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J. N. REYNOLDS ET AL

LINE SWITCH

Filed April 1, 1920

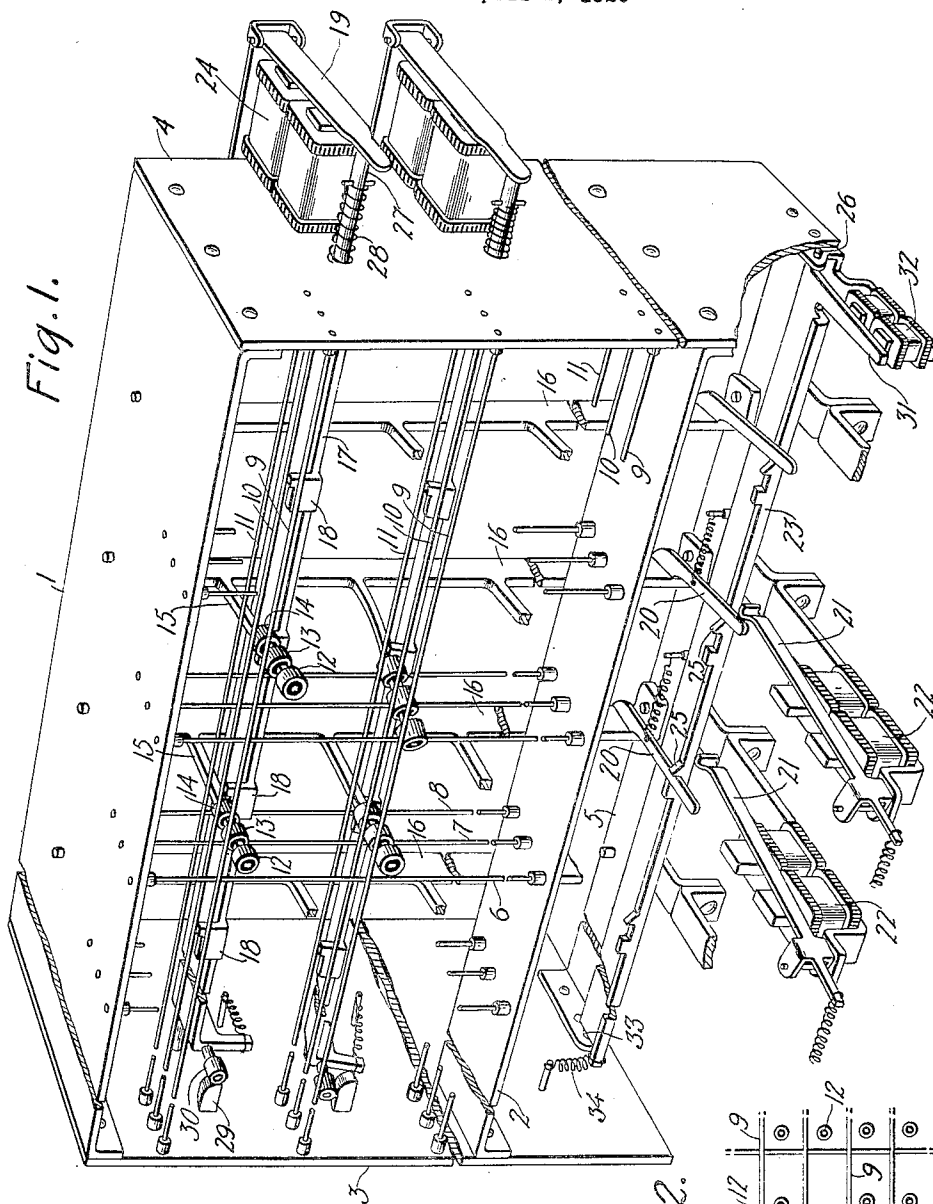
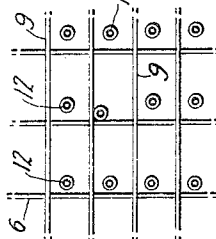


Fig. 2.



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UNITED STATES PATENT OFFICE.

JOHN NEWBERRY REYNOLDS, OF GREENWICH, CONNECTICUT, AND JOHN F. HEARN, OF PASSAIC, NEW JERSEY, ASSIGNORS TO WESTERN ELECTRIC COMPANY, INCORPORATED, OF NEW YORK, N. Y., A CORPORATION OF NEW YORK.

LINE SWITCH.

Application filed April 1, 1920. Serial No. 370,374.

To all whom it may concern:

Be it known that we, JOHN NEWBERRY REYNOLDS and JOHN F. HEARN, citizens of the United States, residing at Greenwich, in the county of Fairfield and State of Connecticut, and at Passaic, in the county of Passaic and State of New Jersey, respectively, have invented certain new and useful Improvements in Line Switches, of which the following is a full, clear, concise, and exact description.

This invention relates to telephone switches and particularly to switches of the cross-bar type. The object of this invention is the provision of a switch of the above character, simple and inexpensive to manufacture, and at the same time dependable in operation.

The principal feature of this invention consists in the provision of a cross-bar switch comprising a wire multiple contact bank.

