



Powerful Electric Passenger Locomotive Having a Continuous Rating of 3,200 H. P.

## Most Powerful Electric Passenger Locomotives

New Power of 112,000 lb. Tractive Effort and 3,200 H.P.  
for the Chicago, Milwaukee & St. Paul

**T**HE CONTINUATION of the Chicago, Milwaukee & St. Paul's electrification program to the Cascade Range includes the electrification of a new section from Othello, Washington, east of the mountains to Seattle and Tacoma.

With this completed there will be 611 miles of trans-continental electrified railroad in operation. The original 440 miles of electrification will eventually have all the passenger trains handled by Baldwin-Westinghouse electric locomotives. These locomotives embody many novel features.

The complete locomotive with a total length over couplings of 90 ft. weigh, ready for service, 266 tons, and has an adhesive weight of 330,000 lb. These new locomotives will be single-cab units, although the horsepower capacity is much greater than for any double-cab electric locomotive now in service. There are two main running gears, each having a four-wheel guiding truck, three driving axles with a 16-ft. 9-in. rigid wheel base, and a two-wheel trailing truck. It thus corresponds to two Pacific type running gears coupled with a link and having two-wheel trucks on the adjacent ends.

The cab is supported on center pins located midway between the first and second driving axles of each running gear. On one running gear the center pin is designed to restrain the cab both longitudinally and laterally, while on the other running gear the center pin restrains the cab only laterally, permitting free longitudinal movement. This arrangement of riding and floating pins relieves the cab of all pulling and buffing strains due to train load, as these strains are taken directly through the running gear side frames and bumpers. The driving wheels are 68 in. in diameter, and carry 55,000 lb. per axle. Guiding trucks have 36 in. wheels. The two-wheel trucks each have a load of 38,500 lb. at the rail, with approximately 62,000 lb. distributed on each of the four-wheel trucks.

On any single driving wheel, the non-spring supported weight is that of wheels, axles and driving boxes only.

With the flexible type of quill drive used the motors are located well above the roadbed and the axle with its wheels is free to follow the rail independently. This drive secures all the advantages of a flexible gear in cushioning the torque and avoids the shock to the rail that is obtained with the common flexible gear construction and mounting.

Each main running gear has three-point equalization with a 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 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 equalized in accordance with accepted steam locomotive practice.

The center of gravity of the main running gear, including motors, is 41½ in. above the rail, and the height of the center of gravity of the complete locomotive is 63 in. above the rail.

Among the novel features which will be found in these locomotives are: Large capacity in single-cab unit; flexibility of running speeds with small rheostatic losses; twin motor design with quill drive; low-voltage auxiliaries simplifying inspection, maintenance and operation; simple and effective regeneration; improved equalization to minimize weight transfer in trucks, and auxiliary train-heating plant.

**Capacity.**—These will be the most powerful locomotives running in passenger service. A single unit is able to haul a 950-ton train (12 coaches) over the entire mountain section at the same speeds as called for by the present schedules. The one-hour rating for one of these locomotives is 4,000 hp. and its continuous rating is 3,200 hp. with a starting tractive effort of 112,000 lb. The normal speed on level track is 60 m.p.h.; on a 2 per cent grade about 25 m.p.h.

**Flexibility.**—One of the noteworthy characteristics of these units, which is very desirable in passenger service, but which has not heretofore been attained with this type of electric locomotive, except at the expense of heavy rheostatic losses, is the flexibility of running speeds. There are nine running positions without rheostatic loss. This is accomplished by the use of six 1,500-volt twin motors on the locomotive, arranged for three speed combinations as follows:

Position No. 1. 1 set 6 motors in series.

Position No. 2. 2 sets 3 motors in series.

Position No. 3. 3 sets 2 motors in series.

During the change from one speed combination to another, tractive effort is maintained.

Two additional running speeds are obtained on each speed combination by means of inductive shunts on the main motor fields, which assist in cutting down current peaks as well as save rheostatic losses, and enabling the power demand over the varying profile to be kept more nearly constant. The speed range is from 8 to 56 m.p.h., depending on the load.

**Main Motors.**—The use of the twin-motor design with quill drive not only permits the most effective use of the space between the driving wheels, but enables the use of two armatures each wound for 750 volts direct current, and geared to

the same quill. This also makes possible the advantage of better commutating characteristics inherent in the lower voltage motors.

**Auxiliaries.**—Low voltage auxiliaries considerably reduce the complication and hazard of high voltage on these locomotives. The only high voltage apparatus among the auxiliaries is the motor of the small motor-generator which is used for train lighting and charging the storage battery. The resultant simplification secured by the use of low voltage appliances decreases the complication of installation, maintenance and operation. Ordinary inspection can be carried on, including the functioning of switches and auxiliaries, with the complete absence of 3,000-volt power on the locomotive.

