The Signal Engineer Volume 2, Number 10 March 1910, pp 372-374

Signal System of the Hudson & Manhattan R. R.

A Description of the Signaling in the Down Town Tunnels of the H. & M. R. R.

By JOHN LEISENRING

(PART 3.)

It should be noted that all possible precautions have been taken with all the pieces of apparatus to provide against water which might drip on to the top of the case, hoods and gaskets being used whenever possible. Case 3 cast of the same pattern as case 4 contains the specially designed electro-pneumatic track relay resistance coils, fuses, etc. (Fig. 1). The large number of circuits which break over the majority of the track relays made necessary the use of a mechanism with a great many more contacts than are usually found on an apparatus of this nature; positive rubbing contacts were also desired which would not disintegrate within a short time and cause trouble.

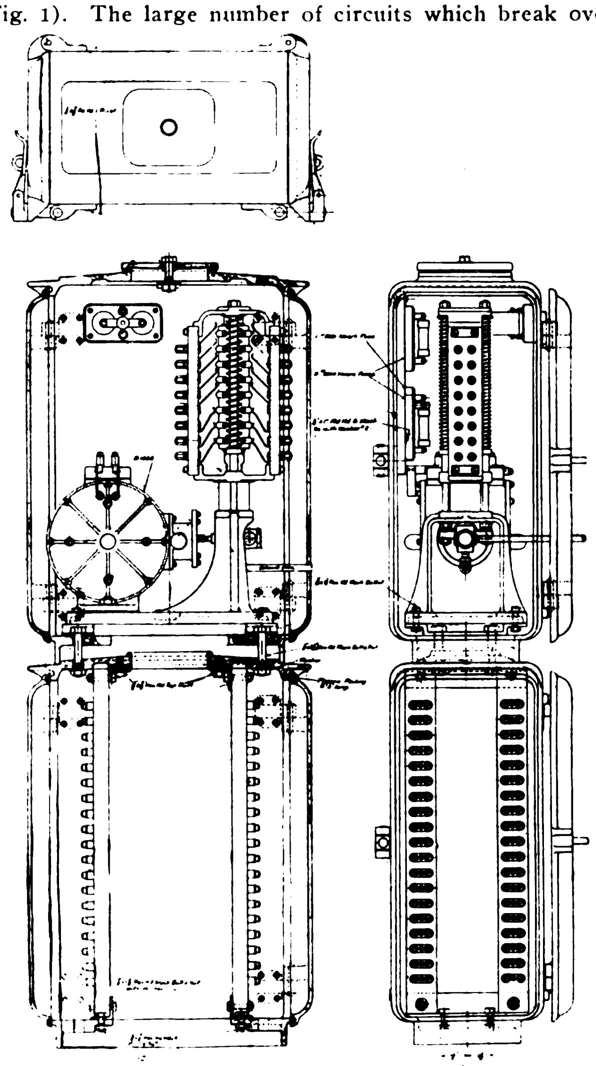


Fig. 1.

With these requirements in mind, the relay as shown in Fig. 2 was developed. A two phase motor having an aluminum disk as an armature operates, through a diaphragm, a pin valve which admits compressed air to a cylinder. A porcelain block is mounted on the end of the piston rod, and on this block strips of copper are fastened which close the circuits as the piston operates. Fig 4 shows a section of the pin valve and the coils of the motor.

There are four coils on either side of the armature mounted on the two heads of the cylindrical case enclosing the disk. When current is applied to the motor the disk revolves rapidly, raising a sector which causes the diaphragm to press outward. This in turn opens the valve and raises the piston. This then is the normal position of the parts when there is no train on the controlling track circuit, any opening of the circuit causing a display of a danger signal, the relay assuming the danger position due to the force of gravity. The spiral springs at the side of the relay are compressed when the relay is energized assisting to return the parts to the danger position when the circuit is broken. These springs

