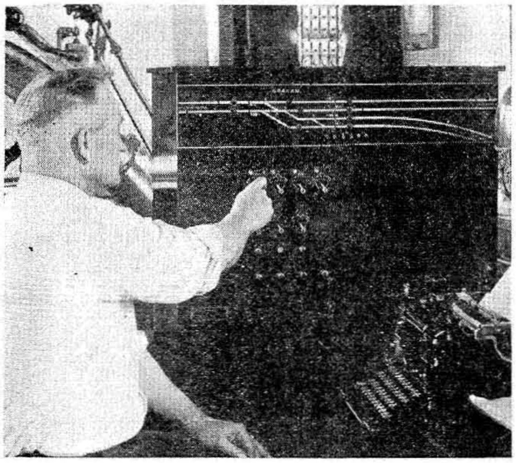
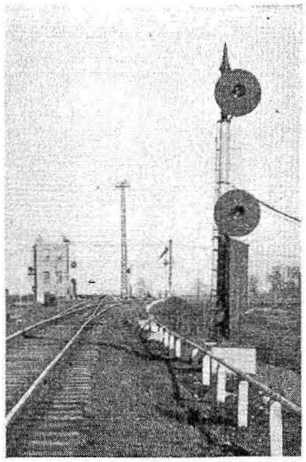
Burlington's Reconstruction Program at Galesburg Involves

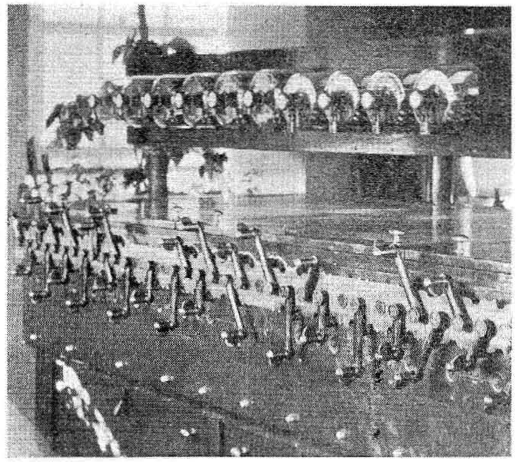
Modern Interlocking Plants



C.T.C. machine for Graham



Searchlight signals near the tower at Waterman



Model-14 interlocking machine for Waterman

Two separate plants are controlled from one tower... Electro-pneumatic system for adjacent plant... Code-type remote control for distant layout

By W. F. Zane

Signal Engineer, Chicago, Burlington & Quincy, Chicago

THE fifth and sixth signal projects involved in the rearrangement and reconstruction of the yard and terminal facilities at Galesburg, Ill., on the Chicago, Burlington & Quincy, are the Waterman interlocking, and the Graham interlocking, respectively. The latter is remotely controlled from Waterman. As these two installations are so closely interwoven they can best be described in a single article.

The Waterman plant is south of the new east-bound retarder-operated classification yard, as well as south of the present rider-operated west-bound classification yard. Consequently, it controls the receiving tracks of the east-bound yard, as well as the departure tracks of the west-bound yard. It also handles connections with the Galesburg-Quincy-Kansas City main line and the double-track freight line to Graham. In fact, this plant is an important unit in the general operation of the yards, and will become even more important when the west-bound classification yard is rebuilt and placed under a retarder system.

Formerly there was an old mechanical plant at the Waterman layout, which controlled a very different track arrangement than that which is in use at present. The old mechanical interlocking machine contained 9 levers for 9 high signals, 8 levers for 8 dwarf signals, 7 levers for 12 switches, 6 levers for 6 derails, 15 levers for 15 detector bars, and 9 levers for 9 switches and 9 detector bars.

