Interlocking Plants at La Coruña and Santiago

H INSULANDER, L M ERICSSONS SIGNALAKTIEBOLAG, STOCKHOLM

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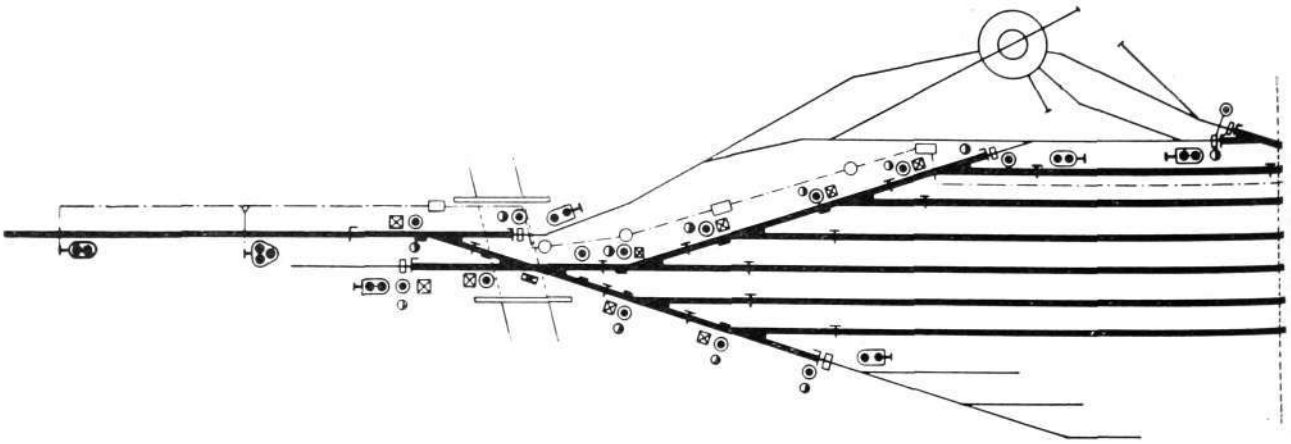
During 1944 Compañía Española Ericsson, Madrid, completed the supply of interlocking plants for the La Coruña—Santiago Railway. La Coruña is a port in north-west Spain and Santiago, or to give it its full name Santiago de Compostela, is a university town situated 50 km south of La Coruña on the road between La Coruña and the Atlantic port of Vigo on the west coast of Spain. The railway line is of recent construction and constitutes part of the programme drawn up by the Spanish Government for the building of new railways in Spain.

All the interlocking plant on this line has been supplied by Compañía Española Ericsson. The installations at the two terminal stations, at La Coruña and Santiago de Compostela, are electrical while the installations at all the intermediate stations are of mechanical construction. These latter have been largely constructed on Swedish patterns with apparatus of the lever type. The installations at the two terminuses, which are entirely electric, will be described more fully here.

Fig. 1 X 7101 X 7393
Station lay-out of La Coruña

- apparatus case
- cable distribution box
- cable branching box
- point or scotch-block lamp
- point machine
- local switch for point
- signal point lamp at double crossing points
- insulation between 2 track circuits
- terminal insulation
- shunting signal
- distant signal or exit signal, 2-light
- exit and shunting signal, 3-light
- main home signal
- signal cabin

The interlocking plants at La Coruña and Santiago, the material for which was entirely manufactured in Spain at the workshops of Cia Española Ericsson at Getafe, are of the »all-relay» type, which was adopted in view of the great advantages this offers compared with other electric types. The »All-relay» interlocking machine has the characteristic that all interlockings between tracks, points and signals etc. are ensured by the employment of relays. Thus there is no mechanical interlocking between switches or locking of the switches. Owing to this it is possible to give the interlocking machine itself extremely small dimensions as compared with other electric interlocking machines, with the further result that a large station area can be controlled from one apparatus. At the same time the surveyability of the apparatus is in no



