Jan. 17, 1933. H. F. OBERGFELL 1,894,828

SUBSTATION TELEPHONE SET

Filed April 27, 1931 2 Sheets-Sheet 1

Fig. 1

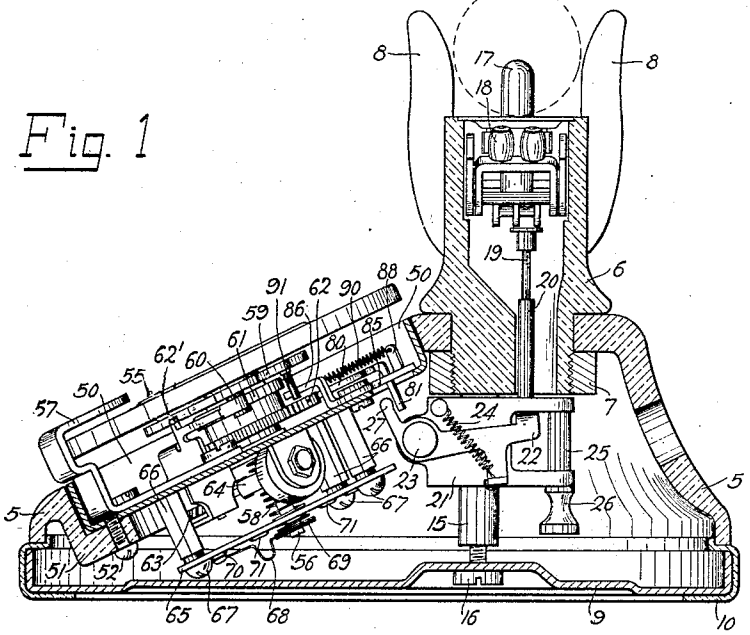
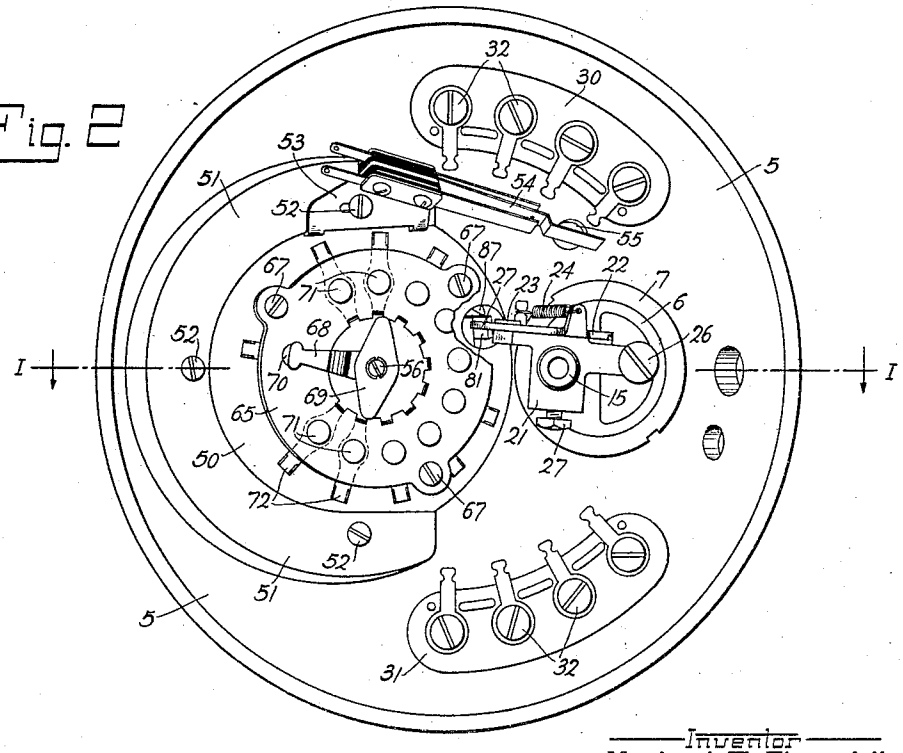


