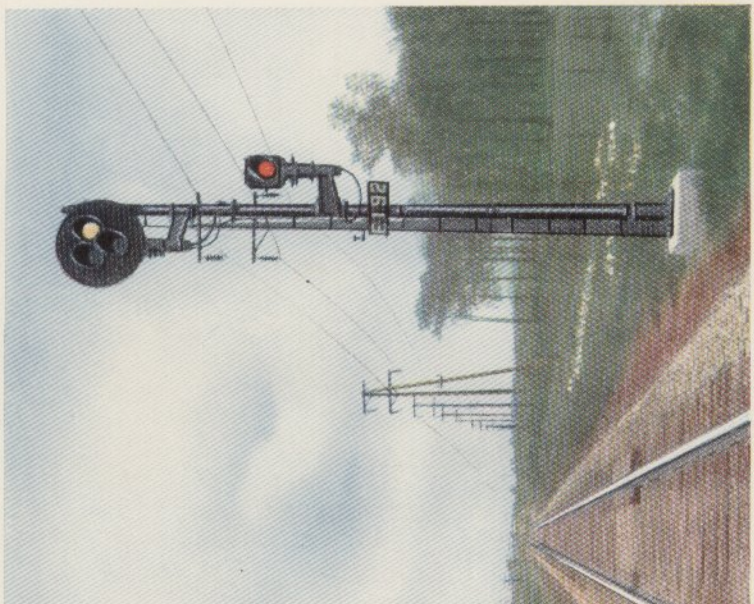
Centralized Traffic Control

GRS

CENTRALIZED

TRAFFIC CONTROL



CENTRALIZED TRAFFIC CONTROL

By

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COMMERCIAL ENGINEER

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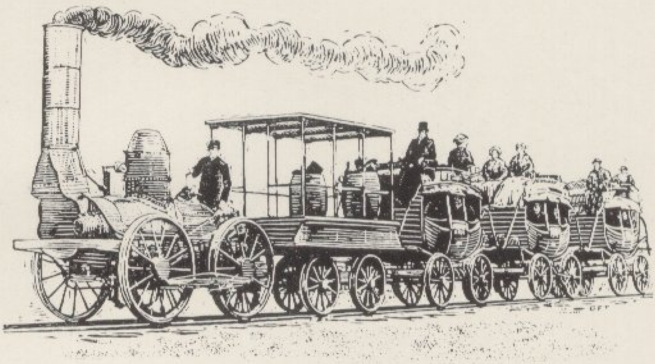
GENERAL RAILWAY SIGNAL COMPANY
ROCHESTER, NEW YORK

ACKNOWLEDGMENT

Indebtedness is acknowledged to those able railway officers, and especially to Mr. B. J. Schwendt of the New York Central Lines, who have given us valuable information as to the essential operating requirements of such a system.

Printed in U. S. A.



Looking Backward

THE first railroad problem was, naturally, not one involving train rights or train interference. It was a problem of mechanical design—motive power, rolling stock and tracks. Train rights, however, became a subject for consideration as soon as there was more than one train on a division of road at the same time. The next logical step was to inaugurate a train schedule, which gave each train definite rights, and which had to be respected by all other trains. The schedule alone served its purpose for a time; but as the number of trains increased, as did also the length of runs, it became inadequate. It was not flexible. One train running behind its schedule caused unnecessary delay to other trains. The answer came in the form of the Morse telegraph which led the way to the telegraphic train dispatching system now in quite general

FIGURE I BALL POLE SIGNAL USED IN THE EARLY DAYS OF RAILROADING. THIS TYPE OF SIGNAL IS RESPONSIBLE FOR THE EXPRESSION "GIVE 'M A HIGH BALL" use in this country. This made possible a certain degree of centralized control of traffic by a dispatcher, who could nullify the train schedule, or a part of it, whenever conditions required; or he could establish new temporary schedules. These fiats from the dispatcher were given out in the form of train orders, which were in reality telegrams copied on prescribed forms and delivered to the parties concerned. It was necessary, of course, that a copy of each order be delivered to each train that might be affected by it.

Improvements have been made in telegraphic train dispatching as new and more complex conditions have developed in train operation. The employment of the principle of *rights by class* and *rights by direction* has lessened the work of the dispatcher, by enabling the train crews to dispatch themselves to a greater extent. Possibly, the most noteworthy improvement has been in the technique of issuing and acknowledging orders. The general use of the telephone instead of the Morse telegraph has been a distinct advantage. The automatic block signal system has greatly increased the safety of operation in that it checks the dispatching and protects against other hazards which are not detected by any other expedient. Furthermore, the automatic block signal system has materially increased the speed of operation—following trains can move under closer headway and the technique of the order system can be simplified somewhat and yet attain a high degree of safety.

Much credit is due the "man at the key" for what he has accomplished with the means at his disposal. The system is deficient in that it does not afford a direct

FIGURE 2. TRAIN ORDER SIGNAL USED IN TELEGRAPHIC DISPATCHING

and complete centralized control of traffic, and does not give adequate information to the central station as to what is taking place on the roadway.

Some advantages have accrued from the placing of men at more frequent intervals along the roadway. Particularly has traffic delay been reduced where these men are located in interlocking towers and serve two purposes, one as the intermediary between the dispatcher and the train and the other as the towerman to operate switches and signals. However, this is indirect control and is usually excessively expensive both as to first cost and operation.

It seems reasonable to conclude that the old telegraphic train dispatching system has reached its zenith, with the present day demanding more. We now stand at the threshold of complete centralized control.

The Problem

THE accomplishment of centralized control is not new, but, until recently, it has been applied only to relatively small areas. However, it has proved its value and efficiency, even under the most intense operating conditions. Grand Central Terminal, New York City, with its huge electric interlocking system is a striking example of centralized control.

Then why has the area of centralized control not been greatly extended before now? Not because it is undesirable. The answer is apparent—cost. We simply have not known how to do it, until recently, without using a prohibitive amount of wire and apparatus. The inherent inertia of the human mind, even though it has a distinctly valuable balancing effect on our lives, holds us back at times and keeps us from progressing into new fields. We have been thinking in terms of interlocking—interlocking as we have known it from its early beginning.

Interlocking is centralized control, and the centralized control, which we are discussing, must be some form of interlocking; but not necessarily the same form as we have known heretofore. Interlocking was at first mechanical and covered very small areas. To insure co-ordination of the functions, locking was inserted between the controlling levers—an obvious means. Later means were provided to insure co-ordination between the lever and its respective function—indication locking. This was going up one leg of a triangle and down the other instead of following the base line. Why not co-ordinate from unit to unit rather than from unit to lever and then from lever to unit?

Moreover, provision must be made to inform the operator at the control station as to what is taking place on the roadway. All this must be accomplished in an efficient and economical manner, as these extended areas involve considerable distance.

This, then, is the problem.

The Solution

REALIZING the need of a direct and economical method of controlling traffic over extended areas, the engineers of this company have been working on the problem intensively. Operating-men as well as signal-men have been consulted; schemes have been tried out and then abandoned if they did not fully prove their worth; while principles have been subjected to the acid test to determine if they could be made to react a little differently for us.

A practical solution has resulted from this intensive work and it now gives the General Railway Signal Company unusual pleasure to offer a system which has passed well beyond the laboratory or experimental stage, a system that is not only safe and dependable but also economical.

