New Northumberland Yard Interlocking

Describing the Push Button, Yard Entrance and Junction Plants Recently Installed

The Pennsylvania recently completed a large freight classification yard at Northumberland, Pa. The movement of freight traffic from western Pennsylvania to the southern part of the state and to New England has, in recent years, been more and more diverted from the main line to the Williamsport division. This, passing to the terminal at Sunbury, which is congested with traffic from four other divisions, made it necessary to build better means for freight handling at Northumberland. In the construction of this yard the experience of the Pennsylvania in building and planning several large classification yards and locomotive terminals has been applied to excellent advantage; and the Northumberland yard is interesting as embodying the results of the careful study of these, and also the classification yards of other systems.

Fig. 1. "B" Cabin, Looking Eastward from a Point 900 ft. West of the Cabin.

The general plan of the Northumberland yard is shown in Fig. 2. Construction work was begun in July, 1909, and the yard was put in operation several months ago. The ladders at the yard are on a No. 7 angle, and the frogs are No. 8. The capacity of the yard is based on a length of 40 ft. per car, and the westbound receiving yard, when entirely laid with rail, will have 12 tracks and a capacity of 1,163 cars, the tracks holding 77 and 110 cars each. Only eight of the shorter tracks are at present in use. The weighing requirements at Northumberland are not such as to warrant the use of scales at the humps, and the 63-ft. scales are on a straight through track. The westbound classification tracks are 20 in number, with a total capacity of 859 cars.

Between the westbound classification and departure tracks there is a small grid of eight tracks with a capacity of eight cars each. This is called the "station order sifter," and is used in the classification of cars for small local freight trains.

The westbound departure yard is planned for eight tracks with a capacity of 90 to 100 cars each, and a total capacity of 783 cars. Only one-half of the tracks are laid at present. At the west end of the yard at the Cabin hump, which has only two tracks, ample space is graded for future enlargement, and there is a cabin storage yard with a capacity for 34 cars. The eastbound yards are arranged tandem, like those above mentioned, but with larger capacity. The receiving yard has five tracks in use on a space designed for eight tracks of full train length and a capacity of 740 cars. The two tracks at the east end of the yards pass over a concrete arch at the hump. Under this arch pass two circular tracks, which, in connection with the thoroughfare tracks, provide the entrance to the engine house, and at the same time permit the engines to be turned without requiring them to go to the turntable. A switch from the two tracks leading out of the eastbound receiving yard permits road and yard engines to descend to the lower level in order to reach the coal wharf and engine house.

The eastbound classification yard has the largest number of tracks but they are shorter, having a capacity of from 28 to 50 cars. The yard is graded for 30 tracks, with a total capacity of 1,170 cars, and all but six of these tracks have been laid. The east end of this yard has three outlets, one leading directly to the station order sifter. Directly north of the sifter there are two yards for crippled cars, one with a capacity of 158 cars and the other graded for five tracks, holding 65 cars. The other two outlets lead directly to the eastbound departure yard, which is graded for 10 tracks and holds full length trains, with a capacity of 805 cars. This yard terminates at the east end with a cabin yard for 72 cars and a cabin hump with three tracks. The usual movement of the engine after leaving the engine house is to back into the cabin yard, get its cabin car and place it at the adjoining hump. It then pulls the train out of the departure yard until its rear end is beyond the cabin hump and then the cabin car descends the grade and attaches itself to the train automatically.

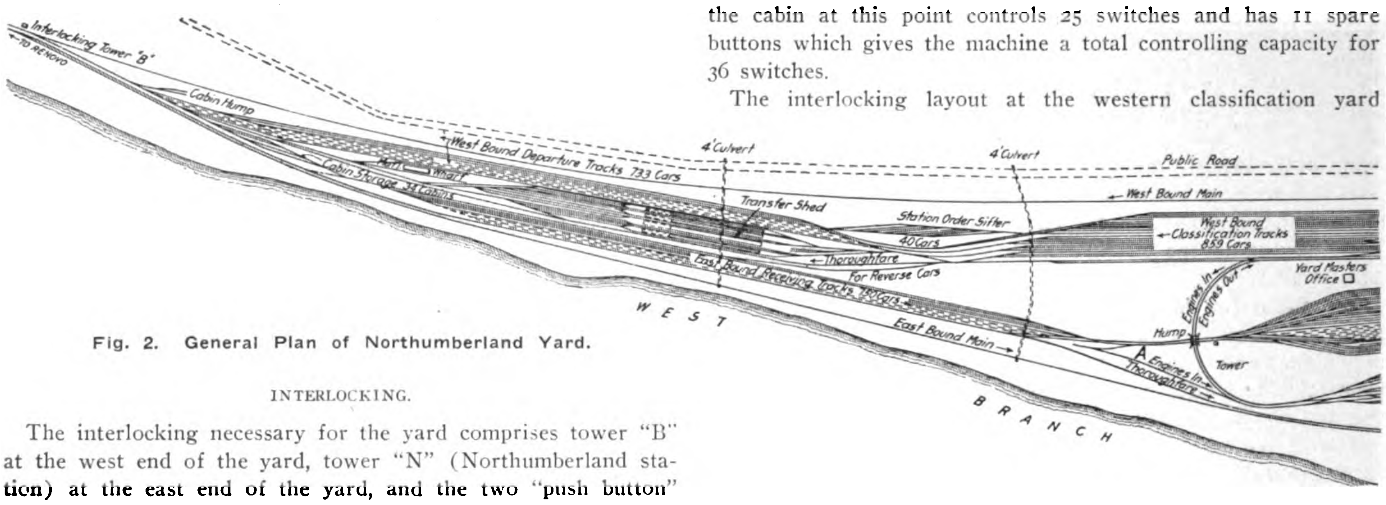

Fig. 2. General Plan of Northumberland Yard.

