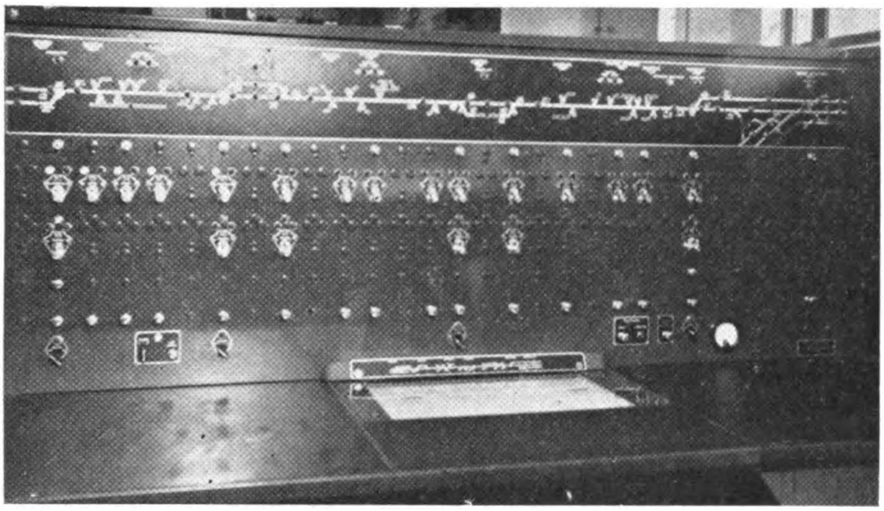


The control machine is in the dispatcher's office at Buffalo

Double to 60 Miles

ON 65.7 miles of line between Buffalo, and River Junction, N.Y., the Erie has changed 56.7 miles from conventional double track to single track with a traffic control system. River Junction is 358 miles from Jersey City, on the Erie's main line between Jersey City and Chicago. The 65.7 miles, branching off at River Junction and terminating at Buffalo, has been double track for years. Within the last 10 years, traffic has gradually decreased on this Buffalo-River Junction territory, and also, the character of through freight between Buffalo and points east has changed, so that traffic is now handled more efficiently in long trains, hauled at increased average speeds by diesel-electric locomotives, rather than in shorter trains by steam locomotives. Recently the passenger train service on the Buffalo-River Junction territory was discontinued. These changes reduced the number of trains, as well as time of trains en route.

$575,000 Salvage Value

Train operation by signal indication in proposed traffic control territory was known to be an important factor in increasing the capacity of single-track. All these considerations led to the decision to change over from double track to single track. The incentive to take action in 1951 was the immediate need for the rails and ties to be removed, as well as to reduce track maintenance expenses. For the project as a whole, the retirements included 47.5 miles of second main track, 2.7 miles of sidings and 17 turnouts. The rail removed included 21.27 miles of 110-lb. laid in 1926-27-28; about 24.37 miles of 112-lb. laid in 1941-48, inclusive; 1.1 miles of 115-lb. laid in 1948; and 0.85 miles of 132-lb. laid in 1949. Roughly 110,000 ties, in condition for reuse in main track, were salvaged. The salvage value is approximately $575,000, and the expense involved in this operation is about $136,200, leaving a net salvage of $439,100. The estimated cost of changing the turnouts and other track changes is $37,570, and the signal changes and additions is $463,347, totaling $500,920. Thus, the salvage of rail and ties paid all but about $62,000 of the entire project. The estimated reduction in track maintenance is $92,000 annually.

