Editorial COMMENT

Train Order Signals

UNLESS an Approach aspect is provided in conjunction with a train-order signal when displaying an aspect indicating that orders are to be delivered to an approaching train, one or both of two situations that are detrimental to efficient train operation result, i.e., either the trains over-run the offices, or else they lose too much time because the enginemen reduce speed when approaching the offices in order that they may see the aspects of the train-order signals in time to stop their trains. Of course, it is not necessary to stop a train to pick up a Form 19 order, but a Form 31 order, which requires a stop, may be issued at any time at any office.

In automatic block signal territory no accident will result if a train over-runs a train-order signal, providing the train is being operated in accordance with the aspects of the automatic block signals. Consideration of improvements in train-order signals, particularly with reference to approach signal aspects, does not, therefore, involve safety, and the matter is one for decision on the part of the railroads to be based solely on its merits as a means for reducing train delays.

A Study of Delays Involved

On the majority of the roads, especially in automatic block signal territory, the train-order signals normally display the clear aspect, and are placed at the Stop aspect only when orders are to be delivered to an approaching train. Even with this practice, a freight train over-ran a station almost a mile recently, although the engineman saw the train-order signal and applied the brakes when approaching the station. In this instance a serious delay was incurred before the orders could be picked up and the train again started on its way.

Perhaps the delays to trains occasioned by reducing speed when approaching train-order offices and also while again accelerating to maximum permissible speed, are not recognized or are accepted as inevitable. By a study of data and curves showing the time and distances involved when braking and accelerating a train, the time lost, as compared with running through at normal speed, can be determined. Assume, for example, that under certain conditions of curvature or weather conditions, the speed of a ten-car passenger train of standard equipment must be reduced from 90 m.p.h. to about 50 m.p.h., in order that the engineman may see a train-order signal within braking distance. Approximately 9 sec. is lost by the time the speed is reduced to 50 m.p.h., without allowing for sighting time, mental reactions, or operation of the brake handle. The rate of acceleration to normal speed depends on the rating of the locomotive, grade, curves, etc. An engineman who can "kick off" the brakes at 50 m.p.h. and accelerate a ten-car passenger train to 90 m.p.h. within a distance of five miles is doing very well, but even in doing this he loses about 55 sec. Thus a total of approximately 64 sec. is lost. The time loss for heavy freight trains, operated at comparatively high speeds, is much greater because longer braking distances and accelerating times are involved. Accurate data can best be obtained by making a series of test runs in which no speed reductions are made when approaching train-order offices.

Definite proof of what these delays may amount to was brought out in a study of a new centralized traffic control installation which had eliminated the train-order signals. Here, passenger trains which operated through the territory without taking siding increased their average overall speed from 49 to 54 m.p.h. The reason is that, under train-order operation, enginemen usually reduce train speed approaching some of the block offices in order to observe the train-order signals while approaching within braking distance, while under C.T.C. operation no such reductions in speed are necessary.

Some roads have spent hundreds of thousands of dollars for major line changes to effect a few minutes saving for each train, and roads with 20 to 30 trains daily have made and are now making curve revisions which cost $10,000 or more for each minute saved for each train. The most practical means of clipping 10 to 15 minutes off a schedule is, of course, to eliminate those factors which necessitate reductions from maximum permissible train speeds. For this reason, the possibility of saving train time by improved train-order signaling cannot be dismissed without at least giving the matter serious consideration from all angles.

Is the Train-Order Signal Essential?

An idea might be advanced that all train-order signals might possibly be eliminated. Train-order signals or their equivalent, however, are essential on all territories where train movements are authorized by time-table and train orders, and this situation exists except where train movements are authorized by signal indication without train orders, such as on territories where controlled manual block or centralized traffic control is in service.

At first consideration, it might seem possible to eliminate train-order signals at some outlying stations, especially where orders are issued infrequently. The answer from operating officers, however, is that although the train-order signals at such offices may be used but rarely, nevertheless they are needed badly under certain circumstances, and, therefore, few if any can be eliminated. Although certain offices are closed during some tricks each day or full 24 hours on Sundays, and the employees time-table gives information to that effect, nevertheless any such office may be placed in service in an emergency; therefore, enginemen must at all times observe the aspects displayed by all train-order signals.

Combine Them With Other Signals

Providing that a study on a given division indicates that the train delays caused by the circumstances outlined above are appreciable, the next problem is to determine a policy concerning train-order signals and Approach aspects for such signals, as well as to decide whether such signals are to be a part of or separate and distinct from existing automatic block or interlocking signals.

