Reorganization of Shunting at Ånge Marshalling Yard, Swedish State Railways

T LUNDBERG, SWEDISH STATE RAILWAYS, STOCKHOLM

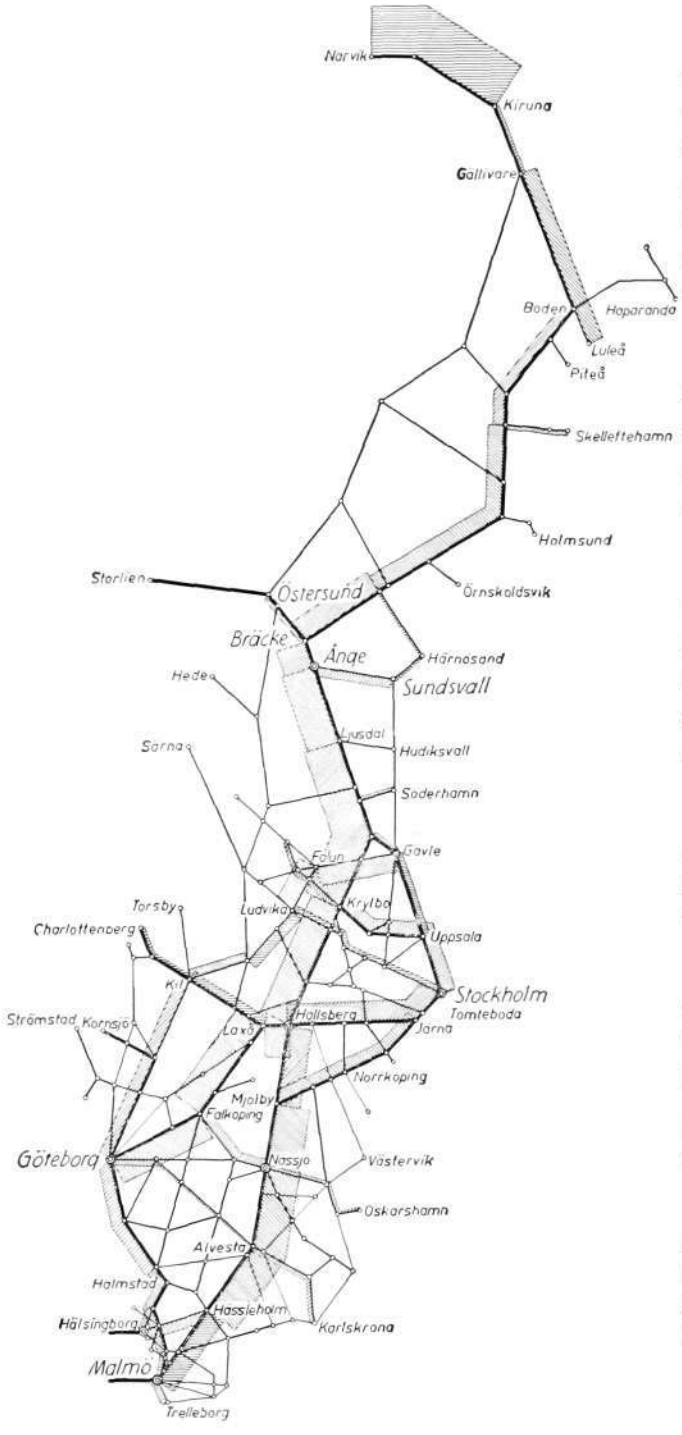


Fig. 1 X 6937

The goods traffic of the Swedish Railways is principally concentrated to the electrified main lines.

The density of goods traffic on the most important freight lines is indicated by shaded ribbons, the width of which is proportional to to the number of freight cars per day. Scale: 200 cars per mm width of ribbon.

U.D.C. 656.212.5:656.256

The Swedish State Railways have taken a big step towards the radical reorganization of freight car handling by the introduction of automatic point switching and car retarders at the Ånge marshalling yard. By the choice of the most northerly of the large marshalling yards for the first experiment in this direction, experience has also been gained of operation under difficult winter conditions.

The automatic point switching plant was constructed by L M Ericsson in intimate cooperation with the Railways Board. The material, including factory-wired relay racks and control equipment, was supplied by L M Ericsson.