An installation of the G-R-S Dispatching System, giving direct and complete centralized traffic control, is now in successful operation on the Ohio Division of the New York Central Lines. It extends from Moline Yard (Toledo) to Berwick, Ohio, and consists of 37 miles of single track and three miles of double track.

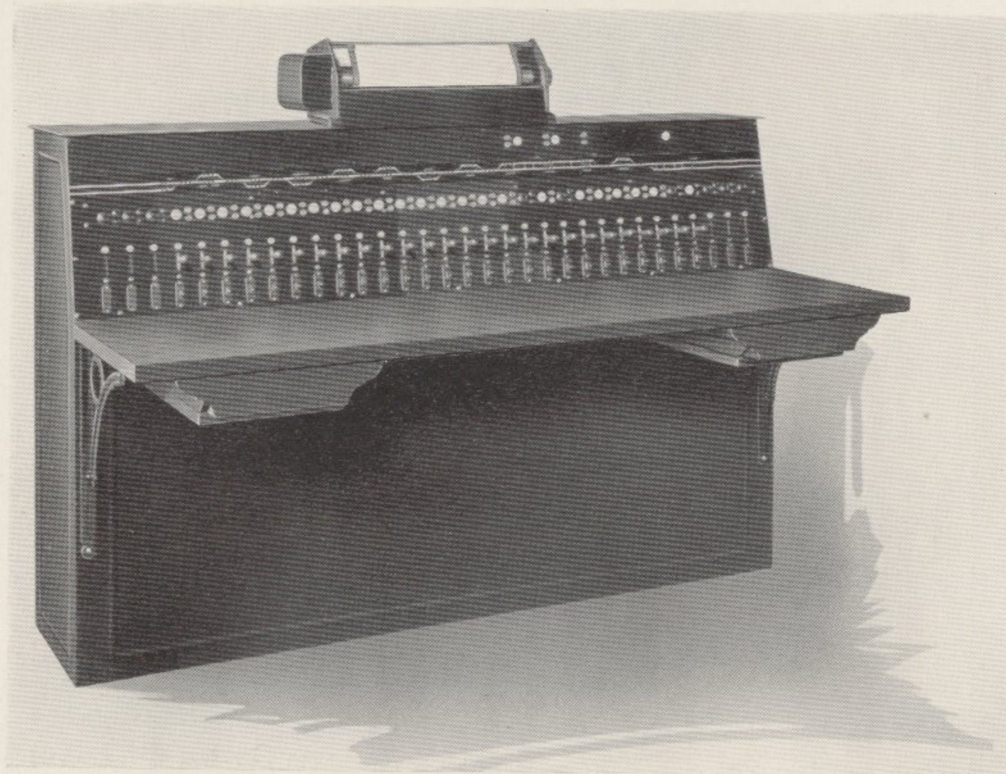


FIGURE 3 G-R-S TRAIN DISPATCHING MACHINE

The System employs modern automatic block signals for the spacing and protection of train movements, power switch machines for the operation of switches and a control machine located at Fostoria which provides a means of controlling the switches and signals. The control machine also gives the dispatcher information as to when each train passes over certain points—"OS" points. Thus, without the use of intermediary men or train orders, one man controls the movement of traffic on this 40-mile section.

The installation is of special interest, not only because it exemplifies an entirely new accomplishment through the use of implements which have by years of service established their dependability and value, but also because the territory covered presents some very interesting problems. The traffic is heavy—twelve fast passenger trains per day and upward of twenty freight trains. The physical conditions over a part of the line are practically normal, while over another portion they are quite special. The installation, therefore, serves most admirably to demonstrate the adaptability of the system.

FIGURE 4 NORTH END OF PASSING TRACK AT WAYNE

Application to Single Track

THE application of the system to single track with single passing sidings is illustrated in *Figure* 5. One lever in the dispatching machine controls the operation of the switch and signals at one end of a siding.

FIGURE 5 SINGLE SIDING ON SINGLE TRACK, SWITCHES POWER OPERATED

Opposing signals throughout are interlocked against each other, as:—

When signal 10 is clear, signal 13 must indicate stop:
When signal 12 or 12A is clear, signals 15, 17 and 17A must indicate stop:
When signal 17 or 17A is clear, signals 14, 12 and 12A must indicate stop:
When signal 13 is clear, signal 10 must indicate stop: and each controlled group is interlocked within itself, as:—
To clear signal 13, switch 2 must be normal:
To clear signal 13A, switch 2 must be reverse:
To clear signal 12, switch 2 must be normal:
To clear signal 12A, switch 2 must be reverse.

It will be seen, therefore, that each controlled group becomes a small interlocking plant and that adjacent groups are interlocked with each other.

FIGURE 6   TRAINS MEETING AT WOODSIDE

Intermediate signals, those between sidings, are not required for the protection of opposing train movements since this protection is fully cared for by the interlocking of opposing signals, as already described. They are used only to secure a closer spacing of following trains. When used, they and other signals have the well known A.P.B. control which is directional so that each signal controls to the next one ahead for trains moving in the same direction, exactly as in double-track signaling, and through to the next passing siding for opposing trains. For example, signal 12 will indicate stop while a train moving from left to right is between it and signal 14. As soon as the train passes signal 14, however, signal 12 will display a caution indication, the dispatcher's lever being set to permit a following move. But, if either signal 17 or 17A is at caution or proceed, or if there is a train moving from right to left between signals 17 and 15, signals 12 and 12A will indicate stop.

An important feature has been provided to facilitate switching movements. This feature is obtained by the use of a Dual Control Selector which enables the train crews, under proper conditions, to operate the power switches by hand. For instance, if switching is to be done over switch 2, the switching crew actuates a lever at this switch, which causes signals 12, 12A, 13, 13A and 15 to indicate stop. It also intercepts the A.P.B. control at signal 15 so that a train moving from right to left may proceed as far as signal 15 while this switching is in progress. The Dual Control Selector will be more completely described later.