**Regeneration.**—The type of regenerative control for holding trains on descending grades used in these locomotives is of particular interest. Special arrangements have been perfected to secure positive operation of this feature over widely varying speeds. The same main motor combinations for "motoring" are used for "regenerating" except that the fields of the main motors are separately excited over a wide range by axle-driven generators. These are so connected with balancing resistance that inherent stability in the motor characteristics during regeneration is assured, irrespective of whether the changes in line voltage are sudden or gradual.

While the regenerative braking of trains lessens the duty on the air-brake equipment, further safety in braking with electric locomotives is introduced with the axle-driven generators. These machines are mounted on the pony trucks of the locomotive, and in addition to exciting the motors during regeneration, furnish the power for operating the air compressors and blower motors when the locomotive is hauling. This method insures a current supply to the air compressor motors irrespective of the overhead trolley supply, and provides that compressed air will always be available for use of the air brakes.

**Weight Transfer.**—In electric locomotives without connected wheels, weight transfer due to tractive effort, is an important point of interest. This is caused by the drawbar pull being exerted at the coupler height, which with the reaction at the rail, tends to lift the leading end and depress the trailing end. This changes the weight distribution and increases the tendency of the wheels to slip. The method of equalization described above reduces the weight variation on the driving wheels to only 6 per cent from normal when pulling at 30 per cent adhesion.

**Train Heating.**—The question of passenger train heating is of vital importance due to extreme weather conditions encountered in that section of the country. Heat must be assured under all conditions of failure of equipment, and delays of trains. The heating plant, therefore, must be entirely independent of the electrification. Each locomotive is equipped with an oil fired steam boiler, designed to burn ordinary fuel oil used by the railway company. Provision is made for a storage of 7,500 gal. of water and 750 gal. of oil in each engine.

The careful attention given to improve the details of design and operation insures that these new locomotives will mark an epoch in the development of the electric locomotive for steam-railroad passenger service.

## Store-Door Delivery

### Proposed in New York

THE DIRECTORS of the Merchants' Association of New York City have published a plan, prepared by J. C. Lincoln, manager of the association's traffic bureau, providing for store-door delivery of freight in New York City, combined with pick-up service; and the plan has been referred to the committee of commissioners who are investigating traffic conditions in New York City—Messrs. J. S. Harlan, of the Interstate Commerce Commission; T. H. Whitney, of the New York State Public Service Commission, and W. E. Danges, of the Public Utilities Commission of New Jersey. The committee has it now under consideration and is expected soon to recommend it to Mr. McAdoo. The plan involves some radical changes which, in ordinary times, could not be carried out without new legislation; and therefore the Merchants' Association seeks the approval not only of this committee, but also of the director-general of railroads. In the absence of legislation the plenary powers of the director-general would be needed to set the scheme in operation.

The report opens with a brief description of the extreme and unusual conditions in New York, especially on Manhattan Island; very inadequate team tracks and consequently large quantities of carload freight to be moved through the freight stations on the piers, and the enormous volume of business of all kinds, resulting in blockades of trucks loaded with outgoing freight very frequently even in normal times. Consignees, as a rule, call for freight only after they have received notice of arrival, and for the great bulk of the merchandise received in the city, this means a delay of at least 24 hours.

Store-door delivery—the trucking of freight away from stations as soon as practicable after its arrival, instead of awaiting the decisions of hundreds or thousands of consignees—is, of course, the ideal arrangement. The present report considers the question of getting each railroad to form a trucking company, and also another proposal that all of the roads should combine to form a company; but recommends, finally, the pooling of present equipment, which is owned by several hundred concerns.

With facilities consolidated the trucking company could have lined up on the pier batteries of trucks serving particular zones in the early hours of the morning and the delivery of freight would begin with the opening of business hours. The same method could be continued during the day. The pier station would thereby be kept free of incoming freight and more adequate facilities would be provided for outbound business. By this method deliveries would be made before the consignee, under present methods, receives notice of arrival.

Continuing, the report says:

"The same trucks should also be employed in picking up freight for outbound shipments. By proper co-operation on the part of shippers, a more even delivery of freight to the pier stations throughout the day could be accomplished and the frightful line-up and delays to trucks which take place in the late afternoon would be avoided. Trucks would be substantially assured of full loading in one direction and probably in both.

"At first the agreement, as a regulation, to be confined to the handling of less than carload merchandise.

"Carload receivers usually maintain their own trucks or have an arrangement with a trucking company to do their hauling; carload consignments could be kept intact and assigned a space on the pier floor where it would be accessible to the consignee. With the removal of the large number of trucks now handling less than carload freight from the

**SELECTED ROUTES FOR BRITISH FREIGHT.**—The Railway Executive Committee of England has given notice that on and after December 1, 1917, traffic for conveyance by freight train between England and Scotland, and Wales and Scotland, will only be accepted and conveyed by selected railway routes. Information as to the route by which traffic for places served by more than one railway should be forwarded, can be had an application to the railway companies' agents.

pier, the carload receiver could remove his freight more expeditiously.