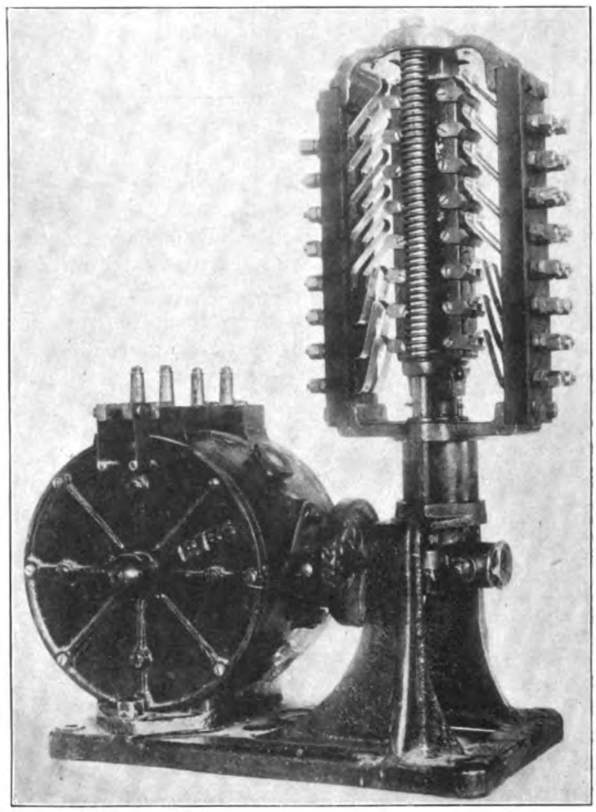
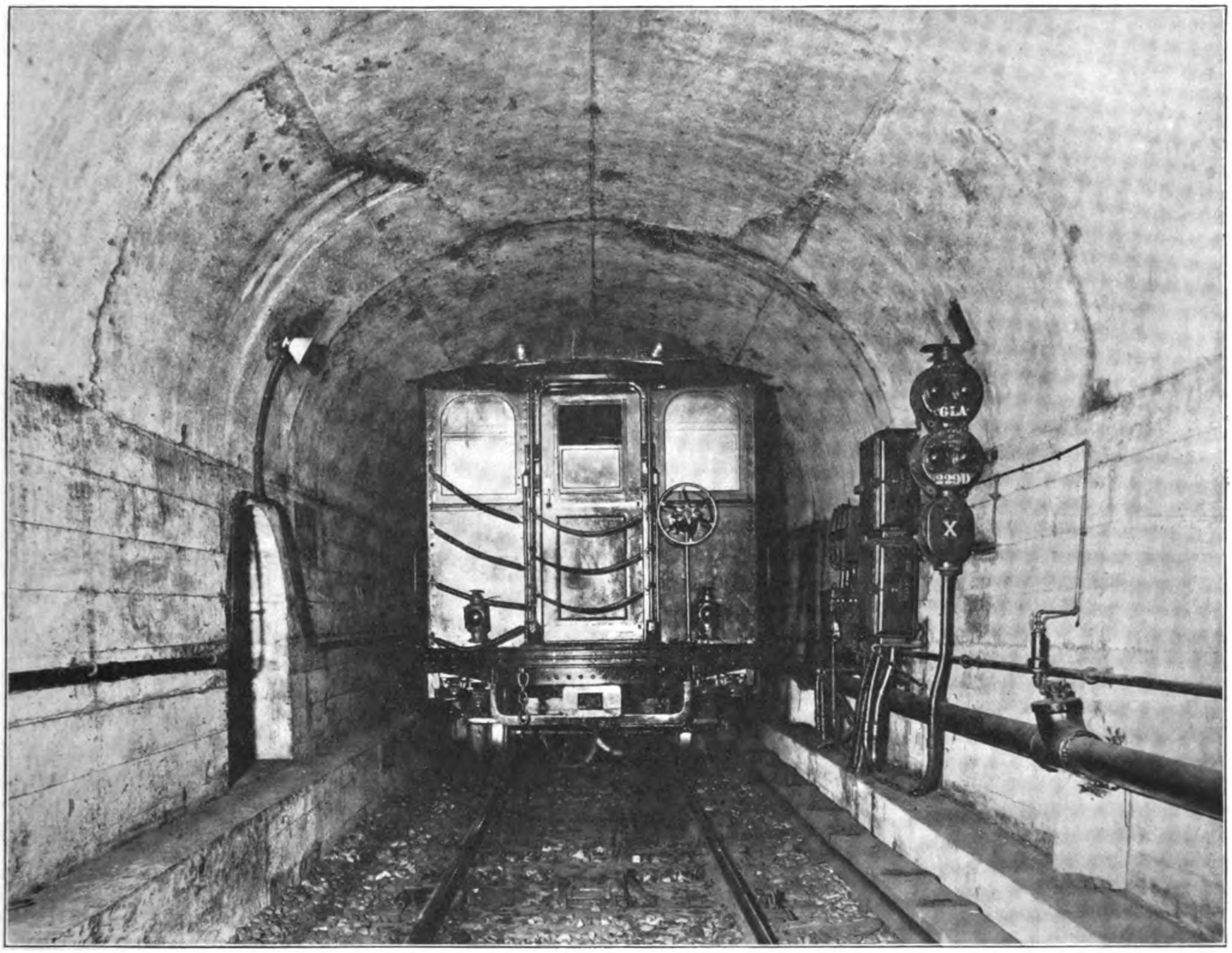


Fig. 2.

can be adjusted by raising the collar at the bottom of the spring and clamping by a set screw to the vertical shaft, in this way insuring a quick and positive breaking of the contacts when the relay is disengaged, the small amount of air in the cylinder being exhausted directly into the atmosphere. It should be noted that there is no mechanical connection between the motor and the pin valve; motor trouble, therefore, cannot cause a false clear indication. This arrangement also facilitates the replacing of a motor in case of trouble, the motor being removed by simply taking out the top screws at the bottom of the case and a new one substituted without disturbing the wires fastened to the binding posts. With a relay of this description ten front and six back contacts can be obtained when desired, and in case of necessity more could be added. It has been found, however, that even with the complicated system of overlaps, automatic stops, etc., in use in the tunnels, one relay of the type described provides more contacts than are required at any signal location, one or two spare points being left for emergency use.