The description applying to *Figure* 5 presupposes

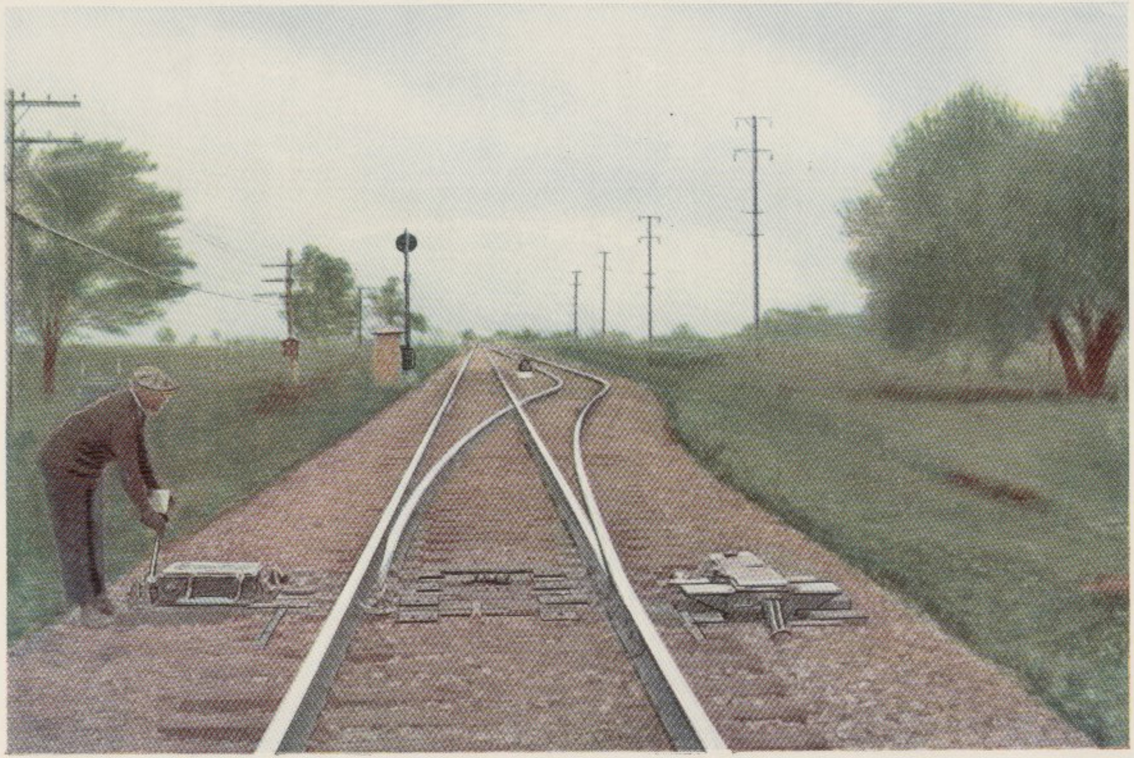


FIGURE 7 DUAL CONTROL SELECTOR APPLIED TO SWITCH AT SIDING

that switches 1, 2 and 3 are remotely operated by the dispatcher. It is not absolutely necessary, however, that the switches be so operated as the system may be applied as indicated in *Figure* 8.

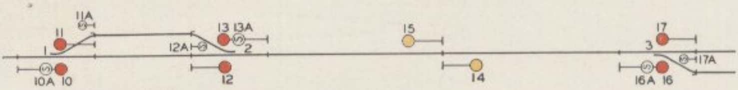


FIGURE 8 SINGLE SIDING ON SINGLE TRACK, SWITCHES HAND OPERATED

In this case switches 1, 2 and 3 are hand operated and set normally for the main track. Signals 10A, 13A and 16A are "take-siding signals," and when displayed mean "open switch and take siding." Signals 11A, 12A and 17A might be termed "leave-siding signals," and when displayed mean "open switch and proceed to next siding."

Obviously, this alternative does not provide nearly as much traffic facility as when the switches are centrally operated, but it does give complete control of traffic and therefore eliminates the necessity for train orders.

The application of the system to lap sidings on single track is indicated in *Figure* 9. All opposing signals are interlocked as before and switches are remotely operated, one lever in the dispatching machine being required for the operation of each switch and the signals that govern over it.

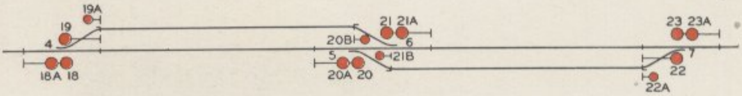


FIGURE 9 LAP SIDINGS ON SINGLE TRACK

FIGURE 10 TRAINS MEET AT WAYNE

Figure 11 shows application to tandem sidings. As before, one lever in the dispatching machine is required for the operation of each switch and the signals that govern over it. Entering signals 24 and 27 may be three-arm signals if desired.

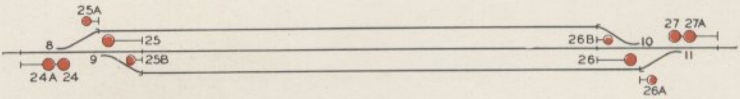


FIGURE 11 TANDEM SIDINGS ON SINGLE TRACK

The signaling arrangement for a long siding with intermediate cross-overs is shown in *Figure* 12. Four levers in the dispatching machine operate this complete layout, one lever being required for each end of the siding and one for each cross-over.

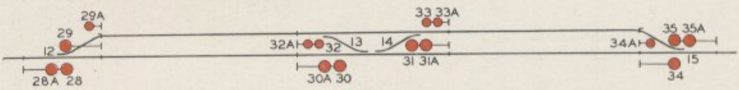


FIGURE 12 LONG SIDING WITH INTERMEDIATE CROSS-OVERS, SINGLE TRACK

FIGURE 13 DOUBLE TRACK—FOSTORIA

Application to Multiple Track

WHEN referring to dispatching, we naturally think of single track since it presents the more difficult operating problems, but the G-R-S Dispatching System is applicable quite as well to double track. We will consider two ways in which to apply the system to double track;—first, where traffic is always in the same direction on each track, and second, where traffic is operated in either direction on either track.

The first application is illustrated in *Figure* 14 where passing sidings are used to permit a superior train to pass an inferior one.

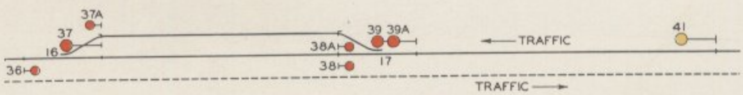


FIGURE 14 SINGLE SIDING ON DOUBLE TRACK

It will be noted that the signal arrangement is very similar to that on single track, the only essential difference being the omission of reverse traffic signals. Back-up dwarf signals 36, 38 and 38A may be used, but they merely serve as markers and to indicate the position of the respective switches. Two levers in the dispatching machine are required for the arrangement shown in *Figure* 14.

The second application is illustrated in *Figure* 16 which shows the signaling on a section of track where cross-overs are provided at suitable intervals to enable trains to pass freely from one track to the other.

FIGURE 15 END OF DOUBLE TRACK AT LOUDEN

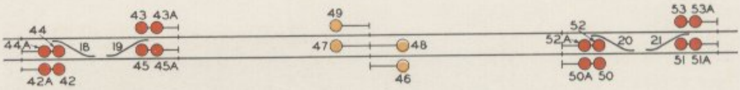


FIGURE 16 CROSS-OVERS ON DOUBLE TRACK, SIGNALED FOR OPERATION IN EITHER DIRECTION

Both tracks are signaled for operation in either direction, A.P.B. signal controls being employed as in the single track operation previously described. Intermediate signals 46, 47, 48 and 49 serve only one purpose, namely;—to secure a closer and more uniform spacing of following trains. All signals are interlocked against their opposing signals; for example, signals 44, 42A or 48 cannot be cleared if either 53 or 51A displays a proceed indication. Four levers in the dispatching machine are required for the complete layout shown in *Figure* 16, two levers being used for the operation of each double cross-over, including the signals which govern over it.

It will be apparent that this arrangement makes possible the utmost flexibility in the operation of a double-track line—trains can be operated in one direction only on each track or they can be operated against the normal direction of traffic as varying conditions require.

FIGURE 17 THE DISPATCHER AT WORK

The Dispatcher at Work

THE Dispatcher is the real guiding head. He initiates and directs all train movements. He confers superior rights on certain trains as the immediate conditions require, and his orders are delivered through the agency of the roadside signals. Train orders, rights by class and rights by direction pass into the discard. One train has no official knowledge of the presence of other trains on the road. Passenger trains have schedules for the benefit of the public and any other schedules are merely for the guidance of the dispatcher.

