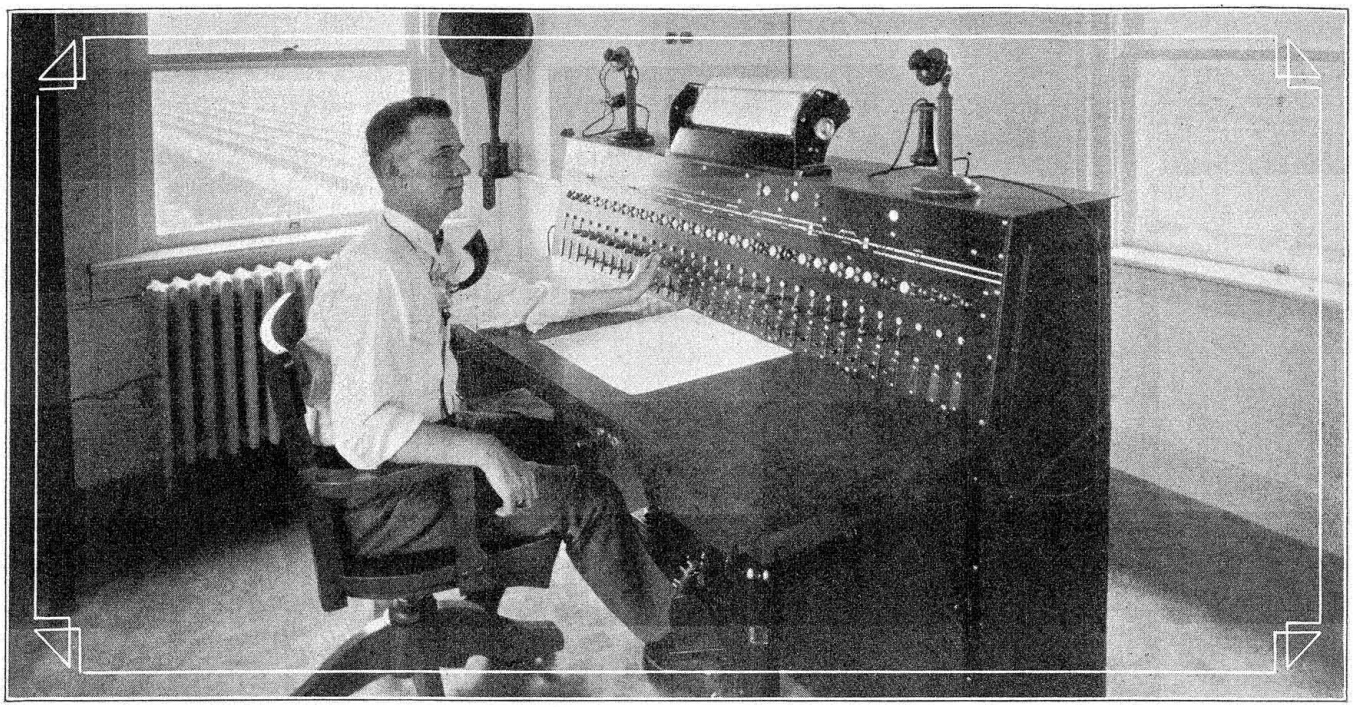


Fig. 1. Dispatching machine at Fostoria, Ohio, on the Ohio division, New York Central Lines

N. Y. C. First to Install Complete Train Dispatching System

Switches power operated and train movements directed by signal indication without written orders, system controlled by dispatcher

By B. J. Schwendt

Assistant Signal Engineer, New York Central Lines West and Ohio Central Lines, Cleveland, Ohio

ON July 25, a 40-mile heavy traffic section of road, consisting of 37 miles of single track and 3 miles of double track, between Toledo, Ohio, and Berwick on the Ohio Central Lines of the New York Central was placed under the direct control of a dispatcher who directs train movements entirely by signal indication. The new signal system supersedes the time table train order system which, with manual blocking, was in use. In this application it differs radically from the general practice in which a signal system is used merely for blocking, supplementing the time table train order system and in this particular case would have superseded manual blocking only. Through a dispatching machine located at Fostoria, Ohio, the dispatcher operates the siding and crossover switches and the block signals along the line, and receives complete information as to the location of all trains. Written train orders and rights by class and direction are abolished. One train has no official knowledge of the presence of other trains on the road, but the dispatcher establishes meeting and passing points as the immediate conditions require. The normal traffic includes 12 fast passenger trains and two local passenger trains per day and about 20 tonnage freight trains, including two local freights.

This installation on the New York Central is believed to be the first and only system complete in every respect for the dispatching of trains by signal indication. The system was designed and installed by the General Railway Signal Company, Rochester, N. Y., under the direction of Sedgwick N. Wight, commercial engineer for the signal company and the writer, assistant signal engineer for the railroad company.

The system and arrangement of signals and apparatus was designed after an intensive traffic survey and analysis was made. The analysis showed that until such time as the number of trains per day increased considerably that the single track layout with slight track changes, supplemented by the dispatching system herein described, would handle the traffic at lower annual cost than if handled by double track operation. In the present arrangement as traffic increases it is probable that existing passing sidings will be extended. When these track extensions meet, double track will be produced coincident with traffic requirements. The same signals and dispatch-

ing arrangement with few changes can then be used to handle the situation on such double track without additional passing sidings by operating each of the two tracks as a single track, one may always be used as a passing siding for the other between adjacent crossover points operated by the central dispatcher as now.

Block Signals and Power Switches

Block signals of the color-light type using standard aspects are located as shown by Fig. 2 and siding

