SIGNALING AT THE NEW GRAND CENTRAL TERMINAL.

WITH TWO INSETS.

The construction of the tracks of the new terminal of the New York Central & Hudson River and New York, New Haven & Hartford roads at 42d street, New York City, may now be said, roughly, to be one-third completed, and the arrangement of the tracks and the scheme of the signaling are so far advanced that we are enabled to give at this time the plans of the tracks, upper and lower levels; plans and elevations of the principal signal cabin and some information about the arrangements for the interlocking.

The plan of the tracks on the upper or express level, which is about 20 ft. *below* the level of the old yard, is shown on the upper inset. These tracks rest on a concrete floor supported by steel columns, and the location of these columns is indicated on the drawing, where possible, by small crosses. That part of the yard in which the structure is finished and on which tracks are now in use is on the east, or Lexington avenue side; but the tracks now in use are not, in all cases, in their final locations. It will be observed that at the south end there is a loop on this level, as well as one on the lower level; this is a recent modification of the plan, which at first provided only for stub tracks on the upper level. The tracks descending from the main line to the lower level, as shown between 53d and 54th streets, are those numbered A, B, F and J. For those readers who may have the patience to read the track figures on the plan, it may be noted that the curves are 599.607 radius, except in the "East yard," which consists of storage tracks, where the radius is 400.782. The frogs are No. 8, unless otherwise indicated.

The area of the lower level is not so great as that of the upper, and, looking at the drawing at 45th street, 14 of the tracks at the east or Lexington avenue side are laid on the surface; that is to say, there is no excavation beneath for the lower level, except for the single track of the lower-level loop. The columns shown in this part of the drawing are the supports for the buildings above the tracks.

The tracks of the lower or suburban level are shown on the second inset. As noted above, the excavation for this level does not extend all of the way to Lexington avenue. Its boundaries are indicated by a heavy black line. On the west, or Madison avenue side, a part of this excavation (not occupied by tracks) is left out of the drawing for lack of space. In this diagram may be seen the outline of the baggage subway, which runs beneath the tracks. This baggageway, some 50 ft. below the former surface of the ground, is connected with the tracks above it by stairways and elevators at suitable locations, and it affords a means of access for men on foot to all parts of the yard with the least possible crossing of tracks. The entrance to the signal cabin at 49th street will be by a stairway down from the street (Park avenue) which will run above the yard on the line of tracks, D, E, F, G and H. Entering the cabin and passing out by the stairway at its south end, one has easy access to the baggage subway and thus may reach all parts of the yard readily from the street.

There are five interlocking plants; stations A, B, C, F and U.

The main signal cabin, which is called a "station" and not a "tower," as it is named in the drawing, is near 49th street. Station A for the upper level is immediately above station B for the lower level. This combination is called a four-story cabin, but in reality it consists of two buildings of two stories each, the upper building resting on the upper track-floor structure. Referring to the diagram of the upper level, station A controls the switches of what may be called the full speed, or passenger, routes from the terminus northward to the irregular line drawn across the tracks between 52d and 54th streets, except the switches leading to and from the loop, which are controlled from station F, which is shown at the extreme left of the drawing of the lower level. Station F controls the switches and signals of the loops of *both* levels. The limits of signaling for the East yard, which is controlled from station C, are indicated by a line drawn across the diagram diagonally from 45th street to a point near sub-interlocking station W, thence northward to a point near the power sub-station at 50th street.

The connections from station A to those switches, signals and track circuits which are a considerable distance away, are run through sub-interlocking stations V, W, X, Y and Z, which are indicated on the drawing by solid black rectangles. The arrangement and functions of these sub-stations are explained below.

Station U at 57th street is an independent station. Sub-station T at 53d street is connected with station U. In the diagram of the lower level the sub-interlocking stations, connected with station B, are shown at N, P, R and S. Station F is independent, as before noted.

The buildings which house main signal stations, A and B, are used not only for the control of the switches and signals but for other purposes also, as will be seen from the drawings; namely, trainmaster's office; yardmaster's office; office of the foremen of car cleaning and car repairs; foremen of electrical equipment; rest room for enginemen and their assistants; rest room for conductors and trainmen; rooms for track repair men.

