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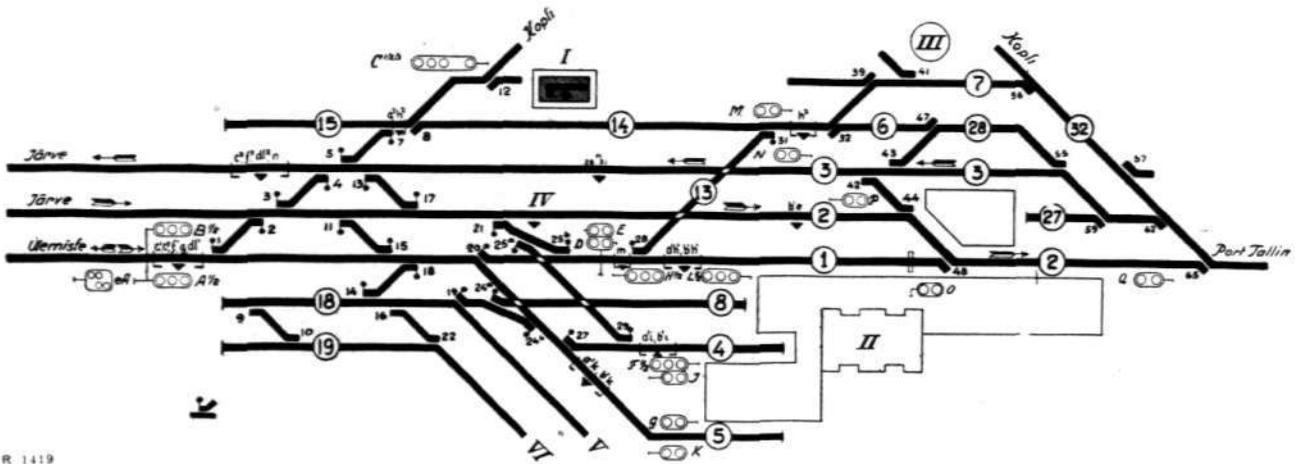
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The Electric Interlocking Plant at the Passenger Station in
Revel (Tallin), Esthonia.



Track Plan of the Passenger Station in Revel (Tallin).

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| I. Electric interlocking machine. | IV. Rail contact. |
| II. Station building. | V. To spur track for trains of empty cars. |
| III. To shunting station at Kopli. | VI. To freight station. |

The passenger station in Revel capital of the republic of Esthonia, has two incoming lines from the southwest, viz. the single track line from Ülemiste (from the directions of Lenin-grad, Pskow and Riga) and the line from Nõmme — recently made over into a double track line and electrified — (from the directions of Hapsal and Baltischport). From a northeasterly direction we have incoming tracks from the docks as well as a number of private spur tracks.

The passenger and freight traffic over the Ülemiste line is light at present, but over the Nõmme line there is a heavy and growing suburban

traffic. Just outside of the Revel passenger station the freight trains from the Ülemiste line as well as trains from the spur track of the A. M. Luther woodworking factory — which enters the Ülemiste track out on the line 3.3 km. from the Revel station — are switched out to the Kopli shunting station, both of the main tracks of the Nõmme line being crossed at track grade. The track system of the recently rebuilt passenger station at Revel — constructed in part as through station and in part as terminal — still has its disadvantages which could not be entirely removed, however, except through a