Mr T. Lundberg, Assistant Chief Engineer Signals, was in charge of the planning work undertaken by Swedish State Railways and directed the work of installation. He describes in this article the equipment and operation of the Ånge yard and the results gained through the reorganization.

The bulk of Swedish goods traffic is now concentrated to the electrified main lines. The traffic density on the largest freight lines is shown in the adjacent map of the main line network (fig. 1).

The organization of goods traffic is such that a consignment is not always transported by the geographically shortest route for which the freight is calculated, but by a longer though more rapid and more economical route. This is because the break-down and build-up of the through goods trains has been concentrated to certain stations that are equipped with marshalling yards.

Marshalling yards exist at stations which are mainly of a terminal character, e.g. Malmö, Hälsingborg, Gothenburg—Sävenäs, Stockholm—Tomteboda and Gävle, and also at stations with predominantly through traffic, e.g. Nässjö, Hallsberg, Ånge.

Some General Remarks on the Ånge Yard

During recent years the Ånge yard has been substantially reconstructed and extended. The final stage of reconstruction was the provision of car retarders and automatic point switching equipment, which will be described below.

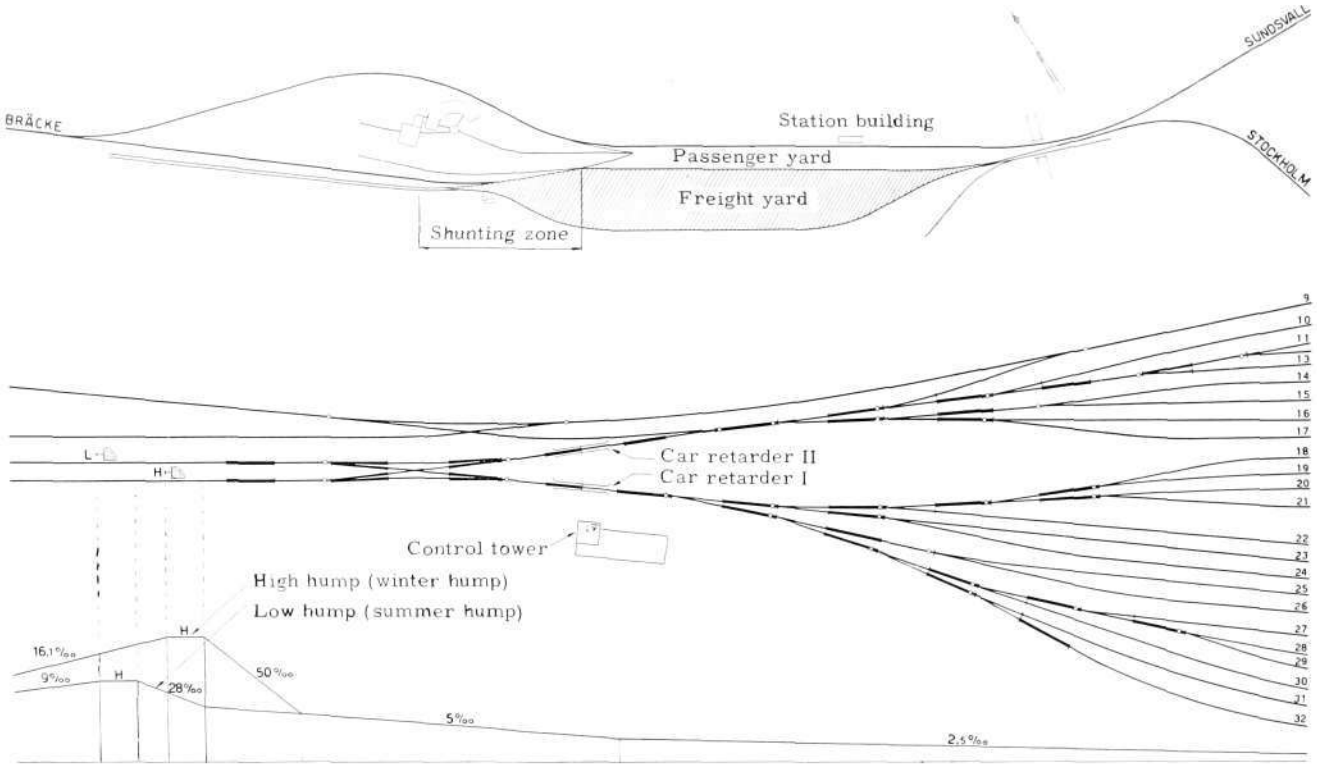


Fig. 2 X 7686

Layout of Ånge station

with connecting lines (top), shunting zone of marshalling yard (centre) and gradients of shunting zone (bottom).

