May 12, 1936. J. N. REYNOLDS 2,040,334

CROSS BAR SWITCH

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FIG. 1

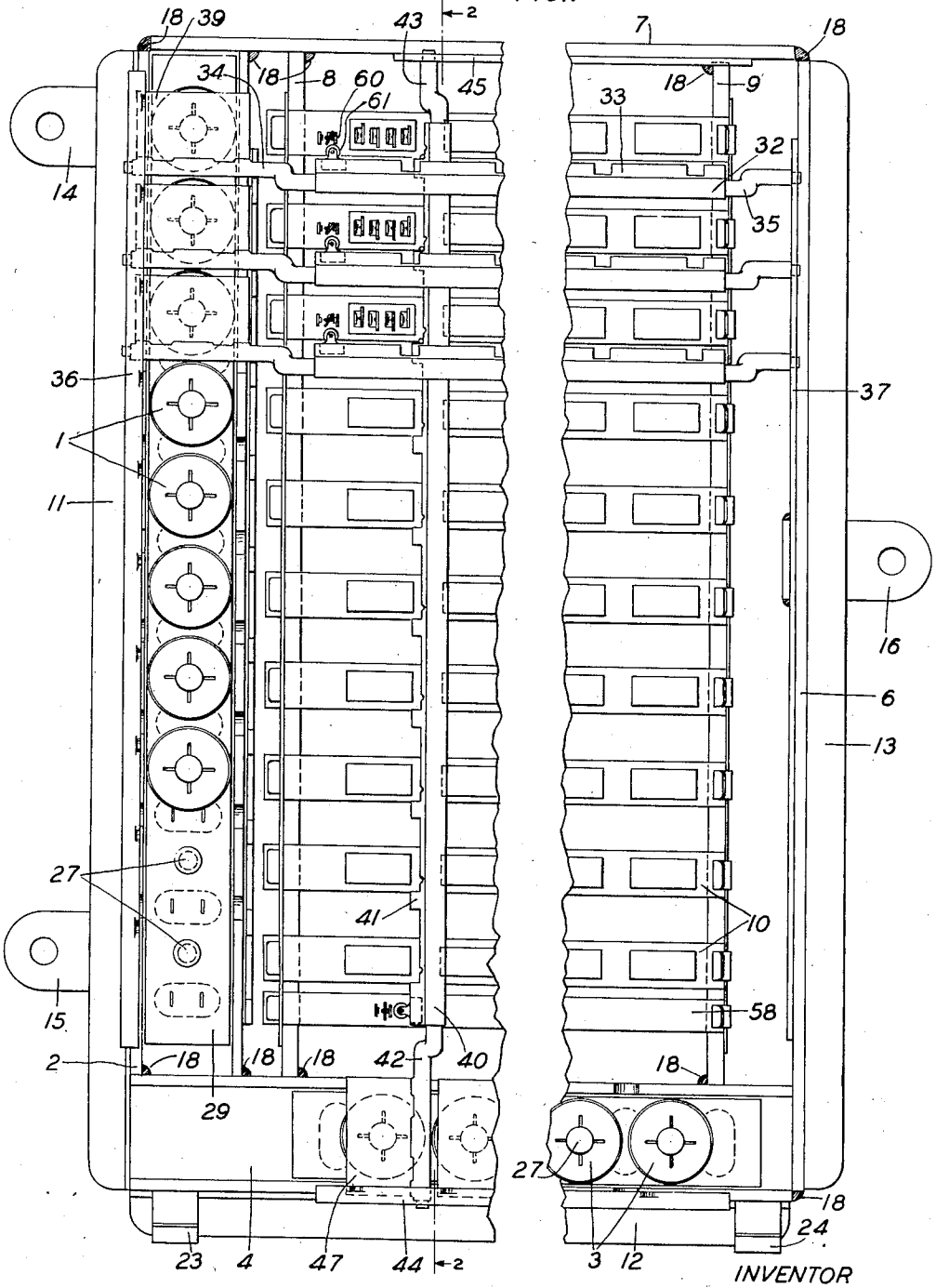

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FIG. 2

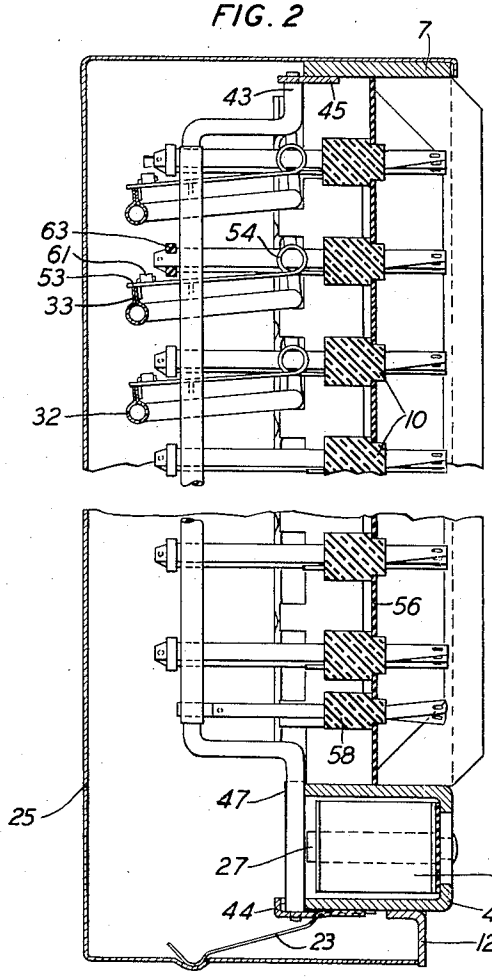

FIG. 3

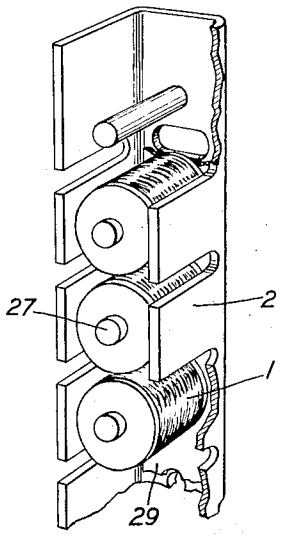

FIG. 5

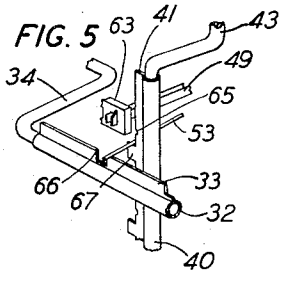

FIG. 4

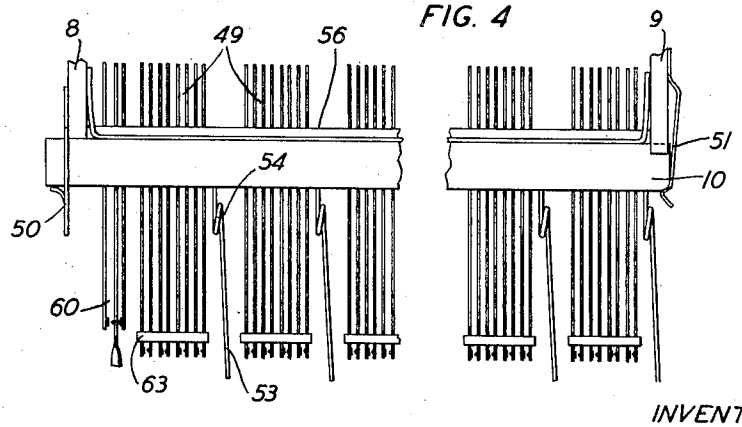

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FIG. 7

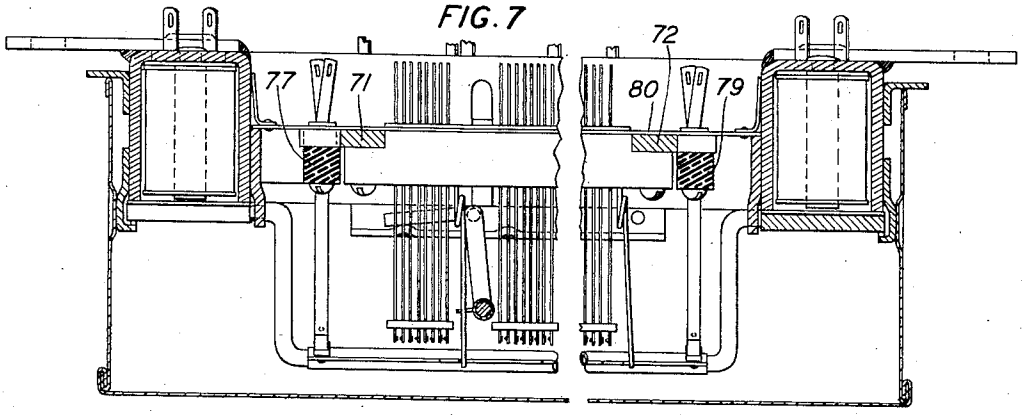
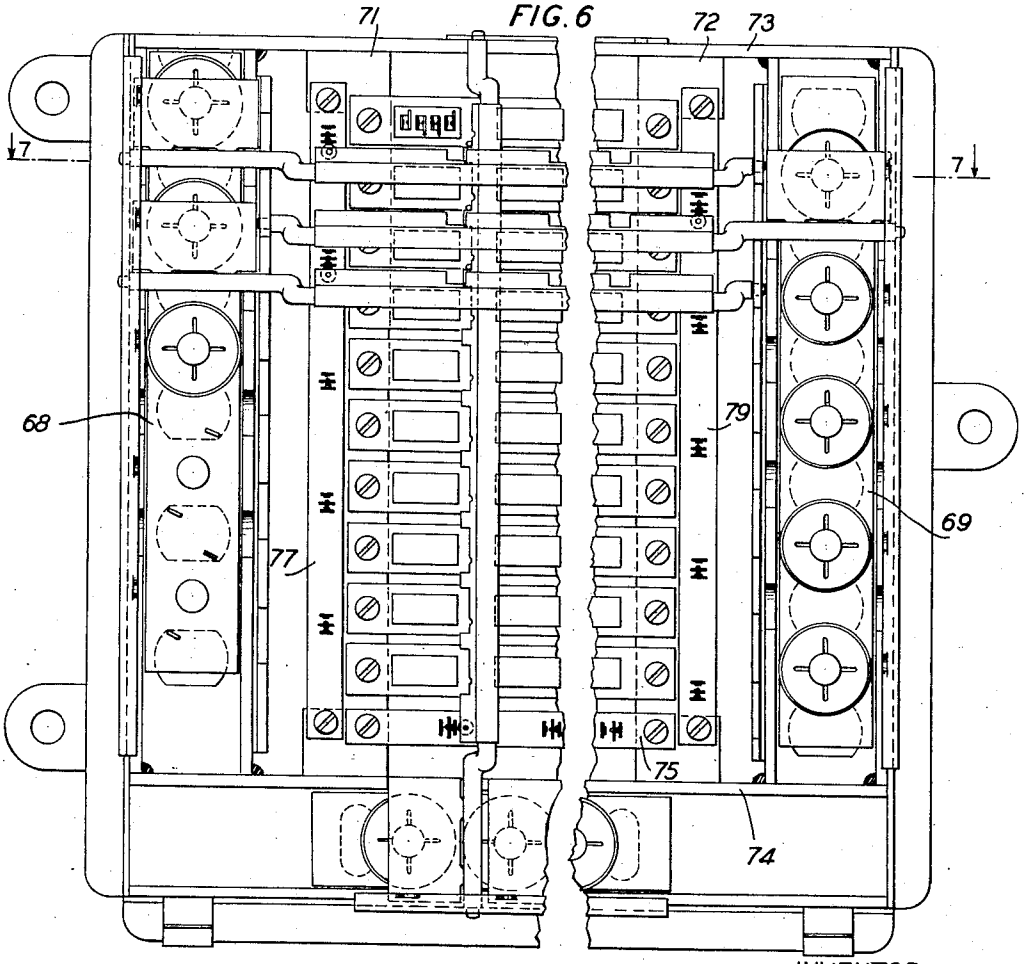


FIG. 6



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UNITED STATES PATENT OFFICE

2,040,334

CROSS BAR SWITCH

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Application November 4, 1932, Serial No. 641,214

8 Claims. (Cl. 179—27.54)

This invention relates to improvements in telephone switch mechanism of the cross-bar switch type.

The object of this invention is to simplify switches of this kind by constructing the component parts in easily assembled units to reduce construction and maintenance costs.

Cross-bar switches of the type to which this invention is applicable may embody the general principles disclosed in my Patent 1,139,722 of May 18, 1915. In such switches sets of intersecting bars are employed, one set for each outgoing line and one set for each incoming line, together with contact sets located adjacent the intersections of the bars, with means whereby the displacement of two intersecting bars causes electrical connections to be established between an incoming and an outgoing line through the contacts of a set located at the crossing point of said two operated bars.

