without indicators and with or without electric locks. Such a device has a distinct advantage over a knife switch for the control of outlying switch movements because an operator will hesitate and think before throwing over one of the levers, which might not be the case were a knife switch used. In other words, the interlocked circuit controller is a distinct piece of apparatus and is associated in the operator's mind only with the idea of the switch and signal control.

Relays and Battery

Standard neutral and polarized relays can be applied to any of the ordinary control circuits used for outlying switches without any changes whatever. It is, of course, desirable to secure relays in which the contact resistance remains fairly uniform through long service, as the current for operating low voltage switch movements is greater for a longer period of time than in any other class of signal service. The relays are ordinarily housed in adjacent signal cases or they may be placed in a separate relay box mounted on the post which also supports the hand crank controller box.

The battery for outlying switch machines should provide 20 volts at the switch movement throughout its operation for the most satisfactory service. Liberal allowance has been made for the satisfactory performance of the low voltage mechanism at potentials considerably less than that stated. It has been explained before why 20 volts was adopted as a normal operating potential, but this does not prevent satisfactory operation of most switches at voltages considerably less than that stated. The 20 volt battery can be divided in two parts so as to provide 10 volts from either half for the operation of the signals and relays. In order that excessive line drop may be avoided it is best for the battery to be located as near the switch movement as possible. Provision should be made for protecting primary battery against cold, as any considerable increase in internal resistance will result in a reduction of voltage because of the current taken and the time required in the operation of the switch movement. Recent developments in battery construction have resulted in a broadening of its practical temperature limitations. The problem of protecting primary battery from the cold is not, therefore, of as serious moment as formerly.

A better measure of the actual load handler by a switch movement can be secured by following the thrust-distance curve instead of trying to arrive at an average thrust. It is easy to measure the thrust on typical switches and arrive at a definite curve representing a fair requirement. I understand that Committee III of the Signal division is now developing such a curve. A switch movement might meet a very rigid average thrust requirement and yet be an absolute failure in handling the real switch load, which may vary from a negative 650 pounds to a positive 850 pounds. The committee should be supported in its endeavor to arrive at a more logical way of specifying the load. The switch-thrust curve will be analogous to the R. S. A. semaphore-torque curve.

The switch-thrust curve is not an easy one to reproduce for shop testing. A better way will be for the railroads to specify that movements be capable of handling a load according to the curve accepted and then if any doubt exists as to the ability of a particular movement to meet the requirement, set up a switch and test out the movement in question. Subsequent tests of movements of the same manufacture and type can be avoided by using the motor current as a measure of the thrust exerted. Each type of movement should be calibrated so the motor current may be used as an indication of the thrust at various points of the stroke.

Summary of Advantages

The advantages of the power operation of remotely located switches are:

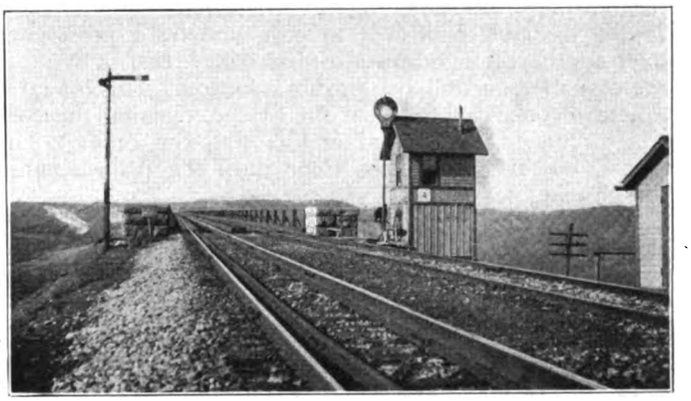
1. Increase in safety to traffic due to better control of train and switch movements at outlying locations.
2. Decrease in operating expense due to elimination of train stops at remotely located switches with resultant saving in fuel, wear and tear of brake and other equipment, and time of trainmen. The number of train orders may be reduced and trains kept under the direction of the dispatcher without stopping for orders. A greater average mileage per hour may be secured because trains can advance farther before taking siding to be met or passed.

A SPECIAL CIRCUIT SAVES MONEY

By R. M. Phinney
Assistant Signal Engineer, Chicago & Northwestern

A SAVING of at least $4300 per year has been brought about as a result of removing a small interlocking plant at Boone bridge on the Chicago & Northwestern and the substitution of automatic features without eliminating any of the safety factors or changing the operating conditions. This work was done at an estimated cost of $900. The bridge is located west of Boone, Iowa, where the C. & N. W. crosses the Des Moines river and its valley. It is ½ mile long and at its highest point is about 180 ft. above the water.