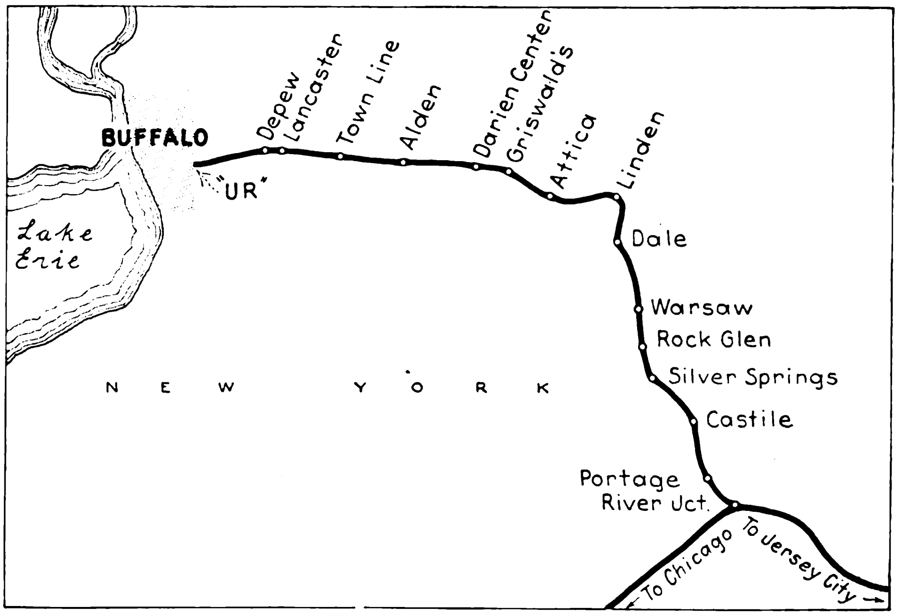
In general, the grade ascends eastward at rates varying up to 0.66 per cent for about 21 miles from "UR" Union Road to a point near Darien Center. Then the grade descends for a few miles to Attica, from where there is a grade of 0.75 to 0.94 ascending eastward for about 5 miles. From there on east, the grade is rolling.

When making the changeover, the double-track main line was not disturbed from Buffalo out through the terminal and yard area for 5.8 miles to a new end of double track at "UR" Union Road, from which point the new single-track main line extends eastward. At the east end of the project, double-track was left in service for 3.4 miles west from River Junction to Portage, which is a new end of double track. Then from Portage to Union Road, there are now 56.7 miles of single main track, instead of previous double-track.

Six to Ten Trains Daily

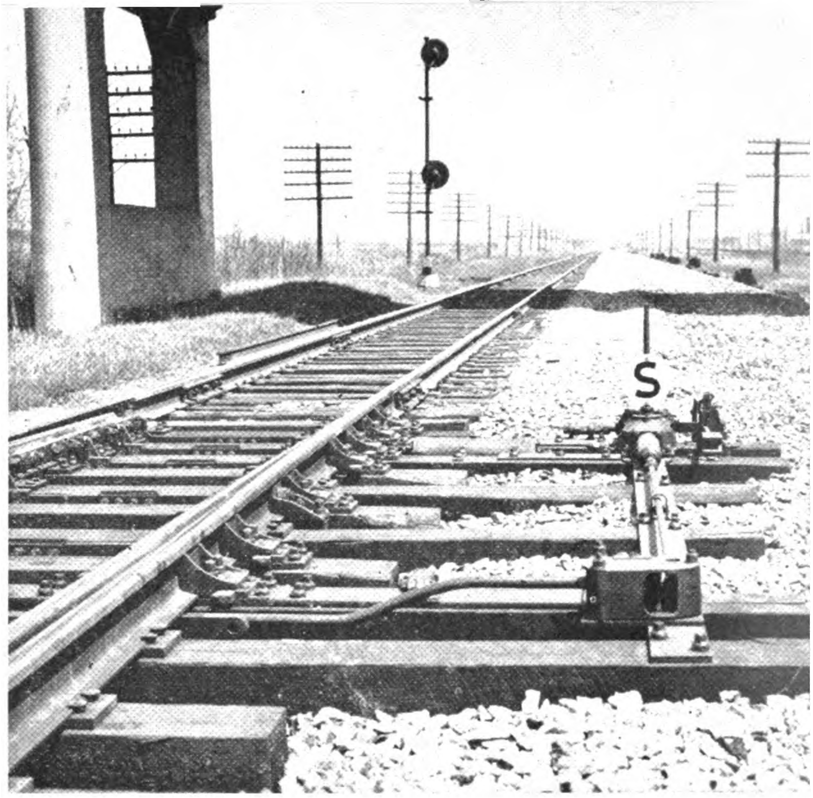
Three scheduled manifest through trains are operated each way daily, but the schedules are such that none of these trains meet in the Union-Portage section. When traffic is heavy, one or two extra trains are operated each way daily. A local freight is operated each way daily except Sunday. Therefore, a minimum of 6 to a maximum of about 12 trains are operated daily.

A study of train operations indicated an average of about 45 meets per month between opposing trains



Map of the territory between Buffalo and Portage

Single Track On the Erie



Signals and switch at end of double track at UR

Operations by signal indication on single track use sidings with hand-throw switches at the entrance ends, spring switches at the leaving ends, as well as at ends of double track

in this 56.88 miles, which is an average of about 1.5 meets daily. Further investigations led to the conclusion that there should be two sidings in this territory, which were formed merely by leaving the second track in place and by installing turnouts to connect to the single main track.