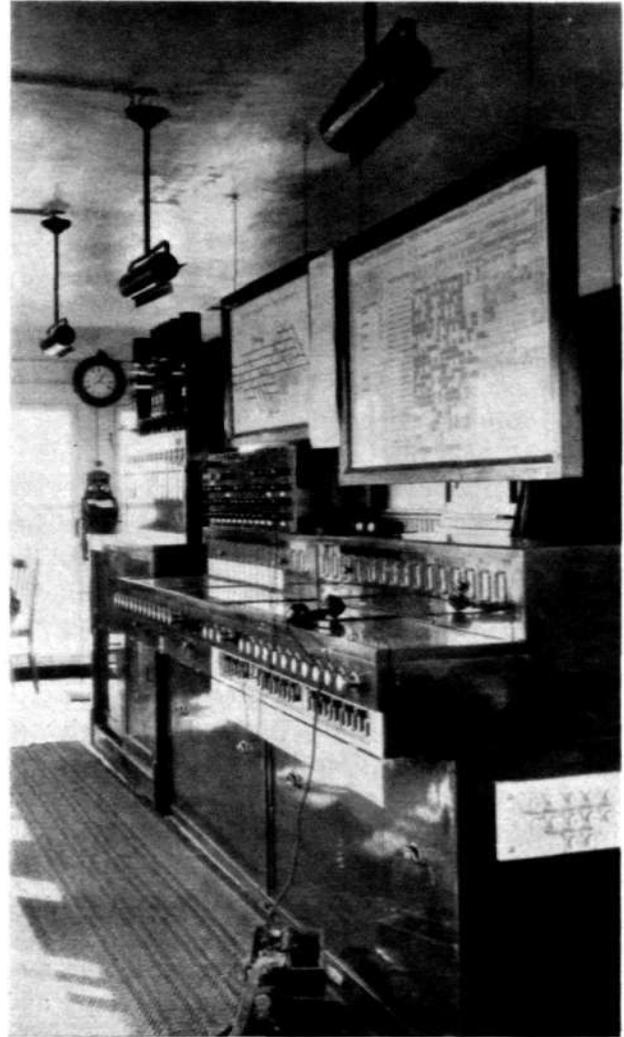
complete and costly reconstruction of the whole installation. Thus, within the area occupied by the passenger station, all of the main tracks are crossed by the many freight and shunting trains passing between the Kopli shunting station, the spur tracks in the northeast part of the track yard, the docks and the freight yard as well as by all the locomotives shunting between the round-house and the tracks of arrival and departure of the passenger trains.

The above-mentioned conditions constituted a serious menace to the safety of the traffic in and about the Revel passenger station, where all of the points, independently of the signals, were manoeuvred by hand, besides which a large personnel was required for the tedious local, manual manoeuvring of the points at the Revel station as well as for the telegraphic train dispatching system used for directing the traffic between Nõmme, Revel and Ülemiste as well as between Ülemiste and the Luther spur track on the one hand and Kopli on the other, improvement of the service as well as a reduction of the personnel being called for.

After the completed reconstruction of the previously quite unsuitable track and train clearing arrangements at the Revel passenger station and after the extension of the second main track to Nõmme, the above disadvantages forced the Esthonian Gov't Railway Administration to take steps for the adoption of modern means for safeguarding the traffic, i. e. the centralization of the manoeuvring of the points and signals at the Revel passenger station and the introduction of electric section blocking on the stretch Nõmme—Revel—Ülemiste. Here, however, it was necessary to figure with the additional and very extensive work of rebuilding the track system, a project which must be accomplished as economically as possible.

The following basic principles were to be applied for the projected interlocking and blocking plant.

An electric interlocking plant should be built for the Revel passenger station and electric section blocking provided for the stretches Nõmme—Revel and Revel—Ülemiste, while all counter points at the Revel passenger station which entered into the regular through tracks and the necessary protective switches and all signals should have central manoeuvring, which latter



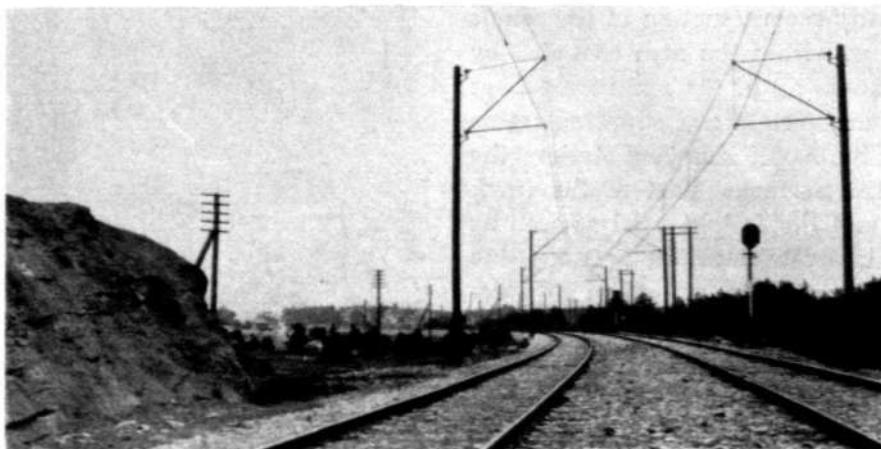
1408 Lock-and-Block Apparatus and Interlocking Machine.

