# Electro-Pneumatic Plant at San Francisco

## Southern Pacific Has Installed New Interlocking in the Third Street Passenger Terminal

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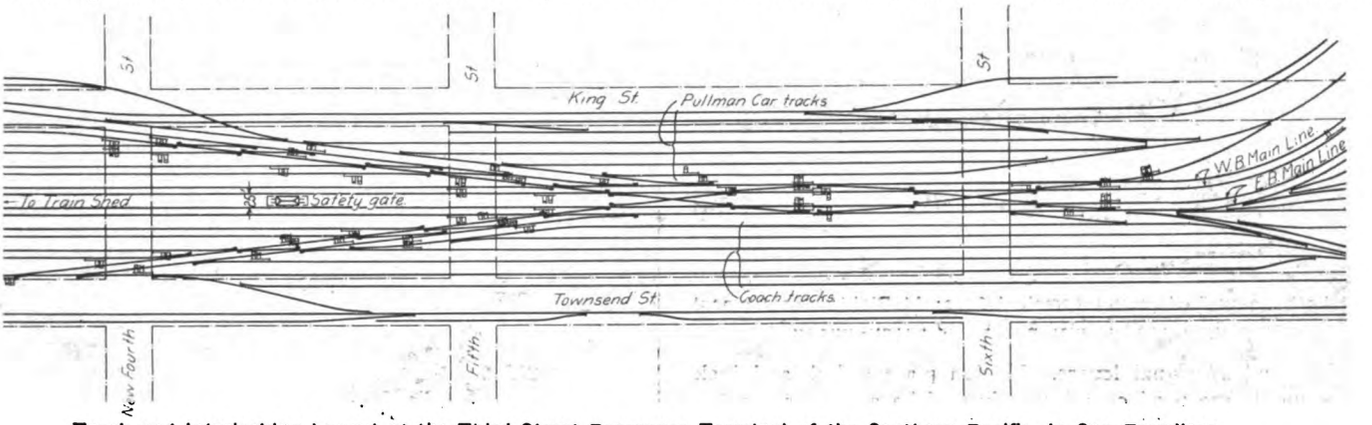
The Southern Pacific has recently completed and placed in service the Fourth street interlocking plant at San Francisco, Calif., which formed a part of the improvement in the passenger terminal facilities at Third and Townsend streets, the terminal for all the trains over the Coast Lines, both through and suburban. The improvement, which was necessitated by increasing traffic, consisted of four main items, the construction of a new passenger station, the removal of the freight houses to a point beyond King street, raising the grade of the yard an average of three feet and adding considerable trackage and the installation of the interlocking plant.

Under the former arrangement the trains entered the terminal over a double track on Townsend street, making a sharp turn off of the street to enter the station. The space from Townsend street to King street and from Fourth to Sixth streets was occupied by freight houses. The removal of these freight houses allowed room to construct tracks to handle all the equipment necessary at the terminal.

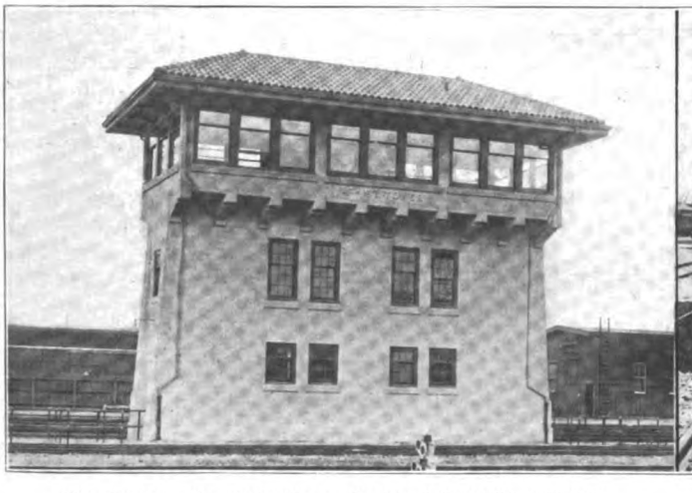
The general layout of the tracks, shown in the accompanying plan, consists of four main tracks with two sets of crossovers in the form of an "X" with double slip switches at the intersections. This gives access to the 14 shed tracks through a double track lead on each side. These leads have double slip switches at all intersections. All of these tracks are controlled by the interlocking. The tracks between these and Townsend street are used for the storage of baggage and mail cars and day coaches. The opposite side of the yard is for the storage of Pullman cars and at the lower end of yard near Seventh street is located the commissary building, where dining cars can be set in for overhauling and restocking.

