Automatic Signals on the P. R. R.

A Description of A. C. Apparatus Used in Connection with Signals Installed in 1913 and 1914

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The signal and interlocking apparatus of the installations, described in the May, 1914, issue of *The Signal Engineer*, was furnished by the Union Switch & Signal Company. The signals are Union Switch & Signal Company type T2, a universal type in which each semaphore arm is operated by an independent mechanism for all aspects and positions, and is so designed that with slight changes signals may be operated by either direct or alternating current. The mechanism is very simple and compact and the electrical parts accessible, and is mounted in a waterproof iron case, secured to the semaphore bearing, which

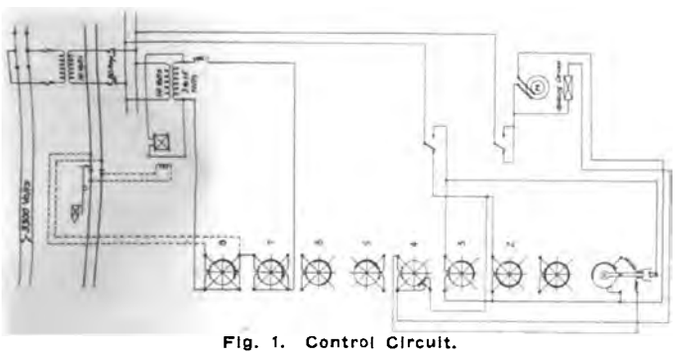

Fig. 1. Control Circuit.

also supports the lamp bracket, and is arranged for clamping to a mast in any desired position. When used as a dwarf signal, the case is equipped with springs to obtain the counterweighting effect of the high signal arm; lugs are provided on the case for bolting to a foundation. The operating mechanism consists of an electric motor driving a train of gears, the ratio of

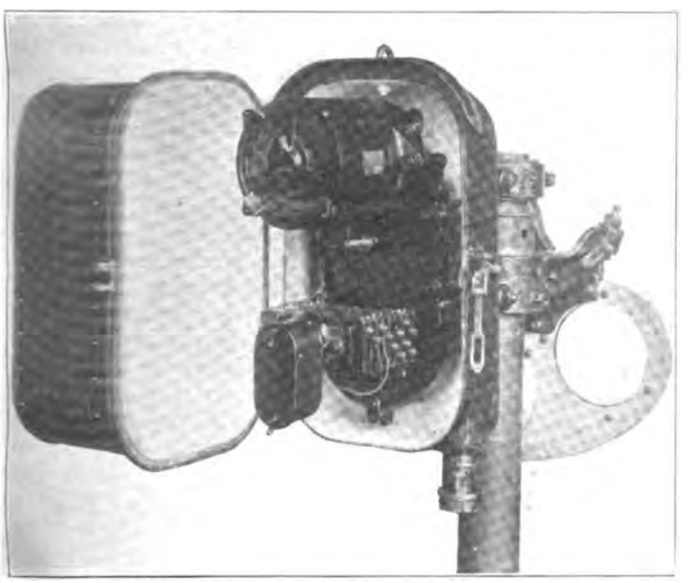

Fig. 2. A. C. Signal Mechanism.

which is 120 to 1, a circuit controller and a holding device for holding the semaphore arm in the proceed position.

The a. c. motors are of the single phase induction type, with squirrel cage rotor and laminated stator; the rotor is loosely mounted on the shaft which it engages through a ratchet when driving the arm toward the proceed position, but is free from the shaft on the backward movement of the arm.

The construction of the holding device is very similar to that of the motor except that it is not as wide and contains only eight poles. The rotor is mounted loosely on the same shaft as the motor rotor by a flexible connection which consists of an arm fixed on the shaft engaging the rotor through helical springs. There is a single winding on the holding stator which produces a flux between the adjacent pole pieces. The rotor bars tend to take up a position outside of this field, which is the middle of the stator poles, and the inductive reaction which is set up will resist any effort to drive them into the field, thus holding the mechanism in the proceed position. The flexible connection of the rotor absorbs the vibration of the arm when brought to a stop, without disturbing the magnetic relations between the rotor and stator.

