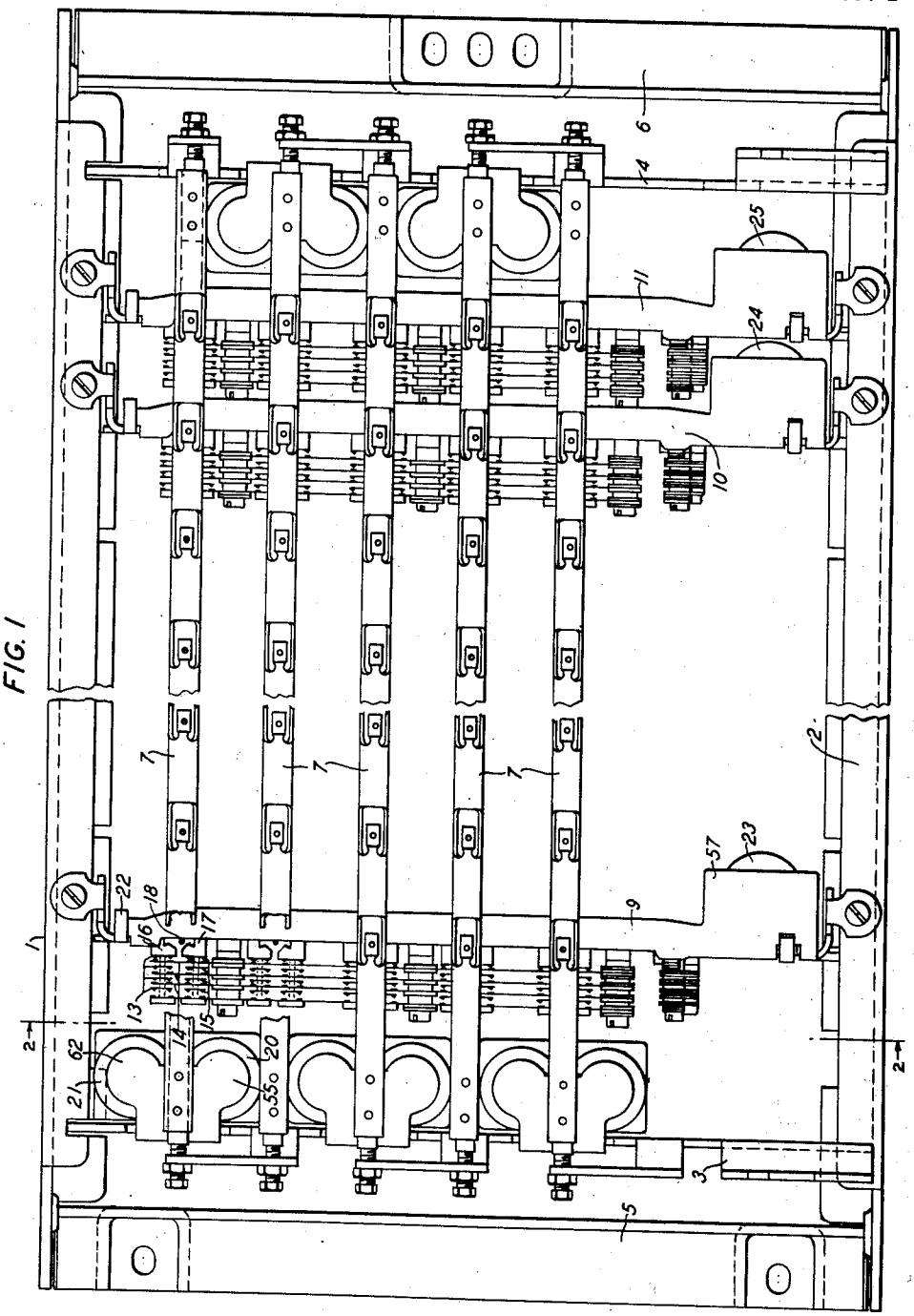
Nov. 10, 1942. S. J. STOCKFLETH 2,301,472

