

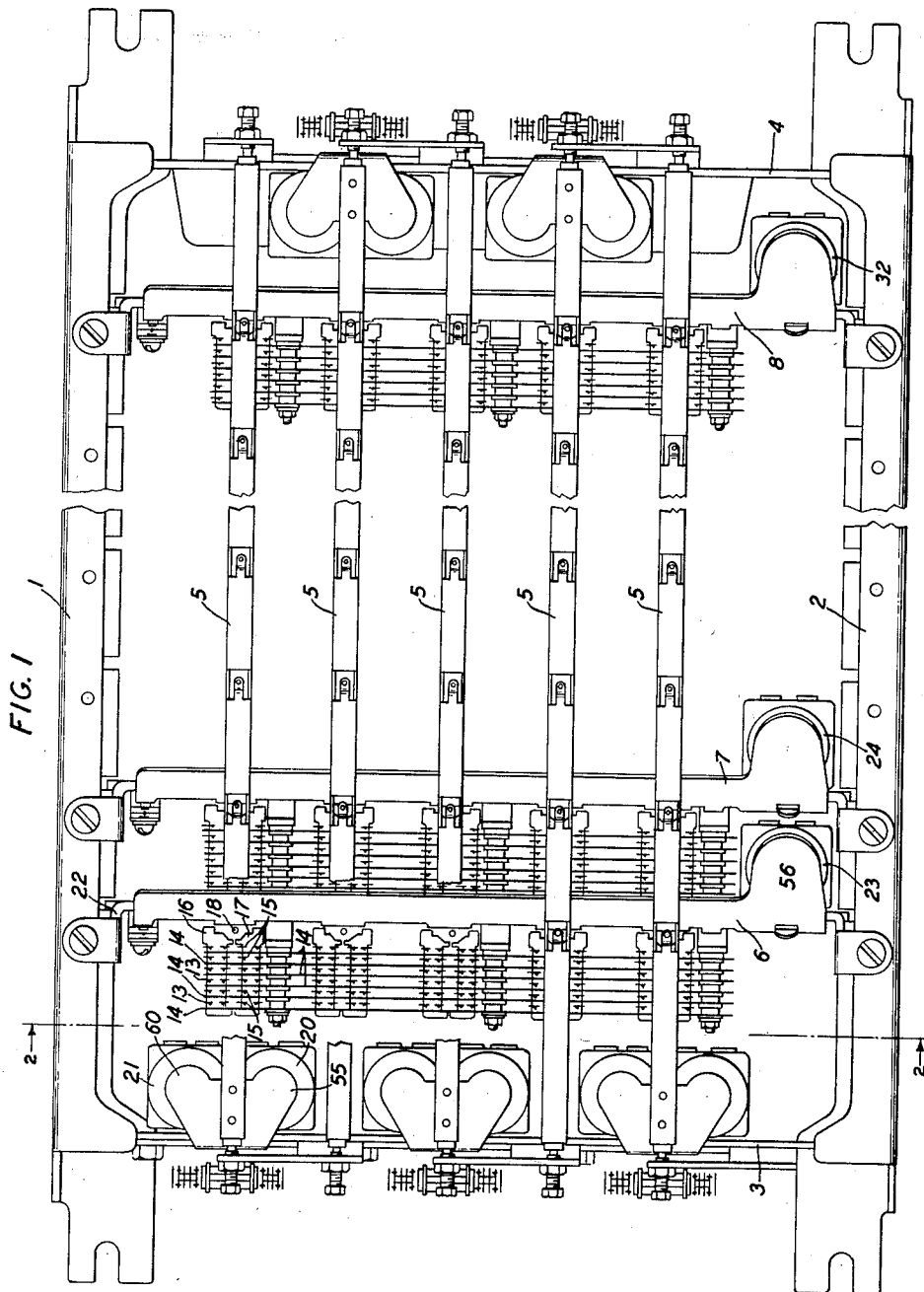
Jan. 16, 1940.