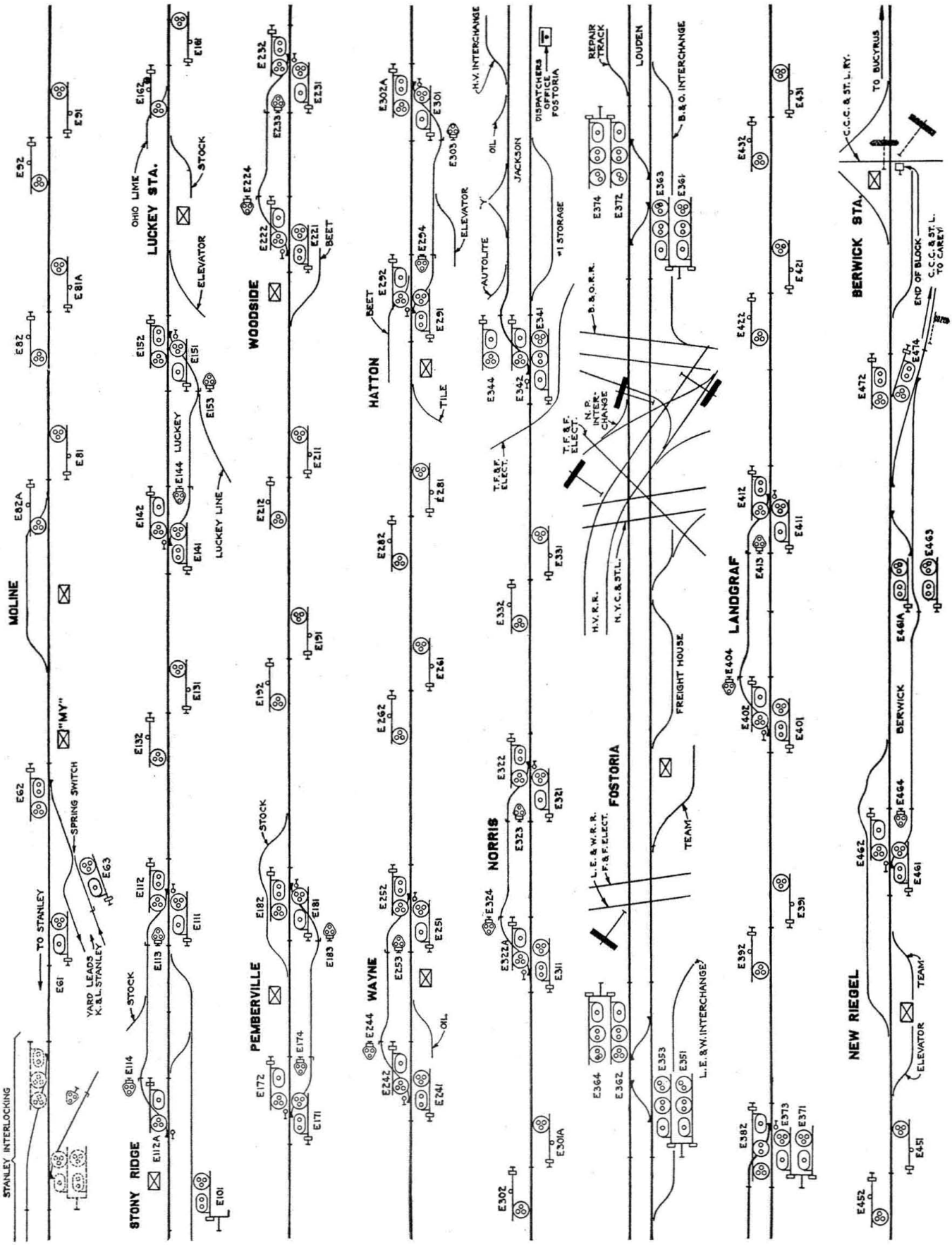


Fig. 2—Track and signal plan for entire installation from Stanley to Berwick

and crossover switches indicated are equipped with power-operated switch machines. The double track is signaled for the movement of traffic in either direction on both tracks, the absolute permissive block (APB) plan of automatic control being used on double as well as single track. This control automatically prevents opposing train movements from siding to siding or from crossover to crossover and permits trains to follow each other from signal to signal. In addition to the automatic control, the signals at the ends of siding and crossover switches

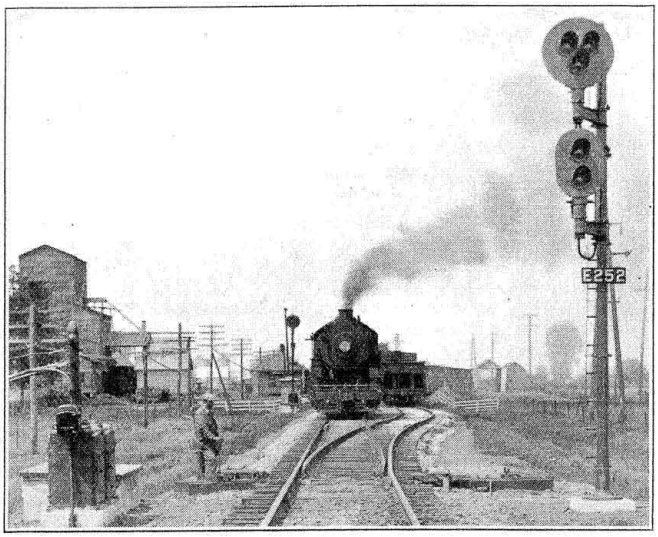


Fig. 3—Trainman operating dual control switch at Wayne

are subject to the control of the dispatcher. The switch machine and signals at the end of each siding or at the end of each crossover constitute a controlled group which is virtually a small interlocking plant controlled by a single lever in the dispatching machine. All opposing signals of each group are electrically interlocked against each other and the opposing signals of one group are electrically interlocked against the opposing signals of an adjacent group. Signal controls are selected through the switch machines so that switches must be in proper position before a proceed signal indication can be displayed. In other words, the controls are self-checking and the dispatcher, in controlling these groups, is only able to permit train movements to be made providing that conditions on the roadway are safe.

The installation includes 20 single-switch controlled groups, counting the double track connections and 6 crossover controlled groups on the double track line, making a total of 26 groups operated by 26 levers in the Fostoria dispatching machine.

Control from Fostoria

Although Fostoria is not centrally located on this 40-mile territory, it is the largest town and one with, perhaps, the best living conditions. It will be central if the signal system is extended so that there will be sufficient work to occupy the time of the dispatcher. Therefore, it was decided to locate the dispatcher there. The dispatching tower is a two story brick structure with basement, electrically lighted, with steam heat and modern plumbing. Figure 1 is an interior view on the second floor, showing the dispatcher at work in front of the dispatching machine. The close-up view of a section of the machine shows five features of importance, namely:

1. The **automatic recorder,** which is located on top of the dispatching cabinet and produces a graphic record of the movement of trains.
2. The **track diagram,** which visualizes for the dispatcher the entire territory, the location of trains and the position of the power-operated switches.
3. The **light indicators,** which show the dispatcher what is taking place on the line and the direction of traffic.
4. The **control levers,** which operate the switches and signals, one being required for each controlled layout. They also operate the minature switches on the track diagram.
5. The **key switch,** located directly under the control lever, which is used to cut-out the audible signal to an "OS" indication and also to prevent a signal from clearing the second time automatically if the dispatcher should wish to hold a following train.

The Manipulation of the Dispatching Machine

The dispatching machine automatically places before the dispatcher information as to the location of trains and gives him the means of controlling the movement of each train. Other information as to

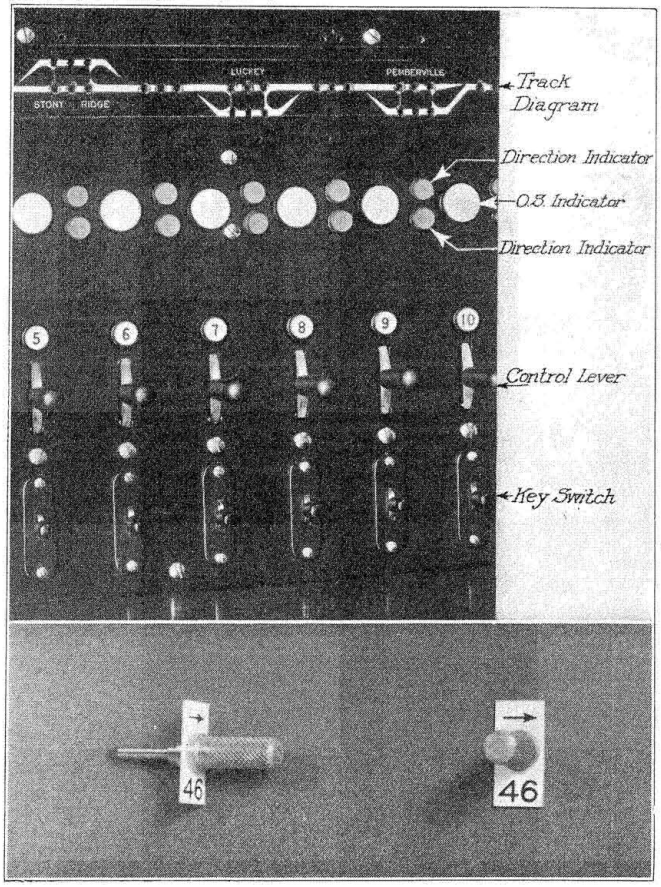


Fig. 5 (Above) Close-up of a section of control panel on dispatching machine

Fig. 6—(Below)—Train token for track diagram

train delays or the movement of local or work trains, or trains about to enter the controlled territory is brought in through the telephone system.

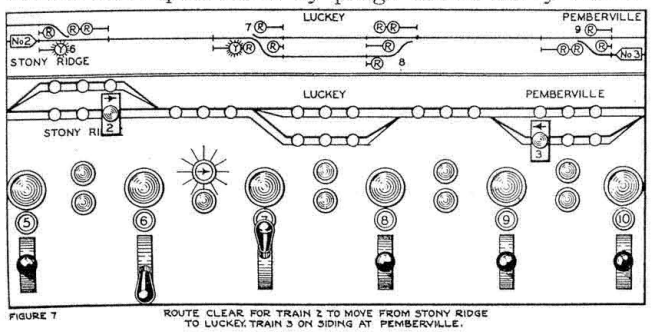
The control levers are arranged in a horizontal row and operate in three positions: central, upward and downward. These positions control the roadway equipment as follows:

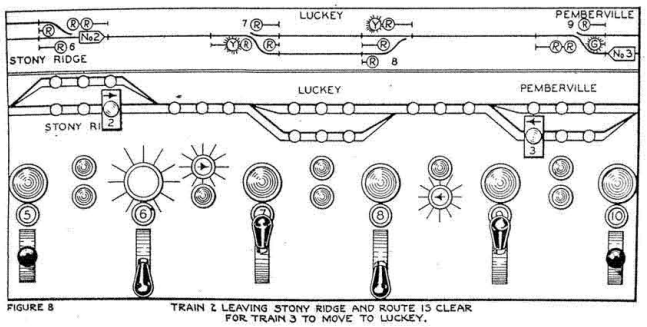
A lever in the central position causes the signals in the respective controlled group to assume the stop position, and the switch to remain in the position to which it was operated.

