July 14, 1936. J. N. REYNOLDS 2,047,383

SWITCHING MECHANISM

Filed Oct. 19, 1935 3 Sheets-Sheet 1

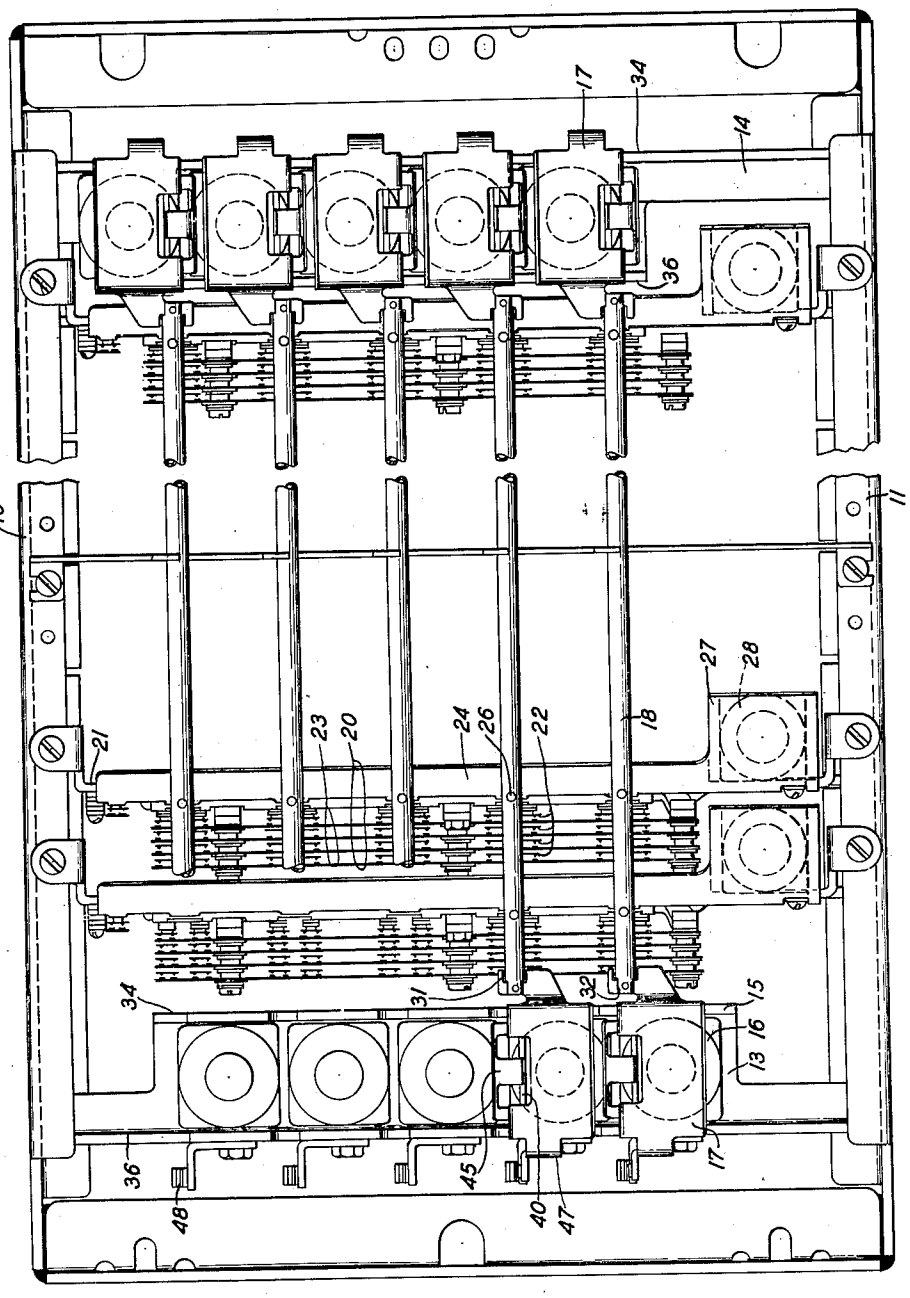

FIG. 1

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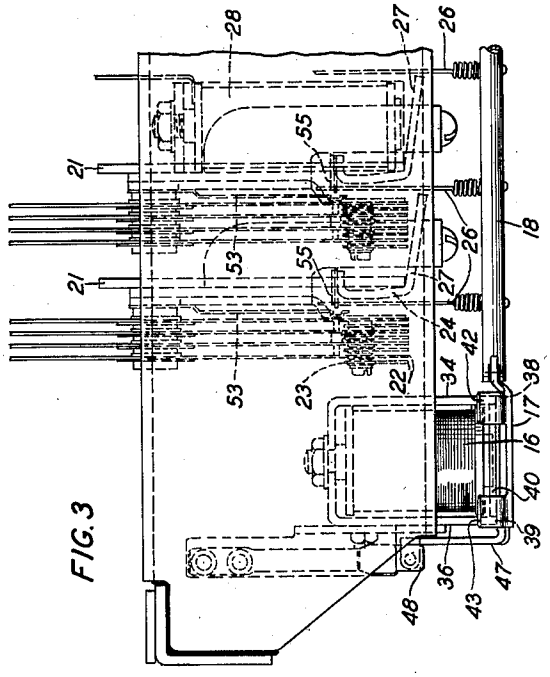

FIG. 3