S. J. STOCKFLETH  
SWITCHING MECHANISM

2,187,577

Filed Feb. 21, 1939

2 Sheets-Sheet 1



INVENTOR  
S. J. STOCKFLETH  
BY *W. McKenney*  
ATTORNEY

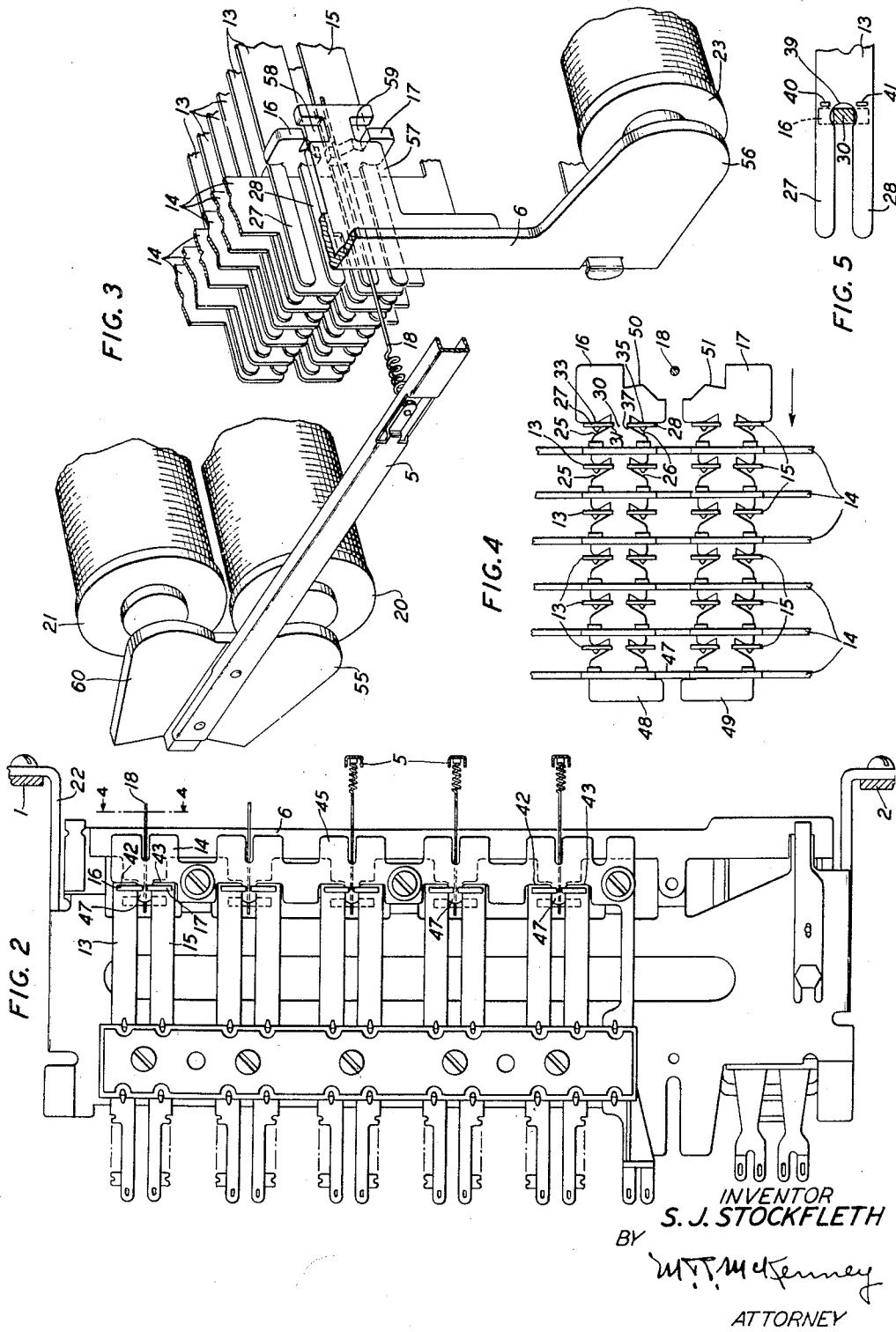
Jan. 16, 1940.

S. J. STOCKFLETH  
SWITCHING MECHANISM

2,187,577

Filed Feb. 21, 1939

2 Sheets-Sheet 2



## UNITED STATES PATENT OFFICE

2,187,577

## SWITCHING MECHANISM

Sigurd J. Stockfleth, Brooklyn, N. Y., assignor to  
Bell Telephone Laboratories, Incorporated,  
New York, N. Y., a corporation of New York

Application February 21, 1939, Serial No. 257,684

5 Claims. (Cl. 179—27.54)

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

It is an object of this invention to improve and simplify switches of this kind to cause them to perform their functions with greater accuracy and reliability.