The floor plans of the main cabin (stations A and B) are shown in Figs. 1, 2, 3 and 4. Fig. 1 is the upper or fourth floor; Fig. 2, the floor next beneath this; Fig. 3, the second floor of the building on the lower level, and Fig. 4 is the lowest floor.

Fig. 5 is the east elevation of these buildings and Fig. 6 is the north elevation.

Fig. 7 shows the three-position dwarf semaphore which is standard in the terminal. The signaling on the main routes in these yards is arranged strictly on the plan of giving home and distant indications, however short may be the distances from one signal to another; that is to say, a signal in the vertical position indicates that the next signal is in the proceed position. It will be observed that the roundels for the different colors, green, yellow and red, are of three different sizes, thus making it impossible to put the wrong color into any one of the spectacles. The signal here shown is in a temporary location, and the tall iron box for holding the resistances and relays, which stands just beyond the signal, is a feature which in the permanent signaling will be conspicuous by its absence, all this class of apparatus being placed either in the block signal station or one of the sub-stations.

The two principal interlocking machines, aggregating a total of 750 levers, will be fixed in the second and fourth floors of the "four story" building. The signal maintainers' quarters, together with certain relays, switchboards, etc., will be in the first and third floors directly under the machine floors. This four-story building is about 200 ft. long and 20 ft. wide, only the northern half being used for signal purposes.

Station F will be a two-story building. It will be in the suburban level at the south end, and will contain the two machines required for the express and suburban level loops, respectively.

By consolidating into five interlocking stations the control of the functions which it was originally proposed to operate by 13 stations, it has been possible to eliminate approximately 100 levers which would have been required for interlocking between towers. Every switch in the terminal will be interlocked and protected by signals, and all of them except storage tracks will have alternating current track circuits throughout their entire length.

Power for the operation of the terminal interlocking will be supplied from a station situated on the south side of 50th street at Park avenue, where are located static transformers delivering alternating current at 300 volts, 25 cycles. The 300-volt lines will be carried around the terminal with cross connections at various points which will give duplicate 300-volt connections to every part of the yards, so that in case of a break in the 300-volt line at any point the duplicate connection can be used. This

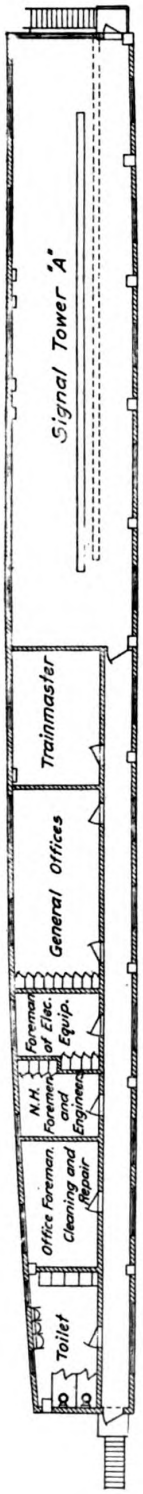

Fig. 1.—Fourth floor.

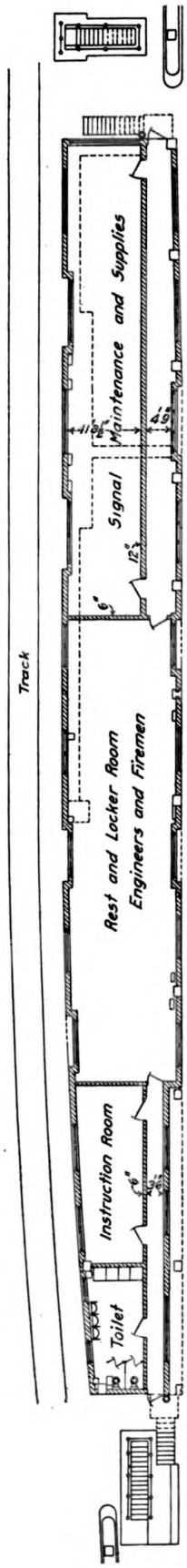

Fig. 2.—Third floor.