We will now visualize the dispatcher at work and consider how he "issues his orders," and obtains his information as to what is taking place on the roadway. *Figure* 17 shows him seated at his desk which is in front of and attached to the control machine. The levers which control the layouts on the roadway are arranged in a horizontal row, two inches apart, and are within convenient reach of the dispatcher while seated. The levers have three positions;—central, upward and downward. These positions control the roadway equipment as follows:—

1st. Lever in central position causes signals in the respective controlled group to assume the stop position, and switch to remain in position to which it was last operated.

2nd. Lever in upward position causes switch to move to the position for the diverging route (if not

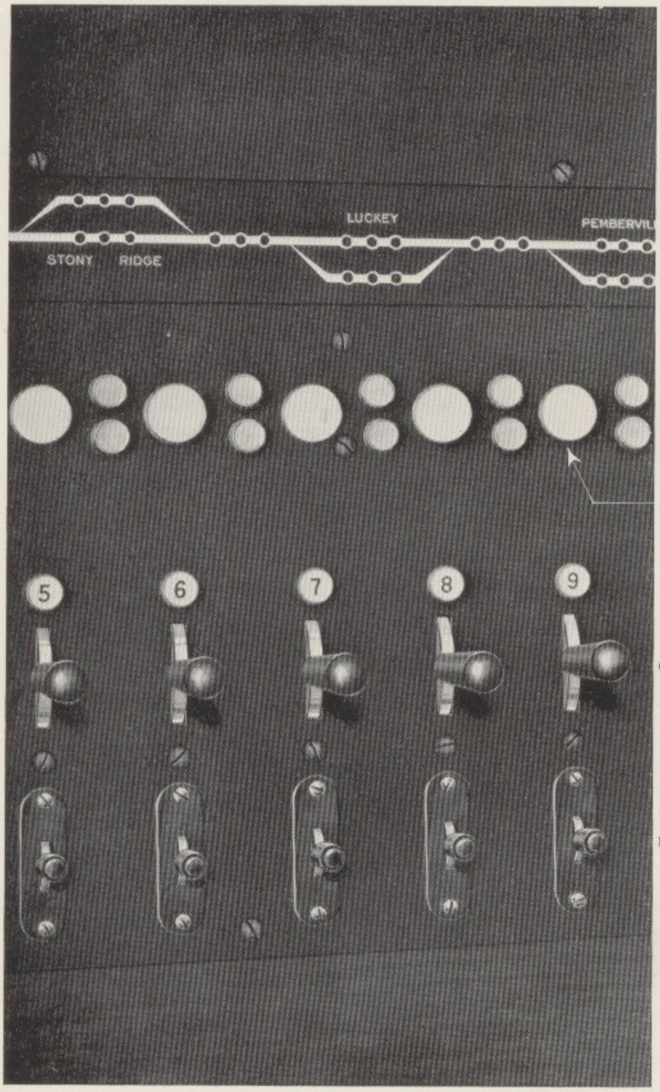


FIGURE 18 CLOSE-UP VIEW OF THE CONTROL BOARD

already in that position), and permits the corresponding signals to give proceed or caution indications, if the respective blocks are not obstructed.

3rd. Lever in downward position causes 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.

Figure 18 is a close-up view of the control board and shows more in detail the track model, light indicators, control levers and key switches. The track model, located near the top of the control board, 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 located along the

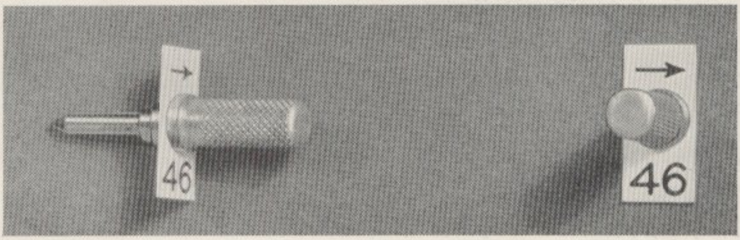


FIGURE 19 TRAIN TOKEN

track model. The train tokens are moved by the dispatcher as he receives information from the roadside by means of light indicators. These 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 on to the short track section in which the passing track switch 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.

The "OS" indicator is also used to inform the dispatcher when the switch responds to the lever movement by giving a brief but distinctive flash when the switch points open and by flashing again when the switch points close. To attract the dispatcher's attention to something having happened which may require action on his part, a single stroke bell sounds whenever 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 (bell) of the "OS" indicator above that 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 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 until the control lever is again operated. This "stick" feature is of value:—

(*a*) When the dispatcher wishes to let one train pass, and stop a second train without further attention on his part.

(*b*) When he is away from his desk for a period and wishes to pick up quickly on his return the location of trains.

Figures 20 to 25 inclusive, show the manipulation of the dispatching machine and what takes place on the roadway as two trains approach and leave their meeting point. *Figure* 20 shows train 2 on the main line between siding limits at Stony Ridge, train token 2 similarly located on the track model, lever 6 down and lever 7 up, and signals clear for a movement of train 2 into the siding at Luckey. *Figure* 20 also shows train 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 3 to Luckey, as shown in *Figure* 21. In the meantime train 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 2 has left Stony Ridge, he 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 *Figure* 22. Train 3 is leaving Pemberville as shown by the "OS" indicator above lever 9.

"OS" indicator 9 goes dark indicating that train 3 has cleared the siding at Pemberville; the dispatcher advances token 3 and restores lever 9 to normal as shown by *Figure* 23. Train 2 is now pulling into the siding at Luckey, as shown by "OS" indicator 7.

