A New Idea in Traffic Locking on the C. & O.

Unique Circuits and Apparatus Proved by Test to Eliminate Chance of Foreign Influence, Facilitates Traffic

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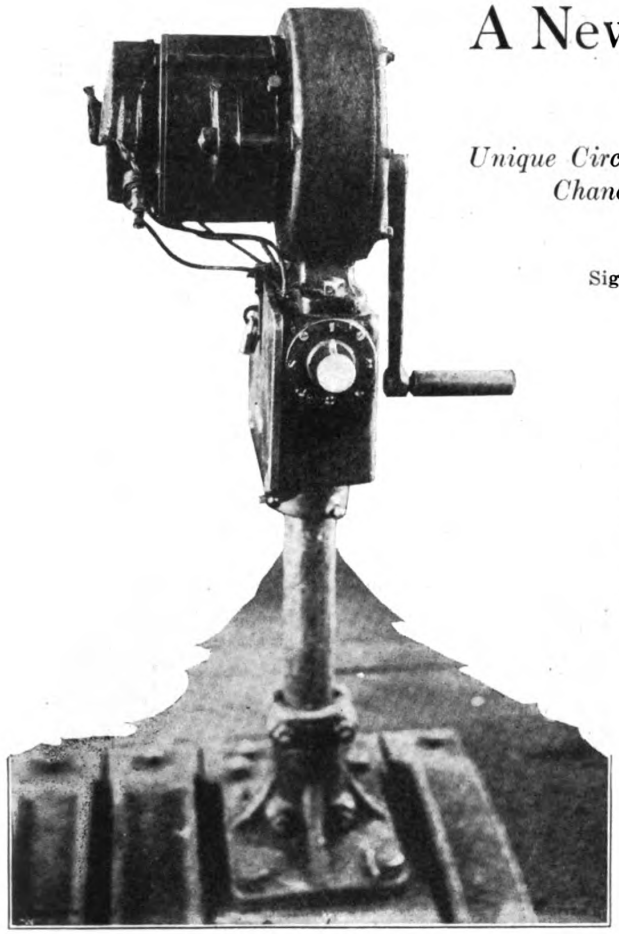


Fig. 1. The Generator and Selective Switch

THE traffic locking scheme discussed in this article was developed in order that the track capacity on certain congested portions of the Chesapeake & Ohio could be increased. It was obvious that a scheme which would make possible the safe operation of trains in either direction over a double-track line and also eliminate the necessity of issuing train orders would reduce delays to a minimum and therefore increase the track capacity. However, if a traffic locking scheme were to be used for diverting all classes of traffic on a double track and to control the traffic direction on single track, necessarily it would have to be one of absolute integrity. It would have to be the premier of the safest signal controls.

The consensus of opinion of those interested was that none of the existing schemes could guarantee safety because of their inherent faults, the first of which is the possibility of receiving energy from some foreign source. This contention is substantiated by the fact that on several occasions on various lines using some form of locking between towers, or traffic locking, false indications have been obtained, which have resulted in the loss of life and property in some cases.

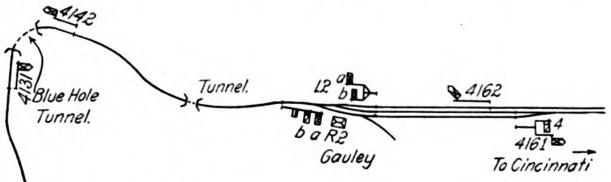
Fig. 2. Track and Signal Plan, Cotton Hill to Gauley

After much consideration and study the scheme finally decided upon was one involving the use of alternating current of 125 cycles frequency, the apparatus being immune from the effects of direct current and inoperative on alternating currents having commercial frequencies of 80 cycles or less. It is believed that, as installed, the scheme guarantees absolute integrity of operation and is as nearly foolproof as it can be designed. The apparatus consists primarily of a generator, hand driven where power is not obtainable, a selective switch (Fig. 5), a selective frequency lock, a push button and an a.c. buzzer. This apparatus, except the generator and the selective switch, is duplicated for each traffic lever.

The generator as illustrated in Fig. 1 is a style T-2 motor, converted into an 8-pole, 1920 r.p.m., 225-volt alternator. It is operated by a crank, geared to the armature shaft with a ratio of 19.2 to 1. A ratchet is provided to allow the armature to continue rotating when the crank is stopped. The exciting current is furnished by a local primary battery at a potential of 10 volts. A flow of 2 amp. is required for efficient operation. The generator is mounted upon the housing of the selective switch, which is provided with a socket for attaching the 3-in. pipe post.