"The following regulations would have to be prescribed and made enforceable:

"No trucks for the handling of less than carload merchandise other than the trucks of the company formed for the purpose of effecting store-door delivery to be allowed on the pier.

"Tender of the property to the consignee at his store door or usual place for the receipt of his property to be a legal tender of such freight, and upon such tender the consignee to pay freight and cartage charges before delivery. (Unless by prior arrangement he shall have arranged for credit.)

"If the property is refused by the consignee or payment is refused, then such freight may be placed in public warehouse.

"When delivery of merchandise is desired by consignee at other than his usual place of business, instructions shall be placed with the cartage company prior to the arrival of the goods.

"Schedules of reasonable cartage charges to be prescribed, which charges shall be strictly adhered to.

"Arrangements should also be made for the assessment of reasonable and non-discriminatory storage and handling charges on merchandise placed in public storage.

#### Method of Procedure

"In order to relieve congestion at stations and the delay to trucks the carrier should be required to make delivery of the property transported, subject to a reasonable charge for the additional service rendered. [This duty of the carrier being recognized, the authority of the director-general in the premises would be unquestioned.]

"The trucking service to be accomplished under government authority and direction, trucking companies now operating to be permitted to pool their equipment, so as to operate as one company for the handling of freight to and from railroad piers and stations. The city to be districted by zones as to piers and places of business to be served—and trucking equipment to be so regulated as to serve these particular zones. The trucking company to have priority rights on the pier.

"Where consignee desires to perform trucking, such trucks to be permitted on the pier in such restricted hours as will not interfere with the operation of the general plan." \* \* \*

## Wood Preserver's Association Studies War Conditions

### The Shortages of Material and Labor Important Topics at the Fourteenth Annual Convention

THE CONVENTION of the American Wood Preservers' Association was held at the Hotel Sherman, Chicago, on January 22 to 24, inclusive. Although some doubt was expressed regarding the attendance previous to the meeting, the number present compared favorably with that of previous years. Approximately 75 members were in the hall at the opening session on Thursday morning.

The officers of this association for the past year were: John Foley, president, forester Pennsylvania Railroad, Philadelphia, Pa.; M. K. Trumbull, first vice-president, vice-president National Lumber and Creosoting Company, Kansas City, Mo.; J. B. Card, second vice-president, president Central Creosoting Co., Chicago, and F. J. Angier, secretary-treasurer, superintendent timber preservation, Baltimore & Ohio, Baltimore, Md.

The convention was called to order by President Foley at 10 o'clock on Tuesday morning, and was opened with prayer by J. H. Waterman, a past president. The report of the secretary-treasurer showed a balance of \$149.77 in the treasury. The membership on December 31, 1917, was 291, including 73 members from 36 railways. Fifteen members were reported in the military or naval service of the United States government.

In his opening address President Foley referred to the unusual problems of the past year arising from shortages in oil, fuel, labor and lumber which are requiring extensive readjustment in the wood preserving industry. He referred to the recognition of this condition in the program for the meeting and urged the members to participate in the discussion of these problems in order that the wood preserving industry might do its full part in helping our government to win the war. He described the great inroads which are now being made on European forests, particularly those of the belligerent nations and referred to the large contribution which this country has made to the lumber demands of its allies. Owing to the depletion of the forests of Europe, the United States, Canada and Russia will be called upon to

supply the timber needs of the world. President Foley also referred to the fact that 5,000 American foresters and lumbermen are already in France and emphasized the effect which this will have on the conservation of American timber resources after the war when these men return from Europe.

#### The War's Effect on Labor Supply

E. T. Howson, engineering editor of the *Railway Age*, spoke on the effect of the war on the labor supply. Although the labor problem is universal at the present time, no definite statistics are available showing the extent of the shortage of men. Such data as are available, however, indicate that the shortage is indeed serious. The causes of the situation are the increase in the demand for labor and the decrease in the available supply. The army draft increased the number of men who had already been withdrawn from industries through voluntary enlistments and the rapid growth of war industries also proved a heavy drain on the labor supply. On the other hand, the flow of alien labor into the country through immigration has almost ceased. Whereas in the 10 years previous to the war an average of 1,012,000 men available as unskilled laborers migrated from other lands to the United States every year, now hardly 250,000 enter the country annually and this number is nearly equaled by the exodus of alien reservists to fight in the armies of Europe. The two largest classes of immigrants are unskilled laborers and agricultural workers. Of the former class, 90,000 entered the country last year and 101,000 left.

Considerable attention has been directed to the Mexican labor supply, particularly in the Southwest. In the aggregate, however, this source of supply is unimportant as in no year have more than 20,000 Mexicans migrated to this country and since the passage of the alien labor law on May 1, 1917, almost a negligible number have entered. The only other source of labor is Asiatic, and although thousands upon thousands of Oriental workers have passed through Canada on their way to France to take over the unskilled