

insulation, mounted on a metal bar and bound with sheet metal in such a way as to completely sheathe the unit. This is practically an indestructible unit when finished and in addition passes the underwriters' requirements, which gives reduction in car and plant insurance. Also the possibility of grounding or causing injury to passengers or clothing is remote. Suitable cases for all mountings with reasonable clearances are provided. The principal features of these heaters are: Safety first, economy and reliability.

#### DUPLEX DIAL WATTHOUR METER FOR ELECTRIC LOCOMOTIVES USING REGENERATIVE BRAKING

Ten new locomotives for the electrified divisions of the Chicago, Milwaukee & St. Paul Railroad are being equipped with Economy watt-hour meters that will accurately measure the energy consumed in driving the trains and the energy returned to the line through regenerative braking, each reading being shown on one of two cyclometer type dials.

The locomotives are of the Baldwin-Westinghouse passenger type, each equipped with six 533-h.p. twin-armature motors. Each locomotive has one meter. The meters are known as the "Sangamo Economy Railway Meters" and are a modification of the type ordinarily used with single dials for energy saving through checking the performance of motormen on street and interurban cars. They are manufactured by Sangamo Electric Company, Springfield, Illinois, and sold by the

on basis of the watt-hour consumption used by locomotives for the respective classes of train service.

2. To check the economic use of power in connection with the handling of the train.

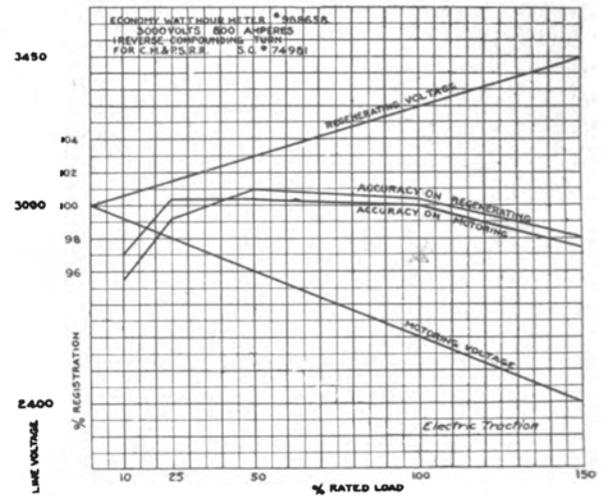
3. To provide operation and engineering data which must be known to check the economic and satisfactory operation of the electrification system as a whole.

The locomotives at present in use are equipped with watt-hour meters which give for any run the net use of power; that is, the regenerated reading is subtracted from the metered reading, and in order to get the approximate values of metered and regenerated energies respectively, it is necessary to read the meters at certain points on the road between which the general use of power is either on the metering side or the regenerating side respectively.

The Economy duplex-dial meters, however, described here, and which will be installed in the new locomotives now being built by the Westinghouse Electric & Manufacturing Company, will make separate records of the metering energy and regenerated energy, so that readings of the meter need be made only at the beginning and end of a run, and the results will be exact instead of approximate.

An appreciation of the wide voltage

these conditions is well shown in the accuracy curves of the meter shown in Fig 1. From these curves it will be seen that there is a variation of less