Above the latter are mounted repeating lamps for all the day light-signals.

should also serve for the section blocking so as to provide absolute safety for the traffic.

Since an ample supply of electrical energy was available at all stations between Nõmme, Revel and Ülemiste — there being even two separate sources of energy at Revel —, all signals were to consist of day light-signals, thereby giving the desired uniformity between the day and night signal light combinations and a simplicity in the plant which would be accompanied by lower costs for both installation and maintenance. As a result, a special source of energy within the interlocking station could be dispensed with.

At the Revel passenger station, it was planned to erect a single interlocking machine close to the common center for all the points with central manoeuvring and for the greater part of all



R 1412

Approach to the Järve Station.

the switching operations. The train dispatcher at the interlocking station was to handle the clearing of all tracks outside and within the passenger station, while the station master was only to direct the travellers, dispatch the passenger trains and give the interlocking operator necessary information by telephone as to cleared tracks, switching operations etc. Emergency keys by means of which a signal might be set to 'stop' were to be installed in the office of the station master, while repeating lamps for the home signals were to be placed on the main platform.

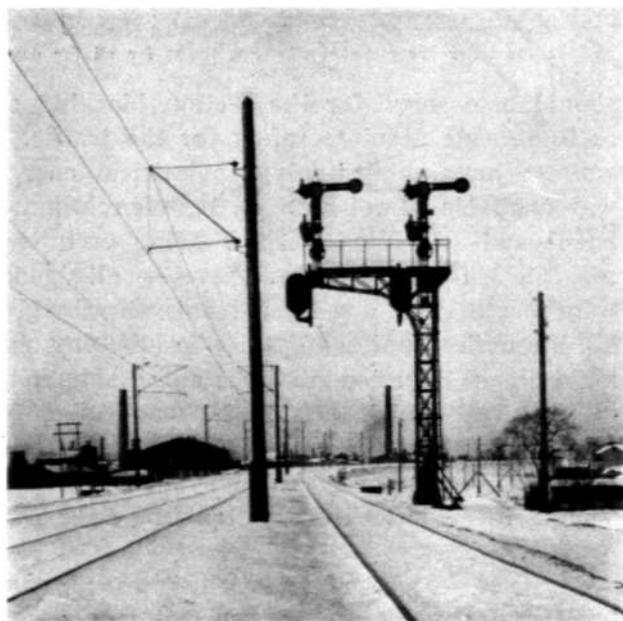
Feed current for the switching machine motors, the testing battery, magnets, relays and

signals was to be obtained direct or through transformers, rectifiers or the like from the Ellamaa generating station or from the city mains with a 50 cycle 220 volt current and triple and single phase respectively.

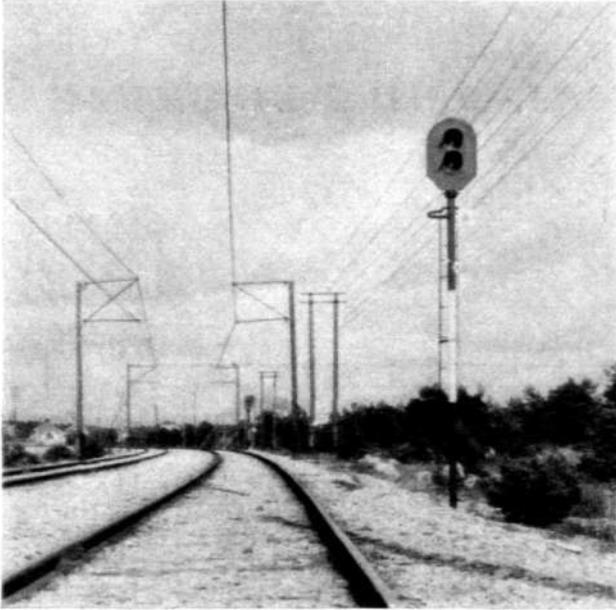
With due consideration for the unfavourable climatic and local conditions, numerous rain-falls, thaws, gravel ballast and inefficient draining, it was necessary to reduce the operating current to a minimum. In most places only one rail was available as a conductor for the signal current, due to the electric traction.

