

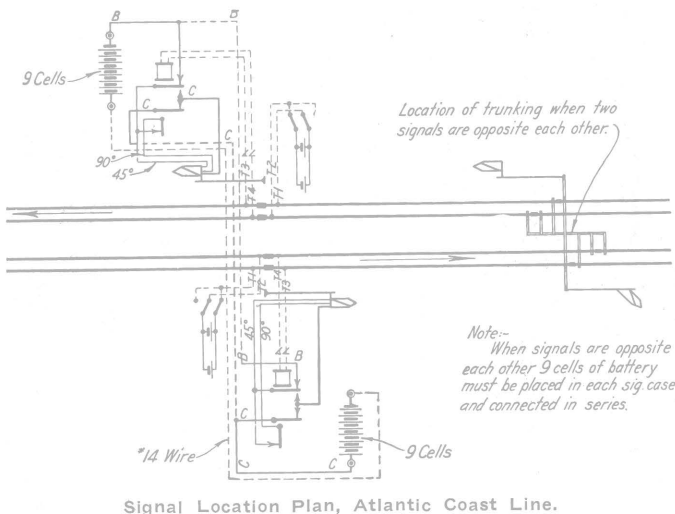
design,—differing very materially from the others,—and plainly stamped “Pusher Staff,” so there is no danger of confusing it with those conveying right to proceed through the block. The pusher staff cannot be withdrawn from the box until a staff for the block has been obtained and used as a key to release it. The regular staff may then be delivered to the train, and the pusher staff to the engine which is to cut loose at the top of the hill and return. Both engine and train will now be fully protected in the movements they are to make, by the fact that the withdrawal of the pusher staff opens the staff circuit, leaving the block completely locked up until it is returned to its place in the box, and the regular staff is placed back in one or the other of the instruments.

In the operation of the staff system here, regular trains starting out receive a clearance card, and extra trains receive a 19 order to “staff” Loomis to Truckee, or vice-versa. No other orders are necessary. Operators have instructions to “staff” the superior train first unless otherwise directed by the dispatcher. Twenty stations are telegraph offices, and 16 are only block stations, the signalmen at these receiving their instructions as to the handling of trains through the operator at the adjoining telegraph station by telephone. There is a telegraph office on at least one side of each telephone station.

The question of maintenance is taken care of by seven repairmen, whose districts average about 13 miles in length. Each repairman looks after everything on his district, and in addition, in the snowshed district, maintains a system of fire-alarm and district-telegraph boxes, which are used in the protection of the track and snowsheds in this territory.

### BATTERY HOUSING ON THE ATLANTIC COAST LINE.

The Atlantic Coast Line lies in a territory of mild climate. J. C. Kelloway, signal engineer of the road, has taken advantage of this condition in the housing of the primary batteries used in automatic signaling on this line. He has found battery wells and chutes unnecessary, and instead employs special rectangular battery jars so designed that 16 cells of primary battery can be placed in the signal case with space enough left for three cells



Signal Location Plan, Atlantic Coast Line.

of gravity battery. These rectangular jars are of heat-resisting glass, and cost but very little more than the porcelain jars.

Where signals are located opposite each other only 18 cells of primary battery are used. Nine cells are placed in each signal case, and the two batteries are connected in series. With 35 blade movements per day it is estimated that a battery of 18 cells, each cell of 400 amp. hrs. capacity, will last a year and probably longer.

The sketch shows the layout and placing of the trunking when signals are opposite. Although this arrangement can be used only in certain parts of the country the economy of employing it wherever possible is evident.