SWITCHING MECHANISM

Filed June 19, 1940 2 Sheets-Sheet 1

FIG. 1



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SWITCHING MECHANISM

Filed June 19, 1940 2 Sheets-Sheet 2

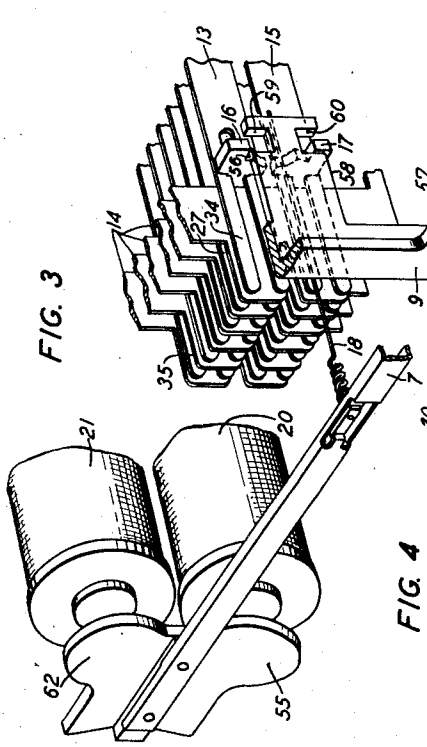


FIG. 3

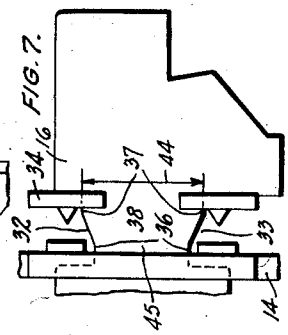


FIG. 7.

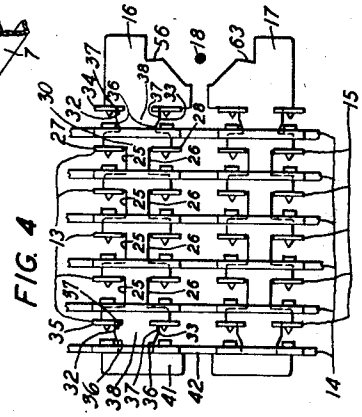


FIG. 4



FIG. 5.

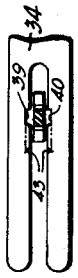


FIG. 6.

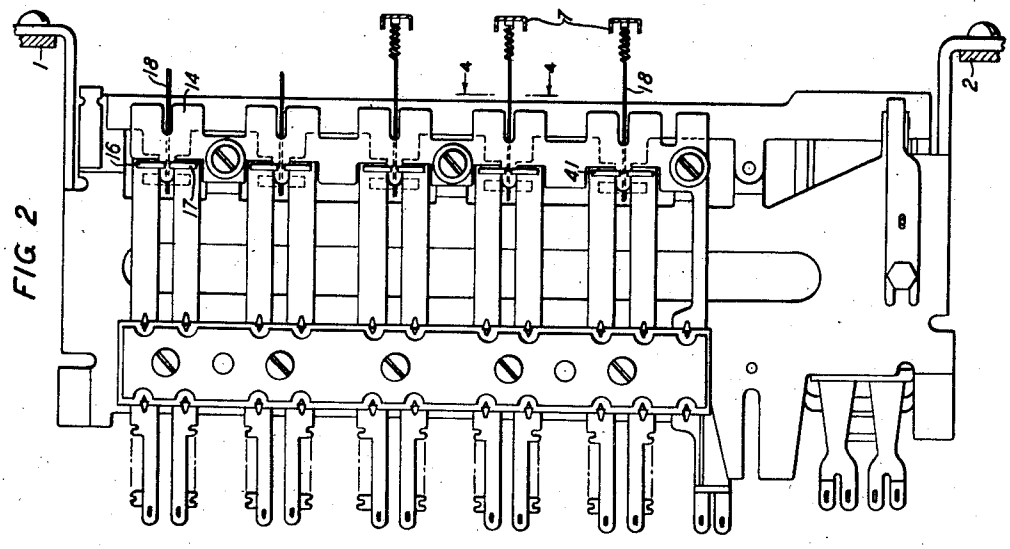


FIG 2

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Patented Nov. 10, 1942 2,301,472

UNITED STATES PATENT OFFICE

2,301,472

SWITCHING MECHANISM

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Application June 19, 1940, Serial No. 341,261

8 Claims. (Cl. 179—27.54)

This invention relates to improvements in switching mechanisms and particularly 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 type 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 types of switches the horizontal operating members are rotated 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 member in one direction or the other and the rotation of a vertical member in one direction. A cross-bar switch of this latter type is disclosed in the patent to J. N. Reynolds 2,021,329 of November 19, 1935.

