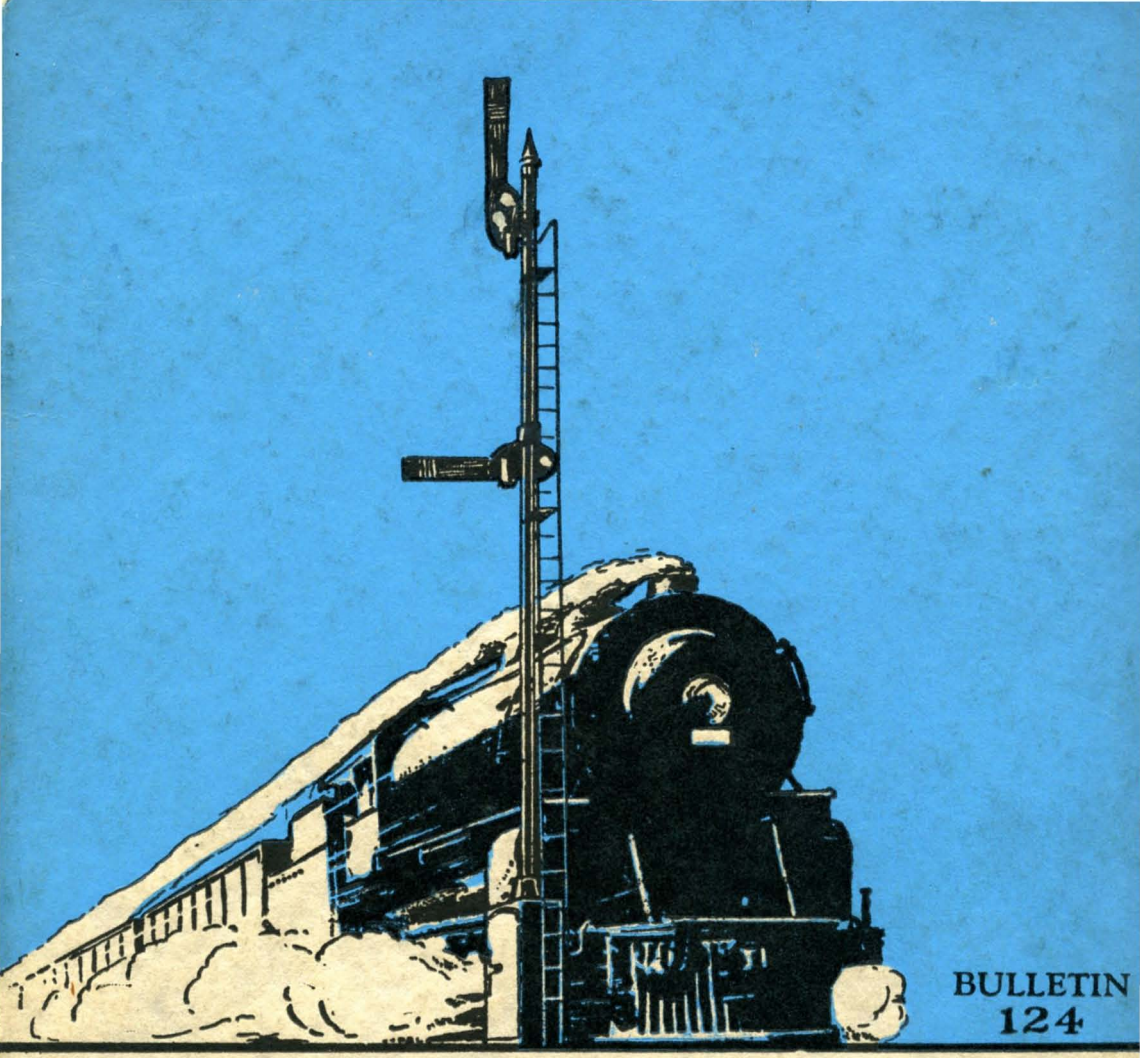

BULLETIN
124

TURNING·MINUTES INTO DOLLARS

Zachary C. Gillihan

Digitally signed by Zachary C. Gillihan
DN: cn=Zachary C. Gillihan, o=ZCG Utility Scrap, ou, email=amerenue04@yahoo.com, c=US
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TURNING MINUTES

into

DOLLARS

BULLETIN 124
JUNE, 1928

Union Switch & Signal Company
Swissvale, Pa., U. S. A.

