# EDITORIAL COMMENT

## Protection at Hand-Operated Switches in C.T.C. Territory

WHEN planning a centralized traffic control installation, including signals for directing train movements without written train orders, and power machines at passing track switches, a question sometimes arises as to what special protection, if any, is needed at hand-operated, main-track switches leading to house tracks or industrial spurs which are long enough to permit a local train to clear the main track.

A few roads have provided electric locks, and in some instances also signals, at these hand-operated switches. The argument advanced for such practice is that, in a C. T. C. territory where train movements are directed by signals without written train orders, there should be no possibility of a train entering a main track without proper authority. Furthermore, the power-operated switches are under the control of the man in charge of the C. T. C. machine, and, therefore, all other switches entering the main line should likewise be under his control. An additional point advanced is that the average switch stand is subject to failures, so that it is a good idea to have a lock to improve the protection.

On the other hand, the majority of the railroads which have C. T. C. in service do not use electric locks on the hand-operated switches, and they advance extended arguments to prove the safety, as well as the practicability, of their practice. A summary of these arguments is given in the following paragraphs.

In approaching this subject, an analysis might well be made of the results accomplished by locks. In the first place, standard practice includes the use of a padlock as a means of preventing unauthorized persons from operating each hand-operated switch, and the same protection is used for the same purpose to lock the dual-selector and hand-operated levers on power switch machines. If an electric lock is needed on a hand-operated switch for the purpose of preventing unauthorized persons from throwing the switch as trains are approaching or passing, then, on the same basis of reasoning, an electric lock should be applied to the levers of a dual-control arrangement on a power switch. Electric locks, apparently, are not applied primarily as a means of preventing unauthorized operation of the switch by mischievous or malicious persons.

This discussion disposes of the argument in so far as operation of the switch when trains are approaching or passing on the main track is concerned. If a device more reliable than an ordinary switch stand is needed to hold the points in place during the passage of a train, thought should be given to a hand-operated switch-and-lock movement, incorporating lock rods, because such a movement is recognized as being superior to an electric lock in meeting the needs outlined above.

Approaching the problem from another angle, it is evident that an electric lock on a switch does not increase safety in movements involving a local train that has been stopped on the main line, and then has cut off part of its train to make switching movements in and out of a house track. On the other hand, if the train is moved onto the house track, thus clearing the main line for a considerable period of time, a somewhat different problem arises, i. e., how can authority be conveyed to the train to enter the main track again? This is accomplished satisfactorily on numerous C. T. C. territories by the installation of a telephone at each switch, the phones being connected to a line extending to the control office.

One theory advanced in the consideration of this problem is that in a C. T. C. territory all train movements are directed by signal indication, and, therefore, movements from a house track to the main line must be protected by electric locks and directed by signals. A little thought, however, reveals that this is not necessarily true. After a train in C. T. C. territory has accepted a signal authorizing a movement through a block, the operation of the train is then governed by automatic block signals just the same as in territory where automatic block signaling is used throughout.

### Automatic Blocks Provide Safety

An important item for consideration is that the signals authorizing trains to use blocks between stations are controlled by a semi-automatic arrangement. In addition to the control set up manually by the C. T. C. system, the automatic control features include track-circuit, switch-position, and fouling protection, the same as in a straight automatic block system. Therefore, so far as the movement of a train from a spur track to the main line is concerned, safety of operation requires nothing more in C. T. C. territory than is provided in automatic block signal territory. In other words, so far as safety is concerned, the crew of the train on the spur track needs to know whether a train is approaching in a section of track that extends one track circuit beyond the second signal governing in the direction toward the switch, in each direction from the switch. A switch indicator with standard control would suffice. If experience indicates that switch indicators are not properly observed and that the indication must be seen by the enginemen, it may then be desirable to provide a dwarf signal on the spur track. In such an arrangement, the equivalent of a switch indicator circuit can be used to control an indicator and the signal, the indicator, either at the switch or as an extra "S" unit on the signal, being used to inform the train crew when it is safe to operate the switch, and derail if used. When the switch is reversed, the signal clears to authorize the engineman to proceed. As a means of saving power that would be consumed by a constant-burning lamp in an "S" indicator or signal, approach lighting involving a short track circuit could be used, or a push button with a stick relay feature might be used. This arrangement provides the requisite degree of safety.