The present invention has been disclosed in connection with a cross-bar switch of this latter type modified in general in accordance with the cross-bar switch disclosed in my Patent 2,187,577 of January 16, 1940. In the cross-bar switch disclosed in the last-mentioned patent, rotation of a horizontal member causes a selecting finger to be placed opposite an actuating card to select a set of contacts. When a vertical member is operated it causes this finger to be pressed against the card at a corresponding cross-connecting point to actuate said card to establish connections between the contact sets at this point.

It is a feature of the present invention to provide improvements in the cards employed to operate the movable contact springs in the contact sets.

The card illustrated may be locked to operate the movable springs by having portions cut to fit snugly in slots in the lower and upper movable springs after having been turned in the slots in the springs and moved longitudinally in the operative direction and provided with projections so that when the card is turned, it engages one of the stationary contact members in the spring assembly or vertical unit to prevent the card from moving out of the locked position. This card is provided with projections against which the movable springs are individually tensioned to space them in relation to the associated stationary contact elements and for actuation when the card is longitudinally moved in the operative direction.

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

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

Fig. 2 is a cross-section taken on line 2—2 of Fig. 1 and shows a side view of one of a vertical unit;

Fig. 3 shows a fragmentary view in perspective of the contact springs at a cross-point, a horizontal 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 a selecting finger in cross-section and located in 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 and shows the position of the card before it has been turned;

Fig. 6 shows a cross-section of a card and a fraction of a contact spring in which the card is inserted in its final position.

Fig. 7 is another view of one of the cards.

Referring now to the drawings and particularly to Figs. 1 and 2, the switch structure to which the applicant's invention may be applied, consists of a frame comprising the members 1, 2, 3 and 4. This frame is mounted in any suitable manner on vertical upright members 5 and 6. Five horizontal bars 7 and a series of ten vertical bars, the first, ninth and tenth of these latter bars have been shown only as comprising the first, ninth and tenth of the ten vertical units. These bars have been indicated with the numerals 9, 10 and 11, respectively. The horizontal and vertical rows of contact strips mounted in these three units have been shown. The first set of contacts in the first horizontal row has been marked 13 and the first vertical row of contacts has been marked 14, while the first set of contacts of the second horizontal row has 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 the contacts 14 and 15 has been marked 17. The first or upper horizontal bar 7 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, by the operation of the magnet 21. The vertical bars 9, 10 and 11 may be rotatably guided on their supporting members 22 and be actuated by a magnet 23, 24 or 25, respectively, to establish connections that will be hereinafter described in detail. The members 22 are secured to the upper and lower horizontal frame members 1 and 2 while the horizontal bars are pivotally supported between the frame members 3 and 4. For a more complete description of other details of this switch structure, reference may be had to the above-mentioned patents.

Referring now to Figs. 3 to 7, 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 symmetrically in opposite sides thereof. These slots are wider than the thickness of the springs of the second, third, fourth and fifth springs of the group 13 and as these springs are bifurcated from their tips to a suitable point beyond the place where the card is located, these bifurcation members such as 27 and 28 of the second spring of the group 13 straddle the portion 30 of the card between the slots 25 and 26 provided for this spring. Similarly, of course, the third, fourth and fifth springs of the group 13 are also bifurcated to straddle corresponding portions in the slots 25 and 26 corresponding to the portion 30. These springs are tensioned to normally rest on the right-hand edges of these slots 25 and 26 so that when the card is moved toward the left looking at Figs. 4 or 7 these springs will be moved by the cards to make contact with the corresponding stationary contact elements in the group 14. On the other hand, the opposite slots 32 and 33 for the first spring 34 and for the last spring 35 of the group 13 are differently shaped. Near the left-hand edge at the point 36 these slots are deeper than at the point 37 near the right-hand edge of the slots. The width of the intermediate portion 38 is therefore greater at the point 37 than at point 36. The purpose of these slots is to lock the card in fixed position in relation to these two springs 34 and 35. It should be noted that the springs 34 and 35 are, in addition to being bifurcated, also provided with transverse slots or apertures 39 and 40 and the distance 43 between the bottom edges of these two slots is equal to the width of the wide portions 44 of the portions 38 between the points 37 of the card, so that the card will fit snugly between the slots 39 and 40 when the card is inserted in place transversely to the longitudinal direction of the spring. This may be accomplished by first inserting the card between the bifurcated ends of the springs, holding the card with the flat wide side thereof in parallel with the sides of the bifurcated ends, then turning the card at right angles to the sides of the spring with the narrow portions 45 of the intermediate portions 38 between the points 36 extending between these sides of the springs and then shifting the card longitudinally towards the left so that the wide portions 44 of the portions 38 at points 37 will enter the slots 39 and 40. It should be noted that to maintain the card locked in this position, the card is provided at its left-hand end with a projection 41 cut to fit, when the card is turned, across the left-hand surface of the stationary contact element 42 of the group 14. It is readily seen that thus the card is locked securely in springs 34 and 35 and held in this position by the stationary contact element 42 so that the card will be prevented from moving towards the right but is free to move towards the left and when thus moved will cause all of the movable springs 13 to be acted upon or shifted towards the left to contacts respectively with the stationary springs 14. It is, of course, not essential that the card be locked by having the projection 41 engage the stationary contact element 42 but may be so cut that a projection such as 41 engages some other part of the spring assembly. For example, the stationary contact elements may be assembled in an insulation molding that may be suitably provided with edges or seats on which the projections 41 may rest or any other suitable supports may be provided. In regard to the bifurcation of the movable springs it is evident that the bifurcation may extend beyond the point where the card is located for any suitable distance to provide a high flexibility of the individual bifurcation members. Thus in case excessive dust particles should gather between the contact on a bifurcation member and the contact on the corresponding stationary contact element this would not in any way interfere with a proper contacting connection being made between the contacts of the companion bifurcation member and the contact on the associated stationary contact element.