The arrangement of the signals used at all automatic locations is shown in Fig. 1, (see THE SIGNAL ENGINEER for February, 1910), in which 5 is the home signal unit, 6 the distant signal unit, and 7 the case containing the valve admitting air to the automatic stop. These signals are built up to meet the existing conditions, the several cases being similar and interchangeable are strung on a bolt which is in turn suspended from a flat iron bracket fastened to the wall of the tunnel. The signal units are separated into two compartments by a fibre partition which slides into place. Fig. 3 shows an assembled two light signal with valve case attached. Behind each lens two 2 C. P. 55 volt standard Edison lamps are mounted with the necessary fuses; should one of the lamps burn out the proper indication will still be given, the light being sufficiently reduced, however, to cause a report of the failure to be turned in.



View in the Tunnel.

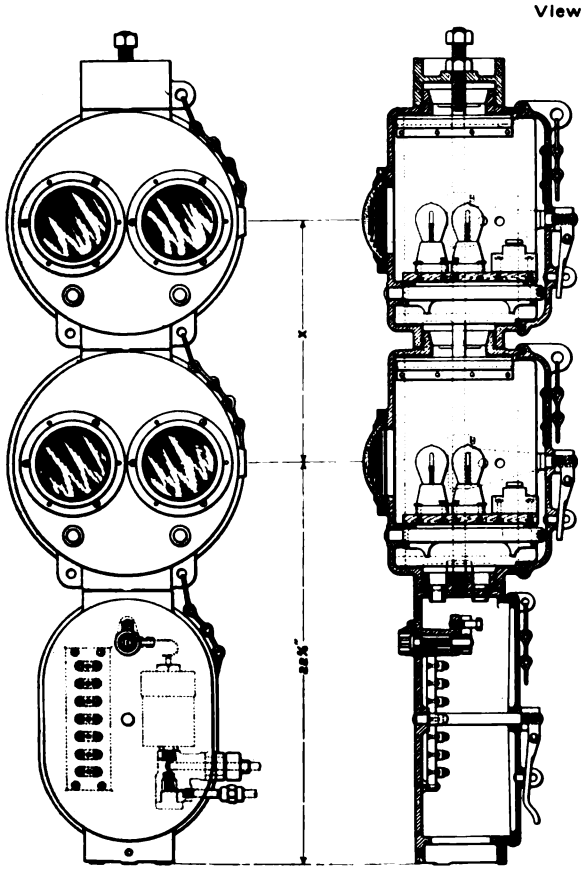


Fig. 3

The valve case besides containing the valve controlling the automatic stop includes a small terminal board from which the local wires to the signal lights are distributed. This valve is made up of a solenoid magnet which operates a pin valve, the armature when the magnet is energized being held down opening the pin valve, admitting air to the cylinder and depressing the trip below the top of the rail into the clear position. The trip is heavily counterweighted, causing it to assume the danger or engaging position in case of failure. When the magnet is de-energized, due to the passage of a train through the block shunting the track circuit, the armature is lifted by a band spring, the raising of the armature cuts off the air supply and opens the exhaust part, the counterweight on the tripper arm forcing the air out of the cylinder and the trip coming to the danger position. Provision was made so that the conductor of a train could in case of signal failure depress the trip and allow the train to proceed. This was accomplished by extending the upper half of the pin valve shaft through the top cover of the magnet and providing a spring for depressing this shaft which could be operated from the front of the box by using a specially made key. The action following the use of the key is exactly similar to that which occurs when the magnet

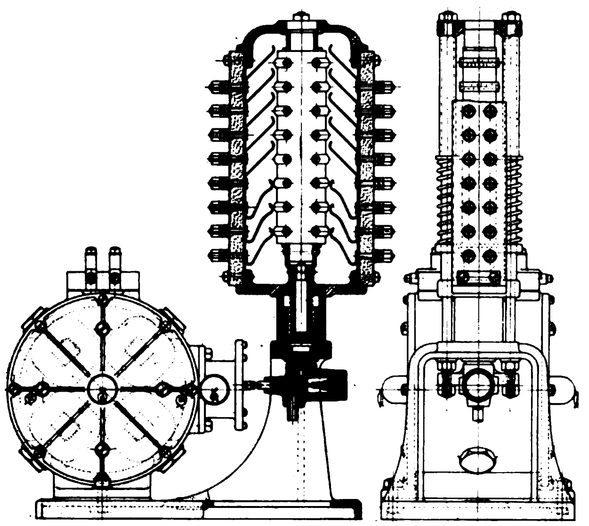


Fig. 4.

is energized, the depression of the pin valve shaft opening the admission part and allowing air to enter the cylinder clearing the tripper arm. The key socket and spring are clearly shown in Fig. 4.

