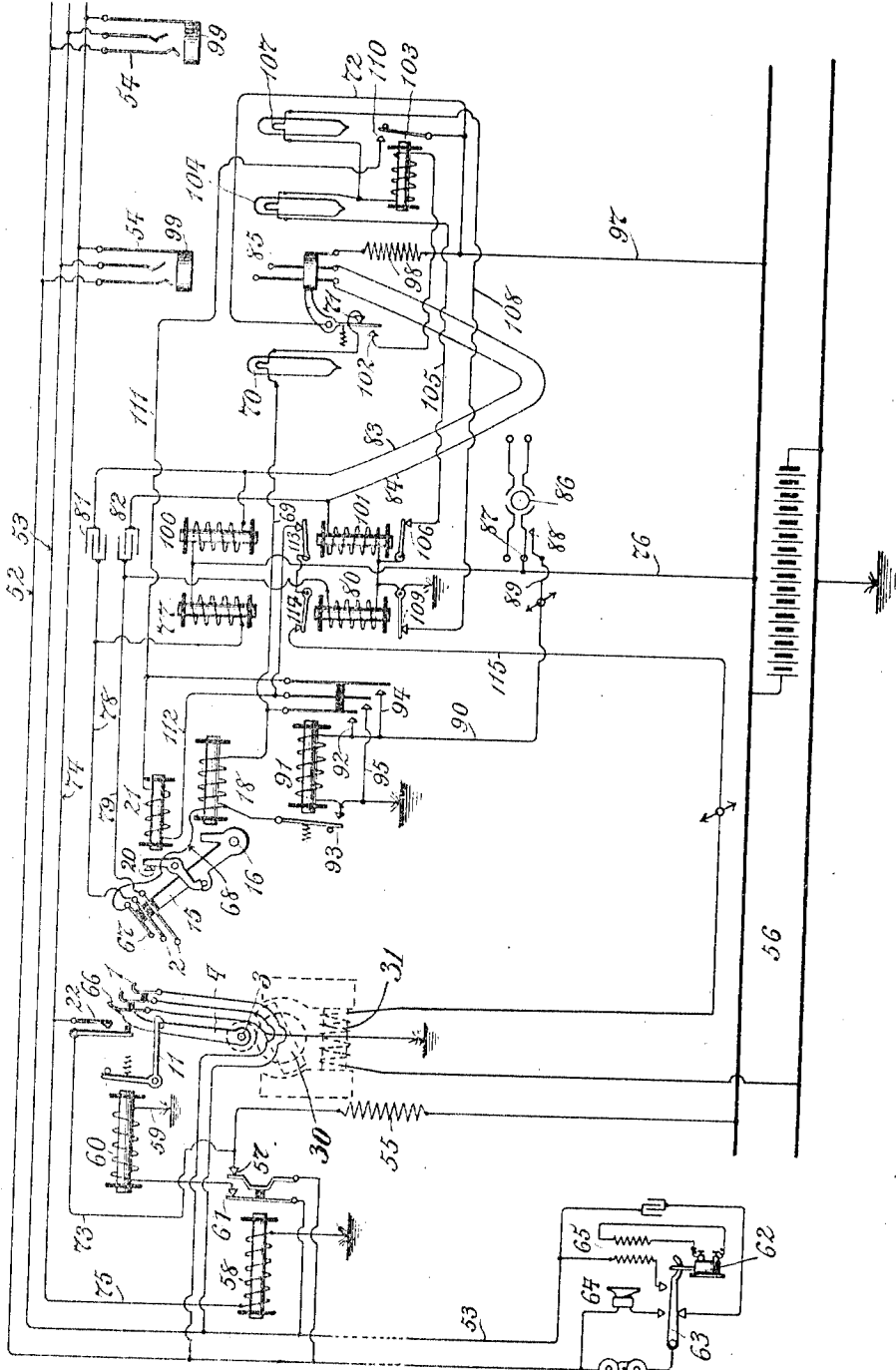


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TELEPHONE SYSTEM.

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TELEPHONE SYSTEM.

1,061,651.

Specification of Letters Patent.

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To all whom it may concern:

Be it known that I, FRANS GUNNAR AGRELL, a subject of the King of Sweden, and resident of Stockholm, Sweden, have invented certain new and useful Improvements in Telephone Systems, of which the following is a specification.

