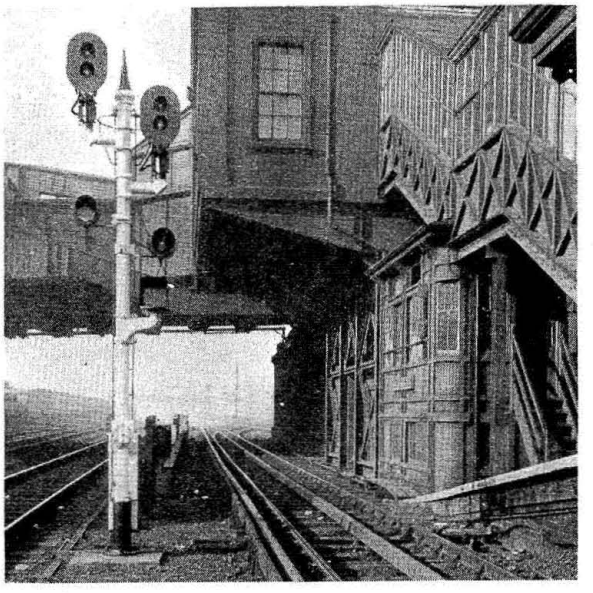
Paddington Power Signaling

An essential part of the improvements at the London terminal of the Great Western is the new all-electric signaling

THE London terminal of the Great Western, in England, has recently been improved with the view of facilitating train movements and providing additional platform space at the Paddington station. A complete revision of the signaling scheme has made possible the increased efficiency of the terminal; the new signal system includes three all-electric interlocking plants, one at Westbourne bridge and one each on the arrival and departure ends of the Paddington station. The first two interlockers displace old mechanical plants; the new Arrival interlocker displaces the old Arrival, the Bishops Road, and the Royal Oak station equipment. The Westbourne Bridge power installation was opened in January 1932, the Departure tower in July 1933, and the Arrival tower in August 1933, at the time of the exceptionally heavy traffic that prevailed during the summer holiday period. A description of these interlockings, as abstracted from an article published in the Railway Gazette, London, is as follows.



Signals and train stop at Royal Oak

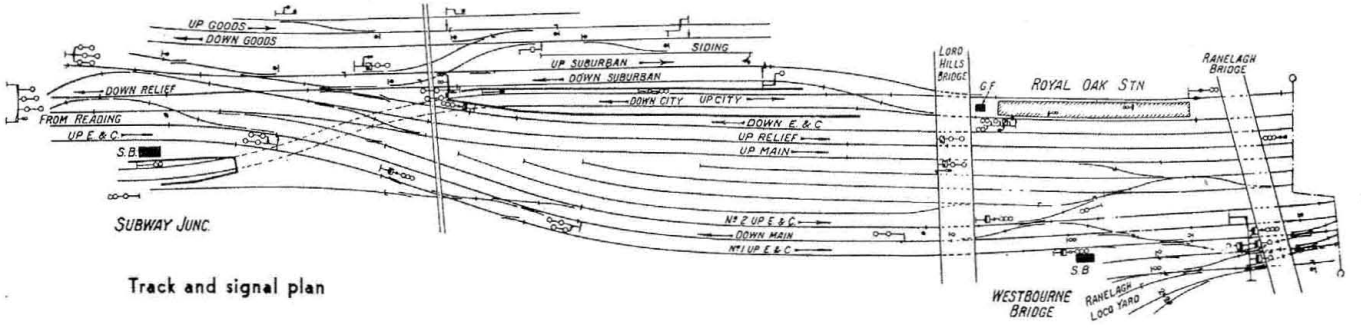
The Signal Towers

The signal towers have been designed to conform in general with the elevations of the buildings surrounding the yard. The Arrival and Departure towers have flat roofs, the Westbourne Bridge tower an ordinary ridge roof, and all three have two floors. The ground floor at each building houses the relays. A single relay rack was sufficient for the apparatus at Westbourne bridge, but, owing to the exceptional complication of the layout, two double relay racks are provided at the Arrival and Departure towers. The interior walls are plastered and painted a light stone color. The floors are made of fire resisting wood. A well, with access from the ground floor, has been made in the floors of all three of the towers to facilitate inspection of the locking frames. The towers are electrically lighted, and the Arrival and Departure buildings are electrically heated.