INTERLOCKING FOR THE NEW NORTHWESTERN PASSENGER TERMINAL AT CHICAGO.

THE NORTH WESTERN LINE

The interlocking and block signal work to be installed for the handling of the terminal layout of the Chicago & Northwestern Railway, at the new passenger terminal in Chicago, comprises five interlocking plants, aggregating 532 working levers. The Lake Street plant controlling the entrance to the new station will have 171 working levers in a 212-lever frame, of which there are 67 levers for 67 dwarf signals, 98 levers for 29 switches, 23 double-slip switches, and 23 movable point frogs, and 6 traffic levers.

The Clinton Street Junction plant, controlling the junction of the Galena Division tracks with those of the Wisconsin and Milwaukee Divisions, has 155 working levers in a 168-lever frame. There are 29 levers controlling 45 high signals, 33 levers controlling 33 dwarf signals, 35 levers controlling 35 derails, 44 levers controlling 26 switches, 6 double-slip switches, and 6 movable point frogs, and 14 traffic levers.

The junction of the new line with the old on the Wisconsin and Milwaukee Division is governed by the Carpenter Street and Division Street towers which have respectively 61 working levers in a 76-lever frame and 88 working levers in a 120-lever frame. The Division Street plant provides 12 levers for 18 high signals, 19 levers for 19 dwarf signals, 17 levers for 17 derails, 34 levers for 25 switches, 3 double-slip switches and 3 movable point frogs, and 6 traffic levers. The Carpenter Street tower provides 8 levers for the control of 14 high signals, 15 levers for the control of 15 dwarf signals, 13 levers for 13 derails, 19 levers for 7 switches, 4 double-slip switches and 4 movable point frogs, and 6 traffic levers.

The Noble Street plant controls the junction of the new line with the old on the Galena Division and has 55 working levers in an 80-lever frame. There are 10 levers for 15 high signals, 11 levers for 11 dwarf signals, 11 levers for 11 derails, 19 levers for 7 switches, 4 double-slip switches and 4 movable point frogs, and 4 traffic levers.

The General Railway Signal Company's electric interlocking machine will be used at all of these plants, and this company's Model-2 switch machine will be employed for the operation of all derails and a few important switches, and the Model-4 switch machine will be used on all other switches and movable point frogs. Electric release route locking will be installed at all except the Lake Street plant, and detector bars will be used only on the Carpenter Street, Division Street and Noble Street interlockings.

All the signals at the Lake Street plant are to be three position upper right hand quadrant dwarf signals. The other interlocking signals are two position lower right hand quadrant, of the C. & N. W. standard. The automatic signals are of the Hall Disc type, there being 26 home and 30 distant signals in the installation. The track circuits will be operated from low voltage storage batteries, and these will also furnish the power for the automatic apparatus. A special system of electric light indicators has been designed for communication between towers and between the train shed platforms and the Lake Street tower, to show occupation of routes, and all switch levers have lights to indicate when they are unlocked. The Lake Street and Clinton Street towers have illuminated track diagrams. The wiring throughout the installation is in lead covered cable, the main conduits being of 3-inch size, fibre, and encased in concrete; while the branch runs above the steel work are 2-inch steel conduit. The remaining branch runs are contained in trunking. The main line rail throughout the whole layout is 100 lbs. A. R. A. type B. The remainder is 90 lbs. A. S. C. E. section.

The contract for this work has been awarded to the General Railway Signal Company.

New York customs statistics for December show that the import value of rubber entered during the month, of all grades—Para, African, Guayule, Bornea and the like—averaged a fraction over $1.10 per lb. This does not cover the cost of transportation, the loss from shrinkage, or the importer's profits. These figures are commended to the attention of those students of economics who are trying to figure out why the cost of living is higher than in those good old times when the price of the best rubber at Para was 10 pence a pound.—*India Rubber World.*

Reports which have been received of the volume of business of the Western Electric Company for the first two months of that company's fiscal year indicate that the year 1909-1910 will show a gross business of approximately $61,000,000. If this estimate is realized the current year will prove the second best in the history of the Western Electric Company, the earnings of only one year having exceeded this figure. The gross earnings in 1906 were $69,000,000.

The Hocking Valley Railroad is preparing to install the telegraph block on a stretch of single track covering 62 miles of the Toledo division. Seventeen stations will be equipped with home and advance signals for both directions of traffic, these being pipe-connected and indicating in the lower right-hand quadrant. The signals will be two-way—arms for both directions on the same mast,—and will correspond to the other signals on this road which are three-position. Upon completion of this work the entire single track between Toledo and Athens, Ohio, will have block signal protection. The installation of the 62 miles will be under the direction of Mr. B. J. Schwendt, signal engineer, and the material will be furnished by the Union Switch and Signal Company.