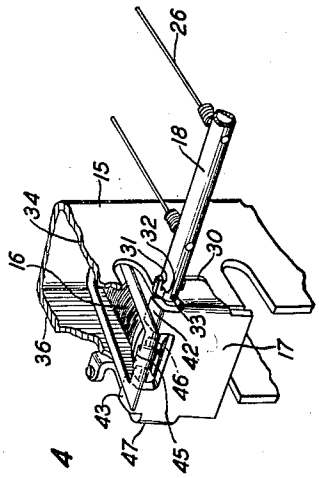

FIG. 4

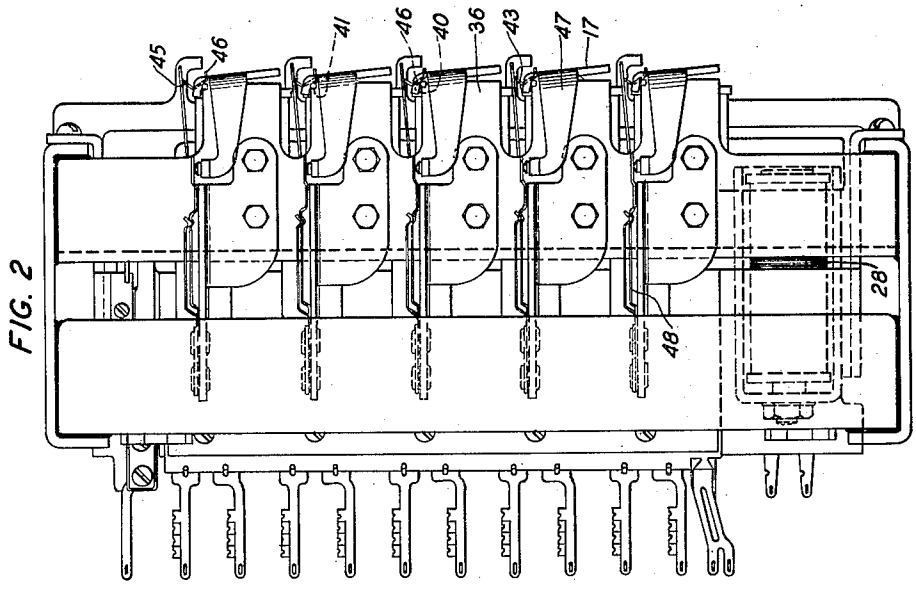

FIG. 2

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SWITCHING MECHANISM

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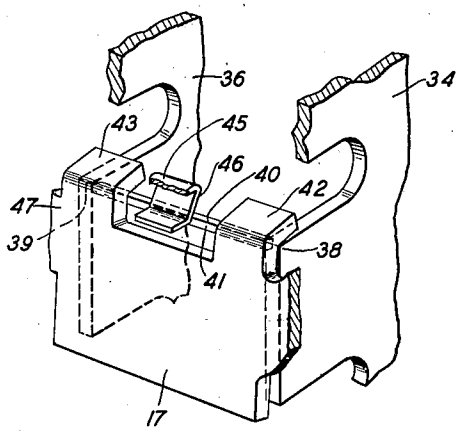
FIG. 5