Fig. 2 (top) shows the extent of the station area with connecting lines southwards to Stockholm, eastwards to Sundsvall and northwards to Bräcke. The shaded portion marks the area occupied by the marshalling yard. Fig. 2 (centre) indicates the shunting zone. The illustration shows how track circuits with different functions are located in relation to points. The car retarders are also shown. At the side of the shunting zone is a control tower from which points and retarders are operated. Fig. 2 (bottom) shows a sectional view of the humps and the gradients of the surrounding area.

The marshalling yard shares with Ånge station an automatic telephone plant, consisting of about 175 telephones, and a selective calling telephone system with 20 extensions for internal communication within the station area. There is also a loudspeaker installation consisting of about 50 loudspeakers split into 13 groups.

When a goods train arrives at Ånge station, a record is made of the destination of every car, whether it is loaded or empty, and whether it requires careful shunting. These data are handed in to a central office which forwards them by teleprinter in the form of shunting bills to the control tower, the uncouplers at the top of the hump, the receivers—whose job is to receive the shunted cars and couple them together—the yardmaster and reloading magazine.

The shunting yard has two humps of different height, one high and one low hump. The method of shunting is that the train is drawn up by a shunting engine on to one of the humps, where a cut of one or more cars is detached and pushed over the crest, whence gravity carries it down to the classification track. The speed of rolling before reaching the retarders varies between 3 and 6 yards per second. Hydraulic retarders with parallel shoe beams, 51 ft. in length, between which the rims are clasped, are located below the hump to regulate the speed of cars according to the distance they are to roll. Equalized shoe pressure

is used, i.e. the retardation is proportional to the weight of the car, and the operator need only consider the oncoming speed and the desired offgoing speed of the cars. The rolling speed below the retarders is 2—3 yards per second.

The rate at which cars are supplied to the hump is regulated by orders from the control tower in the form of light signals to the engine driver—push slowly, push quicker, stop and pull.