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Signal System of the Hudson & Manhattan R. R.

A Description of the Signaling in the Down Town Tunnels of the H. & M. R. R.

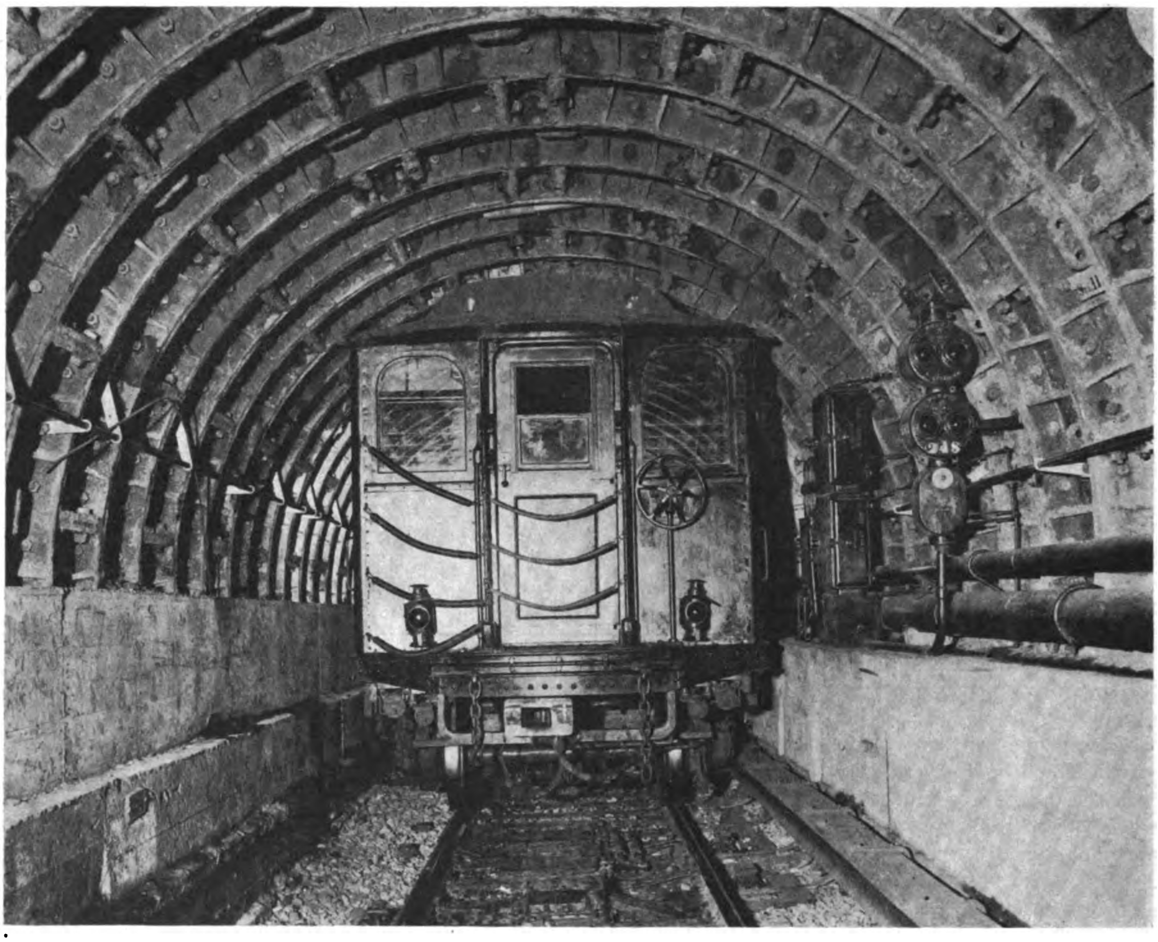
By JOHN LEISENRING

(Continued from THE SIGNAL ENGINEER for March, 1910.)

The wires from the wall apparatus to the track and automatic stops are run in conduit, to the ballast line, where wooden slack boxes are built, and from these the wires are distributed in wooden trunking. Trunking has been found much more satisfactory for track than conduit, the latter having been tried in the previous installation. The life was found to be very short, however, due to the action of salt water encountered in considerable quantities in the tunnels.

Air at an average pressure of 85 lbs. per sq. in. is distributed throughout the tunnel system in pipes run along the bench wall, the pumps placed at the low points of the tunnels to eject the water collected there, being operated from this line, as well as the signal system. At each signal location connection is made to the main, all the air passing through a strainer before entering the apparatus. This strainer is shown at 8, Fig. 1 of THE SIGNAL ENGINEER, for February. In entering the strainer at the bottom the air first strikes a baffle plate, the particles held in suspension, being deposited, dropping to the bottom; they may then be blown out through a pet-cock provided for that purpose. The air after passing up around the baffle plate, passes through a small cylinder made up of very fine copper gauze, 40 mesh to the inch. It has been found, that while all the dust was removed from the air, a certain amount of oil was carried through the strainer in suspension collecting on the pin valves. To absorb this oil, ordinary round lamp wicking was slipped over the gauze cylinder, successfully overcoming the trouble.