All the tracks in the present layout are of new construction and represent a general revamping, both as to tracks and grade, the major portion of the plant being on a new fill well above the old track level. The new plant is of the Union Switch & Signal Company's electro-pneumatic type, installed in accordance with the standards of the signal department, by whose staff the engineering was handled and the plans were prepared. The interlocking machine has a 43-lever frame with 19 switch levers controlling 25 switches, 18 signal levers controlling 36 signals and 6 square spaces reserved for future additions.

The most southernly extremity of the pneumatic tube communication system is in the tower building where the operator is in charge of tubing the way bills of inbound freight trains. He also handles train-orders for west-bound Quincy-Kansas City freight trains as well as west-bound main-line freight trains for the territory west of Graham.

Fireproof Tower

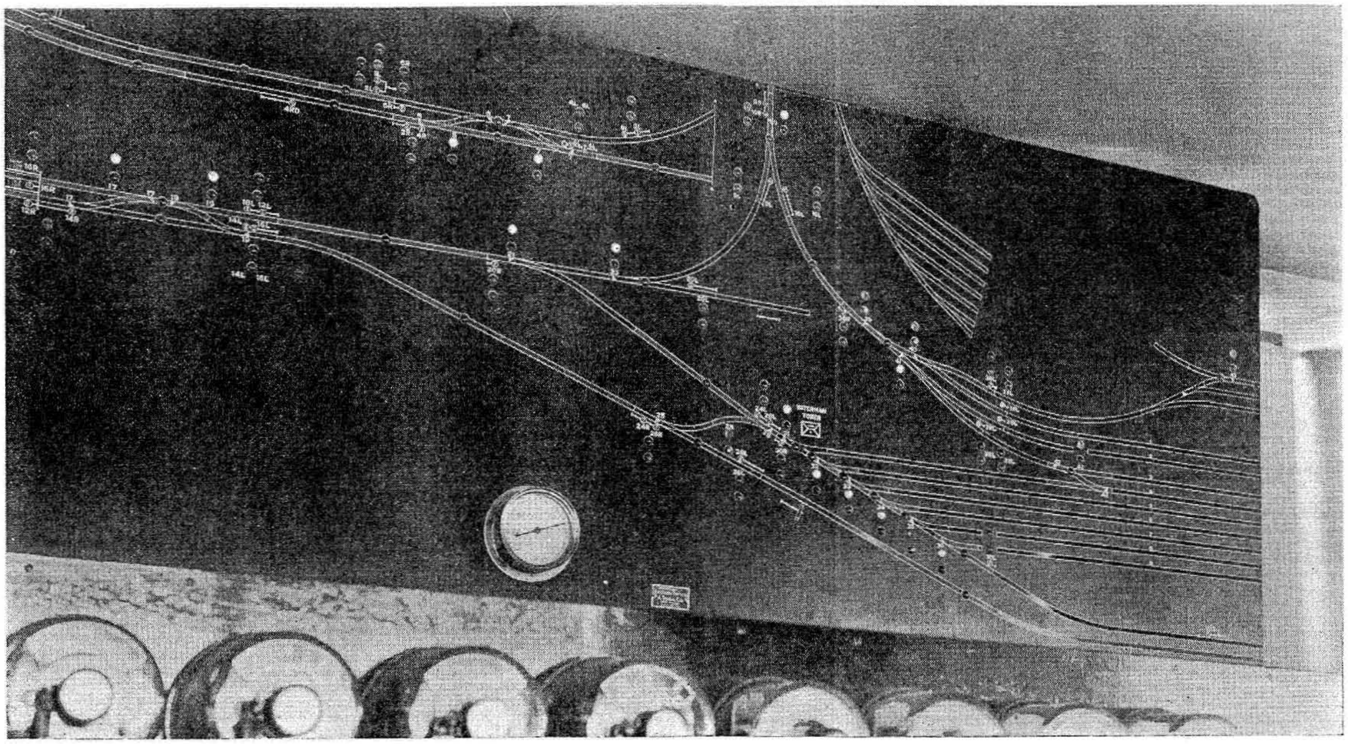
The tower building is of fireproof brick construction, consists of two stories and a basement, and is 22 ft. 8 in. long by 15 ft. 4 in. wide. Because this structure stands on the edge of a fill, the foundation rests on piles. An iron stairway gives entrance to the first and second floors. The building is heated by an individual hot-water plant. The view from the second story windows is comprehensive, which is an advantage in permitting the operator to see the inbound freight trains and also to be in a position to handle way-bills through the pneumatic tubes. It also permits him to impart information to the yard office and the hump office at the east-bound classification yard, as well as to handle the moves of the hump engines.