The interlocking tower is a steel frame building covered with concrete, in the same style of architecture as the station, and is located between tracks midway between Fourth and Fifth streets. It is three stories high, the first two stories being 8 ft. by 40 ft., this width just providing the necessary clearance from the tracks. The third story, which is entirely above the 22-ft. level, is 16 ft. by 40 ft.. In order to prevent a person coming out of the tower from stepping in front of an approaching train on one of the adjacent tracks, safety gates, shown in one of the illustrations, were installed. These compel one to walk out to a distance where a view of the tracks may be obtained and look in both directions before crossing the tracks.

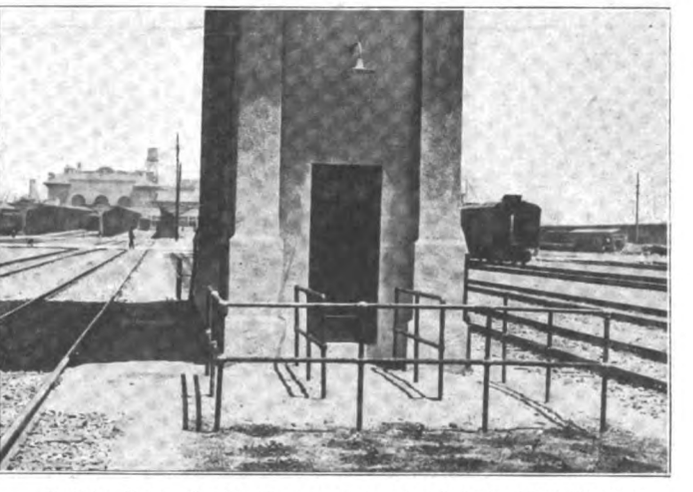
On the first floor are located the clothes lockers, work bench, sink, etc., and on the second, the relay racks, switchboard, rectifier and batteries. As the room is only 7 ft. wide it can readily be understood that the installation of the apparatus was no small problem. The third story is the operating room and contains only the machine and the illuminated




Track and Interlocking Layout at the Third Street Passenger Terminal of the Southern Pacific, in San Francisco.



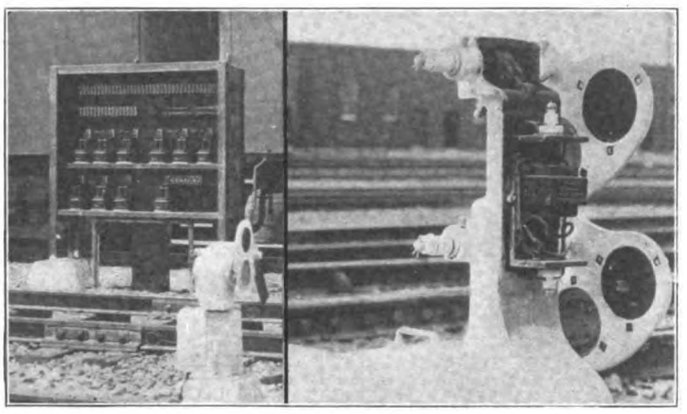
The Fourth Street Southern Pacific Interlocking Tower.



Safety Gate at the Entrance to the Interlocking Tower.

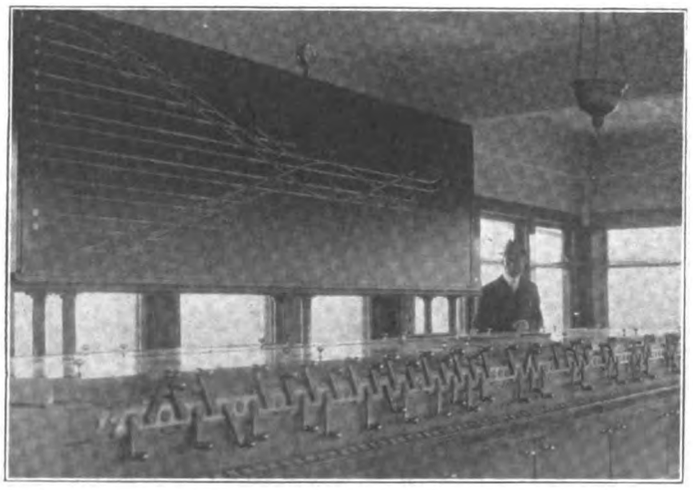
track model. The machine is a 107-lever, vertical roller, electro-pneumatic, with a steel cabinet. Lever lights are located beneath each switch lever. The illuminated track model is located above and at the back of the machine, so that the towerman can more easily and quickly handle the large number of switching movements required in distributing the cars from incoming trains and making up outbound trains.