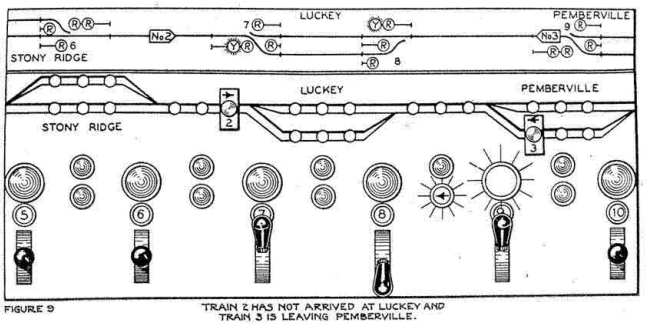
A lever in the upward position causes the switch to move to the position for the diverging route (if not already in that position) and permits the corresponding signals to give proceed or caution indications, if the respective blocks are not obstructed.

A lever in the downward position causes the switch to move to the position for the main track route (if not already in that position) and permits the corresponding signals to give proceed or caution indications, if the respective blocks are not obstructed.

The track diagram aids the dispatcher to visualize the road which he controls and provides a convenient means of keeping track of all train movements. Trains are represented by plugs which carry removable cards on which are indicated the train numbers and direction of movement. The plugs, called train tokens, are inserted in jacks or holes located along the track diagram. The train tokens are moved by the dispatcher as he receives information from the roadside by means of the light indicators which are located directly below each passing track switch on the control board and are known as "OS" indicators. An indicator lights when a train passes onto a short track section in which the passing track switch or crossover is located and remains lighted until the train clears this track section, provided the control lever is left in either the upward or downward position.







Figs. 7, 8 and 9—Illustrating train movements for a meet

The "OS" indicator also informs the dispatcher when the switch responds to the lever movement by giving a brief but distinct flash when the switch points open and by flashing again when the switch points close. To call the dispatcher's attention to something having happened which may require action on his part, a single stroke bell sounds wherever an "OS" indicator lights.

Key switches, located directly under the control levers, are used for two purposes: First, when thrown downward, a key switch cuts out the audible signal of the "OS" indicator above the lever; second, when thrown upward a key switch transforms the roadside signal into a "stick" signal and the "OS" indicator will remain lighted after the train has passed off of the track circuit, and until either the control lever is restored to the central position or the key switch is put back. By "stick" signal is meant a signal which will not clear after being put to stop by a train until the control lever is again operated. This "stick" feature is of value when the dispatcher wishes to let one train pass and stop a second train without further attention on his part; or when he is away from his desk for a period and wishes to pick up the location of trains quickly on his return.

Explanation of Operation for a Meet

Figures 7 to 12 inclusive show the manipulation of the dispatching machine and what takes place on the line as two trains approach and leave their meeting point.

Figure 7 shows train No. 2 on the main line between siding switches at Stony Ridge, train token 2 is similarly located on the track model, lever 6 is down and lever 7 up and the signals are clear for movement of train No. 2 into the siding at Luckey. Figure 7 also shows train No. 3 on the siding at Pemberville.

The dispatcher next operates lever 9 upward and lever 8 downward which lines up the switch at Pemberville and clears the signals for the movement of train No. 3 to Luckey, as shown in Fig. 8. In the meantime train No. 2 is leaving Stony Ridge, the dispatcher being informed of this by the illumination of "OS" indicator above lever 6.

The "OS" indicator above lever 6 then goes dark, indicating that train No. 2 has left Stony Ridge, he then advances token 2 to a location near the point from which he will receive his next "OS" from this train and restores lever 6 to normal, as shown in Fig. 9. Train No. 3 is leaving Pemberville, as shown by the "OS" indicator above lever 9.

When the "OS" indicator 9 goes dark, indicating that train No. 3 has cleared the siding at Pemberville, the dispatcher advances token 3 and restores lever 9 to normal, as shown by Fig. 10. Train No. 2 is now pulling into the siding at Luckey, as shown by "OS" indicator 7.

Train No. 2 is in the clear at Luckey, the dispatcher operates lever 7 downward and lever 6 downward which lines up the route for the movement of train No. 3 to Stony Ridge, as shown in Fig. 11. "OS" indicator 8 in now illuminated which indicates the arrival of train No. 3 at Luckey. When "OS" indicator 8 goes dark, the dispatcher advances token 3, moves lever 8 upward and lever 9 downward which lines up the route for the movement of train No. 2 from the siding at Luckey to Pemberville.

Special Features for Checking

If two trains had been moving in the same direction between Stony Ridge and Luckey at the same time, the token for the first one would have been located, as shown in Fig. 9, and that for the second train in the next jack to the left.

As the opposing signals are interlocked against each other the direction in which traffic can move is dependent upon the sequence of lever movements. For instance, when the dispatcher operated lever 6 and then lever 7, all signals cleared for a movement of train No. 2 from Stony Ridge to Luckey, as shown in Fig. 7. After train No. 2 had moved into the siding at Luckey, he operated lever 7 and then lever 6, which cleared all signals for a movement of train No. 3 from Luckey to Stony Ridge, as shown in Fig. 11.

In order that the dispatcher may know at all times the direction of traffic set up between any two adjacent controlled groups, direction indicators are provided. With the route set up for a movement from Stony Ridge to Luckey the top indicator between lever 6 and 7 displays an illuminated arrow pointing to the right, as shown in Fig. 7. With the route set up for a movement in the reverse direction, the bot-

tom indicator diplays an arrow pointing to the left, as shown in Fig. 11.

Another bit of helpful information for the dispatcher is given by the movable switch points on the track model which move when the control levers are moved to the upward or downward positions but do not move when the control levers are returned to the central position so that the last position to which any switch has been operated is always indicated.

It should be noted that the dispatcher is unable to

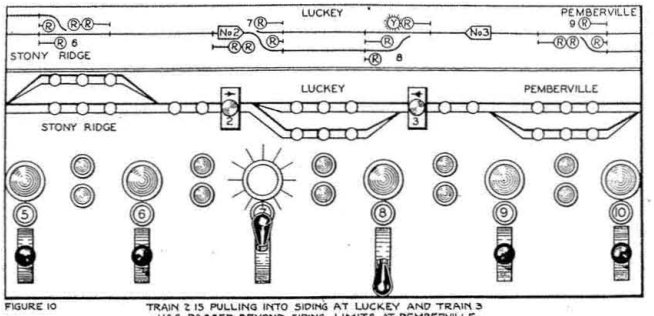


FIGURE 10 TRAIN 2 IS PULLING INTO SIDING AT LUCKEY AND TRAIN 3 HAS PASSED BEYOND SIDING LIMITS AT PEMBERVILLE.

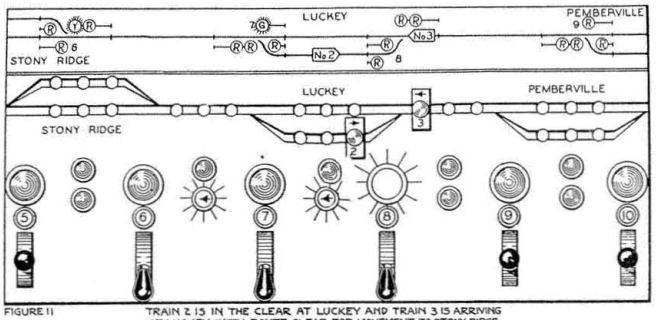


FIGURE 11 TRAIN 2 IS IN THE CLEAR AT LUCKEY AND TRAIN 3 IS ARRIVING AT LUCKEY WITH ROUTE CLEAR FOR MOVEMENT TO STONY RIDGE.