Operation of Switches

The six manifest freight trains are scheduled to make no meets in the Union-Portage territory. Therefore, under normal circumstances, the only trains which take siding are extra trains and the local freight trains. These considerations led to a conclusion not to use power switch machines, thereby reducing the cost of equipment for the project. Spring switches, with Pettibone-Mulliken oil buffers, and Union Switch & Signal, Style S-21 mechanical facing-point locks were installed at the ends of double track and at the west end of each siding. U.S.&S. Co. Style T-21 switch stands and electric locks were installed at the east ends of the two sidings. At these two switches, derails at the clearance points are pipe-connected to the T-21 switch stands. At the ends of double track and at the ends of sidings, new searchlight signals were installed at locations shown in the track and signal diagram.

Control Machine

The new traffic control system between Union and Portage is controlled from a machine in the dispatcher's office at Buffalo. This machine includes levers for controlling signals at the two ends of the two sidings and at the two ends of double track at Union and Portage. Also, on the dispatcher's machine there is a lever corresponding with each of the six switches at the sidings and ends of double track. When establishing control for a signal to direct a train to enter or leave a siding, the switch lever, as well as the signal lever, is thrown to establish outgoing control codes. At the field station, the code established by the position of the switch lever controls a relay that determines the selection between signals. Other levers on this machine control the release of electric locks on hand-throw switches. At the ends of double track, at Union and Portage, the spring switches are normally set to route trains from the single track to the right hand main. An approaching train of the opposite direction on the right hand main track, trails out through the spring switch to the single track. Thus, for trains in either direction, no stop is required to throw switches at these locations.

To Enter a Siding

Sketch No. 2 shows the track and signals at the siding at Alden. When a westbound train, for example, is to be directed to enter this siding, the dispatcher positions his levers and sends out a control that causes westward station-entering signal L44 to display red in each of the two upper units and the letter "S" illuminated white in the bottom unit. This same control also causes the signal in approach, 402-1B, to display the Approach aspect, yellow. The "S" unit consists of a cast-iron lamp body with a ground-glass cover, 14 in. in diameter. This unit is normally dark. When the proper control is received from the dispatcher, the letter "S" appears with a white background, on the ground glass cover.

When the train arrives and stops short of signal L44, the head brakeman operates the T-21 hand-throw stand to reverse the switch. Then the letter "S" is extinguished, and

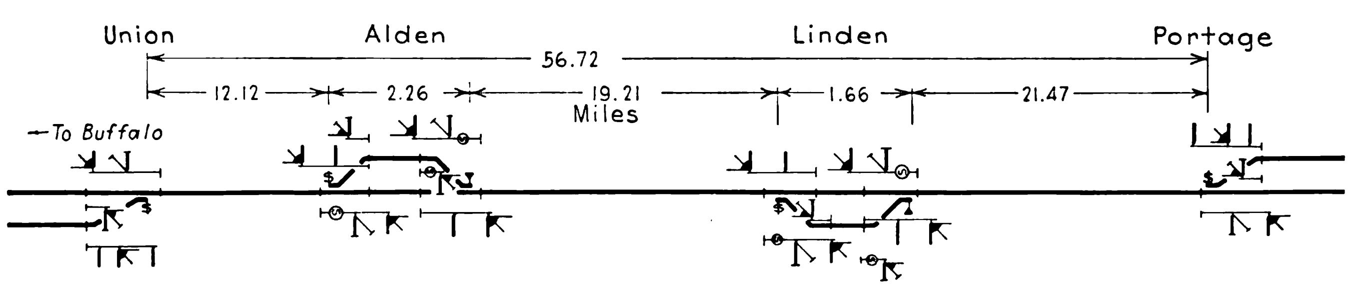
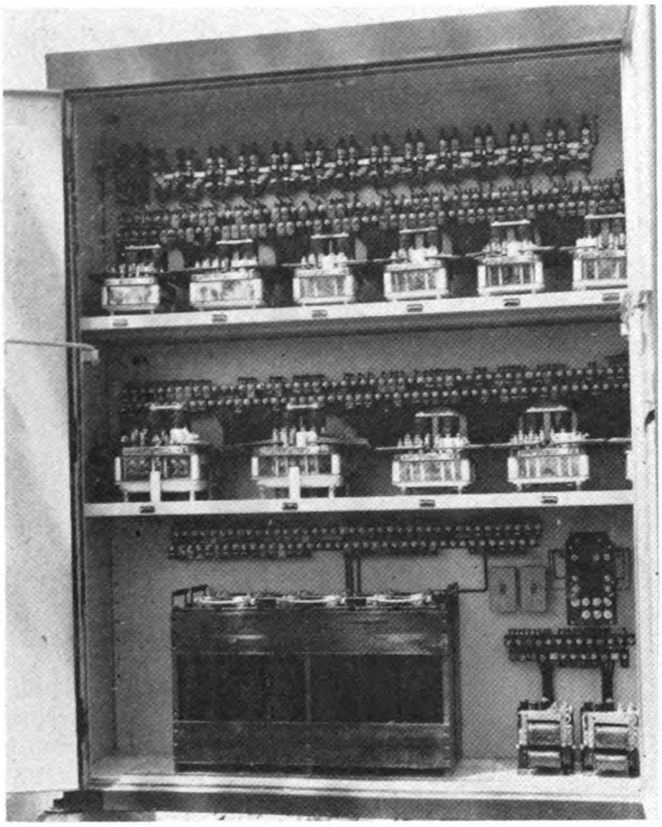


