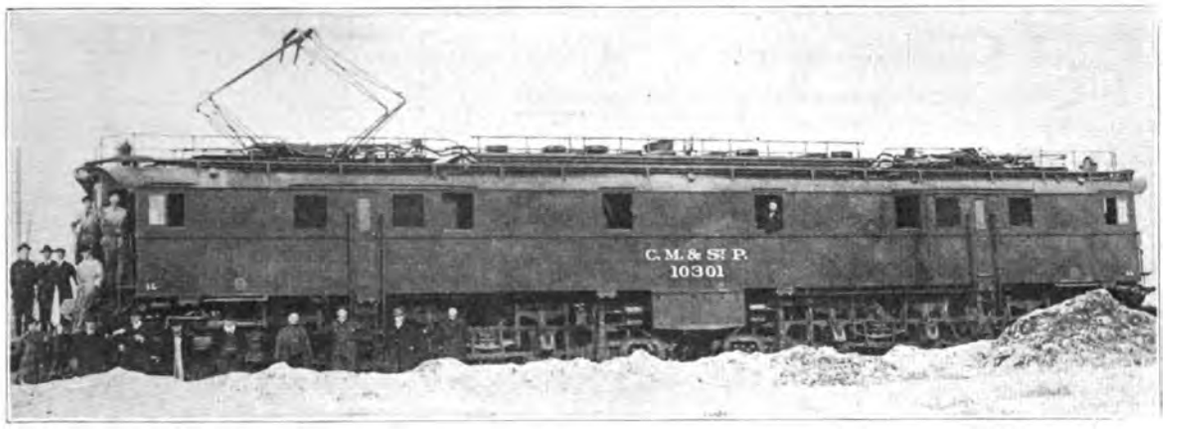
New Two-Hundred Seventy-Five Ton Passenger Locomotives

New Chicago, Milwaukee & St. Paul Railway Locomotives for Passenger Service Weigh Two Hundred and Seventy-Five Tons and Are Rated at 4200 Horse Power—Engines Have Pacific Type Running Gears and 4-6-2—2-6-4 Wheel Arrangement

By T. A. Durkin, Jr.
Westinghouse Electric & Mfg. Co.

Way back in 1835 when Thomas Davenport, a poor Vermont blacksmith, applied an electric motor to a car, little did he dream that he was laying the cornerstone of one of the world's greatest epochs of scientific development. Electric traction today is making very rapid strides and in it lies the best solution to the congested condition of many of our largest carriers.

The electrification of the Chicago, Milwaukee and St. Paul Railway, which crosses the great continental divide, has been extended two hundred miles. This necessitated more rolling stock, and ten locomotives of greater capacity than have ever been used in passenger service were ordered to be built by Baldwin-Westinghouse. Three of these units are already in regular revenue service hauling the "Columbian" and "Olympian," the Chicago to Pacific coast through trains, over the electrified divisions of the Rockies.



Two Hundred and Seventy-Five Ton, Twin Motor, Quill Drive, Passenger Locomotive for C. M. & St. P. Ry.

The first unit, completed early in November, was most rigorously tested to comply with the specifications. The results of these tests were more than a fulfillment of the requirements. The actual service conditions were approximated on the test track by coupling two locomotives together; the first locomotive motoring, the second regenerating.

Capacity

These locomotives are the most powerful in any of the world's passenger services; a single unit having a specified capacity sufficient to haul a 960-ton passenger train (12 steel coaches) over the entire mountain section. They are rated at 4200 h. p., which is in excess of the specified capacity. The locomotives operate up to a maximum speed of 65 miles per hour, and on the two percent grade about 25 miles per hour.

Regenerative Braking

By means of regenerative braking the heaviest train may be lowered down steep grades at a uniform speed and under the positive control of the engineman. At the same time the potential energy of the descending train is being transformed into electrical energy which is transmitted through the trolley to other trains which may be ascending the grade on the other side of the ridge. The same "motoring" combinations are used for "regenerating," except that the fields of the main motors are separately excited over a wide range by the axle generators.

Speed Regulation

Nine running speeds, without rheostatic losses, are made available by the three motor combinations and by two steps of inductive shunting the field in each combination. These speeds range from 8 to 56 m. p. h., depending on the load. The various combinations are accomplished by using six 1500-volt twin motors in the following manner: Combination No. 1, one set of six motors in series giving one-third speed. Combination No. 2, two sets of three motors in series giving two-thirds speed. Combination No. 3, three sets of two motors in series giving full speed. The above characteristics afford great flexibility in the economical manipulation of the train.

Twin Motors

The twin motors with quill drive, not only permit most effective use of the space between the driving

wheels, but obtain the use of 750 volts per armature. In this manner the resultant advantages of the better commutation characteristics, inherent with low voltage, are obtained.

