are involved, the stick relay scheme requires more points than are available on four-point track relays, making it necessary to use two more line relays as track repeaters.

While not much work is generally required in the maintenance of relays, a comparison of these schemes indicates that considerable more work is necessary in the renewal and inspection of the four neutral relays. The interlocking scheme requires the purchase of one interlocking relay per track, whereas the stick relay scheme requires four neutral relays per track. The former scheme, therefore, necessitates less expenditure for relays, relay housing and other material, as well as labor of installing.

Considering the desirable and undesirable features of each scheme, it is my opinion that the interlocking relay scheme is as reliable as the stick relay scheme; it is more economical, and can be arranged more readily to accommodate other circuits.

Prefers to Use a Stick Relay Circuit

By G. A. Rodger
Assistant Signal Engineer, Wabash, Decatur, Ill.

THERE is only one advantage of the interlocking relay control scheme, namely the lower original cost of installation. However, the disadvantages are that the interlocking feature may fail, causing a signal failure. In repairing relays in the shop, the large interlocking relay is the most expensive to repair, requiring more time for adjustment, and considerably more breakage of the porcelain tops is experienced than in the case of the standard size relay.

To reduce the number of failures caused by the interlocking feature of this relay, and to reduce the cost of relay repairs, the stick relay circuit should be used. Even though the first cost is slightly more for the stick relay circuit, the maintenance and upkeep is less and the reliability of its functioning is greater.

Detector Locking Should Not Have an Emergency Release

"When detector locking prevents operation of an interlocked power switch, owing to some circuit interruption or track circuit trouble, is it safe to permit of using any kind of an emergency release to nullify the detector locking? What steps should be taken to restore the leverman's control of the switch, at the same time fully safeguarding train movements?"

Any Circuit Trouble Should Be Corrected by Maintainer Immediately

By W. S. Sibila
Special Staff Engineer, New York Central, Cleveland, Ohio

IN my opinion the use of an emergency release is unnecessary and should not be provided except perhaps at an isolated location where train movements are infrequent and considerable delay would occur before a signal maintainer could reach the location. At a busy terminal interlocking, a competent signal maintainer is constantly on duty and in the case of circuit interruption or track circuit trouble, he should make such temporary repairs as are necessary to correct the trouble before the leverman's control is restored, and during the time required by the signal maintainer to overcome the trouble, the switch should be operated by hand.

By rigid inspection and proper maintenance, circuit interruptions and track circuit trouble can be reduced to a minimum and it would seem that to fully safeguard train movements, the circuit trouble should be taken care of before the leverman's control of the switch is restored.

Strict Discipline Must Be Maintained to Insure the Integrity of Detector Locking Circuits

By E. T. Ambach
Assistant Signal Engineer, Baltimore & Ohio, Cincinnati, Ohio

NO release or device should be used to nullify the detector locking circuit. In answer to the second question I would recommend calling the maintainer at once and moving trains over the plant under a slow-speed or a hand signal, giving the engineman a form or order to advise him of the unsafe condition, in the same manner that a slow order is issued in case of a defective track or bridge.

Detector bars were introduced for the purpose of preventing a switch being thrown while the wheels or any part of a train were passing over it. The introduction of the larger sections and heavier rails with wider heads, together with a tolerance of one inch in wheel gage, one-inch sharp flange and one-inch chipped wheel for two-thirds of wheel perimeter, according to M.C.B. rules, makes the mechanical detector bar obsolete and unsafe.

The detector or switch locking circuit supersedes or entirely replaces the detector bar. If a maintainer had taken a detector bar out of service, in days past, he would have been severely reprimanded or dismissed from the service.

In view of the greater dependence being placed on the detector circuit, it seems that it should in turn call for like discipline in case of a failure to maintain the apparatus properly.

Possibility of Engineman Disregarding Stop Signals at Terminal Plants Makes It Hazardous to Use a Release

By D. W. Fuller
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IF all signal levers governing movements over interlocked switches are provided with some form of time locking which will assure that the signal must be in the stop position for a pre-determined time before the lock on a switch lever can be released, it would appear that it would be a safe arrangement if circuits are designed properly to provide releases for interlocked switches in case of a failure to detector circuits.

Where interlocked switches can be released by the leverman, we are not assured that the arrangement is safe if operating rules are not adhered to, as there is a possibility of an engineman overrunning a stop signal in which event the switch can be thrown under a train. The safest procedure would be for the leverman to know that the train, desiring to use the route on which it is necessary to release the switch, is standing behind the signal, and that it will not proceed until a signal indication is given or is flagged over the route in accordance with operating rules.

On terminal plants, usually there are switches located some distance from the tower and the view is obstructed so that the leverman is unable to see that the train for which he is releasing the switch is at a standstill behind the signal governing movement over the route. If he was to go on the ground to determine the location of the train, the result no doubt would be a

delay to traffic. It would appear, therefore, that the safest arrangement would be to provide adequate telephone communication with the tower or some form of indication to be operated from a push button by trainmen after their train has been brought to a standstill behind the signal.