Fig. 2



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Fig. 3

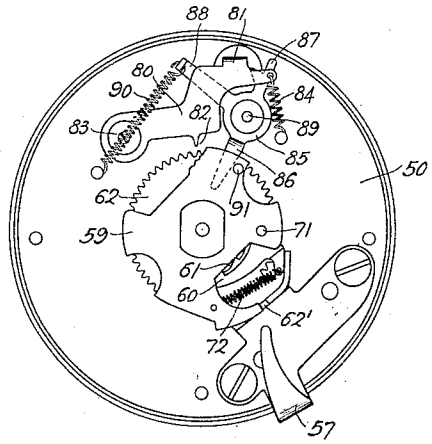
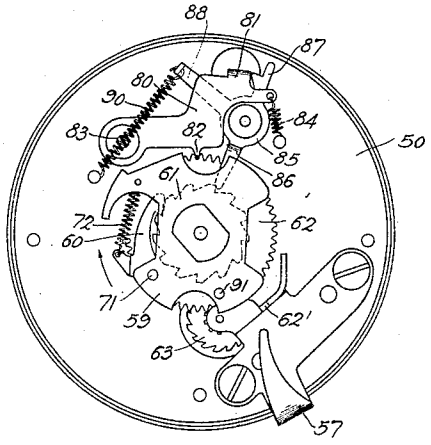


Fig. 4



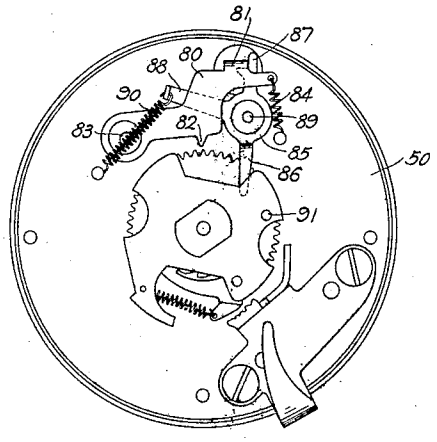
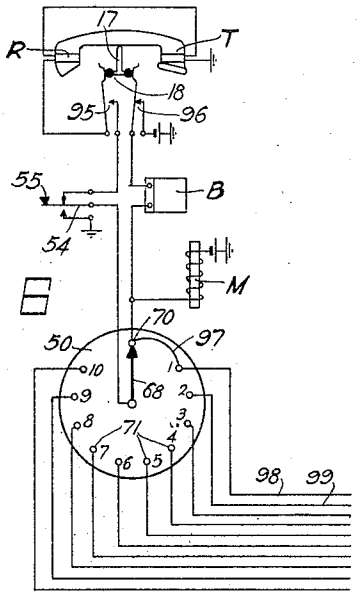


Fig. 5

Fig. 6



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UNITED STATES PATENT OFFICE

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SUBSTATION TELEPHONE SET

Application filed April 27, 1931. Serial No. 533,052.

This invention relates in general to substation sets but is more particularly concerned with improvements in telephone desk sets of the cradle type, and the principal object of the invention resides in the design of an improved cradle desk set for use in intercommunicating telephone systems.

A further object of the invention is to design an improved station selector or calling device for an intercommunicating telephone desk set which incorporates most of the standard parts and operation of a regular impulse sender such as is used in large automatic telephone systems and which may be mounted in a standard automatic telephone instrument case.

In accordance with the above object a station selector or calling device is designed incorporating a number of novel features whereby neatness of construction, reliability of operation, and the simulation to a standard automatic calling device is obtained.

In previous types of intercommunicating systems the telephone substation was usually provided with a station selector consisting in one form of a manually operated knob having an indicator thereon and a wiper for establishing a connection with any desired substation to which the knob is rotated. With this type of station selector no provisions were provided for locking the knob in its operated position or for automatically restoring it to normal after a connection is to be terminated, consequently a subscriber invariably forgot to restore the knob manually before making another call or moved it during the time a connection is taking place. It is an object of this invention therefore, to design an improved station selector having a number of desirable and novel features tending to overcome the above pointed out objectional operating characteristics.