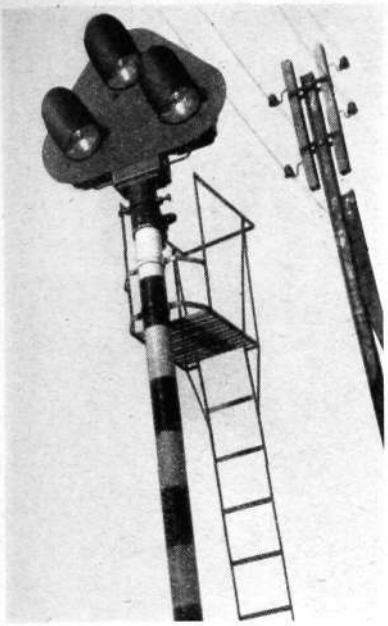


Fig. 2 X 4571
Home signal
the upper signal shows green, the two below show red light

way affected by the small dimensions; extremely good facility is provided for observing the actual situation on the station area from the indicating devices, in this case the lamps on the illuminated track diagram. Thus by the employment of apparatus of this system it is possible to control a much larger area than is the case with apparatus of other systems.

By the adoption of track circuits, together with automatic track locking and track unlocking, the safety for these installations can also be carried to the farthest limit. Faulty operation, therefore, cannot produce an accident but only interruption in running. The installations are moreover so formed that any faults immediately make themselves known.

The relay interlocking machine enables control to be automatised to a high degree. For example, it is possible to carry out the switching of all points etc. for laying a certain train route by throwing a single switch or pressing a single button. This is of great importance on large stations with dense train traffic as it considerably facilitates the work of the signalman. Nevertheless this method had not been employed in the two installations at La Coruña and Santiago.

Colour-light Signals

The signals employed in these installations are colour-light signals of the type common in Sweden. They are completely without movable parts. Thus for a signal which can show different colours, each colour has its separate light opening. The lens system is on the American principle, *i. e.*, with double lenses, with the outer lens uncoloured and the inner one coloured. The signals may show three different aspects: red indicating danger, green meaning clear and violet announcing that shunting is permitted. On some of the signals, *e. g.*, the home signals, the last aspect, shunting permitted, is missing and on others, the shunting signals, the green or clear is as a rule not included. These latter therefore can only show danger or shunting permitted.

Fig. 2 shows a home signal. As may be seen it has three light openings, two below on the same level and one above them. The two lower lights show red. For extra security the red light has been doubled on the home signals. The upper light shows green, which in this case means entrance clear. In Fig. 3 may be seen two signals at Santiago. The one on the left, an exit signal, has three light openings showing green, red and violet light respectively. The right-hand signal, which is a shunting signal and thus cannot show signal for train exit, has the signal aspects red and violet. The signal lamps are easily accessible by means of ladders and platforms on the poles. This greatly facilitates maintenance work, consisting chiefly of changing lamps and cleaning.