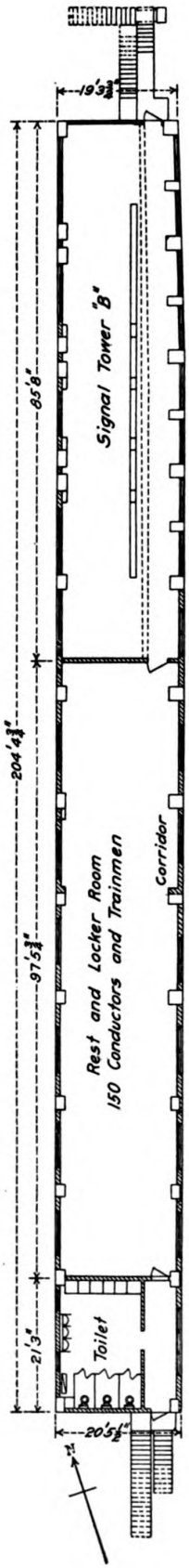

Fig. 3.—Second floor.

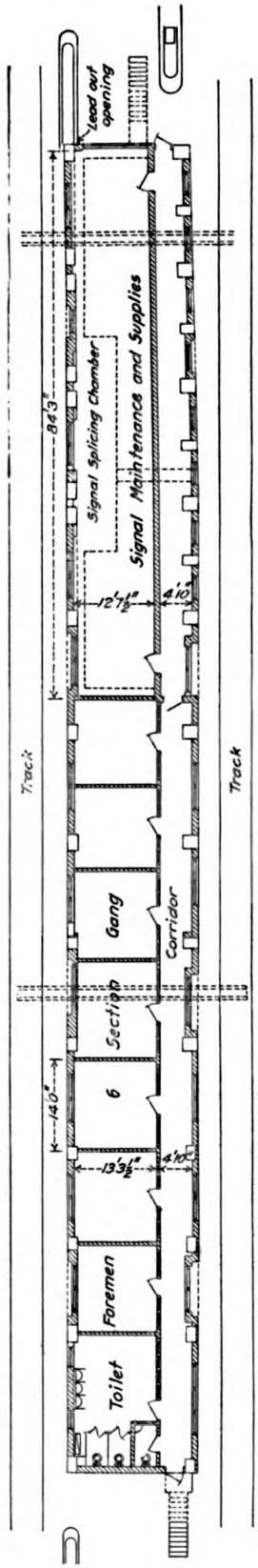

Fig. 4.—First floor.

Figs. 1, 2, 3 and 4—Floor Plans of Signal Stations A and B; Grand Central Terminal, New York City; New York Central & Hudson River Railroad.