A particular feature of the invention resides in providing a station selector which is locked in the position in which it is operated, and is automatically released and restores to normal when the telephone handset is placed upon the switchhook of the telephone.

Another feature resides in providing means whereby the automatic restoration of the station selector brought about by the replacement of the handset on the switchhook cannot be hindered in any manner by repeated operation of the switchhook either accidentally or intentionally.

The above objects and features and others not specifically pointed out will be apparent from the following description which taken together with the two sheets of drawings, constitute a preferred embodiment of the invention.

The invention is illustrated in detail in the accompanying drawings, in which Fig. 1 depicts a cross-sectional side view through a conventional cradle telephone desk set taken along the line I—I of Fig. 2 showing the internal apparatus; Fig. 2 is a full bottom view of Fig. 1; Fig. 3 shows a top view of the station selector or calling device with the finger hole dial and number plates removed to show the internal mechanism; Figs. 4 and 5 are views similar to Fig. 3 showing different positions of the calling device; while Fig. 6 illustrates a diagrammatic representation of the circuit arrangement of one telephone in a ten station intercommunicating system.

Referring more particularly to Fig. 1 the telephone comprises the hollow moulded base 5 shown in cross section having an opening at its top through which the stem of the cradle member 6 projects. This cradle 6 is fastened to the base 5 by means of the nut 7. The cradle member 6 has a projection 8 on each corner thereof to accommodate the handset of the telephone (not shown). This handset when placed in position on the cradle 6 extends between a pair of the posts 8. A metal base plate 9 encloses the bottom of the base 5 and is secured thereto by means of the bolt 16 screwed into a post 15 which is imbedded in the stem of the cradle 6. A rubber pad 10 is clamped between the periphery of the base 5 and the base plate 9 and serves as a cushion for the telephone. The insulated switching member 17 extends upward between the posts 8 in the center of the cradle member 6 and by means of a lever arrangement controls the operating member 18 to move the switching contacts of the telephone

into either the signalling or talking positions.

For a more detailed disclosure of the switchhook contacts and the switching members 17 and 18, reference may be had to Patent 1,738,919, issued to H. F. Obergfell on December 10, 1929.

The cradle member 6 has an opening extending throughout its length through which the pin 19 extends. This pin 19 is directly controlled by the switching member 17 and slides in the sleeve 20 which also holds it in position.

A bracket member 21 has a hole extending throughout its length to accommodate the supporting post 15 to which it is secured by means of the bolt 27, as shown in Fig. 2. This bracket 21 is substantially square-shaped and has a number of projections formed integral with it and between two of which a bushing 25 of insulation is clamped by the bolt 26. This bushing 25 together with the bolt 26 serves to prevent the entanglement of the various wires and conductors in the base of the telephone with any of the working apparatus in the calling device and switchhook operating members. The bolt 26 likewise serves as a tie for the cord of the telephone to prevent undue strain directly upon the wires. Pivoted to the bracket 21 by means of the pivot 23 is a two armed reciprocating lever having one arm 22 in operative relation to the bottom edge of the pin 19, so that when the switching member 17 is depressed pin 19 engages the edge of the lever 22 and moves it downward against the tension of the coil spring 24. The other end 27 of the lever engages a member 81 in the calling device for a purpose which will be later on pointed out.

It will be noted in Fig. 1 that the handset unit of the telephone, for the sake of clearness, has been shown removed from the cradle member 6 but that normally the handset is on the cradle member 6 and the switching member 17 is depressed. This handset is well known and may be similar to that shown in Fig. 6.

Referring to Fig. 2 which shows a bottom view of the telephone, the terminal blocks 30 and 31 are formed integral with the base 5 on opposite sides thereof and each have a number of terminal posts 32 moulded into them together with the soldering tags to which the wires of the telephone are attached.