Train 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 3

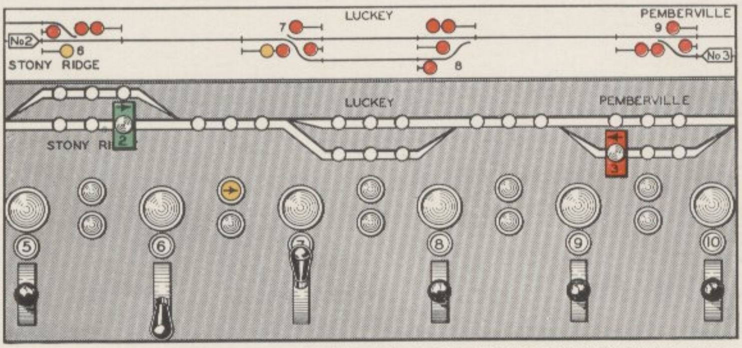


FIGURE 20 ROUTE CLEAR FOR TRAIN 2 TO MOVE FROM STONY RIDGE TO LUCKEY. TRAIN 3 ON SIDING AT PEMBERVILLE

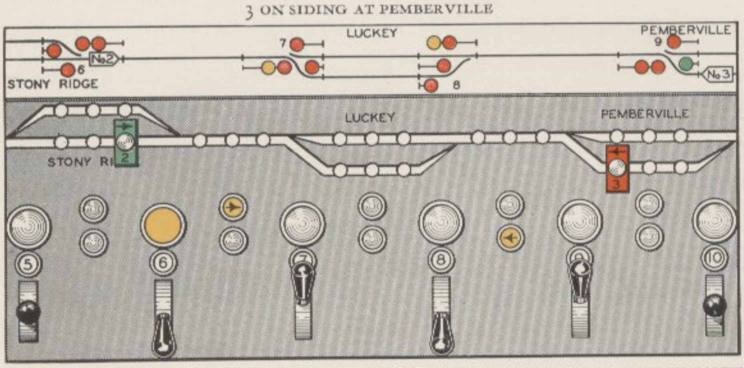


FIGURE 21 TRAIN 2 LEAVING STONY RIDGE AND ROUTE IS CLEAR FOR TRAIN 3 TO MOVE TO LUCKEY

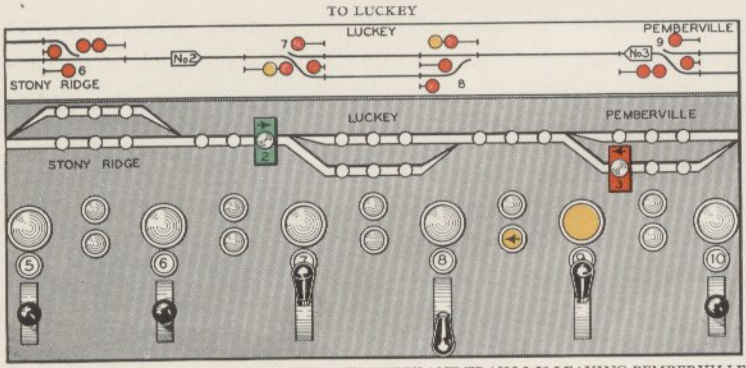


FIGURE 22 TRAIN 2 HAS NOT ARRIVED AT LUCKEY AND TRAIN 3 IS LEAVING PEMBERVILLE

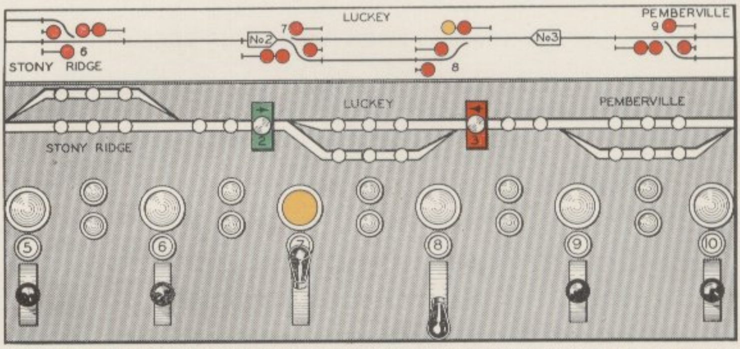


FIGURE 23 TRAIN 2 IS PULLING INTO SIDING AT LUCKEY AND TRAIN 3 HAS PASSED BEYOND SIDING LIMITS AT PEMBERVILLE

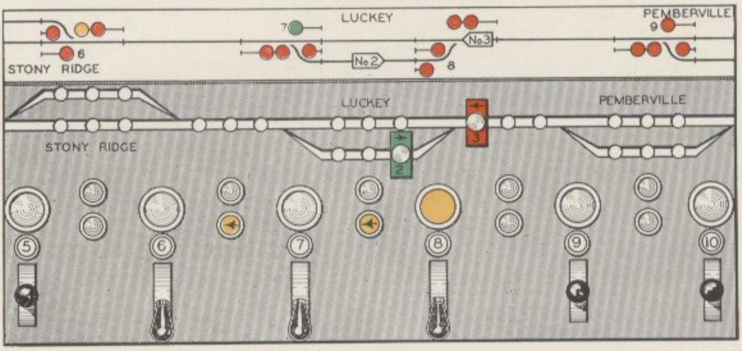


FIGURE 24 TRAIN 2 IS IN THE CLEAR AT LUCKEY AND TRAIN 3 IS ARRIVING AT LUCKEY WITH ROUTE CLEAR FOR MOVEMENT TO STONY RIDGE

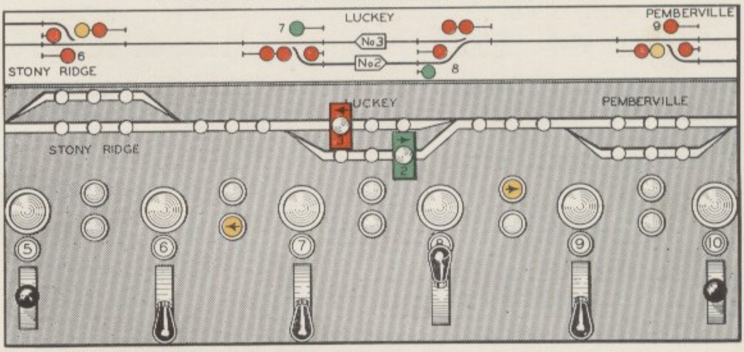


FIGURE 25 TRAIN 3 HAS PASSED WITHIN SIDING LIMITS AT LUCKEY AND ROUTE IS CLEAR FOR THE MOVEMENT OF TRAIN 2 TO PEMBERVILLE

to Stony Ridge as shown in *Figure* 24. "OS" indicator 8 is now illuminated which indicates the arrival of train 3 at Luckey.

"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 2 from the siding at Luckey to Pemberville.

Had there been two trains moving in the same direction between Stony Ridge and Luckey at the same time, the token for the first, would have been located as shown in *Figure* 22 and that for the second train in the next jack to the left.

The opposing signals being interlocked against each other as already described, the direction in which traffic can move is dependent upon sequence of lever movements. For instance, when the dispatcher operated lever 6 and then lever 7, all signals cleared for a movement of train 2 from Stony Ridge to Luckey, as shown in *Figure* 20. After train 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 3 from Luckey to Stony Ridge, as shown in *Figure* 24.

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 levers 6 and 7 displays an illuminated arrow pointing to the right, as shown in *Figure* 20. With the route set up for a movement in the reverse direction, the bottom indicator displays an arrow pointing to the left, as shown in *Figure* 24.

Another bit of helpful information for the dispatcher is given by the movable switch points on the track model. They move when the control levers are moved to the upward or downward positions but do not move when control levers are returned to central positions 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 create an unsafe condition by the wrong manipulation of levers. He is only able to permit train movements to be made provided that conditions on the roadway 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 signal indication can be displayed.
3 Manual control,—dispatcher must give his consent.