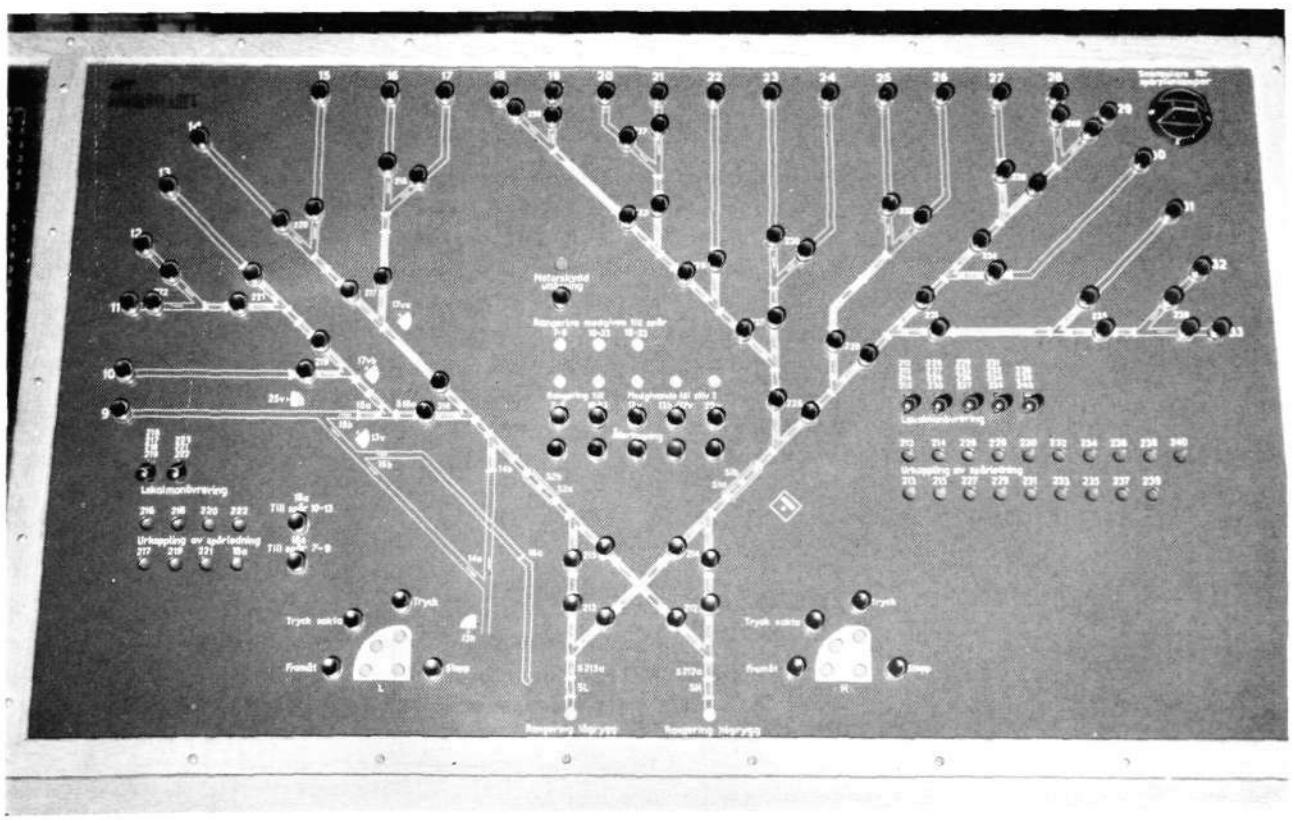
Immediately below the humps are the first points, which distribute the cars to the north and south groups of tracks in the yard. The two retarders are located below the first points, and thereafter are the points for the 24 tracks in the groups. All 27 points have electrical high speed point machines with a switch-over time of about 0.5 secs. The tracks in the shunting zone are divided into track circuits with d.c. relays which are operated when the track circuits are free from vehicles. It has not been found advisable, however, to insulate the rails on the car retarders, and therefore so-called optical track circuits have been installed, consisting of flood lights on one side of the track and photocells on the other. The beam is screened by the cars as they pass, and the automatic mechanism operates in the same manner as on ordinary track circuits.

Fig. 3 X 7685

The track diagram section of the control machine