Fig. 1—Track and signal plan of the 56.7 miles of single track between Union UR, and Portage



Interior of sheet-metal case showing the arrangement of relays and battery at a typical signal

the signal displays red-over-yellow, which authorizes the train to enter the siding. After the rear end is in the clear, the rear brakeman places the switch normal.

When the dispatcher is ready for the westward train on the siding at Alden to depart, he sets his levers and sends out a C.T.C. control which causes the leave-siding dwarf signal, LD48, to display a proceed aspect. The train then trails out through the spring switch without stopping for a trainman to operate the switch stand. As the rear of the train passes through the switch, it is restored automatically to its normal position.

Ordinarily the dispatcher would put westbound, rather than eastbound, trains on siding. However, if need be, he can control the eastbound station-entering signal to direct an eastbound train to enter at the west end of a siding. For example, as shown in Fig. 2, the dispatcher sends out a control to cause eastward signal R48 to display red in each of the two upper units and letter "S" illuminated white, in the bottom unit. When the train arrives and the head brakeman throws the switch, the letter "S" is extinguished and the signal displays red over yellow to direct an eastbound train to enter the Alden siding as shown in Fig. 2. When the dispatcher is ready for this eastbound train to depart from the siding, he sets his levers and sends out a control that causes eastbound leave-siding signal RD44 to display red over an illuminated "S" and also effects a release of the electric lock on the hand-throw switch stand. The aspect of red over "S" authorizes the head brakeman to go to the switch and reverse it, which also removes the pipe-connected derail from the track. When the signal displays red over yellow, the train pulls out on the main track and stops to wait for the brakeman to place the switch normal. Ordinarily this operation would be used only for the local freight train or a work train.

Relays and wiring, using No. 9 solid copper wire, were installed in cases while in the shop

Electric Switch Locks

This new traffic control territory includes 23 hand-throw main track switches leading to house tracks and industry spurs. At each of these switches, there is a manually-operated switch-and-lock movement. On each F.P.L. stand, there is an electric lock which locks the lever in the normal position. At the clearance point on each of these turnouts to spur there is a Hayes derail which is pipe-connected to the switch stand at the switch. Short track circuits, about 150 ft. long, extend in either direction on the main line from each switch. These circuits enter into the control of the release of the electric lock. Also, the release is controlled by trains on approaching sections of

