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THE NEW TYPE KANDO ELECTRIC LOCOMOTIVE

In the old type Kando locomotives the so-called Kando triangular jack shaft was particularly delicate. This triangular part had the function of transmitting the power from the motor to one of the driving wheels and through the side rods, to the four driving wheels. This triangular jack shaft has been the source of a considerable amount of breakdown in the past. In many cases, after not more than 5,000 kilometers, it broke or was bent to such an extent as to be completely useless. This triangular jack shaft was made of chrome-nickel of the best quality with a one-hundreth millimeter tolerance.

The frequent breakdowns prompted the specialists of the Hungarian State Railways, in cooperation with the Ganz Electric Works, to design a new type of locomotive, which was to retain the advantages of the Kando system and to eliminate its defects. This object was to be realized by a change from axle drive to direct transmission of power to the four wheels by means of separate motors and separate gear transmissions. The design, as well as the production of this new locomotive could not be completed because of the national collapse in 1944. Bombing damage to the Ganz Electrical Works has, however, been repaired in the meantime.

The technical description of the new locomotive is as follows: The locomotive has four driving and four idle axles. Each driving axle is driven by a four-pole, 1,000 horsepower-hour squirrel cage induction motor. The frequency converter has four poles and runs at 1500 revolutions per minute. The induction regulator connected with it is a 6/12 pole induction motor, with slip rings, which runs at 1,000 and 500 revolutions per minute, respectively, in either direction. Speeds between synchronous speeds can be obtained by means of the liquid rheostat which is built into the rotor of the induction regulator.

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Pole changing is effected by the improved Dahlander system which has been introduced by the Ganz Electrical Works. Pole changing in this system is effected essentially by connecting the stators of both the frequency converter and the induction regulator with the secondary winding of the phase shifter, the rotor of the frequency converter with the driving motors, and the rotor of the induction regulator with the liquid rheostat. In order to conserve space, the connections of the frequency converter are reversed; thus, the rotor is connected with the phase shifter and the stator with the driving motor. This, however, does not materially affect the operation of the locomotive.

In starting the locomotive, after the phase shifter has been set in motion, the frequency converter group, too, must be accelerated up to 1,500 revolutions per minute, which corresponds to 0 (zero) secondary cycles. Acceleration is effected in the following manner: The induction regulator is gradually braked down with the aid of the rheostat to 1,000 revolutions per minute, using the six-pole connection. It turns in the same direction as the frequency converter and acts as an asynchronous generator. The secondary cycles of the frequency converter are thereby gradually increased to 16-2/3. Subsequently, the induction regulator is switched to 12 poles and gradually braked down to 500 revolutions per minute, which corresponds to 33-1/3 secondary cycles. Then, retaining the 12-pole connection, the induction regulator is switched into reverse. Thereby the regulator and converter group is braked to a stop and is subsequently accelerated to 500 revolutions per minute in the opposite direction, while the secondary cycles are increased, first to 50 and then to 66-2/3. Continuing in reverse, the revolutions are increased to 1,000 revolutions per minute and the secondary cycles to 83-1/3 by using 6 poles of the induction regulator. In the middle of the third speed, when the frequency converter passes the neutral position and the secondary cycles are at 50, the driving motors may be connected to the phase

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shifter directly omitting the frequency converter group, and can be run in this position at a constant speed. The five economical operating points are therefore 16-2/3, 33-1/3, 50, 66-2/3, and 83-1/3 secondary cycles corresponding to 500, 1,000, 1,500, 2,000, and 2,500 revolutions per minute, respectively; the five economical speeds are 25, 50, 75, 100, and 125 kilometers per hour.

These locomotives cannot be used anywhere else in the world, because there are no railroad lines anywhere else operating on 15,000 volt, 50 cycle alternating current. When the Budapest-Hatvan line is electrified in the course of the Five-Year Plan, 20 to 25 locomotives will be built for this line. Otherwise, this type of locomotive will not be built serially at the Ganz Electrical Works.

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