In the dispatcher's office, the control board, and the automatic train graph are incorporated in the one cabinet making an efficient and self contained unit for the operation of trains by the "UNION" Dispatcher Controlled Signal System.

Turning Minutes into Dollars

WHETHER the minutes turned into dollars represent a profit or a loss depends upon *how* the minutes are utilized. A moving train produces revenue; one standing, is a source of constant expense. Unnecessary stops at outlying switches mean an average loss of time of about 15 min. per stop while an equivalent loss of time also results from "stopping a train to tell it to proceed," and additional delays occur from waiting on meets. Minutes saved through the elimination of these losses mean dollars earned.

More Ton Miles Per Train Hour

A railroad's revenue is directly dependent upon the number of ton miles it produces; its expenses are dependent upon the number of train miles or train hours required to produce the ton miles. The tonnage offered the carrier for transportation fluctuates with business conditions and is therefore ordinarily beyond the control of the road.

Operating expenses are, however, subject to control of the management to a very great degree and remarkable strides have been made by the railroads of this country to improve operating efficiency and thus reduce the cost of producing transportation. One need only examine the results of the past decade to be convinced that American transportation efficiency is increasing at a very rapid rate.

Railroads, limited in the charges they may make for their services, are looking to the operating officers for a lower cost per traffic unit so that they may earn a fair return upon the money invested in the system. These men are charged, not only with the task of keeping operating expenses at a minimum, but also with the utilization of physical property to its fullest extent. It is fully as important that the fixed charges

applicable to each ton mile or passenger mile be kept within reasonable bounds as it is that the direct operating costs be kept at a minimum.

The "Union" Dispatcher Controlled Signal System Makes Minutes Count

Many railroad officers have looked to modern signaling to aid them in solving the problem of lowering the operating ratio and have found that, in addition to being able to handle trains more expeditiously with increased safety, the signal installations have increased the capacity of the line to the extent that multiple tracking can be deferred for a sufficient time to pay for the signaling many times over.

The "Union" Dispatcher Controlled Signal System goes a step beyond any previous development in the art of signaling in that it combines all the functions of control over traffic into one centralized unit. Protection, direction and the actual manipulation of the switches for the passage of trains are brought about by this newly developed system, which is new only in the sense that it coordinates various signaling and interlocking functions of proved reliability previously used individually. It is adaptable to any existing signal system and can be applied to any type of automatic, manual block signaling, interlocking or train control installation.

Facilitating Train Operation

Under operation by the "Union" Dispatcher Controlled Signal System all trains are moved by signal indication regardless of time table superiority. Trains are not delayed awaiting the transmission and delivery of train orders at points along the line. The movement of through trains is expedited by the elimination of train orders and local trains can spend a larger portion of their time in productive work. The dispatcher is not concerned with trains which are called

to leave from terminals until they are actually ready to depart. Under normal train order operation where few operators are located on the territory the effect of trains in yards which have to be figured on by train dispatchers is generally to slow up opposing moves.

An advantage of the "Union" Dispatcher Controlled Signal System over normal double track operation is that trains may be run around each other with ease when it is desired to put a following train into a terminal ahead of a preceding train of less importance. This can be done, without relying upon any external means of communication, by a simple set-up of switches and signals through the dispatcher control board.

Another advantage of this type of installation is that local trains may be permitted to work between the switches of a siding on the main line without interruption while through trains are run around through the siding.

Application of the System

Wherever there is a "bottle neck" on a railroad, whether on a stretch of single or multiple track, the "Union" Dispatcher Controlled Signal System should be investigated before it is decided to increase the track facilities. The cost is but 10 to 15 per cent of that of an additional main track and ordinarily the increased capacity provided will be more than adequate to care for the traffic for a number of years to come. A great saving in capital expenditure will result and, at the same time, the improved operating efficiency will appreciably reduce operating expenses.