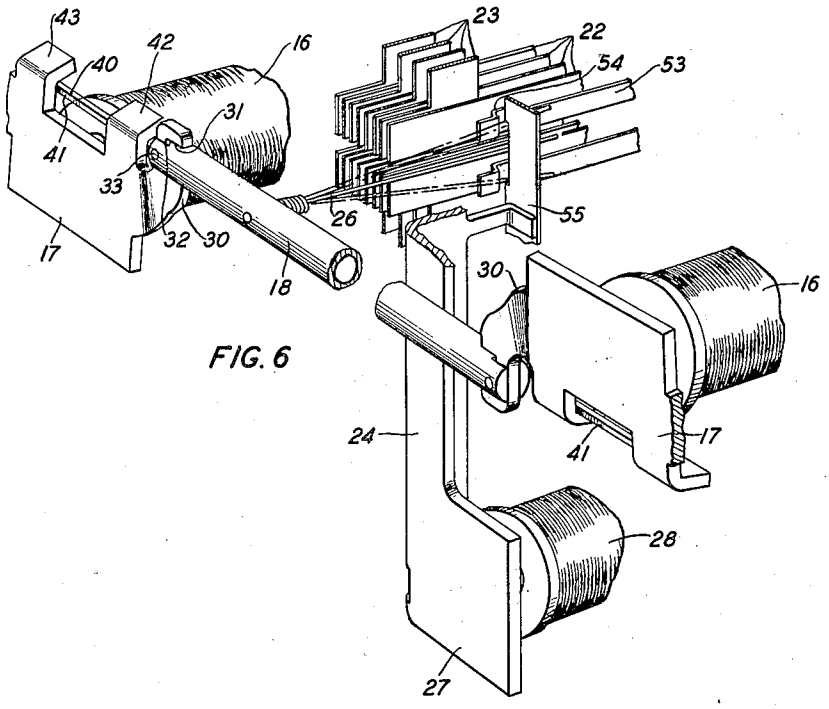


FIG. 6

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UNITED STATES PATENT OFFICE

2,047,383

SWITCHING MECHANISM

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Application October 19, 1935, Serial No. 45,732

8 Claims. (Cl. 179—27.54)

This invention relates to improvements in switching mechanisms and particularly to switches of the cross-bar type for use in establishing connections in telephone systems.

It is an object of this invention to provide an improved and simplified switch structure of this type of reduced manufacturing and installation costs and of more dependable operation.

Cross-bar switches are well known in the art and consist essentially of a number of sets of contact-making strips arranged in horizontal rows and corresponding sets arranged in vertical rows, with one set of each kind adjacent intersecting points of said rows and means including one group of operating members intersecting another group of such members controlled by magnets. In switches of this type, the number of intersecting members or bars of one group, for example, the horizontally located bars, may be half that of the intersecting members or bars of the other group or vertically located bars. In such switches, the rotation of a bar of the smaller group may be in either of two directions to control the selection of one or another horizontal row of contact sets for operation by a single movement of a bar in the larger group.

It is in connection with this latter type of switches that the present invention has been disclosed although it should be understood that the improvements forming the subject-matter of the present invention are applicable to other type of cross-bar switches without departing from the spirit of the invention.

It is a feature of the present invention to locate one armature of each of the horizontal bars and its associated magnet at each end of the horizontal bar so that the operation of one magnet will act on the associated armature to rotate the horizontal bar in one direction and the operation of the other magnet will act on its associated armature to rotate the horizontal bar in the opposite direction. This arrangement of the armatures enables the placing of the operating magnets for these bars so that the odd-number magnets may be placed at one end of the switch structure and the even-number magnets placed at the opposite end of the switch in numerical order, thus simplifying the wiring of the various electrical connections for the switch.

It is another feature to join each armature to its associated horizontal bar by means of a universal coupling. This enables the use of horizontally extending knife edge mountings for each armature on the associated magnet structure and the magnet structures for each bar need not be mounted with such great precision on the frame as to bring the knife edges on the opposite magnet structures in perfect alignment.

This invention has been illustrated in the accompanying drawings in which;

Fig. 1 shows a front view of a cross-bar switch;

Fig. 2 is a left-hand side view of the switch shown in Fig. 1.

Fig. 3 is a partial top view of the switch shown in Fig. 1;

Fig. 4 is a fragmentary perspective view of a horizontal bar, an armature and a magnet structure;

Fig. 5 is a fragmentary perspective view showing how an armature is suspended on the pole-piece of the magnet structure; and

Fig. 6 is a perspective view of a portion of the operating mechanism.

A switch of the kind to which the present invention is applicable is disclosed and described in detail in applicant's copending application, Serial No. 702,453, filed December 15, 1933, matured into Patent No. 2,021,329, Nov. 19, 1935.

