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THE NORTH ELECTRIC MFG. COMPANY GALION OFIC J.S.A.

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1. OBJECT

The North All-Relay automatic Telephone System embodies a number of unique features, not to be found in other well known automatic system. Among the most distinctive of these features is the ingenious method of using relays for selecting one line out of a large number of lines. The following description is intended as a brief introduction to this North relay selection scheme without going into other details of the North system.

2. GENERAL

The surpose of the All-Relay telephone system is to provide talking connections from any calling station to any wanted station in the system, for as many stations as may wish to talk at the same time.

In the All-Relay System the term "Link" is used to designate the squipment necessary to complete one talking connection from a calling station to a wanted station. Diagram BS=2405 is a simplified illustration of one of these links suitable for a 100 line system, but showing only 30 lines.

Since it is necessary to provide for more than one simultaneous talking connection, it is obvicus that a number of links must be available in the system. Only one of these links is shown in the diagram, which is intended primarily to linkstrate in a schematic manner how a talking connection is established. The other links are exact duplicates of the one shown and may be imagined as being connected to the right hand end of the diagram.

For the sake of clarity the lines shown in the diagram consist of single wire, while actually a line requires two wires outside of the switchboard and three wires within the switchboard.

3. FUNCTION OF LINK

When a station makes a call it automatically engages an idle link for the duration of the call. The manner in which an idle link is selected will not be described here. A full explanation of this function may be found in the detailed circuit description. In the following, it will be assumed that the link shown in the diagram is the one selected by the calling station.

After the link is engaged the talking connection is completed in the following successive steps:

The calling station is connected to the connector control relays.

The number of the wanted station is registered, in the connector control relays by means of the dial.

The connector control relays are connected to the wanted station,

That part of the link which makes the connection to the calling line is called the "Line-Finder". The relays in the link which register the wanted number by receiving the dial impulses from the calling station are designated "Connector Control Relays," and the part of the link involved in making the connection to the wanted station is termed "Connector."

4. LINE-FINDER

The function of the line-finder is to connect the dialling line to the connector control relays. To accomplish this, the calling line must be selected from the 100 lines in the system and a circuit extended from this line along to the connector control relays. The line-finder performs this function by selecting the 10-line group containing the calling line and then one line out of these ten. For example, if line 21 is calling, the line-finder selects the 10-line group 20-29 and then line 1 in this group, thus picking out line 21.

The proper 10-line group if selected by the operation of one of a number of so-called line-finder TENS relays designated F20, F30, F40, etc., and the desired line in the group is picked out by the operation of one of a number of line-finder UNITS relays, designated F0- F1, F2, etc. Only three linefinder TENS relays are shown on the diagram, but it will be understood that the system may be expanded merely by the addition of further TENS relays.

The operation of the line-finder TENS and UNITS relays is controlled by the line relay of the calling station in a manner which need not be described here. When line 21 is calling, its line mlay causes the operation of TENS relay F20 and UNITS relay F1. By referring to the diagram it will be seen that the operation of TENS relay F20 connects the 10 lines 20-29 to the linefinder UNITS relays, but as long as no UNITS relay is operates, the connection is not extended to the connector control relay. As scon as UNITS relay F1 operated, line 21 is connected through, while the other nine lines in group 20-29 remain disconnected at the contacts of UNITS relays F0 and F2-F9. The circuits of the other 10-line groups remain open at the contacts of their respective TENS relays.

The line circuit is now extended to the connector control relays overthe following path.

Station 21, through the contact of relay F20, through the contact of relay F1 to the connector control relays.

5. CONNECTOR CONTROL RELAYS

The connector control relays are for the purpose of registering the desired station number as indicated by the dial. The operation 35 these relays need not be described here; it is sufficient to say that the connector control relays receive the impulses sent from the dial and cause the operation of the connector TENS and UNITS relays corresponding to the numerals dialled.

6. CONNECTOR

The function of the connector is to extend the line from the connector control relays to the dalled line. As in the line-finder a selection must be made from the 100 lines in the exchange and a circuit extended to the line and to that line alone. This is accomplished by selecting the desired 10 line group and then one line out of these ten. The selection is performed by connector TENS relays, designated C20, C30, C40, etc., and by connector UNITS relays designated C0, C1, C2, etc.

If for example, the number of the vanted station is 45, the calling subcriber first dials the numeral "4" and then the numeral "5". By dialling the numeral "4" the connector control relays are caused to function in such a manner as to energize the connector TENS relays C40, thereby selecting 10-line group 40-49. The connector control relays are then automatically switched from the connector TENS relays to the connector UNITS relays, so that dialling the next numeral "5" results in the operation of the connector UNITS relay C5. With relays C40 and C5 energized the circuit is extended from the connector control relays to the wanted line over the following path:

Connector control relays, contact of relay C5, fifth contact of relay C40, station 45.

The circuits of the other nine lines in the 10-line group 40-49 remain open at the contacts of relays CO-C4 and C6-C9. The circuits of the other 10-line groups are open at the contacts of their respective TENS relays.

7. ILLUSTRATIONS OF COMPLETED CONNECTIONS

The connection from the calling station 21 to the wanted station 45 is now completed as a result of the operation of relays F2O and F1 in the linefinder and 040 and 05 in the connector. The connection may be traced through the link as follows: beginning at station 21 in the upper left hand corner of the diagram, follow the horizontal line leaving this station to the point where it connects with a vertical line; follow the vertical line down to the contact of relay F1 which is operated, continue down and then to the right to the contact of relay F1 and through the connector control relays and to the contact of relay C5, continue to the right to the point where a vertical line is encountered, follow the vertical line up to the point where a horizontal line is met, following the horizontal line to the left will complete the connection to station 45.

A completed connection from station 39 to station 30 would cause the operation of relays F30 and F9 in the line-finder and C30 and C0 in the connector. The circuit established would now be; station 39, contact of relay F30, contact of relay F30, contact of relay F30, contact of relay C0, contact of relay C0, contact of relay C30, station 30.

8. RINGING AND BUSY SIGNALS

Automatic ringing and "Busy Signal" are provided in the exchange in a manner explained in the detailed circuit descriptions.

9. COMPARISON WITH STEP-BY-STEP SWITCH

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For those who are familiar with the so-called step-by-step type of automatic telephone switches, it may be pointed out that the operation of a TENS relay corresponds to the selection of a "Level" by means of the vertical steps of the switch while the operation of a UNITS relay is equivalent to the selection of the desired line in the "Level" by means of the rotary steps.

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