The system is applicable to almost any set of traffic conditions and to any length of territory from a few miles to an entire division. Any section of railroad can be equipped profitably on which it would be advantageous to eliminate stops of meeting and passing trains to head into sidings, or

on which the existing train order or manual block signal system is inadequate, too cumbersome or too expensive, whether it be a short section between sidings or an entire division.

Application to multiple track lines in conjunction with reverse track signaling is worth consideration, especially on lines where the traffic capacity peak is rapidly approaching or on sections where the traffic is directional at some hours of the day with a peak passenger movement virtually tying up freight trains in one direction during the rush hour. "Union" Dispatcher Controlled Signaling is especially applicable to multiple track lines near a terminal or on a long grade. Dispatcher operation of the crossovers involved makes it possible to move these trains from one track to the other readily without stopping them, and the direction of the move by signal indication makes it possible to take advantage of the unoccupied opposing track without delay.

It might be supposed that the system is applicable only to lines where freight movements predominate, but this is not the case. The advantages to be secured by the application of the principles of "Union" Dispatcher Control to territories on which much freight is originated and where conditions closely approximate those of yard operation, but where movements are largely by train order, are much greater than might at first appear. On such a territory the advantages of manual blocking, without its expense and with a greater degree of flexibility, can be attained.

On one road a study revealed that, while double tracking would produce an actual increase of operating expenses, dispatcher control would show a substantial saving and that the installation would pay for itself in a little more than 2 yrs. This is a road on which additional capacity must be provided shortly to handle a steadily growing peak business although additional trackage is almost prohibitive in cost

because of the light traffic through the major portion of the year. Dispatcher control will provide for the increase at 10 to 20 per cent of the first cost of building an additional track and at a much smaller maintenance cost. The saving in train hours will also add a great deal to the savings which may be credited to the system.

The Dispatcher's Efficiency is Increased

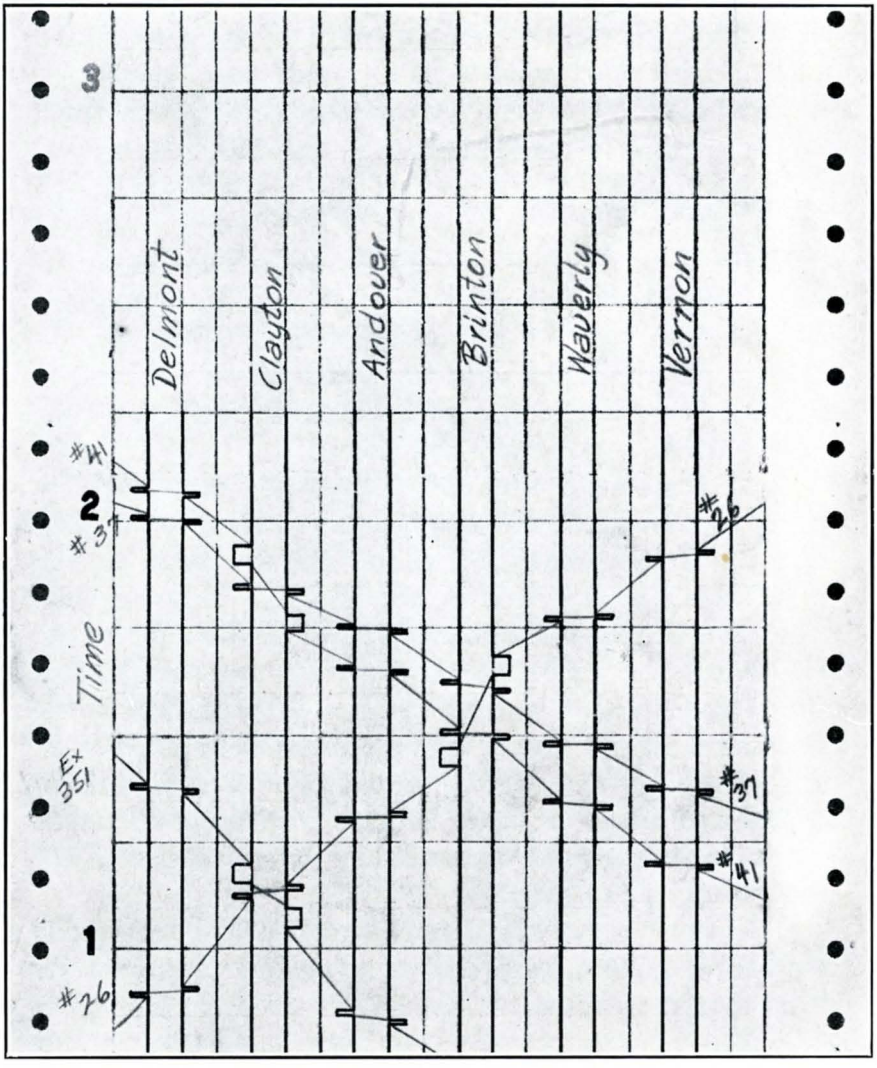
Train dispatching is simplified by the elimination of much of the routine required under a train order system for the preservation of safety and the process of dispatching trains is placed on the same basis with modern automatic signaling with a minimum of dependence upon the ever-present factor of possible human error.