The basement is divided into three rooms. The furnace room, which is 20 ft. 6 in. by 6 ft. 4 in., contains the boiler and heating accessories. The coal room is

8 ft. long by 6 ft. 2 in. wide. The 11 ft. 10 in. by 6 ft. battery room contains shelved racks for storage battery; these racks accord with the signal department's standards and permit inspection of each end of every cell. The storage battery is all of the Exide lead type. The code battery is of the BTM type and the local tower battery the KXHS-7, while the remainder are the KXHS-11 type. The different sets furnish power to the functions as follows: One set of seven cells for controlling switch valves; one set of five cells for controlling signal and detector locks; two sets in parallel, each set consisting of six cells, for controlling direct-acting switch movements; one set of eight cells for controlling local code units; one set of nine cells for the code line; one set of five cells for the local tower circuits.

Following the prescribed standard practice of the signal department, the first floor houses the relays, rectifiers and switch test board. The instrument rack in the center of the room is constructed of angle-iron frame and transite board shelving with a center aisle which is closed at each end by doors. In this aisle are the transite boards on which are mounted the A.R.A. terminals as well as the transite wire chases. The outer sides of this rack are open shelves of transite for supporting the relays, and one portion is used as a panel board for instruments and rectifiers. On the panel board are seven copper-oxide rectifiers made by the Union Switch & Signal Company. Three rectifiers are Type RT-42; two rectifiers, RT-21; and two rectifiers, RT-11; these charge the storage batteries in the basement. The neutral relays are of Burlington design and assembly and are a product of the signal department's signal shop. The polarized relays are U. S. & S. Co. Type DP-14. Square-D metal duct is used for wire runs between rack and battery in basement and also to the second floor. However, the major portion of the conductors between the first and second floors are in manufactured cable.

The second floor contains the control machines for both Waterman and Graham. The Waterman machine is the U. S. & S. Co. Model 14, complete with enameled steel cabinet, separate detector equipment with forced-down feature and with all machine wiring terminated on multiple-unit terminal boards. The illuminated diagram for this machine is 8 ft. 7 in. by 3 ft. 4 in. with the Burlington's standard arrangement of lights. It is constructed of furniture steel with black front-plate and with the track circuits shown in colors thereon. The smaller machine which controls the Graham plant remotely, is of the code-relay type embodying stick and non-stick control of signals and contains seven levers which operate train-order signals and which are provided in addition to the levers for the Graham operating functions.



Track diagram showing the extent of the electro-pneumatic interlocking

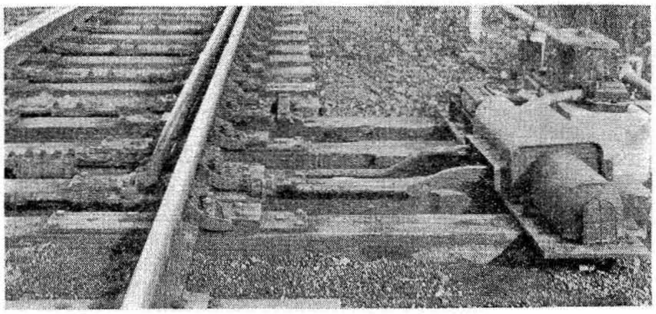
In describing this installation, which consists of two component parts, each of a different type of apparatus and method of control, it is necessary to discuss the field installations for Waterman and Graham separately.

