



Further Railroad Electrification Important

Electrical Equipment Presents a Most Effective Way of Increasing Transportation Capacity—Considerations Why This Is Now a Timely Subject

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IN NO other period of our history has the necessity of adequate means of transportation been more evident. We are now at war, and one of our most important duties is to transport a vast amount of goods over long distances. Even under ideal conditions this would be a herculean task, but unfortunately for the last five years or more the railroads have been obliged, mainly because of adverse legislation, to follow a halting program of development and this condition is proving a most serious handicap to the prosecution of the war. Had there been in Public Opinion, which after all governs our legislation, a better comprehension of the requirements of our steam railroads, the present burden on the nation and on each individual would be materially less. But at least we are now fully alive to our lack of foresight, and we should be prompt to correct this ominous situation.

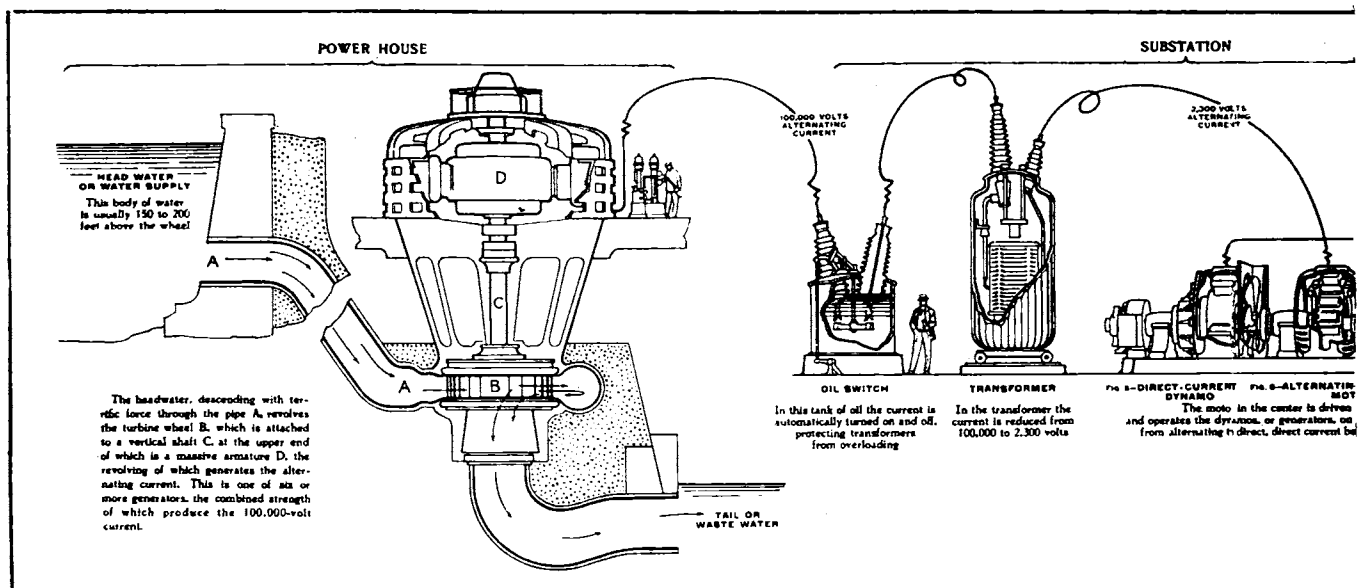
The need for increased transportation facilities has long been apparent to those well informed in such matters. Experience has shown that the traffic on our railroads about doubles every twelve years and that an annual capital expenditure of \$1,000,000,000, at normal

price levels, is needed to keep pace with this expansion. Since, for the last few years so much less than this has been invested, the sum now necessary to bring our railroads up to the point where they will be adequate to the needs of the nation is literally enormous. No such capital being now available, normal methods can no longer be followed, and therefore in the present emergency any and every means to utilize our existing railroad plant to its fullest efficiency should be carefully considered.

The Railroad War Board, despite legislative handicap, has already made phenomenal progress toward unifying the railroads' facilities, and if these handicaps were removed, it could practically eliminate all duplication of service by the common use of terminals, tracks, and equipment and by a thorough revision of traffic routing.

When all this is accomplished, however, a further improvement in the transportation situation can be secured by means of electrification.

Electrification can help the railroads and the nation in three ways:



- 1—By increasing the capacity of existing track and terminal facilities.
- 2—By decreasing the consumption of fuel, and
- 3—By conserving the labor necessary for operation and maintenance.