Cross-bar switches to which the present invention may be applied are well known in the art and consist essentially of contact sets arranged in horizontal and vertical rows and means including a group of horizontal operating members intersecting a group of vertical operating members controlled by magnets. In some type of switches the horizontal operating members are rotatable in two directions so that connections may be established at either of two sets of contacts at an intersecting point by the rotation of a horizontal bar in one direction or the other and the rotation of a vertical bar in one direction.

The present invention has been disclosed in connection with a cross-bar switch of this latter type and particularly with a switch of the type disclosed in the patent to J. N. Reynolds 2,021,329 of November 19, 1935. In this switch the rotation of a horizontal bar causes a selecting finger to be placed opposite an actuating spring to select a set of contacts. When a vertical bar is operated, it causes this finger to be pressed against the actuating spring which in turn causes a connection to be established between the contact sets at the corresponding cross-connecting point. The actuating springs operate on insulation studs placed between one set of springs to be actuated to close connections with the corresponding set of springs at the cross-points.

It is a feature of the present invention to provide improvements whereby these actuating springs and insulation studs are replaced by a specially constructed actuating card for each set of contacts on which the selecting finger may act directly when a vertical bar is operated.

While this feature of the invention may be realized by different embodiments, the one illustrated herein shows a card having slots cut diagonally and symmetrically on both sides of the card and wider than the thickness of the springs and having the springs bifurcated to straddle the portion of the card between opposing slots. The slots in the springs are therefore so cut that each spring will be securely held by the card by engaging the inner upper corner and outer lower corner of opposing slots. The card is prevented from shifting in the slots by being turned at right

angles to the slots in a circular hole at the bottom of the bifurcation, and the card is prevented from turning after being once located by indentations on the springs on one side and by lying flat against the inner surface of the horizontal contacts in the vertical unit on which individual rows of vertical contact springs are mounted.

The invention has been illustrated in the accompanying drawings in which:

Fig. 1 shows a front view of a cross-bar switch structure of the type disclosed in the above-mentioned patent and to which the applicant's invention has been applied.

Fig. 2 shows a side view of one of the vertical units in this cross-bar switch structure.

Fig. 3 shows a fragmentary view in perspective of the contact springs at a cross-point, a vertical bar with its operating magnet and a selecting finger and a portion of a vertical bar and its operating magnet.

Fig. 4 shows an enlarged view taken from the front of a vertical unit disclosing two of the cards in accordance with the applicant's invention and the associated contact springs, with the selecting finger in cross-section and looking in the direction of the arrows 4—4 as indicated on Fig. 2.

Fig. 5 shows a cross-section of a card and a fraction of a contact spring in which the card is inserted.

Referring now to the drawings and particularly to Figs. 1 and 2, the switch structure to which applicant's invention may be applied may consist as disclosed in these figures of a frame comprising the members 1, 2, 3 and 4, five horizontal bars 5 and a series of ten vertical bars, the first, second and last of these latter bars have been shown only as comprising the first, second and last of the ten vertical units. These bars have been indicated with the numerals 6, 7 and 8, respectively. The horizontal and vertical rows of contact strips mounted in these three units have been shown. The first set of horizontal contacts in the first horizontal row have been marked 13 and the first vertical row of contact springs has been marked 14 while the first horizontal contacts of the second horizontal row have been marked 15. The card for establishing connections between the contacts 13 and 14 has been marked 16 and the card for establishing connections between these contacts 14 and 15 has been marked 17. The first or upper horizontal bar 5 may be actuated to rotate the actuating finger such as 18 to select the upper row of horizontal contacts 13 by the operation of the magnet 20 and to select the second row of horizontal contacts 15. This up-

per horizontal bar 5 may be actuated by the magnet 21. The vertical operating bars 6, 7 and 8 may be rotatably guided on the supporting members 22 and be actuated by magnets 23, 24 or 32 to establish connections that will be hereinafter described in detail. The members 22 are secured to the upper and lower horizontal bars 1 and 2 while the horizontal bars are pivotally supported between the frame members 3 and 4. For a complete description of other details of this switch structure reference may be had to the above-mentioned patent.