Another feature of the invention comprises a combination of line and trunk conductors arranged coordinately, that is to say, extending at right angles one to the other, and in close proximity but out of contact with each other, and contacting means at each juncture of the line and trunk conductors so formed, whereby an electrical connection can be established between any pair of line and trunk conductors.

In its preferred form this invention comprises a plurality of sets of line conductors (usually each set consists of three conductors) arranged in a parallel group and a plurality of sets of trunk conductors also arranged in a parallel group and extending at right angles to the line conductors. Each set of line conductors crosses each set of trunk conductors in close proximity to but out of contact therewith. At each point of juncture between the line and trunk conductors there is provided a set of contact sleeves for establishing connections between the line and trunk conductors. These contact sleeves are mounted on but insulated from the flexible arms of a so-called trunk-bar and are normally held in such position that they cannot be engaged to make contact with their respective line and trunk conductors. Upon the preselection of a trunk, the trunk-bar associated therewith is rotated out of its normal position into a

stand-by position where it awaits the next incoming call. The operation of moving a trunk-bar into stand-by position moves the contact sleeves carried by the flexible arms of that trunk-bar toward the trunk conductors but not into contact with them and the flexible arms are so positioned that any one of them may be engaged by a line-bar associated therewith.

With each set of line conductors there is associated a line-bar, and each line-bar is provided with a plurality of lugs, one for each trunk-bar. These lugs are designed to engage, upon operation of the line bar, any of their respectively associated flexible arms which may be in a stand-by position but to pass by, without interfering with, the flexible arms standing in normal position. The line bars are so arranged as to move their lugs upon operation both longitudinally and rotatively and thus to move the flexible arms in such a way as to cause the contact sleeves thereon to be brought into contact with both the trunk and line conductors simultaneously. As soon as one of the flexible arms of a trunk-bar is engaged by a line-bar, the trunk-bar is released and returns to its normal position carrying with it all the flexible arms thereon, except the one engaged. The immediate return of the busy trunk-bars to normal position prevents subsequent subscribers from cutting in on busy trunks. A detailed description of the switch follows:

Referring to the drawing, Fig. 1 is a perspective view of the switch with some parts broken away for the sake of clearness, and Fig. 2 is a diagrammatic illustration showing the relation between line conductors, trunk conductors, and contact sleeves. The electrical circuit with which this line switch would ordinarily be associated is omitted from the drawing and description, as it will be obvious to those familiar with the art. In Fig. 1 there is shown a frame structure in which members 1, 2, 3, 4 and 5 constitute the principal parts to which all the other elements of the switch are shown attached. Sets of trunk conductors, each consisting of small rods or wires 6, 7 and 8, are shown attached to the frame members 1 and 2 and insulated therefrom, and three sets of line conductors, consisting of small rods or wires 9, 10 and 11, are shown at-

tached to frame members 3 and 4 and insulated therefrom. Each set of line conductors will be seen to form a juncture with each and every set of trunk conductors, but they are so arranged that they do not make contact therewith. Associated with each set of trunk conductors is a trunk-bar 16, which is pivotally attached to the frame members 1 and 5. Each trunk-bar is provided with a number of flexible arms 15, one for each set of line conductors. These flexible arms may be attached to the trunk-bars or may form an integral part thereof. Mounted on each flexible arm 15, but insulated therefrom, are shown three annular contact sleeves 12, 13 and 14.

Associated with each set of line conductors is a line-bar 17, pivotally mounted in the frame members 3 and 4 and so arranged that it may be moved longitudinally and rotatively. One end of each line-bar is provided with an elongated fulcrum pin 27, which projects through an aperture in the frame member 4, and a spring member 28 engages the elongated fulcrum pin 27 so as to normally force the line-bar 17 into its extreme right-hand position. The armature 19 of the electromagnet 24 is arranged to force the line-bar out of its normal position longitudinally towards the left side of the switch upon energization of its electromagnet 24. Each line-bar is provided at its left-hand end with a cam roller 30, designed to engage the cam 29 and thereby cause the line-bar to rotate about its pivots. Each line-bar is provided with a plurality of lugs 18, one for each trunk-bar. These lugs are so designed and positioned that, upon the longitudinal and rotative movement of their respective line-bars, they will engage any of the flexible arms with which they are respectively associated, which may happen to be in a stand-by position, but the lugs will pass by without interfering with any of the flexible arms which are standing in normal position.

Each trunk-bar 16 is provided at its lower end with an arm 20 arranged to be engaged by an armature 21 of an individual electromagnet 22. Upon preselection of an idle trunk, the electromagnet 22 is energized, whereupon it draws up its armature 21, which engages the arm 20, forcing the latter to the left side of its associated lug 25 on the latch plate 23. The latch plate is pivoted at 26 and 33 and is retained in its normal position by the spring 34. Upon the movement of any one of the arms 20 into a stand-by position, the latch plate is forced down against the tension of its spring 34 by virtue of the arm 20 bearing against the angular surface of its associated lug 25. Immediately following the seizure of a preselected trunk by a subscriber's line, the electromagnet 32 is momentarily ener-

gized and attracts the arm 31, which forms a part of the latch plate 23, pulling the latter downwardly, thereby releasing the trunk-bar associated with the trunk just seized.