### NEW 400-LEVER INTERLOCKING MACHINE.

H. S. Balliet, engineer of maintenance of way of the Grand Central Terminal, New York City, and signal engineer of the electric division, has just erected a 400-lever electric interlocking machine in one of the two principal cabins of the terminal. A picture of the machine as it was set up for testing in the shop of the General Railway Signal Co. at Rochester, N. Y., is shown herewith. Back of this machine is seen the 360-lever machine for the upper level; the first mentioned being for the lower level. These machines have “lever lights” or illuminated numbers over each lever. Some of these are faintly discernible in the picture. The irregularity of appearance of the controllers at the back of the machine is due to the fact that on some of the levers these controllers are two tiers in height, on others three, and on others four or five. The construction of these “unit levers” was described in *The Signal Engineer* for October, 1910, page 168, and the design of the “four-story” fireproof signal cabin was shown. In this the rooms used for the machines are in the second and fourth stories (at the north end), that in the second story for the lower level tracks, and that in the fourth for the upper. This building, just north of 49th street, stands close to the line of Park avenue, which is overhead, and which runs parallel to the center tracks through the yard. The signal station for the upper level is designated “A,” and that for the lower level “B.”

The interlocking machines are the General Railway Signal Co.’s Model 2, but the lever arrangement and numerous details were designed by Mr. Balliet and his assistants.

The 400-lever machine is 67 ft. 7 in. long, 2 ft. 6 1/8 in. wide and 4 ft. 3 5/8 in. high. It is built in 10 sections, each section comprising 15 locking plates, a total of 150 plates. In order to have perfect alinement of tappets and locking, these plates, which are 16 in. long, have been milled to within 1-1,000th of an inch of the calculated size. The length of the longest locking strip used in this machine is 210 in.

There are five distinct operating sections to this interlocking machine. It is an assemblage of five machines interconnected by mechanical interlocking, instead of electrically, as would be necessary if there were five separate plants. The following tabulation shows the number of units controlled from each section:

|   | Section Nos.— |    |    |     |     | Ttl. |
|---|---------------|----|----|-----|-----|------|
|   | 1             | 2  | 3  | 4   | 5   |      |
| Levers for signals.....                 | 21            | 43 | 34 | 51  | 60  | 209  |
| Levers for switches and M. P. frogs.... | 10            | 33 | 26 | 45  | 39  | 153  |
| Total working levers.....               | 31            | 76 | 60 | 96  | 99  | 362  |
| Spare spaces .....                      | 5             | 8  | 7  | 11  | 7   | 38   |
| Total frame .....                       | 36            | 84 | 67 | 107 | 106 | 400  |

There is a lever for each signal, no signals being worked through selectors. There is also a lever for each point switch, each set of slip points and each set of movable-point frogs, the entire arrangement having been worked out on the basis of the simplest method of maintaining the apparatus and of promptly making repairs if failures occur. The 153 switch levers control switches as follows: 13 turnouts No. 6 1/2; 16 turnouts No. 7; 35, No. 8; 1 No. 10; and 1 No. 12; 6 No. 7 double slips; 23 No. 8 double slips, and 29 movable-point frogs, 6 of them No. 7 and 23 No. 8. The use of sub-stations at 10 points in the yards was described in our former article, referred to above.

The levers in this machine are numbered from 701 to 1,100 inclusive. Throughout the yard each switch, slip, movable-point frog and signal has a different number, so that there are no duplicates anywhere in the whole terminal, including both the upper and lower levels. This plan was adopted to simplify the issuing of orders and the interchange of directors and other employes between the different cabins. Thus any function in either yard can be quickly and accurately designated with the least possible chance of error.

With the two machines in stations A and B this building will house the largest number of interlocking levers ever assembled under one roof. As the cabins, both in the upper and lower levels, are surrounded by numerous columns supporting the structure above, the signal men will have to depend entirely on their electric indicators for their knowledge of the position of trains. This being so, it would have been entirely feasible to put all of the 760