A dispatcher's efficiency is improved because of his ability to transmit orders directly to the train *at the point and time where they are to be acted upon* and to take advantage of variations in the performance of trains. Inferior class trains can be moved against superior schedules when the trains using those schedules become late, and these moves can be accomplished without the use of train orders which consume a large portion of the available time in preparation and delivery. Many possibilities of improved operation will suggest themselves to those familiar with train operation and the advantages of operation by signal indication will undoubtedly be apparent.

The actual operation of the control board is characterized by its simplicity and requires no special training of the dispatcher or operator.

The Automatic "OS"ing Feature

The automatic "OS" gives the dispatcher the equivalent of *an operator at each end of every passing siding,* and at every other point where an "OS" is desired, without the work re-



Portion of a Graph Sheet Showing Opposing and Following Move as Made by the Automatic Train Graph.

quired in receiving these reports and the expense of maintaining operators at each of these points.

A feature of the system is that while each train gives its own "OS" it also leaves a record on a specially designed graphic meter in the dispatcher's office so that the passage of the train is not only brought to the attention of the dispatcher but is made part of a permanent record which may be attached to the train sheet. This record is made even though the dispatcher may be momentarily otherwise engaged.

Resulting Economies

The savings brought about by the installation of the "Union" Dispatcher Controlled Signal System are of two general classes:

1. The conservation of capital by providing increased capacity of existing facilities at a much lower cost than by any other improvement.
2. The reduction of operating expenses by providing for greater efficiency in the movement of trains, by reducing the number of train hours and by the elimination of train stops to take siding or to receive train orders.

Among operating expenses the savings will be greatest in the individual items which go to make up the direct costs of running trains, such as overtime wages, fuel, the wages of telegraph operators and the expense of maintaining telegraph and block stations, but there will also be a great many other operating accounts in which savings will be brought about by the greater operating efficiency.

The saving in equipment costs as reflected by a reduction of Per Diem charges and the release of owned equipment for a new tour of productivity is important although in absolute amount it does not compare with the wage and fuel sav-

ings. The speeding up of traffic makes it possible to move the tonnage of the division with a smaller number of locomotives and brings about a substantial saving in locomotive costs, because the released power can ordinarily be used at some other point on the railroad. The purchase of new power can often be deferred because of the increased availability of existing locomotives for service.

Railroad officers in all departments are giving greater attention to the cost of train delay and are coming more to the realization that the elimination of unproductive train hours and train stops means dollars in the treasury of the carrier. The money value of a saved train hour will vary with conditions on each road but for most purposes will range from $15 to $20. Where a road is near its margin of capacity the saving of a number of train hours per day will be of even greater importance.

The value of a train stop saved is calculated at a wide range of figures depending upon the length and tonnage of the typical train involved and the characteristics of profile of the road. Every stop saved means from one to three dollars saved in direct costs of operation. "Union" Dispatcher Controlled Signaling eliminates stops by providing power operation of switches and by eliminating the need for stopping or slowing down trains to receive orders.