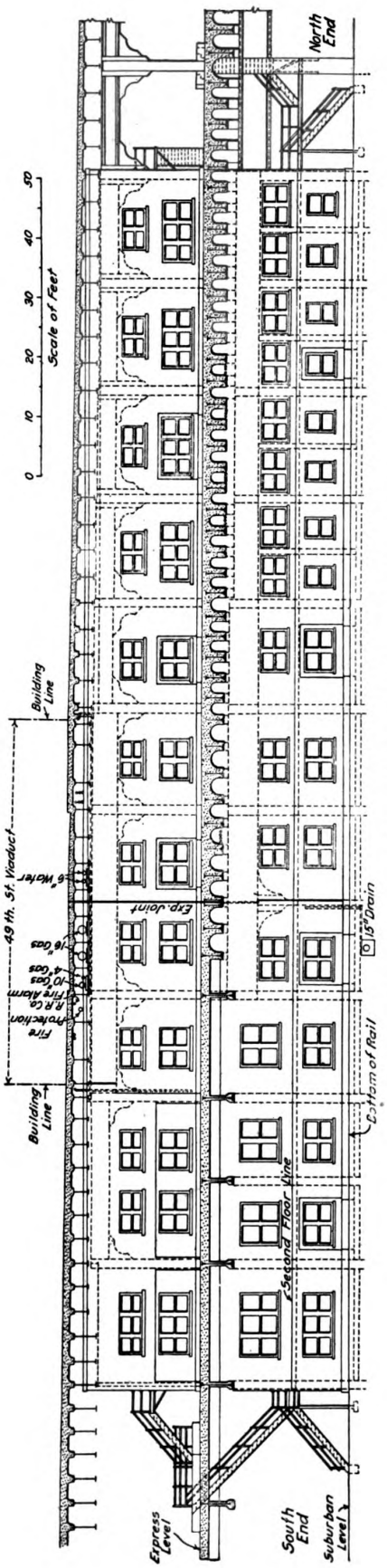

Fig. 5—East Elevation of Signal Stations A and B; Grand Central Terminal.

is shown on Fig. 9. The main storage battery and motor generator which will supply 110 volt direct current for the switches and signals in the terminal will be located in the power house.

The sub-interlocking stations were introduced in order to dispose conveniently the great number of wires which will lead from the large interlocking machines in cabins "A" and "B" to the very numerous operated units. Each level has been divided into sections or groups, each of which will have one of these central distributing points. There are six of these in the express level and four in the suburban level. These will be small one-story buildings housing the transformers, switchboards, terminal boards, relays and resistances. All control wires for switches, signals and locks will be carried from the main interlocking station to the sub-interlocking stations in large cables which will be run in ducts. From the sub-interlocking station to the operated units single wires or two or three-conductor cables, as required, will be used, and these will be carried in trunking. Duplicate transformers feeding the signal lamps, the track circuits and the lever lights are provided in each sub-interlocking station with throw-over switches to be used in the case of a breakdown of either transformer.

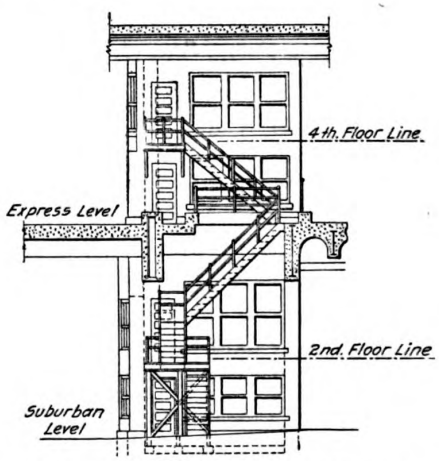

Fig. 6—North Elevation of Signal Stations A and B.

All track circuits in one group are fed by the transformers in the sub-interlocking station for that group, and there will be no track transformers on the ground. As all wires run to or through a sub-interlocking station no track or relay boxes are necessary outside of the station. Variable resistances of the tubular type are used in the leads to the track. These are placed on slate boards in the sub-interlocking station. A set of transformers, switchboards, etc., similar to that used in sub-interlocking stations is provided in each main interlocking station for the control of the units adjacent thereto.

A typical arrangement of the circuits between the terminal board of the interlocking machine and the operated units is shown in Fig. 10.

The interlocking machine is the General Railway Signal Co.'s type Model No. 2. To increase the efficiency of the machine and to facilitate inspection and maintenance, the lever proper has been placed in a re-designed guide which permits a lever to be removed without disturbing any other levers in the machine; in other words, the unit lever idea has been adopted. Alternating-current locks are used on all switch levers, the circuit for which is cut through a normally open controller on the latch of the lever. Thus this circuit is open at all times except when the lever is in use. The unit lever and the lever lock have been worked up from designs suggested by the Signal Department of the Electric division.

Lever lights controlled by the track circuits will be provided over all levers, as shown in Fig. 11. These will indicate, in the case of switch levers, whether the electric lever lock is ener-

