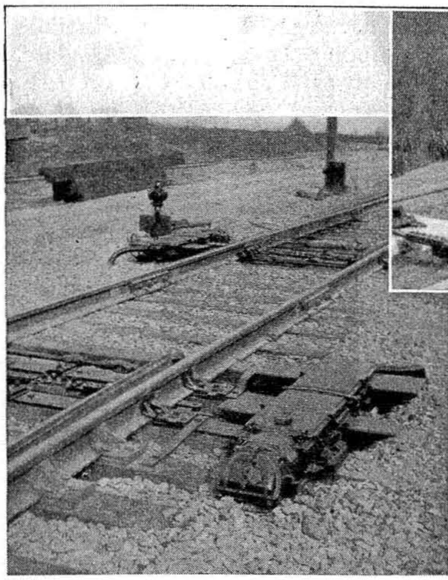

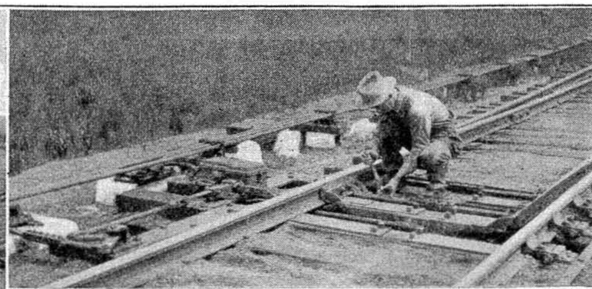

What's the Answer?

An open forum for the discussion of maintenance and construction problems encountered in the signaling field. *Railway Signaling* solicits the co-operation of its readers both in submitting and answering any questions of interest.

To be answered next month

1. *What has been your experience with the use of wooden trunking treated with preservative such as creosote? How extensive has it been used on your railroad?*
2. *What types of electrical measuring instruments do you use for signal maintenance; what scale ranges do you recommend? What special care do you take while on the road to prevent injury to instruments?*
3. *What has been the average life of poles used in signal pole lines on your railroad? What kind of poles have been used? Do you know the average labor cost of replacing a pole?*
4. *What are the benefits of heavier rails in lengths up to 39 ft., with respect to the installation and maintenance of bonding and track circuit connections?*
5. *How do you locate broken bond wires on your territory? Do you depend on finding them by watching from a motor car or do you walk the track? How successful have you been in preventing signal failures from broken bond wires?*

Train Operation Without Written Train Orders

"What mileage of road on your railroad is now operated by signal indication without written train orders and what methods are used?"

Train Order Signals on the Erie Controlled by Dispatchers Eliminate Necessity for Written Orders—Information Is Conveyed to Trains at the Point They Are Required to Act Upon It

THE use of written train orders on the Susquehanna division of the Erie was almost entirely discontinued following the installation of the three-position train order signal for the purpose of directing train movements by signal indication. This use of the three-position train order signal was at that time a distinct step forward in train operation. An article describing this first installation on the Susquehanna division between Susquehanna, Pa., and Hornell, N. Y., was published in the July, 1918, issue of the *Railway Signal Engineer.*

On each succeeding installation of automatic block signals we have followed the same scheme and method of operation until we now have a total of 889.3 miles of road so equipped, the last installation being 28.7 miles of three-position color-light signals between Salamanca, N. Y., and Cuba Junction.

On the first installation old style train order signals have been replaced with three-position signals electrically operated and mounted on the mast with the automatic block signals. These train order signals are controlled from the nearest train order office, thus making it possible for the train dispatcher to direct the operation of these signals by telephone instructions to the offices controlling them. The blind passing siding and also blind crossovers were equipped with both telephone and train order signals. By this arrangement the train dispatchers direct train movements at these points by signal indication which is a marked improvement over operating blind sidings equipped with telephones only.

The circuits controlling the train order signal require the block signal upper arm to be in the stop position whenever the train order signal is moved to either the 45 deg. or the stop position. This arrangement of the circuits insures the display of the caution block signal approaching the train order signal whenever the latter is either in the 45 deg. or stop position. This provides a distant or approach indication for each train order signal. The circuit controlling the train order signal is a polarized one over a single line wire with a common return between the signal and train order office.

