Layout of Apparatus in the Cab

Of the Chicago, Milwaukee & St. Paul Locomotives

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THE ARRANGEMENT of the apparatus in the cab of an electric locomotive has much to do with its successful operation from various standpoints, such as ease of maintenance, life of apparatus, accessibility for adjustment in operation, etc. The arrangement of apparatus in the Chicago, Milwaukee & St. Paul locomotives was determined upon after a careful consideration of the theoretically ideal combination and of the experience which had been gained through the design and operation of various other types of electric locomotives of essentially similar operating characteristics. The principal characteristics of the arrangement adopted are as follows:—

1—The heaviest pieces of apparatus are mounted well within the truck center pin limits, and on the center line of the locomotive, in order to reduce both swinging and rolling "dumb-bell" effect.

2—The weight is distributed evenly about both longitudinal and transverse center lines.

3—The apparatus is mounted so that the parts are accessible for inspection and repairs, or can be removed with minimum disturbance or adjacent parts.

4—The pantagraphs are located over the truck center pins, to minimize the effect of side displacement on curves.

5—The apparatus is arranged so that a minimum length of cab and wiring results.

6—The apparatus is installed on a central deck, with an aisle on each side to facilitate inspection and to afford the greatest possible protection to the apparatus in case of a wreck.

7—All high tension apparatus is enclosed in a grounded compartment as a safety measure.

8—The minimum amount of inflammable material is employed and cable is protected by conduit to reduce fire hazard.

A longitudinal weight distribution diagram of the cab, including the principal pieces of apparatus, is given in Fig. 1. The full line shows the weight per foot length of cab for average running conditions; the dotted line shows the conditions when the locomotive has a full complement of sand, oil and water. This location in the center of the cab of a large proportion of the total mass supported by the trucks, indicates why these locomotives have shown no tendency to "nose" since entering service.

An engineer's compartment is located at each end of the cab, thus affording an unrestricted vision of the track to the engineer, even on curves. The engineer's compartment has all walls and ceiling lagged and is supplied with double glass windows, since temperatures as low as 50 degrees below zero are encountered. In this compartment, the parts of the air brake system most sensitive to freezing—the triple valve, transfer valve and reducing valves—are mounted directly over a steam radiator. An electric foot warmer is located under the engineer's foot rest.

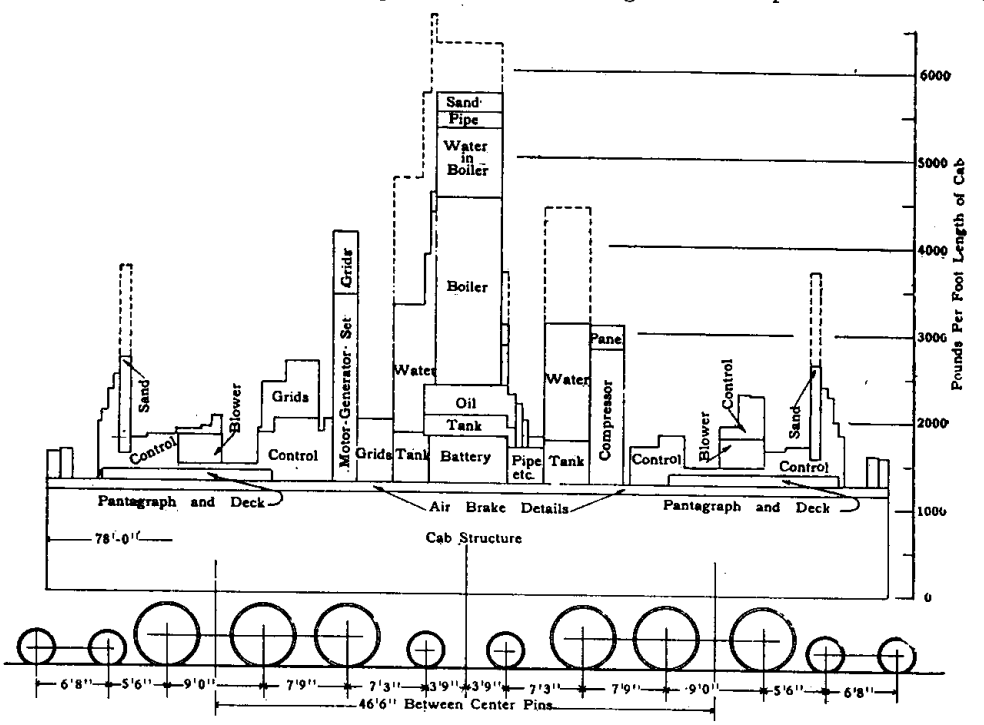

FIG. 1—DIAGRAM OF WEIGHT DISTRIBUTION ON THE LOCOMOTIVE CAB FRAME

The pantagraphs are located as nearly as possible over the truck center pins. Each pantagraph is mounted on and insulated from an iron deck which is, in turn, insulated from ground by porcelain insulators; the purpose being to prevent burning the roof if the pantagraph should be damaged. The insulators used for both pantagraph and deck are interchangable.