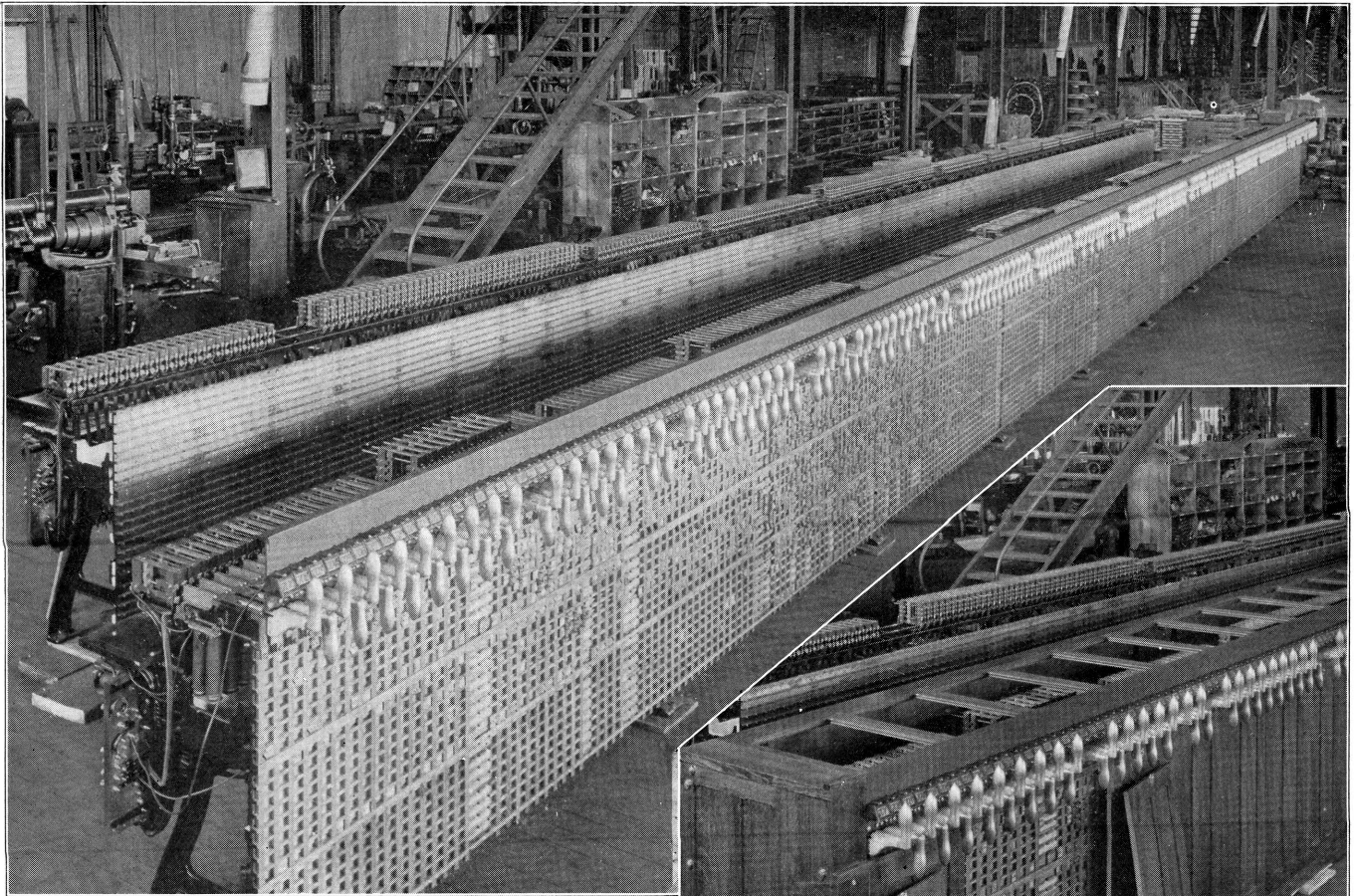
levers in a single frame, on the fourth floor; but, after considerable study, it was concluded that the separate arrangement would best promote simplicity of operation. The minimum force of men in each cabin will be a director with one assistant and enough levermen to set the switches and signals with the requisite promptness.

The wooden cabinet which is to inclose this machine will have hinged doors for all of its openings, and these will be locked with Yale & Towne standard locks, thus affording protection against the leverman who yields to the temptation to pick an indication.