INTERLOCKING.

The interlocking necessary for the yard comprises tower "B" at the west end of the yard, tower "N" (Northumberland station) at the east end of the yard, and the two "push button" interlocking plants at the humps at A and B. In addition there

Fig. 3. "B" Cabin, Looking Eastward from a Point 200 ft. West of "B" Cabin.

is an interlocking plant at the junction of the Sunbury and Williamsport divisions on the east side of the Susquehanna river. The layout of the plant at tower "B" is shown in Fig. 12; that for tower "N" at Northumberland in Fig. 17; and that for "DY" cabin in Fig. 16.

"PUSH BUTTON" INTERLOCKING PLANTS.

The interlocking layout at the hump for the eastward classification yard is shown in Fig. 8. The push button machine in the cabin at this point controls 25 switches and has 11 spare buttons which gives the machine a total controlling capacity for 36 switches.

The interlocking layout at the western classification yard is shown in Fig. 9. This machine controls 21 switches, the total capacity of the machine being 24. Fig. 11 shows the machine which is in use at the cabin, controlling the eastward yard.

The westward yard, looking from the cabin window, is shown

Fig. 4. "N" Cabin, Looking Eastward.

in Fig. 5. The eastward yard is illustrated by the photograph, Fig. 7, which is a view from the hump.

Each of the push button plants has its separate storage battery in duplicate. These batteries are charged from the lighting circuit by means of mercury arc rectifiers, one of which is shown

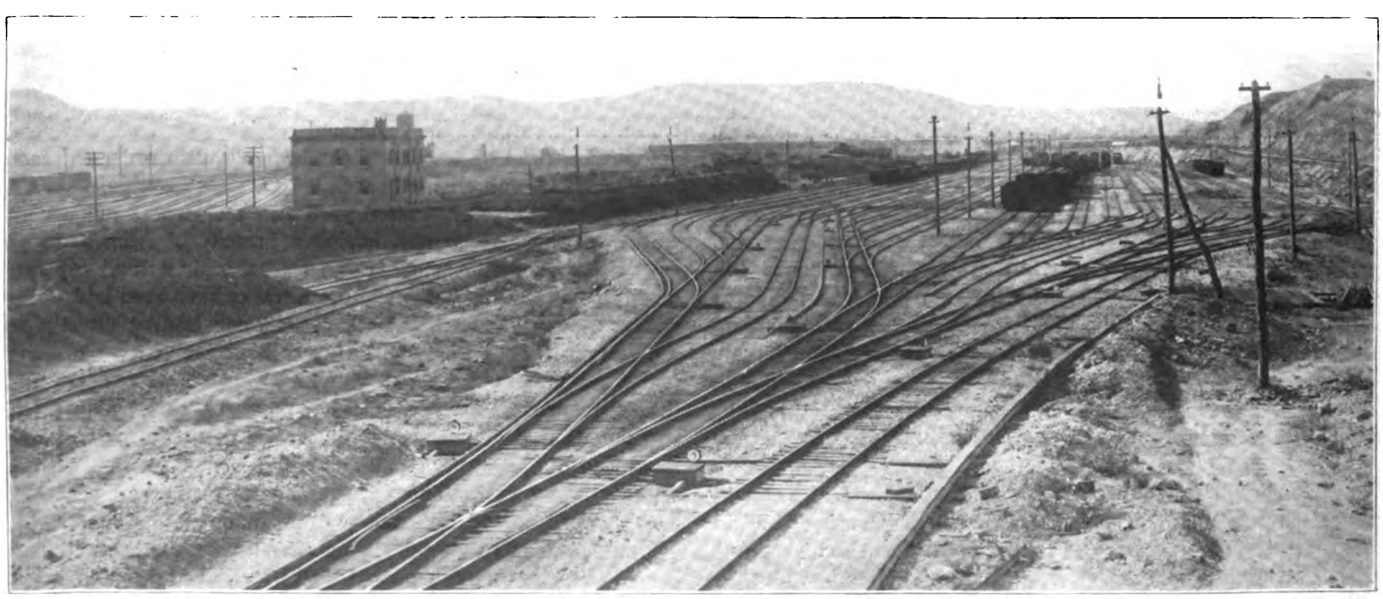

Fig. 5. Westward Classification Yard, Looking Westward from the Cabin Window.

in Fig. 13. The track circuits are fed from the main battery through suitable resistances, and are arranged as shown in Fig. 6. This arrangement permits the cars or "cuts" to follow each other at the shortest possible intervals consistent with safe and efficient switch locking. This allows the maximum capacity of the yards to be utilized.

A push button interlocking machine of the same type as those used at the two humps in this yard was described on page 264 of *The Signal Engineer* for July, 1911. The push button machines are furnished in 12-way sections. The upper row of buttons is termed the "normal" and the lower row the "reverse," corresponding to the two positions of the lever of an interlocking machine. The normal and reverse buttons are joined together by a balance lever in such a way that the pushing in of the normal button forces its corresponding reverse button out, and *vice versa*. The interconnection of the normal and reverse buttons is shown in Fig. 6. The indicators above the buttons are operated by track circuits and they show whether the tracks are clear or obstructed. The arrangement of the indicators for this purpose is also indicated in Fig. 6.

The switch cylinders and valves used with push button machines are similar to those employed for interlocking work, the only difference being the omission of the control or lock magnet. The switch points are connected directly to the piston rod of the air cylinder without the intervention of a switch and lock movement or crank or other device.