This invention relates to telephone systems and has for its object the provision of a new system of devices and connections, adapted for use in a telephone exchange and by means of which the operation of the exchange is greatly simplified and rendered partially automatic.

One object of my invention is to do away with that part of the operation of the exchange which consists in connecting the calling subscriber's local line with a switching circuit, this being accomplished automatically by the use of my invention.

Another object and result accomplished by the use of my invention is the distribution of the operator's load which heretofore has been accomplished by means of manually operated distributing switchboards.

By the use of suitable devices, which will be more fully described hereinafter, a calling subscriber is in my system automatically connected to a switching circuit controlled by an operator or other means which is not busy at the time.

Other objects will be in part obvious and in part pointed out hereinafter.

By means of a device which I have designated as a connector and which may be located in the exchange, any subscriber's calling will be automatically connected to a switching circuit controlled by a "not busy" operator or other means.

In the drawings accompanying this specification I have illustrated one form or embodiment of my invention in a central energy or "common battery" system with a combination of circuits and devices, many of which may be altered to meet the various requirements of telephone service and to adapt the same for use with other systems.

The figure represents diagrammatically the circuits of a central exchange forming part of a system such as above described.

The connector is indicated diagrammatically in the accompanying drawings by the movable arms 4 and 15 and the motor 30—31, and it is not thought necessary to describe the same in detail here further than to state that the movable arm 4 carries ter-

minals 1 to which is connected the line from the subscriber's station, there being as many arms and sets of terminals as subscribers. The movable arms 15 carry terminals 2 to which are connected the switching circuits from the plugs and jacks, or selecting devices, and these terminals are so positioned that connection may be made with any subscriber's terminals. The magnet 60 operates the latch 11 to release the arm 4 allowing the same to fall and cause the terminals 1 to engage the terminals 2 on the arm 15. The magnet 18 then operates to swing the arm 15 into such position that it will not be engaged by a subsequently operated subscriber's line and is held in such a position by the latch 20 which is operated by the magnet 21 to release the same, when the arm 15 will assume its former position. It will be understood that the movable arms 4 and 15 may be mounted upon the armature shaft of the motor 30—31, or otherwise suitably connected therewith, so that when the motor is connected in circuit the arms are restored to their original positions, breaking the contact between the terminals 1 and 2, but when disconnected are free to fall by gravity to make the desired connections. The motor 30—31 is shown in dotted outline in its position relative to the movable arms 4 and their shaft 3. The construction of this portion of the device is shown in detail in Figures 3, 4 and 5 of my co-pending application filed contemporaneously with this application under Serial No. 338,309. An important feature of the system using this connector is that all connections between a large group of subscribers' lines for instance, one hundred and the switching circuits assigned to said group are performed by the same device. In systems formerly devised a plurality of devices in the strict meaning of the word, each individual to a subscriber's line or individual to a switching circuit have been employed making such a system extremely complicated.

Referring now to the drawing, 64 represents a subscriber's station connected to a common battery type of exchange by means of the line 52—53. In the central exchange, said lines carry multiple jacks 54, one at each multiple board as now regularly used. Instead of the regular answering jack the terminals 1 of the connector are used. Current is supplied to the subscriber's station