Each pantagraph circuit is provided with a dis-

connecting switch, Fig. 2, supplied with a sleet hood, and mounted on two insulators, similar to those used on the pantagraph. The pantagraph cable, before going to the main motor circuits, connects to another disconnecting switch inside of the cab, which is a duplicate of the two outside switches, except that the sleet hood is omitted.

There are two blower motors, each supplying forced ventilation for the motors of one truck. The intake to each blower motor is secured through four louvres located in the upper part of the cab side sheets. The outlet for the blower housing is approximately over the truck center pin. This outlet connects with the main air conduit by a flat sliding ring and sleeve construction which allows for relative motion, both vertical and horizontal, between the cab and the duct. The air duct is bolted rigidly to the main motor frames, one duct for each truck.

The cab structure is of usual Baldwin-Westinghouse design. A central equipment deck, raised with respect to the floor of the side aisles, affords ample space for the main motors. The roof is removable in five sections. There are also three removable side

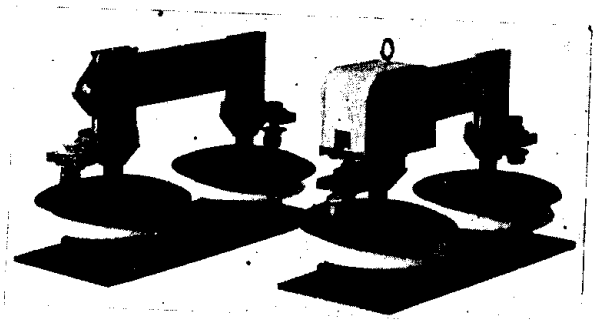

FIG. 2—PANTAGRAPH DISCONNECTING SWITCH

sheets, one for the motor-generator set and one for each of the blowers.

The equipment deck is divided into five spaces, four of which have sheet iron side walls forming compartments in which the electrical controlling apparatus is located. These side walls have inspection doors, conveniently located, by means of which a large part of the apparatus may be inspected from the side aisles.

The main line switches and resistor switches are mounted so that the arc blows toward the center of the locomotive. Asbestos barriers are located in front of the switches to confine the arc. This space is ventilated through the roof. Fig. 3 shows a rear view of a group of these switches. Each switch is a unit in itself and is designed so that most of its parts which require inspection can be reached from the rear.

The main accelerating grid resistors are mounted in cradles, which are assembled complete with grids, insulators and interconnections while on the floor; the whole assembly being then lifted into the cab. The resistors are provided with triple insulation. The insulation between individual grids and between grids and end frames is composed of mica washers. The frames are insulated from the supporting cradle by porcelain and bakelite duck insulating bolts. The cradles are, in turn, insulated from the cab supports by similar bolts.

Ventilation is obtained by having expanded metal in the lower half of the grid compartment walls and by providing ventilators in the roof. These ventilators may be controlled individually from the side aisles and may be completely closed, half opened, or fully opened; the position depending on operating conditions relative to snow. The stabilizing resistors differ from the accelerating resistors in that they are of low ohmic resistance and are subjected to larger currents. Where several grids are paralleled, the paralleled ends are welded together after being assembled in the frames. These grids have the same means of ventilation as the accelerating grids.

The train-heating equipment, consisting of a steam boiler, water tanks, oil tank, forced draught

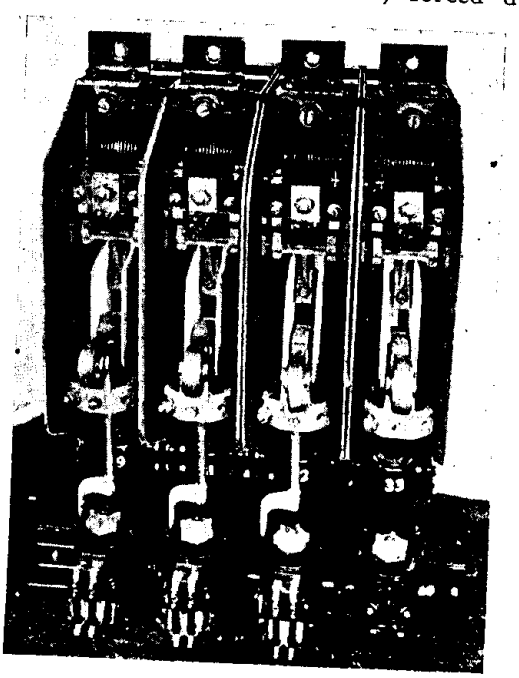

FIG. 3—REAR VIEW OF SWITCH GROUP

blower, oil and water feed pumps and other accessories, requires 30 percent of the total length of the equipment deck and the weight of this equipment is approximately eight percent of the total locomotive weight. The oil tank is mounted under the boiler and below the cab floor in order to minimize the fire risk.

The battery boxes are located just outside of the oil tank and are lagged on the inside with maple. The battery trays are arranged with flexible leads so that individual trays may be taken out for inspection.

The motor-generator set is mounted cross-wise of the deck to facilitate the removal of end housings and to avoid end thrust of the rotor.

The height from the rail to the center of gravity of the complete locomotive is 68 inches and that of the running gear complete with main motors is 43.75 inches. The relatively high center of gravity obtained with motors mounted in this way is of special importance from the standpoint of road characteristics of locomotive operations.