The Waterman Plant

The piping system for the air supply at the Waterman plant is of first importance. The source of supply is the compressor plant located at the nearby timber-treating yard. This compressor station is dependable as it contains a duplicate set of compressors and ample storage facilities, as well as an atmospheric condenser. From this source a pipe line approximately 1,800 ft. long carries the air to the interlocking plant, where it is again passed through an atmospheric condenser and into storage tanks of 250 cu. ft. capacity. Ahead of the condenser an attachment is provided for a locomotive to pump air in case of an emergency. From the local storage tanks, air is distributed to the functions of the interlocking. The main lines are above ground, and only the cross lines that pass under tracks are below ground, while conveniently located valves control the flow of air through the several paths. In order to reach the units of the interlocking, the following pipes are used: 5,700 ft. of 2-in., above ground; 500 ft. of 2-in., below ground; 3,300 ft. of ¾-in., below ground; and 75 ft. of ½-in., below ground.

Two types of switch machines are in use: The U. S. &

S. Co. Type A-1 and the direct-acting type. The A-1 machines are used on all switches excepting those on the receiving tracks for the east-bound classification yard, where the direct-acting type is used. Both kinds of machine operate on from 50 to 80 lb. pressure. The Type A-1 machine is equipped with lock rods, but the direct-acting type is directly connected to the switch point and uses separately connected switch boxes for signal selection. Both types are installed 4 ft. 7¾ in. from the gage of rail, except in a few cases where clearance limits did not permit. All machines, regardless of type, are placed on top of the tie, thus eliminating the necessity for tie framing and also making it possible to place the machine away from the ground.



Typical switch layout at Waterman

Searchlight signals displaying two, or three-color indications, as required, to show the standard aspects of the Burlington, are the media by which train moves are made. These signals are the U. S. & S. Co. Type H-1; they are ground-type signals, except one location on the Galesburg-Quincy-Kansas City line, where a two-track signal bridge was used. The lights in the signals burn directly off the a-c. power line, except in case of a power failure, at which time they are automatically transferred to storage battery, through power-off relays.

Aerial and Underground Cable

Conductors for all controls are carried about the plant in cable, according to the Burlington's standard practice. This cable is mostly No. 16 gage, fabricated in conformity with the signal department's specifications. Aerial cable is supported by 6,000-lb. messenger and hung thereto by cable rings. The regular telegraph poles, where properly located, support the cable, and where such lines are not available, stub poles were used. The power lines are No. 6 triple-braid weather-proof wire, and are carried on glass insulators on the same poles with the cable. These lines carry 220-volt single-phase 60-cycle current. Track connections are of Okonite parkway cable, underground from their point of connection to the nearest terminal box or instrument case. The ends of parkway cable are sealed with sealing compound.

Terminal boxes and instrument cases are located on the poles that carry the aerial cable, thus keeping them completely away from all tracks. Both the aerial and parkway cable terminate in these boxes, and in them also are the terminal blocks, lightning arresters, relays, rectifiers, power-off relays, storage battery, and the power-entrance switches and fuses protecting the 220-volt supply. The neutral relays are the Burlington's standard type, the polarized relays are the U. S. & S. Co. Type DP-14, and the power-off relays are the Union's Type ANL-30. The rectifiers are of the copper-oxide type and are of two kinds, namely the RT-11 and the RT-42.

All switches are fitted according to standard practice. Four gage plates are used under each pair of points, one on the first tie ahead of the points, one on the tie under the points and one on each of the following two ties. These plates are cut in the center so as to provide insulation for the track circuits. A total of eight rail braces, four on each side, are used so as to control the track gage, and two tie straps, fastened to and spanning nine ties, together with plenty of rail anchors, prevent the switches from getting out of alinement. Bossart switch adjustors and U. S. & S. Co. Type U-3 switch boxes complete the interlocking part of the switch layout.

The Waterman interlocking plant was constructed by the forces of the signal department. The work started in September, 1931, and was completed in December of the same year.

