

New Interlocking Plant at Stockholm East Station

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The Stockholm—Roslagens Railways have for some years had a number of relay interlocking control machines (with press-buttons) in operation. As the traffic at the biggest station of this railway system, Stockholm East, had grown to such an extent that a complete reorganization of the whole station has become necessary and with it a new signal interlocking plant had to be constructed, the administration decided to equip the station with a relay interlocking control machine of Signalbolaget's manufacture. That this choice was made is due largely to the good experience obtained from earlier plants.

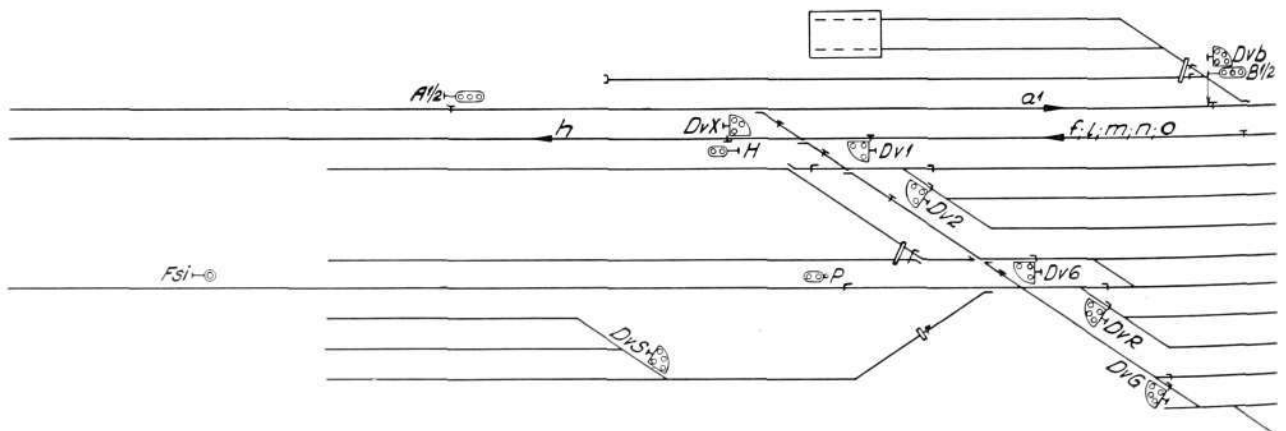
Stockholm East normally has to deal with about 180 trains per day of traffic, special trains and doubling excepted. Of these, 102 consist of local trains to and from Djursholm, 70 of passenger trains to and from Rimbo, Vallentuna and Österskär, the remainder being goods trains. All the Djursholm trains run on a special double track, see Fig. 1, which continues as a single track through Engelbrektsgatan for about 1 km into the city proper with terminus at Humlegården. The other passenger trains are distributed over tracks II—V, to be seen on the figure below the Djursholm tracks. Goods trains are run as a rule to and from the goods yard over a side-track which cuts across the main tracks just inside the outermost signals.

Fig. 1
Track lay-out at Stockholm E

X 7248
X 7247

-  home signal with three lights
-  home signal with two lights
-  distant signal
-  dwarf signal
-  insulated rail joint
-  scotch block
-  signal cabin

Obviously the amount of traffic requires far-reaching rationalization of the operation of the station while the demands of operating safety must not be neglected. The relay interlocking machine has been produced with the object of creating a type of interlocking machine which is so easily operated that the train dispatcher alone may be capable of handling both the interlocking machine and the train dispatching even for moderately large stations. The interlocking machine therefore must be so constructed that the train dispatcher from his office is not only in a position to keep an eye on it without trouble but, with the least possible exertion, can deal with its operation, Fig. 2. In addition he must have automatic control over all movements of trains and trucks and over the positions of signals on the station area.



