

A NEW SYNCHRONISM INDICATOR FOR ALTERNATORS.

BY FRED P. WOODBURY.

When throwing large alternate current generators in multiple, it is desirable to have them as near perfectly in phase as possible to prevent the welding of the switch contacts that is likely to occur if the machines are put together slightly out of step.

Mr. Paul M. Lincoln, resident electrician for the Niagara Falls Power Company, has devised an instrument that not only indicates exactly the synchronism of two machines to be paralleled, but also shows the relative speeds and the constantly varying phase difference between the machines during the process of bringing them into synchronism. The instrument is mounted upon a frame that resembles a fan motor, with a dial and pointer replacing the fan.

Fig. 1 shows a front view of the instrument, with the hand at the point of synchronism. Fig. 2 is a back view, with the rotor, one bearing and pointer removed and lying at the right. The lamp at the top is used for a non-inductive resistance; an inductance coil is placed in the base. A phase of each of the machines to be paralleled is connected to the four binding posts upon the base.

Both rotor and stator are built of laminated iron. The stator is bipolar and has winding with a sufficient number of turns to produce a strong magnetic field. The rotor is a drum-wound armature having upon it two coils set at right angles to each other. Three slip rings are fitted upon the shaft that connect the coils to the external circuits through suitable brushes. The shaft rests in ball bearings.

In Fig. 3 F' is the stator with the coil, F , upon it. G and H are the two rotor coils that revolve in the field of F' . The R 's are the slip rings and brushes. An end of each of the coils, G and H , is connected to the middle slip ring, and the remaining ends of the coils are connected to the other two slip rings. In series with coil, G , is an inductance, K , so proportioned as to produce a lag of the current in coil, G , approximately 90 deg. behind the current in coil, H . An ohmic resistance, L , is placed in series with coil, H , sufficiently great to make the currents in the two coils equal. The leads from K and L then unite.

To use the synchronism indicator the leads from the stator are put upon a phase of one of the machines to be paralleled, and the rotor leads connect with the corresponding phase of the other machine.

When the machines are in synchronism, coil G will stand at right angles to the field of F' , and when the machines are in opposition, coil G will still be at right angles to F' , having turned 180 deg.; thus the rotor will take up intermediate positions between these two extremes corresponding to the constantly varying phase relations of the two machines, and the pointer, moving over the dial, will indicate to the attendant the necessary procedure to bring the machines into synchronism.

Mr. Lincoln has made several instruments in the power company's workshop.

A New Electromobile Record.

The well-known French chauffeur and manufacturer, M. Krieger, on the 16th of October last broke all

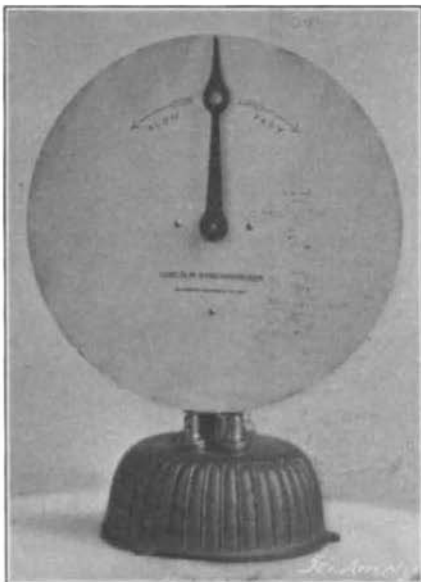


Fig. 1.—SYNCHRONISM INDICATOR.

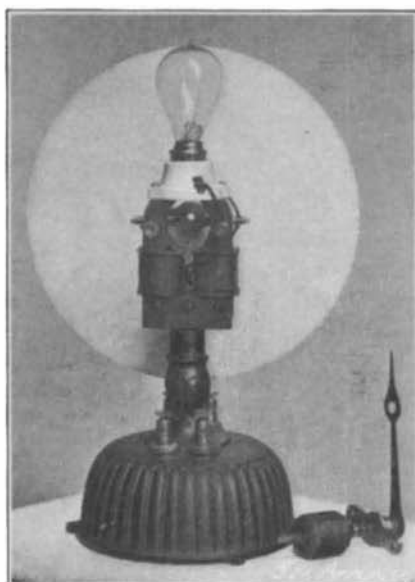


Fig. 2.—BACK OF INDICATOR.

records for long-distance runs in electric automobiles. M. Krieger, accompanied by Georges Prade, traversed the distance from Paris to Chatellerault, 307 kilometers (190.6 miles) without recharging his battery. The journey was accomplished without accident in 15¼ hours at an average speed of 20 kilometers (12.4 miles) per hour.