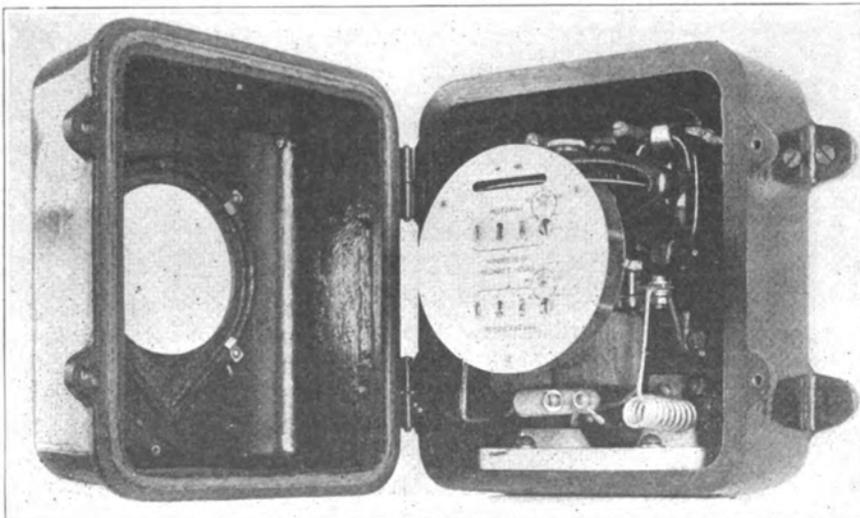


Curves Showing Accuracy of Meter Registration Under Severe Operating Conditions

than one half of one per cent in the accuracy of registration between metering and regeneration from 25 per cent to 150 per cent of rated load and over a potential variation from 2400 volts to 3450 volts.

This very desirable accuracy characteristic has been achieved through the use of the standard Sangamo D-5 mercury flotation 10-ampere meter element with special series compounding. Each meter has an external shunt of 800 amperes normal capacity, capable of high overload service. The meter element has one series compound around the shunt field. This compound-winding is reversed from normal practice and therefore acts as a bucking compound winding when the locomotive is metering and as a boosting compound winding on regenerating. This winding is a part of the current circuit itself, carrying the full-load current of the meter element which is 10 amperes, diverted by the 800-ampere open type shunt which is cut in on the negative side of the meter group.

In its mechanical design these duplex dial locomotive meters differ from the regular Economy meters as used in electric railway power-saving work only in the dials and gear trains. The dial is of the duplex type with openings for two sets of figures (see photograph shown herewith). The reading for the metering is above and for regenerating below, so that a subtraction can easily be made to get the actual net energy used for any period. The single meter element drives the two gear trains through a differential, so arranged that when the locomotive is metering, the energy drawn from the trolley is registered on the upper train and when it is regenerating the energy is recorded on the lower train. The reversal is



View Showing Dust-Proof Meter Case Opened

Economy Electric Devices Company, Chicago.

The Chicago, Milwaukee & St. Paul Railroad uses watt-hour meters on its locomotives for three main reasons:

1. The distribution of certain accounting charges is required to be done

and load conditions under which these meters must operate can be gained from the fact that the voltage varies from an average of 2600 volts on metering to an average of 3300 volts on regeneration. The success which the meter is expected to give in meeting

made without loss of motion in the gear train.

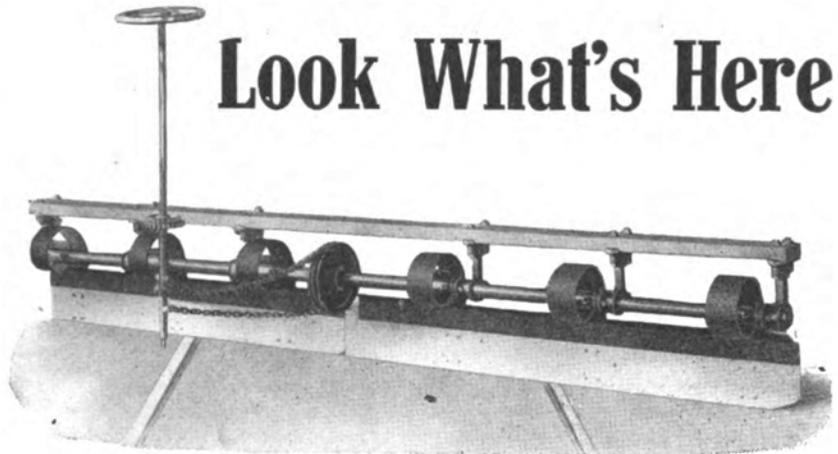
In the design of this meter standardized parts are used. The meter element is so mounted on a sub-base that it may be removed from the case with little effort and without disturbing any heavy circuits. The case which protects the element is of heavy construction which tight-fitting joints designed to exclude dust. These meters, without their shunts, may be easily checked as 10-ampere units.