The automatic stop box with the shaft and tripper arms is shown at 9 and 10, Fig. 1, THE SIGNAL ENGINEER for February. An assembly plan of the stop box itself is given in Fig. 2, the circuit breaker, counterweight and cylinder being clearly shown. Over this circuit breaker various signal circuits are broken as shown in Fig. 5. Air in the cylinder holds the stop normally clear, the heavy counterweight moving it to danger when the supply is cut off. The small light in the stop is used to indicate to the motorman the position of the tripper arm, independent of the position of the signal, the idea being to facilitate traffic by allowing a train to proceed past a red signal, after having come to a full stop, provided the light in the stop is burning.



Hudson & Manhattan Tunnels—View Showing Car and Signals.

A detail of the tripper arm and the valve on the car trucks is shown in Fig. 3. A branch of the main air line is carried along the equalizer bar of the truck on diagonally opposite corners of every car, the air pipe terminating in a specially constructed valve made adjustable as to height above top of rail by the use of a small rack. A removable piece A, when in the position as shown, closes the opening

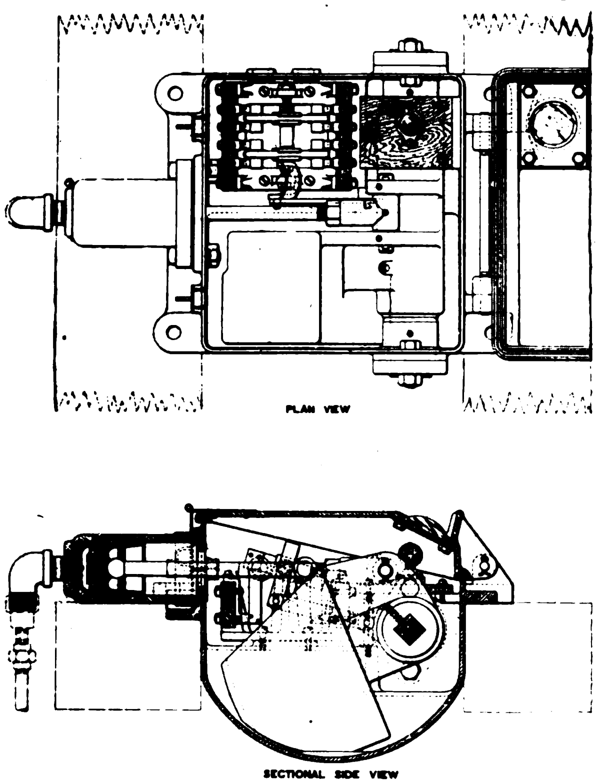


Fig. 2.

in the line allowing the brakes to be operated in the ordinary way. If, however, the motorman runs by a signal indicating stop, the tripper arm operated by the automatic stop, being in the upright or engaging opposition, as in the

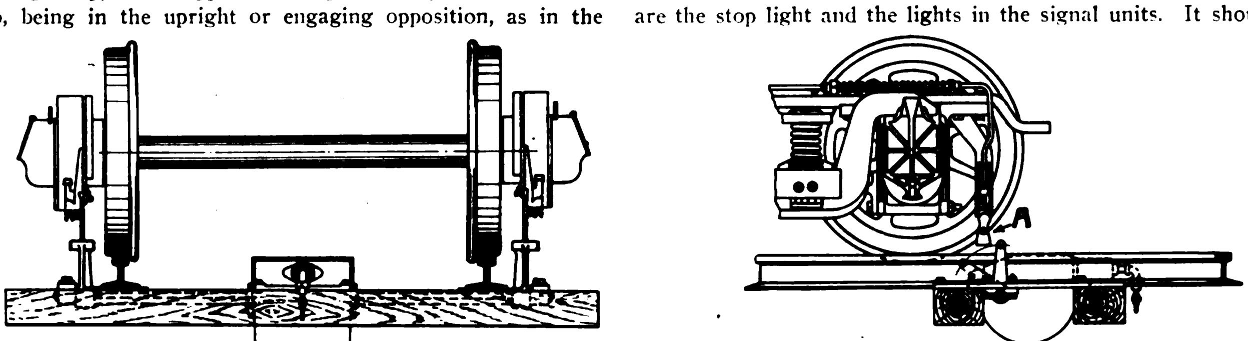


Fig. 3.

figure strikes the piece A, knocking it entirely out of place, allowing the air to escape, and making an emergency application of the brakes on all the cars of the train. Before a train can be started, after being tripped, the motorman must first replace trigger A in position. This is comparatively sim-