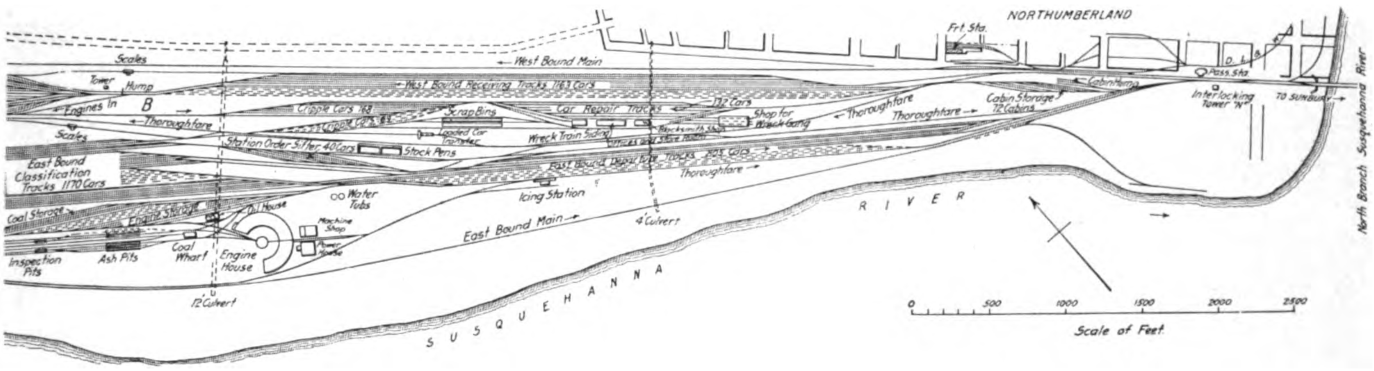

Fig. 2 (Cont.). General Plan of Northumberland Yard.

The push buttons are electrically connected to their respective switch valve magnets so that by pushing the button in the upper or normal row the switch is made to assume the normal position, and, correspondingly, the pushing of the lower or reverse button opens the switch, which is in keeping with the arrangement by which the normal and reverse buttons represent the positions of an interlocking lever.

The indicators are in electrical connection with the switches, and the track is divided by insulated joints, each track circuit section embracing a turnout. One of the switch points to each of the turnouts is insulated from the ladder lead. Normally, or when the lead is clear, the indicator shows white, but if the track in the vicinity of the switch or within fouling distance of the frog is occupied, the action of the circuit will cause a red marker to move across the aperture of the indicator. In

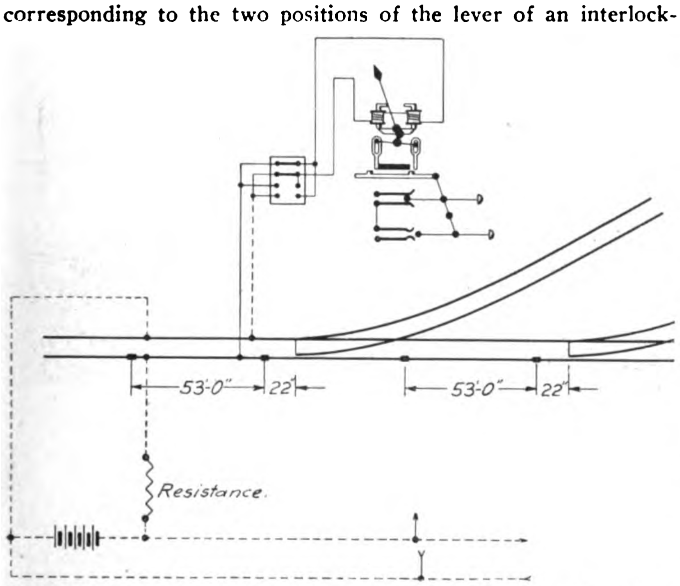

Fig. 6. Arrangement of Insulated Joints at Switches Controlled by Push Button Machine.


Fig. 7. Eastward Classification Yard Looking Eastward from the Hump.

operation, therefore, the appearance of the indicator gives information as to whether the switch has completed its throw, or a neighboring track is occupied by a car.

The usual operation of this push button interlocking plant involves providing the operator with a schedule of the movements required to distribute the train. He is then able to follow the movements of the different cars by the successive appearance and disappearance of the indicator markers. These indications are a permanent feature of the machine, as with them rapidity of movement can be effected with certainty as to the positions of the cars.

Both plants at this yard are operated 24 hours per day by three levermen working eight-hour shifts.

and a view of the cabin looking eastward into the yard is shown in Fig. 3.

The high signals at this plant are the model 2A, made by the General Railway Signal Co., and the dwarf signals are the style "T," furnished by the Union Switch & Signal Co.

Power for the operation of the electrical units of the plant is obtained from storage batteries arranged in duplicate. These are charged from the lighting circuits through mercury arc rectifiers.