Auxiliaries

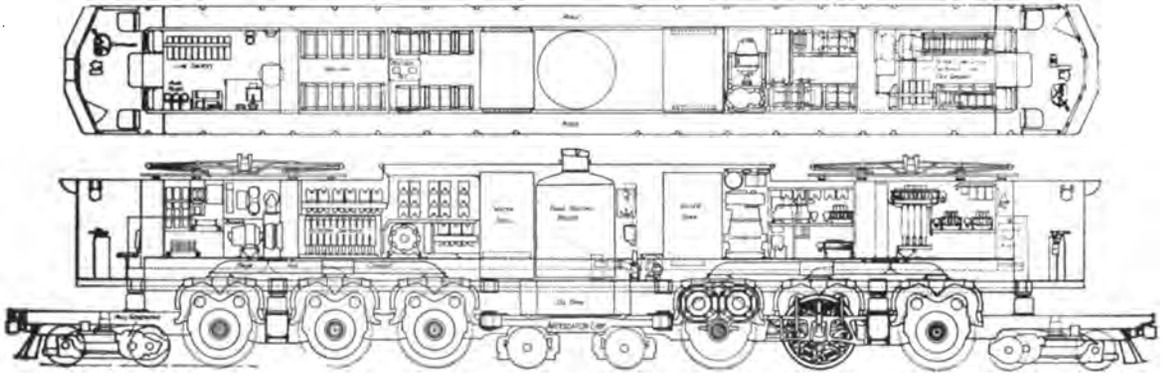
The only high voltage used on the auxiliaries is at the motor end of the motor generator. The remainder of the auxiliary circuits are 80 volts and are available from three sources, namely, the motor generator, the two axle generators, and a storage battery mounted under the cab at the center.

Center of Gravity

The center of gravity of the main running gear, including motors, is about 41 inches above the rail, and the height of the center of gravity of the complete locomotive is 63 inches above the rail. The non-spring supported weight of any single driving wheel will be only that of the wheels' axles and journal boxes.

Quill Drive

This flexible drive affords a means of permitting a motor, located well above the roadbed, to drive an axle, which with its wheels is free to follow the rail surface, independently. It is evident that this drive secures all the advantages of a flexible gear in cushioning the transmission of torque and avoids the road shock far more effectively than the ordinary mounting.



New, Ninety-foot, Electric Passenger Locomotive with Double Pacific Type Running Gear and 4-6-2—2-6-4 Type Articulation; C. M. & St. P. Ry.

Axle-Driven Generator

The axle generators, in addition to exciting the main motors during regeneration, carry the load of air compressor during motoring.

Train Heating

Because of extreme weather conditions often encountered, the reliability of heating equipment must be assured. The heating plant is, therefore, entirely independent of the electrification, each unit being equipped with an oil-fired steam boiler, designed to burn crude oil. Provision is made for a storage of 4,000 gallons of water and 750 gallons of oil in each engine.

Cab and Running Gear

The concentration of all the auxiliaries and control apparatus in a single cab is one of the striking features of this new type of locomotive. This cab is carried on the two Pacific type running gears coupled back to back by a heavy link, thus giving a 4-6-2—2-6-4 wheel arrangement. The main running gear center pins are located midway between the first and second driving axles of each running gear. On one, the center pin is designed to restrain the cab longitudally. Thus the cab is relieved of pulling and buffing strains. These stresses are taken up through the running gear side frames and bumpers. The driving wheels are 68 inches in diameter, and carry 55,000 pounds per axle. The guiding trucks have 36-in. wheels. Each two-wheel truck has a load of 33,500 lb. with approximately 62,000 lb. carried on each of the four wheel trucks.

The complete locomotive with a total length over the couplers of 90 feet weighs 275 tons, of which the adhesive weight is 330,000 pounds.

Equalization

Each main running gear is arranged with a three-point equalization with the single point toward the end of the locomotive, in accordance with accepted steam locomotive practice. The four-wheel guiding truck center pin and cross equalized leading pair of driving wheels are equalized together on the longitudinal center line of the locomotive. This arrangement combines all the advantages of the standard front end construction of the American and Consolidation types of steam locomotives. The two remaining pairs of driving wheels and the two trailing wheels of the main running gear are side equalized together again, following accepted steam locomotive practice.

SAFE HANDLING OF FALLEN WIRE

One of the precautions necessary in the handling of a fallen trolley wire which is most likely to be overlooked in the excitement is the taking up of slack when picking it up to avoid contact with rails or wet pavement. The severe arc which results brings the hazard of burns from flying metal to the "innocent bystander." If a newspaper is used in picking up the wire, it should be at least four or five sheets thick. The use of a "pick-up," with which some cars are supplied, is an important aid to the safe handling of fallen wires.