The interlocking machine controls 19 double slip switches, with movable point frogs, 21 single switches, 45 double-arm and 6 single-arm dwarf signals. These are handled by 38



**At Left, Relay Shelter and Terminal Case; At Right, Dwarf Signal Showing Transformer and Lamp Arrangement.**

switch and 29 signal levers. Motion plate switch and lock movements are used on all switches. The cylinders are 6½ in. in diameter, with metallic packing. The operating coils are 130 ohms, and the lock coils are 400 ohms. There are no high signals and no derails in the plant. The top arm of the double-arm signals is the stop signal, is controlled from the interlocking machine and is not slotted. The lower arm is the caution arm and is controlled by the track circuits and by the stop signal in advance. Where several routes are possible the control of the caution blade is selected



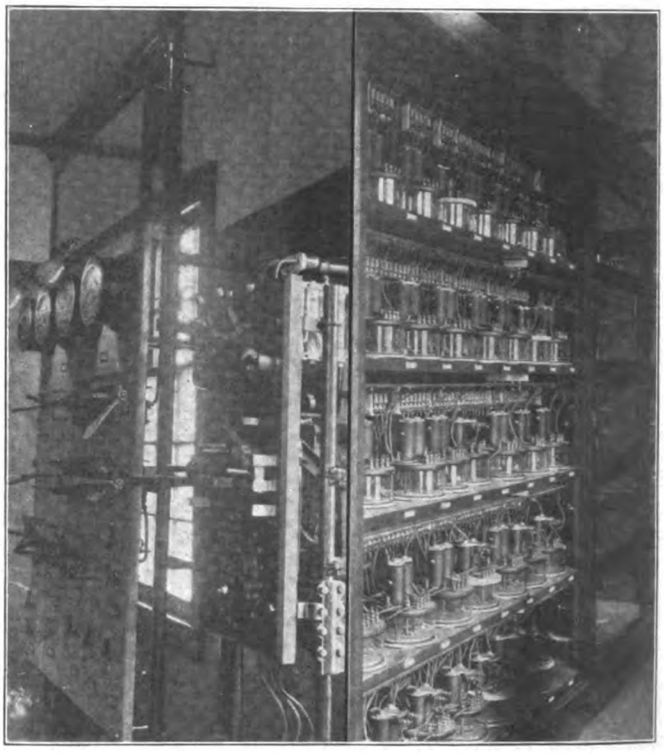
**Interior of the Tower Showing Illuminated Track Model and Electro-Pneumatic Machine.**

over the combination plate on the machine. All the signal material was furnished by the Union Switch and Signal Company.

The signals are lighted by 2-cp., 6-volt, 2.5-watt lamps, to which current is supplied by bell-ringing transformers 110-volt to 55-volt of 10 watts capacity, which are mounted in the lamp cases on the signals. A transformer supplies current for not more than four lamps. This method of lighting allows the use of No. 14 wire for the 110-volt circuit. The total current for lighting all of these signals in the yard is 240 watts.

The main wire leads are of built-up trunking, the wires being protected by soft asphaltum. Terminal cases are located at convenient points where all wires are brought to porcelain terminals, and where all wires are given numbers indicating their functions. All relays in the vicinity are housed in these shelters. The track circuits are for the most part short, controlling the switch lever locks, lever lights and caution signal blades. The 56 track circuits are fed by 12 cells of 240-ampere hour storage battery. The battery wires are run to all parts of the plant and suitable resistance is inserted in the track connections to give each relay its proper amount of current and to keep the short-circuit current as low as possible. The track relays are all quick acting, so as to lock the switches quickly, and when at some distance from the tower they control 500-ohm relays located in the tower.

The wires are brought in under the tower and then run up through the floor into the relay rack and from there they are distributed to the machine. On account of the limited



**Switchboard and Relay Rack on the Second Floor of the Tower.**

room available the relay rack had to be made so that all work could be done from the front.