In the vast majority of instances, semaphores are used for train-order signals, and the two arms, one for each direction, are both mounted on one mast, which, except in rare instances, is located at the office building rather than being associated with or at the right of the track governed. Thus with reference not only to the purpose, but also the location, as well as the type of signal and operating arrangement in many instances, the train-order signal is foreign to either automatic signaling or interlocking. In other words, the train-order signal is a hang-over from practices that prevailed prior to the installation of automatic block signaling. In the early days, interlockings were, likewise, a thing unto themselves. When automatic block signaling was developed, however, the track circuits were extended through the interlockings, and the home signals as well as the approach signals are arranged to operate semi-automatically under track circuit control as automatic block signals. The next problem, therefore, is to determine whether this essential nuisance, the train-order signal, can be brought into the automatic block-interlocking family. The problem is, of course, not new, and several roads have developed and installed arrangements which partially or totally solve the problem. The review of some of these systems should be of interest at this time when the train-order signal problem is becoming acute on account of the necessity for making every possible saving in train time.

Viewing the problem from the standpoint that the most important factor is to provide an Approach aspect, some roads have installed circuit controllers and have so connected control circuits that if the train-order signal is displaying a Stop aspect, the automatic block signal in approach will display the Approach aspect. Although this practice has been in effect for many years on several railroads with satisfactory results, signal engineers of other roads argue that if an engineman obeyed an Approach aspect displayed on an automatic signal and then picked up a train order at an office, he might assume that he had fulfilled all of the requirements of the indication of the Approach aspect, and then would accelerate his train, without considering the fact that the automatic signal, or perhaps an interlocking home signal, which he is to arrive at next, may be indicating stop.

A Consolidated Signal

In consideration of the contention last mentioned, one practice is to eliminate the separate train-order signal, used exclusively for that purpose, and to install two combined automatic block-train order signals, one for each direction located within a hundred feet on the departure side of the station. At all times when no train orders are on hand to be delivered to an approaching train, the operator leaves the switches on his desk in the normal position, thus completing the circuit for the manual control feature of these signals. If orders are on hand, he throws the switch corresponding with the signal for the given direction of the approaching train and thereby opens the control circuit for the signal, thus causing the signal to display its most restrictive aspect and the next automatic signal in approach to display the Approach aspect. At all times the regular automatic block signal controls by track circuits are in effect. Thus in all respects this combination of train order-automatic block signal is equivalent to the use of interlocking signals also as automatic block signals, as previously explained.

The combined train order-automatic block signal should, of course, be an absolute signal, Rule 292, and should be so designated by the usual arrangements; in addition it might be well to adopt a practice followed in some instances of mounting on the mast a sign reading "Train Order Signal." Introduction of signals capable of displaying the Stop aspect, Rule 292, into a system in which the remaining signals display the Stop-and-Proceed aspect, Rule 291, calls for the provision of telephones at offices which may be closed part time, so that, when a train is stopped by an absolute stop signal on account of a signaling failure, a member of the train crew can communicate with the dispatcher.

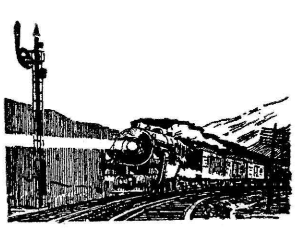
An Entirely Separate System

In order to obviate this ever-present absolute signal situation and also to provide a system of train-order signals, not only at the offices but also the Approach aspects, which are separate and distinct from the automatic block system, the Michigan Central has developed and extensively installed a unique arrangement. Here, each train-order signal at an office, as well as the approach train-order signal, consists of an extra searchlight-type signal unit mounted on the mast of regular automatic signals, brackets being used to set the center of the special unit 2 ft. 9 in. to the right of the mast. In order to inform an engineman whether he is to slow down to pick up a Form 19 order or to stop to pick up a Form 31 order, a different arrangement of aspects is provided not only on the train-order signal at the office but also on the approach train-order signal. This system was explained in detail in an article on page 158 of *Railway Signaling* for May, 1931.

The combined train order-automatic block signal previously described, and the Michigan Central system both necessitate that signals should be located near and preferably a bit "beyond" the office. When planning new installations on multiple-track lines, such an arrangement might readily be provided; and at this time when many roads are respacing signals to provide adequate train-stopping distances, the proper arrangements might be accomplished without much additional expense. On single track, with the usual locations of signals at the passing track switches, and with the office located within the limits of the passing track, additional train order-automatic signals would, obviously, be undesirable, and the use of the station-leaving signals for the combined purpose would depend on the distances involved and the frequency with which train orders are issued at the office being considered.