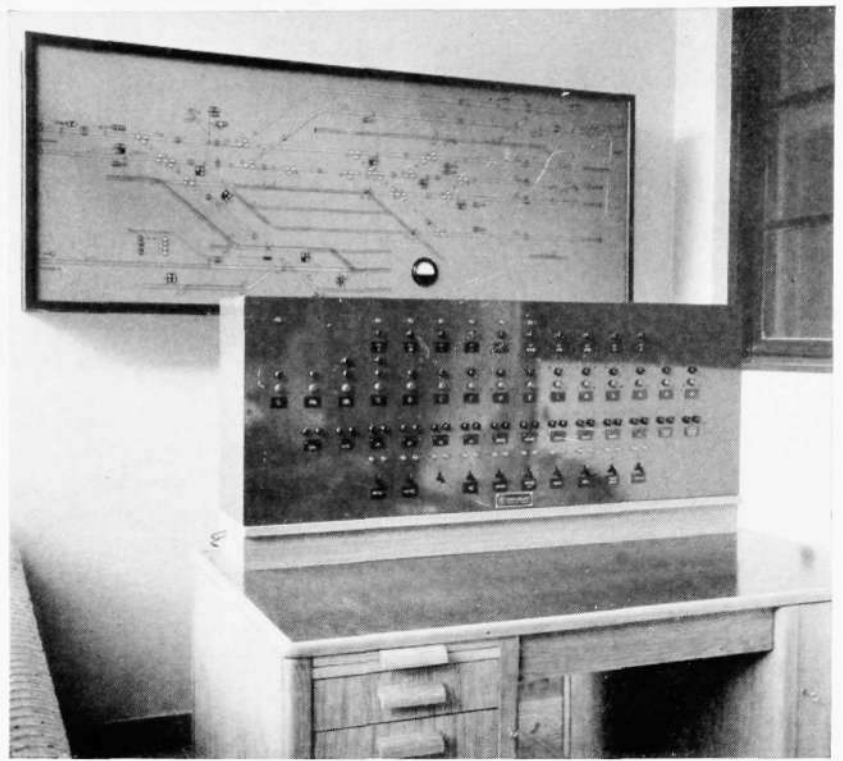


Fig. 2 X 5816
 Interlocking machine and illuminated track diagram
 located in the train dispatcher's office

The first of these conditions is fulfilled by the interlocking machine being constructed in very concentrated form with the simplest possible of operating devices, arranged in a manner that is surveyable and logical. Thus signals and points are operated by press-buttons and locking devices by small tumbler switches. The second condition is met by an illuminated track diagram. On this a number of goods tracks have been left out as these are not comprised in the locking, and truck movements can proceed to a limited extent on them without disturbing train movements.

Each illuminated signal that is governed by the train dispatcher's operations is repeated on the track diagram by a miniature pattern which reproduces its actual appearance. A small number of dwarf signals which are automatically dependent on nearby points etc. are not repeated in the signal patterns. In addition plus and minus position is indicated for all centrally operated points, whereby the train dispatcher can immediately check if certain routes are switched correctly. For those points which have both central and local operation the lamp which marks the point tongue or crossing point constitutes an indication of whether permission for local switching has been given or not. Normally the lamp shines but if permission for local switching has been given it is extinguished.

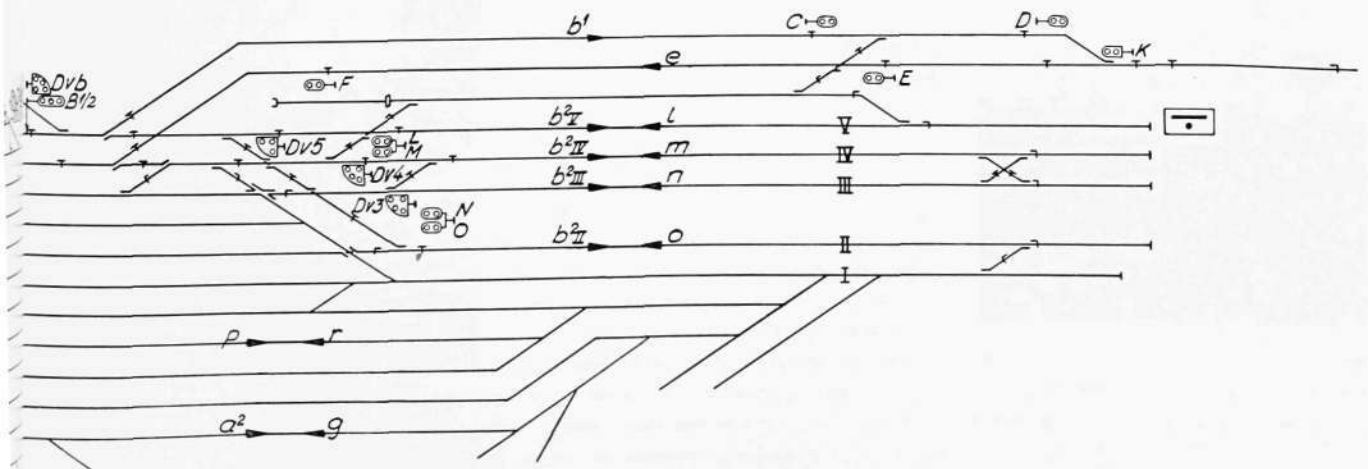
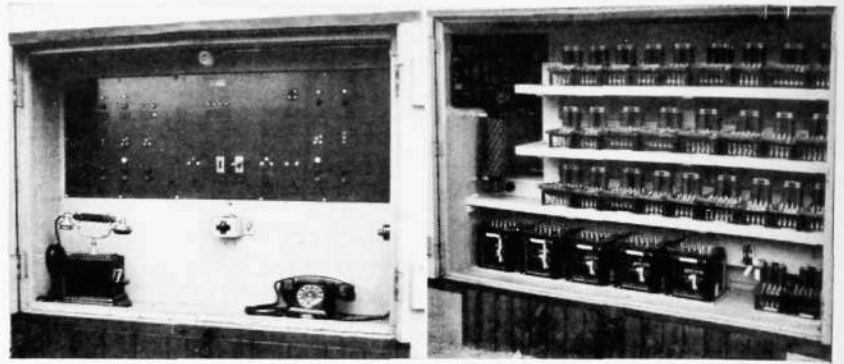