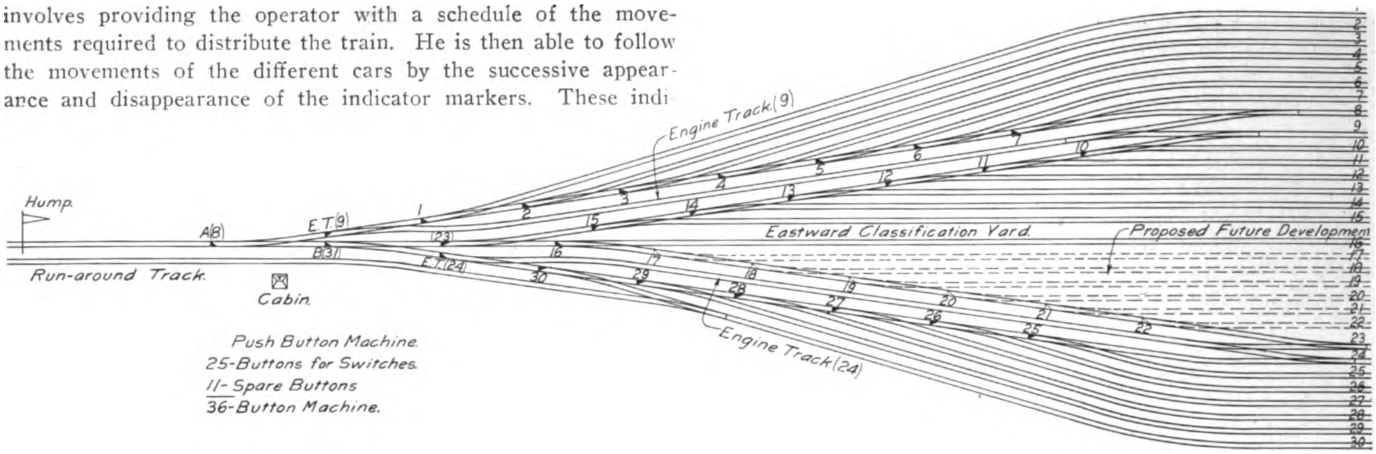

Fig. 8. Plan of the Eastward Classification Yard, Showing the Interlocking.

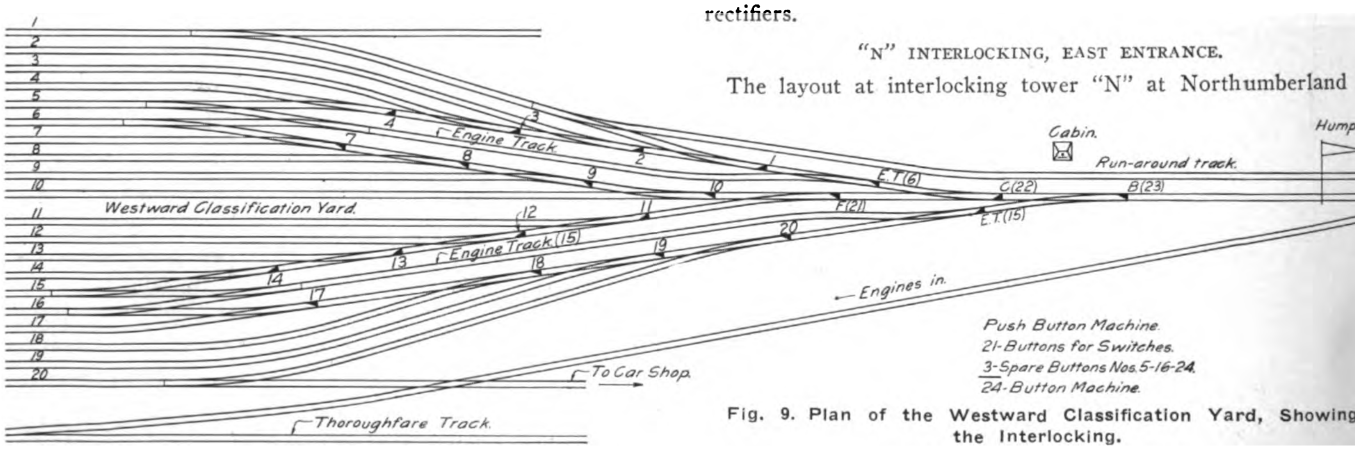

Fig. 9. Plan of the Westward Classification Yard, Showing the Interlocking.

"N" INTERLOCKING, EAST ENTRANCE.

The layout at interlocking tower "N" at Northumberland is shown in Fig. 17. A view of the cabin looking eastward along the main track is shown in Fig. 4, and Fig. 14 is a view of the interior of the tower. This is a mechanical plant throughout with the exception of the distant signals, which are power-operated, model 2A mechanisms being used. There are levers for three crossovers, three single switches, two derails, two home signals, and two advance, two distant, and seven dwarf signals

"B" INTERLOCKING, WEST ENTRANCE.

The interlocking plant at "B" tower, situated at the west entrance to the yard, contains a machine of the electro-mechanical type. There are four switch levers operating two crossovers and two single switches, and levers for two home interlocking signals, two advance signals, and two distant and four dwarf signals. The layout of this interlocking is shown in Fig. 12,