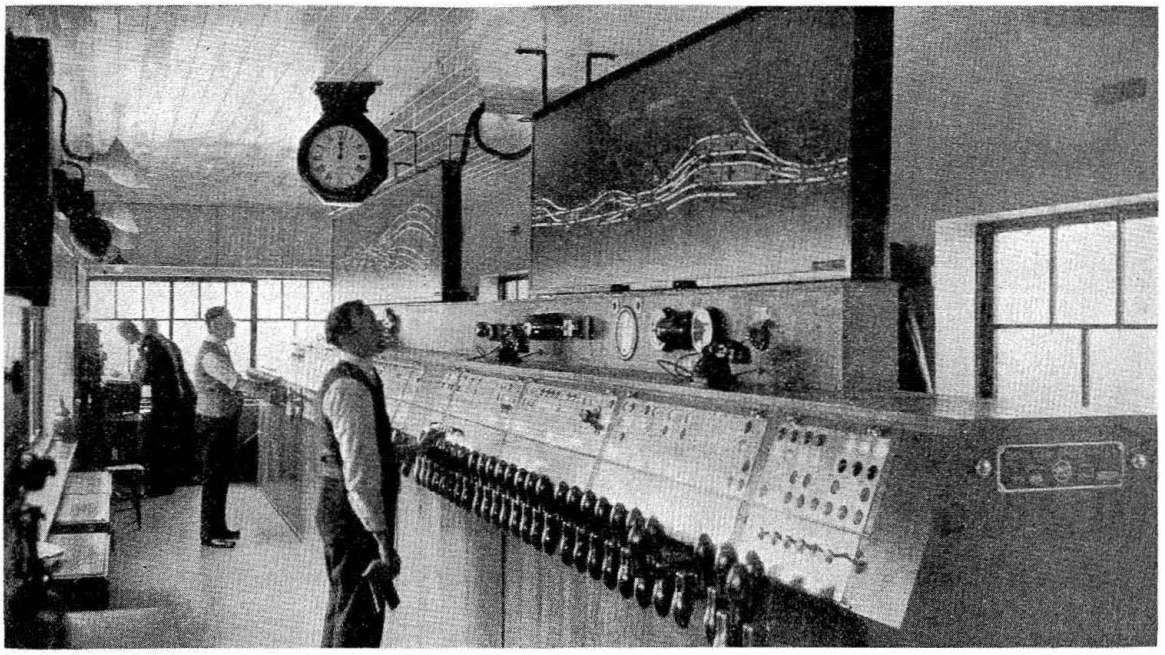
The Interlocking

At Westbourne bridge the 88-lever all-electric machine was the first on the Great Western in which the interlocking was accomplished electrically, no mechanical interlocking being employed. One lock only is employed for the purpose of the interlocking, track and other locking. At the Arrival and Departure plants, mechanical interlocking has been used. The Arrival machine has 184 levers and Departure 96 levers. This type of lever is sometimes called a "slide."

The signal levers are approach locked and an automatic time release is given by means of thermal relays. Signals may be put back to "danger" at any time but normal indication locks are provided to check the danger aspect of the signal. Switch levers are of the pull-through type, that is, no normal or reverse indication locking has been provided on them. Normal and reverse track locking and sectional-release route locking is provided on switch levers. All signals detect each switch in the route, whether facing, trailing or derail point. The usual repeaters for all signals and switches, and lights showing when the electric locking is free, are provided on all track-controlled signals and switch levers. Call-on and switching signals are controlled by means of push