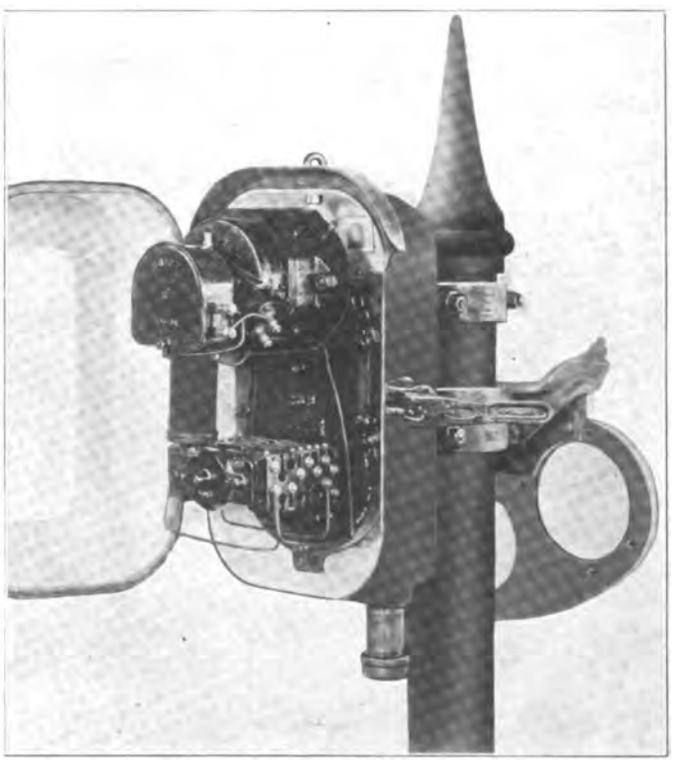

Fig. 3. Interlocking Signal Mechanism.

The circuit controller consists mainly of a revolving drum carrying contact segments moving in a space between two porcelain blocks which support the contact fingers. The drum is driven by the gears through an arc three times as great as, and in the opposite direction to, that through which the arm travels. Each controller is equipped with eight contact segments, two of which are used as a pole changer; the quick movement of the controller and the fact that the motor can pick up at any point of the stroke renders a snap pole changer unnecessary. An auxiliary circuit controller, attached to the end of the regular circuit controller shaft, is used to produce a retarding torque through the motor when the arm is returning from the 90 to the 45 deg. position. The 45 deg. control circuit is closed momentarily through this controller before the semaphore arm reaches the 45 deg. position, to assist the holding device in bringing the mechanism to a stop at 45 deg. When the

mechanism is at stop or when it is being driven to the proceed position, this circuit controller is open. Fig. 1 shows control circuits of a one-arm automatic signal and Fig. 2 shows one of the a. c. signal mechanisms.

The interlocking signals are of the same type as the automatic signals except that they are operated by direct current motors. The motor is of the four-pole type with its armature mounted on a hollow shaft; this shaft has a ratchet connection engaging only in the direction of rotation, which moves the arm toward the proceed position. Therefore, when the arm returns to the stop position, this ratchet frees the armature so that no strain is transmitted to any part of the mechanism. The holding device which is attached to the front of the motor case consists of an ironclad magnet and an arm to which is attached a contact finger and a steel roller. When the magnet is energized the arm is raised and the motor control circuit is closed through the contact finger; the steel roller is brought into the path of the blades of the stop drum on the end of the motor shaft, stopping the rotation of the drum, but allowing the motor to revolve by virtue of the ratchet. When the magnet is de-energized the arm falls by gravity. It is also assisted in this movement by the blades of the stop drum, which tend to force the roller out of engagement. Fig. 3 shows one of the interlocking signal mechanisms.

The track relays are of the Union Switch & Signal Company's radial polyphase type, consisting of an induction motor which drives a shaft through a small pinion and crank. On the shaft is mounted a toothed porcelain wheel. The contacts are carried on a porcelain ring set in the frame, one member of each set of