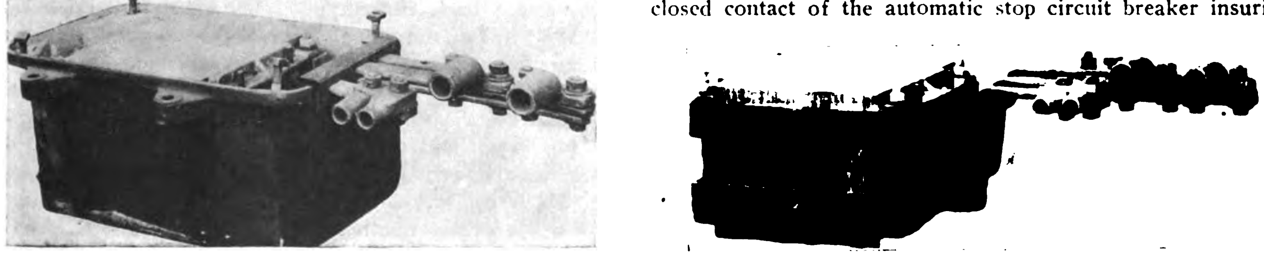


Fig. 4.

ple as the trigger is suspended by a small chain from the truck and need only be forced into place. The results to the motorman guilty of such an act are, however, far more serious.

Balanced reactance bonds are used at all signal locations, their use being necessary in order to afford a continuous path for the return propulsion current. A view of the complete bond and case and also of the bond with the case removed, is shown in Fig. 4. The bonds used for the ordinary track circuit have two coils of very heavy copper, four complete turns in each. These coils are connected to the rails through the terminals on the bond, 350,000 cir. mil. bare cable being used for this purpose. The two adjacent bonds are also connected by two 750,000 cir. mil. cables sweated into the terminals fastened to the center taps. With the bonds connected together and to the rails, a continuous path of low resistance is afforded the return propulsion current, while a comparatively high resistance is offered to the alternating current tending to pass through the bond from rail to rail. At points where special steel, such as maganese, is used as one side of the track circuit, special bonds are used with more turns of copper on one side than on the other, this is necessary in order to overcome the unbalancing effect due to the much higher relative resistance of the maganese than that of ordinary Bessemer steel. For a complete and instructive description of the theory and use of various types of bonds, the reader is referred to Mr. W. K. Howe's paper on "The Use of Alternating Currents in Railway Signaling," read at the Railway Signal Association meeting on June 8th, 1909, and published in THE SIGNAL ENGINEER for July, 1909.

A typical arrangement of the automatic block signal circuits is shown in Fig. 5. Here it is seen that the different pieces of apparatus as shown in Fig. 1 (see THE SIGNAL ENGINEER for February) are included at each signal location of the typical plan. For instance, current at 55 volts is taken from one of the taps of the transformer through resistance and 2 ampere fuses to the pneumatic relay over whose ten front and six back contacts the various circuits are broken. The circuit breaker in the automatic stop is also shown as are the stop light and the lights in the signal units. It should be noted that the first signal on the right gets battery on its green home light over a front point of the relay at the signal two blocks ahead, it being necessary for the second block ahead to be clear and this relay picked up before the clear signal can be given. This control wire is also carried over a front point of the intermediate relays and a normally closed contact of the automatic stop circuit breaker insuring that the stop, at the signal in question, is in the clear position and all sections unoccupied before a green signal is given. In case a stop is out of order and does not clear properly, the home and distant lights of the signal at the point of failure are lighted by battery direct over the normally open, but now closed, contacts of the stop circuit breaker. The method of control of the stop itself should be scrutinized, the stop magnet is of course, normally energized, admitting air to the cylinder and holding the tripper in the clear position, energy for the stop magnet coming over a front, or normally closed contact of the second relay ahead. A train entering from the right drops the first relay, retaining the stop in the clear position by putting energy directly on the stop magnet over a back contact. This is to provide against tripping a train while spanning a signal location, regardless of the conditions ahead. The stop is retained at clear until the train is entirely out of the first section and relay 1 energized, when it will assume the tripping position by gravity, all energy being now cut off. This condition remains until the train has passed out of the second block in advance when energy is again applied. The retaining circuit, or that holding the stop clear over a back contact of the relay at the same signal, was developed to provide for the condition of a long train overlapping two signals, in which case, if the stop control began at the signal in advance, and no retaining circuit was used the rear part of the long train would be tripped. With the arrangement as shown, it is also possible to run trains against normal traffic, the stop at the far end of a section clearing up as the train enters the block. Reverse movements between towers can only be made, however, after the operating of the check locking levers in the machine. This will be taken up in the next issue.

(To be continued.)

