ELECTRIC LOCOMOTIVES

At the meeting of the Chicago Section of the American Society of Mechanical Engineers, May 14, the subject of electric locomotives was discussed by A. H. Armstrong and A. F. Batchelder, of the General Electric Company, Schenectady, N. Y. Mr. Batchelder gave an illustrated talk in which he briefly described the various mechanical features of electric locomotives. He was followed by Mr. Armstrong who spoke on the performance of these locomotives.

Mr. Armstrong called particular attention to the rating of electric locomotives, stating that the time element is a most important factor in its determination. The motors when operated continuously deteriorate when heated above a certain temperature, although it takes considerable time to reach a dangerous point. It is therefore necessary to know the rating of the electric locomotives, in addition to their starting tractive effort, for short periods of say one hour's performance in addition to the continuous performance. It is important that this be clearly understood at this time when long distances of steam railroads are being electrified. In acknowledging the improvements that have been made in the steam locomotives, it being now possible to get a horsepower with about 15 lb. of steam, Mr. Armstrong claimed that the electric locomotive, notwithstanding these improvements, offered many claims for consideration.

In considering high speed passenger service he called attention to the latest type of New York Central electric locomotive, which will handle a 1,200-ton train at a speed of 60 miles an hour, giving an output continuously without danger from overheating of 2,000 hp.; 2,600 hp. can be obtained for one hour. This engine is able to handle the service of overland trains for any distance at a speed of 60 miles an hour or more.

Referring to electric locomotives for freight service, he called atttention to the installation on the Butte, Anaconda & Pacific. This was made for the sole purpose of obtaining more economical operation. The preliminary report indicated that the money saved by putting in the installation would pay 18½ per cent on the capital required to make the change from steam to electric operation. For the first six months the results obtained indicated a yearly return on the capital invested of 20 per cent. This road operates heavy freight trains which average from 3,500 to 4,000 tons, and 4,500 tons is not unusual. Each locomotive unit weighs 80 tons, two units being used to handle the heavy trains on the 0.3 per cent grade. The locomotives have a tractive effort of 26,000 lb. at a speed of 16½ miles per hour continuously. This corresponds to a factor of adhesion of about 6. From investigation Mr. Armstrong stated that it is found to be almost universal practice to give a locomotive a rating calling for a tractive effort on the ruling grade of about 18 or 19 per cent co-efficient of adhesion, and that the electric locomotive was designed to follow this practice very closely, although advantage is taken in the electric locomotive to obtain a greater output for a short time than it can sustain continuously. In heavy trunk line work the difference between the short period rating and the continuous rating is small.

Speaking of the new installation on the Chicago, Milwaukee & St. Paul, Mr. Armstrong explained that this system is a 3,000 volt direct current system, practically the same as used on the Butte, Anaconda & Pacific. The weight of each locomotive unit is 110 tons on drivers and where two are used, as will be the general custom, the total weight will be 270 tons. A continuous 24-hour rating of 3,200 hp. is obtained with these engines and a tractive effort of 72,000 lb. at a speed of 15¾ miles an hour. Mr. Armstrong claimed an increase of 10 per cent in tractive effort for the electric locomotives with the same weight on drivers over that which can be obtained in a steam locomotive on account of the reciprocating and imperfect rotary motion of the steam locomotives.

Over the Belt Mountains where there is an average grade of .71 per cent for 49 miles, one of these 270-ton locomotives will haul 2,500 tons at a speed of approximately 16 miles an hour. The locomotives for both passenger and freight service are identically the same with the exception that those used in freight service are geared to a ratio of 4½ to 1, while those in passenger service are about 2½ to 1. This is standardization to the highest degree and permits of the minimum number of repair parts. As stated before, electric locomotives are made in two sections, being connected together with an articulated joint for the purpose of permitting the operation of each half singly. This will be of special value in light local passenger trains or for shifting work.

The Chicago, Milwaukee & St. Paul electric locomotives introduce for the first time direct current electric braking of the regenerative type. In other words, the motors are reversible. Going up the grades they receive electrical power, and in going down the grades the train will drive the motors as generators and thus brake the train or hold it electrically and return power to the line. In ascending grades these engines consume from 4,500 to 5,000 kw., and the efficiency of a locomotive under these conditions is about 88 to 89 per cent without considering the losses of the blowers, air compressors and fans and incidental parts of the locomotive itself. In Mr. Armstrong's opinion the benefit of this electric braking on the mountain grades will be not so much in the power returned to the line as the economy introduced thereby in the elimination of derailments due to broken shoes and overheated wheels on the the long down grades.

Referring back to the latter type of New York Central locomotives, Mr. Armstrong stated that there are no bearings on the motors of those locomotives, thus eliminating mechanical friction. This permits of an efficiency as high as 93 to 94 per cent; that is, of the electrical power input to the locomotive between 93 and 94 per cent is returned as mechanical output at the rim of the drivers. The Milwaukee locomotives, on the other hand, will give an efficiency of not much higher than 84 or 85 per cent operating on level track. The profile of the Milwaukee road was such as to preclude the use of the gearless type used on the New York Central.

The Milwaukee electric locomotives have a tractive effort of 72,000 lb. per unit and a starting tractive effort of 120,000 lb. or when run double-headed, a starting tractive effort of 240,000 lb. With the 3,000 d. c. line voltage there will be 1,500 volts on each motor. The electrified portion of the Milwaukee road is 440 miles long, and there will be 14 substations at approximately an average distance of 30 miles apart on the entire road.

Women Railway Workers in Germany.—It has been reported from Berne that the Prussian and Hessian State Railways are employing a number of women as line keepers (Streckenarbeiter), although this is very heavy work. All women, before being engaged, are obliged to sign an agreement that they will have nothing to do with Social Democracy or with the Transport Workers' Association, that they will never attend Social Democratic meetings, or be in any way associated with the Social Democratic propaganda or efforts.

Railways in Asia Minor.—The Turkish Ministry of War is reported to have been granted a large credit to build and operate four main and two branch lines, all under military control. The chief of these lines are from Angora to Erzerum, from Erzerum to a point on the Black sea, from Murally to Rodosto, and from a point on the Erzerum Railway to the Black sea.

Better Facilities on Philippine Trains.—The Board of Public Utilities Commissioners has handed down a decision ordering the Philippine Railway, on its Cebu lines, to install better lights in its second- and third-class coaches and to supply to all passengers individual drinking cups at a nominal cost. The company is also forbidden to permit more passengers than there are seats to ride in the coaches.