Ever since the electric carriage ceased

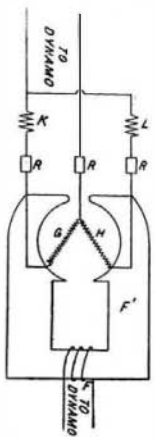


Fig. 3.

DIAGRAM OF INDICATOR.

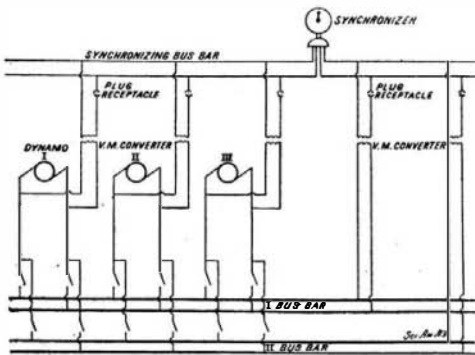


Fig. 4.

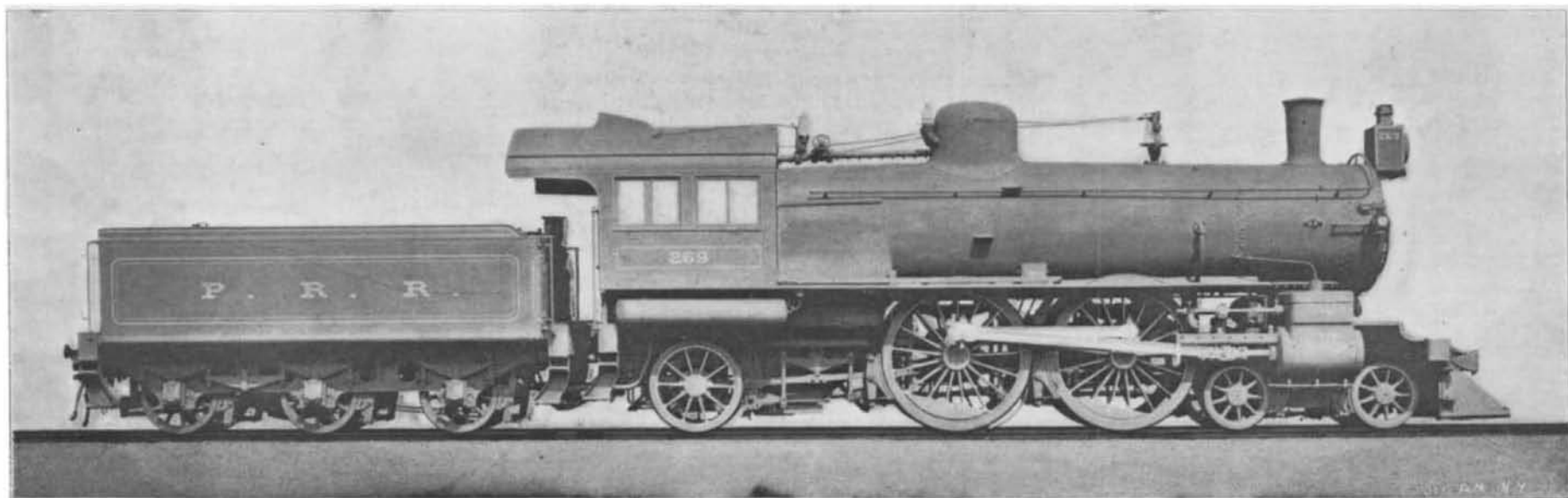
CONNECTIONS OF SYNCHRONIZER AS USED BY NIAGARA FALLS POWER CO.