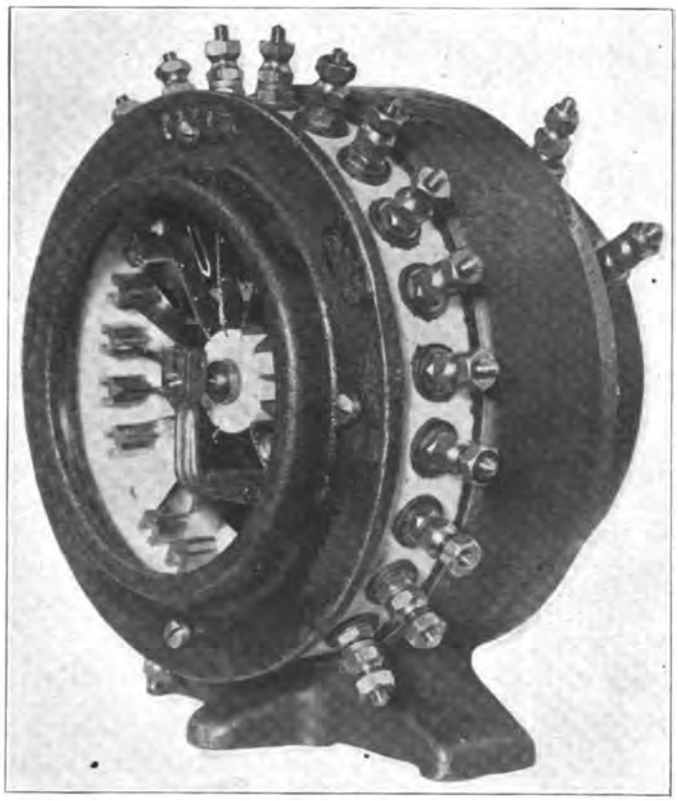

Fig. 4. Relay Complete.

contacts projecting into a notch of the porcelain wheel. When the wheel is turned by the motor, it moves the contact member to one side, thereby making or breaking the circuits. There are two sets of coils in these relays, one of which is connected to the track and the other to a 15-volt tap of the track transformer. These relays are very efficient and economical. Fig. 4 shows one of the relays and Fig. 5 shows one disassembled.

The track circuits are fed with 220-V.A. air-cooled transformers with 110-volt primary; the secondary has four taps from which 3, 5, 7, 8, 12 or 15 volts may be obtained. An impedance coil is placed in one lead of each track circuit between the transformer and rail. This coil is provided with six taps and a variable air gap by which the potential across the rails may be varied. The coil is so arranged that when the track is short-circuited the power consumed is less than with the section unoccupied.

The rails are bonded with two copper-clad bond wires placed outside the angle bars and held in place by bond wire protectors. Non-interlocked crossovers are equipped with combination plunger locks and circuit controllers operated by a hand lever

Fig. 5. Relay Disassembled.

located between the rails at the middle of the crossover. This lever must be thrown before the switch at either end can be thrown. Reversing this lever unlocks the switches and closes the contacts of the circuit controller which shunts the track circuits. This arrangement insures that the switches are in the right position and locked before the signals protecting the switches are set at proceed; it also prevents an engine or car being left standing on the crossover with the switches at both ends closed. The electric locks on the mechanical machines and the block and approach indicators in the cabins are of the Union Switch & Signal Company's standard d. c. type of apparatus. The storage batteries at the interlocking plants are types A4 and B4 Edison portable.

GOOD WORK AS AN EVERY-DAY TASK

The New Haven road is receiving unstinted praise from the newspapers for the very successful way in which it took 33,000 passengers to and from the New Haven football game in one day. President Elliott's letter reviewing the work done contains a significant paragraph wherein he says that "a well-equipped, well-organized, well-managed and well-manned railroad should be able to perform this task satisfactorily." In other words, he expected the fine results which were produced. And he had good grounds for the expectation. The New Haven road has done excellent work with the football crowds before. The special passenger movement this year was heavier than ever before, but the company during the past year has carried out a careful and thorough scheme of expansion of its facilities, and it was to be expected that what the officers set out to do, they would do. To those newspapers which have so generously praised the New Haven in connection with this special passenger movement, we offer the suggestion that commendatory mention of railway efficiency would be quite appropriate in many other cases. Beginning with the assumption that the New Haven has been very bad, it is easy to make a glowing paragraph concerning what is seen to be very good. But the striking antithesis is not essential. A 2,000-mile railroad is too big a machine to be thus dealt with. Its good and its bad cannot be tossed off in a paragraph. We make these observations in this connection because they are believed to be worth consideration in connection with other railways and by all newspapers.—An Editorial in the Railway Age Gazette.

PROTECTED RAILWAY TO THE SUEZ CANAL.—It is reported from Copenhagen that advices have been received from Berlin to the effect that the Turks, under the direction of German engineers, are constructing a military railroad from Maan to the Suez Canal.