In general the structure comprises a frame including U-shaped upper and lower horizontal members 10 and 11 and vertical side members 13 and 14. Each side member consists of a U-shaped pole-piece 15 in which magnets 16 are inserted and on which the armatures 17 for the horizontal bars 18 are mounted in a manner as will hereinafter be described. The horizontal and vertical frame members may be welded together and between the horizontal frame members are mounted vertical assembly units 20. Each of these units comprises the usual vertical plate 21 secured by means of lugs and screws as shown to the upper and lower horizontal frame members. On the plate 21 is mounted at the rear thereof a series of ten sets of horizontal contact strips 22, insulated from each other and from the plate 21. At the front portion of plate 21 is secured a group of vertical contact strips 23 suitably insulated from each other and from the plate 21. The horizontal strips are flexible and may be operated upon by the operation of the vertical bars 24 and the horizontal bars 18 and the usual selecting fingers 26 to cause connections at the cross-point of the two operated bars in a manner as will be described hereinafter. For a full and detailed description of cross-bar switches of this type, reference may be had to the above-mentioned copending application.

In accordance with the present invention, each horizontal bar may consist of a round central tubular portion to which an armature 17 is attached at each end by means of a universal joint. Referring specifically to Fig. 4, this joint may comprise a lug 30 on the armature 17 having a slot 31 in which the bar 18 may move freely in a vertical direction, while bar 18 has a slot 32 in which the lug 30 may move freely in a horizontal direction. The bar is secured to the lug by means of a pin 33 that is riveted to the bar and moves freely in a hole in the lug. The clearances in the slots and the hole in the lug 30 are such as to permit the armature to be mounted for rotation slightly out of alignment with the bar and yet cause the bar to be rotated by the armature without undue lag. It should be understood that this universal joint between the armature 17 and bar 18 may be of any other well-known type without departing from the spirit of the invention. The armature 17 on the left-hand side locking at Fig. 1 will rotate the bar in the counter-clockwise direction to raise the fingers 26 and the armature 17 on the right-hand end of the bar 18 will rotate the bar in a clockwise direction to lower the fingers 26, for the selection of connections above or below the bar 18.

The suspension of the armature 17 on the U-shaped pole-piece 15 will now be described. If reference is made particularly to Figs. 4 and 5, it is clearly shown that the armature is suspended on the side members 34 and 36 of the pole-piece 15. It will be noted that there will be practically no friction at the point where the armature is hinged on these members due to the fact that the knife edges 38 and 39 on the side members 34 and 36, respectively, are in line with the edge 40 of a bar 41 having a square cross-section and secured to the armature 17 in the inner right angle pockets formed by the lugs 42 and 43 bent up from the armature. The length of this bar 41 is such that it fits between the inner surfaces of the side members 34 and 36 without permitting any sideways motion of the armature 17. The armature 17 may therefore swing on the knife edges 38 and 39 engaging the same pockets in which the bar 41 is located. The armature is held against these edges by the spring 45 anchored between the coil 16 and the inner surface of the bottom portion of the pole-piece 15, and resting on the edge 40 of bar 41 with its curved end portion 46. The armature 17 is, therefore, suspended with the minimum of frictional contact. The armatures 17 are also provided with angular extensions 47 that engage snubbing springs 48 to hold the rod 18 in the neutral position.

The operation of the switch mechanism is best described in connection with Fig. 6 which shows a portion of a horizontal bar 18 with an armature 17 at each end arranged to operate the bar from the neutral position in opposite directions under control of the magnet coils 16. A portion of a vertical bar 24 has been shown with portions of the corresponding vertical set of contact strips 23 and two sets of horizontal contact strips 22 in two adjacent rows. A connection, for example, with the upper set of horizontal strips and the vertical strips may be established by first operating the horizontal bar 18 in a counter-clockwise direction by the energizing of the left-hand magnet 16. This will place the selecting finger 26 in a position in front of the special spring 53 associated with the upper set of horizontal strips and across the U-shaped portion 54 thereof. When the vertical bar 24 is rotated in the counter-clockwise direction by the energization of the vertical magnet 28 operating on the armature 27, it causes the member 55 connected to the bar 24 to press the selecting finger 26 against the spring 53. This spring in turn causes the upper set of horizontal strips 22 to make contact respectively with the corresponding vertical strips 23. The movement of the horizontal strips may be accomplished in any well-known manner with, for example, insulating studs such as are shown in the above-mentioned copending application. The vertical bar when operated will maintain the selecting finger in its engaged position, but the horizontal bar may be returned to normal position. The return of the horizontal bar will restore the remaining selecting fingers of the bar to a neutral position, and this bar may now be used to initiate connections at other points. If the horizontal bar had been moved in the opposite direction, the lower row of horizontal contact strips would have been selected for connection with the vertical strips in the same manner.

