sulting from this source, can easily be determined. The vital question is, how many train hours can be saved? That is, how much delay time can be avoided?

Delay time avoidable with centralized traffic control may occur in three ways: Waiting time in the yard for orders before starting; slow running due to entering and leaving sidings or because of a slower train ahead; and time spent on the passing tracks. A reasonably accurate estimate of the delay time that can be eliminated by C.T.C., and therefore of the operating results obtainable therefrom, can be made by plotting train movements from the dispatcher's train sheets, and then replotting the same train movements as they would be made under centralized traffic control. The assistance of the trainmaster and a dispatcher, thoroughly familiar with the territory, is essential in this work.

Usually there is a short territory where most of the delay time occurs. This is apt to be adjacent to the terminal, where trains are unable to get in or out ahead of a superior train that does not make its expected time. By relieving conditions at such spots by installing C.T.C., it is often possible to improve operating conditions on the entire district. One of the greatest advantages of this system is that a short installation is just the first step and can be added to without change when traffic increases to such an extent that additional territory must be equipped.

If the study shows that the installation will produce a meager return over and above its carrying charges during a period of low traffic, it is certain that it will pay handsomely when traffic increases, as delay time increases seriously with increased traffic.

A. H. Rice, signal engineer, Delaware & Hudson, states that, with centralized traffic control, traffic can be moved at greater speed and at less cost than under old methods of operation; that the operating results can be determined by a study of any C.T.C. installation; and that no allowance should be made for low-traffic periods.

Automatic Interlockers

"What type of interlocking would you install at a railway grade crossing on one line of which it is not feasible to use track circuits?"

Gate-and-Signal Plan

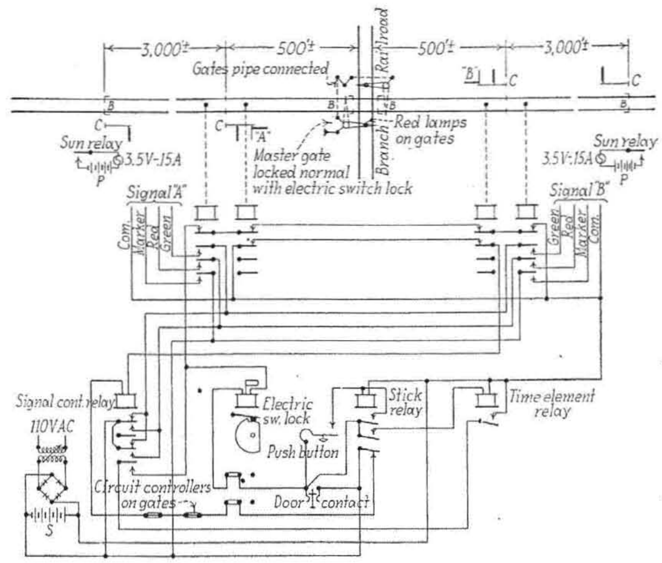
T. H. Kearton

Superintendent of Signals, Chicago Great Western, Chicago, Ill.

We have a few crossings with industry or switching tracks that are protected only by crossing gates, and several branch line crossings that are protected by automatic interlockings. However, there are certain crossings with branch or unimportant lines where gates alone would not provide adequate protection and where, because of conditions inimical to the operation of track circuits on the branch lines, it would not be feasible to install automatic interlockings.

The sketch shows a scheme of gate-and-signal protection which we propose to install, if it meets with the approval of all concerned, for just such locations. This arrangement consists of two single-track gates locked normally across the branch line by an electric switch lock and connected so that they will operate simultaneously. The protection on the important line consists of two home signals and inoperative distant signals of the color-light type. The operation is as follows:

Trainmen on the branch line, upon opening the door of the housing for the electric lock will cause the indicator-type lock to pick up and release the gates, providing there is no train approaching on the conflicting line within the limits of the distant signals. The trainman can then move the gates across the other line and



Scheme involving two single-track gates locked normally across the branch line by an electric switch-lock

signal his train over the crossing. When the lock is reversed, the home signals assume the "stop" position, and when the gates are placed in their normal position and locked by the electric lock, the signals will again go to "Clear".

In case the electric lock fails to pick up when the trainman opens the door, due to a train approaching or failure of a track circuit, the trainman pushes the button, thereby picking a stick relay and starting a time-element relay to operate. After a predetermined time interval, the electric lock will release. When the stick relay picks up, it puts the home signals at "Stop".

This scheme could be worked out in automatic signal territory, and, I believe, will provide adequate protection with certain speed restrictions. The installation would cost approximately $3,000.

Crossing at Interlocking Plant Presented Similar Problem

R. C. Charlton

Signal Engineer, Oregon-Washington Railroad & Navigation Company, Portland, Ore.

We operate and maintain a terminal interlocking plant within the limits of which there is a paved main thoroughfare in the center of which are located the tracks of a foreign road used for switching purposes only. The pavement and switching tracks cross the two main tracks of the terminal plant at an angle of approximately 60 deg.

The pavement makes it almost impossible to install track-circuit protection on the switching line but, fortunately, the switching line, after it crosses the main tracks entering the terminal, diverges from the pavement sufficiently so that it is practical to locate a derail on one side of the crossing.

The switching motors always approach our crossing from the opposite side and on that side we have located a color-light signal whose normal indication is Stop. The foreman, after the motor has stopped at this signal, walks over the crossing to where the derail is located. At the derail there is a telephone connecting with our towerman and if the route is not to be used by main-line trains, the towerman gives the switch foreman a release so that the derail can be reversed, clearing the signal.