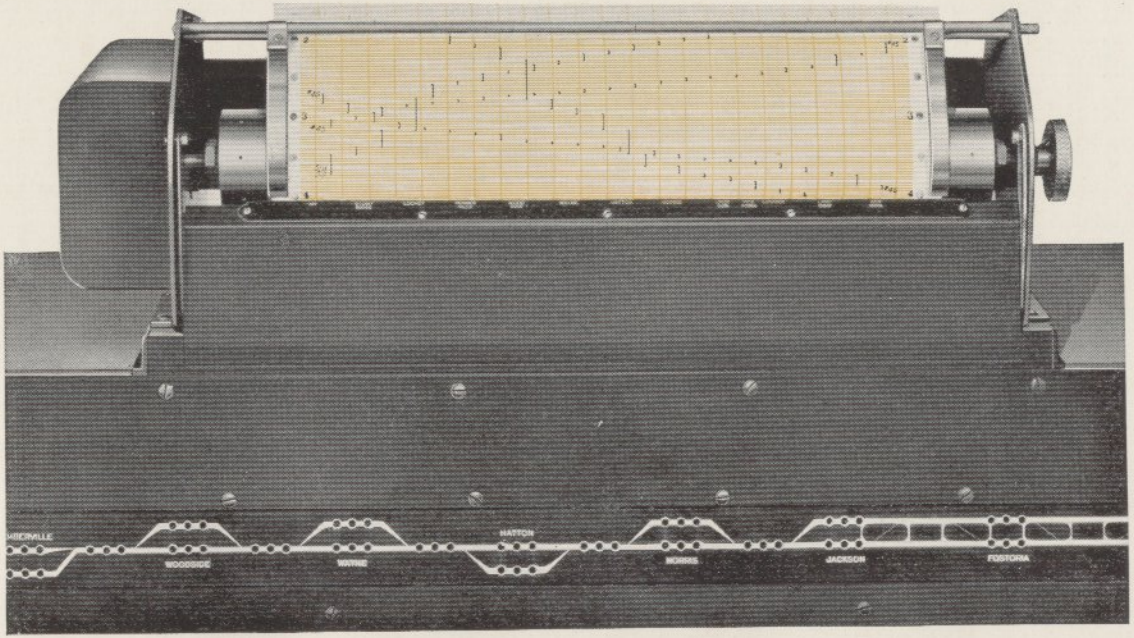


FIGURE 26 AUTOMATIC TRAIN SHEET RECORDER

The Record

THE train sheet has been used in the past, not only as a record of operation, but also as a means of keeping track of the trains and forecasting their movements. The form of train sheet in common use is shown in *Figure* 27. It consists essentially of columns of figures which denote time at the various "OS" points, separate columns being used for each train.

In some respects, a hand made graphic train sheet possesses advantages over the written train sheet although it has not been used extensively up to the present time. From it the locations of trains are more quickly visualized and delays are much more apparent. *Figure* 28 shows in graphic form a portion of the same operation as *Figure* 27 shows in written form.

In the G-R-S Dispatching System, using the track model as already described, it is apparent that the train sheet will have little if any value other than that of a record. It will not be needed to keep track of trains, nor to any great extent in forecasting operation. The form of the train sheet used with this system, while possibly not a matter of primary importance, has nevertheless been carefully worked out in such a manner as to simplify the duties of the dispatcher to a maximum degree and thus leave him free to study his operation.

Let us again consider the use of the track model. Assuming that the dispatcher moves the train token in each case as soon as the "OS" comes in, the time during which a token is left in one place on the model is the

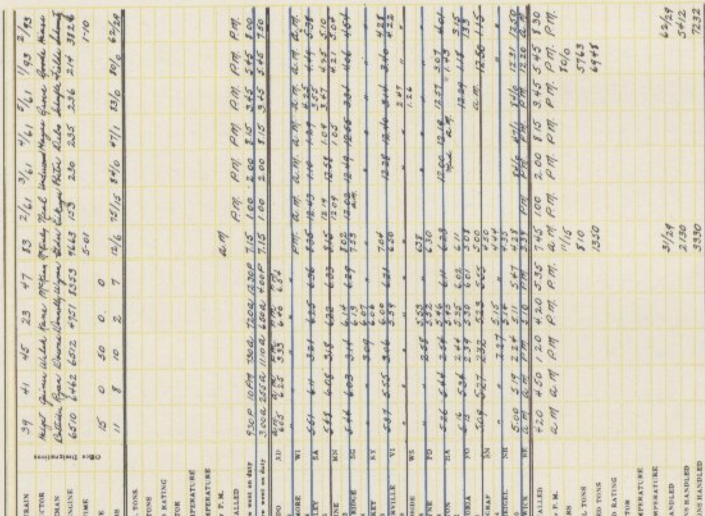


FIGURE 27 TRAIN SHEET—WRITTEN FORM

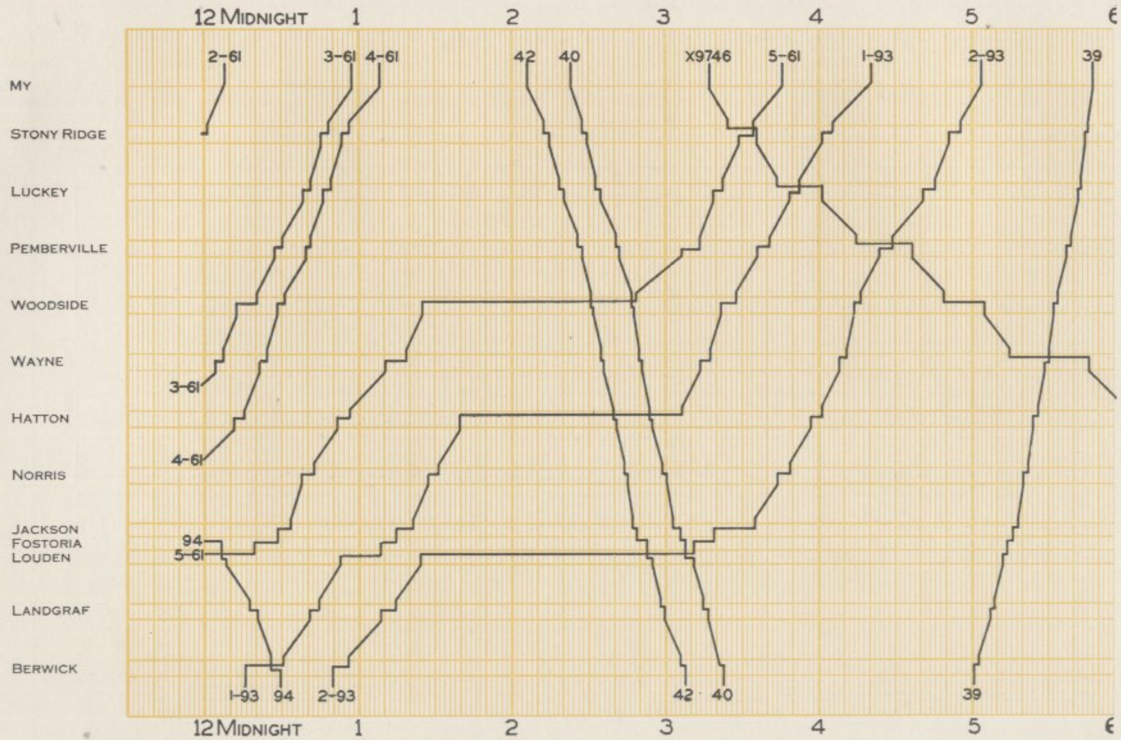


FIGURE 28 TRAIN SHEET—GRAPHIC FORM

DATE July 25 1927

CHIEF DISPATCHER F.D. Poland

DISPATCHERS ON DUTY
C.H. Dye - F.R. Colgrove FROM 7 a M. TO 3 p M.
J.H. Sickey 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	—		"	"			

SOUTHWARD TRAINS

TRAIN NO.	ENGINE NO.	CONDUCTOR	ENGINE MAN	CALL	TIME ON DUTY TRAIN CREW	TIME ON DUTY ENGINE CREW	DEPARTURE	LOADS	EMPTIES	GROSS TONS	TONS	ARRIVAL	REMARKS
84	4662	Peter	Korn	815a	745a	730a	902 am	7	8	440	—	405p	
Exa	233	Malone	Insley	815a	735a	730a						1238p	Delayed 1 hr 28 min. Louden, bad order car.
X 24	4751	—	—	—	—	—	—	—	—	—	—	—	By Be 922a
44	6510	Costello	Conover	950a	920a	935a						1137a	
46	6445 6511	Doyle	Gottlieber Swinger	145p								258	
94	9139	McClure	Stewart	930P	900P	830P	930P	21	1	806	12 06	12 35 12 35	Delayed 70 min at B&O grade crossing. Sig E461A