Fig. 3 & 4 X 7246
 Local interlocking machine for the goods yard
 left, control board; right, relay cabinet



All tracks which concern the train routes are divided up into a number of track circuits which are marked on the track diagram, each being there provided with a control lamp which shines with a pale blue light when the track circuit is free from rolling stock. The track circuit lamps have the purpose of informing the train dispatcher concerning train movements on the different tracks.

When the track circuit in which a centrally operated point is included is entered by a vehicle, the switching device of the point is blocked automatically by a contact on the track relay blocking the operating current circuits for the point's switching.

As at all terminal stations, the train routes at Stockholm E branch out fan-wise from the main tracks, Fig. 1. Departure from this rule occurs, however, owing to the necessity of giving the Djursholm tracks an exceptional position due to the special traffic on them and because the goods yard has received a direct entrance and exit train route. The branching of this train route requires a first entrance signal $A^{1\frac{1}{2}}$ and the separating of the Djursholm trains from the other passenger trains another entrance signal $B^{1\frac{1}{2}}$. The Djursholm trains enter on signal $B1$ and other passenger trains enter for one of four train routes on signal $B2$. The four corresponding exit signals L, M, N and O are combined with a number of dwarf signals as protection for the points when shunting. As the two Djursholm tracks are relatively long it has been possible with advantage to divide them by an intermediate signal on each track, enabling the succession of trains both in and out to be made closer. This arrangement is only a logical consequence of the automatic line blocking existing for 15 years, which allows of a train density of app. one train a minute.

Signal $A1$ has been made semi-automatic, *i. e.*, in addition to being operated when necessary from the interlocking machine it changes automatically to danger when it is passed by trains but returns to clear when the train leaves the block circuit covered by the signal. In addition the signal shows green flashing light when signal B is at danger. It can thus for this train route be made to function in the same manner as an automatic block signal. The entrance signal C and the exit signal E northwards to and from the Djursholm train platforms function in similar manner.

For transshipping between the Roslagsbanan railway and the State Railways there is a track connection between Stockholm E and the State Railway station Stockholm N. This track crosses the Roslagsbanan railway goods train route after which it is divided in the goods yard into three tracks one of which is built as a three-rail track.

On the comparatively few occasions when train movements take place on these goods train routes the signals and locking are operated from a local interlocking machine, Fig. 3 and 4, set up in the immediate vicinity of the crossing between the State Railways and the Roslagsbanan railway tracks. The local interlocking machine is of the same type as the main interlocking machine but of simpler construction. Thus there is no illuminated track diagram but the control lamps and miniature signals to be found on it are instead



Fig. 5 X 4162
 Exit northwards from Stockholm E
 left, entrance signal H to first block section;
 middle, between tracks, rear view of dwarf signal;
 further to the right, entrance signal $A^{1\frac{1}{2}}$

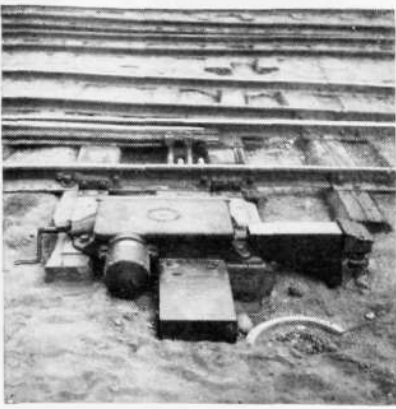


Fig. 6
Electric point machine

X 4151

grouped on the control board in a manner easily visible. The track circuits in this section can, like the home signals, therefore be controlled both from the local and the main interlocking machine. The local interlocking machine is concerned with only three points switched centrally that are also combined in the train routes for passenger trains. These points are always switched from the main interlocking machine, after which when the train route to or from the goods yard lies clear permission is given to the local switchgear to operate the signals concerned whereby the train route is locked. The train routes to and from the State Railways group of tracks do not touch the passenger train routes but all the same permission from the main interlocking machine is required for these train routes. Consequently the train dispatcher has control here also over train movements and signal positions.