The selective switch illustrated consists of a square shaft upon which the Union Switch & Signal Company standard T-2 contact segments are arranged in such a manner that the circuit selected may be closed by pushing a knurled knob. The knob is attached to the end of the shaft, which extends through the switch housing. A dial and pointer are provided to indicate the circuit selected.

The lock shown in Fig. 3 is an induction motor which rotates in a vertical plane. The armature is mounted upon a hollow shaft, to which is attached two centrifuge arms. These arms are thrown outward and upward by centrifugal force when the armature rotates at a sufficiently high rate of speed, thus raising the stem of an indication latch which extends through the shaft. The arrangement



of the locking segment or slot is such that the indication latch can be raised only when the traffic lever is at the indication position, and that when the lever is returned to the normal position the indication latch is mechanically forced to the de-energized position. In order that the motor may properly perform its function it must receive alternating current of 125 cycles frequency at 130 volts. This lock is in many respects similar to the indication motor

which was used on the early Union electric machines for indication purposes.

First Installation

Traffic locking of this type was first installed on a 4-mi. stretch of single track on the Hinton division between Cotton Hill, W. Va., and Gauley, in conjunction with A.

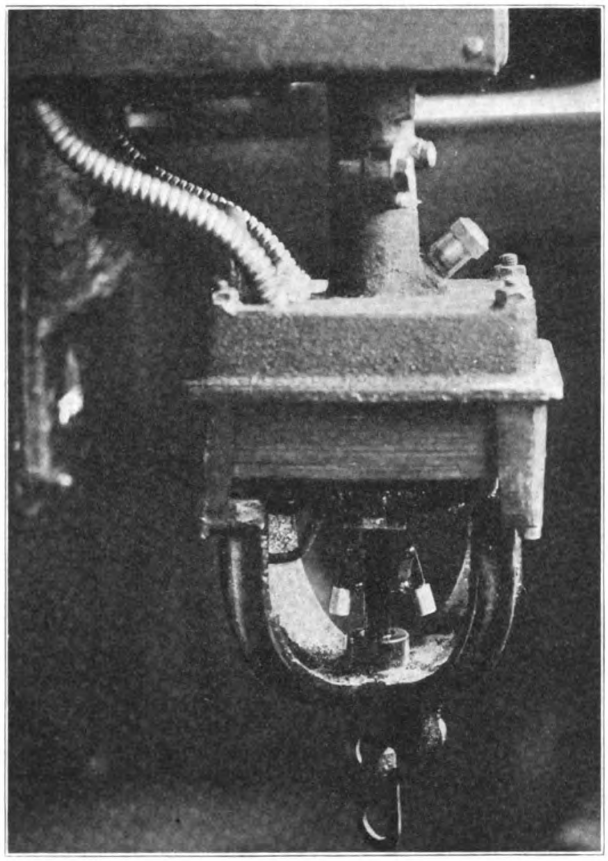


Fig. 3. Selective Frequency Traffic Lock

P. B. signaling. This single track, which runs through a very narrow gorge or canyon, connects the ends of double track at Cotton Hill and at Gauley. The river, which is on one side of the track, is very close throughout the entire length, while on the other side are high cliffs of solid rock. The course of the river is irregular, making necessary many sharp curves in the track and permitting but few tangents, the longest of which is about 1,000 ft. It was necessary to construct 3 tunnels on the course of this difficult 4-mi. length of single track.

All main line eastward and westward traffic must pass over this single track, which presented a serious operating problem worthy of careful consideration. It had been proposed at various times to build a second track in order that the "neck of the bottle" might be eliminated, but the cost of the proposed second track was considered prohibitive. Traffic was formerly controlled by means of an absolute train staff system with mechanical interlocking at Cotton Hill and at Gauley, there being no automatic signals on the single track, but with the present installation of A. P. B. signals and traffic locking, operating officers claim that the traffic conditions have been improved over 200 per cent.

The Track Layout and Circuits

The track layout of this installation is shown in Fig. 2. A diagram of circuits is shown in Fig. 4. For the sake of clearness, traffic locking circuits only are shown. The entrance or starting signals to the A. P. B. territory are interlocking home signals, L 2 at Gauley and R 5 at Cotton Hill, and these lock traffic levers 5 and 7 reverse, respectively. The home control of automatic signal 4132 is carried over the normal contact of traffic lever 7 at Cotton Hill and the home control of automatic signal 4131 is