has press buttons for semi-automatic shunting, individual point operation and signalling to the shunting driver, and keys to permit local operation of switches. It also accommodates lamps for indication of car positions, state of points etc.

To guarantee the operation of points under snow, all points are electrically heated by resistance coils screwed to the stock rails. To avoid the formation of ice round and under the points, other coils are dug down into the ballast to allow the water to run off. The pressure cylinders in the retarders are also electrically heated. The heat is regulated from an instrument panel in the control tower.



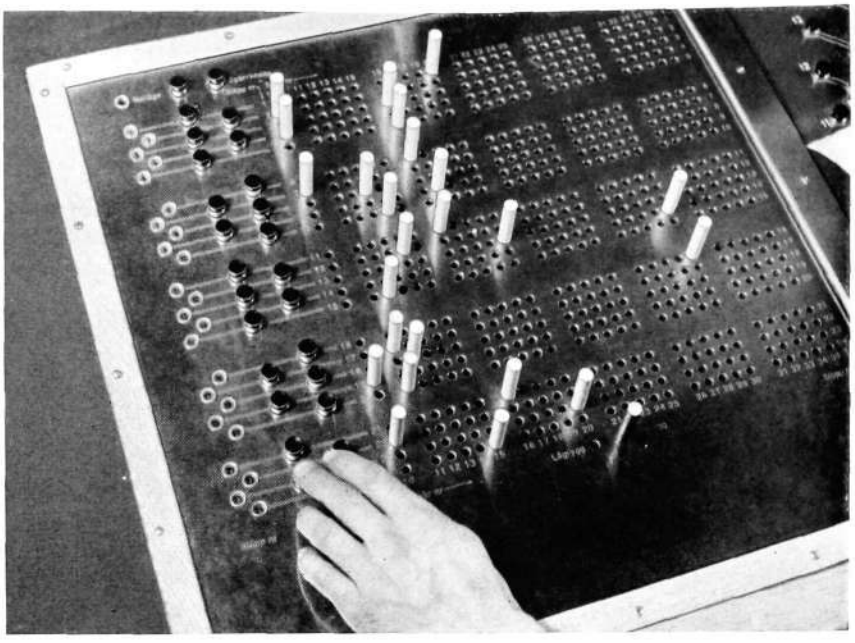


Fig. 4 X 6940

The shunting program operating panel on the control machine

has plug holes for the selection of high or low hump and of classification track. The panel is also fitted with correction buttons and indication lamps.