On the double track line to Nõmme it was decided to install electric section blocking with four sections and with five sections for the single track line to Ülemiste; the Luther spur track was to have three blocking sections and form a part of the entire blocking system.

On account of the electric traction over the Nõmme line (a traction current of 1200 volts D. C. in the overhead wire) and the aerial power line from Ellamaa (35000 volts triple phase A. C.) which for the most part run parallel to each other and at a distance of up to twenty-five metres from the tracks, special return lines for the blocking system would be necessary in order to avoid eventual disturbances in the lock and block apparatus. At some points, where both railway lines run on the same bank and where the lines for the blocking system numbered as many as eighteen, these lines were to be run in a cable and laid in the ground. The points at the neighbouring stations Nõmme and Ülemiste were to be retained with local manual manœuvring until further notice, as there are plans afoot to rebuild these stations within the



R 1409 Main Home Signals B ¹/₂ and A ¹/₂ at Revel.
New day light-signals installed; the old semaphores have not yet been removed.



R 1410

Main Day Light-Signal.
Home Signal A at Järve.

near future. The points at Järve and in the Luther spur track were to be provided with locks which — in the latter case — were to be constructed as point locks and included in the section blocking system.

An apparatus for controlling the traffic over the tracks in question was to be installed in the station building at the Kopli shunting station.

The track gauge of the Esthonian Gov't Railways being the same as in Russia (1.524 m.) and the signal devices according to German design, it was necessary that the new devices be suited thereto. Since the electric switching machines were to be provided with tongue control and inside locking, it was decided that the catch locks were superfluous and could be removed.

Both of the lines from Nõmme and Ülemiste have towards Revel, a long, steep incline of up to 1.1 per cent; the track yard at Järve and the branching for the Luther spur track lie on an incline of .8 per cent, thereby rendering more difficult the installation of the various apparatus.

On the submitting of tenders in the spring of 1928, Signalbolaget — a Stockholm subsidiary of the Ericsson Company — was successful in obtaining the contract for the Revel passenger station and adjoining tracks. On account of intervening changes (the manner of executing

the second main track to Nõmme and the corresponding reconstruction of the track systems at Revel, Järve and Nõmme was not finally decided until after tenders had been requested for this work) the whole project underwent a radical change, so that the contract was not signed until the 4th of July 1928. The work of installation was commenced in the middle of September 1928, and in spite of the extremely rigorous winter of 1928—29, which considerably hampered this work, the entire plant was completed and put in operation on April 5, 1929, according to contract, i. e. after nine months.

Since that time and up till now (October 1929) the plant has functioned most satisfactorily, no trouble of any kind having occurred.