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 7 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 56 of card 16. If now the vertical bar 9 is operated by the magnet 23 operating on the armature 57, the angular projection 58 on the bar 9 will be moved toward the cards 16 and 17. This projection 58 is provided with slots 59 and 60 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 58 will merely engage the finger 18 to move it towards the spring, but will have no effect as far as establishing connections is concerned. However, as the finger 18 is moved upward as mentioned, it will be moved in the same direction as the projection 58, as the finger now straddles the upper slot 59, and the finger will engage the section 56 of card 16 and thus cause the card 16 to be moved in the same direction as the projection 58. Looking at Fig. 4, this direction of the card would be toward the left and thus cause the springs 13 to contact respectively with the stationary contact elements 14. The horizontal bar 7 may then return to normal while finger 18 is held in engaged position by the projection 58 of bar 9, to maintain the connection established between the contacts. On the other hand, if bar 7 is moved in the opposite direction by the magnet 21 operating on the armature 52, this finger 18 will be lowered to be placed in front of the cut-out portion 63 on card 17 and when the bar 9 is then rotated the projection 58 will engage the finger and it will be moved against cut-out section 63 and move the card 17 to establish connections between the contact elements 14 and springs 15.

What is claimed is:

1. In combination, stationary contact elements, movable contact springs to engage individually corresponding stationary contact elements when moved, each movable spring being formed with two parallel prongs, an operating card for said movable springs, an operating mechanism for said card to actuate said movable springs to make contacts individually with corresponding stationary contact elements, a fixed member associated with said stationary contact elements, the card being associated with the movable springs by having opposite slots cut in said card for each movable spring and having the prongs of each movable spring tensioned against corresponding surfaces of the opposite slots at right-angles to the card, and having the slots in the card for certain of said movable springs so cut that when the card is turned to this right-angle position and then moved longitudinally in the operative direction the intermediate portion of the corresponding slots in the card for said movable springs will fit snugly in an aperture in said certain movable springs to lock the card in the right-angle position, and a projection on one end of the card that fits above the fixed member when the card has been turned to the right-angle position so that the card is prevented from movement out of the locked position in said certain movable springs.

2. In combination, stationary contact elements, movable contact springs arranged to engage individually corresponding stationary contact elements when moved, each movable spring being formed with two parallel prongs, an operating card for said movable springs, an operating mechanism for said card to actuate said movable springs to make contact individually with corresponding stationary contact elements, the card being associated with the movable springs by having opposite slots cut in said card for each movable spring and having the prongs of each movable spring tensioned against corresponding surfaces of the opposite slots at right-angles to the card having the slots in the card for certain of said movable springs so cut that when the card is turned to the right-angle position and moved longitudinally in the operative direction the intermediate portion of the corresponding slots in said card for said springs will fit snugly in an aperture in said springs to lock the card in the right-angle position, a projection on one end of the card fitting outside above one of the stationary contact elements when the card has been moved to the right-angle position and moved longitudinally in the operative position so that the card is prevented from moving out of the locked position.