NORTHWARD TRAINS

TRAIN NO.	ENGINE NO.	CONDUCTOR	ENGINE MAN	CALL	TIME ON DUTY TRAIN CREW	TIME ON DUTY ENGINE CREW	DEPARTURE	LOADS	EMPTIES	GROSS TONS	TONS	ARRIVAL	REMARKS
	218	Grove	Lloyd	815a	815a	815	—						
83	5682	McKinley	Elder	745a	715a	715	—					503p	
45	6495	Welsh	Downs	120p	1135a	1125	7						
	9739	Johnson	Mader	1230	1200p	1150a	210p	100	0	7452	9452	520p	
	218	Grove	Lloyd	815a	815a	815a	—	80	4	5728		555	Conn.
	151	Flanigan	Subick	12 m	12 m	1200m	625p	81	0	5780	6995	907p	Lake
	236	Ryan	Anderson	1245p	1245p	1245p	640p	81	1	5746	6976	940p	
	230	Smith	Connor	430p	430p	430p	930p	84	1	5791	7071	1159p	
	9741	Boyer	Morehead	230p	200p	150p	447P	96	4	7479	9478	823	
47	6467	Henn	Collins	535P	1245	405	545P					618P	10C
23	4753	Mulligan	Leonard	420p			534P					702p	Landgraf 12 m sdg for 47 to pass
60	6102	Underwood	French	545P	545P	540P	830	27	2	1210	1605	1000p	
K	215	Johnson	Young	630P	630P	630P	1130P	86	0	5768	7076		Comm in 2 Lots {Transferred}
K	217	Harris	Strock	730P	730P	730P	–	83	7				Tol 8%
	9740			1145P			–			New Shaler			
	220	Chapman	Darring	1015P			–	80	0				Yd E Lots

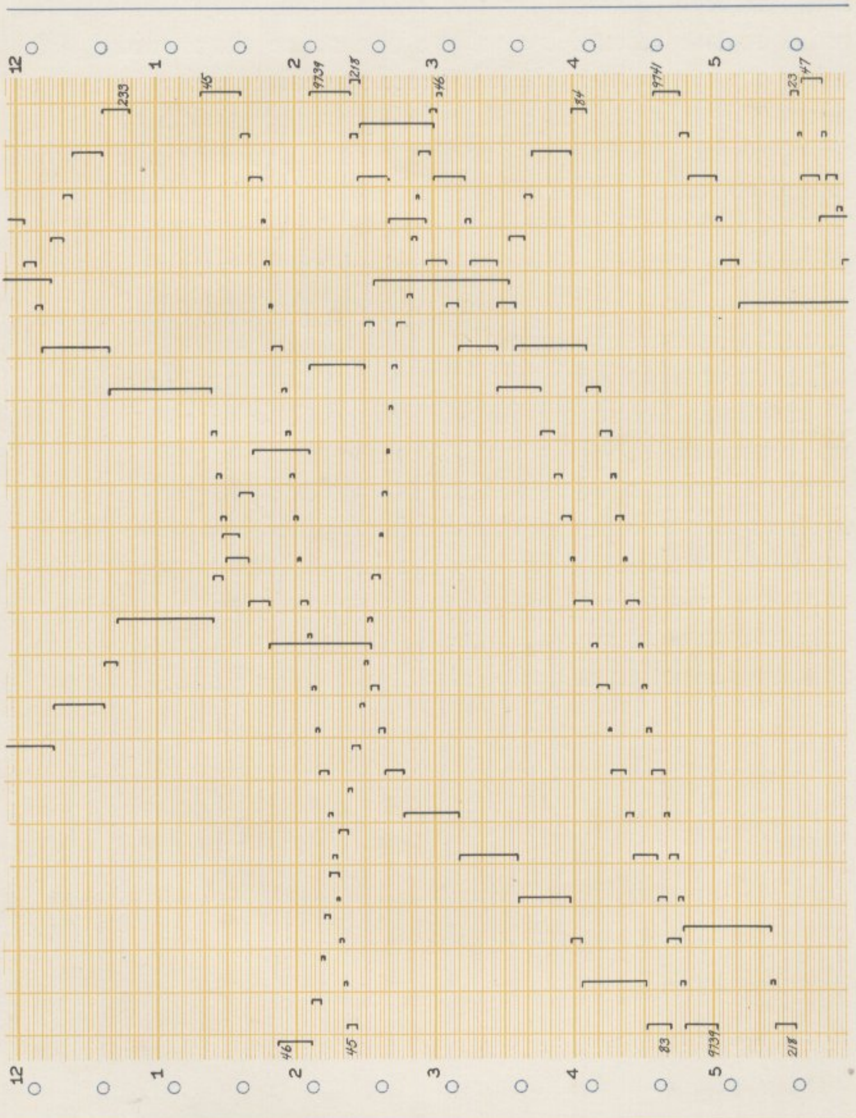


FIGURE 29 TRAIN SHEET—GRAPHIC FORM, PRODUCED BY AUTOMATIC TRAIN SHEET RECORDER

exact time consumed by the train from one "OS" point to the next. Now, if we can cause that train token to draw a line while inserted at each location in the model, the length of line being in proportion to time, we shall have produced a record denoting the lapsed time of a train between adjacent "OS" points. The advantage is of consequence, as the considerable amount of time otherwise required to prepare his record can be better used in studying the traffic and planning future movements.

The Automatic Train Sheet Recorder shown in *Figure* 26 produces the record just described. The record is made on a chart which goes into the machine in roll form and is removed at the end of each 24 hour period in sheet form. Each day's record is attached to a heading sheet, which is filled in by the dispatcher and gives the usual routine information as to train numbers, engine numbers, tonnage, loads, empties, etc. *Figure* 29 shows a section of a typical record.

Some Operating Side Lights

IT is apparent that no part of a line under control of a dispatcher should be occupied by a train or otherwise obstructed without his knowledge and consent. In most cases his consent is given by the signals, yet there are times when he must communicate with train crews through some other agency. Telephones, therefore, are of importance. They should connect directly with the dispatcher's office and be available at:

(*a*) Each passing siding switch, cross-over 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.

Should it be necessary for a work train to do work between certain points, its crew will obtain the consent of the dispatcher who will designate the working and time limits.

Should a train have occasion to do switching at the end of a passing siding, permission will likewise be obtained from the dispatcher. He gives over, as it were, for a specified time the portion of the line required for the work.

Should a train go into the clear at an outlying switch not controlled by the dispatcher, it will do so with his knowledge and consent and must not come out without his consent.