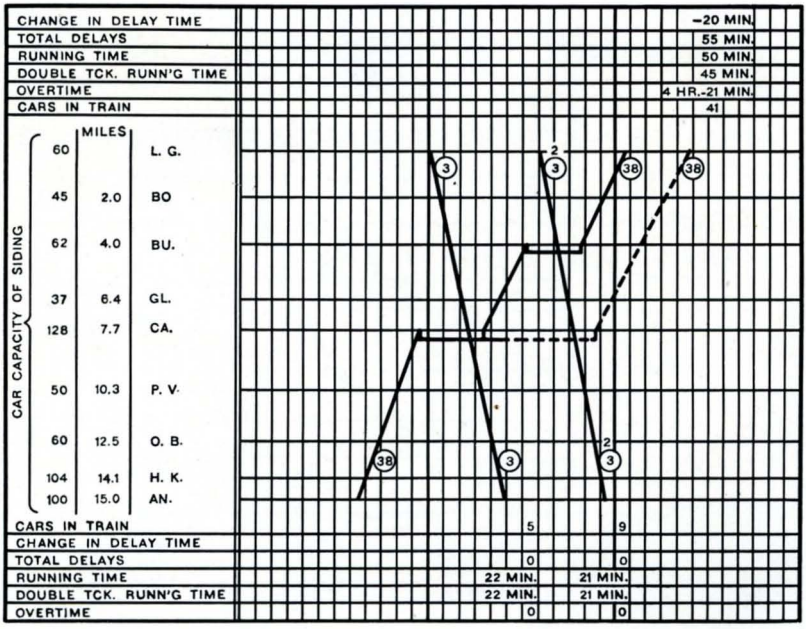
Wherever the operating costs are unduly high on a portion of a railroad even though no serious consideration of additional tracks is involved, it will pay to investigate what can be done by running trains by signal indication and operating siding switches by dispatcher control. The savings in direct operating costs alone will ordinarily make the installation financially desirable.

How the "Union" System Speeds Up Traffic

THE three following graphic examples of what "Union" Dispatcher Controlled Signaling may be expected to do on any railroad bring out very clearly the way in which savings in train hours are brought about.

The heavy line represents train redispatched by the "Union" Dispatcher Controlled Signal method—the dotted lines, operations under train orders. These have been taken from actual examples of railroad operation.

EXAMPLE A—The common occurrence of a freight train meeting two sections of a passenger train at a blind siding. In this instance the second section is 35 min. behind the first and the freight train could easily have been moved to the