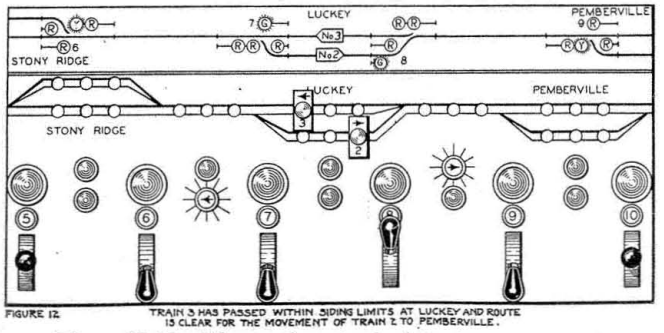


FIGURE 12 TRAIN 3 HAS PASSED WITHIN SIDING LIMITS AT LUCKEY AND ROUTE IS CLEAR FOR THE MOVEMENT OF TRAIN 2 TO PEMBERVILLE.

Figs. 10-12—Illustrating typical train movement

create an unsafe condition by the wrong manipulation of levers. He is only able to permit train movements to be made, provided conditions on the line are safe. In other words, each signal has a triple control, namely: 1—automatic control, 2—switch control—switches must be in proper position before the signal indication can be displayed, and 3—manual control—consent of dispatcher must be secured.

The graphic train sheet, automatically produced by the recorder, keeps before him a record of lapsed time of each train between adjacent "OS" points. Train numbers shown on the graphic sheet are written in by the dispatcher as the graphs are being made and serve as quick identifications.

It will, therefore, be seen that the dispatcher, by observing the information automatically placed before him and by operating these control levers, controls the movement of trains within his territory, and establishes his meeting and passing points accurately with the result that trains operate over his district in much less time than under the former system employing written train orders. Many interesting comparisons are occurring daily, one is here cited: Freight train No. 94 left Toledo at 9:30 p. m., July 25, and did not shut off the engine until it arrived at Fostoria, making two meets, taking siding in both instances, both trains keeping moving while making these meets. As a result of this prompt movement of No. 94, the crew was turned at Bucyrus for a return trip to Toledo, the loop mileage being 134.

It is recognized that a remotely controlled power operated switch is not well adapted to the switching of cars unless some convenient means of hand operation is provided. It is too slow for this kind of work and it is also difficult, if not impossible, to know when the switch should be thrown. The G.R.S. Dual-Control Selector, overcomes this difficulty by making it possible for the train crew under prescribed rules to operate switches by hand when switching is to be done. All of the 32 power operated switches from Stony Ridge to Berwick are so equipped.

Telephones for Switching and Work Trains

Telephones are not required in the regular dispatching of through movements of trains under this system except to announce to the dispatcher the ap-

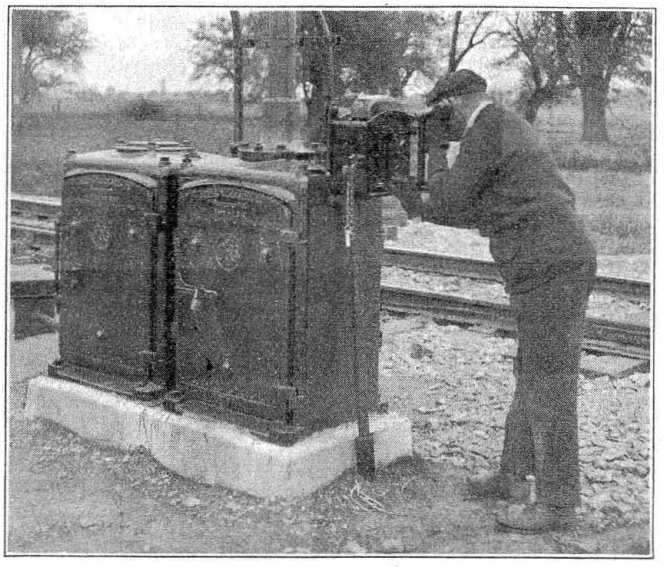


Fig. 4—Trainman calling dispatcher by roadside telephone

proach of such trains about to enter the territory and for the dispatcher to announce to other districts when trains will arrive from the controlled territory; they are also used for the handling of work trains, the switching of cars and for communication with train crews in case of emergency. Telephones connecting directly with the dispatcher's office are available at: (a) each passing siding switch, crossover or controlled group of switches and signals, (b) each switch (not located in a controlled group) where a train can or is likely to get in the clear, (c) each intermediate pair of signals, (d) each way station and (e) general yard master's office, at Stanley yard.

If it should be necessary for a train to do work between certain points, its crew obtains the consent of the dispatcher who designates the working and time limits and protects with stop signals. If a train should have occasion to do switching at the end of a passing siding, permission is obtained from the dispatcher. He gives over, as it were, for a specified time, the portion of the line required for the work and protects with stop signals. If a train should go into the clear at an outlying switch not controlled by the dispatcher, it does so with his knowledge and

consent and must not come out without his consent. Trains cannot enter the controlled territory without the dispatcher's consent. If they enter on the main track or other signaled track such consent is manifested by signal indication.

Instructions for Operation

Aside from a bulletin order making the new arrangement effective superseding manual block and train orders, modifying and superseding corresponding rules, etc., a booklet of instructions is used for the guidance and examination of enginemen and trainmen and all employees concerned. This booklet also contains the track and signal plan shown as Fig. 2.

Instructions for Operation of Trains Under Signal Dispatching System

Rules referred to by numbers are the Rules for the Government of the Operating Department, unless otherwise specified.

Definitions

Signal Dispatching System.—An automatic block system upon which is superimposed manual control of certain signals and switches, which manual control is exercised by the Train Dispatcher.

Lever Marker.—A card for attaching to lever of dispatching machine to serve as a reminder.

Dual Control Switch Mechanism.—A mechanism provided with a hand-throw lever and a selector lever so arranged that when selector lever is operated the control of switch will be transferred from the power operated switch machine to the hand-throw lever, or from the hand-throw lever to the power operated switch machine.

Dual Control Switch.—A switch equipped with a dual control switch mechanism.

Governing Signal.—The signal first in advance of a train governing its next movement.

Abbreviations

G. R. S.—General Railway Signal Co.

General

B-1. "General Signal Rules," "Automatic Block Rules" and "Interlocking Rules" govern where they apply.

Train Dispatchers

Train dispatcher, when giving permission to hand operate a dual control switch or when giving permission for a train or engine to occupy or foul the main track at a hand operated switch, must:

(a) Notify trainman as to the next train or engine approaching from each direction, giving engine numbers and locations.

(b) Notify trainman as to time during which train or engine may use switch or may foul the main track and designate working limits. The time limit may be extended on request of trainman if conditions permit.

(c) Place and leave in central position dispatching machine control levers governing movements over the designated working limits and attach red lever markers. While red lever markers are attached, levers must not be moved.

(d) Make record, on the prescribed form, of engine number; time granted; location of train or engine; time work is completed or main track is cleared.

(e) When trainman reports having finished using a hand operated switch and that switch is closed and locked or when trainman reports having finished using a dual control switch mechanism and that the selector lever has been restored to the "switch machine" position and is locked, the red lever markers on the control levers must be removed.

1004. In case of signal failure, or in emergency, train dispatcher may verbally authorize a train or engine to pass a stop signal and must:

(a) Secure information that points of dual control switches are in proper position and safe for movement.

(b) Check the permits issued to trains or engines granting permission to hand operate dual control switch, and those permitting the fouling of main track at hand operated switch to determine whether a conflicting movement is involved, and if so, protect it.

(c) Make record of the signal number and train or engine number.

(d) Authorize movement.

Enginemen and Trainmen

(a) To operate a dual control switch by hand, trainman must secure permission from the train dispatcher. When permission, including time and working limits, is granted, and when train or engine is on the siding or on the main track between switches of a siding, trainman must check indicator (where provided) adjacent to the switch; if green, he must immediately operate selector lever to the "hand-throw" position; if red, or if fails to indicate, trainman must not operate the selector lever, but must ask the train dispatcher for further instructions. When the time limit has expired or work is completed, the selector lever must be restored to the "switch machine" position, selector lever and hand-throw lever locked, and so reported to the train dispatcher; at the same time he must report the location of train or engine and the number of the governing signal.