Control Tower Equipment

The control tower is equipped with a control machine divided into two sections—the track diagram and shunting program operating panel—for the control of points and signals, blocking of adjacent tracks and indication of the state of points and track circuits.

The track diagram (fig. 3) is a representation of the track system in the shunting zone. It has push buttons at the end of the semi-automatic shunting tracks and at the individual branching points. Toggles are used to permit local operation of points. In addition, there are push buttons for signal operation and other buttons, communicating with the interlocking plant in the passenger yard, for closing and opening train and shunting routes connecting with the shunting zone. Indication lamps show the state of points, track circuits etc.

The shunting program operating panel (fig. 4) is used for automatic shunting. It contains a number of holes, each vertical row of holes corresponding to one track in the yard and each horizontal row to a cut of cars. One plug for every cut is placed in the hole marking the position of the cut in the train and its destination track. The positions of the plugs are registered in the apparatus by means of impulses which are generated as a cut rolls over the track circuits and successively switch the points to the correct positions. The various cuts are marked on the program panel by indication lamps. Other push buttons are provided for correcting the position of the rotary selector which records the advance of the cuts. There are two plug holes for selection of high or low hump.

Automatic Shunting Circuits

The equipment incorporates safety relays for functions on which the safety of train movements depends, and telephone relays and a 25-point rotary selector for functions which do not affect the safety. The former group comprises track relays, point operating relays etc., while the latter group comprises relays for automatic shunting. The telephone relays have reinforced insulation and withstand a test voltage of 2,000 V.

Fig. 5 shows, on the left, a section of a shunting zone. The track circuits are designated *SH, SL, S1, S2, S3* etc., and the points *1, 2, 3* . . . Track circuit *SH* lies below the high hump and track circuit *SL* below the low hump.

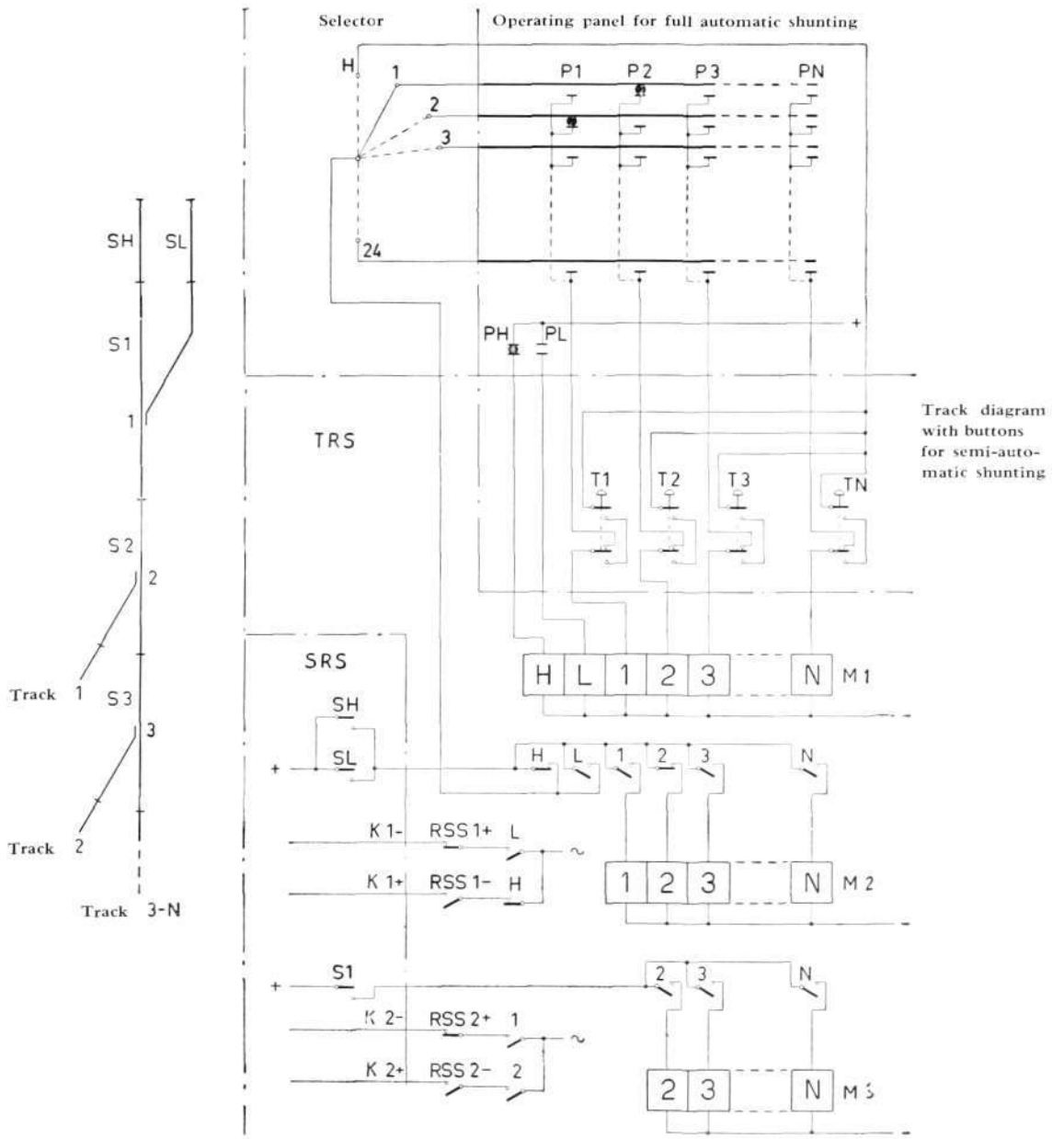
The general principle of the automatic shunting equipment is shown on the right hand side of fig. 5, the designations referring to the shunting zone on the left of the figure. It is assumed that shunting shall take place from the high hump and that the first cut will proceed to track *2* and the second to track *1*. Plugs are therefore inserted in the operating panel in hole *PH* for selection of the high hump, and in the second hole of the first row and first hole of the second row for selection of tracks for the first two cuts.