The Graham Plant

Before passing to a description of the Graham plant, it is interesting to describe the intervening tracks and their signal protection. This is a double-track freight line, connecting the yards at Waterman with the double-track Chicago-Denver main line at Graham. The freight tracks are signaled in both directions and the entire distance of three miles consists of one block in each direction on each track. All trains are operated by signal indication, as the entrance signals at each end are under the control of the operator at Waterman. The signals at the Waterman end are of the color-light type, while those at the Graham end are of the semaphore type.

The Graham track arrangement is shown in the illustration of the control machine, from which it will be noted that the crossovers are so arranged that all freight trains use the freight line in and out of the yards, which is the normal route, as the line between here and the passenger station at Galesburg is purely a passenger line. Only slight track changes were made when the old plant was superseded by the new remotely controlled one, as the traffic previously had been handled the same, except that train-orders were used. This plant replaced an old mechanical plant having 11 levers for 11 high signals, 3 levers for 3 dwarf signals, 4 levers for 6 switches, 2 levers for 2 restricting-speed route signals, 2 levers for 2 derails, and 4 levers for 5 detector bars.

The Graham plant is of the Union centralized traffic control type, controlling 10 signals and 6 switches. The control machine is located in the Waterman tower and has three levers for the 10 signals, four levers for the six switches and one spare space. The machine has a track diagram with lights for each track circuit, normal and reverse switch indication lights, and signal indication lights. The entire operation is with code, requiring only two line wires, which are in cable, from Waterman to Graham.

The switches are fitted according to standard practice as described previously in this article, excepting the General Railway Signal Co. Type-5A switch machines controlled from U. S. & S. Co. Type-F controllers. These machines have lock-rod protection, are dual control, operate in 10 seconds, and their source of power is 16 cells of lead storage battery housed at the central location.

All signals are of the semaphore lower-quadrant 60-deg. type, having power-operated top-post mechanisms and are the same signals that were in service at the old plant. These signals required only a change in their controls to adapt them to the new code apparatus. The track circuits required no changes and existing track relays were used in the new arrangement.

A concrete house 6 ft. by 6 ft. is located on the south side of the main tracks, opposite the location of the old tower building. It contains, throughout its interior, wood shelving on which are located 3 time-element relays, 12 switch-repeater relays, 52 control and repeater relays and code equipment consisting of one field-station line-coding storage unit, three field-station storage units, and all neutral relays and other equipment necessary for the local electric locking.

The following storage batteries and rectifiers are housed in this central instrument house: One set of five cells of KXHS-7 Exide lead storage battery for local controls, which is charged by one RT-21 copper-oxide rectifier, and two sets, in multiple, of eight cells of EMGO-9 storage battery in series. The latter battery is for switch-and-code oeration and is charged by two RT-42 copper-oxide rectifiers.

Graham was installed by the signal department's construction forces following the completion of the Waterman plant and was completed February, 1932. The code apparatus is of the U. S. & S. Co. design and was installed in accordance with the plans and engineering standards of the signal department.

As previously stated, Waterman and Graham are two separate plants of widely different types of construction. Yet, due to the control of each being centralized and the connecting tracks operated from the same point, they actually are one operating unit. Also, since the traffic is in several directions, and some of it never seen by the operator, it is handled by signal indication only. This traffic, as it is today, is shown in the following statement, from which an idea may be had as to what the traffic would be in normal times: Graham plant only: Six passenger trains westbound daily, and six passenger trains eastbound daily. Both the Waterman and the Graham plants: Seven freight trains westbound daily, and seven freight trains eastbound daily. Waterman plant only: Four passenger trains westbound daily, four passenger trains eastbound daily, seven freight trains westbound daily, and seven freight trains eastbound daily.