With three-position signals at a blind siding electrically controlled from the nearest train order office which may be one or more miles away it is a simple matter for the dispatcher to display at the blind siding the required signal indication for directing the train movement to be made at the siding. Trains at a blind siding either continue on main track or take siding as required by the signal indication of the train order signal. If they enter the siding they report by telephone to the office from which the train order signal is controlled. The dispatcher makes no written record of the train movement authorized by him until after the train has acted upon the instructions of the train order signal.

The article previously referred to sums up the advantages of this scheme of operation as follows: "There is a marked difference in the simplicity of this method of directing a train movement by signal indication as compared to the written train order method. Under the written train order method the dispatcher would have issued a Form B order, the signalman would have been required to deliver the order to the train, the train would have had to slow down to receive it and finally after the train had made the movement as required, the conductor would have had to telephone the completion of the movement." Under the present method the dispatcher with a few words over the telephone directs the train order office to display the required train order signal and the signal is displayed at the point where the train is required to act upon it. The train is not required to slow down simply to receive instructions, as the instructions are conveyed to the train by the unmistakable indication of the train order signal.

New York. M. A. Baird,
Signal Engineer, Erie.

Multiple Track Line of the Illinois Central From Chicago to North Gilman, Ill., a Distance of 79 Miles Is Operated Entirely by Signal Indication

The Illinois Central operates trains by signal indication from North Gilman, Ill., to Chicago, 79 miles, as follows:

North Gilman to Otto, 19 miles, double track, with tracks signaled in both directions, permitting following moves at one-mile intervals with no normal direction of traffic. Control of all movements is in the hands of levermen at the towers of which there are five, including North Gilman and Otto.

Otto to Monee, 26 miles, three track, center track signaled in both directions permitting following moves at one-mile intervals with no normal direction of traffic. Control of all movements is in the hands of levermen at the towers, of which there are six, including Otto and Monee.

Monee to Richton, 4 miles of four track road, signaled for current of traffic only; signal indications supersede time table authority.

Richton to Chicago, 30 miles of terminal six, eight and ten-track road, signaled for movements with current of traffic only; signal indications supersede time table authority.

Chicago H. G. Morgan,
Signal Engineer, Illinois Central.

Nashville, Chattanooga & St. Louis Operates Trains by Signal Indication on 11-Mile Section Over the Cumberland Mountains

The section of our line on which trains are operated by signal indication entirely without written train orders has been described a number of times in recent years. At the Signal section meeting in Chicago, March, 1925, I presented a paper covering this installation, a full account of which can be found in Volume 22, of the 1924 Proceedings of the Signal section, pages 697 to 706.

In 1911 the signal department of this road undertook to install a more modern system of signals and interlockers between Cowan, Tenn., and Sherwood, a distance of 11 miles over the Cumberland mountains. Such operating handicaps as two per cent grades and pusher engines are encountered on this section. Since this installation was completed, not a single train order has been issued in this territory as compared to a very large number of train orders issued prior to its completion. As first installed this system comprised three operating offices, two of which were mechanical interlockings and one which handled the entrance block signals only, all signals being power operated with continuous track circuits. The intermediate signals were automatic and the system was designated for the want of a better name as a semi-automatic controlled manual block system. The line is single track with a passing track at Rockledge, Tenn., located on the summit of the Cumberland mountains.

In 1915 certain track changes were made within this territory and we then introduced remote power switches, one of which is a trifle over two miles from the point of control. At that time this was considered as a record distance for the remote control of a switch. This particular switch is located at the foot of a two per cent grade six miles long and constitutes the end of a short stretch of double track which is signaled in both directions. The former passing track at Rockledge was lengthened and this is now used as double track, being signaled for both directions. The system at present involves the operation of trains in both directions on single track and both with and against the current of traffic on double track.

On account of the changed track arrangement it was impossible to operate some of the switches and signals mechanically so one of the two mechanical interlockings was made electrical and the other one electro-mechanical. Three-position upper-quadrant electric high and dwarf semaphore signals are used in this territory.