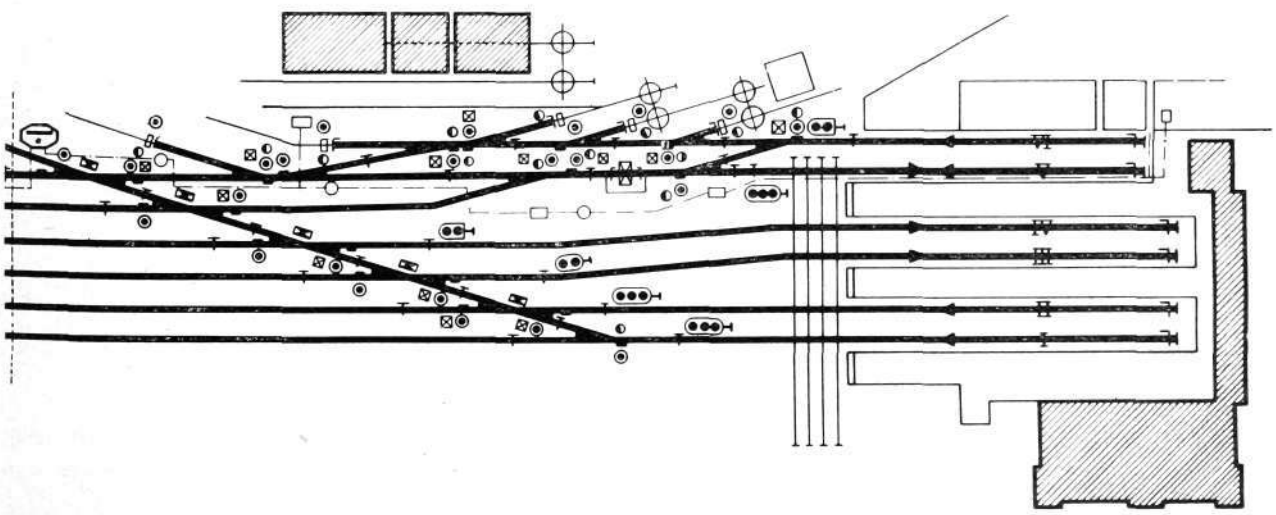


Fig. 3 X 6128
Colour-light signals
left, exit signal; right, shunting signal

Track Circuits

As stated the track systems at these stations are entirely insulated, *i. e.*, all tracks on which trains run or may run are provided with track circuits. A track circuit consists of a section of track, the rails of which are insulated from other rails and from each other, with a current source at one end of the section and a relay coil at the other. The current passes from the current source through one rail over the relay coil to the other rail and through this back to the source. Thus the relay is normally energised. When a train enters the section the current is led from one rail via the train axles to the other and back to the current source. The relay coil will then be deprived of current and the relay falls. The fact that the relay has fallen indicates that the track is not free for traffic. Obviously the relay may fall because of fault but such an indication would only mean an interruption of traffic and would involve no danger.

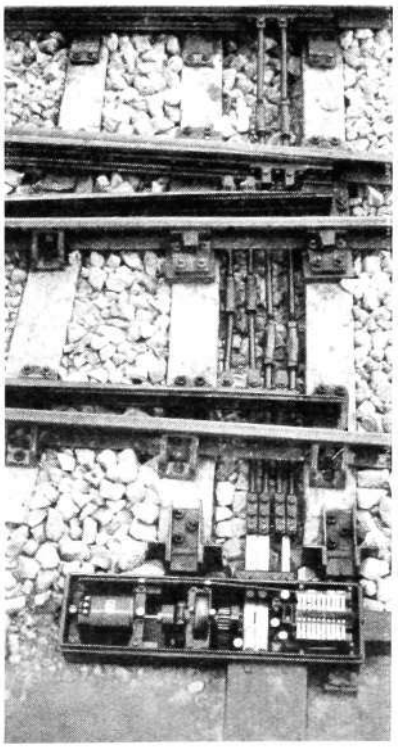


Fig. 4 X 4370
Point machine
with cover removed

The track circuits also serve other purposes, including that of preventing a point operated centrally from being changed under or immediately before a vehicle. Therefore a centrally operated point cannot be changed if the track in and in front of the point is not free from vehicles, this being controlled by the track circuit relay concerned. The track circuits also collaborate in the automatic train route locking and the automatic train route releasing. When a signal for the entrance or exit of a train is set at »clear», all points and scotch blocks of the train route are locked in appropriate positions, while all other signals which might permit a train or shunting movement in the train route or in dangerous proximity to it are locked at danger. This is the automatic train route locking. Immediately the train has passed the signal set at clear the signal changes automatically to danger owing to the action of the track circuit, but the train route remains locked until the whole train has passed the points included in the train route. First then is the train route released so that the points are again open for switching. This is the automatic train route releasing. It can also be arranged at the relay interlocking machine that the train route is released successively as the train proceeds.