A feature of this invention is a frame comprising magnet structures, each including a row of operating magnets and a common pole piece, and metal strips welded together. A preferred form of construction of the frames may be an arrangement where two magnet structures provide respectively a vertical and a horizontal side of the frame and two metal strips provide the two other sides of the frame. An alternate form may be a frame in which two opposite or vertical sides are formed respectively of a vertical magnet structure and in which one horizontal side is formed by a horizontal magnet structure and the other horizontal side is formed by a metal strip.

Other features of this invention relate to construction details of a switch of this kind such as detachable operating bars and contact strips and their construction and arrangements for mounting them.

Referring to the drawings Fig. 1 shows a front view of a cross-bar switch embodying the features of this invention with but a few intersecting operating bars shown for the sake of clearness;

Fig. 2 is a cross-section taken on the line 2—2 of Fig. 1 with but one vertical and three horizontal intersecting operating bars shown for the sake of clearness;

Fig. 3 is a fragmentary perspective of a relay unit of operating magnets in their common pole piece;

Fig. 4 is a top view of one of the detachable contact strips;

Fig. 5 is a fragmentary perspective of a horizontal and a vertical intersecting operating bar and a portion of a set of springs and intercepting finger to show the manner in which these bars cooperate to establish circuit connections;

Fig. 6 is a front view of a modified form of a cross-bar switch embodying features of this invention with the vertical operating magnets in their common pole piece structures arranged to form the left and right sides of the frame structure; and

Fig. 7 is a cross-section taken on the line 7—7 of Fig. 6 showing a contact strip, a vertical and a horizontal intersecting operating bar and the associated operating mechanism.

Referring now to Fig. 1 the frame structure for the switch consists of a row of vertical operating magnets 1 in their common pole piece structure 2, a corresponding row of horizontal operating magnets 3 in their common pole piece structure 4, and corresponding vertical and horizontal frame members 6 and 7. This frame also consists of two vertical plates or partitions 8 and 9 on which the contact strips such as 10 are mounted. To the pole pieces for the horizontal and vertical operating magnets and the right hand frame member 6 are secured angle iron strips 11, 12 and 13, respectively, to serve as back rest for a dust-proof cover shown in Fig. 2. To the pole piece 2 and frame member 6 are also secured lugs 14, 15 and 16 for mounting the cross-bar switch to the usual mounting rack or frame in an exchange. To the pole piece 4 are secured springs 23 and 24 for the securing of the dust-proof cover 25 over the switch structure.

This cross-bar switch frame structure may be manufactured by cutting the pole pieces 2 and 4, the frame members 7 and 6, and partitions 8 and 9 to dimensions within ordinary commercial limits and slightly shorter than the desired measurements of the frame. These members are then placed in a suitable jig fixture and welded together, for example, by the arc welding method. The jig fixture will thereby locate the various parts of the frame within very close limits without having the frame members cut to very exact dimensions. The welding may be done at such places as are marked with the numeral 18.

The vertical and horizontal magnet structures 1, 2 and 3, 4 may be of the general construction as shown in my Patent 1,958,640 of May 15, 1934. In general, the magnet structure comprises a U-shaped common pole piece in which cores 27 are welded to the central portion. Over these cores are slipped form wound windings such as 1 and 3 which may be held in place by suitable washers. On the inside of these central portions of the common pole pieces are placed

insulation strips **29** through which the terminals of the windings may be extended through suitable slots in the central portion of the pole pieces to the back of the frame structure.

The horizontal operating bars may comprise a tubing **32** having projections **33** at right angles and at the ends of this tubing S-shaped rods **34** and **35** are mounted in bearing plates **36** and **37** secured respectively to the common pole piece **2** and the frame member **6** by welding. To the S-shaped member **35** is welded the armature **39** in position over the corresponding operating magnet. The vertical operating bars are constructed in the same manner as the horizontal operating bars each comprising a tubing **40** with projections **41** and the S-shaped members **42** and **43** rotatably mounted on the bearing plates **44** and **45** welded respectively to the frame member **7** and the common pole piece **4**. To the vertical operating bar is welded the armature **47** in position to be attracted by the corresponding operating magnet.