Track and signal plan



The Arrival machine. Note the pushbuttons for calling-on signals

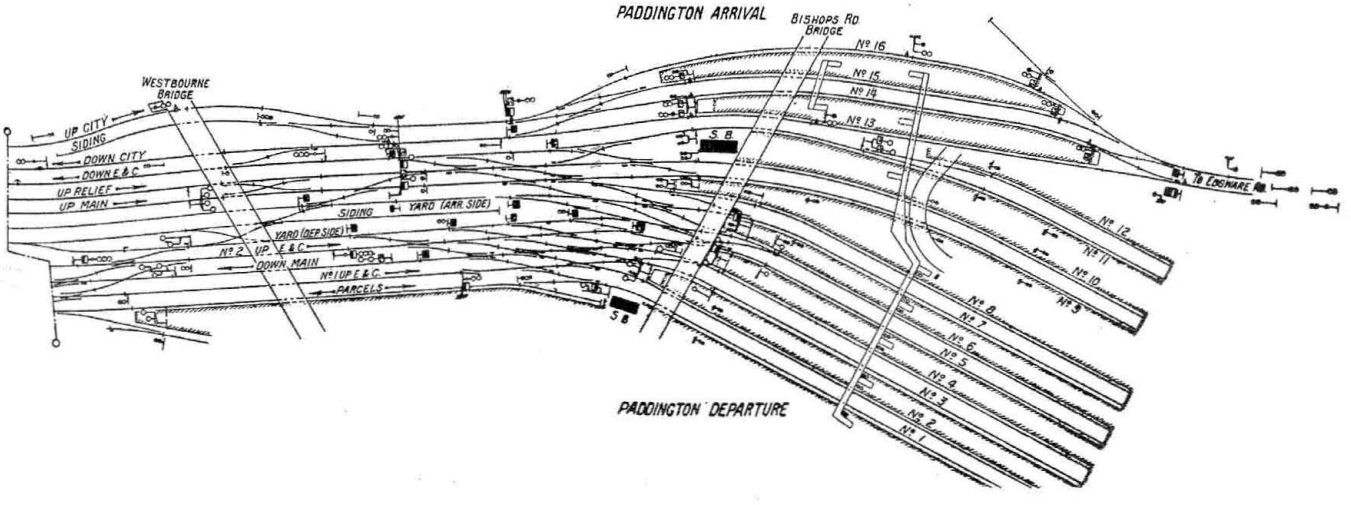
buttons, interlocking with the corresponding home signal lever. The primary function of the push button is to release the normal lock on the signal lever when the section ahead is occupied and to clear the calling-on signal when the lever is operated.

The interlocking machines are arranged so that the levermen work with their backs to the tracks and have easy access to the windows, and an unobstructed view of the yard. The block instruments and inter-tower telephones are mounted on the machine. All other telephone circuits have been arranged to be brought into annunciator boards. The illuminated diagrams are of the spotlight type, two small red lights for each track circuit indicating its occupancy. There are two diagrams, in the Arrival tower, one for the steam lines and the other for the electrified lines, two levermen being on duty in this tower ordinarily.

Searchlight Signals

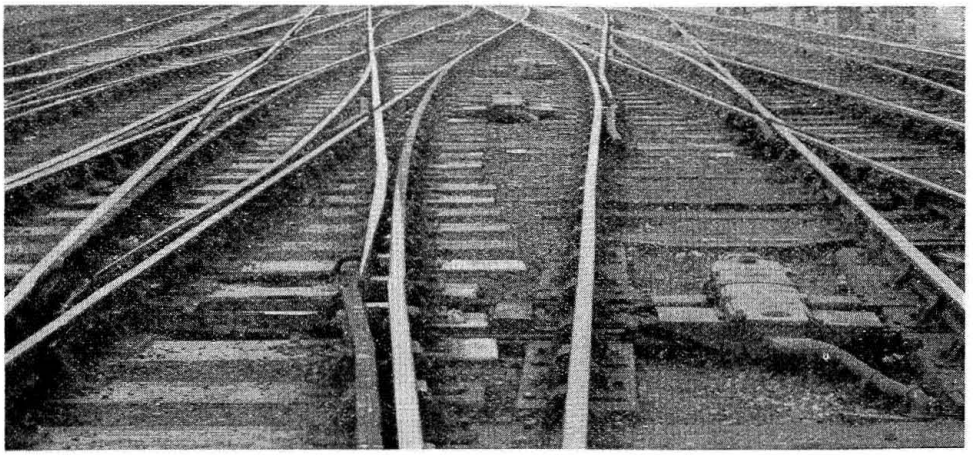
On the main passenger tracks, the signals are of the a-c. searchlight type and give the usual Great Western aspects of red and green for home signals and yellow and green for approach signals. A relay in series with the lamp is used for repeating the lamp filament; the lamp current for each searchlight signal lamp is supplied by a separate 110/12-volt transformer. The backing, loop and ground signals are of the multiple-lens type with red and green aspects; the lamps for these signals are 110 volt. Route indicators, mostly of the compartment type, are used. Two indicators of the lighted type are fitted on the up main and relief inner home bridge signal, as there is a large number of platform destinations to indicate. All route-indicating ground signals are made up in one case. The engine and passenger track signals are of the three-aspect type showing green for clear, yellow for caution and red for stop; an automatic calling-on signal is provided, however, if the section ahead of the signal is occupied. The calling-on signal takes the form of a small green light which shows when the lever is pulled with the track circuits ahead of the signal occupied, and the short approach track circuit occupied in addition. In the case of the automatic signals on the passenger tracks this small green light is exhibited automatically when the necessary conditions are fulfilled. Calling-on, warning, and switching signals on the passenger roads take the form of an illuminated stencil representing a small semaphore arm with a "C" "W" or "S" as required. These signal lights are normally extinguished.