The calling device or station selector consists of a cup-shaped frame member 50 which supports the various mechanisms of the device. This supporting member 50 is secured to the boss 51 formed integral with the base 5, by means of screws 52. One of the screws 52 likewise holds the bracket 53 to the boss 51. This bracket 53 supports the spring combination 54 which is operated by the ringing push button 55, accessible from one side of the stem of the cradle member 6. These contact springs 54 are used for signalling a called telephone. For a more detailed description and showing of the various parts of the calling device or station selector, reference may be had to Patent 1,642,822, issued to H. F. Obergfell, September 20, 1927. The calling device disclosed in this patent is essentially the same as that disclosed in the instant application, except that the impulse springs and shunt springs have been removed and other mechanism substituted. In general this calling device comprises a post 56 which extends through the bottom of the dial plate 50 and has the plate 59 rigidly secured to one end of it. A finger stop 57 formed integral with its supporting bracket is screwed to the bottom of the dial plate 50 and has a projection 62′ which acts as a normal stop for the plate 59. The finger-hole plate 55 having the usual ten holes around its periphery through which the numerals 1 to 10 are visible, as shown in the above patent, is keyed into the plate 59. A coiled spring 58 encircles the post 56 and one end engages the bottom side of the dial plate 50 while the other end is secured in a slot in the post 56. A pawl 60 is pivotally secured to the underside of plate 59 and is adapted to engage the teeth of ratchet wheel 61 and thereby impart motion to the gear wheel 62. The gear wheel 62 in turn drives the worm wheel 63 and this imparts motion to the combination worm gear and governor 64 to retard the return movement of the dial.

With this arrangement it will be seen that when the finger-hole plate 55 is rotated clockwise, the plate 59 rotates with it and moves the pawl 60 over the teeth of the ratchet 61 until the finger plate 55 is stopped by the finger of the operator engaging the finger stop 57, at which time the finger-hole plate 55 is released, and then under control of the coil spring 58 the finger plate 55, together with the plate 59, turns the pawl 60. This pawl 60 in turn engages one of the teeth of the ratchet 61 to turn the gear wheel 62 in a counter-clockwise direction to rotate the governor wheel 63 and thereby slowly rotate the mechanism back to its normal position. The above is substantially the action which takes place in an ordinary automatic impulse sender or calling device as is disclosed in the above-mentioned patent. In the instant case, however, the restoration of the mechanism is temporarily arrested until some other action takes place which will be pointed out hereinafter.

A circular insulating terminal plate 65 is secured to the rear of the dial plate 50 by means of three posts 66 and their associated screws 67. A spring wiper 68 is fastened to the end of the post 56 and is clamped between two spring members 69 which assist in storing tension in the spring 58 when the assembly is completed. The wiper 68 normally

rests on a home position contact 70 which is associated with the instant telephone. Other contacts 71, of which ten are shown, are arranged in a circle within the path of movement of the wiper 68. Each contact 71 corresponds to a particular telephone in the system and is associated with a certain figure on the number plate under the finger-hole plate 55. Each of the contacts 71 is riveted on the opposite side of the insulating plate 65 to a soldering tag 72 for the purpose of connecting a wire thereto and establish a connection. These soldering tags engage notches on the inner periphery of the hole in the insulating plate 65 to prevent their turning about the axis of the contacts 71.

Referring now more particularly to Fig. 3 in connection with Fig. 1, the mounting plate 50 has pivoted at 83 the lever 80, which has a projection 81 on one end extending outward through a hole in the plate 50 and in the path of movement of the end 27 of the reciprocating movable arm 22 which is actuated by operation of the switch member 17. The mechanism of Fig. 3 is shown in its normal position and, therefore, due to the weight of the handset upon the cradle switching member 17, the lever arm 22 is depressed against the tension of the spring 24 and the opposite end of the arm 27 engages the inner edge of the extension 81 of lever 80 and forces it outward against the tension of the coil spring 84. A stop 82 formed in the lever 80 is in its normal position disengaged from the teeth of the gear wheel 62.