INCREASING TRACK CAPACITY

Any method by which the capacity of our steam railroads can be increased would be of paramount importance at this time. Electricity can accomplish this by permitting the use of locomotives of larger power, higher speed and greater mobility than is possible with steam operation. The largest type of electric freight locomotive built by the Pennsylvania Railroad is capable of developing 7000 hp. for brief intervals and 4000 hp. continuously, regardless of weather and other conditions that reduce the capacity of a steam locomotive. This is nearly the limit in power for a single road locomotive with the drawbar strength of the freight equipment now in general use. With all-steel equipment, heavier trains can be run, and under special conditions it is entirely practicable to operate trains requiring an input of 20,000 hp., including both road locomotive and helper. Such a concentration of power as this will obviously expand enormously the traffic possibilities of existing track facilities and will make additional tracks unnecessary.

The efficiency of electric operation in the most exacting service has already been demonstrated. On the Norfolk & Western Railroad, electric locomotives have replaced high-powered steam locomotives of the most efficient type, and have eliminated all congestion on the grades and, it is estimated, have doubled the capacity of this system at an expense that is considerably less than the cost of a corresponding increase in the number of tracks. In this instance, the power input for single trains is about 11,000 hp. for starting and 8000 hp. for continuous operation.

Furthermore, the electric locomotive is ready to start at any time, needs no fuel or water supply, can run in either direction, accelerates very rapidly, and has great overload capacity. All of these features simplify and expedite yard movements and train dispatch-

ing and thus increase the capacity of existing terminals for traffic movement.

THE CONSERVATION OF FUEL

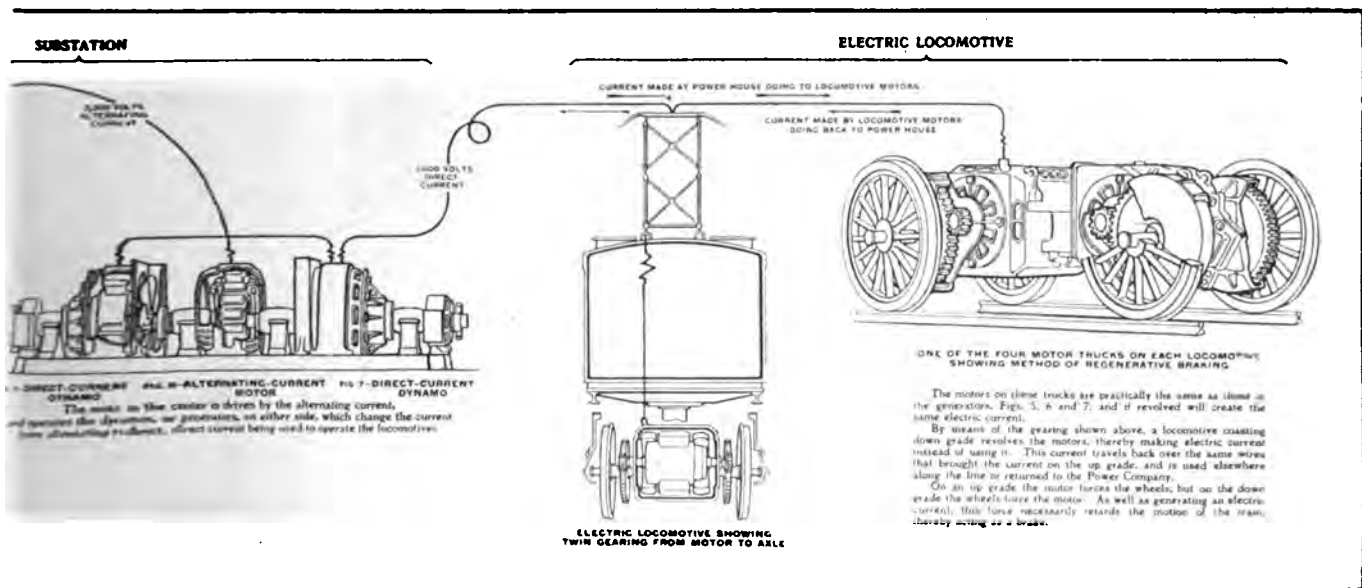
The aggregate power generated in our steam locomotive boilers is about 50,000,000 hp., and to produce this one-quarter of all the coal mined in the United States is consumed. By a somewhat curious coincidence this total horsepower is just about equal to the amount of water power that is going to waste in this country. Hence, it is apparent that if our hydroelectric power was used for railroad operation, 150,000,000 tons of coal would be saved annually, and the cars and crews needed to haul this coal would be released for other purposes. Actually the case is far stronger than this, for owing to the fact that the load factor of the individual locomotive is less than 25 per cent, power stations having a combined capacity of 12,000,000 hp. would suffice to operate our entire system of railroads, thus still leaving 35,000,000 hp. of water power available for other purposes.