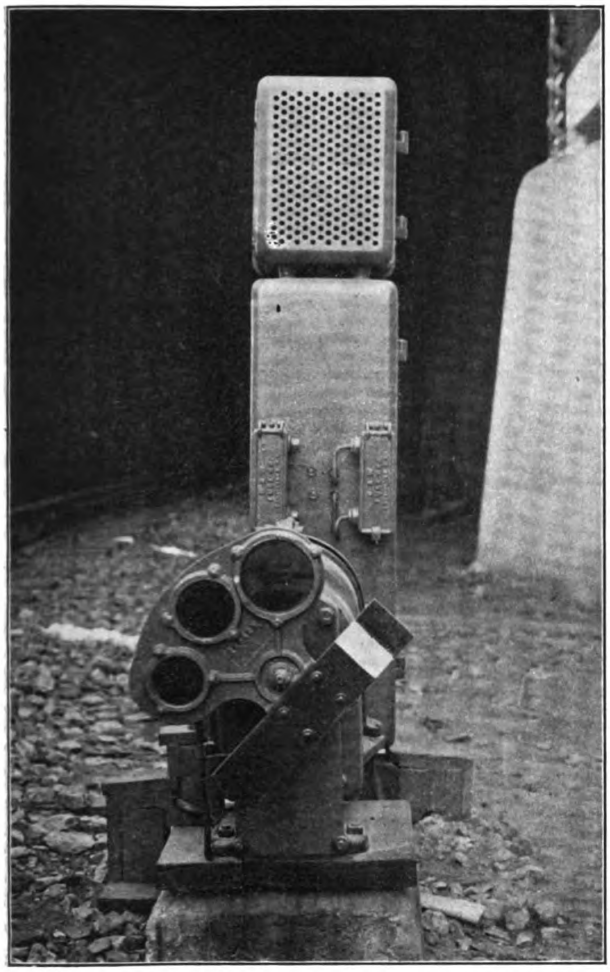

Fig. 7—Three-Position Dwarf Signal.

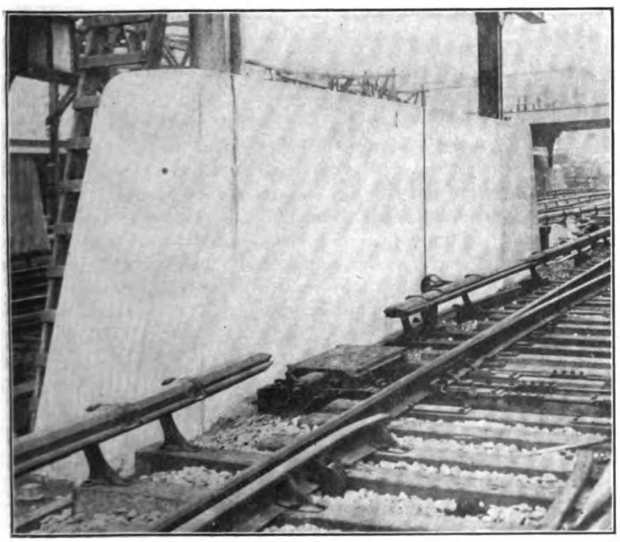

Fig. 8—Switch and Switch Movement; Grand Central Terminal.