A three-arm lever 85 is pivoted at 89 to the mounting plate 50 and one of the arms 86 is urged against the pin 91 of the plate 59 by another arm 88 through the medium of the coil spring 90. The tension normally stored in the coil spring 58 encircling the main dial shaft 56 overcomes that which is stored in spring 90 and, therefore, the pin 91 moves the arm 86 a short distance which is determined by the stop 62′ of the finger stop 57 engaged by a projection of the plate 59. The third arm 87 of the lever 85 is shaped in the form of a trigger so that when the pin 91 moves away from arm 86, and the lever 85 has imparted to it a rotary motion under the influence of coil spring 90, the trigger arm 87 will engage the underside of the projection 81 of lever 80, and thereby prevent the stop 82 from coming into engagement with the teeth of the gear wheel 62, until such time as the pin 91 of plate 59 again engages the leg 86 and rotates the three-arm lever 85 to the normal position shown in Fig. 3.

The parts of the invention having been described in detail as to their construction, the manner in which the various parts cooperate to produce the results desired, will now be pointed out by referring more particularly to Figs. 3, 4, and 5. In the normal position of the telephone the handset on the cradle member is resting between the posts 8 and 8 and consequently the switching member 17 is depressed and this in turn bears down upon the rod 19 to move the arm 22 of the lever in a downward direction about its pivot 23 against the tension of spring 24. This moves the opposite end of the lever 27 into engagement with the extension 81 to hold the lever 80 in the position shown in Fig. 3. At the same time with the calling device or station selector in its normal position the plate 59 under control of the coil spring 58 has one edge of it bearing against the stop 62′. The pin 91 in the plate 59 likewise bears against the arm 86 of the three-arm member 85 and slightly turns the member 85 against the tension of the coil spring 90 which is attached to arm 88. This is the normal position of the telephone. In this position it will be seen that should the telephone user either intentionally or accidentally rotate the finger plate 55 without first removing the handset from the cradle member no connection with another telephone station will be established because upon the rotation of the finger plate 55 the plate 59 will move the stop pin 91 away from the arm 86. This moves the trigger arm 87 to a position below the extension 81 and prevents the downward movement of the lever 80 around its pivot 83 under the influence of the spring 84. The stop 82 on lever 80 therefore cannot enter between the teeth on the gear wheel 62 and lock the wiper 68 upon a particular station contact. It therefore follows that as soon as the subscriber releases the dial plate 55 it automatically restores until the plate 59 encounters the stop 62 on the finger stop plate 67.

When a person at the telephone desires to establish a connection with another telephone in the intercommunicating system he removes the handset from the cradle member 6, thereby permitting the switching member 17 to assume the position shown in Fig. 1. The plunger 19 now moves upward in the sleeve 20 by the action of coil spring 24 moving the end of the lever 22 upward about the pivot 23. The arm 27 is thereby moved away from engagement with the extension 81 of lever 80. Lever 80 consequently is permitted to be moved downward by spring 84 about the pivot 83 so that the stop point 82 comes into engagement between two of the teeth on gear wheel 62 in the position shown in Fig. 4. The person making the call then rotates the finger plate 55 from a position opposite the number of the desired subscriber, until he encounters the finger stop 57. The plate 59 follows the finger plate 55 and the pin 91 moves away from engagement with the arm 86 of the member 85. The member 85 is thereby given a slight rotation under the influence of spring 90 attached to arm 88 until the trigger arm 87 strikes against

the right-hand edge of extension piece 81 of the lever 80. At the time the finger plate 55 is rotated to the desired station, the wiper 68 attached to the shaft 56 is likewise rotated until it rests upon one of the station contacts 71 corresponding to the called station. As the gear wheel 62 is now locked from rotation by projection 82 on lever 80 the calling device remains in the position in which it was operated as long as it is desired to remain in telephonic communication with the called telephone.