On the electrified Hammersmith and City lines, train-stops work in conjunction with all stop signals which



are of the multiple-lens type. Levers are provided in the interlocking machine for converting the controlled signals on the electrified section into automatic signals. The circuits for these signals are arranged for train-stop checking.

The switch machines are of the d-c. type and are fed from a 120-volt, 200-a.h. battery. Where possible, the machines are fixed outside the four-foot way on long ties. All detection rods, bolt rods, etc., for the switch points, whether single, double, or slip points, are brought straight into the switch machine. The switch machine circuits are arranged for direct-current operation, dynamic braking and superimposed alternating current for the point detection. Each switch machine can be operated by a hand crank, the insertion of which breaks down both the operating and detector circuits. The track circuits are condenser-fed alternating-current circuits with vane relays. The condenser is connected in the primary of the track-feed transformer, with the exception of the electrified lines where 20 mf. condensers are connected in the secondary of the track-feed transformer.



Switch machines, looking west from the platforms

Cables and Power Supply

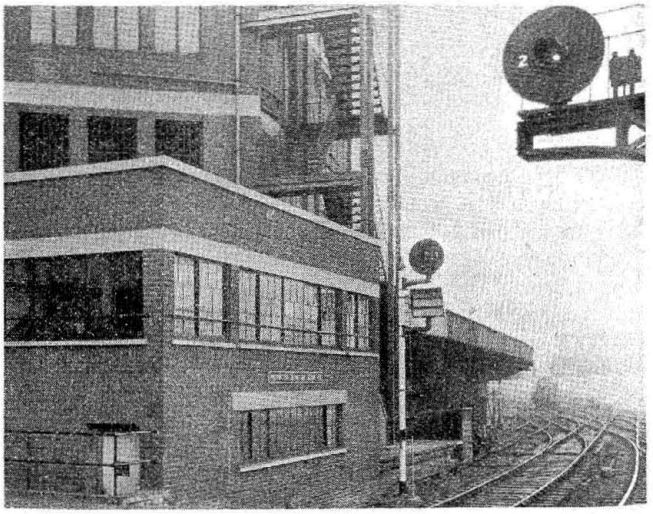
The cables are of lead-covered impregnated-paper-insulated type, and are terminated on porcelain terminals in welded sheet-steel location cases. The local connections from the cable ends are of braided-rubber-compound insulated wire. All cables are run at ground level in wooden trunking. On the arrival side of the station there was no room for the location cases to be placed in a safe position for access by the maintainer, and therefore a special gallery was built along the goods shed wall to carry the cables and instrument cases.

The power supply for the installation is obtained from the company's substation at Royal Oak, the supply being 460-volt single-phase 50-cycle alternating current. An alternative supply is available from the Metropolitan Electric Supply Company at Paddington departure in case of failure of the railway company's supply. Both a-c. and d-c. loop mains are provided in the yard to guard against cable failures. The d-c. supply for the switch machines is obtained from either of two 200-a.h., 120-volt lead storage batteries, one of which is located in Royal Oak substation and the other at the Arrival tower.

Although the preceding description covers the final power signaling installation, it should be appreciated that a considerable number of transition stages was necessary in order to effect the rearrangement of the tracks and platform extensions. In all, the alterations to the tracks and the signaling modifications were carried out in about 80 stages. These were undertaken week by week, and arranged so as to cause the minimum disturbance of traffic. The whole of this transitional work was the subject of very careful planning and co-ordination on the part of the departments involved.

Changing Over

As far as the signal department's work was concerned, most of the stage work was carried out in connection with the mechanical locking machines, in the old Westbourne Bridge, Arrival, Departure and Bishops Road signal towers. The facilities for work in these towers were considerably handicapped as the installations were already out of date, and there was very little room in which to install and house any extra apparatus required. As an example, at a certain stage of the work at the old Arrival plant, it became necessary, owing to shortage of space for mechanical piping, to bring into use a considerable number of switch machines controlled from mechanical levers. A large amount of electrical control apparatus had to be installed in the old Arrival tower and was in use for over a year, until the new Arrival tower was brought into use. Similar remarks apply in varying degrees to the other plants.



Paddington Departure tower

The contractor for the signal installation was the General Railway Signal Company, and for the cables the Callender's Cable Company.