The storage batteries are in two sets, each of which consists of 7 cells of operating battery, and 12 cells arranged in banks of two cells each for the track battery. The wires from the battery are run to the switchboard, which is arranged to make the necessary connections for throwing the banks in multiple for discharging, or connecting them in series for charging. The current for charging is furnished by a mercury-arc rectifier of 30-amperes capacity. As a rule one set of operating, and one set of track battery are charged in series, but the switches are arranged so that either one can be charged alone. An ammeter and voltmeter are provided for both operating and track battery. The ammeter can be cut into the circuit by means of a field discharge switch, which in one position shorts the terminals of the ammeter and in the other removes the short and can thus be cut into the circuit without opening it.

The track battery is taken out in three leads, one for each direction from the tower. Each one is controlled by a knife switch. Any one or all of them can be thrown into the ammeter, and in this way any variations from the normal can be located. The operating battery can also be thrown on the

ammeter to test the current consumption. A ground detector is provided so that the grounds on the machine or operating coils can be located and removed before they become heavy enough to cause trouble.

The illuminated track model is lighted by 329 1-cp. 6-volt lamps, and the lever lights by 2-cp. lamps, the current for which is supplied by a 110-5.5-volt transformer. At the station end of the illuminated model is a light for each track in the sheds. When a train is about to leave, the gateman rings a small bell in the ticket office as a notice to the ticket clerk to sell no more tickets for that train. When the last passenger is through the gate the gateman pushes a switch which lights two lights in the umbrella shed over the platform the train is standing on. The lights are located so as to be near the conductor for either a long or short train. Immediately under the light is a push button which the conductor presses when he is ready to leave. This lights a green light for the corresponding track on the model board and makes one stroke on a small bell. When the towerman clears the signal the light is extinguished.

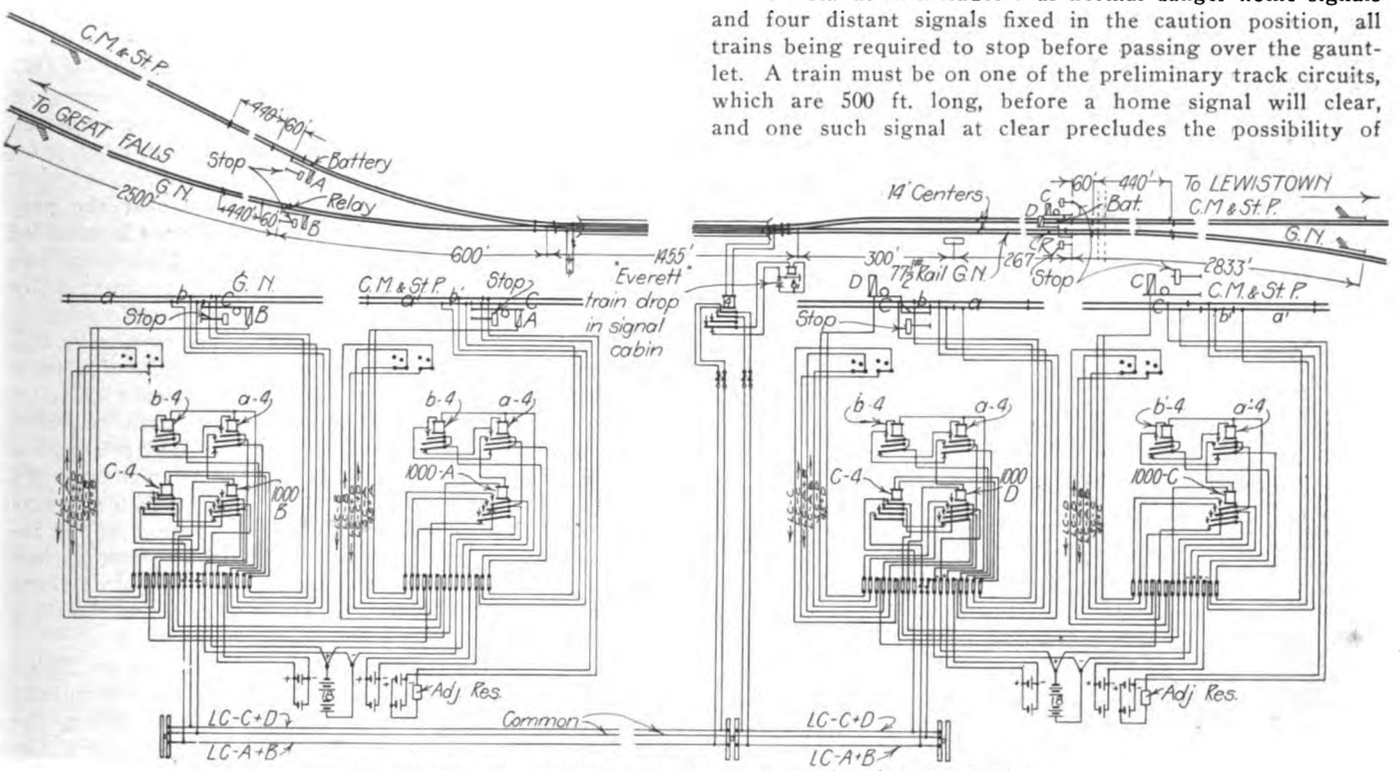
The air to operate the plant is obtained from a steam plant located on Townsend street, between Third and Fourth streets. This supplies heat for the station and all other buildings in the yard, and air for cleaning and testing, and for the operation of the interlocking. The compressor is a Bury two-stage with a capacity of 850 cu. ft. of free air per minute. Of this the interlocking requires approximately 50 ft. The air is taken out of the reservoirs through three main pipes, one for interlocking, one for cleaning and one for testing, each line having a reducing valve to regulate the pressure. The signal main is a 4-in. pipe across the street and is then reduced to 2 in., which serves as the main air line throughout most of the plant. At several points the main air pipe is brought up under a relay cabinet and a valve inserted so that if necessary the air can be quickly shut off.