When the user of the telephone desires to terminate the conversation he replaces the handset on the cradle member 6 and thereby depressing the switching member 17 which in turn moves plunger 19 downward onto the arm 22 against the tension of coil spring 24. This action moves the arm 27 against the extension 81 of lever 80 and moves lever 80 about pivot 83 to the position shown in Fig. 3. The stop 82 is disengaged from the teeth of the gear wheel 62 so that this wheel is free to rotate the finger plate 55 and other apparatus to their normal positions under the influence of the coil spring 58, until the plate 59 encounters the stop 62′. When the gear wheel 62 rotates it operates the worm wheel 63 to rotate the governor 64 so that the return movement of the calling device is retarded, until plate 59 is engaged by the stop 62′ when the return motion is arrested. At the same time that the stop 82 is disengaged from the teeth of gear wheel 62 the member 85 is given a further rotation under the influence of coil spring 90 due to the fact that the extension 81 has been moved to the position shown in Fig. 3. The trigger arm 87 thereby moves under the extension 81 and holds the lever 80 in the position shown in Fig. 5 so as to prevent the stop 82 from engaging the teeth of gear wheel 62 while the return motion of the dial is taking place. This feature, it will be noted, locks the dial or calling device in its releasing position so that any further movement or replacement of the handset upon the switchhook member 17 and the consequent movement of the levers 22 and 27 will have no effect upon the movement of the lever 80 to arrest the return motion of the dial until such time as it has assumed its normal resting position. This occurs as soon as the stop 91 on plate 59 encounters the arm 86 of the member 85 and rotates it in a clockwise direction against the tension of spring 90. This, it will be seen, moves the trigger arm 87 from under engagement with the extension 81 so that the lever 80 may now rotate about its pivot 83 under the influence of spring 84, provided the handset is not on the switchhook member 17. If the handset is upon the switchhook member 17 this rotation of the lever 80 does not take place because extension 81 will be held by the lever 27. After the plate 59 has stopped rotating and encountered the stop 62′ the calling device or station selector is in its normal position as indicated in Fig. 3.

From the foregoing description of the operation of the telephone, which takes place in initiating a call from one station to another in the system it will be appreciated that the procedure is substantially equivalent to making an ordinary call from a substation equipped with an impulse sender for transmitting impulses in a regular automatic telephone system. It is likewise seen that no harm results or no false calls are made due to the operation of the finger-hole plate 55 either accidentally or intentionally as long as the handset is on the cradle member. The station selector merely restores to its normal position after having been operated when this action takes place. Likewise, as soon as the handset is removed from the cradle member the dial is locked in position so that the wiper 68 will remain upon the contact associated with the calling station as long as the call exists. In addition as soon as the handset is replaced on the cradle member and the switchhook operating member 17 is depressed the station selector returns to its normal position, and due to the inter-locking action of the lever 80 and the member 85 this release action of the station selector cannot be arrested by repeatedly operating the switching member 17, either accidentally or intentionally, and the station selector continues to rotate back until it reaches its normal position in which position it is ready to again be operated in establishing another telephone connection. This obviates the necessity of manually restoring the station selector to its normal position which action was an objection in previous known intercommunicating systems.

Referring now more particularly to Fig. 6 this illustrates diagrammatically a schematic circuit arrangement of one station in an intercommunicating telephone system embodying the telephone of the invention. The station selector 50 is shown diagrammatically as is the wiper 68 which is adapted to be placed in position on any one of the station contacts 71 of which there are ten, each connected to a separate conductor leading to its associated telephone. It will be noted from this figure and from Fig. 2 that the wiper 68 normally rests on the home position contact 70, and it will be assumed that this telephone is telephone #1 in the system. Therefore, the first bank contact 1 will be permanently connected by jumper wire 97 with the home position contact 70. Telephone #2 in the system will have its home position contact jumpered by a similar conductor, such as 97, with its associated contact 2. The other stations will be similarly connected with their home position contacts and also the contacts associated with their respective telephones. When the