Comparing traffic in 1911, with that at present it is found that an average of 34 freight and passenger trains per day were operated over this stretch of single track in 1911, while at present there is an average of 56 freight and passenger trains operating over the same territory, some of this additional capacity being realized by the two short stretches of double track which are virtually long passing tracks. The passenger train time was benefited very little by the installation of the signal system except for additional safety, because these trains possessed rights over other trains under the train order system. The freight trains, however, show savings of 20 per cent northbound and 14 per cent southbound, respectively, which represent an annual saving of 1,022 hours.

Nashville, Tenn. Geo. S. Pflasterer,
Signal Engineer, Nashville, Chattanooga & St. Louis.

Central of Georgia Eliminates Train Orders on Short Stretches of Single and Double Track

Trains are operated by signal indication without written train orders on the Central of Georgia on two separate sections, one 8.4 miles of double track and the other 4.9 miles of single track. On the double track section there are three interlocking plants at one of which freight trains are diverted from the passenger track to tracks leading to the freight yard. The timetable states that eastward trains shall use main track No. 1, and that westward trains shall use main track

No. 2, being governed by signal indications. It also provides that if for any cause either of the tracks should be obstructed the trains shall be handled by the absolute block system on single track.

On the single track section of 4.9 miles the signals are semi-automatic, being under the control of an operator at an interlocking plant located at one end of the section. The signal arrangement and method of operation were described in an article in *Railway Signaling* in May, 1925, page 190. This section is at the end of an operating division where connections are made with two other divisons and in addition to the through train movement there is helper service for westbound freight trains and considerable switching at industry tracks. This particular 4.5-mile section of single track is the "neck of the bottle" for the division to the west and affects somewhat two other divisions. The physical conditions, however, are such that double tracking would be very expensive. It was decided, therefore, to add to the existing automatic signals the necessary equipment to place all signals between Paynes, Ga., and Macon, under the control of the operator at the Macon Junction interlocking plant (electric interlocker located at the east end of the territory) and to abolish timetable and train order rights in this territory. The switches at the east and west ends of the east passing track are hand operated but the operator at the interlocking plant controls the one at the east end by means of a switch indicator. To place the control of the signals in the hands of the operator six interlocked table circuit controllers were used. Special run around movements of switch engines are provided for to facilitate operation in this section. Authority for such movements are given by signals from the operator at Macon Junction interlocker.

All signals in this territory are absolute. The automatic control relay of each lever controlled signal is cut through an extra relay controlled by one of the six levers. All functions pertaining to one block have a lock circuit, front and back, in series so that when a lever is restored to normal all functions must be normal, and when a lever is reversed a check is made that all opposing signals are actually at stop. Approach locking is used for eastbound moves but is not considered necessary for westbound. There is a cross protection relay for each block so that when the lever controlled relay of a signal is energized the original automatic control circuit of the opposing signal is opened.

The elimination of trains orders for helper engines and switch engines has expedited their movements. Switch engines in this territory are now handling more cars with less overtime than was formerly the case. The yard is cleared by the prompt moving of trains when ready. The dispatcher is able to issue orders based on the actual time westbound freight trains leave the yard instead of when they expect to be ready to leave. Inferior trains have available the full extent of the time that a superior train is late on schedule. This system is more flexible than manual block and provides for the complete control of train movements through three blocks by one operator.

Savannah, Ga. E. B. DeMerritt,
Signal Engineer, Central of Georgia.

Controlled Manual Block Signaling on Missouri Pacific Eliminates Written Train Orders and Abolishes Time-Table Superiority of Trains

A COMPLETE description of our Leeds, Kans., to Osawatomie district where trains are handled without written train orders appeared in the February, 1926, issue of *Railway Signaling*, pages 55 to 62.

In addition to the changes in passing track facilities which were made in this district, measures were taken to eliminate train stops previously occasioned by picking up train orders. The controlled manual block system was superimposed upon the existing manual block without any increase in the number of manual block offices except at Osawatomie. There are seven telegraph stations intermediate between the ends of double track at Leeds and Osawatomie. Lap sidings, with each side of the lap holding a 100 cars or more are located at five of these telegraph offices, while at the two remaining offices single sidings are installed on account of grade conditions and the necessity of being able to stop and start a tonnage train.