Referring now to Figs. 3, 4 and 5, it will be noted that the cards 16 and 17 are secured and locked as follows to the contact springs 13 and 15, respectively. Referring specifically to one of these cards for example card 16, it will be noted that this card has a series of slots 25 and 26 cut diagonally and symmetrically on opposite sides thereof. These slots are wider than the thickness of the springs 13 and as the springs 13 are bifurcated from their outer tips to the place where the cord is located, these bifurcated portions, such as 27 and 28 of the first spring of the group 13, straddle the portion 30 of the card between the slots 25 and 26. The slots 25 and 26 are therefore so cut that each spring will be securely held by the card. The portion 27 will therefore engage at its inner left-hand lower edge the inner left-hand corner 31 of slot 25 (looking at Fig. 4) and at its upper right-hand side, the upper right-hand edge 33 of slot 25; while the portion 28 will engage at its left-hand upper edge the inner left-hand corner 37 of slot 26 and its lower right-hand side the lower right-hand edge 35 of the slot 26. The portion 30 fits therefore into the enlarged circular hole 39 at the bottom of the bifurcation as shown in detail in Fig. 5. Card 16 may be held in this position transversely across the springs 13 by the protrusions 40 and 41 raised on the springs 13 against which one side of the card 16 may rest. The opposite side of the card may rest against the flat surface 42 on the vertical contact strips 14. The card 17 rests against the flat surface 43 on this strip 14 as shown in Fig. 4. It should be noted that this outer vertical contact strip 14 is also provided between the portions 42 and 43 with the rearwardly extending portions 47 and that the cards 16 and 17 have projections 48 and 49 that may respectively engage the portion 47 on transversely opposing edges. This holds the springs 13 and 15 in proper fixed relations to the vertical contact strips 14. The cards 16 and 17 at the ends opposite to the projections 48 and 49 have cut-out sections 50 and 51 to permit the contact finger 18 to be placed in these cut-out sections when the cards are to be actuated as will hereinafter be described. The cards 16 may be inserted in the springs 13 by sliding it edgewise between the bifurcations 27 and 28 and then turning it at right angles to the springs in the hole 39 and, when assembling the parts, the outer vertical strip 14 is inserted so that the projection 47 will extend between the cards 16 and 17 and the flat surfaces 42 and 43 will rest against the projections 48 and 49 of the cards 16 and 17. By properly placing the slots 25 and 26 and cutting the projections 48 and 49 in relation to these slots, the springs 13 and 15 may be properly adjusted in relation to the vertical strips 14 when the parts are in normal position.

The operation of the switch structure to which the applicant's invention has been applied may be described in connection with the perspective

view shown in Fig. 3. For example, if the horizontal bar 5 is operated by the magnet 20 acting on the armature 55, the selecting finger 18 will be moved upward to be placed in a position in front of the cut-out section 50 of card 16. If now the vertical bar 6 is operated by the magnet 23 operating on armature 56, the angular projection 57 will be moved towards the cards 16 and 17. This projection 57 is provided with slots 58 and 59 in its upper and lower edges so that normally if the finger 18 is in its central position as shown in Fig. 3, this projection 57 will merely engage the finger 18 to move it towards the springs but will have no effect as far as establishing contacts is concerned. However, if the finger 18 is moved upward as mentioned, it will be moved in the same direction as the projection 57, but as the finger now straddles the upper slot 58, the finger will engage the section 50 of the card 16 and thus cause the card 16 to be moved in the same direction as the projection 57. If reference is made to Fig. 4, the card 16 will be moved in the direction shown by the arrow and thus cause the springs 13 to contact respectively with the horizontal springs 14. The bar 5 may then return to normal while finger 18 is held in engaged position by the projection 57 of bar 6 to maintain the connection established between the contact springs. On the other hand if bar 5 is moved in the opposite direction by the magnet 21 operating on armature 60, this finger will be lowered to be placed in front of the section 51, and when the bar 6 is then rotated, projection 57 will engage the finger and it will be moved against the section 51 and move the card 17 to establish connections between the contacts 15 and 14.

What is claimed is:

1. In combination in a switch of intersecting rows of separately operable contact sets, the contact sets at each intersecting point comprising a group of stationary contact springs and a group of movable contact springs, contact operating cards each individual to a group of movable contact springs and secured thereto to move said movable contact springs to make contact individually with the corresponding associated stationary contact springs, each of said cards being secured to a series of said movable springs by having opposing slots in said cards and by having two prongs on each movable spring engaging opposing slots at right angles to the cards, said opposing slots being wider than the thickness of the spring but cut on a bias so that the prongs will be held securely in said slots, selecting bars having selecting fingers thereon individual to the several contact sets and projecting into proximity with the corresponding card, means for actuating any one of said selecting bars to move the fingers thereof into operative positions with respect to the associated cards, holding bars and means for actuating any one of said holding bars to engage and move a positioned selecting finger and the associated card to close the associated movable contact springs into engagement with the associated stationary contact springs.

