Though the decree of the court in the case here will be final in form, yet because of the exceptional circumstances the plaintiffs will be directed to keep their accounts and be prepared promptly to pay their employes on the basis of the Adamson law should the decree be not sustained."

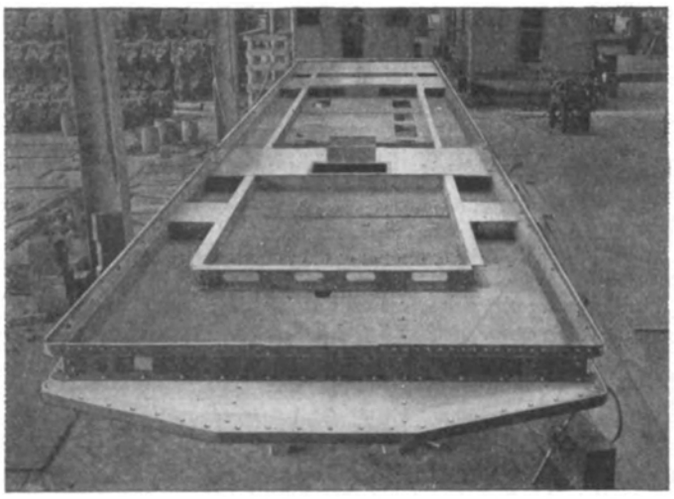


Fig. 14—Top View of Cab Platform, Electric Locomotives of the C. M. & St. P. Ry.



Fig. 15—Under Side of Cab Platform, Electric Locomotives of the C. M. & St. P. Ry.

Following Judge Hook's decision, Frank Hagerman, special counsel for the government, gave notice of an appeal. Mr. Hagerman also moved that the railroads' action against the officers of the four brotherhoods, who were made joint defendants with the government either be dismissed or that the brotherhood officers be permited to take an appeal similar to that of the government.

The decree was mailed to Washington and was to be filed in the Supreme Court Friday. On December 4 the government attorneys will appear and urge that the court advance the case on the docket and hear it at once. Arthur Miller, attorney for the receiver of the road, will at this time add his plea to that of the government for an immediate hearing. Considering the question of expedition, the Supreme Court is due to take its customary recess for the Christmas holidays on December 18. For more than 100 years the court has never handed down decisions except on Mondays. Unless it is possible to have this case argued and decided December 11 or December 18 it seems improbable that an opinion will be given before January 8, since the two intervening

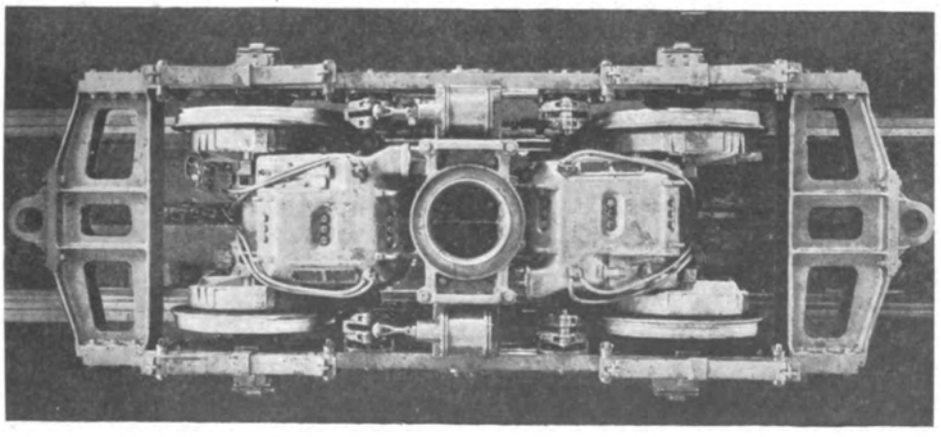


Fig. 16—Plan View of Two Motors and Truck, Electric Locomotive of the C. M. & St. P. Ry

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