telephone shown in Fig. 6 receives an incoming call ground is fed over conductor 98, station contact 1, jumper wire 97, home position contact 70, through the low resistance buzzer B, switchhook springs 96 to battery. The impedance coil M is of relatively high resistance and is for the purpose of furnishing talking battery after a connection has been established. The buzzer B, however, receives sufficient current to operate and audibly informs the subscriber at this telephone that a call is waiting to be answered. In responding to the call the subscriber removes the handset from the switching member 17 which, through the medium of the insulating switch 18, permits the switchhook contacts 95 to close and contacts 96 to open. Contacts 96 upon opening terminate the action of the buzzer B while the contacts 95 when closed complete a circuit extending from ground, through transmitter T and receiver R of the handset, contacts 95, normally closed contacts 54 of the ringing push-button 55, wiper 68, home position contact 70, jumper 97, bank contact 1, and out over conductor 98 to the station originating the call. Talking battery for both the calling and the called station is furnished through the impedance coil M at the called station as in Fig. 6.

On an incoming call as has just been described it will be noted that no action is required on the part of the called subscriber, except the act of removing his handset from the cradle member. It is not necessary to rotate the finger plate 55 to the position designated by the calling station, and when the conversation has been completed it is merely necessary to restore the handset upon the switching member 17 to place the telephone circuit in condition for receiving additional calls or to transmit outgoing calls.

When the user of the telephone desires to make an outgoing call he will remove the handset from the cradle member 6, thereby permitting the switching member 17 to operate springs 95 and open the signalling springs 96 to disconnect the buzzer B. The dial plate 55 is then rotated from opposite the number indicating the desired subscriber until the finger stop 57 is encountered. This rotates the wiper 68 onto a contact 71 associated with the desired telephone. The dial plate 55 and the wiper 68 remain in this position as long as the handset is off of the cradle member 17. In order to signal the desired telephone the ringing button 55 is depressed and this closes a circuit extending from ground through normally open springs 54, wiper 68, the bank contact 71 upon which this wiper is now resting, (#2 for example) over conductor 99 to the associated telephone. At this telephone the current passes over a conductor similar to conductor 98, through its associated contact #2, the jumper 97, the home position contacts 70, through its buzzer B, and through the closed switching springs 96 to battery. The operation of the buzzer B at the other telephone notifies the subscriber that he is being called and he removes his receiver, whereupon conversation between the two telephones take place. Talking current in each instance being furnished by a battery through the impedance M at the called telephone.

It will be understood that the construction described is by way of example only, and while it is the preferred form, any number of modifications may be made in the constructional features without departing from the spirit of the invention.

What is claimed is:

1. In a substation telephone set, a switching member, a calling device, means for operating said calling device and locking it under control of said switching member, means for operating said switching member to release said calling device to permit it to restore to normal, and means for preventing said switching member from interfering with the restoring motion of said calling device until it reaches its normal position.

2. In a telephone desk set, a cradle member for supporting a handset and controlled thereby, a calling device in said set controlled by said cradle member, means for operating said calling device to establish a telephone connection, said cradle member locking said calling device in the position in which it is operated, means when the handset is replaced on the cradle member for releasing the calling device to permit it to restore to its normal position, and means in said calling device for preventing the cradle member from exercising its control over said calling device as it rotates to its normal position and until it has reached that position.

3. In a substation telephone, a switch operating member, a calling device in said telephone controlled by said switch operating member, means for rotating said calling device to a position corresponding to a called station and for locking it in that position under control of said switching member, means for operating said switching member to release said calling device to permit it to restore to normal, and means in said calling device for locking it during its releasing position until it has restored to normal.

4. In a station selecting device, a dial, means for operating said dial and rotating it to a position corresponding to a desired station, means for locking said dial in said position, means for releasing said dial to permit it to rotate to its normal position, and means for locking said dial during its releasing movement until it reaches its normal position.