3. 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 elements 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 elements, each of said cards being associated with a series of movable springs by having two opposite slots cut in said cards for each associated spring and having the prongs of each associated spring tensioned against corresponding surfaces of the opposing slots at right-angles to the cards and having the slots for certain of said movable springs so cut that when the card is turned to this right-angle position and then moved longitudinally in the operative direction the intermediate portion at the corresponding slots for said springs will fit snugly in an aperture in said certain springs to lock the card in the right-angle position, a projection at one end of said card that fits outside a stationary contact element when the card has been turned in the right-angle position so that the card is prevented from movement out of the locked position in said certain springs, and means for actuating any one of said cards to close the associated movable contact springs into engagement with the associated stationary contact elements.

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 elements 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 elements, a fixed member associated with each group of movable contact springs and stationary contact elements, each of said cards being associated with a series of movable springs by having two opposite slots cut in said cards for each associated spring and having the prongs of each associated spring tensioned against corresponding surfaces of the opposite slots at right-angles to the card and having the slots for certain of said movable springs in a group so cut that when a card is turned to this right-angle position and then moved longitudinally in the operative direction the intermediate portion at the corresponding slots for said springs will fit snugly in-between slots cut in the opposing prongs at right-angles to the springs to lock the card in the right-angle position, a projection at one end of said cards that fits outside the associated fixed member when the card has been turned to the right-angle position so that the card is prevented from moving out of the locked position in said certain movable springs, means for actuating any one of said cards to close the associated movable contact springs into engagement with the associated stationary contact elements.

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 elements 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 elements, a fixed member associated with each group of movable contact springs and stationary contact elements, each of said cards being associated with a series of movable springs by having two opposing slots cut in said cards for each associated spring and having the prongs of each associated spring tensioned against corresponding surfaces of the opposing slots at right-angles to the card and having the slots for certain of said movable springs so cut that when the card is turned to this right-angle position and then moved longitudinally in the operative direction the intermediate portion at the corresponding slots for said springs will fit snugly in an aperture transversely cut across the two prongs in said certain springs to lock the card

in the right-angle position, a projection at one end of said cards that fits over the associated fixed member when the card has been turned to the right-angle position so that the card is prevented from moving out of the locked position in said certain movable springs, means for actuating any one of said cards to close the associated movable contact springs into engagement with the associated stationary contact elements.

6. In a switching mechanism, a row of stationary contact elements, a row of movable contact springs to engage individually the corresponding stationary contact elements when moved in the operative direction, each movable spring being formed with two prongs at the end thereof, said prongs having opposite apertures therein, an operating card for said movable springs having opposite slots cut therein for each movable spring and having intermediate tapered portions between the slots for the two outer movable springs in the row, the prongs of each movable spring being tensioned against the corresponding surfaces of said opposite slots at right angles to the card, the narrow portion of the taper serving to permit the card to be turned through a right angle into its operative position with respect to said movable springs and the wide portion of the taper serving to register with the said apertures while the tension of the said movable springs is exerted against the card in a longitudinal direction to lock said card against turning movement, and means for operating said card longitudinally to actuate the movable springs into contact individually with the associated stationary contact elements.

7. An operating card for simultaneously moving a plurality of contact springs arranged in pairs in parallel rows, said card in its normal position being provided with a shoulder for each of said springs, the surface of said shoulder being parallel to the surface of its associated contact spring and normal to the longitudinal axis of said card, said longitudinal axis being parallel to the direction of movement of said springs, the intermediate portion of said card for certain pairs of said springs being less than the normal distance between the springs of a pair, the intermediate portion of said card for certain other pairs of said springs being greater than the said normal distance between the springs of a pair, and corresponding slots cut in the springs of said certain other pairs to cooperate with said greater intermediate portions of said card to prevent rotation of said card on its longitudinal axis.

8. An operating card for simultaneously moving a plurality of contact springs arranged in pairs in parallel rows, said card when in its normal position being provided with a shoulder for each of said springs, the surface of said shoulder being parallel to the surface of its associated contact spring and normal to the longitudinal axis of said card, said longitudinal axis being parallel to the direction of movement of said springs, the intermediate portion of said card for certain pairs of said springs being less than the distance between the springs of a pair, the intermediate portion of said card for certain other pairs of said springs being tapered in part less than the normal distance between the springs of a pair and increasing in the direction of the longitudinal axis of the card to a part greater than the normal distance between the springs of a pair, and corresponding slots cut in the springs to cooperate with the greater intermediate portions of said card whereby said card may be inserted between said parallel rows of contact springs, moved to its said normal position and locked against rotation on its longitudinal axis.

SIGURD J. STOCKFLETH.