Each train order signal is locked electrically, being controlled by the operator at that station in co-operation with the operator at the distant end of the block and also by a train in the block. The train order signal is the two-position type (0 to 90 deg.) controlled from telegraph station to telegraph station and is displayed to the crew on both the front and the rear of a train. The indication for the movement of a train into a block is given by semi-automatic block signals which are controlled by track circuits and located near the far end of the siding. The caution position is used as an approach indication for the signal next ahead.

A telephone circuit is provided from station to station sidings and also to intermediate sidings. The latter may also be connected to the dispatcher's telephone circuit for the entire subdivision.

Indicators at each block station enable the operator to determine whether the block is clear; (1) through his station limit, (2) to the intermediate blind siding, (3) between the intermediate siding switches and (4) between the intermediate siding and the next telegraph office. Indications also show when each block signal changes and the remote power switch points move. A bell rings to announce the approach of a train to the telegraph station.

All train movements are supervised by the dispatcher and handled by the block operators through signal indication. No written train orders are issued and timetable superiority of trains is abolished. To move a train into a block the operator calls the operator at the next station and the signal is cleared through his cooperation. All intermediate signals at the blind sidings govern toward the operator who controls them so as to bring the train toward the operator who protects against opposing trains. While the train occupies any section of the space between two telegraph stations each of these operators is informed automatically of its location and conflicting signals are held at stop automatically.

If it should be desired to direct an approaching train to enter a blind intermediate siding the signal at the siding entrance is held at stop. The train crew then communicates with the block operator by telephone at the switch and when so directed operates the switch by hand. If this signal should be against the train on account of an opposing train heading in at the other end of the siding, the first train can be given the information by telephone and can then await its signal to clear.

The train on an intermediate blind siding calls the block operator by telephone as soon as the opposing train appears and after receipt of a favorable response opens the switch after the other train has passed and proceeds when the block signal at the clearance point on the siding clears. Two acts are required for every movement into a block, as for example, two signal indications, or one signal indication and a supplementary communication with the operator, or a signal indication and a caution card.

The accuracy of the spacing for the single track sidings is such that trains frequently arrive at the meeting points so nearly together that neither train is required to stop at the meeting point to await the opposing train, but both keep moving through the sidings.

St. Louis, Mo. B. H. MANN,
Consulting Signal Engineer, Missouri Pacific.

Controlled Manual Block System on Pennsylvania Permits Train Operation by Signal Indication Eliminating Written Train Orders

THE paper which I presented at the March, 1925, Signal section meeting, relative to train operation by signal indication covers pretty thoroughly the conditions at present existing on this railroad. A good deal of work would be required to assemble the number of miles of road on the Pennsylvania operated by signal indication. Our rule No. 251, governing this operation, reads as follows:

"On portions of the railroad so specified on the time-table, trains will run with the current of traffic by block and home signals whose indication will supersede time-table superiority, or may enter a block between block stations to do work or run with the current of traffic by permission of the signalman, which permission will supersede time-table superiority."

The above rule applies where we have automatic block signals on two or more tracks and with few exceptions where we have manual block signals on two or more tracks, and on single track where we have controlled manual block signals. Our railroad is practically 100 per cent block signaled wherever passenger trains are operated. On single track in manual block territory the above rule does not apply.

Generally it has not been considered as good practice to operate trains on single track or against traffic by signal indication only, unless controlled by track circuits and traffic locking. A system of continuous track circuit and traffic locking was first installed on the Renovo division of the Pennsylvania between Huntley, Pa., and Cameron, on January 7, 1907. This original installation consisted of a single-track railroad 8.6 miles in length, with three interlocking block stations.

With the controlled manual system for directing train movements the signal indications are absolute for opposing movements and permissive for following movements. Continuous d-c. track circuits are provided and each interlocking is equipped with approach locking with clock work time releases. A block instrument controlling each block is found at each interlocker. This instrument consists of two electrically locked semaphore indicators and circuit controllers, each having its own miniature lever standing normally in the vertical position, but which can be moved to the right or left. One lever is used to control the block between the block station and the one at the other end of the block and is known as the block lever. The other lever is used for the control of the signal and is known as the signal lever. The indicator on the block instrument over the block lever known as the block indicator shows whether or not the block lever is unlocked from the next block station and whether the track is clear from any switch controlled by this block station to the next block station.