The contact strips **10** comprise molded bars of insulation material in which are molded the groups of contact springs **49**. These contact strips are mounted between the vertical plates **8** and **9** and secured in front of and to these plates by means of springs **50** and **51**. In each contact strip and associated with each group of contact springs there is an obstruction finger **53** molded into the contact strip. These fingers **53** may be formed in a loop **54** near the point at which they are secured to make them more flexible in any direction. Behind the contact strips is mounted an insulation plate **56** to cover the entire back of the switch structure between the plates **8** and **9**. These plates are provided with apertures through which lugs in the contact strips and the operating springs project for making the necessary connections. At the bottom of the regular contact strips is mounted a special contact strip **58** in which contacts are placed in position to be operated, one set by each vertical bar and similarly in each of the regular contact strips is located a special series of contacts **60** to be operated by a roller **61** on each corresponding horizontal bar. These contacts may be called off-normal contacts and may be used for various circuit connections to be made each time a vertical and a horizontal bar is operated. Each set of operating springs is provided with an insulation plate **63** to which every other spring of a group may be attached, so that when this plate is moved the contact springs connected to it will all be moved in unison to make electrical connection with the associated free spring projecting through apertures in the plates.

The operation of this cross-bar switch may be explained as follows, referring specially to Fig. 5. The operation of a set of contacts is established by the operation of a vertical bar and a horizontal bar. The obstruction finger **53** rests in the corner formed by lug **67** on projection **41** and the horizontal bar is operated first to place this obstruction finger **53** between the projection **41** in front of a notch **65** thereon and the plate **63**. Then the vertical bar is operated to move the obstruction finger horizontally to force the plate **63** towards the left thus causing electrical contacts to be established between the springs controlled by plate **63**. The vertical bars are now held in this operated position to maintain the obstruction finger in the notch **65** and to maintain the electrical connection between the associated spring contacts and the horizontal bar is released. If the same horizontal bar is operated again to make another connection at a closing point between this bar and another vertical bar, the obstruction finger **53** held by the vertical operating bar will not be touched or affected as the projection **33** on the horizontal bar is provided with a notch **66** which is so placed as to permit the horizontal bar to be operated without disturbing the obstruction finger **53** when engaged by the vertical bar. When the connection is to be released the vertical bar operated will return to normal position and thus permit the obstruction finger to be returned to rest on a lug **67** against projection **41**. The tension on the obstruction finger **53** is such that it will always return to this position.

The modified form of the cross-bar switch shown in Figs. 6 and 7 is identical in construction to that shown in Figs. 1 to 5 except that the vertical operating magnets are divided in two groups, the operating magnet for every other horizontal operating bar being placed on opposite sides in two separate magnet structures **68** and **69**. For example, the first, third, fifth, etc. horizontal operating bars are controlled by the magnet in the unit **68**, while the second, fourth, sixth, etc. are controlled by magnets in the unit **69**. In these constructions of a cross-bar switch the magnet structure **69** takes the place of the frame member **6** of the cross-bar switch shown in Figs. 1 and 5. In this modified form the arrangement of the contact strips is also somewhat different in that they are secured by means of screws to vertically placed partitions **71** and **72** which are secured by welding to the upper frame member **73** and the horizontal operating magnet structure **74**. The strip **75** for the off-normal contacts controlled by the vertical bars is secured in the same manner as the other contact strips while the off-normal contact strip **77** for the odd numbered horizontal operating bars is secured at the top and bottom of the vertical partition **71** and the off-normal contact strip **79** for the even numbered horizontal operating bars is secured at the top and bottom to the partition **72**. Behind the contact strips is placed an insulation plate **80** having apertures through which the contacts may project for connection.

It should be noted as shown in Figs. 1 to 5 that the operating bars may be removed individually from the switch structure by slightly bending them and removing them from their bearings in the bearing plates **36**, **37**, **44**, **45**, and as hereinbefore noted the contact strips may also be removed from their mountings between springs **50** and **51**. In the modified form shown in Figs. 6 and 7, the operating bars may be similarly removed and the contact strips removed by removing the mounting screws for these strips.

What is claimed is:

1. In a telephone switch, a frame, the sides of which comprise vertical and horizontal magnet structures and metal strips with their adjacent ends welded together and with their lengths slightly less than the outside dimensions of the frame and in which each magnet structure includes a row of operating magnets and a common pole piece, and switching means controlled by said operating magnets.

2. In a telephone switch, a frame comprising vertical and horizontal magnet structures and metal strips welded together to form the sides of the frame, each magnet structure including a row of operating magnets and a common pole piece, horizontal and vertical bars mounted in said

frame in position to be moved by corresponding magnets, groups of contacts, means operative in response to displacement of a horizontal and a vertical bar for establishing electrical connections between contacts in a group near the crossing point of the actuated bars.