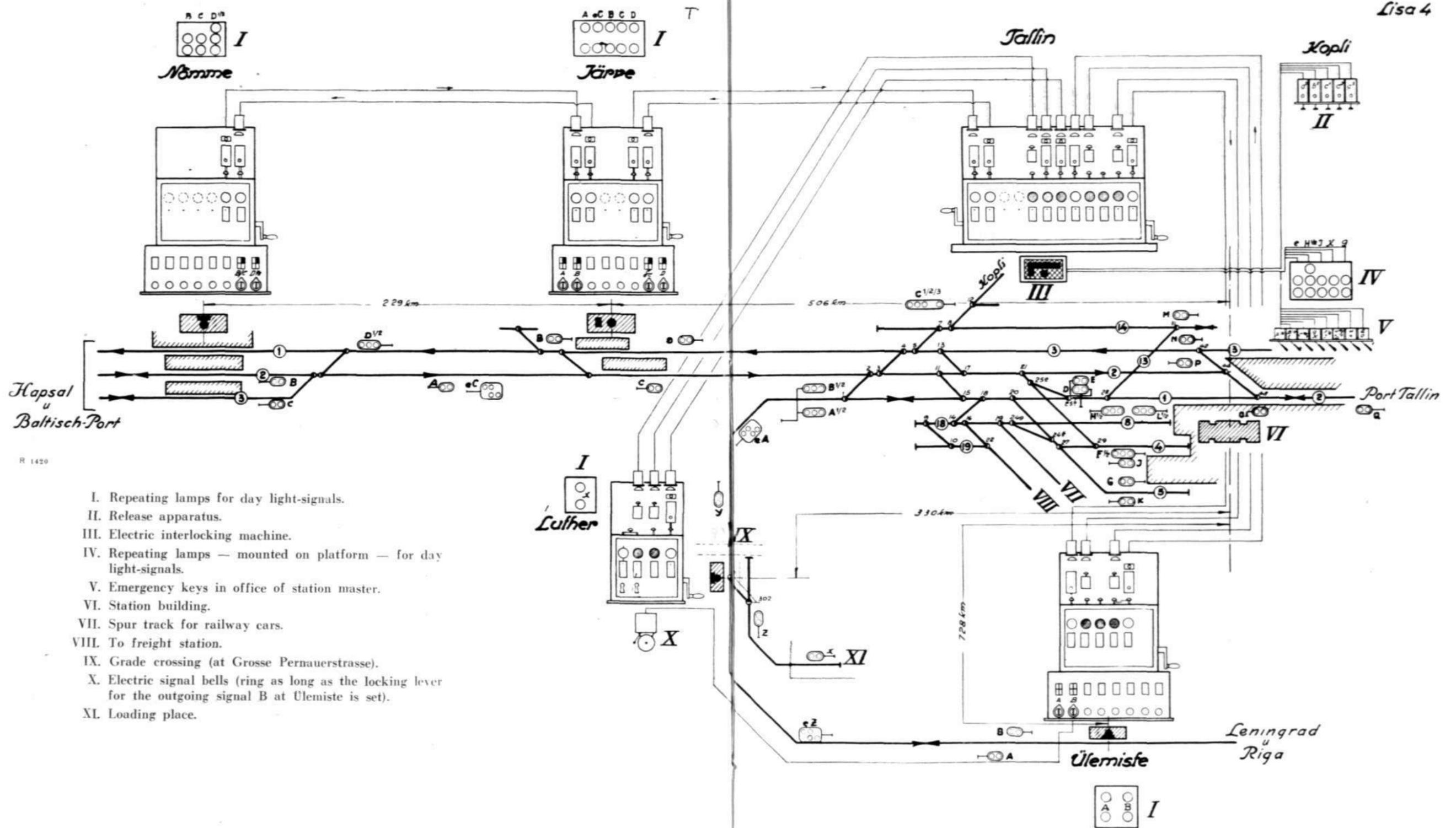
The building for the interlocking station was erected in two stories (the lower of masonry and the upper of timber). The floor of the upper story is on a level with the top of the loading profile for the freight cars, or 5.25 m. over the top of the rail. The interlocking room has wide windows on every side with two bay-windows between which there is a small open balcony, permitting a wide and unobstructed view of the entire track system and all the switching operations, since most of the latter take place in the vicinity of the interlocking station.



R 1411

Distance Day Light-Signal.
Outgoing Signal eC at Järve.