An indicator is provided known as the C indicator, which shows whether or not the track is clear for a distance of about 300 ft. from the block signal. A proceed block signal cannot be given when this indicator is not clear. An indicator known as the D indicator is provided, which shows whether the track is blocked between the block signal and a point several hundred feet beyond any switch controlled from the block station. This indicator is not necessary where there is no such switch in the block.

A switch indicator is located at each switch in the block and is cleared to permit a train to leave the siding by movement of the signal lever to the left and is cleared for a train to enter the siding from the main track by the movement of an auxiliary circuit controller lever in the station providing the short releasing track circuit ahead of the switch is occupied by a train.

Since the installation between Huntley, Pa., and Cameron, there have been 45 similar ones, a few of which in terminal territory are not controlled by track circuits. Most of these installations are over stretches of track where it is necessary to move trains in both directions frequently. It is difficult to determine the money saving due to facilitating traffic but there is no doubt that it is considerable in each case.

Philadelphia, Pa. W. M. POST,
Assistant Chief Signal Engineer, Pennsylvania.

Chesapeake & Ohio Employs Traffic Locking Scheme Using 125-Cycle Alternating Current to Insure Integrity of Circuits

AT the annual meeting of the Signal section, in March, 1925, a paper was presented by B. T. Anderson, superintendent of signals of the Chesapeake & Ohio, relative to the operation of trains by signal indication without the use of written train orders. This article described in complete detail the circuit control features of the traffic locking scheme used on the four-mile section of single track between Cotton Hill, W. Va., and Gauley. A section of double track, 28 miles long, between Scott, W. Va., and "DK" Cabin, near Huntington, W. Va., is similarly controlled.

A scheme of traffic locking was developed in order that the track capacity at these congested portions of the railroad might be increased. It was recognized that a scheme which would make possible the safe operation of trains in either direction over a single or double track line and also would eliminate the necessity of issuing train orders would reduce delays to a minimum and increase track capacity. Such a traffic locking scheme, however, would, from necessity, have to be one of absolute integrity. The possibility of a traffic locking circuit receiving energy from some foreign source was carefully considered and the scheme finally decided upon was one involving the use of 125-cycle alternating current. This apparatus is immune from the effects of direct current and is inoperative on alternating current of commercial frequency or less.

The apparatus consists primarily of a generator, hand driven where power is not obtainable, a selective switch, a selective frequency lock, a push button, and an a-c. buzzer. This apparatus, except for the generator and selective switch, is duplicated for each traffic lever. The traffic lock is an induction motor which rotates in a vertical plane and has two arms which are thrown outward and upward by centrifugal force when the armature rotates at a sufficiently high rate of speed, thereby raising the stem of an indication latch which extends through the shaft.

Traffic locking of this type was first installed in conjunction with the A. P. B. signaling on the single track section of the Hinton division, connecting the ends of double track at Cotton Hill, W. Va., and Gauley. This section of line is situated in a narrow gorge or canyon, the river on one side of the track being very close throughout its entire length, while on the other side are high cliffs of solid rock. Owing to the irregular course of the river there are many sharp curves in the track and in addition three tunnels, making this a difficult four-mile length of single track over which all main line eastward and westward traffic must pass.

The cost of second tracking this "bottle neck" has been considered to be prohibitive. Prior to the installation of the traffic locking scheme trains were controlled by means of an absolute train staff and mechanical interlocking plants at Cotton Hill and Gauley.

One of the novel features of the scheme is that communication and unlocking is accomplished over the same wire. It was found also that due to the change in sound of the buzzer at the generating end of the circuit when a lever being unlocked is reversed it is not necessary for the operator at the distant station to push the button signaling that the unlock has been obtained as this is indicated by the change in tone of the buzzer. The exciting current of the generator field is carried over a normal contact of the traffic lever, thus making it impossible to generate current unless the traffic levers are normal, and insures that the unlocking energy must, in all cases, come from the generator at the other tower.

Under train staff operation the average time of freight trains on this four-mile section of single track was 20.5 min. as compared to an average time of 16.3 min. under the present signal and traffic locking operation. This reduction in time, 4.2 min., is equivalent to an increase in speed of approximately 19.8 per cent. The estimated annual saving on this installation exceeds $60,000, using as a basis the value of $18 per train hour. This saving is three times the cost of the installation, including the cost of rearranging the interlocking plant.