**ADDITIONAL RAILWAY APPLIANCE COMPANIES AT A. E. R. A. CONVENTION**

The following list of railway appliance companies, received too late to classify, have also been allotted space in the Railway Appliance Exhibit at the coming A. E. R. A. convention in Atlantic City:

- American Steel & Wire Co., Chicago, Ill.
- Bemis Car Truck Co., Springfield, Mass.
- Cleveland Frog & Crossing Co., Cleveland, Ohio.
- Barron G. Collier, New York, N. Y.
- Gurney Ball Bearing Co., Jamestown, N. Y.
- Jennison-Wright Co., Toledo, Ohio.
- Monroe Calculating Machine Co., New York, N. Y.
- National Tube Co., Pittsburgh, Pa.
- National Railway Appliance Co., New York, N. Y.
- St. Louis Car Co., St. Louis, Mo.
- Texas Oil Co., New York, N. Y.
- C. H. Wheeler Mfg. Co., Philadelphia, Pa.
- M. Welte, New York, N. Y.

# Look What's Here



You will probably say it's just a scraper. It is but it's a different kind of scraper—A scraper that takes the place of a SWEEPER. It can do all any sweeper will do and more. Run it if you wish three times as fast as you would a sweeper and it will do the work. It will take care of wet packed snow perfectly.

This scraper is 12 feet long and projects 3 feet outside of the rails so as to take care of the "devil strip." Can be operated by air, windlass rod and chain lever.

We would be pleased to interest you in our new No. 7 Improved Scraper. It can be operated either by air or hand—A scraper designed for low cars or in fact any city car.

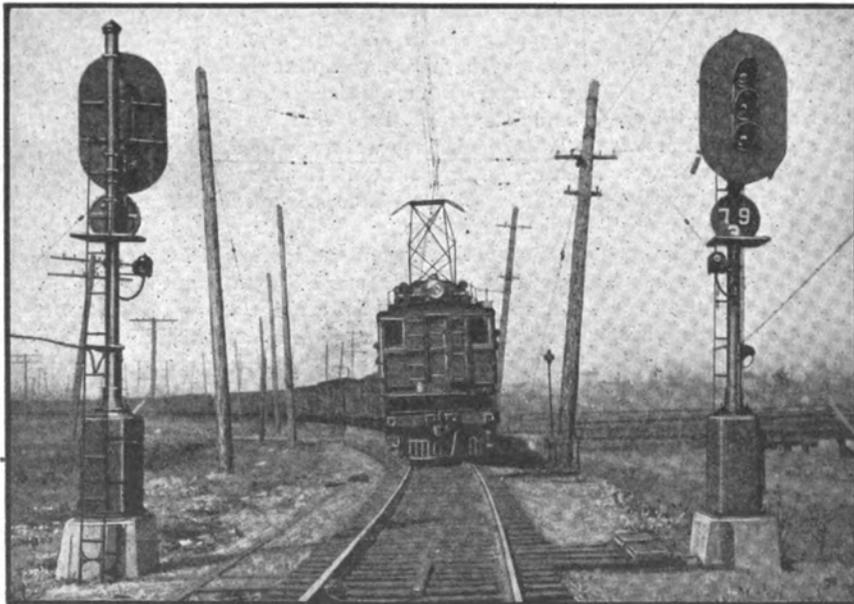
## Root Spring Scraper Co.

KALAMAZOO, MICH.

# UNION STYLE "L" COLOR LIGHT SIGNALS

Safeguard the important freight and passenger traffic on the entire 660 miles of the St. Paul's electrified divisions over the Rockies and the Cascade Range.

*"UNION" STANDARD UNIFORM A. C. EQUIPMENT THROUGHOUT*



## Union Switch & Signal Co.

SWISSVALE, PA.