from the battery 56 over the resistance 55, over the contact 57 of a cut-out relay 58 to the one side 52 of the subscriber's line, and from ground side of the battery over the lead 59, the releasing magnet 60, the contact 61 on the relay 58 to the other side 53 of the subscriber's line. The usual answering cord and plug are substituted by the terminals 2 of the connector. Only a few cords from each operator goes to each connector, the remaining being connected to other similar connectors. If the subscriber takes his receiver 62 off the hook 63 current will flow from the battery through the resistance 55, over the contact 57, over the line 52, through the transmitter 64 and induction coil 65 back to the line 53 and from there through the contact 61 to the releasing magnet 60, line 59 back to ground and battery. Now the releasing magnet 60 will operate its latch 11 releasing the arm 4 of the connector. This arm will now fall until the terminals 1 engage and make contact with the terminal bars 2 on the arm 15. At the same time contact is made between terminals 66 and 67 and the ground side of battery 56 is connected through the line 68 to the magnet 18, the lead 69, the lamp 70, the plug contact 71 and leads 72 and 97 to battery. Thus a complete circuit is formed and the magnet 18 will operate, carrying the arm 15 to its busy position where it is locked by the latch 20. At the same time the lamp 70 lights, indicating that a subscriber has called. When the arm 4 moved away from its original position contact was made between springs shown at 22 and current went from battery, over the resistance 55, the lead 73, the contact 22 to the third conductor 74 in the multiple, making the multiple jacks of said subscriber indicate "busy". The current also went from the contact 22 through the line 75 and the relay 58 to ground. Now this relay operates and the contacts 57 and 61 are broken, disconnecting the battery from the subscriber's line. This line is now connected to battery through lead 76, retardation coil 77, line 78, through contacts 1 and 2 of the connector to the subscriber's line and then through lead 79 and relay 80 to ground. Through the contacts 1 and 2, the leads 78 and 79 and the condensers 81 and 82 the subscriber is connected to the cord circuit 83-84 ending in the plug 85. This cord circuit is provided with the ordinary means for listening in on the operator's side and for ringing, not shown in the drawing. When the lamp 70 lighted the operator threw the key 86 to connect her talking circuit to the cord, asked the subscriber for the number wanted and lifted up the plug 85 and connected it to the desired multiple jack. When the key 86 was thrown current went from the battery through the lines 76 and 87 to the key contact 88 and out

on a line 89, which branches to every connector to which trunks go from said operator's position. This branch line 90 goes to a relay 91 and from there to ground. Now this relay operates and connects the electromagnet 18 to the battery on one side by means of the contact 92 and to the other side of battery through ground by means of the contact 93. All trunks belonging to said operator will now be moved out of reach for any subscriber's line by the operation of the connector arm as above described as long as the operator is "busy", that is, as long as the key 86 is thrown. They are not locked in this position, however, as the releasing magnet 21 is also connected to the battery through the contacts 94 and 95 so that when key 86 is restored and the contact 88 broken the arm 15 will go back to its original position. When the operator lifted up the plug 85 the contact 71 was broken, thus putting out the lamp 70 and also breaking the current in the magnet 18.

Now consider station 64 as the subscriber being called, the diagram of connections being the same as for the calling subscriber. When the operator plugs in to the desired multiple jack 54 current will go over the line 97, the resistance 98, the sleeve 99 to the third conductor 74 of said subscriber's multiple and through his cut-out relay 58 to ground. The cut-out relay will operate, breaking away that current from its line which went over the resistance 55 and the release magnet 60. This subscriber is now indicated "busy" and his calling arm 4 cannot be released. He is now connected through to the calling subscriber and receives current from the common battery through the lead 76, the retardation coil 100 to the one side of the line and is connected with the other side through the relay 101 to the ground side of the battery. Now current goes from the leads 97 and 72 to the plug contact 102, which was closed by the lifting of the plug, the relay 103, the lamp 104, the lead 105 and contact 106 of the relay 101 back to ground and battery. Now the lamp 104 lights. The operator now signals to the subscriber in the ordinary manner. When the called subscriber takes his receiver 62 off the hook 63 the relay 101 is energized and the contact 106 is broken, thus putting out the lamp 104. Now the two subscribers are connected and in conversation. When the call is finished and both subscribers put their receivers on the hooks the current in relays 80 and 101 is broken and contacts 109 and 106 go back to their original positions. Current now goes through the lead 97, lead 72, the plug contact 102, the relay 103, to the lamps 104 and 107. From the lamp 107 the current goes through the lead 108 to the contact 109 of the relay 80 to ground, and from the lamp

104 it goes through the lead 105 and contact 106 to ground. Both lamps now light and the relay 103 is operated. Current goes now to the contact 110 the lead 111, the release magnet 21, the lead 112, the contact 113 of relay 101, the contact 114 of relay 80 the lead 115 to the restoring motor 30—31, back to ground and battery. Now the arm 15 is released and goes back to its original position and the motor carries the arm 4 back to its original position. The contact 22 is broken and the cut off relay 58 goes back to its original position. Everything is now restored as far as the calling subscriber is concerned and the operator pulls out the plug 85 from the jack 54 of the called subscriber, thus breaking the current from his cut off relay 58. Now this subscriber's apparatus is restored. When the plug goes down to its seat the contact 102 is broken thus disconnecting the relay 103 and the lamps 104 and 107. When the relay 103 ceases to operate the current is broken from the release magnet 21 and the restoring motor 30 and everything is now restored to its original position.