In Fig. 1 the second trunk-bar from the left of the switch is shown in a stand-by position, its associated set of trunk-conductors having been preselected, for the next connection to be established. Any one of the flexible arms 15 of this trunk-bar may be engaged by a lug 18 of one of the line-bars 17 associated therewith.

The trunk-bar, shown in the third position from the left of the switch, is busy, the second flexible arm from the top being engaged by its associated lug 18. It will be seen that this trunk-bar has been released from its stand-by position and that all the flexible arms, except the one engaged, have returned to their normal positions, thereby preventing another calling subscriber from being connected with the busy trunk associated with that trunk-bar. It will be understood by those skilled in the art that a master switch for selecting idle trunks would be provided for use with this line switch.

In the diagram, Fig. 2, the vertical trunk-conductors to the left of the view have been preselected and their associated trunk-bar is in stand-by position, the contact sleeves being in close proximity to their trunk-conductors. The trunk shown in the middle position is busy and the contact sleeves in the second position from the top are seen to be in contact with their respective line and trunk-conductors. The trunk-bar associated with the trunk to the right of the view is in normal position and the contact sleeves at that position are seen to be considerably farther away from their associated trunk-conductors than are the contact sleeves associated with the trunk-conductors to the left of the view which are in stand-by position.

Throughout the duration of every call one of the electromagnets 24 remains energized, retaining its line-bar in operated position and as soon as the call is finished and the connected subscribers hang up their receivers the electromagnet 24 is deenergized releasing its line-bar allowing it to return to normal position.

What is claimed is:

1. In an automatic telephone switch, sets of line conductors and sets of trunk conductors arranged coordinately but out of contact one with the other, a trunk-bar associated with each set of trunk-conductors and having a plurality of flexible arms, one for each set of line conductors and on each flexible arm a set of contacting media each associated with one of the crossing points of said line and trunk conductors, means for moving said trunk-bar from normal po-

sition to stand-by position, and means operable upon the initiation of incoming calls for engaging said flexible arms individually and moving them so as to move said contacting media into contact with their respective line conductors and trunk conductors.

2. In an automatic telephone switch, sets of line conductors and sets of trunk conductors arranged coordinately but out of contact one with the other, a trunk-bar for each set of trunk conductors, said trunk bars being mounted to be rotatable about an axis parallel with said trunk conductors, a plurality of flexible arms attached to and projecting at right angles from each of said trunk-bars, a set of contact sleeves insulatively mounted on each of said flexible arms, each set of contact sleeves being situated in propinquity to one of the crossing points of said line and trunk conductors but normally out of contact with said line and trunk conductors, means operable upon the preselection of an idle trunk to rotate the trunk-bar associated therewith from normal to stand-by position, a line-bar for each set of line conductors, said line-bars mounted parallel with said line conductors and movable longitudinally and rotatively about an axis parallel with said line conductors, each line bar being common to one flexible arm of each trunk bar and provided with means whereby it will engage upon operation any one of its associated flexible arms which may be in stand-by position and move said engaged flexible arm into a position where its contact sleeves will make contact with their respective line and trunk conductors, but will not engage any of the flexible arms in normal position, means for moving said line bars longitudinally and rotatively upon the initiation of calls on their respectively associated lines, means for retaining a preselected trunk bar in its stand-by position until said trunk bar is engaged by a line bar, and means for releasing said trunk bar from its stand-by position subsequent to the engagement of said trunk bar by an operated line bar.

3. In an automatic telephone switch, two groups each comprising a plurality of sets

of parallel wire conductors, the sets of the two groups being arranged coordinately and out of contact one with the other, a set of active contacts situated in propinquity to each crossing point of said sets of conductors and means for moving said active contacts into engagement with their respectively associated sets of conductors, jointly, to establish electrical connections therebetween.

4. In an automatic telephone switch, multiple bare wire contacts arranged in intersecting relation to each other and normally out of engagement, and movable means at each point of cooperation and separate from said multiple wires for effecting connections between said multiple wires.

5. In an automatic switching mechanism, a plurality of sets of stationary conductors arranged in intersecting horizontal and vertical planes, each vertical conductor passing adjacent to and out of contact with a horizontal conductor, a plurality of sets of connectors, each set of said connectors being in propinquity to each point of intersection between said sets of conductors and separate from said conductors, and means operable to move said sets of connectors to effect electrical connections between said sets of conductors.

6. In a switching mechanism, a plurality of sets of stationary conductors, a plurality of rows of movable contact members disposed in approximately coordinate relation to said sets of stationary conductors, a plurality of other sets of stationary conductors arranged coordinately to the first mentioned sets of stationary conductors and said rows of movable contact members, and a plurality of operating bars arranged to cooperate in pairs to effect engagement of the said row of movable contact members with the first mentioned and second mentioned sets of stationary conductors.

In witness whereof we hereunto subscribe our names this 30th day of March, A. D., 1920.

JOHN NEWBERRY REYNOLDS.
JOHN F. HEARN.