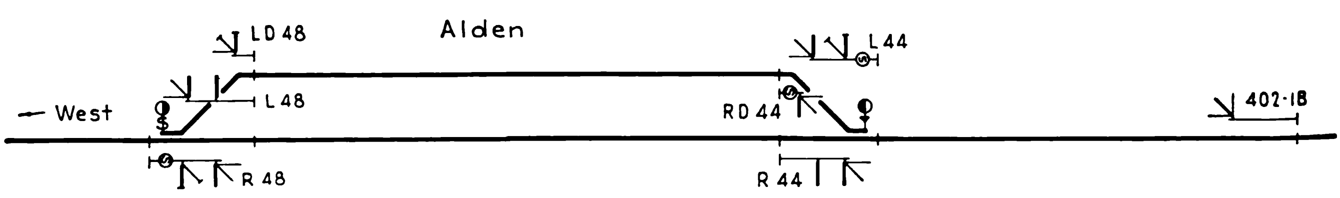
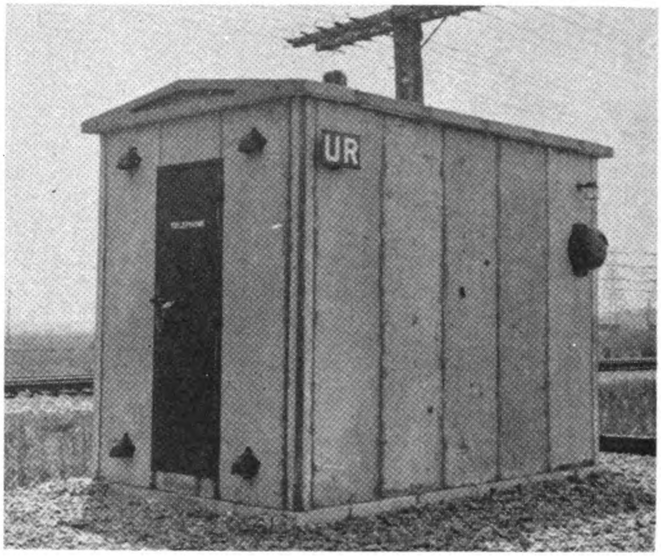


Fig. 2—Track and signal plan of siding layout at Alden

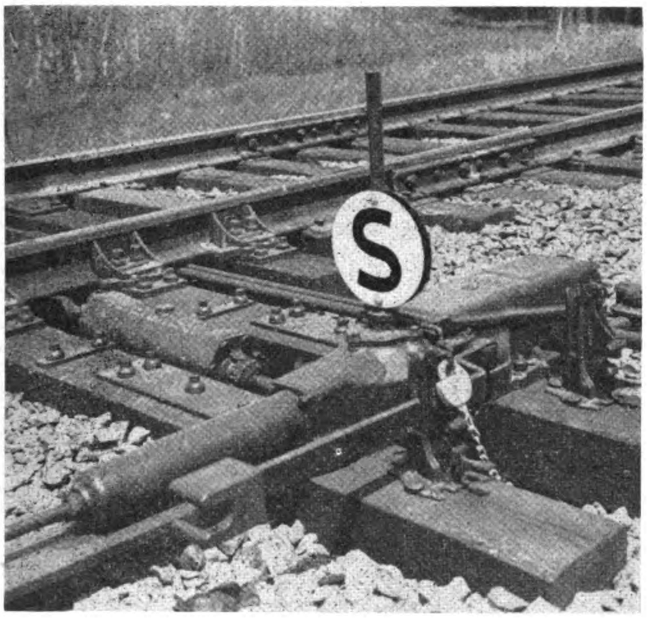
main track in a manner similar to approach locking at interlocking. Near each of these switches there is a telephone box and a short pipe mast with an indicator and a key controller. Before using one of these switches the conductor of a train must use the telephone to get permission from the dispatcher. When the indicator shows Stop and the dispatcher has given permission to use the switch with the approach occupied, the conductor inserts his switch key in the key controller and turns it to the right. This initiates a six-minute automatic time release. After this interval the lock is released.

Construction of Switches

New No. 16 turnouts with 30 ft. switch points were installed at the two ends of double track. Five Ramapo Ajax Type M vertical-pin switch rods and type MF front rod were installed in each of these switches. Ramapo Ajax adustable rail braces were placed on six ties in each switch. On the No. 9 tie, is a 1-in. by 8-in. insulated gage plate and this plate extends out under the crank in the automatic facing-point lock release. Two pair of U.S. & S. Co. roller bearings is applied to each pair of these switch points.



Pre-cast concrete sectional type of house for relays and battery at UR



Each spring switch layout includes a hand-throw mechanism with an oil buffer and spring

Instrument Houses

At each of the six C.T.C. field stations there is a 6 ft. by 10 ft. sectional-type reinforced concrete house. The new signal foundations are the sectional concrete type. These houses and foundation were made by the Permacrete Company, Columbus, Ohio. A second door at the rear of each house opens to a wiring space at the rear of the terminal board, as shown in one of the pictures. Underground cables are brought up through a hole in the concrete floor, the voids around the cables in this hole being filled with sealing compound.

At intermediate signal locations and crossing signal layouts, new sheet-metal cases were installed on concrete foundations. At the rear of each case doors open to a wiring space behind the terminal board. Underground cables come up through a section of four-inch asbestos pipe, the voids being sealed with compound. Each conductor in the cables goes through an individual hole in the board to a terminal post on the face of the board.