Relay *H* is operated and point *1* switched to positive. The automatic equipment is started by setting the selector to position *1*. When the first cut passes track circuit *SH*, relay *2* in magazine *1* operates. Relay *2* in magazine *3* operates and point *2* is switched to positive, if not already in this position.

Fig. 5 X 7684

Section of a shunting zone (left) and extremely simplified diagram of automatic shunting equipment

SH, SL, S1, S2, S3 etc.	track circuits
PH, PL, P1, P2, P3 etc.	plugs
TRS	telephone relay rack
H, L, 1, 2, . . . N	relays
SRS	safety relay rack
K	contactor
M	magazine
RSS	points indication relay



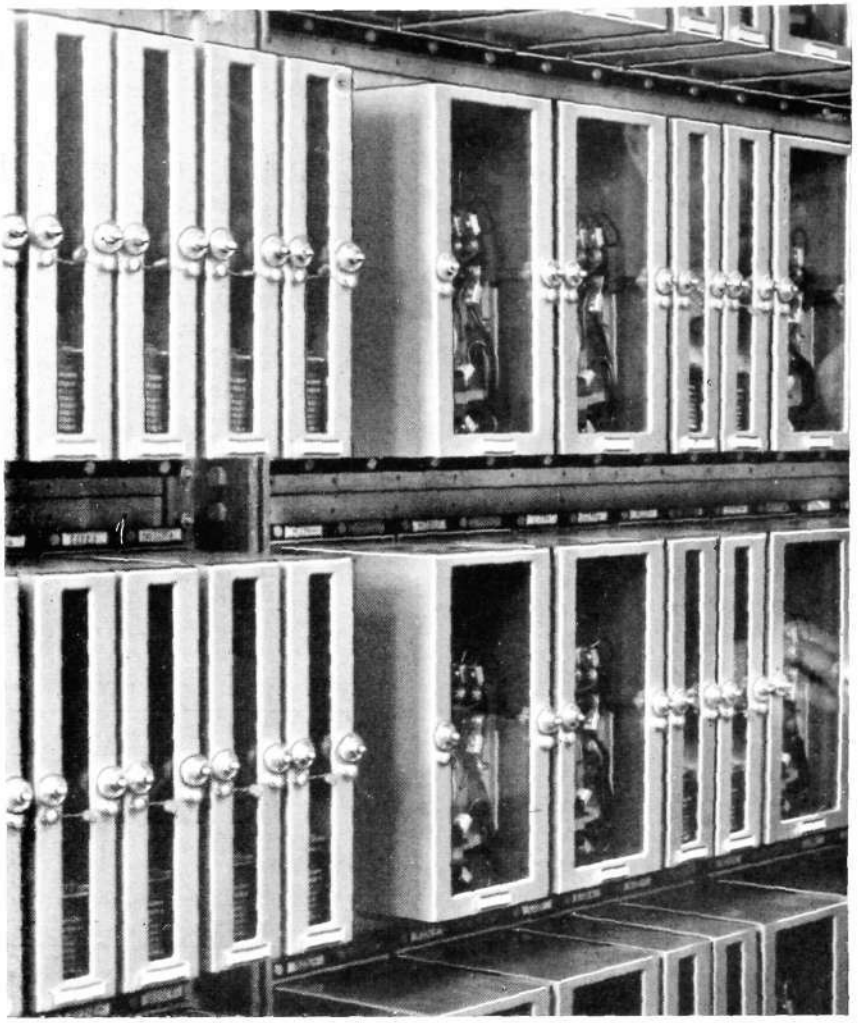


Fig. 6 X 6960
Part of safety relay rack
with relays of plug-in type

When the first cut left track circuit *SH*, the selector advanced to position *2*. The process is thereafter repeated with the exception that the points for the second cut are switched for track *1*.

Semi-automatic shunting is done by operating one of the buttons *T1*, *T2* . . . at the end of the respective track on the track diagram. The operation of the equipment for this purpose will be apparent from fig. 5.

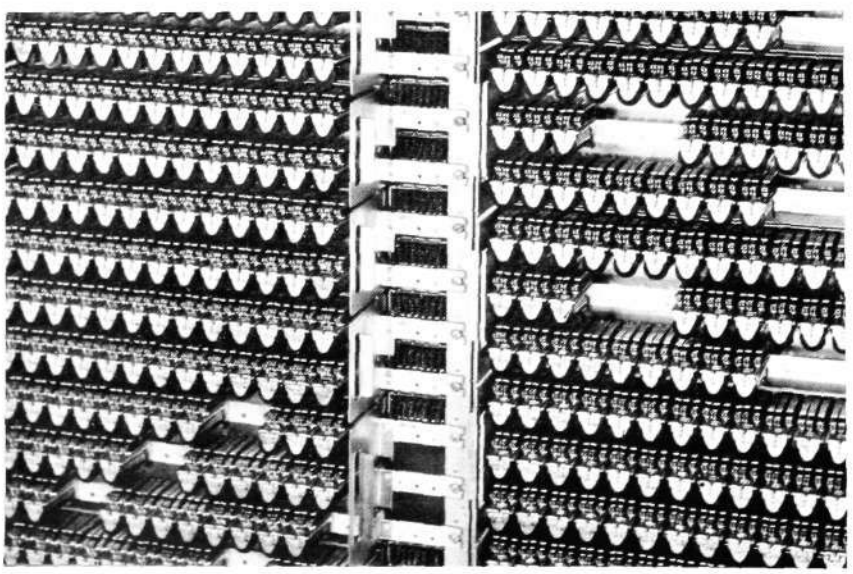


Fig. 7 X 6938
Part of telephone relay rack
with plug-in type relay groups

Fig. 8 X 6939
Automatic shunting from the high hump

Result of Reorganization

The introduction of automatic point operation and car retarders at the Ånge yard has meant primarily that the station crew has been reduced by 10 men. It has been found, moreover, that the number and extent of accidents to cars and goods has been heavily reduced. This is primarily due to the fact that the retarders assist in adjusting the speed of cars to the distance they are to roll, so avoiding violent collisions with stationary wagons.

The system has only been operating for a few months, but a quicker handling of goods trains is already noticeable. When crews and equipment have been brought fully up to scratch, it is estimated that a 50 car train consisting of about 35 cuts will be shunted in 10 minutes. Heavy snowfall and temperatures down to — 40 ° F have not affected the efficiency of the system.