For geographical reasons it is of course impossible to generate all railroad power hydraulically, and steam stations must in any event be relied upon to supply part of it. But 1 lb. of coal will produce as much power at the locomotive in a modern electric power plant and transmission system as 2 lb. or more under a locomotive boiler. Hence when this economy is combined with the reduction in the total capacity required, due to the low load factor of the locomotive, it is evident that enormous savings in fuel are possible even when steam stations are used. Irrespective of considerations of economy, our right to deplete our fuel resources in the face of this vast waste of water power is decidedly questionable.

HOW ELECTRICITY SAVES MAN POWER

The third important result secured through the electrification of the railroads is the conservation of labor. This is accomplished in several ways.

In the first place, by effecting a great saving in coal consumption, electrification releases an army of mine and railroad workers for other purposes. Re-



lief of this kind would be especially beneficial at this time, as well as of great economic importance after the war.

Secondly, since the use of electricity increases the amount of power that can be concentrated in a single locomotive and permits the operation of longer trains at higher speeds, a given number of men can handle a much greater volume of traffic on an electrified road than they can on a steam road.

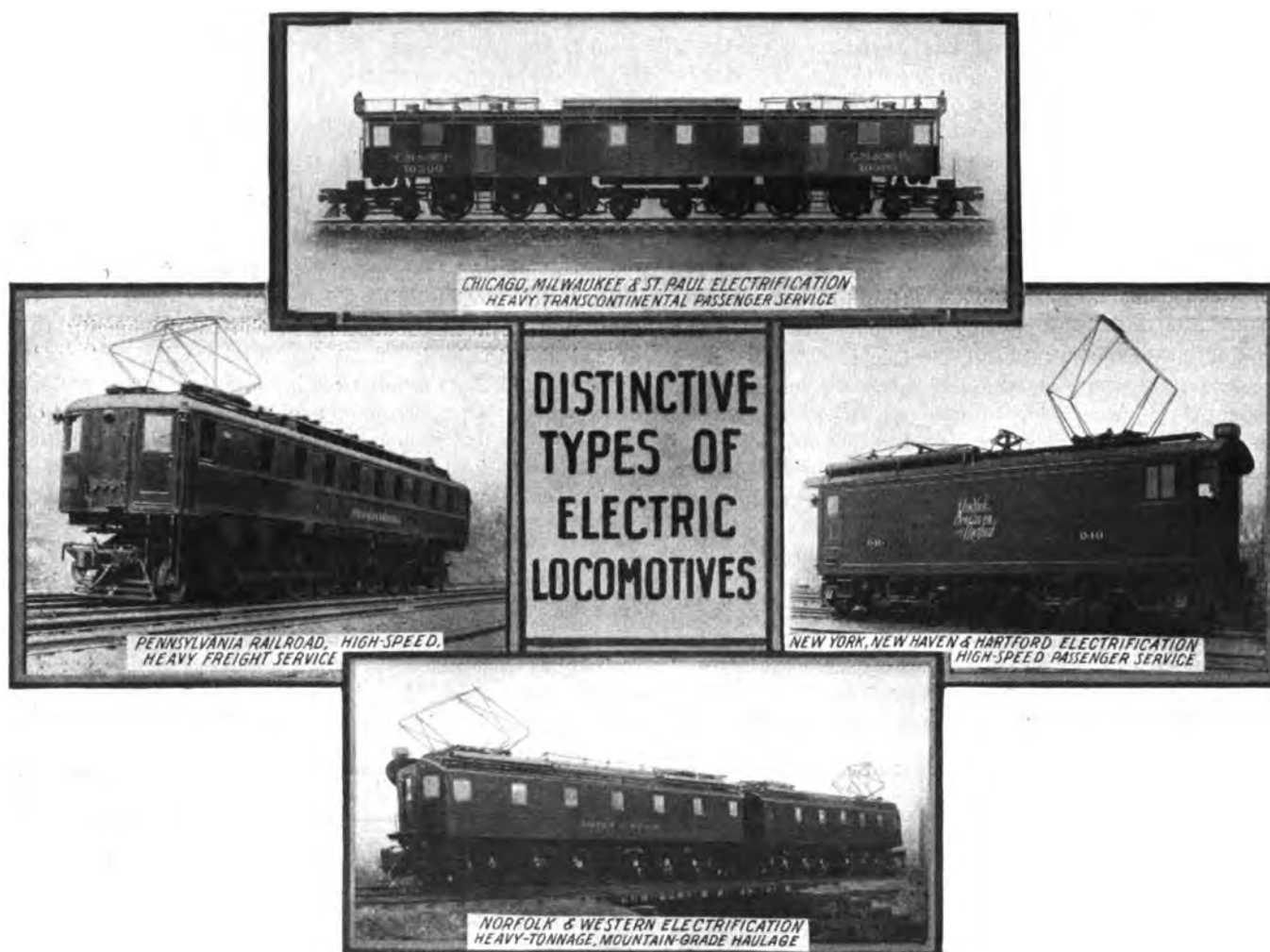
Again, electric locomotives require much less labor for maintenance than steam locomotives. On the Chicago, Milwaukee & St. Paul Railroad the electric locomotives run 500 miles before receiving terminal attention, whereas steam locomotives are ordinarily taken to the roundhouse after runs of 100 miles. On the Norfolk & Western, twelve electric locomotives