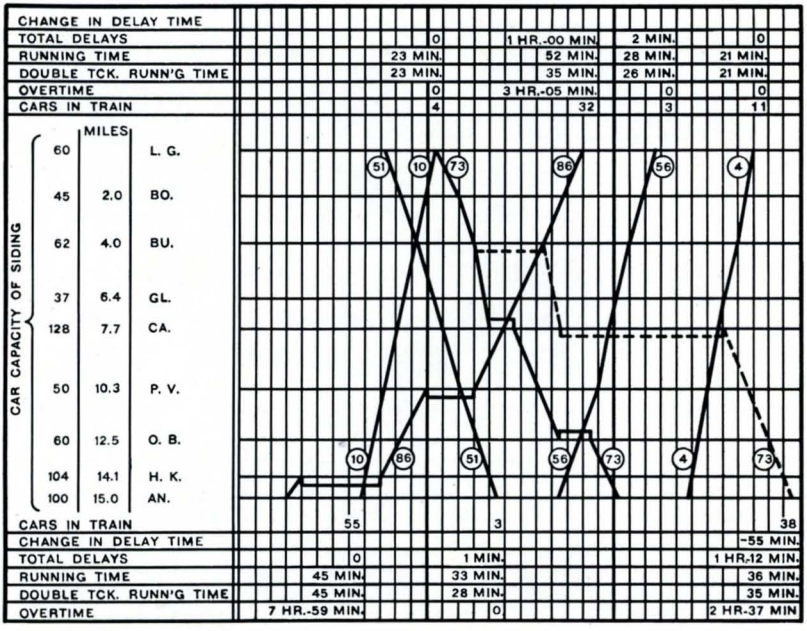


Example A

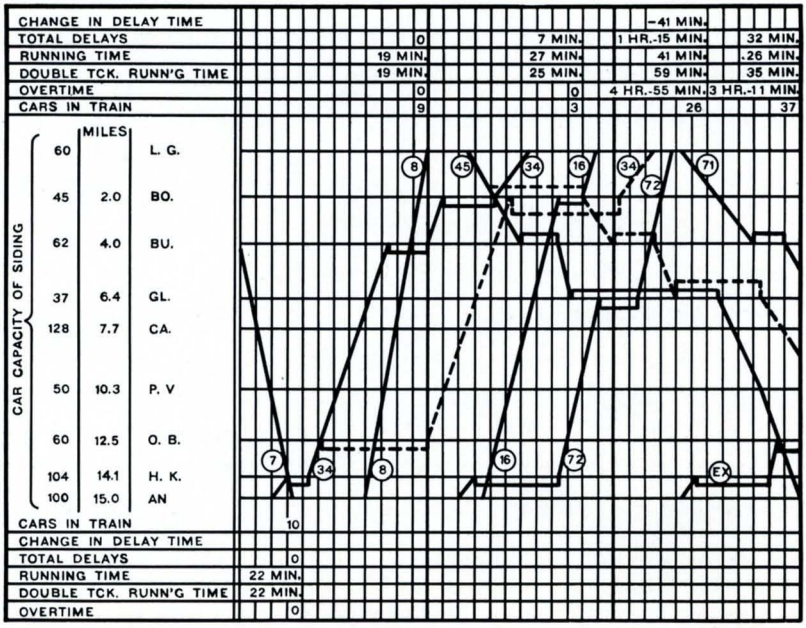
next siding to meet it. Instances of this kind happen every day in actual railroad practice, the example shown being representative of actual conditions found while making a study of operations on one road.

The saving from this one move above amounted to 20 min. or one third of a train hour. Using $20.00 as a train hour value, this move, which is made possible by Union Dispatcher Control would save the railroad about $6.67. Many moves of a similar nature will happen on every road every day.

EXAMPLE B—Progressively advanced meets, taking advantage of actual performance of opposing trains, show a saving of 55 min. on one freight run without delay to any of the opposing trains. Dispatcher control in this instance



Example B



Example C

would save the railroad in the neighborhood of a full train hour or $20.00.

EXAMPLE C—A freight train is advanced four stations beyond the point it took siding for a following passenger train. This train not only had time to make the move but might even have been advanced one station further because with dispatcher-thrown switches the delay in taking siding is negligible and following moves may be much closer because trains do not have to stop to head into sidings. Inasmuch as delay is a cumulative matter to all opposing trains, the value of its elimination cannot be adequately measured.

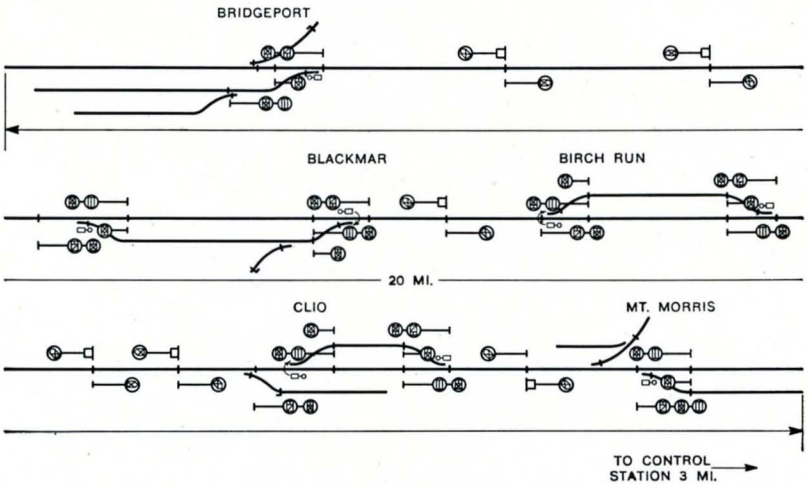
The effect of this move on an opposing freight train is shown in the same example. A southbound freight, which under the train order system had to remain at station BO for number 16, is enabled to proceed to the first siding beyond to

meet this train because the first freight train has arrived sufficiently in advance of the passenger train to enable the move to be made. This clearly illustrates the cumulative characteristic of delays eliminated.