Signals Disobeyed

THE head-end collision between a passenger train and a freight train on the Louisville & Nashville at Wald, Ala., on September 29, resulting in the death of three mail clerks and two employees, and the injury of nine passengers, one mail clerk, five railroad employees, and four Pullman employees, was caused primarily by the failure of all concerned to provide adequate flag protection and by the failure of the enginemen of both trains properly to observe and obey signal indications, according to the report of the Interstate Commerce Commission, Bureau of Safety. This report follows, abstracted:

In the vicinity of the point of accident this is a single-track line over which trains are operated by time-table, train-orders, and an automatic block signal system. The accident occurred 185 ft. south of the south passing track switch at Wald. The signals involved are of the three-position upper-quadrant type approach-lighted operating on the A. P. B. principle and displaying red, yellow and green for Stop, Caution and Proceed, respectively.

Southbound second-class freight train second No. 17 upon arrival at Wald, pulled down on the main track to the south switch where the engineman delivered the copies of a train-order to the engineman of train first No. 17. The latter train at once started to depart from Wald, but when it was entirely out on the main track the brakes were applied by Conductor Capell, who had not received a copy of the order. Unable to proceed farther, due to the passage of time, train first No. 17 then backed in on the siding; the second section backed up on the main track and headed in at the north switch, coming to a stop behind the first section with its caboose and 12 or 15 cars standing out on the main track. The head brakeman of the second section was sent out to protect that train against trains first No. 2 and No. 38.

Northbound passenger train first No. 2, in charge of Conductor Hughes and Engineman Urghart, upon approaching Wald, found signal 5392 displaying a caution indication and then was flagged and found signal 5382 at stop. The engineman was informed of the necessity of sawing by the two sections of train No. 17 and pulled down the main track and stopped near the north switch. As soon as train first No. 2 was clear of the south switch train first No. 17 again started to head out, this time for the purpose of sawing by train first No. 2, but it had reached a point only 185 ft. south of the switch when it was struck by train No. 38.

Northbound passenger train No. 38, in charge of Conductor Wilson and Engineman Cowell, passed the flagman from train second No. 17, and collided with the head end of train first No. 17 while traveling at a speed estimated to have been between 50 and 60 m. p. h.

The employees killed were the engineman of train No. 38 and the head brakeman of train first No. 17; those injured were the fireman, conductor, and flagman of train No. 38 and the engineman and fireman of train first No. 17.

Signal Maintainer Cowart said the signals at Bolling and Wald had been operating properly since July, 1930, and that he had inspected them thoroughly only six days prior to the accident. He proceeded to the point of accident from Georgiana and found signal 5402 at caution, while stop indications were displayed by signals 5392, 5382, 5391, and 5381. None of the signals had been broken and after the track had been cleared and some rail bonds renewed he made tests of the signal apparatus and found everything working properly.

Signal Supervisor Baker arrived at the scene about four hours after the occurrence of the accident and confirmed the statement of Signal Maintainer Cowart concerning the indications which were displayed by the northbound signals.

Engineman Cowell, of train No. 38, failed properly to observe and obey signal indications as well as the flagman's stop signals. The signal system is believed to have been operating properly, and because of the presence of train first No. 2, in the block ahead, Engineman Cowell must have received a caution indication at signal 5392. It can not be stated definitely whether Engineman Cowell sounded the required whistle signal in acknowledgement of the caution automatic signal indication, but apparently he did not acknowledge the flagman's signals and there was no application of the brakes until a very few seconds before the accident occurred; in addition, at the high rate of speed at which he was operating his train Engineman Cowell could not possibly have obeyed the stop indication of signal 5382. Practically all the employees involved in this accident either failed entirely to do what was required or else did it only half way. The signal system was in proper condition, the employees involved were men of long experience, and there was nothing to show that the rules were not adequate to provide for the safe movement of the various trains involved. The circumstances surrounding this accident strikeingly direct attention to the necessity for officials of this line to enforce obedience to the rules, particularly in respect to signal observance, flagging, and the issuance and delivery of orders to trains at outlying points.