While this invention has been illustrated in connection with but a single form of switch, it should be understood that the various features thereof could readily be applied to other types of switch structures without departing from the spirit thereof and that the present disclosure should only be considered as illustrative of one embodiment of the invention.

What is claimed is:

1. In a cross-bar switch, horizontal and vertical intersecting bars, sets of contact-making strips at each intersecting point of said bars, independent means at opposite ends of each horizontal bar for rotating it in opposite directions, means for rotating each vertical bar, and means responsive to the rotation of a horizontal and a vertical bar for actuating sets of contact-making strips at the intersecting point.

2. In a cross-bar switch, horizontal bars, an armature at each end of the horizontal bars extending at right angles from the bar in opposite directions, a magnet for each armature for operating on the armature to rotate the bar in opposite directions, vertical bars intersecting said horizontal bars, means for rotating said vertical bars, sets of contact-making strips at each intersecting point of said horizontal and vertical bars, and means responsive to the rotation of a horizontal bar and a vertical bar for actuating sets of contact-making strips at the intersecting point.

3. In a cross-bar switch structure, horizontal and vertical intersecting contact-making strips, horizontal and vertical intersecting operating bars, an armature at each end of each horizontal bar, magnet for each armature for operating on the armature to rotate the bar in opposite directions, magnets for rotating the vertical bars in one direction only, and means responsive to the rotation of a horizontal bar in either direction and the rotation of a vertical bar for establishing connections between horizontal and vertical contact-making strips at the intersecting point of said rotated bars above or below the horizontal bar depending on the direction of rotation of said horizontal bar.

4. In a cross-bar switch, horizontal bars, an armature at each end of a bar and extending at right angles to the bar in opposite directions, a magnet for each armature for operating on the armature to rotate the bar in opposite directions, vertical bars intersecting said horizontal bars, means for rotating said vertical bars in one direc-

tion only, two sets of contact-making strips at each intersecting point of said bars, means responsive to the rotation of a horizontal bar in one direction and the rotation of a vertical bar for actuating one set of contact-making strips at the intersecting point of said bars, and means responsive to the rotation of a horizontal bar in the opposite direction and the rortation of a vertical bar for actuating the other set of contact-making strips at the intersecting point.

5. In a cross-bar switch, horizontal and vertical intersecting operating bars, an armature at each end of each horizontal bar, a flexible coupling between each armature and its bar, a magnet for each armature for operating on said armature to rotate the bar in opposite directions, magnets for rotating the vertical bars, sets of contact-making strips at each intersecting point of said bars, and means responsive to the rotation of a horizontal bar and a vertical bar for actuating sets of contact-making strips at the intersecting point.

6. In a cross-bar switch, horizontal and vertical intersecting contact-making strips, horizontal and vertical intersecting operating bars, an armature at each end of each horizontal bar, a universal coupling between the end of each horizontal bar and the associated armature, a magnet for each armature so placed that the operation of the magnet on the armature at one end of a horizontal bar rotates the bar in one direction and the operation of the magnet on the armature at the other end of the bar rotates the bar in the opposite direction, magnets for rotating the vertical bars, and means responsive to the rotation of a horizontal bar in either direction and the rotation of a vertical bar for establishing a connection between horizontal and vertical contact strips at the intersecting point of said rotated bars above or below the horizontal bar depending on the direction of the rotation of said bar.

7. In a cross-bar switch, horizontal bars, an armature at each end of said bars, a magnet structure for each armature, including a magnet and a support therefor, knife edge mounting means for each armature on its magnet support, said armatures and magnet structures being so located that the operation of one magnet for a bar causes a bar to rotate in one direction and the operation of the other magnet causes a bar to rotate in the opposite direction, vertical bars intersecting the horizontal bars, means for rotating the vertical bars, sets of contact-making strips at each intersecting point at said bars, and means responsive to the rotation of a horizontal bar and a vertical bar for actuating sets of contact-making strips at the intersecting point.

8. In a cross-bar switch, horizontal bars, an armature at each end of said bars, a magnet structure for each armature, including a magnet and a support therefor, knife edge mounting means for each armature on its magnet support, said armatures and magnet structures being so located that the operation of one magnet for a bar causes the associated bar to rotate in one direction and the operation of the other magnet causes the associated bar to rotate in the opposite direction, vertical bars intersecting the horizontal bars, means for rotating the vertical bars in one direction only, sets of contact-making strips at each intersecting point at said bars, and means responsive to the rotation of a horizontal bar and a vertical bar for actuating sets of contact-making strips at the intersecting point, a universal coupling means between each armature and its associated bar.

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