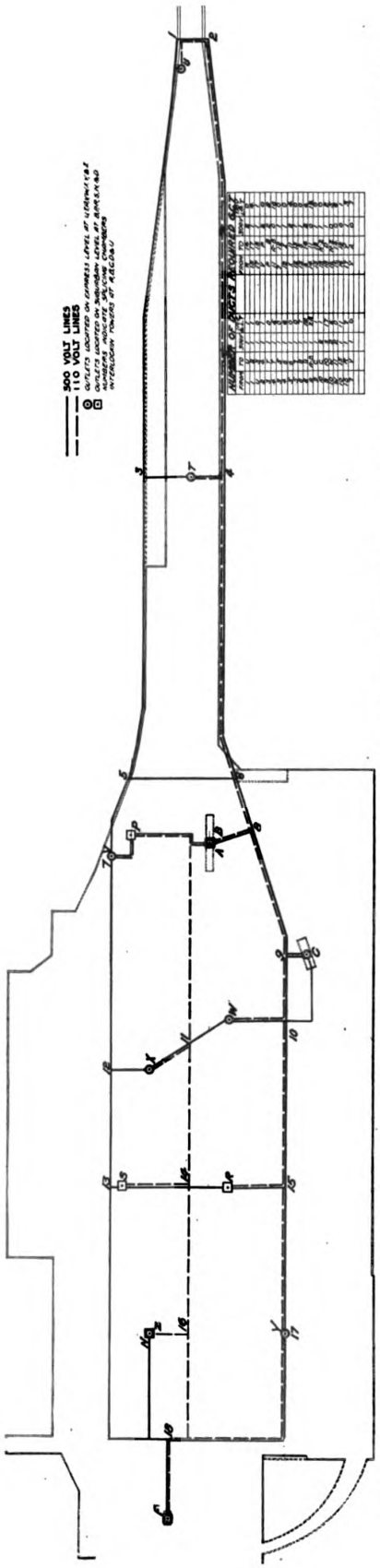

Fig. 9—Arrangement of Ducts for Control, Indication and Power Lines for Electric Switch and Signal Movements; Grand Central Terminal, New York City.

The Power-house is at 6.