Automatic train route locking and releasing is also employed with other types of interlocking machines, but they can never be so completely utilised as with the relay switchgear.

Fig. 5 X 6130
Scotch block
provided with driving device. To the right of the driving device may be seen the lamp that indicates the position of the scotch block

Point Operation

All the track points included in the track sections are provided with point machines. By means of these the points may be changed centrally, *i. e.*, from the interlocking machine or, with authority from the interlocking machine, locally by the operation of a contact device at the points. Fig. 4 shows a point machine with the cover removed at one end of a double crossing point. The point machine is furnished with built-in point tongue lock — a device by means of which it can be checked that the distance between the tongue and the supporting rail does not go beyond a fixed maximum. On Fig. 5 may be seen a scotch block which is also provided with a driving device. To the right of the driving device can be seen the lantern which informs the staff at the station of the position in which the block is. Between the driving device and the lantern lower down in the illustration is the contact device by which the driving device can be operated locally. A lamp shines in this when local operation has been authorised from the interlocking machine. The contact device itself is operated by the foot.

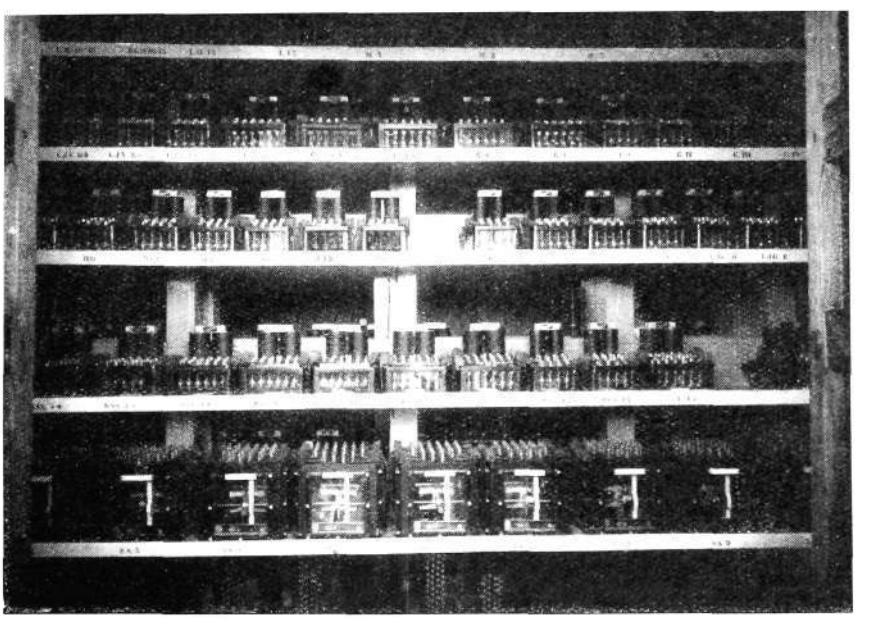


Fig. 6 X 6127
Relay shelves in the signal cabin

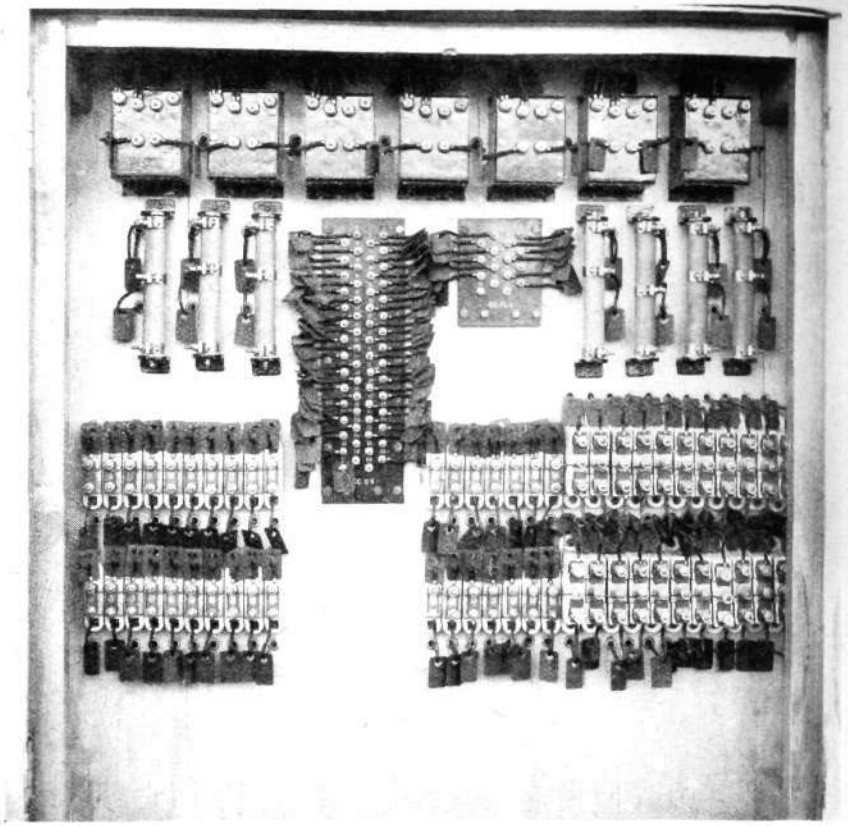


Fig. 7 X 6125
Inside of apparatus case out in the station area

Top row, transformers and, below, adjustable resistances and terminal blocks

Fig. 6 shows an inside view of the ground floor of the signal cabin. Relays have been set up on the five shelves. The lowest shelf houses the point position control relays, which are A.C. current relays with three positions. Each outside position indicates a corresponding position of the point. The middle position is assumed when the point is not closed, *e. g.*, while it is being switched over. On the other shelves D.C. relays are placed. Throughout the whole station area there is naturally a cable network leading from the interlocking machine to all track circuits, signals, point machines etc. Certain of the devices are placed in cases out in the station area. Fig. 7 shows an inside of such a case. It will be seen that in Spain there is retained after completion a kind of label on all wires, unlike the custom in Sweden.