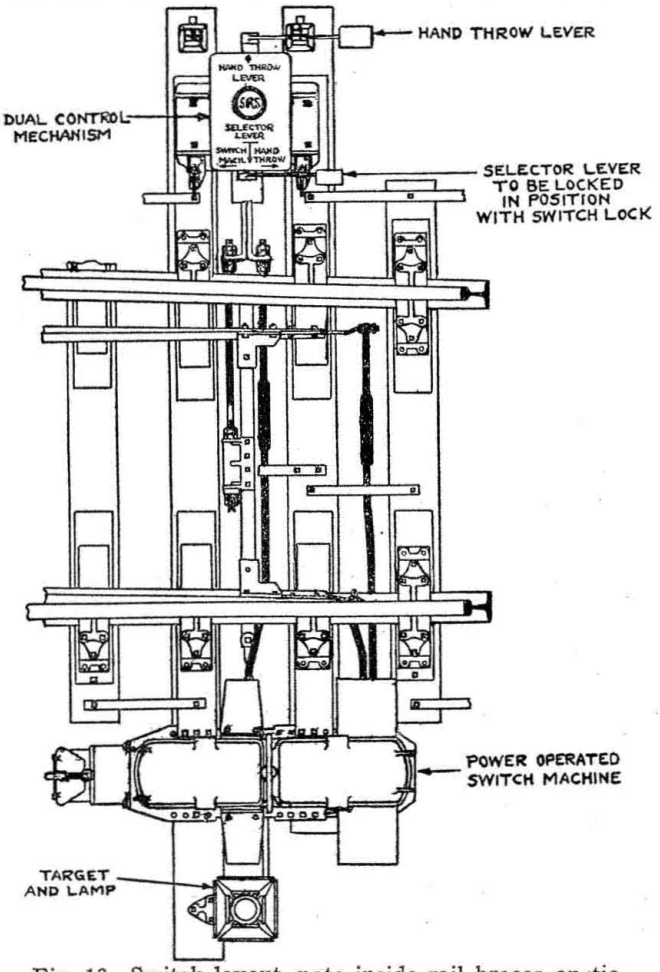


Fig. 13—Switch layout, note inside rail braces on tie ahead of switch

(b) When selector lever on dual control mechanism is placed in the "hand-throw" position all signals immediately adjacent to the switch governed, will indicate "Stop." Under these conditions the train or engine authorized to use switch may consider the indications of the adjacent signals suspended and make train movements over the switch as necessary during the time the selector lever is in the "hand-throw" position and locked.

(c) The permission granted by train dispatcher to a trainman to hand operate a dual control switch does not authorize any part of the train or engine to move beyond the designated limits even though the selector lever is operated as in instruction (a).

If and when movements beyond the designated limits are necessary during the time dual control switch is being hand operated, trainman must communicate with train dispatcher and be governed by his instructions.

(d) To hold the main track to do work or to operate main track hand-throw switch, trainman must secure permission from train dispatcher. When work is completed or train or engine is clear of main track or when time limit has expired and switch is closed and locked, trainman must so report to the train dispatcher. (This does not apply to passenger trains doing station work).

(e) If additional time is needed trainman must, before time limit has expired, report to the train dispatcher for instructions.

(f) If unusual delays occur, trainman must notify train dispatcher.

10-H. Lights on dual control switches will be lighted only when selector lever is in the hand-throw position.

1004. When governing signal indicates "Stop," and the cause for such signal indication is not apparent, conductor or engineman must notify train dispatcher at once; if cause is apparent and the signal continues to display the "Stop" indication for five minutes, he must report to the train dispatcher for instructions.

In case of signal failure, or in an emergency before passing "Stop" signal, conductor or engineman must secure permission from train dispatcher.

After receiving permission, train will proceed at once at slow speed to the next signal expecting to find train in block, broken rail, obstruction or switch not properly set.

If it becomes necessary for a train or engine to reverse movement, such movement must be made under flag protection to next "Stop" signal. If head end passes a stop signal and then reverse movement is made so that it is again in rear of signal, train dispatcher must be notified.

812. When about to make movements over a dual-control switch by the use of the hand-throw lever, trainman must notify engineman when the selector lever is in the "hand-throw" position and also notify engineman when it is returned to the "switch-machine" position, so that engineman will know when to be governed by fixed signals adjacent to the switch and when to be governed by hand signals, (fixed signal indication suspended).

Engineman must not accept hand signals as against fixed signals in making movements over a dual control switch unless the selector lever on dual-control switch has been placed in the "hand-throw" position, (indications of signals adjacent to switch suspended), or unless in an emergency, when engineman is fully informed as to the circumstances.

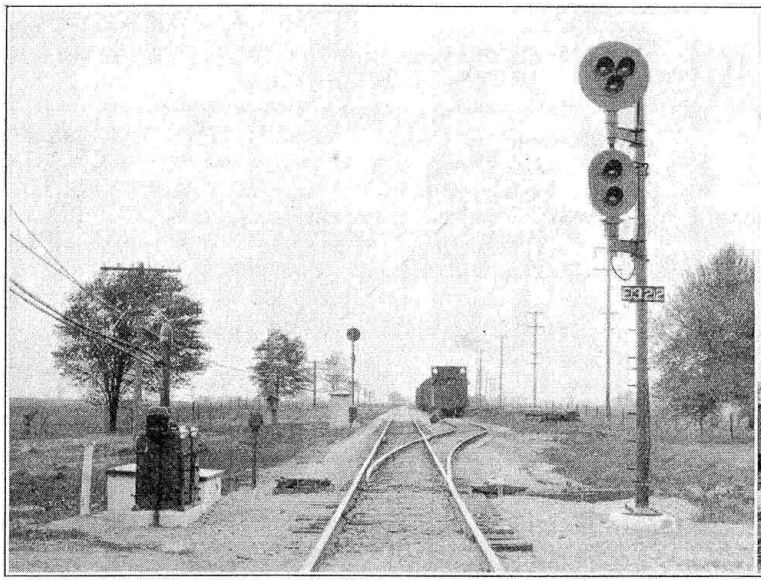


Fig. 14—Controlled siding location

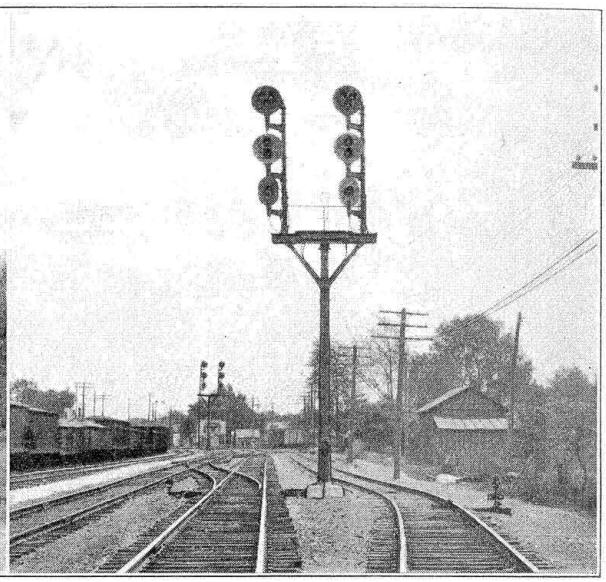


Fig. 15—Double track crossover location

Placing in Service

The new system was placed in service in one minute, at which time all trains in the district stopped, and then immediately proceeded in accordance with signal indication. It so happened that two trains were stopped. Within ten minutes after the hour and minute of service and in accordance with a prearranged schedule, the reports of all field men had been received by telephone indicating that all apparatus was in service as intended.

Protection against all usual failures, such as failure of communication due to broken line wires or pole lines blown down in storms, etc., failure of power operated switch to operate, failure by fire, etc., is built into the system to help insure continuity of service equal to the system replaced.

Benefits of New Dispatching System

The dispatching of trains over this section of track has been made highly efficient by the system, the track capacity is increased, running time cut down, safey of operation has been increased, and a material reduction in operating costs made including a reduction in overtime as on an average all freight trains were on overtime.