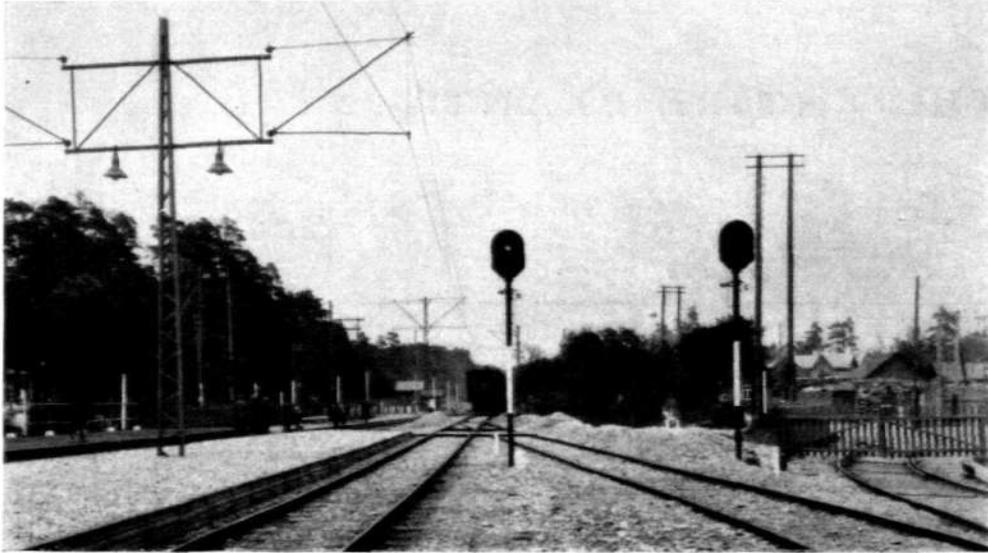
SIGNAL AND BLOCKING DIAGRAM FOR THE ENTIRE PLANT.



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R 1420

- I. Repeating lamps for day light-signals.
- II. Release apparatus.
- III. Electric interlocking machine.
- IV. Repeating lamps — mounted on platform — for day light-signals.
- V. Emergency keys in office of station master.
- VI. Station building.
- VII. Spur track for railway cars.
- VIII. To freight station.
- IX. Grade crossing (at Grosse Pernauerstrasse).
- X. Electric signal bells (ring as long as the locking lever for the outgoing signal B at Ülemiste is set).
- XI. Loading place.



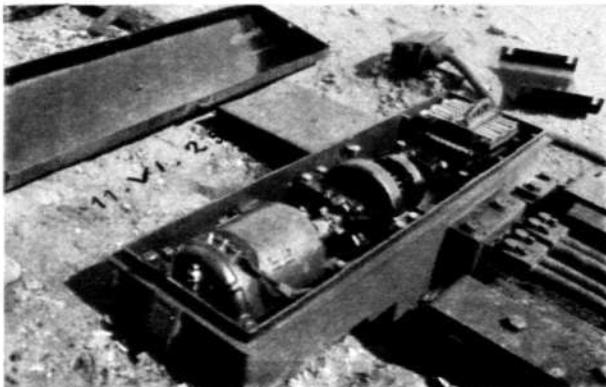
R 1412

Outgoing Signals B and C at Nömme.

The distances from the interlocking station to various points are as follows

	<i>N. E. direction.</i>	<i>S. W. direction.</i>
a. to the most distant signal	703 m.	2860 m.
b. to the most distant point with centralized manoeuvring	235 m.	453 m.

The upper story has a floor space of $10 \times 4 = 40$ sq. m. and contains the interlocking machine, lock-and-block apparatus, relay cabinet, instrument board with metal rectifiers for connecting up to the A. C. power net, a cabinet for high-precision mensuration instruments, a writing desk for the train dispatcher, a table with Morse receiver and the necessary boards, furniture and heating apparatus. Space is provided for a 1.95 m. extension of the interlocking machine.



R 1415

Electric Switching Machine.

An electric signal horn, by means of which the train dispatcher gives acoustic switching signals, is mounted on the balcony. Special care has been given the problem of adequately lighting the interlocking room at night, so as to provide good lighting of the apparatus, clock and writing desk without in any way impairing the clarity of the view from the windows. The interlocking operator is able to get into immediate communication with the station master by means of a loudspeaker and with the nearest railway stations, the more important groups of switches and the telephone exchange by means of the telephone.

All of the incoming and outgoing cables and wires terminate in the space provided for this purpose between the two stories.