Even though this bridge is double tracked, only one

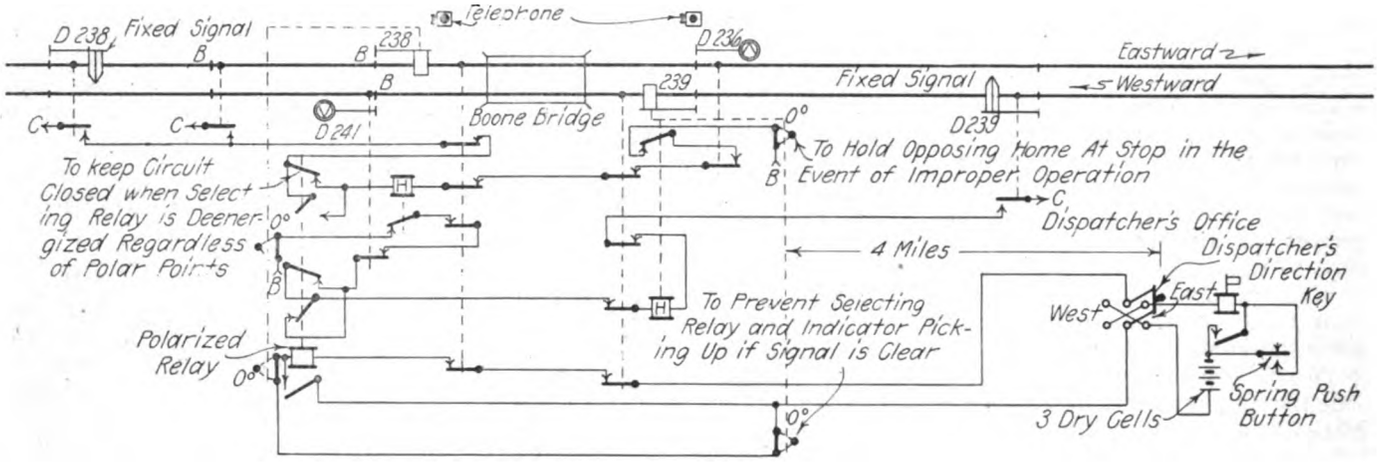


East End of Boone Bridge, Showing Old Mechanical Signal, Later Changed to Power-Operated Signal

train is allowed on it at one time, simply as a safety measure. Since its installation, this arrangement of only one train at a time has been assured by stop signals located at each end. These signals were originally controlled by dwarf interlocking machines located in cabins, with suitable check locking between them. When automatic signals were installed about 10 years ago the machine at the west end was removed and the signals at that end were then controlled electrically from the interlocking at the east end. Bridge watchmen were still retained at the west end. With the advent of the eight-hour day this arrangement required six men, three operators and three watchmen.

Recently the arrangement was changed in order to reduce operating expenses. The dwarf interlocking machine was removed and the home signals were made automatic, standing normally at danger, clearing upon the approach of a train and the distant signals were made fixed. The clearing circuit operates as a train passes the distant signals, "first come, first served." Only one signal can be cleared at a time. This is assured by controlling each

signal through a back point of the opposing control relay. The circuits also break through the opposing signals at stop to give greater safety in case of improper operation. Both signals are controlled through the track circuits on both tracks across the bridge. With this arrangement alone a number of trains in one direction might hold up an important train in the other direction, or an important train might be held up by an unimportant one. To obviate this difficulty a control circuit was run to the despatcher's office at Boone, four miles away. This circuit is designed to control direction when desired, but normally the trains operate the signals automatically. If the despatcher desires to give one train preference over another he operates a direction key, east or west as the case may be, and also pushes a button. This operates a neutral polarized relay at the bridge, opening the control circuit of one signal and closing the other. The signal, however, does not clear until the train reaches the clearing section.



Signals 238 and 239 Clear Automatically, Only One at a Time, Upon the Approach of a Train. The Dispatcher May Control the Approach by Means of the Direction Key

An indicator is provided on the despatcher's desk in series with the polarized relay which indicates when selection has been completed. This indicator is provided with a front contact in multiple with the push button so that when it is energized it remains so through its own contact. The indicator and selecting polarized relay are de-energized automatically when the engine passes the signals onto the bridge, or the despatcher may de-energize these relays by opening the direction key in case he desires to cancel the selection.

A View of Boone Bridge from the East Abutment

By referring to the circuits it will be seen that it is impossible to effect selection while a train is on the bridge. Also, after either signal has been cleared by a train, the selection circuit cannot be operated as its circuit depends upon both signals being at "stop" at the time when selection is made. Therefore, selection cannot be made by despatcher after a train has done so; the despatcher is informed of such a situation when the indicator will not pick up.

If a following move is desired in one direction ahead of a train in the opposing direction, the despatcher must, after the indicator drops for the first train, hold the push button down until the indicator picks up, when selection is effected.

There is a minimum time limit of two minutes for a train to cross the bridge. The despatcher can check this time limit for a train by pressing the button as would be done for a following train and timing the interval between the dropping of the indicator, caused by the engine passing the signal, and the picking up of the indicator when the rear of train passes out of section. Of course allowance must be made for the length of the train.

The back contact on the neutral part of the polarized relay is provided so that when the relay is de-energized there will be no interference with the circuits by the polarized points, regardless of the position they were left in at the last operation.

The direction key and push button are standard telephone apparatus mounted on the despatcher's table. A dry battery is used since the selecting circuit is required infrequently and also because there was no convenient place to locate a soda battery. Telephone communication is provided in the cabins at each end of the bridge for trainmen in order to get permission from the despatcher to pass the signal at stop in case of necessity.

These changes have made it possible to eliminate the three operators at the interlocking, thus saving an average of $360 per month. It was necessary, however, to retain the three watchmen to patrol the bridge.

The Arkansas Supreme Court, while recognizing that some courts hold that it is the duty of a traveler to stop and look and listen for the approach of a train, says: "We have not laid down the rule so strictly, but have uniformly held that a person who would pass over a railroad track at a crossing or elsewhere must do all that a man of ordinary care would do under similar circumstances to avoid any probable or possible danger from a passing train, and, if need be, stop as well as look and listen. Whether such care requires stopping as well as looking and listening depends upon whether, without it, the danger to be apprehended could be so well ascertained and avoided.—St. L.-S. F. vs. Stewart (Ark.), 207 S. W. 440.