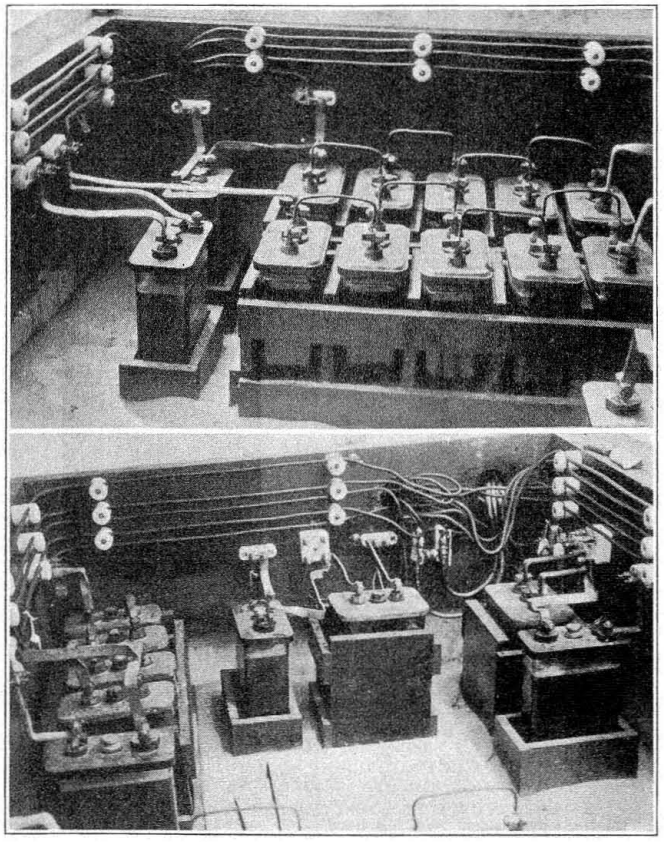
Some of the factors contributing to these improvements are as follows:

(a) Eliminates time loss due to stops and reduction in speed required for delivery of train orders.
(b) Eliminates about 90 No. 31 orders and 3,600 No. 19 orders per month.
(c) Eliminates two out of three stops when a train is taking siding.
(d) Trains are instructed what to do by signal indication which is displayed at the point where action is required.
(e) Meets and passes may be readily established or changed as the immediate conditions require.
(f) Accurate "OS" information.
(g) Intermediary operators are dispensed with.
(h) Elimination of delay caused by former superiority and clearance rules as well as much of the clearance time formerly required in making out schedules.
(i) Protection of train movements by automatic block signals thereby increasing safety.
(j) Increases facility by ability to operate more trains over the same track and by ability to get more productive hours from cars and locomotives, or the same traffic may be handled by less cars and locomotives.
(k) Gives work trains, local freights and yard engines full information and protection.
(l) Makes unnecessary any delay to road movements account rule No. 93 (yard limits).
(m) The automatic recorder shows dispatcher the time elapsed before train starts moving from siding after signal is displayed.
(n) Eliminates delays account train crews figuring their rights.
(o) The graphic train sheet shows unusual delays at a glance and is readable by others than those skilled in dispatching.
(p) Relieves load on dispatcher allowing him to apply himself fully.
(q) Makes possible loop runs (allowing a crew to be home each night) thus reducing the cost of operation as compared with two singles runs of less than 100 miles, in a greater span of time.

Increased Safety

Aside from all the usual safety features preculiar to automatic block signals, and interlocking, this system within an hour after being placed in service demonstrated a new one. It occurred as follows: Freight train No. 233 south with approximately 80 cars passed the Fostoria dispatcher's office on the east main. It was observed that there was a car off center in about the middle of this train, the front trucks being driven back to about the middle of the

car. The route had already been lined up for the through movement. The dispatcher restored the signal in advance of the train to the stop position, stopping the train at the end of double track. A member of the crew immediately came to the phone at the stop signal in accordance with instructions and was told of the trouble by the dispatcher. The defective car was cut out. Under the old arrangement it would have been impossible to notify this crew until the next office was reached, approximately four miles away. It is quite probable that the front end of the defective car would have dropped down to the track



Above Fig. 16—Rectifier cells and switch battery
Below Fig. 17—Rectifier and track battery

before reaching that point, thus causing a serious accident.

A switch lamp with day discs amounted on target stand is used at each dual control switch. However, the lamp is lighted only when dual control switch is being hand operated. When operated by the switch machine, the signals tell the story.

The Power Supply

The a-c. floating system is used for the power supply for the dispatching system including the dispatching control circuits, the APB circuits, the signal and the switch machine operation. Two No. 6 weatherproof solid hard-drawn copper wires strung on the two track pins of the lower (10-pin) arm, are used to carry the 440-volt a-c. power circuit. Power is purchased at four points in the 40 mile territory so that the longest feed circuit is only about 8 miles.

Taps from this circuit are taken in a separately made up cable to Brach No. 25 arresters and then to a Westinghouse insulated enclosed snap-switch, then to fuses and to the transformer with secondary taps at proper ratings for the lights and the Balkite rectifiers that charge the operating and track battery. One rectifier cell is provided for charging each track battery.

At a switch location a 10-cell battery is provided for the operation of the switch. This battery is split in two sets of five cells each for charging, a Balkite cell being used for each set. A four cell storage battry is used for signal operation and line control circuits, separate battery for each signal.

The signal lights are 10-volt, 18 watt, 2-filament type for high signals and 10-volt, 10-watt for dwarf signals. The light circuit feed is normally from an 8-volt tap on the transformer but if the 440-feed is cut off the cut-over relay switches the light feed circuit to the 8-volt storage battery. Storage battery capacities are as follows: for approach lighted signals, 75 a.h.; for continuous lighted signals, 125 a.h.; for track, 75 a.h.; for switch machine, 75 a.h.

A tell-tale arrangement is provided in one station on each feed section. This arrangement includes a line transformer and a normally energized a-c. relay with a local circuit including a buzzer and set of dry cells controlled through the back contact of the a-c. relay. When the power goes off the relay drops and the buzzer sounds. The agent may turn it off but then it will again start ringing when the power comes on; thus the arrangement gives complete information.

One cell of lead storage battery is used for each track circuit. Track sections vary from 300 ft. to 6,200 ft. in length, rock ballast being used. Separate track

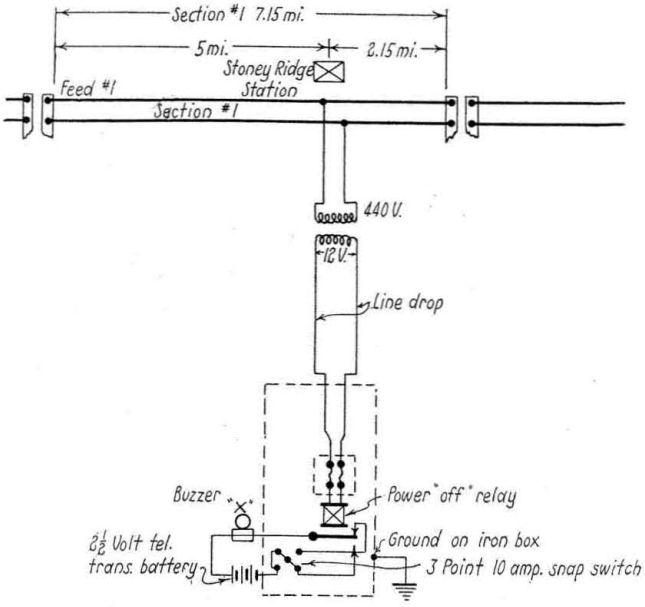


Fig. 18—Circuits for power-off tell-tale

circuits with 12-ohm relays are used on turnouts and crossovers, 4-ohm relays being used for all other track circuits. Wall type relays are used throughout. Trap circuits are used across dead sections in railroad crossings through Fostoria.