... A number of factors are directing constructive thinking in many quarters toward electrification at the present time, and of these the following are most important:

1. The present scarcity of labor, which will undoubtedly continue after the war.

2. The scarcity and high cost of fuel. While present prices are not likely to obtain in the future, it is the general belief that they will never drop to their former level.

3. The inevitable growth of traffic in the United States which will necessitate increased traffic capacity. Electrification in many cases provides the cheapest means of increasing capacity, especially in settled communities and in mountain sections where increasing the width of the right-of-way for additional tracks



have replaced thirty-four Mallet steam locomotives, so that between the greater capacity of the electrics and their greater time in service, the reduction in the amount of labor necessary to operate and maintain them is most marked. Moreover, because of the simple construction of electric locomotives, even major repairs, such as the replacement of a motor, can be accomplished in a few hours, in striking contrast to the length of time required for important repairs to steam locomotives.

Finally, because electric locomotives are independent of fires, steam pressure, fuel and water, electric operation secures an economy of yard and terminal labor.

would be either enormously expensive or practically impossible.

4. The increasing capacity and efficiency of hydroelectric and steam generating plants, which are constantly tending to augment the relative economy of the electric locomotive as compared with the steam locomotive.

5. The increase in the size of transmission systems throughout the country not only makes electric power more readily available to the railroads but increases the facility and ease with which the fluctuating railroad loads can be carried.

6. The improvements in trolley design and construction, which are constantly reducing costs per track-



PHILADELPHIA PASSENGER TERMINAL
BROAD ST. — PENNSYLVANIA R.R.



NEW YORK FREIGHT TERMINAL
N.Y., N.H. & H.R.R.

ELECTRIFICATION HAS PROVED THE MOST ECONOMICAL MEANS FOR CARING FOR TRAFFIC AT TERMINALS LIKE THESE

mile. Because of the number of track-miles involved, this reduction of the cost of overhead construction will have an important influence on railroad electrification.

7. Improvements in the standards for freight car equipment which will permit trains of greater tonnage to be hauled in the future. The power capacity of electric locomotives being practically unlimited, these heavier trains can be hauled electrically over existing grades, but to handle them with steam would require most extensive grade revisions.

8. Greater regularity and reliability of operation. One of the important results of every electrification has been improvement in service. The New York Terminal locomotives of the Pennsylvania Railroad have, for example, a record over a term of years of 100,000 locomotive-miles for each case of detention. Such accomplishment in maintenance of schedules directly increases capacity.

THE IMMEDIATE OUTLOOK

With the unification of the direction of the railroads by the action of the President it is expected that capital expenditures during the war will be governed by

broad consideration of traffic necessities, conservation of fuel and conservation of man power. In those situations where traffic congestion is most acute relief will be available in some cases through the utilization of existing electric generating stations, so that the construction involved would be limited to that of locomotives, substations and trolley installation, and would therefore involve a minimum diversion of effort.

The means by which this can be accomplished remains to be developed. If the improvements are for the benefit of the nation and the property concerned, the financial means will be forthcoming.

A hopeful view of the situation is that full opportunity for the continuance of individual incentive and ability will prevail, so that the splendid achievement, so characteristic of past American railroad history, will obtain in the future. The further upbuilding and improvement of the transportation facilities for the country should unquestionably be the dominating part of our activity after the war, so that certain electrification, desirable but deferred, should now be planned for, to form part of the nation's immediate constructive program as soon as opportunity affords.



HOOSAC TUNNEL, — BOSTON & MAINE R.R.



ELKHORN TUNNEL, NORFOLK & WESTERN RY.

ELECTRIC LOCOMOTIVES ALSO SAVE THE COST OF ADDITIONAL TRACKS IN CONGESTED SERVICE ON MOUNTAIN DIVISIONS