From the description of my system as above illustrated it will be seen that when an operator or selective means is busy attending to a call all of the switching circuits controlled by said operator or selective means are automatically indicated busy and rendered inaccessible to any subsequent call and any such subsequently calling subscriber will be automatically connected with a switching circuit controlled by a not busy operator. It will also be seen that in my system the connection of the calling subscriber to a switching circuit is made almost instantaneously. Consequently a more efficient service than is possible with present systems can be given where my system is employed and this can be accomplished with a smaller number of operators or selective devices.

It will be understood that the term "indicated busy," and similar terms, are herein used in their broadest sense. It will be evident that there are many ways in which a circuit may be "indicated busy" and the means here shown and described not only fill this function but also operate to render the busy circuits inaccessible for use while the operator or selecting device which controls such circuit or group of circuits is busy or being operated.

As many changes could be made in the above construction, and many apparently widely different embodiments of my invention designed without departing from the scope thereof, I intend that all matter contained in the above description or shown in the accompanying drawings shall be interpreted as illustrative merely of an op-

erative embodiment of my invention and not in a limiting sense.

What I claim is:

1. In a telephone exchange, in combination, a number of switching devices adapted to be controlled by a number of operators, a number of movable terminals, a number of circuits connecting said switching devices and said movable terminals, a number of subscribers' lines each provided with movable terminals, means adapted to move the terminals of one of said subscribers' lines into operative engagement with the terminals of one of said switching circuits, means adapted to move said last named terminals when so connected to such a position that the same will not be engaged by a subsequently operated subscriber's terminals, means for moving the terminals of all other switching circuits controlled by any one operator into such a position that the same will not be engaged by a subsequently operated subscriber's terminals when said operator is busy, and means for restoring the terminals to their original position.

2. In a telephone exchange, in combination, a number of switching devices adapted to be controlled by a number of operators, a number of movable terminals, a number of circuits connecting said switching devices and said movable terminals, a number of subscribers' lines, a device adapted to connect one of said subscriber's lines with the terminals of one of said switching circuits, means adapted to automatically move said terminals when so connected to such a position that the same will not be engaged by a subsequently operated subscriber's line, means for moving the terminals of all other switching circuits controlled by any one operator into such a position that the same cannot be connected with a subsequently operated subscriber's line when said operator is busy, and means for restoring the terminals to their original position.

3. In a telephone exchange, in combination, a number of switching devices adapted to be controlled by a number of operators, a number of movable terminals, a number of circuits connecting said switching devices and said movable terminals, a number of subscribers' lines each provided with movable terminals, electrically operated means adapted to move the terminals of one of said subscribers' lines into operative engagement with the terminals of one of said switching circuits, electrically operated means adapted to move said last named terminals when so connected to such a position that the same will not be engaged by a subsequently operated subscriber's terminals, electrically operated means for moving the terminals of all switching circuits con-

trolled by any one operator into such a position that the same will not be engaged by a subsequently operated subscriber's terminals, when said operator is busy, and means for restoring the terminals to their original position.

4. In a telephone exchange, in combination, a number of switching devices, a number of movable terminals, a number of circuits connecting said switching devices and said movable terminals, a number of subscribers' lines each provided with movable terminals, electrically operated means adapted to move the terminals of one of said subscribers' lines in to operative engagement with the terminals of one of said switching circuits, electrically operated

means adapted to move said last named terminals when so connected to such a position that the same will not be engaged by a subsequently operated subscriber's terminals, electrically operated means for moving the terminals of all switching circuits into such a position that the same will not be engaged by a subsequently operated subscriber's terminals, and means for restoring the terminals to their original position.

Signed at New York, in the county of New York and State of New York this 9th day of Oct. A. D. 1906.

FRANS GUNNAR AGRELL.

Witnesses:

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LEWIS J. DOOLITTLE.