In addition to the usual APB circuits, only one line control wire is required for the train dispatching system from the dispatcher's machine to each switch group as outlined previously. In order to eliminate as far as possible all line trouble these control circuits are run in rubber insulated cable which is covered with two wrappings of steel tape (0.40 in. thick) so as to be practically bullet proof from shots of hunters or malicious persons. Number 14 solid wire is used in these cables for the control circuits and No. 10 for the common. This cable was painted one

DATE July 25 1927

CHIEF DISPATCHER J. D. Poland

DISPATCHERS ON DUTY (Ohio Div.) F. R. Colgrove FROM 7 A.M. TO 3 P.M.
J. H. Sharkey FROM 3 P.M. TO 11 P.M.
D. K. Robinson FROM 11 P.M. TO 7 A.M.

N. Y. C. R. R. Co.
OHIO DIVISION

RECORD OF WEATHER

	6 A.M.	12 NOON	6 P.M.	12 MIDNIGHT
Toledo	—	Clear 75		65+ Cloudy
Fostoria	—	"		

	TRAIN NO.	ENGINE NO.	CONDUCTOR	ENGINE MAN	CALL	TIME ON DUTY: TRAIN CREW	TIME ON DUTY: ENGINE CREW	DEPARTURE	LOADS	EMPTIES	GROSS TONS	ADJ. TONS	ARRIVAL	REMARKS
SOUTHWARD TRAINS	84	9662	Peters	Korn	815a	745a	730a	902 a.m.	7	8	440	–	406p	
	Loc	233	Malone	Insley	815a	735a	730a						1238P	
	x 24	4751	—	—	—	—	—	—	—	—	—	—	—	By Bc 922a
	44	6510	Costello	Conover	950a	920a	935a						1137a	
	46	6443 6511	Doyle	Butcher Finnegan	145P								258	
	94	9739	McClain	Stewart	930p	900p	830p	930p	21	1	806	1206	1235 1235	28 Eng 1 am B+O 70 Sty E+H 61a (Grade Crossing)
NORTHWARD TRAINS														
		218	Greer	Lloyd	8 15a	815a	815	–						
	83	5682	McKelvy	Elder	745a	715a	715	–					503P	
	45	6495	Welch	Downo	120P	1125a	1125a	7						
		9739	Johnson	Mader	1230	1200P	1150a	210P	100	0	7452	9452	520P	
		218	Greer	Lloyd	815a	815a	815a	–	80	4	5728		555	Com
		151	Flanigan	Lubick	12m	12m	1200M	625P	81	0	5780	6995	907P	Lake
		236	Regan	Anderson	1245P	1245P	1245P	640P	81	1	5746	6976	940P	
		230	Smith	Conner	430P	430P	430P	930P	84	1	5791	7071	1154P	
		9741	Boyer	Mendel	230P	200P	100P	44P	96	4	7479	9478	823	
	47	6467	Hinn	Collier	535P	1245	405	545P					638P	10 c
		23	4752	Mulligan	Leonard	420P			534P				702P	Landgraf 12M Sty for 47 to pass
	60	6102	Underwood	Franck	545P	545P	545P	830	27	2	1210	1605	1000P	
		215	Pearson	Young	630P	630P	630P	1130P	86	0	5768	7076	—	Conn Sw 2 Lake (Unreported)
		217	Harris	Streit	730P	730P	730P	—	89	0	—	—	—	Ml 89/0
		9740			1145P			—					—	
		220	Chapman	Klesing	1015P			—	80	0				Gd E Lake

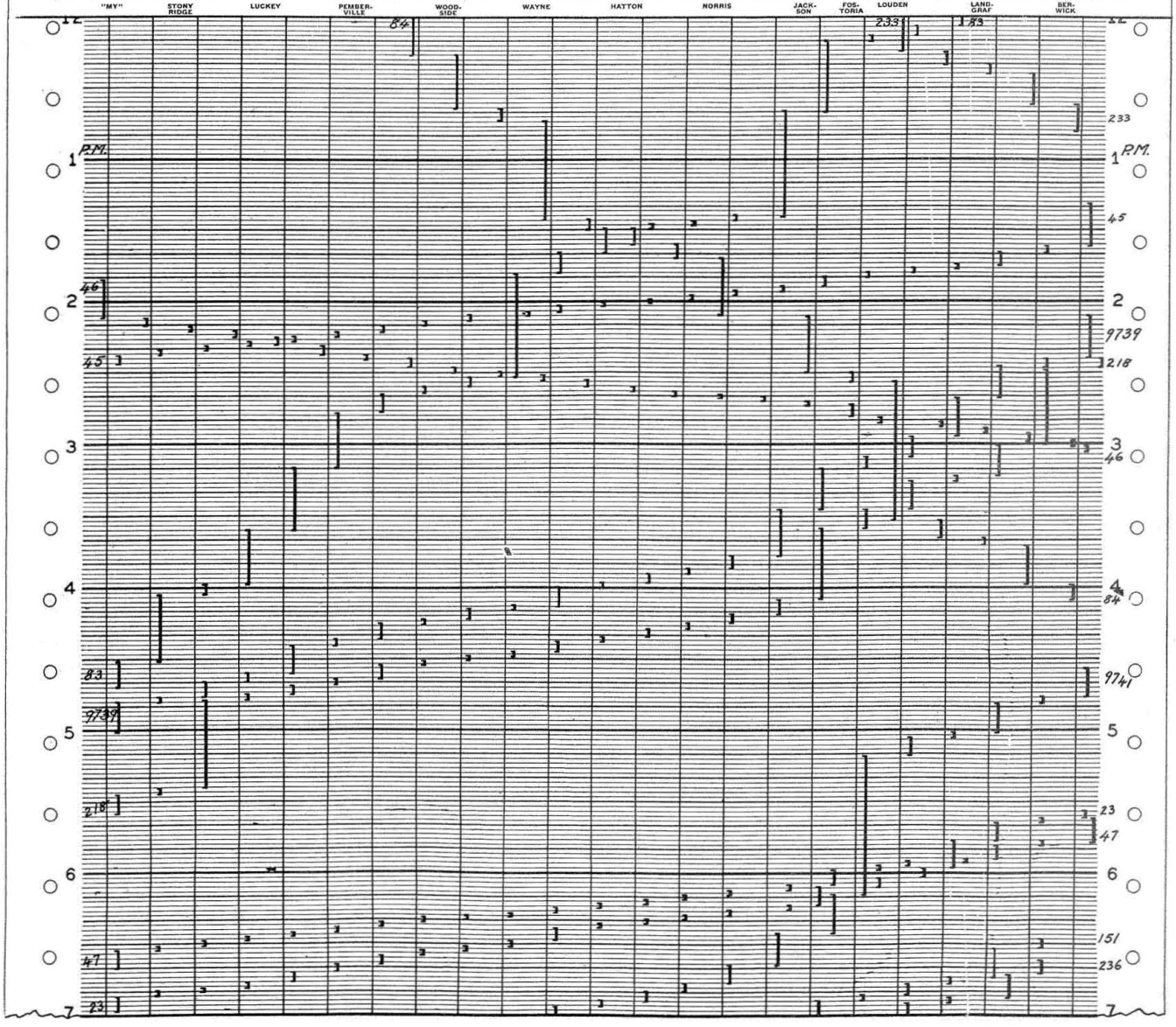


Fig. 19—Section of graphic train sheet, with heading, for July 25, 1927

coat of Mitchell Rand Company's "EB" paint and one coat of railroad company's formula "F" paint. The advantages leading to the decision to use armored cable were as follows: 1—lightning protection, 2—freedom from wire breaks which would cripple the system in event of line failure, 3—protection from gun shot and miscellaneous crosses, 4—continuous working even when pole line is torn down by storms.

The cable is supported from a stranded messenger by cable rings spaced 12 in. apart. The messenger is made of seven strands of galvanized iron wire except in yards or other smoke infested territory where copperweld stranded wire is used for both messenger and rings. This messenger is supported from ordinary cable brackets attached beneath the lower cross arm on the pole line.

Line poles at signal locations are guyed four ways to insure against breaks in line drops to signals should the pole line come down for any reason such as storms. The pole line carrying the cable is also strengthened at road crossings to give adequate protection against poles coming down in storms with the result that highway traffic would be tempted to cut through the wire obstruction and thus put the system out of commission. Standard guying is used at all track crossings and storm guying is provided in accordance with standards of the telegraph department.