The derail is of the ordinary Hayes type operated by a switch stand, the only signal at this end of the arrangement being a standard switch light. The switch stand is locked with an ordinary electric lock, controlled by a lever in the interlocking plant. Reversal of this lever unlocks the derail and locks up all conflicting routes to the interlocking plant. When switching has been completed, the foreman returns the derail to normal, only after his engine has departed and cleared the crossing beyond the color-light signal on the other side. This is the weak spot in such an installation for it is possible for the foreman or switchman to hold the engine just inside the derail, replace the derail to the normal position, inform the towerman that they are departing and then move on over the crossing without further control on the part of the towerman. Our rules prohibit such practice and frequent checks are made to insure that the rules are obeyed. We have not had any trouble due to violation of the rule, but one can readily see that the safety of such an arrangement would depend largely upon constant policing from the angle of surprise tests.

In our plant we have also an additional safety feature which would not obtain at an automatic plant and that is that our towerman is always on the alert watching this crew do their switching and when they return the plant to him by placing the derail normal and dropping the electric lock, he always insures safety by actually observing that the motor or engine has passed on over the crossing and out of the plant.

The above will illustrate that such an arrangement can be provided. Its application to an automatic plant, of course, would naturally be nothing more nor less than controlling the electric locks of the derails on the non-track circuit lines through the approach and priority locking of the automatic plant.

But I would by all means recommend that two derails be provided and that signals also be provided for the movement of the trains over the non-circuited trackage; the operation would be that the switching crew or train crew on the inferior line, upon reaching the plant, would, after observing that there were no trains approaching, attempt to get an "unlock" of the first derail. If the approaches were not occupied and priority relays were in the proper position, the switchman would obtain his "unlock" and reverse the derail. He would then proceed to the other side of the crossing or have one of the other men do so, and go through the same performance, but having once secured an "unlock" of one of the derails there should be no question about getting an "unlock" of the other, even though a train on the conflicting line should occupy the approach circuit in the meantime. The main-line train would be obliged to wait until *both* of the derails were returned to normal and locked.

At this point dependence on strict observation of the rules would be the only assurance that the engine had moved beyond the interlocking limits, although with a derail on each side of the crossing, the situation would be quite satisfactory.

I cannot believe that a safe plan of automatic interlocking can be provided where one of the routes cannot be track-circuited unless derails are provided on the secondary line. Omission of derails and use of time releases only would not be safe, as the presence of a train without track circuit control would deprive such an arrangement of the most essential safety feature of interlocking. The use of derails would, to a considerable degree, minimize the potential weaknesses resulting from this omission.

Proper Protection Obtainable Only with Track Circuits on Both Roads

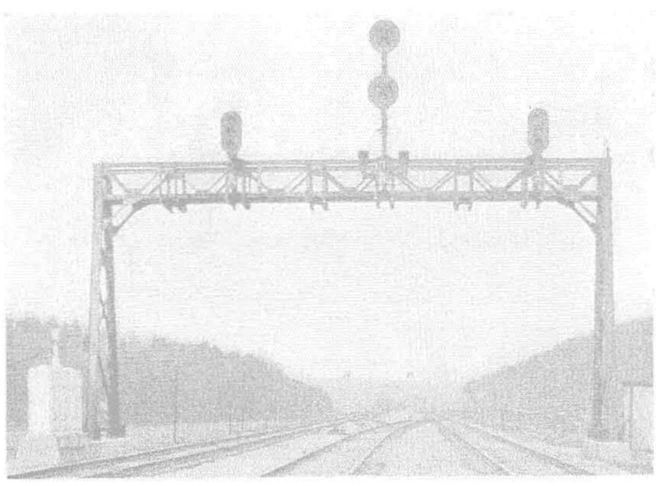
C. A. Taylor
Superintendent of Telegraph and Signals, Chesapeake & Ohio, Richmond, Va.

While we have never had occasion to consider the installation of an automatic interlocking at a railroad grade crossing on one line of which it would not be feasible to use track circuits, since reading the foregoing question we have given the matter considerable study and have come to the conclusion that it would not be practicable to provide adequate protection automatically at such a crossing unless track circuits could be used on both roads.

The only scheme that we feel might be considered in lieu of track circuits on one line would be track instruments which would be used to control directional stick relays; the control relays for the home and distant signals on the other railroad being controlled over the directional stick relays. We feel, however, that this scheme has its objections, in that it does not afford the required protection against a car or a part of a train being left on the crossing when the movement was being made on the non-track-circuited road. Where such conditions exist I would not consider the installation of an automatic interlocking practicable and I believe that the only type of interlocking that could be installed that would provide proper protection would be one in which the trains operating on the road where track circuits could not be installed would be required to stop and operate derails or smash boards, thereby automatically setting the signals on the other road to display their most restrictive indication and clearing the signals on its own road before the train could be allowed to proceed over the crossing.

Standard approach locking circuits would have to be provided so as to prevent the possibility of the trainmen, on the line on which track circuits could not be installed, closing the derails or clearing the smashboard in their track when a train was approaching the crossing on the other railroad, except through the operation of a time release which would be set for a specified time.

We have one interlocking of this kind in service and we consider it as being automatic for one railroad and manual for the other. This particular plant has been in service for the past four or five years and has given very good service.


Centralized-traffic-control signals on the Missouri Pacific, near St. Louis