

# Railway Interlocking Plant in Portugal

C. DE AZEVEDO NAZARETH, CHIEF ENGINEER, COMPANHIA DOS CAMINHOS DE FERRO PORTUGUESES, LISBON

*Ermezinde is an important junction on the Minho and Douro lines and, after the opening of the Ermezinde—Leixoões line, tracks from four directions meet there; since the station was taken over by the Portuguese State it has been necessary for it to undergo a radical modernization. One of the arrangements necessary in this connection was a modern signalling and interlocking system, and the technical department of the Companhia dos Caminhos de Portugueses was charged with investigation of this question in conjunction with the extension of the station. Among the tenders asked for, the conditions prescribed were best satisfied by the project submitted by Compañía Española Ericsson for an electric interlocking plant of Signalbolaget's system. This company therefore was asked to supply the installation which was put in service on August 6, 1937.*

*The following description of the installation is reproduced by kind permission from »Boletim da CP», September 1937.*

After a serious study of the different tenders which were received from specialized firms as well as existing similar installations installed by foreign railway administrations, the Portuguese State Railways decided to provide the station with one single interlocking cabin and to use electric local operation of certain points under the supervision of the cabin. All dependences between the signals, the points and the track circuits as well as the supervision devices on the interlocking machine are purely electrical and obtained by means of relays. In this manner an economic solution of the problem was also obtained from the point of view of operating costs, as it proved that the interlocking machine could be attended to by a single man per shift. Under the control of this operator, who acts as train dispatcher, were placed all the elements necessary for an efficient supervision of all train movements inside the station.



Fig. 1  
Interlocking cabin at Ermezinde

X 3800

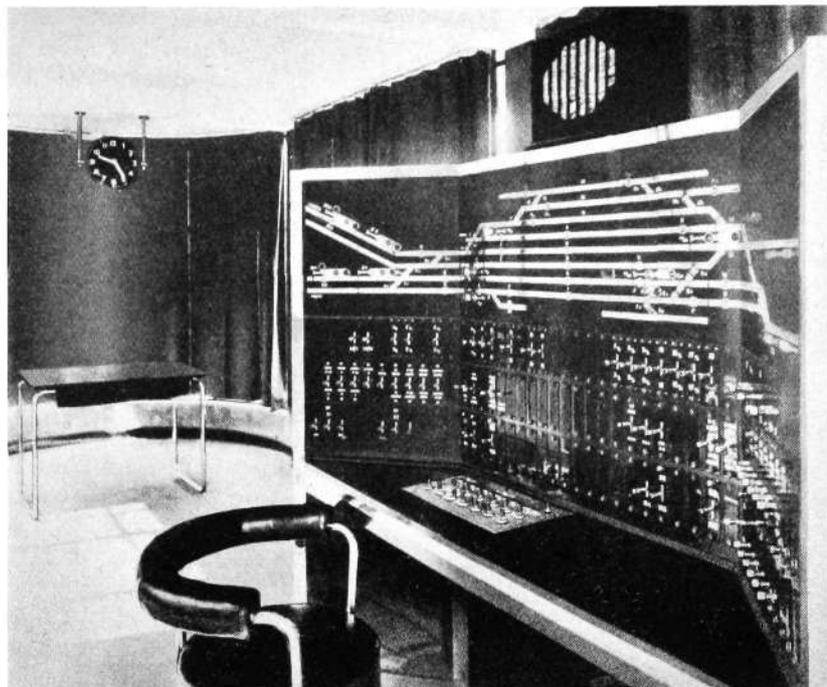
## Interlocking Cabin

The interlocking cabin, Fig. 1, is an attractive building of reinforced concrete with modern lines. It was designed and constructed by the railway's own staff. The building has three stories. On the ground floor there are the cable intakes, a distribution panel, a reserve power plant and a room for the mechanic. On the first floor there are the relay group and lockers for the staff. Finally the second floor which is entirely surrounded by glass windows contains the interlocking machine room, Fig. 2. The machine comprises three panels and a table-top. On the panels there is on a black background a diagrammatic track plan of the station, made up of chromium-plated bars and small electric lamps which reproduce the position of the signals and the points inside the station and indicate whether the track circuits are occupied. Under the diagram there are three rows of operating switches; the upper row is used for operating the different points and for giving permission for their local operation; in the second row there are road switches, *i. e.*, a series of switches which check that all conditions necessary for setting a certain signal at »clear» have been fulfilled; finally small signal switches are mounted in the lower row. On the table there