Richmond, Va. C. A. TAYLOR,
Assistant Superintendent of Signals, Chesapeake & Ohio.

M-K-T Saves $4,500 a Year on a Five-Mile Single-Track Section Where Trains Are Operated by Signal Indication

WE have five miles of single track which includes a junction point at one end and a terminal at the other, where trains are operated by signal indication without the use of train orders. This installation eliminated the services of three telegraph operators at the junction point, which effects an annual payroll saving of approximately $4,500, and in addition to this saving it greatly facilitates train movements between this junction point and the terminal.

Denison, Texas. J. A. JOHNSON,
Signal Engineer, Missouri-Kansas-Texas.

Winter Starting of Motor Cars

"What methods do you use to prevent trouble in starting a motor car in cold weather?"

Essential That Water or Snow Be Kept Out of the Gas Tank—Motor Car Should Be Covered with a Tarpaulin When Set Off the Track

THE motor car should be well lubricated in winter time, but should not have a lot of surplus oil around the bearings which is apt to freeze and stiffen up to such an extent that it will make it difficult to start the car. Great care should be used in filling the car with gasoline not to get snow or water into the gas tank. The spark plugs should be cleaned at least once a week and more often if the mileage necessitates, and the batteries kept in good condition.

When using a car in cold weather and it is necessary to set it off while performing work, a tarpaulin should be spread over the car to protect it from the weather and to keep the engine as warm as possible.

When the car is put up for the night or any length of time, the gasoline should be shut off and drained from the carburetor. This is done because there is usually a certain amount of water in the gas and the water will collect in the carburetor. Motor cars should, in all cases, be protected at night in a suitable building or motor car house. On starting a motor car after it has been setting idle the gas should be first turned on and the engine primed with fresh gasoline.

Russell, Ky. J. D. KEILEY,
Supervisor of Maintenance, Chesapeake & Ohio.

A Good Hot Spark Is More Essential in Winter Than in Summer—Heating of Carbureter Is Not Recommended Because of the Tendency to Collect Moisture in the Cylinder

ON the western lines of the Atchison, Topeka & Santa Fe we are supplied with gasoline for our motor cars which is already mixed with a grade of engine oil particularly suited to air cooled gas engines. At times this oil and gas mixture varies, making it difficult to maintain one adjustment only of the air mixing valve on the carbureter. Aside from this the operator of a motor car will find that by keeping his engine as free of carbon as possible, the mixture of gas and oil free from water and grit, the spark plugs and timer clean, the magneto points free from pits and the ignition batteries in good condition, he will experience very little trouble, if any, in starting his motor car in winter weather. I have found that dry cells should not be allowed to run down as low in winter as in summer because a good hot spark is essential to properly fire a gasoline mixture in cold weather.

Many motor car operators are in the habit of heating the carbureter with some kind of a torch on cold days but I try to avoid this because the heat thus transmitted will cause condensation of moisture inside the cylinders and will foul the spark plugs eventually. It is well to carry a duplicate set of spark plugs, cleaned and adjusted, in order to have them immediately available whenever a fouled or flooded plug has to be removed.

Amarillo, Texas. C. H. HILDEBRAND,
Leading Signalman, Atchison, Topeka & Santa Fe.

Recommends That Carbureter Be Drained After Using Motor Car in Extremely Cold Weather—Ignition Dry Cells Depreciate Rapidly in Cold Weather and Need to Be Checked Up Frequently

I HAVE followed the practice of filling the gasoline tank on my motor car at the end of the day. If I am using a car that has a carbureter I shut off the gasoline supply to the carbureter and drain it. This eliminates any condensation and freezing of water which might accumulate in the bottom of the carbureter. Where dry cells are used for ignition, trouble may be experienced due to their depreciation in current output in extremely cold weather. I have found it a good practice to keep cotton waste packed tight around the dry cells in the ignition box and to check up on their current discharge capacity at periodic intervals. When these readings indicate that the cells are more than half discharged I replace them with new cells, using the old ones for emergency telephone service.