3. In a telephone switch, a frame comprising vertical and horizontal magnet structures and metal strips welded together to form the sides of the frame, each magnet structure including a row of operating magnets and a common pole piece, horizontal and vertical rocking bars detachably mounted in said frame in position to be moved each by a corresponding operating magnet, groups of contacts, means for detachably mounting said groups in said frame, and means operative in response to the movements of the horizontal and the vertical bars for establishing electrical connections between contacts in a group near the crossing point of the actuated bars.

4. In a telephone switch, a frame comprising vertical and horizontal magnet structures, and metal strips forming the sides of the frame, each magnet structure including a row of operating magnets and a common pole piece, horizontal rocking bars arranged in rows, vertical rocking bars arranged in rows, means for rotatably mounting said bars at their respective ends to the corresponding sides of the frame, an armature welded to each bar to cooperate with the corresponding magnet in the horizontal or vertical row, insulation strips, contact springs arranged in groups in rows partly embedded in said insulation strips, means for securing said insulation strips between the vertical sides of the frame in horizontal layers, means operative in response to the movement of a horizontal bar and a vertical bar for establishing electrical connections between contacts in a group near the crossing point of the actuated bars.

5. In a telephone switch, a frame comprising vertical and horizontal magnet structures and metal strips welded together to form the sides of the frame, each magnet structure including a row of operating magnets and a common pole piece, insulation strips, contact springs partially embedded in said insulation strips and projecting on each side thereof, means for securing said insulation strips between the vertical sides of the frame, an insulation plate on one side of said frame covering said insulation strips and having apertures through which the contact springs project, horizontal and vertical bars mounted in said frame on the other side of said insulation strips in position to be moved each by a corresponding operating magnet, means operative in response to the movement of a horizontal and a vertical bar for establishing electrical connections between contacts in a group near the crossing point of the actuated bars.

6. In a telephone switch, a frame comprising vertical and horizontal magnet structures and metal strips welded together to form the sides of the frame, each magnet structure including a row of operating magnets and a common pole piece, groups of contacts, horizontal and vertical bars in said frame mounted in position to be moved by said operating magnet, bronze mounting bearings for said bars connected to said frame, means operative in response to the movement of a horizontal and a vertical bar for establishing electrical connections between contacts in a group near the crossing point of the actuated bars.

7. In a telephone switch, a frame comprising vertical and horizontal magnet structures and metal strips welded together to form the sides of the frame, each magnet structure including a channel shaped pole piece, a row of magnetic iron cores connected to the central portion of said pole piece and an energizing winding mounted on each core to form a corresponding independent operating magnet, two intermediate vertical metal partitions mounted in parallel relation between the vertical sides of the frame and welded at their ends to the horizontal sides of the frame, insulation strips, contact springs arranged in groups in rows and partly embedded in the insulation strips, means for detachably mounting said insulation strips in horizontal layers between and to said intermediate strips, horizontal rocking bars each comprising a central tubular portion and a solid bent end portion welded thereto, vertical rocking bars each comprising a central tubular portion and a solid bent end portion welded thereto, phosphor bronze strips secured to the vertical and horizontal sides of said frame having bearing apertures therein for the mounting of the rocking bars in vertical and horizontal rows respectively, an armature welded to one solid end portion of each bar in a position to be acted upon by a corresponding energizing winding of said magnet structures to operate the associated bar, means operative in response to the movement of a horizontal and a vertical bar for establishing electrical connections between contacts in a group near the crossing point of said actuated bars.

8. In a telephone switch, a frame comprising a vertical and a horizontal magnet structure and two metal strips welded together to form the sides of the frame, each magnet structure including a row of operating magnets and a common pole piece, insulation strips, contact springs arranged in rows in groups partly embedded in said insulation strips, means for securing said insulation strips between the vertical sides of the frame in horizontal layers, two transfer contact insulation strips having the contact springs arranged in a row in groups partly embedded therein, means for securing said transfer contact insulation strips between the horizontal side of said frame in vertical position with one strip at the left and the other at the right of the first mentioned strips, a third transfer contact insulation strip having the contact springs arranged in a row in groups partly embedded therein, means for securing said third transfer contact strip between the vertical sides of the frame in a horizontal position below the first mentioned insulation strips, horizontal and vertical bars in said frame mounted in position to be moved by said operating magnets, means operating in response to movements of a horizontal and a vertical bar for establishing electrical connections between contacts in one of the first mentioned insulation strips in a group near the crossing point of the actuated bars and for establishing electrical connections between contacts in a group of contacts in one of the two vertical transfer contact strips and corresponding to the horizontal bar moved and between contacts in a group in the third transfer contact strip and corresponding to the vertical bar moved.

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