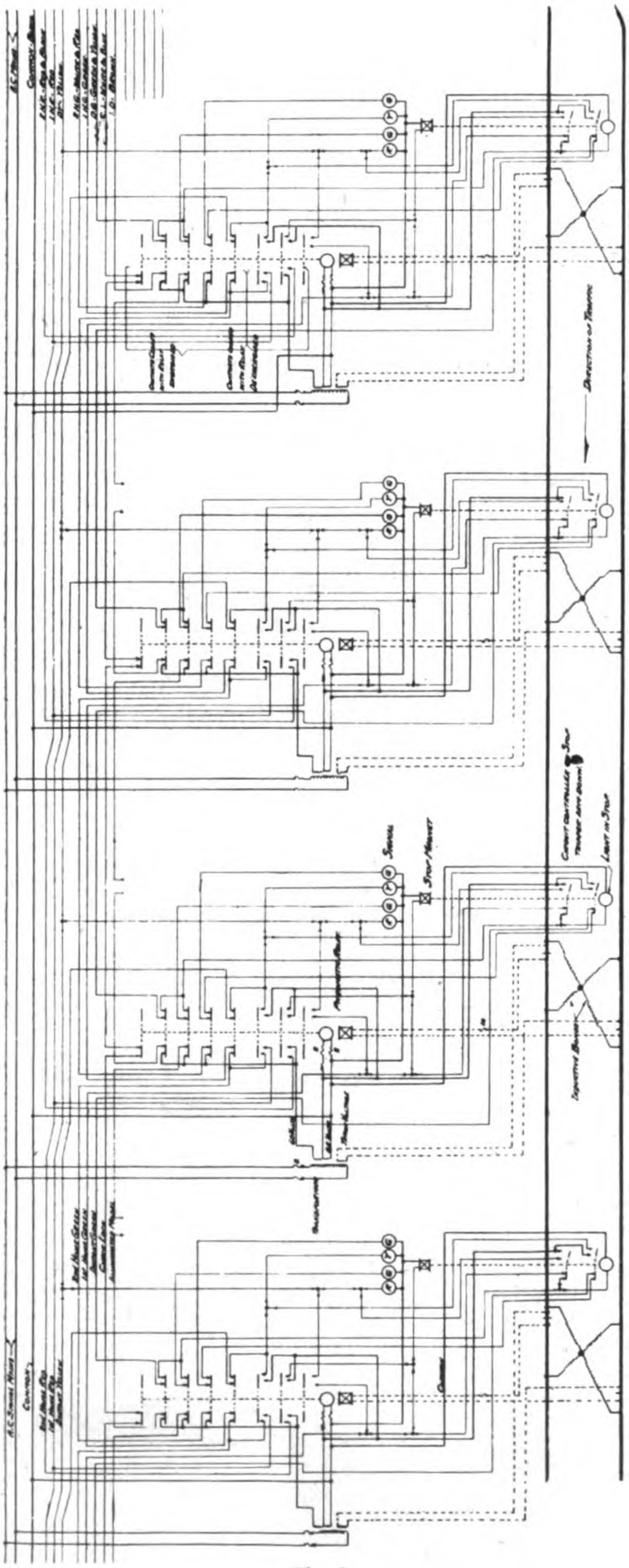


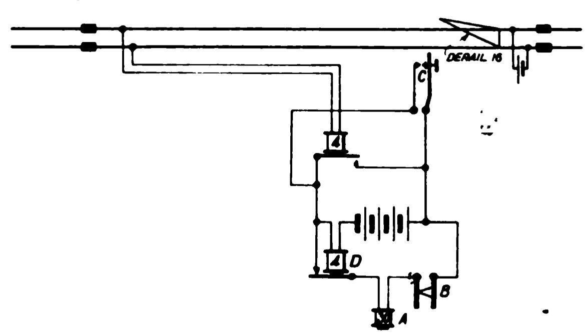
Fig. 5.

ELECTRIC LOCKING CIRCUIT.

To the Editor, The Signal Engineer:

I notice the article by "Electrician" in the April number giving a sketch of an electric locking circuit. We have in use on the Santa Fe a slightly different circuit which is simpler and does away with one set of batteries in addition to using one-point relays instead of two-point, as in the article referred to.

The circuit breaker B, instead of being applied to the derail lever, is attached to the home signal lever, and the contact is normally closed instead of open and is broken when the home signal lever is reversed. This drops the stick relay D and the armature on the electric lock falls into the notch in the locking on the derail lever, which has previously been reversed. The home signal lever must be restored to normal before the train passes completely off the circuit or the stick relay cannot pick up. The emergency push is provided to enable the lever to be changed should occasion require after once clearing the route. A train entering the circuit drops the track relay, closing the back contact and picking up the stick relay thereby; and if the signal lever is put normal so that the circuit breaker is closed the lock A will pick up when the train passes off the circuit and breaks the back contact on the track relay.



Electric Locking Circuit.

This circuit is doubtless an old one to a great many but noticing the article of last month I thought it would prove interesting. Any number of locks can be connected in series and any number of circuit breakers. **C. A. C.**

Committee No. 8 on Arrangements, of the Railway Signal Association, held a meeting at the office of Sidney Johnson in New York on May 6 to complete arrangements for the October meeting. All the members of the committee were present.