The wire from these terminals to the relay posts is No. 9 solid with $\frac{3}{64}$-in. Okolite insulation and $\frac{1}{64}$-in. Okoprene covering. This wire is shaped carefully in place, as illustrated in the pictures. This practice of using No. 9 solid wire gives a neat appearance and holds the relays in place.

Construction Organization

Construction headquarters were at Attica, N.Y., about midway in the installation. A part of the old freight house was used to store tools and equipment. In this building the sheet-metal instrument cases were wired complete with terminals, wiring and relays in place. Also, in this building a special framework was set up on which were mounted the wall planks and terminal boards for the inside of the concrete instrument houses. Then the wiring was installed on these boards complete, each such assembly then being taken from the rack and transported to its house where it was installed. Also, the 4 ft. 2 in. by 7 ft. 8 in. large terminal boards on the rear inside wall of the instrument houses were completely equipped with terminals, arresters, resistance units, switches, etc., at Attica, before being hauled out to the field. Thus, all wiring of cases or houses was done in the freight house at Attica rather than at field locations.

In each concrete instrument house at a siding or end of double track, a special lever control unit is mounted on the rear wall. This small panel has switch and signal levers and a master lever. The master lever is normally sealed. If the code line is out of service, due to storm damage, a man can be placed on duty at each concrete house to control the signals locally. First the seal is broken and the master lever is reversed, then the other levers take over the control locally.

As part of this project two new No. 8 Copperweld line wires, with Anaconda Duraline covering, were installed for the code line circuit. Local line controls are on No. 10 Copperweld line wire with Anaconda Duraline covering. Commercial a.c. power, at 110 volts, is secured locally at numerous locations along the road, as required, and is extended for short distance to signals or track feed locations on No. 8 wire.

At a hand-thrown switch a conductor observes indicator and then uses key in controller to start time release

At each of the spring switch and traffic control system controlled signal layouts there is a set of 12 cells of 240-a.h. Edison A6H storage battery, which feeds the line code and local circuits as well as acting as standby feed for signal lamps, if the A.C. power fails.

Within the traffic control system controlled signal limits at each of the spring switch turnouts there is a series-connected track circuit, fed by one cell of Edison 120-a.h. B6H storage battery. Other track circuits are each fed by 3 cells of 500-a.h. Edison primary battery. Three-position upper-quadrant semaphore signals, formerly in service as automatic signals on the double track, were retained as intermediate automatic signals on the single-track. At each of these intermediate signals there is a set of 16 cells of Edison 500-a.h. primary battery for operating the signal and line circuit. The semaphore lamps, rated at 300 m.a., 3.5 volts are on approach control using four carbon cells in multiple series. The track relays for long circuits are rated at 2 ohms, and for short circuits, such as on the detector circuits, 4 ohms quick-acting. Four-ohm quick-acting relays are used on short track circuits over road crossings protected by flashing-light signals.

Gas-Fired Switch Heaters

In order to keep snow clear of the switches on this territory, gas-fired heaters, remotely controlled as part of the traffic control system, were installed at the switches at the ends of sidings and the ends of double track.

The principal of operation of the switch heater is that the stock rails through the length of a switch are heated, and the heat from these sections of rail, is adequate to melt snow which falls or is drifted into the switch between the stock rails and the points, as well as within a distance of 6 in. or more from the rails.

The heaters are made up in sections each 11 ft. 6 in. long. For 30-ft. switches, there are three such 11 ft. 6 in. sections placed end to end, with the end of the first section 18 in. ahead of the switch point. Each 11 ft. 6 in. section is made up of seven malleable iron units each 19 in. long. On the side away from the rail, these units look like pieces of 1-in. pipe 19 in. long, connected by 1-in. pipe couplings, and with 1-in. pipe caps at the two ends of a 11 ft. 6 in. section.

Between the burners and the edge of the rail, there is a baffle plate made of Mayari-R sheet steel, 16-gage.