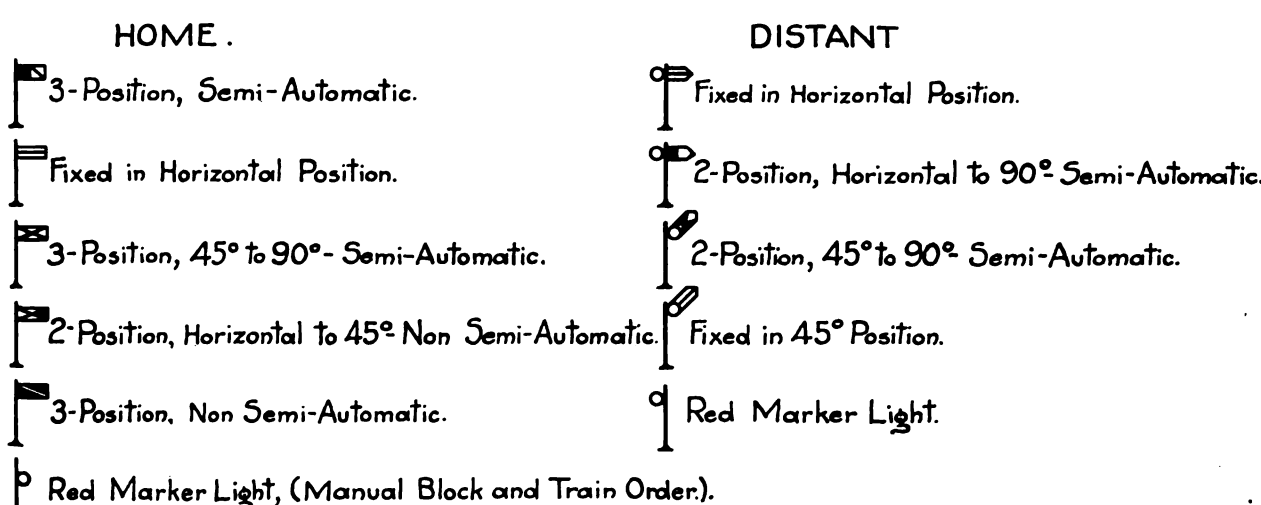

Fig. 10. Symbols for Upper Quadrant Signals Used in Plans of the Northumberland Interlocking.

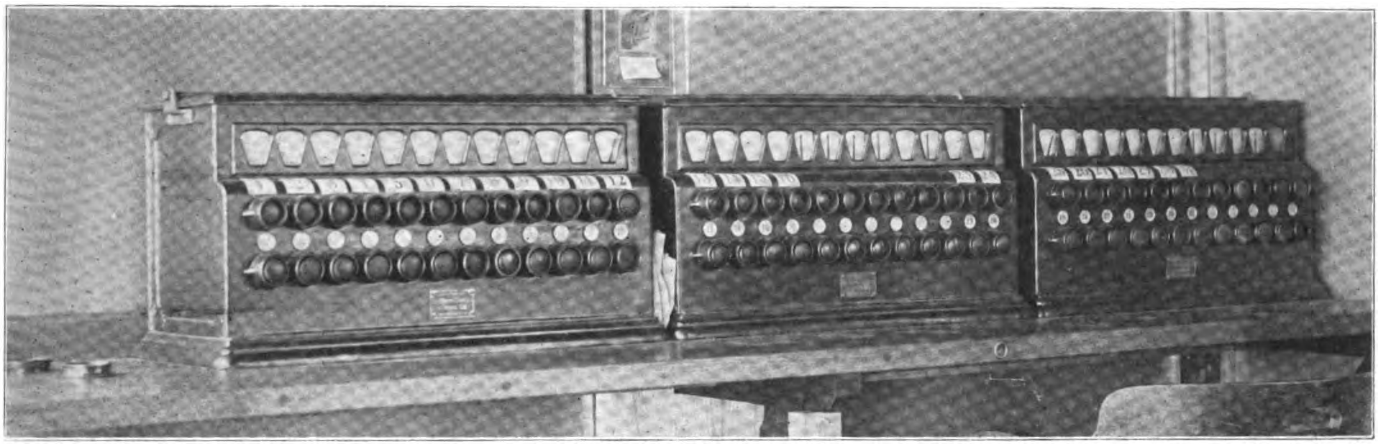

Fig. 11. Push Button Machine at the Eastward Hump.

in a 28-lever machine. The arrangement of storages batteries at this plant is the same as at "B" interlocking.

"DY" JUNCTION INTERLOCKING.

The layout of the "DY" interlocking at the junction of the Sunbury and Williamsport divisions is shown in Fig. 16. The tower contains a 40-lever machine with levers for three cross-overs, five single switches, four home, four advance, four distant and seven dwarf signals. All high-speed home signals and two of the low-speed signals on the Williamsport division, as well as the distant signals, are power-operated, using model 2A mechanisms. The storage battery arrangement is the same as at "B" interlocking. The "DY" interlocking plant has just been completed. Fig. 18 shows the new cabin, looking eastward. The old cabin may be seen in the background.

The Northumberland yard was designed by W. A. MacCart, assistant to the principal assistant engineer, under the direction of a sub-committee consisting of J. H. Nichol, principal assistant engineer; S. A. Sloan, assistant engineer of construction, and division superintendents H. P. Lincoln, L. W. Allibone, C. A. Preston and W. B. McCaleb. This sub-committee co-operated with a committee consisting of W. H. Myers and G. W. Creighton, general superintendents, and A. C. Shand, chief engineer. This committee in turn reported to the general manager, W. W. Atterbury. The yard was built by George Nauman, assistant engineer, under the direction of Mr. Shand.

The track layouts at the interlocking plants were constructed

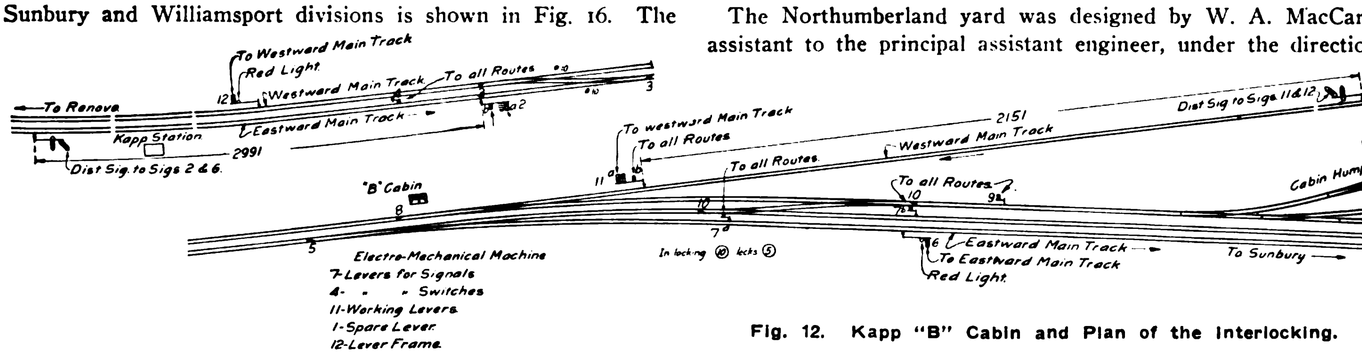

Fig. 12. Kapp "B" Cabin and Plan of the Interlocking.