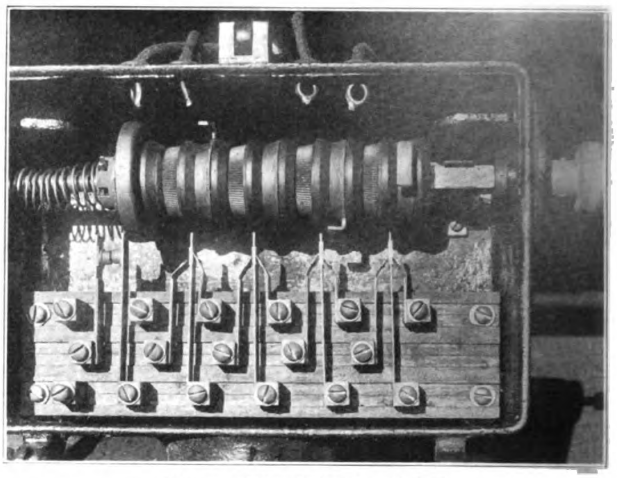


Fig. 5. The Selective Switch

carried over the normal contact of traffic lever 5 at Gauley. This checks the absolute feature of the A. P. B. circuits. The permissive feature is obtained by the use of a relay of the selector type. The operation of the traffic locking circuits is as follows:

The normal direction of traffic is eastward. Traffic lever No. 5 at Gauley is normally reversed. Let us assume that the operator at Cotton Hill desires an unlock for a westward movement—he signals Gauley, hereafter called "Y," to this effect by cranking the generator and pushing the button of selective switch 7 FZ. This allows current to flow over the normal contact of traffic lever 7 at

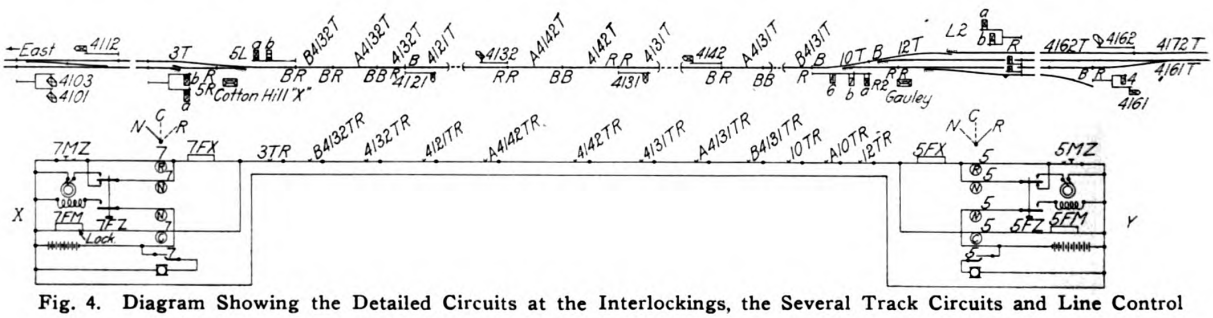


Fig. 4. Diagram Showing the Detailed Circuits at the Interlockings, the Several Track Circuits and Line Control

Cotton Hill, hereafter called "X"; through the a. c. buzzer, 7 FX; then over the line to "Y"; through 5 FX at "Y" and over the reverse contact of traffic lever 5 at "Y" and the push button 5 MZ to common.

In doing this, both buzzers become audible, which informs "Y" that "X" desires an unlock. "Y" opens the circuit by operating push button 5 MZ, interrupting the circuit and stopping the buzzer, which is recognized as a signal by "X" that "Y" will give the unlock desired. "Y" puts the traffic lever 5 normal, thereby releasing his