2. In combination in a switch of intersecting rows of separately operable contact sets, the contact sets at each intersecting point comprising a group of stationary contact springs and a group of movable contact springs, contact operating cards each individual to a group of movable contact springs and secured thereto to move said movable contact springs to make contact indi-

vidually with the corresponding associated stationary contact spring, each of said cards being secured to a series of said movable springs by having two opposing slots cut on a bias in said cards for each movable spring and wider than the thickness of the spring and having a longitudinal slot cut in each spring slightly wider than the thickness of the card and a circular opening at the bottom of the slot in each spring of a diameter approximately the same as the width of the portion of the card between two opposing slots, said card being inserted through the slot into said circular opening in the spring and turned into the opening at right-angles to the spring, projections on said springs located so as to hold the card in said right-angled position, selecting bars having selecting fingers thereon individual to the several contact sets and projecting into proximity with the corresponding card, means for actuating any one of said selecting bars to move the fingers thereof into operative positions with respect to the associated cards, holding bars and means for actuating any one of said holding bars to engage and move a positioned selecting finger and the associated card to close the associated movable contact springs into engagement with the associated stationary contact springs.

3. In combination in a switch of intersecting rows of separately operable contact sets, the contact sets at each intersecting point comprising a group of stationary contact springs and a group of movable contact springs, contact operating cards each individual to a group of movable contact springs and secured thereto to move said movable contact springs to make contact individually with the corresponding associated stationary contact springs, each of said cards being secured to individual movable springs by having two equal slots wider than the thickness of the movable springs cut in opposing edges of the card for each spring, said slots being cut at equal angles to the longitudinal direction of the card and in a downward direction and by having each movable spring bifurcated with the prongs formed thereby inserted in said slots at right-angles to the card so that each prong rests at its inner edge in the corner of a slot and so that the outer lower edge of the slot rests against the surface of the prong near the outer edge thereof, selecting bars having selecting fingers thereon individual to the several contact sets and projecting into proximity with the corresponding cards, means for actuating any one of said selecting bars to move the fingers thereof into operative positions with respect to the associated cards, holding bars and means for actuating any one of said holding bars to engage and move a positioned selecting finger and the associated card to close the associated movable contact springs into engagement with the associated stationary contact springs.

4. The combination in a switch of intersecting

rows of separately operable contact sets, the contact sets at each intersecting point comprising a group of stationary contact springs and a group of movable contact springs, each movable spring being formed with two prongs at the end thereof, contact operating cards each individual to a group of movable contact springs and secured thereto to move said movable contact springs to make contact individually with the corresponding associated stationary contact springs, each of said cards being associated with a series of said movable springs by having two opposing slots cut in said cards for each associated spring and having the prongs of each associated spring engaging said slots at right angles to the cards, said slots and prongs being so shaped that when a card is turned to this right-angle position the springs and the card lock in fixed cooperative relation to each other, selecting bars having selecting fingers thereon individual to the several contact sets and projecting into proximity with the corresponding card, means for actuating any one of said selecting bars to move the fingers thereof into operative position with respect to the associated cards, holding bars, and means for actuating any one of said holding bars to engage and move a positioned selecting finger and the associated card to close the associated movable contact springs into engagement with the associated stationary contact springs.

5. The combination in a switch of intersecting rows of separately operable contact sets, the contact sets at each intersecting point comprising a group of stationary contact springs and a group of movable contact springs, each movable spring being formed with two prongs at the end thereof, contact operating cards each individual to a group of movable contact springs and secured thereto to move with said movable contact springs to make contact individually with the corresponding associated stationary contact springs, each of said cards being associated with a series of said movable springs to move them by having two opposing slots cut in said card for each associated spring and having the prongs in each associated spring engaging opposing slots at right angles to the cards, said slots and prongs having configurations coacting to hold the card between the prongs in the right-angle position so that the springs and the card move together, selecting bars having selecting fingers thereon individual to the several contact sets and projecting into proximity with the corresponding card, means for actuating any one of said selecting bars to move the fingers thereof into operative position with respect to the associated cards, holding bars, and means for actuating any one of said holding bars to engage and move a positioned selecting finger and the associated card to close the associated movable contact springs into engagement with the associated stationary contact springs.

SIGURD J. STOCKFLETH.