At each signal this cable is brought down from the pole line (See Fig. 14) to the signal case from each direction and taps terminated on spark gap arresters. Conductors not terminating or tapped are cut on through without arresters, but test terminals are provided at each passing siding. This not only eliminates pole line taps, arrester or terminal boxes on the pole, but centralizes everything in the relay case for test purposes. As shown in the view the cable is brought down through the cable outlet in the top of the case and a Crouse-Hinds fitting is provided to hold the ends of the steel tape and to form a watertight joint. Caulking compound is used. All line work including the erecting of cables and wires, also the work of placing telephones, etc., was done by the railroad telegraph-telephone department under direction of R. F. Finley, superintendent of telegraph.

No Trunking Used

Parkway cable is used for all circuits running under ground, all of the conductors being flexible copper wire, No. 8 being used for the light circuits from the relay box to the signal on the opposite side of the track, No. 8 for the track connections, No. 6 for the switch operating circuits and No. 14 for control circuits from the relay box to the switch circuit controllers.

When making the concrete foundations, a space is left at the top for a slack box and holes extend from this box diagonally to a point about a foot below the ground line through which the parkway cable is brought in. At switch machines and switch circuit controllers the parkway cable comes up out of the ground at a long slant as shown in one of the views.

At the ground line all parkway passes through a two foot length of 3 in. cast iron soil pipe. These pipes are poured full of petroleum asphaltum, RSA specifications, to seal out water and deterioration. The purpose of this pipe is to protect the cable at the ground line where the changes in temperature and moisture are most apt to affect the cable. Parkway cable is also used for telephone line drops as described later on.

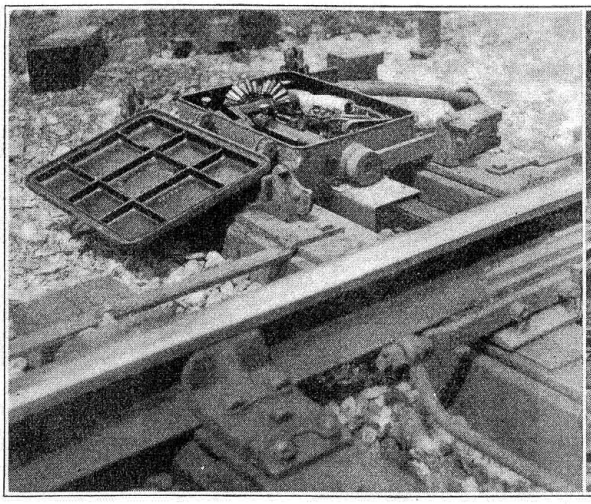


Fig. 20—Dual control selector

Fig. 21—Power switch machine layout

At a switch circuit controller the cable comes out of the ground in the same manner and a special type of outlet on the box is provided which permits a slight movement between the portion clamping the cable and the main part of the box. This type of construction, both at switch machines and switch boxes, allows 2½ or 3 ft. of cable between the end of the pipe and the box to dissipate the motion of the ties with reference to the ballast.

At the rail, the parkway cable is brought up through a bootleg and carried along the rail where the flexible cable wires are joined and soldered to the wire bonded into the rail. A piece of hose is taped onto and over the joint and a wire loop passing around the section of hose is bonded into the rail to hold the bootleg in place. This construction allows two feet or more of the cable between the loop and the top of the pot-head to take up the motion between the rail and the ballast. The pot-head is made of a piece of 2 in. galvanized iron pipe set in concrete.

The parkway cable is brought up through the holes in the signal foundation to the slack box which is sunk below the top of the foundation. Here the outer covering steel pipe jute, etc., is taken off and the ends of this covering are taped up and covered with P & B, the insulated conductor being carried on up to an arrester or terminal as the case may be. Parkway is also run up bracket poles to a clamp at the bottom of the signal head thus terminating in the signal case without a break or splice. This arrangement is also

used on ground signals on the side of track away from pole line. Parkway is also used to connect up electric lights on target stands at switches.

Case Wiring

Relay rack construction is used in wood lined cases. Solid No. 14 insulated wire is used from terminals and arresters and is run up the center of the

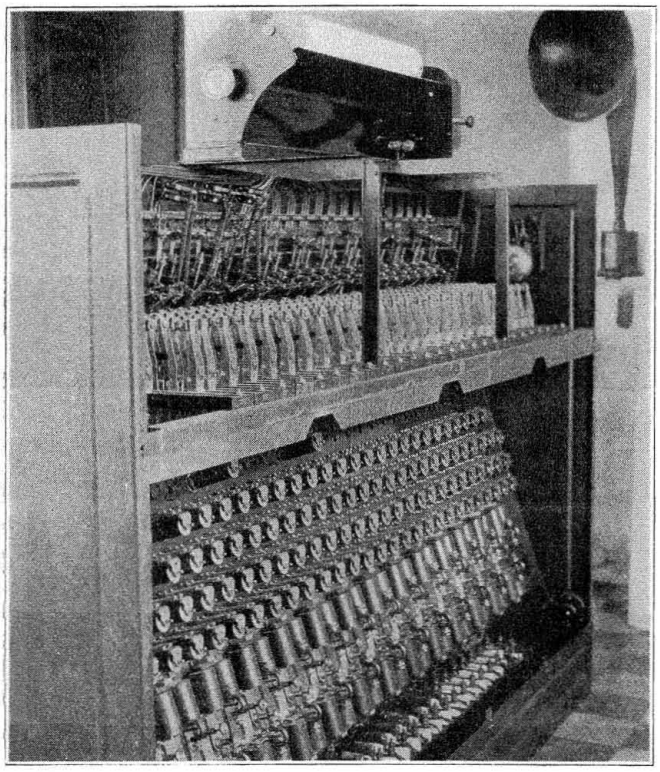


Fig. 22—View of rear of dispatchers machine with cover removed

case and through holes provided in the boards on which the shelf type relays are spring mounted. In the picture shown of the relay case, the device mounted between the two relays in the top row is a new current limiting device. In event a switch is blocked this device will cut off the current after 90 sec. so as to prevent exhaustion of the battery. The fact that a switch does not complete its stroke would be indicated at once to the dispatcher who could call the maintainer or section forces and in the meantime the signals surrounding the switch would indicate stop. Should a train arrive in the meantime it would get stopped and crew would remove the obstruction. This done, the operation of selector lever on the dual control restores the special relay and all is normal again.

Communication Circuits

In order that train crews or others including maintainers as required may talk to the dispatcher at any time, mine type Western Electric Company telephones are located at all signals except that a booth phone is used at the clearance point of each end of each passing siding as above described. A telephone circuit of two No. 8 hard drawn copper wires was strung on the two pins on the field end of the new cross arm (10-pin signal arm in the lower gain). In order to prevent trouble from scrap pieces of wire thrown on the line, tree shorts, etc., or line wires on the ground, weatherproof wire was used. This circuit is normally connected to the loud speaker in the dispatcher's office and any of the phones at the signals or booths may be connected to this circuit by a cordless pin jack at the phone. As an additional protection for communication two other phone circuits are also made available by a pin jack at each phone, one of these being the through division dispatching phone circuit and another the messenger phone circuit both of which are in use as a phantom. The phones at the signals and booths can be plugged into any one of these three circuits by changing the jack plug at the phone itself; therefore, if a trainman finds the normal circuit (Fostoria Dispatcher) dead he can switch to one of the others and still get the dispatcher.

Special construction is provided to bring these telephone wires from the pole to the phone. Line taps are taken into a regular wooden pole junction box

Fig. 23—Interior of typical relay case at switch location

where protectors are housed. From these protectors the circuits are taken in a 10 conductor armored parkway cable without lead, down the pole, under ground and up to the bottom of the phone. The conductors in this cable are No. 13 solid copper. Conductors (5 pairs) are formed into two quads and an extra pair. The dispatcher uses a universal calling key to ring any station desired on his line. The dispatcher can ring both terminal stations—at which trains arrive and depart from dispatcher's territory. He can also ring the targetmen at several crossings in Fostoria.

The construction of the dispatching system, including the signal and interlocking equipment, was handled by the General Railway Signal Company under the immediate supervision of Oscar Falkenstein, supervisor of signals, Ohio Central Lines, of New York Central.