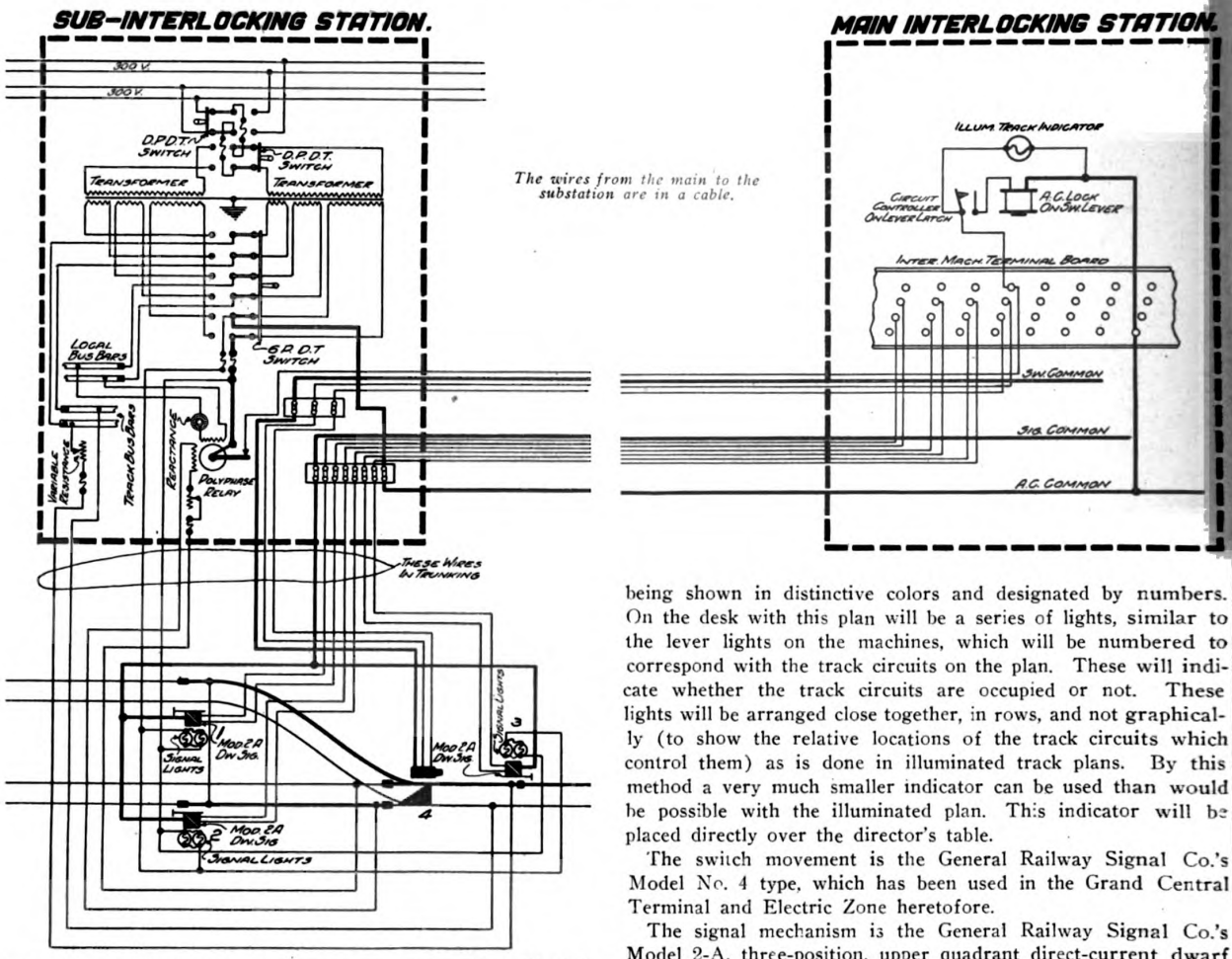

Fig. 10—Typical Arrangement of Circuits for Electric Interlocking; Grand Central Terminal.

gized (thus permitting the lever to be operated), and in the case of the signal levers, whether the signal is indicating "stop" or "proceed."

The train director in each cabin will have a track indicator in addition to the lever lights. These track indicators will consist, first, of a plan (not illuminated) of the tracks, switches and signals controlled from that machine, the track circuits being shown in distinctive colors and designated by numbers. On the desk with this plan will be a series of lights, similar to the lever lights on the machines, which will be numbered to correspond with the track circuits on the plan. These will indicate whether the track circuits are occupied or not. These lights will be arranged close together, in rows, and not graphically (to show the relative locations of the track circuits which control them) as is done in illuminated track plans. By this method a very much smaller indicator can be used than would be possible with the illuminated plan. This indicator will be placed directly over the director's table.

The switch movement is the General Railway Signal Co.'s Model No. 4 type, which has been used in the Grand Central Terminal and Electric Zone heretofore.

The signal mechanism is the General Railway Signal Co.'s Model 2-A, three-position, upper quadrant direct-current dwarf signal. There will be no high signals. The design is shown in Fig. 7. The design of the semaphore spectacle was decided upon as the only one which could be used in the very scant clearances available in the Grand Central Terminal.

For the information here given we are indebted to George W. Kittredge, chief engineer, and H. S. Balliet, signal engineer.

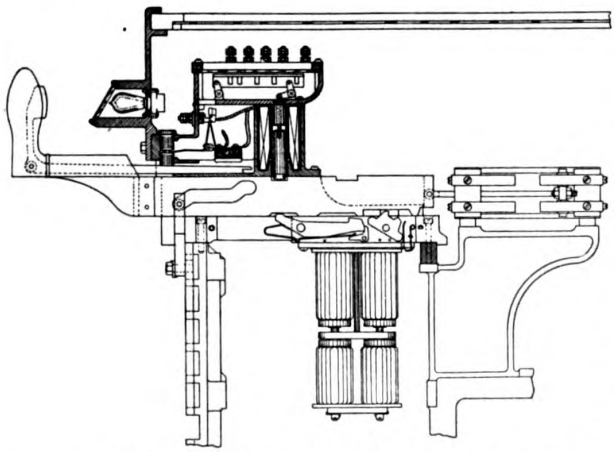

Fig. 11—Unit Lever for Electric Interlocking Machine; Grand Central Terminal, New York City.

FOREIGN RAILWAY NOTES.

Plans are being made for a direct line of railway between Genoa, Italy, and Piacenza, to be extended as far as Cremona, passing through the valley of the Bisagno and Trebbia. Such line would place the rich agricultural region of the Department of Emilia in much closer communication with the most important seaport of Italy than at present. Committees composed of members of the leading commercial bodies of Genoa and Piacenza are urging the government to provide, without delay, for the construction of the line.

The Russian government has decided to build a railway direct from Odessa to Moscow, by way of Bakhmach, the latter place being now connected by rail with Odessa. This road, as planned, would undoubtedly bring many additional cargoes to Odessa. However, a short distance from Bakhmach is the village of Voznesensk, located upon the Bug river. In order to divert from the railway cargoes intended for Odessa, public interests of Nicolaieff are arranging to dig a small canal from Vosnesensk to Bakhmach. The Russian government, it is understood, in view of this new development of affairs, has under consideration the matter of rearranging the plan of the new line.