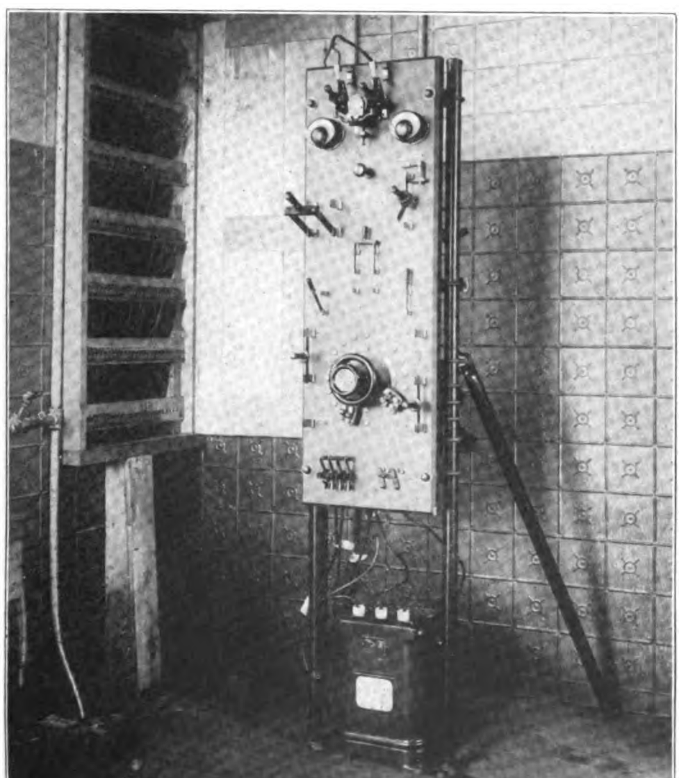

Fig. 13. Rectifier and Battery Charging Panel and Terminal Case at the Eastward Hump.

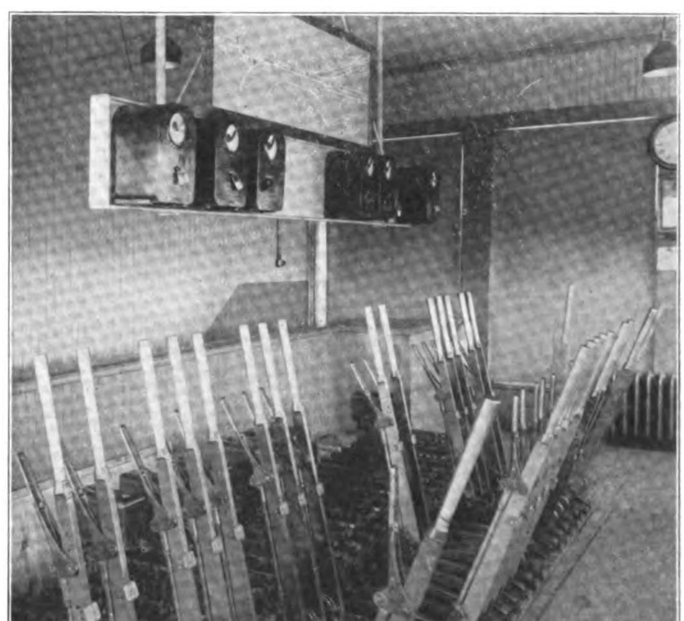

Fig. 14. "N" Cabin Interlocking, Looking Westward.

Fig. 15. "N" Cabin from the East End of the Westward Platform.

by J. E. McIntire, supervisor. The interlocking plants and signals were installed by L. E. Carpenter, supervisor of signals, and the signal cabins were built by W. H. Gemmill, master carpenter, under the direction of W. T. Covert, division engineer.