**Fig. 2**  
**Interlocking machine**

X 5424

above track diagram, below point switches, road switches and signal switches; on the table-top telephone exchange



is a telephone exchange which is connected with adjacent stations, the station master's office and the telephone instruments mounted near the different tracks and platforms inside the station.

## Track Circuits

The track diagram over Ermezinde station, Fig. 3, shows the disposition of the interlocking cabin, the signals and the points, and the division of the track system into insulated sections, *i. e.*, track circuits. The track sections are normally insulated from each other through insulating junctions of wood or through fibre junctions where there is no place for wood junctions. All electric circuits outside the cabin are of insulated signal cable of normal type. These cables are buried in the road-bed over a layer of sand to facilitate drainage and are protected above by bricks.

Each point or group of points composes a track circuit which is interlocked with the signals and prevents these being set at «clear» when the section in which they are comprised is occupied by vehicles; at the same time the track circuit locks the point or the group of points when it is passed by trains, also signalling to the cabin that the section is occupied. The track circuits are fed by low tension AC; in this manner the interlocking plant is protected against DC disturbance from adjacent traction circuits.

Track circuits are also arranged in the whole stretch of the tracks I, II, III, IV and V, partly to signal to the cabin when the tracks are occupied, partly to prevent a signal being put to «clear» for a track which is already occupied. The tracks VI, VII and VIII and the platform tracks are not

**Fig. 3**  
**Track diagram of Ermezinde railway station**

X 7132

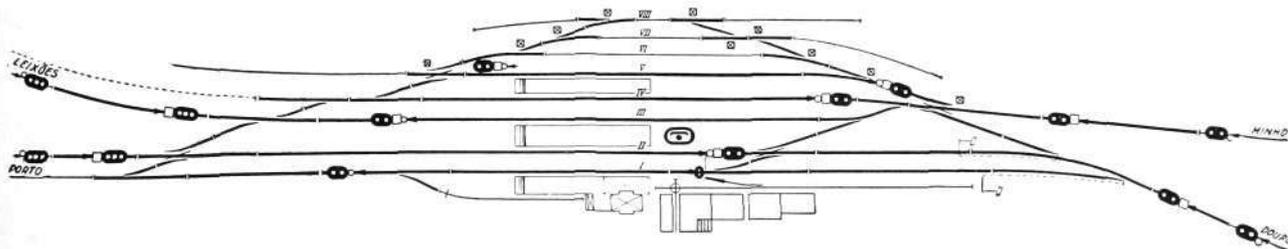




Fig. 4 X 3801  
Main signal with luminous sign

provided with track circuits, being used as side tracks which are generally occupied by vehicles and never used for train movements. Finally a track circuit is arranged before the main signal at the entrance of each track to the station in order to signal to the cabin when a vehicle passes a signal or when shunting movements are going on outside the entrance signal.

## Roads

When it is required to make up a road to receive or send off a train, all signals which are comprised in the road must be set at «clear». However, before it is possible to set at «clear» a signal which controls any of the entrance or departure roads to the station it is necessary that all points which are comprised in the road or give access to it should be in the right position, that these points are duly locked and that their position has been electrically supervised from the interlocking plant. There should be no vehicles on the track section which are comprised in the road, and all signals belonging to an opposed road should be set at «stop». If for some reason any of these safety measures has not been fulfilled, it is not possible to set the signal at «clear». A road which has been made up but which is not to be used may be cancelled in the interlocking plant by means of an emergency key which is normally sealed. When, however, the road has been made up and the train passes through the points, these are released one after another and the corresponding signals are automatically set at «stop».