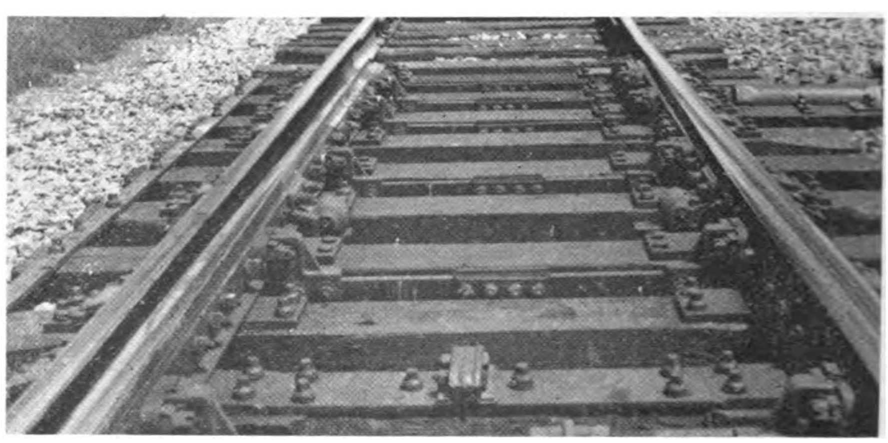
The baffle plate is attached to the burner units by means of drive rivets, known as Kaylong fasteners. The assembled burner units and baffle plate as a complete 11 ft. 6 in. section is installed in a position so that the edge of the baffle plate, fits along the lower edge of the side of the head of the rail, and is held in this position by strap iron brackets which extend down at an angle to the tie, and nailed thereto by spikes.

Center-fed Burners

On the side away from the rail and in the center of each 11 ft. 6 in. section, there is an inspirator, in which incoming raw gas is mixed with air and then feeds into the burners in both directions to the ends of the 11 ft. 6 in. section. In the burner sections, on the side toward the rail, small holes ⅛ in. in diameter, spaced ¾ in. apart, feed gas flame at an angle down through holes in the baffle plate to strike the web of the rail.

From the tanks, the gas feeds through an electro-magnetic valve to a pipe along one side of the tracks, with ½-in. laterals to the ends of the ties, and from there 24-in. lengths of ½-in. neoprene hose extend to the inspirators. The cross lead to feed the burners on each switch has a pressure gage and a differential valve to adjust the pressure at the burners—usually about 8 lb. to 11 lb.

The electro-magnetic valve in the pipe from the tank is controlled remotely through the traffic control system by the dispatcher in Buffalo. When he operates a button and sends a control code to a switch location, the final overstep, operates a



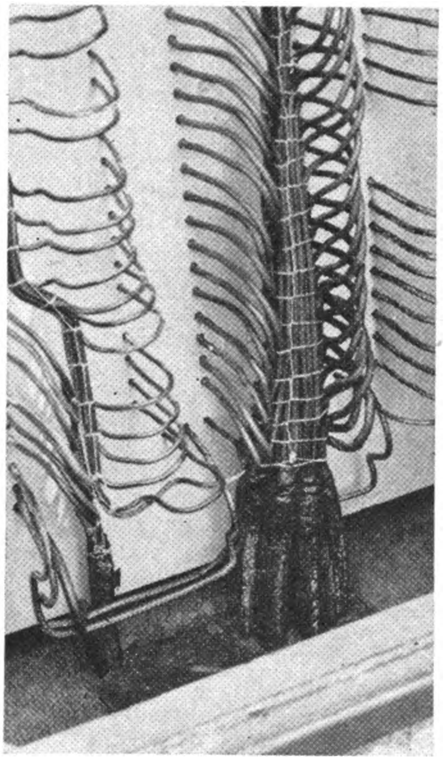
Roller bearings and vertical-pin type rods on switches heater control relay to its energized position and it sticks in that position.

Bi-Metallic contact closed by the heat at the heater energizes a heater indication relay to send in an indication, the same as a "power-off," to light a lamp on the dispatcher's control panel. This lamp serves as a reminder to the dispatcher that he has turned the switch heaters on.

Gas Lighted Electrically

Operation of the heater control relay, as explained above, closes a circuit to energize the coil in the electro-magnetic valve at the tanks, thus feeding gas to the main pipe in the switches. The gas in each heater can be lighted by means of any one of several methods, but on this territory the Erie uses lighters operated by d.c. from a 6-volt storage battery.

At each switch there is a micro-switch operated by gas pressure, which closes a contact that feed battery to the ignitors, of which there are two for each switch, i.e., one for each 34 ft. 6 in. heater. Each ignitor is enclosed in a section of brass pipe 1½ in. in diameter and 6 in. long that is screwed up into the lower part of a heater section. In each ignitor there is a hot-wire element which, when fed by a 6-volt battery, becomes red hot and thus ignites the gas. The flame spreads throughout the entire length of the 11 ft. 6 in. section, and from there on through the other two 11 ft. 6 in. section, so that all the burners are lighted. This action is aided by the flash tube which is an auxiliary unit consisting of ¼-in. pipe with numerous holes, and open ends, extending within the baffle plate for the entire 11 ft. 6 in. section, and the flame action from one section to the next goes through a short length of flexible conduit.