The battery consumption of the machine, switch magnets, relays, etc., is 3¼ amperes. The battery consumption of the 56 track circuits is an average of 16 amperes, an average on ten track circuits being shunted all the time. Five towermen are required to operate the plant, two on each of the first two shifts and one on the third. Three maintainers are required.

## AUTOMATIC SIGNALS FOR GAUNTLET BRIDGE PROTECTION

The Great Northern recently installed automatic signals for the protection of movements over the gauntleted bridge crossing Cottonwood creek and Big Spring creek, near Kingston, Mont., used jointly with the Chicago, Milwaukee & St. Paul. This bridge is located on a branch line of the Great Northern from Moccasin to Lewistown and the branch of the Milwaukee recently completed from Lewistown to Great Falls. The placing in service of the latter line made necessary some form of protection at this viaduct, which is a pile structure 1,316 ft. long, and the automatic signal installation illustrated herewith was adopted. The traffic to be controlled at present is not heavy on either road, but ultimately these lines should develop considerable traffic, and in the meantime the signal installation provided affords good protection at a reasonable cost.

The installation includes four normal danger home signals and four distant signals fixed in the caution position, all trains being required to stop before passing over the gauntlet. A train must be on one of the preliminary track circuits, which are 500 ft. long, before a home signal will clear, and one such signal at clear precludes the possibility of clearing any of the other home signals. The home signals operate only to the caution position. A standard 11 ft. by 43 ft. portable signal cabin is provided for the signal repairman, who also acts as bridge watchman.




**Control Circuits for Automatic Signals Protecting Gauntlet Bridge.**

The signal poles are standard R. S. A. two-arm type, with the top arm operating and a marker disc, signal D being placed on a structural steel offset bracket pole. The R. S. A. No. 1040 spectacle casting is used with standard 3 ft. 6 in. blades and roundels showing red for stop and yellow for proceed on the Great Northern, and green for proceed on the Milwaukee. The signal batteries are BSCO R. S. A. No. 401 type, housed in Massey style G special concrete vaults, and the track batteries are BSCO with suitable resistance, housed in concrete vaults where possible, and otherwise in 9-ft. cast-iron chutes with three-cell elevators. The track relays are 4 ohms resistance with four platinum to graphite points and two platinum to platinum back points. The control relays are 1,000-ohm, with four platinum to graphite front points and two platinum to platinum back points. Relay boxes are of the R. S. A. standard, supported on horn brackets on signal poles, and fitted with terminal boards. All line wires are No. 10 bare copper-clad iron and all track and motor wires are No. 10 Kerite with 4/64-in. wall, 1 tape and 1 braid.