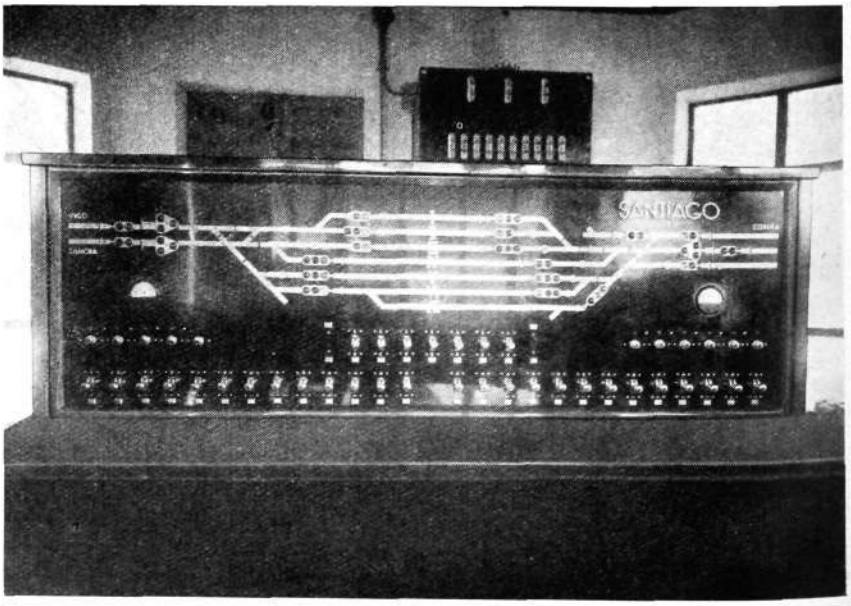


Fig. 8 X 8123
Interlocking machine at Santiago

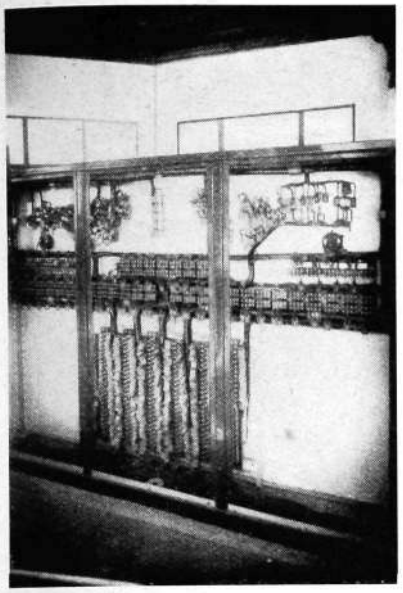


Fig. 9 X 4339
Interlocking machine at Santiago
rear view

Interlocking Machines

The interlocking machines are made as desk apparatus. Thus the signalman can execute all operations from his seat in front of the apparatus. The appearance of the control apparatus at Santiago may be seen from Fig. 8 and 9. As shown by Fig. 10 there is an illuminated track-diagram, placed above the control apparatus, with three lamps for each point. One of these stands just at the branching point of the track, the two others a little way off, one in each track. The first lamp is lit when the point is not released for local operation. Each of the others lights up when the point has taken up the corresponding position. When the point is to be included in a train route, therefore, two of the lamps are lit, namely that corresponding to the position in the train route and the lamp at the point of intersection. While the points are being switched the two lamps showing position do not shine. The rather larger lamps placed singly in the track as seen on Fig. 10 indicate when they are shining that the track in question is free from vehicles (track circuit relay is attracted) and when not shining that there are vehicles on the track. Therefore, when a train is to proceed over the station area all lamps must be shining at the places where the train is to pass. Only when that is the case can the signal be set at »clear». As may be seen the signals are repeated on the track plan.

Signals, points and scotch blocks are all operated by means of small spring switches, see Fig. 11. These switches normally always take up a middle position. From this middle position they may be thrown, when points are concerned, to two other positions, up and down. From these two positions they have automatic spring return to middle or home position. The two positions up and down correspond to plus and minus positions of the point. If the point is in minus position and the switch is moved over to plus position for a moment, the operating relay of the point receives an impulse, if there is nothing to prevent it. The operating relay attracts and switches the point over to plus position. The operation of the relay is such that it is self-holding, so that only a short impulse is required for point switching. It is essential that the control devices for points and signals should be so made that after being switched over they should automatically return to their home or neutral position. In this way the possibility has been kept open of changing over all points with a single switch, *e. g.*, for a train route. If a certain position of the point must correspond to an equivalent position of the switch this would mean when switching for a train route the switches of all the points included