The lower story consists of two rooms, one of them being used for an electrical repair shop and the other for housing the storage battery and the stock of material and spare parts.

The stairway to the upper story is inside the building, which is provided with a heating plant, water, fire hydrant and two lightning rods. Hand fire extinguishers are placed at suitable places in both stories.

The interlocking station is manned by a train dispatcher and a signal operator.

The lock-and-block apparatus are made with fields for alternating current. The interlocking machine at Revel, besides being provided with electric control by means of locking magnets, has a mechanical cross locking gear. 24 tracks



R 1414

Electric Switching Machines with Tongue Control and Enclosed Points Lock.

can be cleared and 1 advance signal, 21 signals and 21 points (of which two are simple crossing points) can be manoeuvred from the interlocking machine by means of 13 track signal levers and 14 point levers. Shunt supervisory lamps for all of the signals are mounted in an extension to the interlocking machine. A true picture of all the signals may thus be obtained by the train dispatcher.

Since most of the switching operations take place in the immediate vicinity of the interlocking station and may be easily supervised by the train dispatcher, no special arrangements were made in order to prevent the setting of points occupied by rolling stock. The more dangerous switching operations which include the crossing of a main track and which take place at a comparatively great distance from the interlocking station, however, are considered as separate tracks and are provided with the corresponding safety arrangements.

Electrical energy may be obtained according to necessity, either from the Ellamaa generating station or the city mains.

A D. C. supervisory current of about 40 volts' tension for the magnets and relays is obtained from a 220 volt A. C. net by means of a 6 amp. dry rectifier. The direct current thus obtained might of course be carried direct to the interlocking machine for supervisory purposes, and this is also done when necessary, for instance when the storage battery is disconnected. For a regular supply of supervisory current, however, there is a storage battery with a capacity of 34 amp. h. and composed of 30 nife cells. This battery is placed on a shelf with a surface of but .26 sq. m. and therefore requires no special room.

All the signals are day light-signals. The separate lamps have double lenses and simple 127 volt single wire incandescent lamps. Each light and colour has its own separate lamp. Since the visibility of the lights is much diminished by the smoke from slate fuel, especially at the Revel station, comparatively strong lamps were selected for the day light-signals, viz. 40 watts for main and shunting signals and 20 watts for advance signals. The necessary A. C. for the day light-signals is obtained from the 380 volt triple phase net at Revel by means of a star connection, after which it is transformed down to 220 volts. The transformers are placed in the respective station buildings.

The switching machines are provided with tongue control and inside locking. The motors for these machines are for .6 HP and are fed direct with a 220 volt A. C.

220 volt A. C. direct from the service mains is also used for the lamps in the switch lanterns installed by the railway. Those points which are not used for shunting operations but only



R 1416

Cable Distribution Boxes.

Distribution boxes of this type are placed wherever more than three cables are brought together.

for the regular train traffic have not been provided with switch lanterns, as this was considered superfluous.

The insulated rails are fed with a 6 volt alternating current transformed down from the 220 volt service current in the interlocking machine. By introducing resistances in the circuit, their purpose being to limit the intensity of the current on the passage of a train, the tension is reduced from 6 volts to 3.8 volts in the insulated track sections lying nearest the interlocking station, and to 1.2 volts in the more distant ones. At these latter sections the voltage on the relay side is transformed up from 1.2 volts to a tension more suitable for the relays.

In spite of the above-mentioned disadvantages, the arrangements have proved to be entirely

reliable, no trouble whatever having occurred in the releasing of the tracks.

The energy consumed by the Revel interlocking plant amounts to about 20.7 kWh per 24-hour day. Of this amount, about 19 kWh are used by the signal and repeating lamps and for the lighting of the interlocking station, leaving only 1.7 kWh per day for the control and manoeuvring current, corresponding to a consumption of energy of .074 kWh per motor and 24-hour day.

We specially wish to emphasize that it was possible to carry on this work smoothly, quickly and efficiently thanks to the very kind cooperation of the administration of the Esthonian Gov't Railways, this statement being upheld by the fact that not one single deviation from the original project was found necessary.



R 1418