At Interlocking Plants

For use at interlocking stations which also are train-order offices, various arrangements of combined train order-interlocking signals have been developed. Some roads provide, on the home signal mast, an extra lamp unit which is normally extinguished. When orders are to be delivered, the speed of an approaching train is reduced in accordance with an Approach aspect on the signal in approach. An aspect including a yellow light in the regular home interlocking signal "arm" and a yellow light in the extra unit indicates that a route is complete for the train to proceed as far as the office to pick up orders. To make the aspect significant, some roads flash the lamp in the extra unit. Also, some roads use red instead of yellow in this extra lamp unit. One idea, which perhaps has not yet been attempted, would be to provide no extra unit but to flash the lamp in the regular interlocking signal unit when orders are to be picked up. Another arrangement is to utilize the interlocking signals, including the approach and the home signal, to bring a train to a stop, and then, by means of a flag or an illuminated sign in the window of the tower, authorize the train, when the home signal is cleared, to proceed as far as the office to pick up orders. In some instances, the stop at the home signal can be eliminated by using the Slow-Clear aspect, Rule 287. In addition to these several methods, the Michigan Central system of separate train-order signals is applicable for use at interlockings.



NEW DEVICES

Graphite Lubricant for Signaling

The Acheson Colloids Corporation, Port Huron, Mich., has developed lubricants which are claimed to be especially adaptable for use in the railway signaling field, to lubricate padlocks, and for use on contacts in interlocking machines, circuit controllers, etc.

The graphite used in these lubricants is originally produced in electric furnaces, and then colloidalized by the Acheson process so that the vast majority of the particles of graphite have a dimension of less than one micron, and, therefore, are many thousands of times finer than ordinary powdered or flaked graphite. This extreme subdivision permits the graphite particles, practically speaking, to impregnate the pores of the metal, thus forming a more tenacious bond which resists removal to a much greater degree. This coating of graphite serves as a solid lubricant to minimize wear between metal surfaces. The long life of the lubricating surface is an important factor in reducing the attention required for cleaning and lubricating the apparatus.

In order that the colloidal graphite may be applied in liquid form, thereby forming a uniformly thin coating, a vehicle of carbon tetrachloride is mixed with the graphite to form a liquid which can be applied with an oil can. After application, the carbon tetrachloride, having served its purpose as a vehicle, evaporates, leaving no residue to which dust might cling.

The manufacturer claims that the colloidal graphite as applied to contacts in electrical equipment forms a lubricating surface of extremely low electrical resistance, such that this factor need be given no consideration. The lubricant is, therefore, recommended by the manufacturer for use on contacts in various types of circuit controllers in the signaling field such as controllers on interlocking machines, in switch circuit controllers, power switch machines, etc.

In addition, the lubricant is used in padlocks, especially for those used out of doors where they are subjected to weather conditions, such as those locks on instrument cases, signals, switch machines, circuit controllers, junction boxes, etc. The construction of a padlock necessitates that the lubricant must be thin enough and must possess certain characteristics of surface tension and adhesion to penetrate to the inaccessible portions of the lock and leave a lubricating coating on these parts. The lubricant should not be subject to gumming, and high temperatures during summer weather should not cause it to creep out of the lock. The manufacturers claim that colloidal graphite in a vehicle of carbon tetrachloride possesses the necessary penetrating characteristics and that it will not gum or creep out during summer temperatures. Thus by the use of a lubricant that gets to all the contacting surfaces within a padlock, and stays there for an extended period, the life of the lock is materially increased. Furthermore, the presence of the lubricant minimizes the condensation of moisture on these surfaces in a lock; thus the tendency for locks to freeze during low temperatures is obviated.

Micrometer Drill Grinder

The Atlas Press Company, Kalamazoo, Mich., has developed and placed on the market a micrometer drill grinding device, known as the W-30, which can be attached to power bench and floor grinders made by this company or to most types of grinders made by other manufacturers. One reason for developing this device as an attachment, rather than a complete machine, was to make it practicable from an economical standpoint to provide equipment for accurate drill grinding in numerous small shops and in crews on the railroads, especially for gangs which are applying rail bonds for track circuits. With the