Many other examples could be cited but these will illustrate the general type of savings brought about by Dispatcher Control.

Installations Which Meet Different Operating Conditions

An installation of this system is now about ready for service on the Pere Marquette for a distance of approximately 20 mi. covering a "bottle neck" existing between Bridgeport, Mich. and Mt. Morris. This installation controls the switches and signals on a section of single track between two sections of double track. Three controlled passing sidings are included in the single track section. Sidings have been lengthened and No. 15 turnouts have been used to permit of faster moves to and from sidings and to make possible the making of meets without stopping trains.



The Track Layout on the Pere Marquette

The "UNION" Dual Control Style M-2 Switch and Lock Movement combines in one machine the function of power and hand throw switch apparatus and gives flexibility of operation not obtained by other means. The use of this machine makes it possible for the dispatcher to authorize the hand operation of the switch. This mechanism is an important unit of the Dispatcher Controlled Signal System.

The traffic is such that maximum capacity is required at certain hours of the day resulting in heavy train movements over a short period of time.

This territory has been operating under time table, train orders and manual block. Under dispatcher control, train movements will be by signal indications controlled from one central point.

Plans and estimates had been prepared for a second track to be built between Mt. Morris and Bridgeport before a study was made of the application of the "Union" System to the existing single track. It was found that the cost for double tracking this 20-mi. length of line would be more than seven times the amount required to install the "Union" System. Furthermore, it is estimated that the installation of the Dis-

patcher System will delay the necessity for constructing additional main track for many years to come. In addition, this installation will increase track capacity and safety of train operation and facilitate train movements. The savings to be effected are those of fewer train stops, fewer train hours, operators released for other duties and delayed double tracking. The last saving mentioned, that of postponing double tracking, presents a particularly attractive feature of Dispatcher Controlled Signals when the volume of traffic apparently is reaching the saturation point for single track operation.

Five applications of this system for the control of middle order siding signals are in service or in process of installation on the Cleveland, Cincinnati, Chicago and St. Louis Railway. The locations at which this system are being used are at Horace, Ind., Gossett, Ill., Duncanville, Ill., Trimble, Ill., and Ernst, Ill.

Still another installation is in service on the Chicago, Burlington & Quincy Railroad controlling a stretch of single track between ends of double track from Concord, Ill. to Arenzville.

The Norfolk & Western has contracted for an installation controlling one outlying power-operated switch with full complement of interlocked signals and for the control of head block signals at the end of double track.

The installations mentioned above illustrate some of the uses for which the "Union" System can be utilized. These installations also show some of the existing operating conditions and suggest ways in which savings may be effected through the application of this system for train operation.

The Operation of the System

The operation of the system is simple. The control board is located in the Dispatcher's office and on it is a track model of the territory. Immediately below the track model

is located a row of small levers for the operation of the switches. In conjunction with these levers are two small indication lights which show whether the switches are locked in their normal or reverse position. Immediately below the switch levers is another row of small levers which control the signals at each end of each passing siding. The operation of the levers sends out an electrical code to the functions controlled by the levers.

Each of these codes represents a desired operation of a particular switch or signal in the territory under the dispatcher's control. This code, consisting of a series of electrical impulses, is carried over a pair of line wires to the location of the switch or signal. Receiving equipment, which takes the place of an operator, is located at each switch or signal. This equipment immediately responds to its code and operates the switch or clears the signal to the desired position. After the switch or signal has completed its operation, this system is so arranged that, if desired, an indication can then be sent back to the dispatcher to that effect. This indication is also in the form of a code originating at the outlying location and received at the dispatcher's panel where it is translated into an indication light at the lever governing the function.