to be a curiosity, manufacturers have endeavored to increase the radius of action. As early as 1885, Trouvé succeeded in driving a tricycle by means of accumulators. In 1894 the electromobiles of Jeantaud and Krieger were able to cover as much as 30 kilometers (18.6 miles) without recharging. The radius was rapidly increased. In 1898 electric cabs

tromobile of 15 horse power, driven by 60 Fulmen elements grouped in series and weighing 1,250 kilogrammes (2,750 pounds). The weight of the carriage empty with the accumulators is 2,225 kilogrammes (4,895 pounds). The available voltage is 120; the capacity of the battery is 400 ampere-hours. The weight of the carriage ready for the road with two passengers is 2,500 kilogrammes (5,500 pounds). Six speeds are available, the last of which is used only in recuperating on down grades. The fifth speed on the level enables the chauffeur to cover a kilometer (0.621 mile) in 2 minutes and 15 seconds, or 26 kilometers (16.1 miles) in an hour. At this rate 28 to 30 amperes under a pressure of 120 volts were more or less constantly used. On gentle up-grades 35 to 40 amperes were required. Near Sainte Maure, a rather hilly country, the second and third speeds were used, with the result that the consumption rose to 60 and 75 amperes. After stopping at Chatellerault, the voltage rose to 105 volts, or 1.7 volts per element. At the start it was 154 volts, or 2½ per element.

NEW ATLANTIC TYPE OF PASSENGER LOCOMOTIVE ON THE PENNSYLVANIA RAILROAD.

The Pennsylvania Railroad Company has recently brought out a new fast passenger locomotive, which is shown in the accompanying illustration. It is of the well-known Atlantic type, which is becoming very popular for express service, especially where it is desired to haul heavy trains at high speed. The advantage of the type is that by placing the two driving axles forward of the firebox and carrying a trailer beneath the latter, it is possible to use a firebox of large dimensions and secure the increased boiler capacity resulting therefrom. This engine may be compared with the new Atlantic type of express engines which is now working the fastest expresses on the New York Central & Hudson River R. R. It is not so large or powerful as the latter, especially as regards its boiler. It has a maximum heating surface of 2,640 square feet, as against a maximum of 3,500 square feet in the New York Central boiler. Like all the locomotives, and particularly those for express service, turned out by the Pennsylvania Railroad, it is a very handsome design. It will be noted that it has the six-wheel, rigid base, type of tender, which seems to be favored by this company. The cylinders are 20 inches in diameter by 26 inches stroke. The weight on the drivers is 53,800 pounds on the first pair and 55,233 on the second pair; the weight on the truck is 36,650 pounds; and the weight on the trailer is 30,917 pounds, making a total weight for the whole engine of 176,600 pounds. The total length of the engine and tender is 70 feet 8 inches, and the height of the center of the boiler above the rails is 9 feet 3 5/16 inches, while the top of the stack lacks only ½ inch of being 15 feet above the rails. The boiler has a heating surface in the firebox of 166 square feet, and in the tubes of 2,474 square feet; making a total of 2,640 square feet for the whole boiler. The grate area is 55.5 square feet and the steam pres-



Cylinders, 20 inches diameter by 26 inches stroke; heating surface, 2,640 square feet; weight on drivers, 109,033 pounds.

NEW ATLANTIC TYPE PASSENGER LOCOMOTIVE FOR THE PENNSYLVANIA RAILROAD.

Fig. 4 is a diagram of connections of the synchronizer used on the switchboard of the Niagara Falls Power Company.

The phase relation between either machine and the power busbar may be found by merely inserting the proper dynamo and busbar plugs.

At the request of some of his professional friends,

at a *concours* covered 60 kilometers (37 miles) with a single charge; and last year M. Garcin made a new record by covering the distance from Paris to Alesia, 267 kilometers (165.8 miles) with but a single charge of his batteries. It is this record which Mr. Krieger has beaten.

The vehicle which performed this feat is an elec-

sure is 205 pounds to the square inch. The tender, as noted above, differs from the standard American type, having only three rigid axles in place of the customary two four-wheeled trucks. This is a modification of the standard English tender; but it has the advantage that the springs of the two rear axles are compensated.