The entrance signals from State Railways trains have been constructed as ordinary illuminated signals while the exit signals for both State Railway and Roslagsbanan railway goods tracks have been made for practical reasons as dwarf signals with four light apertures.

In order to be able without difficulty with single track operation to take in the trains, a special dwarf signal for the up-track, Fig. 5, has been arranged which can be set at caution and danger from the main interlocking machine. When the signal is set at caution all signals enemy to this are simultaneously blocked.

From Stockholm E there has for long been, as stated above, an automatic block system for the line northwards. The entrance to the first block section after Stockholm E is signal H, Fig. 5. This signal is controlled by the train dispatcher to the extent that he can set it at »danger», but not always to »clear». On the other hand he can set it so that it acts as automatic block signal. In this way therefore the automatic block signal system and the relay interlocking machine have been linked up.

Signalbolaget has supplied for this interlocking plant a new electric point machine, Fig. 6 and 7, which differs in essential parts from its predecessors. As the point machine can be laid between two sleepers the normal distance apart, thus requiring only two straight iron plates for fixing the machine to the point plate, the foundation bedding has been considerably simplified. The fully enclosed motor is fixed on the outside of the point machine. The power is transmitted to the drawbars by an angle gear. For moving the points in case of failure of current or other faults there is used a crank, Fig. 6, by means of which switching is completed with 11 turns only as against about 50 previously. Moreover, as may be seen by Fig. 7, the box holds the necessary contacts etc. for relay current circuits, supervisory current etc. The motor's power is 0.5 hp. The whole point machine weighs only 180 kg, *i. e.*, 40% less than the older type.

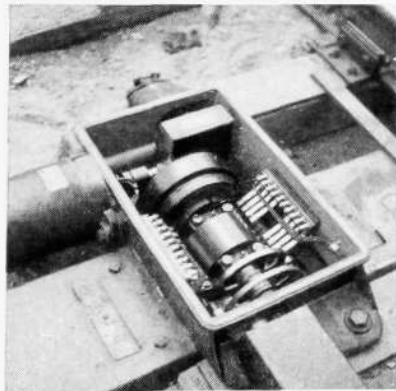


Fig. 7
Electric point machine
with cover removed

X 4152

To accommodate the interlocking control machine and the train dispatcher a small extension to the station building has been added, on the wall of which the illuminated track diagram has been set up. At a convenient distance from this a desk for the train dispatcher is placed with the control board mounted on the back edge, Fig. 2. The whole of the left wall consists of a window with a clear view over the platforms. On one wall there is a wholly enclosed electric plant, fed from the station main supply with 220 V A.C., 50 c/s. From this plant the current is distributed to group plants for the interlocking machine and station illumination. In this office there is a main switch by means of which all lights on the station can be extinguished. Further fuses for the interlocking machine are grouped in a relay room for all relay current circuits and in a cupboard of the desk for all motor current circuits. These last consist of automatic fuses by means of which if a fuse blows in a motor current circuit the train dispatcher can rapidly and easily re-connect the current without needing to call in signal repairers.

The relay compartment is in the cellar beneath the interlocking machine room. In this way it has been possible to draw the wires in a convenient and simple manner through the beams. In addition to five lighting and telephone cables there lead out from the interlocking machine 15 signal cables, with altogether about 400 wires. Of these, 10 are main cables which lead to as many distribution boxes and apparatus cabinets to which signals, track transformers, locking devices, point machines and so on are connected by local cables. In the relay compartment and the apparatus cabinets all multi-wire cables have been terminated in boxes, so that the wires should be most easily accessible for test and repair.

The work of fitting, which was done by the staff of the Roslagsbanan Railway with the assistance of a fitter from Signalbolaget, was begun in the summer of 1940 and has just been completed. The cost of the plant amounts to some 130000 kronor.

In addition to the advantages stated there is the further gain with the electric interlocking machine that the staff previously required is set free for other work, which means a decrease of operating costs by about 13000 kronor per year. Apart from the fact that the old interlocking machine would not have been capable of dealing with present traffic without thorough-going reconstruction the saving referred to constitutes satisfactory interest on the capital expended.