The passage of a train into and out of the track section at each end of each passing siding is automatically indicated to the dispatcher by means of lights on the track model of his panel. This feature is generally used at "OS" ing points in the territory and is also made to register automatically the time of such passage on the automatic train graph. This indication, as well as all other operations of the system, is the result of a code sent out from the point of origin and received and translated at the other end into the desired indication or indications.

Storing Features when Line is Busy

In view of the fact that only two wires are used over the entire system for carrying the various codes, the question naturally arises as to what happens when these wires are busy with a code and it is desired to send out another code impulse. The code-sending apparatus is equipped with a storing means whereby a code or codes set up when the line is "busy" are automatically stored until the line is cleared for sending. Thus, a dispatcher may *immediately issue* an order or series of orders even though the line is "busy." When the line clears these orders will go out *at once.*

Should an outlying code and a dispatcher's code both be waiting on a "busy" line the dispatcher's code takes precedence when the line clears and will go out first. The system, therefore, saves time and thought on the part of the dispatcher as once a code order is issued no further action is required even though the line was "busy" when the order was issued.

An indication may be provided on the dispatcher's panel to show when the line is "busy." This indication is in the form of a pair of small lights, one representing out-going code and one in-coming code. When code signals are being sent out one or the other of these lights "wink" in harmony with the code. When the line is clear neither light is lit.

The following outline based upon a report prepared by Committee I, Economics of Railway Signaling of the Signal Section, A. R. A. may be used as a guide by those railroad officers who desire to know just how the "Union" Dispatcher Controlled Signal System will help solve their particular operating problems.

PROPOSED
"UNION" DISPATCHER CONTROLLED SIGNAL SYSTEM

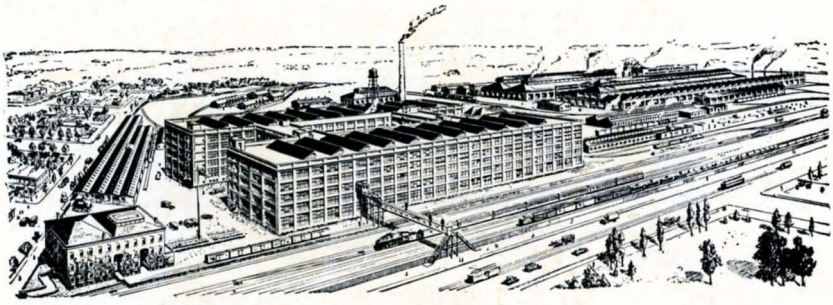
Between.....and.....

SUMMARY YEARLY SAVINGS

ITEM NO.	NATURE OF SAVING	TRAIN HOURS	AMOUNT
1.	Train hours saved due to increase in average speed.		
	(a) Speeding up train movements in bad weather.....		
	(b) Elimination of train orders.....		
	(c) Train waiting for block.....		
	(d) Elimination of train stops.....		
	(e) Traffic locking.....		
	(f) Miscellaneous.....		
2.	Operating expense saved due to reduction in number of:		
	(a) Locomotives and cars.....		
	(b) Operators.....		
	(c) Train orders.....		
	(d) Switch lights.....		
	(e) Manual block stations.....		
3.	Reduced operating cost due to:		
	(a) Per diem.....		
	(b) Reduced cost of collisions and accidents.....		
	(c) Electric lighting.....		
	(d) Reduction in overtime (other than train and engine crews)		
	(e) Delayed installation of additional tracks.....		
	(f) Remotely operated switches.....		
4.	Gross saving (Items 1, 2 and 3).....		
5.	First cost of "Union" Dispatcher Controlled Signal installation: (*Consider allowing credit for engines and cars saved.)		
	*(a) Investment.....$		
	(b) Operation.....$		
	(c) Total.....$		
6.	Estimated annual cost including maintenance and operation of "Union" Dispatcher Controlled Signal installation (not including interest).....		
7.	Estimated saving per year, Item 4 minus Item 6.....		
8.	Annual return on expenditure, Item 7 divided by Item 5-c..... per cent.		
9.	Annual return on capital account, Item 7 divided by Item 5-a..... per cent.		

Office of.....Date.....Signed.....

Our specialists are at your service to assist in any desired studies, and without obligation.



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