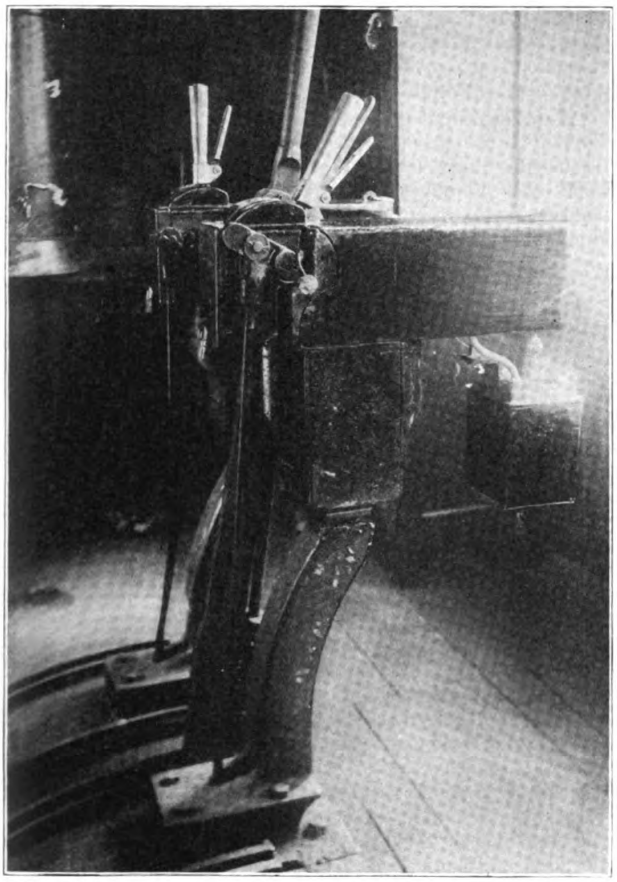


Fig. 6. Lock Applied to a Johnson Interlocking Machine

unlock and mechanically forcing the indication latch down. He then pushes the button of the selective switch 5 FZ and cranks the generator; current flows from the generator over the selective switch 5 FZ and over the normal contact of traffic lever 5; through the buzzer 5 FZ to line. The operator at "X" moves traffic lever 7 to the center or indication position and current then flows over the indication contact of traffic lever 7 to lock 7 FM, raising the indication latch which mechanically closes a bell contact when the indication latch is in the position to allow the lever to move from the indication to the full reverse position. When this movement is made the indication contact is opened and a reverse contact is closed, causing current to flow through push button 7 MZ to common. The operator then pushes button 7 MZ, thereby signaling to "Y" that the desired unlock has been obtained.

One of the novel features of the scheme is that communication and unlocking is accomplished over the same wire. It was also found that, due to the change in tone of the buzzer at the generating end of the circuit when the lever was being unlocked, it was unnecessary for the operator to push the button signaling that the unlock had been obtained. The tone change is caused by the increased amount of current flowing through the buzzer when the traffic lever is moved to the full reverse position opening the indication contact and closing the reverse contact, causing current to flow over 7 MZ push button to common wire.

It will be noted that the exciting current of the generator field is carried over a normal contact of the traffic levers. It is, therefore, impossible to generate current unless the traffic lever is normal, which insures that the unlocking energy must in all cases come from the generator at the other tower. As a further check, it is mechanically impossible to raise the indication latch except when the lever is at the center or indication position.

Figure 6 illustrates the method of applying the lock to a Johnson interlocking machine, while Fig. 7 shows the character of the country where the traffic locking is in operation.

Second Installation

Traffic locking has also been installed between Hurricane, W. Va., Milton and Barboursville, a distance of 20 mi., on double track, for operation of trains in either direction on signal indication. Electric and electro-mechanical interlockings with signals arranged for reverse traffic operation are located at the above points. Traffic is diverted with a minimum reduction of speed by the use of No. 16 crossovers. The circuits and the operation of the apparatus are the same as on the first installation. This installation has not been in service long enough to determine how great a saving has been effected. How-

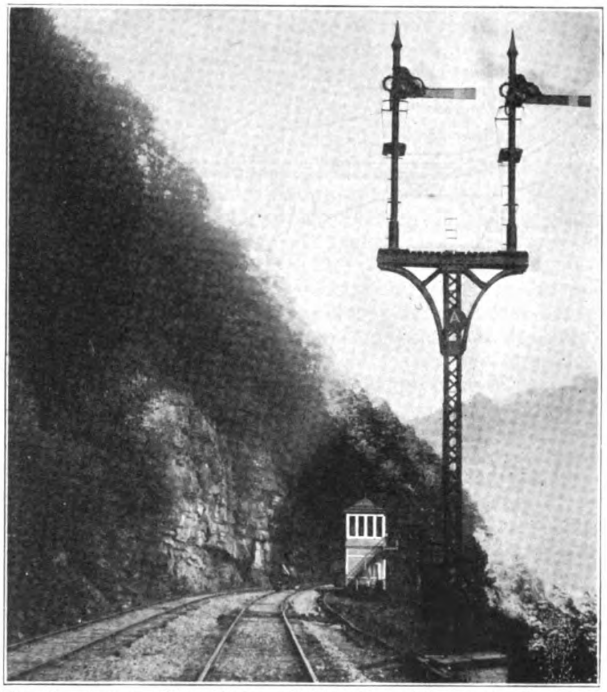


Fig. 7. Approaching Cotton Hill Interlocking from the East

ever, it is proposed to make a further extension of the installation for about 20 mi.

The foregoing method of locking between towers was developed by members of the signal department of the Chesapeake & Ohio. The apparatus was developed and manufactured by the Union Switch & Signal Co. and is covered by patent rights.