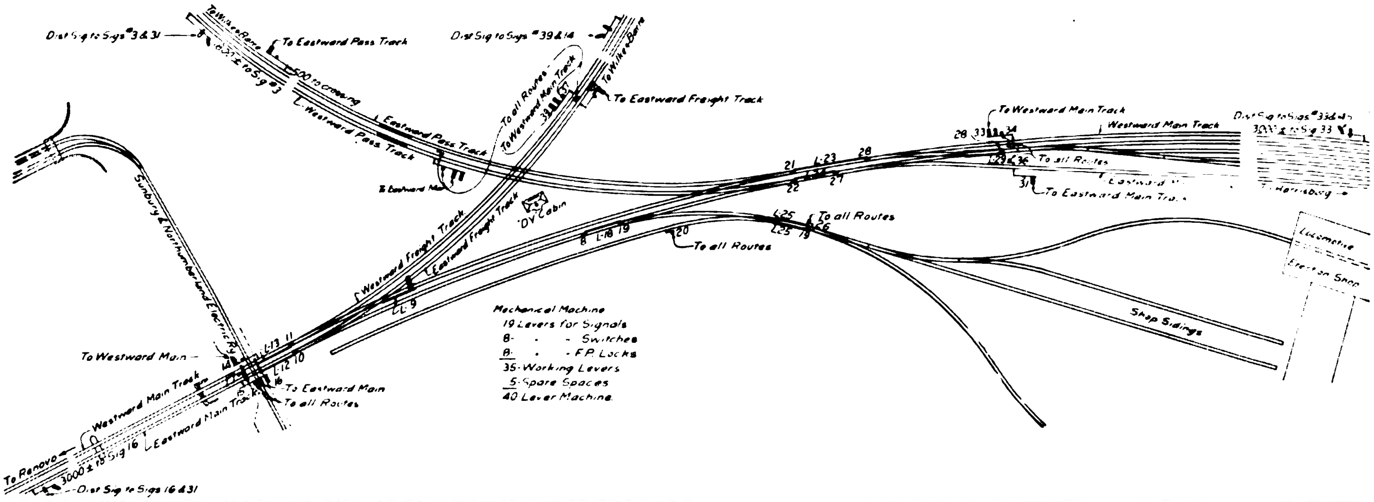

Fig. 16. "DY" Interlockng at the Junction of the Sunbury and Williamsport Divisions.

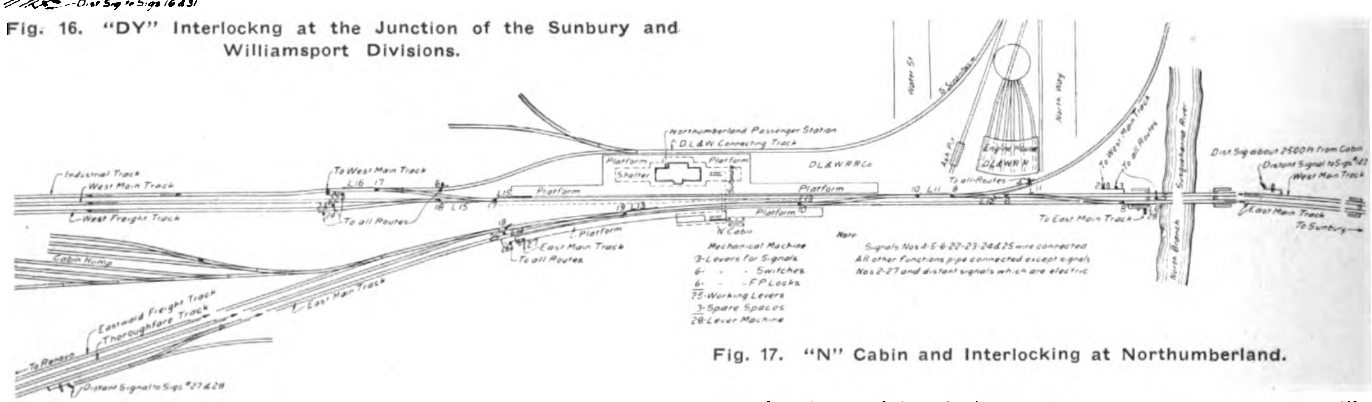

Fig. 17. "N" Cabin and Interlocking at Northumberland.

Fig. 18. "DY" Cabin Looking Eastward and Showing both Old and New Cabins.

THE FUNDAMENTAL PRINCIPLES OF CONTROL CIRCUITS.*

There are certain fundamental principles in connection with automatic signaling using track circuits as the medium of control which should be incorporated whenever possible and which may be illustrated by a few simple diagrams furnished for the report by the General Railway Signal Co. The first circuit in Fig. 1 is drawn to show the proper location of the source of energy, the controlling contacts and the receiving devices in any signal circuit. It will be noted that the receiving device R is at one end of the circuit, the source of energy T at the other end with the controlling contacts C, C located between the source of energy and the receiving device. This sequence should always be observed whenever possible for the reason that a cross X existing between the two series of wires A and B will not tend to falsely hold the receiving device R in its energized position. It is further evident that any break in the wires A or B would de-energize the receiving device R for the reason that the controlling contacts on said receiving device are opened by the force of gravity and held in their closed position by the continued flow of current.

Attention is further directed to the fact that all signal circuits, where safety is concerned, should, as far as possible, be based on the "closed circuit" principle, illustrated by Fig. 1; whereby any derangement in the circuit, such as an open wire or a failure of energy, would result in giving a stop indication.

The second circuit is drawn to show how, over a single line wire, three results can be accomplished. In this circuit the receiving device R is of a polarized nature, i. e., is such that one set of contacts will be closed with positive energy flowing over the line, a reverse set of contacts closed with negative energy flowing and another set of contacts closed by gravity, no energy being on the line. The pole changer, PC, is used to change the polarity of the line and the control contacts, C, C are used to open the circuit. This method of control is usable where a three-

*From Appendix B of the report of the Joint Committee on Block Signals for Electric Railways of the American Electric Railway Association.

position signal is controlled from a distant point. It is also usable in two-arm, two-position automatic signaling where it is desired that one arm shall clear with the next block ahead unoccupied and the other arm with two blocks ahead unoccupied. Circuits of this kind, modified as required, have a very extensive application in automatic signaling as a means of economizing in the amount of apparatus and line wire required.