Viewing the situation from the standpoint of preventing delays to through trains that may be approaching, it is desirable that the crew of the local train on the spur track be given information as to whether through trains are approaching. As mentioned previously in discussing a different phase of the problem, telephones at the switches, connected to a line extending to the C. T. C. office, can be used effectively for this purpose.

It is granted that the discussion above is devoted for the most part to a presentation of arguments advanced by those not in favor of electric locks. Attention is called to the fact that the Open Forum column, as well as the What's the Answer department of *Railway Signaling,* are available to those who desire to comment on either side of this or other important questions.

# OPEN FORUM

*This column is published to encourage interchange of ideas on railway signaling subjects. Letters published will be signed with the author's name, unless the author objects. However, in order to encourage open discussion of controversial matters, letters may be signed with pen names at the request of the author. In such instances, the correspondent must supply the editor with his name and address as evidence of good faith. This information will not be disclosed, even on inquiry unless the correspondent consents.*

## 110-Volt Machines For Outlying Switches

New Haven, Conn.

To the Editor:

Referring to the articles concerning the use of low-voltage switch machines, as published on page 45 of the January issue of *Railway Signaling,* it occurs to me that the readers may be interested in the practice used on the New Haven.

About eight years ago, an investigation showed that, at certain interlockings on the New Haven, the switches within 3,000 ft. of the signal station were operated on 110 volts d-c., while certain switches located a considerable distance away were operated by low-voltage machines. The 110-volt machines would operate and indicate in three to four seconds. The low-voltage machines required a much longer period to operate. The difference in time was objectionable from an operating standpoint. Furthermore, the low-voltage machines moved the points too slowly and were more likely to fail to complete the stroke, lock up and indicate, in instances when a little snow, ice or a piece of coal partially obstructed the operation. In other words, the operation of the switches operated by low-voltage machines lacked pep. A study of the problem led to the decision that 110-volt switch machines should be used at all locations.

### Dry Cells To Be Used

This decision led to an investigation of the practicability of providing 110-volt power at the outlying locations, where a-c. power was not available and where primary battery had previously been used for operation of the low-voltage machines. Consideration was then given to the use of dry-cell battery to supply the 110-volt power.

A 110-volt switch machine requires not more than 4 amp. for 4 sec., equal to 16 ampere-seconds, to operate 30-ft. switch points for 131-lb. rail. At this rate, each ampere-hour of the battery capacity is good for 225 switch operations. The effective ampere-hour capacity of the average No. 6 dry cell, with a voltage at the cut-off point of 1 volt per cell, is approximately 30 a.h., which would provide energy for 6,750 switch operations. With an average of 10 switch operations daily, the bank of battery would last 670 days, which is more than the shelf life.

The experience of the New Haven in operating switches from dry cells has been such as to place the proposed scheme beyond the experimental stage. At one time, a Union Type-B interlocking plant, due to loss of power units, was operated for about 10 days by a series-multiple bank of dry cells. The most extensive use of dry cells on the New Haven was for the operation of switches during the transition period of rebuilding a gravity classification yard, where 220-volt d-c. switch operation was inaugurated. The 220-volt d-c. electric switch movements were installed in place of the old low-voltage equipment and were controlled by relays, which in turn responded to push buttons at the tower. Power for the new d-c. electric switch movements was furnished temporarily by banks of series-multiple No. 6 dry cells. The battery banks consisted of three sets of multiple of 200 cells each in series, and operated a cluster of switch movements within a radius of about 300 ft. The banks lasted from 8 to 12 weeks during constant use for classifying trains, and then had to be renewed where the permanent d-c. supply circuit lines had not been completed.

At each outlying power-operated switch, where no 110-volt power is available, the New Haven plans to use a standard 110-volt d-c. switch machine the same as those at regular interlockings, and to operate each machine at such a location by a battery of 100 No. 6 dry cells. The battery is to be properly housed to protect it from the effects of sub-zero temperatures, the same as with storage cells. The high voltage when the battery is new will do no harm. When the voltage on the bus drops to 100 volts, i.e., 1 volt per cell, the battery will be replaced.

The estimated cost of power for one year is $25, including labor of replacing the battery. If the battery does not render a life of more than one year, then the cost will probably increase to perhaps $30 annually.

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