The signals which control the shunting movements are not interlocked with the track circuits, which allows of carrying out shunting movements on sections already occupied by rolling stock.

## Signals

The signals are luminous daylight signals with coloured lights in two or three positions and consist of a lamp with a two-lamp system, of which the external one is uncoloured and the internal one coloured. The electric lamp is situated at the focus of the optical system and gives a light with very great visibility even in strong sunlight. The main signals, Fig. 4, are provided with luminous signs made up as small lamps which compose a number or a letter indicating the entrance track or the departure direction. The signals have screens which prevent the reflexion of sunlight and are mounted on plates coloured black. Each signal with luminous sign is mounted on a tubular steel pole which stands on a concrete base and is fitted with a ladder and inspection platform.

## Points

All the points inside the station are operated directly from the interlocking cabin, but certain points have a device for electric local operation, Fig. 5; this latter can be used only after permission has been obtained from the cabin, which always has the possibility to cancel the permission in case of emergency, *e. g.*, if the point is to be used in an entrance or departure road or if the cabin wants to take charge of the direct operation of the points. Near the points intended for local operation there is a pillar which supports a cabinet containing operating switches and a lamp which lights up when local operation is permitted by the interlocking cabin. The switch is operated by means of keys which are distributed to the employees who have the right of local operation.

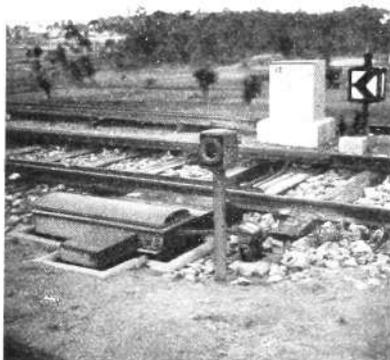


Fig. 5 X 3799  
Point driving machine with local switch

The point driving machines are fed by 220 V AC and provided with internal locking; when the points are moved to one or the other position, they are locked in this position and simultaneously it is supervised by

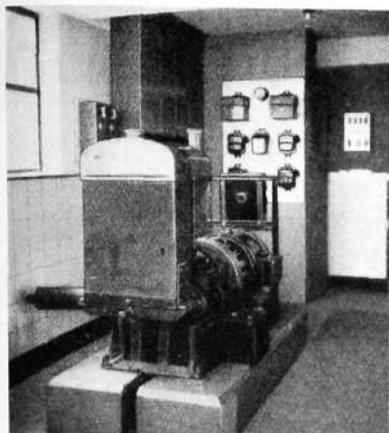


Fig. 6  
Reserve power plant

X 3802

the interlocking machine that the point is in the correct position and that the point proper has come to the extreme position. In case of faults or current interruptions of long duration the point driving machines may be operated by hand by means of cranks which are usually stored in the cabin under the supervision of the operator.

## Power Plant

The installation is normally fed from the electricity mains, but in case of interruption of that source of current there is a reserve power plant, Fig. 6, consisting of a motor generator group, composed of a petrol motor, direct coupled to an AC generator. This group is installed on the ground floor of the cabin and starts automatically in case of interruption on the mains current or in case of abnormal voltage drop. When automatic start is not used the group is started with a key.

In order to give an idea of the extent of the interlocking installation at Ermezinde station, it may be mentioned that it controls 28 points and 21 signals and comprises about 300 relays and over 20 000 connections. The electric junctions in the interlocking machine are about 8 600 and comprise 15 150 m insulated copper wire. The earth cables outside the cabin of which two are hundred-wire have a length of 7 840 m and represent 140 300 m single wire.

It is desirable that similar installations be generally introduced in all great stations, not so much for the facility of operation they offer, but above all for the increase in the traffic safety which they represent. This claim which might seem exaggerated to those not quite familiar with railway operation, is entirely confirmed by the following words, expressed by the French minister of public works in a speech which he delivered in Paris over the remains of the two hundred victims of the railway accident at Lagny on Christmas Eve 1933: »In everything that concerns the traffic safety of railways, whether it be question of material, brakes or signals, there should be no mention of any economy except that of human life.»