The wires which extend from the machine to the switches and signals are led out through a series of small doors at the bottom of the cabinet. These wires all start from a termi-

## RESULTS OF INSPECTIONS MADE BY THE BLOCK SIGNAL AND TRAIN CON- TROL BOARD.

In order to obtain data regarding the actual methods employed in handling train movements by the dispatching system, and the various signal systems in use, as well as other practices, the board has had inspections made of such methods and systems, and has investigated a number of complaints which have been received of improper methods of safeguarding train movements. It is encouraging to find that so high a percentage of train dispatchers, telegraph operators, signalmen and trainmen are intelligent, well trained and faithful. The instances of what appear to be undesirable conditions, which are cited, should not be con-

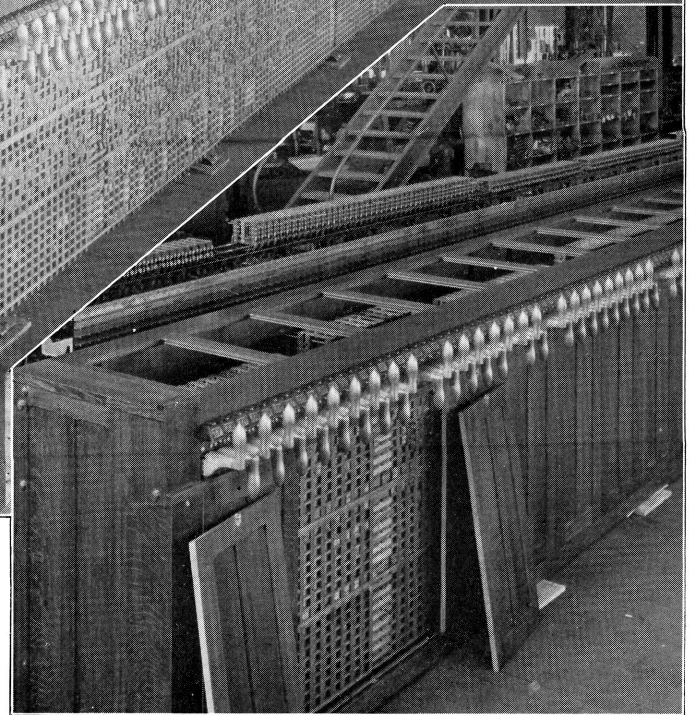


The 400-Lever Electric Interlocking Machine for the Grand Central Terminal, as It Was Set Up for Testing

nal board on which connections are so made that any lever can be disconnected and taken out quickly without disturbing adjacent levers or interfering with the locking.

This machine in station B controls the switches and signals in a territory of about  $23\frac{1}{2}$  acres—a yard 3,000 ft. long and 600 ft. wide, the limits of which are 55th street on the north and 43d street on the south, Lexington avenue on the east and Vanderbilt avenue on the west. South of 43d street there is an independent small cabin for the loops, one cabin for both levels. Diagrams of the tracks of these yards were published in the issue of October, 1910. Station B, when put in service, will take the place of a 68-lever electric interlocking machine of the General Railway Signal Co., which is now in use at the east side of the yard, not far from the new building. A number of the tracks controlled from this temporary cabin are not in their permanent locations, and will be superseded by others when the control is finally transferred to station B.

This will be the second permanent interlocking to be set up in the new terminal, the first having been the 144-lever machine at station U, at the entrance to the yard (57th street), which was set up about a month ago.



Showing the Wooden Cabinet for the Machine.

sidered as indicating the general practice. They are pointed out with a view to calling attention to inherent defects in some operating methods, and to directing the attention of those concerned to remedial measures.

It is believed that one important source of carelessness, lack of skill, inattention to duty, and the use of loose methods on the part of employes in transportation service is due to lack of sufficient supervision and inspection. While in a number of instances the responsible officers were found to have been aware of undesirable conditions, to which their attention was called, and lacked either the courage or energy to correct them, it was more frequently found that the officers in responsible charge were overburdened with detail work and actually unable to give proper

\*From the report of November, 1910, Appendix E.