Cable potheads behind board

When the gas burns within the ignitor, a bi-metallic leaf is heated, and, as it expands, it opens a contact, thus opening the circuit to the hot-wire element. Also a back contact is closed which is used to send an indication to the office that the burner or burners are lighted. The hot-wire element in each ignitor takes 3.5 amp. at 6 volts for about 30 seconds, or until the gas flame opens the bi-metallic contact. The 6-volt d.c. energy for the two ignitors at each switch is fed by a special type of low-drain lead storage battery rated at 200 a.h. With one charge, it has capacity to operate the ignitors for a winter season. This is a lead type battery, type DD5 made by Willard.

When gas is being fed to the heaters, if a pipe or hose should break to allow a big leak, a device, known as an excess-flow valve is operated by increase of gas flow, thus shutting off the gas.

When the dispatcher is ready to cut off the switch heaters, he sends out a control on the traffic control system that operates the heater control relay to its normal position, thus releasing the coil of the electro-magnetic valve at the tanks which cuts off the supply of gas to the heaters, and the flame is thereby extinguished. As the heat subsides, the bi-metallic contacts in the ignitors cool, thus opening the back contacts which opens the heater indication relay to send an indicator to control office that burner or burners are normal and then closing of the front contacts returns the system to normal condition.

These switch heaters burn propane gas. At each switch this gas is stored in 24 steel cylinders 12 being in service and 12 for standby each containing 100 lb. of gas in liquid form under pressure.

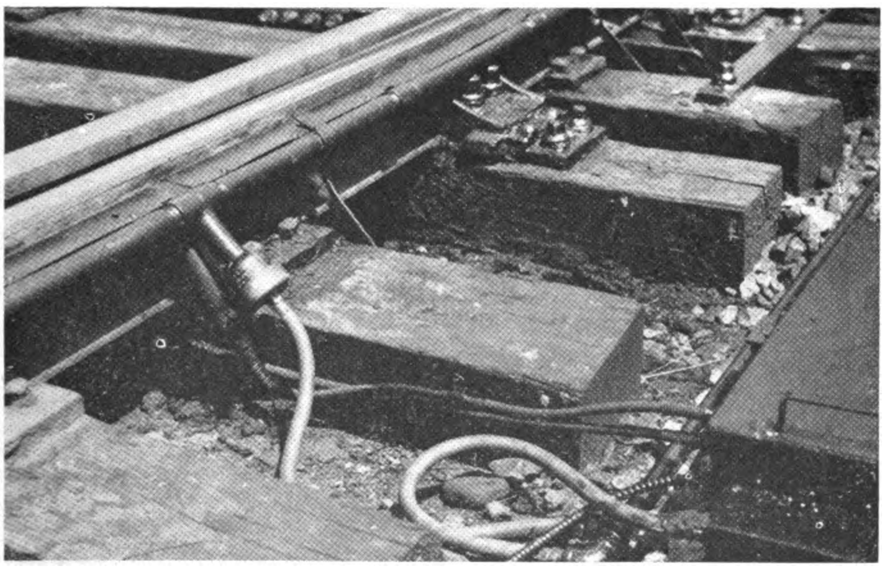
These cylinders have been set vertically on a wood platform adjacent to a pier for an overhead bridge. All the cylinders are connected to the feed pipe to the burners.

The tanks are filled with liquid to a maximum of 80 per cent capacity. The gas evaporates into the space above the liquid to build up pressure. When the dispatcher sends out a control to operate the heaters, the main valve is opened thus relieving pressure in the tank which causes the liquid to evaporate as gas. The burners at a switch consume about 11 lb. of gas per hour, which is at the rate of about $.605 per hour.

On all its lines the Erie now has a total of approximately 75 gas-fired snow melter switch heaters. The burning costs per hour vary somewhat depending upon type of propane gas supply, i.e. cylinder or bulk tank and prevailing propane gas prices in different localties.

The gas-fired switch heaters and lighter control equipment was furnished by the Rails Company, New Haven, Conn.

This traffic control system project was planned and constructed by signal forces of the Erie, under the direction of W. S. Storms, signal engineer, the major items of signaling equipment being furnished by the Union Switch & Signal Company.



Gas-fired heaters, controlled by dispatcher, melt snow at switches