Experience shows that the possibility of enginemen over-running signals at terminals is much greater than at isolated plants and it would appear that in order to prevent accidents it is very important to give the matter of enginemen over-running signals consideration, for the reason that even though the signal apparatus might have functioned correctly, an accident might occur. Therefore, in order to prevent this possibility, consideration should be given to what would be the result if an engineman overlooked a stop signal while releasing of the detector locking is carried out.

Elimination of Lock Rods

"In your opinion is it practicable or advisable to use no lock rods on power-operated switches in terminals where low train speeds prevail?"

Necessity for Lock Rods Has Disappeared Because with Heavier Rail, Rolling of the Switch Point Is Not Likely to Occur

By C. D. Cronk

Assistant Signal Engineer, Cleveland Union Terminal, Cleveland, Ohio

IN reviewing the signaling to be decided upon for the new Cleveland Union Terminal, the matter of the elimination of the lock rod was discussed and it was decided that a study should be made of switch mechanisms, which brought out that switch mechanisms, meeting the requirements of A. R. A. Sig. Sec. Spec. No. 10,120, "Universal Electric Motor Switch Operating and Locking Mechanism" as developed by the General Railway Signal Company and the Union Switch & Signal Company, do not require the use of the lock rod for holding the switch points in position. The Model-5 and 5A switch machines of the General Railway Signal Company, provide in the slide bar mechanism for the operation of the pole changer, and lock rod locking if used, a dog which blocks in position, the cam which operates the throw bar of the switch, likewise the Style-M switch machine manufactured by the Union Switch & Signal Company provides in the gear train, when the switch machine has completed its stroke either in normal or reverse position, that the gears which directly operate the throw bar are thrown off center, which in effect provides a means of maintaining the position of the switch machine when external force is applied to the points. Therefore, the necessity for lock rods disappears, for the reason that with the larger rail, the rolling of the switch point is less liable to occur. Also when front rods with a cross section of 1 in. x 2½ in. of a design as shown on A. R. A. Signal Section Plan 1534 is used with any size rail. Therefore, the analysis of the above determines that with the use of SS control, which when operated through the medium of a switch machine which requires that the switch be in proper position corresponding to that of the lever and locked in that position through the agency of the locking of the throw rod, signals governing movements over such switches cannot be cleared unless the agencies of the SS control have been completed.

A further study of the signaling to be decided upon, determined that indication parts could be eliminated and in this connection there are a number of reasons why indication parts are not required. Basicly and foremost we do not hesitate to apply electric interlocking principals to a mechanical interlocking machine. This was first inaugurated by the introduction of the power operated home and distant signal. It is true at the outset, we provided electric locks as indication locks, however, that was before the extensive use of route and detector locking. With the advent of route and detector locking and approach locking, it very soon became apparent that the electric locks used as an indication lock on the lever controlling a power operated signal, performed no function except to retain and not permit the release of mechanical locking until the signal controlled by such lever had assumed its most restrictive indication, however, it was apparent that this function could readily be transferred to the electric lock on the facing point lock lever, and with a considerable saving of expense in connection with electric locks which were used only for the purpose of checking the position of the power-operated signal.

Therefore, in analyzing the necessities for indication locking, it became apparent that with the proper design of control circuit for the home and dwarf signal it was unnecessary to maintain a switch lever in its indicating position until such indication had been received as in the analysis of this, the only functon that the indication lock or indication magnet performed was or is to derange the mechanical locking between levers to such an extent as to make it impossible to reverse a signal lever controlling a series of such routes until indication has been received. Therefore, with this as a basis it was decided that indication parts were unnecessary in so far as the performance of the plant was concerned, provided all of the electrical features which are now embodied in the present control of indication parts were maintained so that with the completion of the stroke of the switch machine, the same medium which now energizes the indication parts of the power interlocking machines now on the market, are maintained, and the control for signals governing movements over such routes is provided for by the electrical device that formerly released the mechanical locking in connection with the indication magnet.

Briefly, we have retained all of the electrical characteristics in connection with indication circuits, and have eliminated all of the mechanical characteristics now present in machines of each signal company manufacture, and have reduced the interlocking machine to one of primary mechanical function, that is, a means of controlling switches and signals by levers provided with mechanical locking to require the predetermined sequence of operation without the undesirable features which have ever manifested themselves in connection with all indication parts as originally designed.

In connection with the above features we are providing an electric lock on each switch lever so controlled that with the signal lever reversed and the signal clear or the track circuit occupied, the electric lock is de-energized.

In the study of the signaling for the Cleveland Union Terminal, it was decided that an additional indication should be provided. This we called the "fourth indication" which provides a red over a