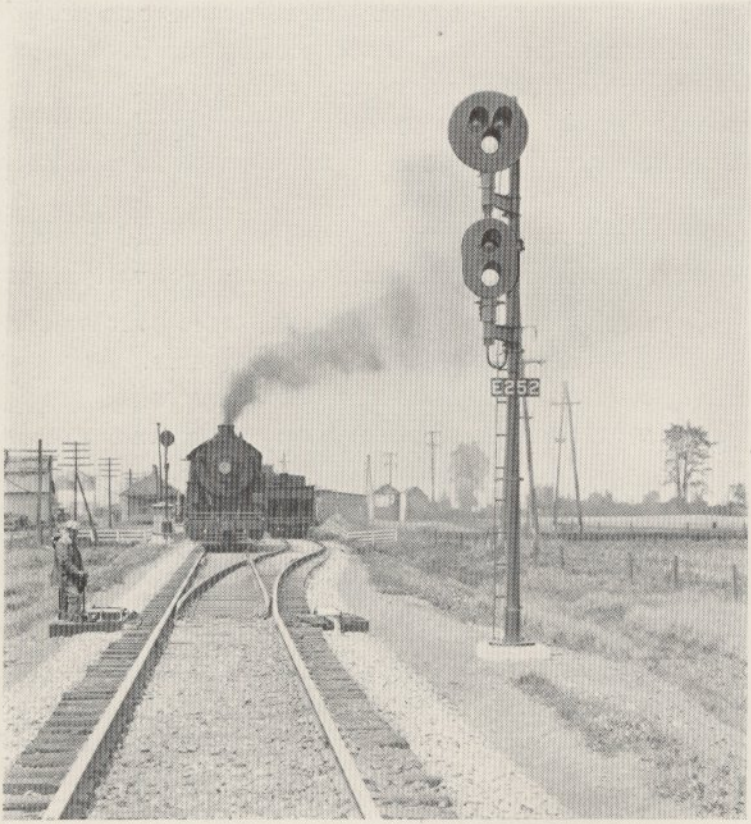


FIGURE 30 LOCAL TRAIN SWITCHING AT WAYNE BY MEANS OF DUAL CONTROL SELECTOR

Some Secondary but Important Considerations

COMPLETE approach and section locking is provided for each power operated switch. The approach locking prevents the operation of a switch after a train has had the opportunity to accept either the proceed or caution indication of the signal at the

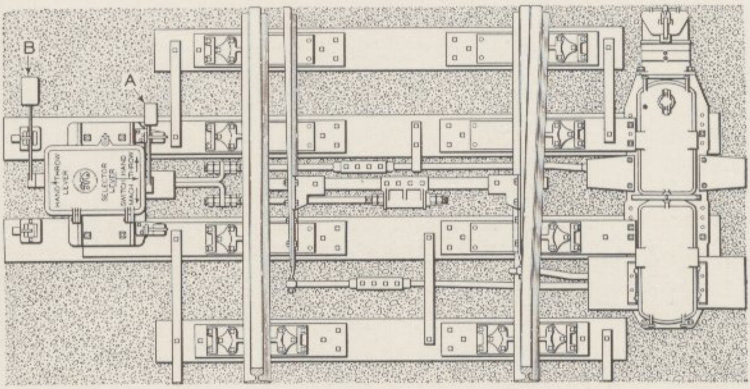


FIGURE 31 DUAL CONTROL SELECTOR AND MODEL 5A SWITCH MACHINE APPLIED TO SWITCH

switch or the proceed indication of the distant signal in the approach to the switch. The section locking prevents operation of the switch if a train is on the track circuit in which the switch is located.

Remotely controlled power-operated switches are not well adapted to the switching of cars unless some convenient means of hand operation is provided. They are too slow for this kind of work and it is difficult if not impossible for the operator to know when the switch should be thrown. The G-R-S Dual Control Selector, shown in *Figures* 30 and 31, overcomes this difficulty by making it possible for the train crews to operate switches by hand when switching is to be done.

This selector operates in a very simple manner. Lever A, *Figure* 31, changes the connections of the switch rod from the power machine to the hand thrown lever and at the same time causes all signals protecting the switch to give stop indications. Lever B throws the switch in a manner familiar to all trainmen.

Effect on Train Operation

THE efficiency of train dispatching has a very definite effect on railway earnings, and, therefore, is one of the most important factors in operation.

The advent of the G-R-S Dispatching System marks the beginning of a new era in railroad operation. While it may be regarded as revolutionary, it is truly a logical step. It provides an economical means whereby signals are made use of, not only to protect and space traffic, but also to dispatch traffic.

The system lowers operating costs, reduces delay, promotes safety and increases the use of track and equipment.

OPERATING COSTS ARE REDUCED:—

- by reducing delay,
- by dispensing with intermediary operators,
- by reducing the number of stops.

DELAYS ARE REDUCED:—

- by eliminating stops or slow speed for delivery of train orders,
- by eliminating two out of three stops when trains take siding,
- by making closer meets and passes due to flexibility of system.

SAFETY IS INCREASED:—

- by automatic block signal protection,
- by eliminating written train orders.

FACILITY IS INCREASED:—

- by ability to operate more trains over same mileage of track, by ability to handle maximum traffic at any hour, day or night.

From those railroad executives who are interested in better dispatching we invite correspondence and inquiries through our nearest district office as shown below.

Principal Office and Works

GENERAL RAILWAY SIGNAL COMPANY
Rochester, New York

District Offices

PEOPLES GAS BUILDING
122 South Michigan Avenue, Chicago, Illinois

PERSHING SQUARE BUILDING
100 East 42nd Street, New York, New York

RAILWAY EXCHANGE BUILDING
611 Olive Street, St. Louis, Missouri

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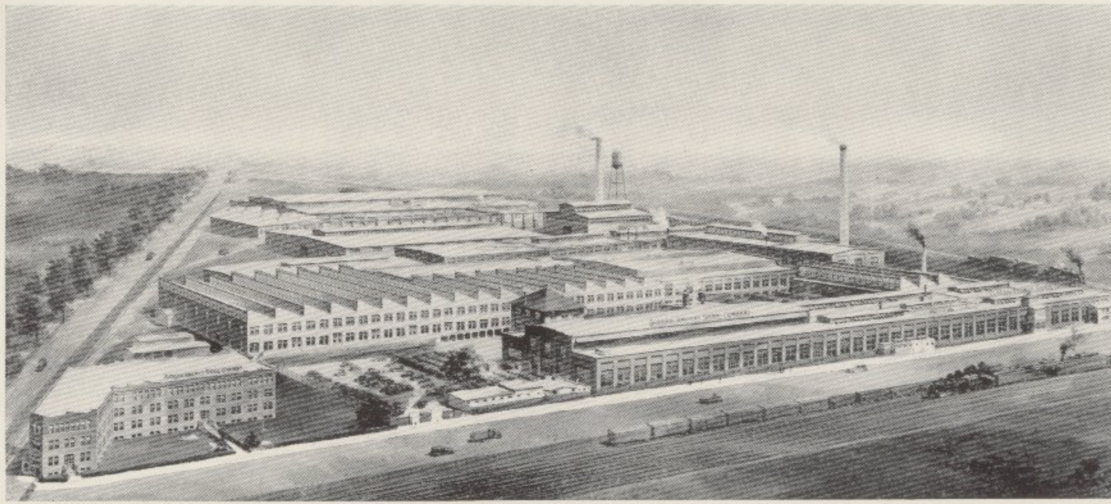
METROPOLITAN VICKERS-GRS., LTD.
Head Office, 9 Kingsway, London, W. C. 2

COMPAGNIE FRANCAISE THOMSON-HOUSTON
173 Boulevard Haussmann, Paris, France

GENERAL RAILWAY SIGNAL COMPANY
PTY. LTD.
Melbourne, Australia



PRINCIPAL OFFICE AND WORKS, GENERAL RAILWAY SIGNAL COMPANY, ROCHESTER, NEW YORK