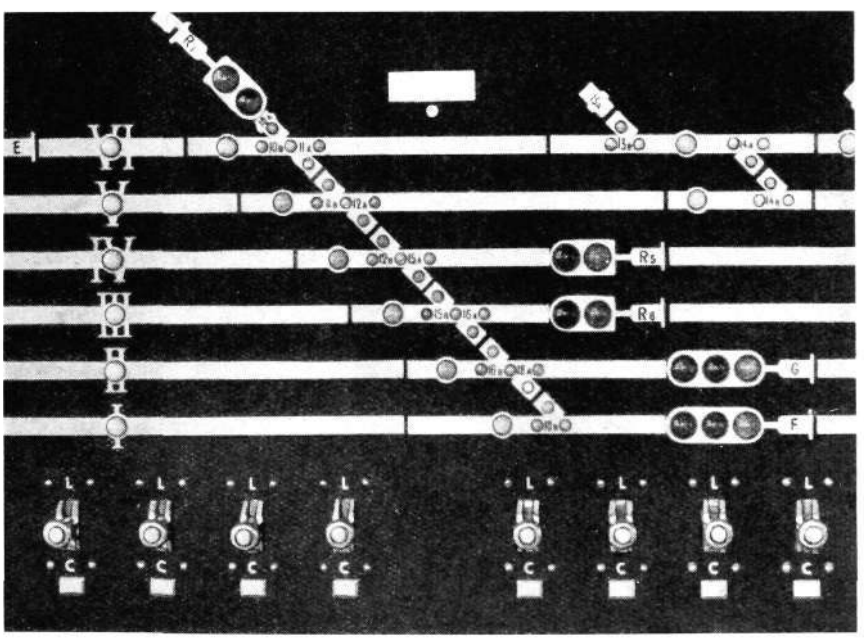


Fig. 10 X 6124
Section of track diagram on interlocking machine

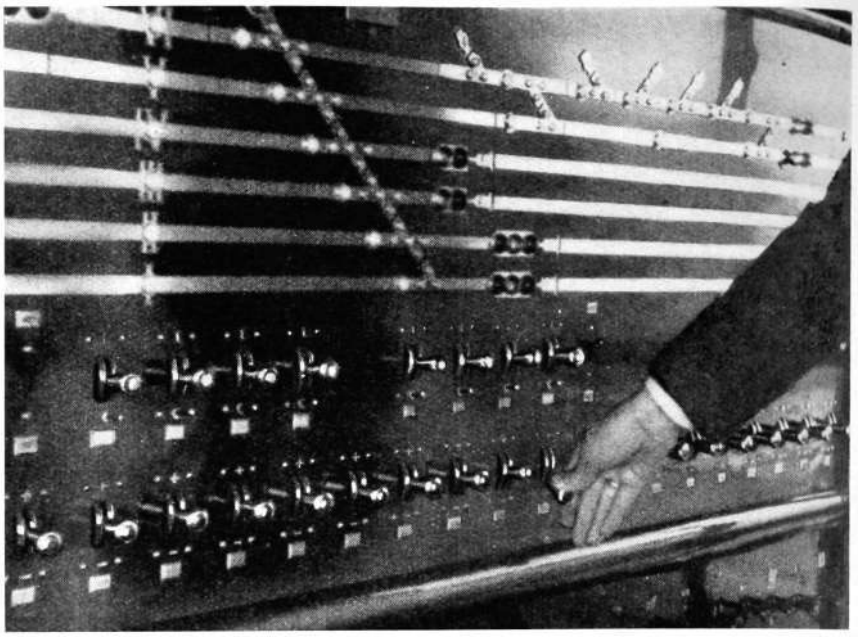


Fig. 11 X 6129
Switching over of a point
is done by operating a spring switch on the interlocking machine

in the route would have to be thrown to the position corresponding to the point position. While it takes very little time to switch over these switches, owing to the impulse operation, yet the saving in time is appreciable if it is possible to switch over a train route by a single movement, instead of having to check whether each separate point switch concerned in the train route is in the position corresponding to this train route.

The appearance of the interlocking machine may be seen on Fig. 8. On the illuminated track diagram the tracks are marked by metal strips fixed on a green enamelled sheet-metal ground. The track diagram reproduces the lay-out of the station area, somewhat skeletonized. All existing signals are repeated on the track diagram with exactly the appearance they have in reality. At each end of the track diagram, instruments are fitted, one indicating the supervisory current voltage, normally 24 V, the other the intensity of current for the motor current to the point machines. Below the track diagram there are arranged two rows of switches for operating points and signals and for giving authority for local switching.

In the room where the interlocking machine is installed there are also located devices for the supply of electric energy to the installation. The power delivered is three-phase 220/127 V. In the relay room, located immediately below the control room, in addition to relays and cable boxes for the outgoing cables, there are housed transformers for track diagram, relays, point machines and signals.