In order to show a simplified application of signal control, the third circuit has been drawn. It shows an arrangement of opposing signals on a single track such as might be used in connection with curve protection, for example. Signals 1 and 2 are normally clear and controlled by the track circuits A and B. It will be noted that when track circuits A and B are unoccupied the track relays are closed; motors M1 and M2 then receiving current will cause their respective signals 1 and 2 to assume the clear position. If a train enters track circuit A, relay RA will

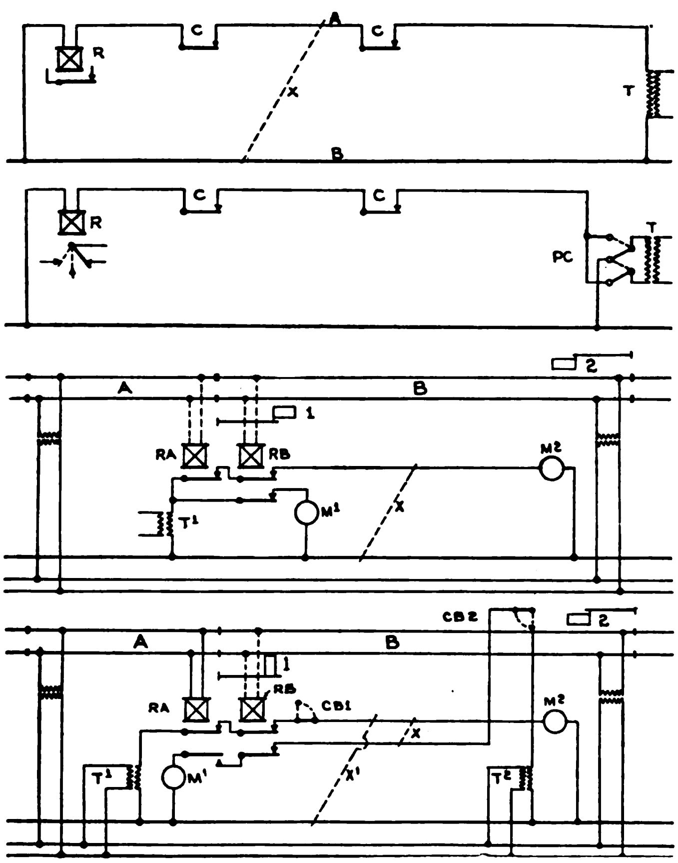

Fig. 1. Diagrams of Control Circuits.

open, depriving motor M2 of current, allowing signal 2 to assume the stop position by gravity. When the train enters track circuit B, relay RB will open the circuit to motor M1 in addition to that of M2, in which case both signals will be in the stop position and will remain so as long as the train is occupying track circuit B. When the train leaves this track circuit both relays will be closed energizing the motors M1 and M2 and causing the signals 1 and 2 respectively to again assume the clear position. It will be noted in this circuit that energy T is placed at one end and the receiving devices M1 and M2 are placed at the other end of their respective circuits, with the controlling contacts intermediate as explained in connection with circuit 1.

It will also be noted that a cross as at X will cause signal No. 2 to assume the stop position, as will also a break in the control wire or failure of the energy T1.

The fourth circuit accomplishes the same result as the third and is drawn to illustrate how an additional element of safety can be effected by electrically interlocking opposing signals. In this circuit it will be noted that signal No. 1 is normally in the stop position, signal No. 2 being clear. It will further be noted that the energy that controls signal No. 1 cannot flow until signal No. 2 has been put to stop, thus closing the circuit for the clearing of signal No. 1 and vice versa. This means that if, for example, No. 2 should be falsely held in the clear position by sleet or ice or any other cause, No. 1 could not be cleared until No. 2 had been put to the stop position and vice versa. Whereas many systems are in operation controlled in accordance with the principles shown in circuit No. 3, it is believed that the additional security secured by the use of the circuits as shown in the fourth circuit justifies the additional line wire through the block. It will be noted that if a cross occurs, as at X, signal No. 2 could not be falsely cleared for the reason that it would be receiving energy through its own back contact, therefore, if it tried to move it would open its own circuit. A cross at X^1 cannot produce the false operation of signal No. 2 for the reason that it shunts energy out of No. 2 rather than applying it. The circuit shown is therefore proof against crossed or broken line wires. In short, before a train can get a clear signal into a block the opposing signal must be at stop and no change in the condition of this signal can take place subsequent thereto by any crosses or breaks on the line.

In view of the fact that alternating current must be used for the track circuits and hence a transmission line must be run anyway to distribute this current for such purposes, the various signals, relays, signal lights, switch lights, etc., may also be operated from the same source, thus avoiding all batteries and reducing the operating charges to a minimum.

On electric lines using alternating current for propulsion, a signal current having a different characteristic from that of the propulsion current is used and relays provided which are responsive only to such signaling current and not to the traction current. The cost of such a system would be somewhat higher than with direct current propulsion on account of the greater number of cut sections that would have to be employed.

THE SIGNAL LAMP AND ITS EFFICIENCY.

BY SIGNAL SUPERVISOR.

The signal lamp for night indications is regarded by some as more important than the position, or color, or shape of a blade for day indications. When it is considered that enginemen must make the same, or faster, time at night with more adverse conditions, it is easily seen that this opinion has some foundation in fact.

The art of lamp-making has shown wonderful improvement in recent years, and the Railway Signal Association standard lamp is all that can be asked for at present.

The lamp is as good as the man who maintains it. We often see poor night indications, not because the lamp is poor, but because it is not properly cared for.

The question may be summed up in the following way:

Lamps	Oil
Founts	Lenses
Burners	Roundels
Wicks	Range

The maintainer should have instructions somewhat as follows:

(1) Lamps should be cleaned twice each week, removing all accumulations of soot and dirt in the hood and body of the lamp.

(2) Founts should be emptied and rinsed once each month, and when filled should not be filled full, but should have a small air space left. Founts should fit the lamps.

(3) Burners should be cleaned twice each week, and boiled out once each month so that the openings for air will be kept open.

(4) Wicks should be large enough properly to fill the wick tube, and any undersized wicks should be rejected. It is a good plan to cut ¼ in. off each time the lamp is cleaned so that the wick will be used up before it becomes clogged by impurities.

(5) Oil should be tested as soon as received, and oil which