5. In a telephone substation, a station selecting device having a governor, a wiper attached to said station selecting device and

rotatable therewith, a set of contacts accessible to said wiper, each contact corresponding to a particular telephone substation, means for operating and rotating said station selector to position said wiper on a particular contact, means for locking said selector and wiper on said contacts, means for releasing said selector and wiper, means for restoring the selecting device and the wiper to normal position under control of said governor, and means for locking said selecting device during its restoring movement until it has reached its normal position.

6. In an intercommunicating substation telephone set, a station selecting device, a wiper attached to said device and rotatable therewith, a set of contacts accessible to said wiper, each corresponding to a different substation in the system, means for operating said station selecting device to rotate the wiper onto a particular contact corresponding to a desired station, means for locking said station selector and said wiper in said operated position, means for unlocking said station selector, and means for restoring the station selector and the wiper to its normal position and for preventing the locking of said station selector again until it reaches its normal position.

7. In an intercommunicating substation telephone, a station selecting device, a switching member for controlling said device, a wiper attached to said selecting device and rotatable therewith, a plurality of contacts accessible to said wiper each corresponding to a particular station, means for rotating said selector to position the wiper on a particular contact, means for locking said selector under control of said switching member, means operated by said switching member for unlocking said station selector, means for automatically rotating said station selector and the wiper to its normal position, and means for preventing the exercise of the control by said switching member over said dial during its return movement and until it has reached its normal position.

8. In a substation telephone set, a switch operating member, a calling device in said set having a wiper attached to and rotatable therewith, a set of terminals accessible to said wiper each corresponding to a different station, means for operating said calling device to rotate the wiper to a particular one of the terminals, means responsive to the operation of said switching member for locking said calling device in the position in which it is operated, means for restoring said switching member to unlock said calling device, and means for preventing the locking of said calling device by said switching member until it has been restored to its normal position.

9. In a substation calling device, a locking member, a lever interacting with said locking member, means for operating said calling device and said lever, means for operating said locking member to lock the calling device in its operated position, means for restoring said locking member to release said calling device to permit it to rotate back to normal, and means controlled by the operation of said lever for preventing the locking of said calling device by said locking member until it has restored to its normal position.

10. In a substation calling device, a pivoted lever, a locking member interacting with said pivoted lever, means responsive to the operation of said device for operating said locking member to lock said calling device in its operated position, and means for operating said lever to release said locking member from said calling device and for locking the member under control of said lever until the calling device reaches its normal position.

11. In a substation telephone set, a switch operating member controlled by the removal and replacement of the telephone on the set, a calling device for selecting any one of a number of other substations, a locking lever in said calling device controlled by said switching member, means for operating said calling device to select a particular station, means responsive to the removal of the telephone from the switching member for operating said switching member to control said lever to lock the calling device in its operated position, means responsive to the replacement of the telephone on said switching member for operating the switching member to move said lever and unlock the calling device to permit the calling device to be rotated back to its normal position, and a rotating member in said calling device controlled by the operation and the release of the calling device for locking said lever and preventing its engagement with the calling device until the calling device reaches its normal position.

12. In an intercommunicating substation telephone set, a switching member for supporting a handset, a station selector, said station selector being normally rotatable, means for rotating said station selector to a position corresponding to a called station, means responsive to the removal of said handset from said switching member for locking said station selector in the position to which it is rotated, means responsive to the operation of said station selector prior to removal of said handset for rendering said locking means ineffective, and means for returning said station selector to its normal position.

13. In a substation telephone set, a switching member for supporting a hand telephone, a normally rotatable calling device in said telephone set, means for rotating said calling device to a position corresponding to a called telephone station and locking it under control

of said switching member when the telephone is removed therefrom, means responsive to the replacement of the telephone on the switching member for releasing said calling device, means responsive to the operation of said calling device prior to removal of the telephone for rendering said locking means ineffective, and means for returning said calling device to its normal position.

In witness whereof, I hereunto subscribe my name this 23rd day of April, A. D. 1931.

HERBERT F. OBERGFELL.