

June 14, 1938.

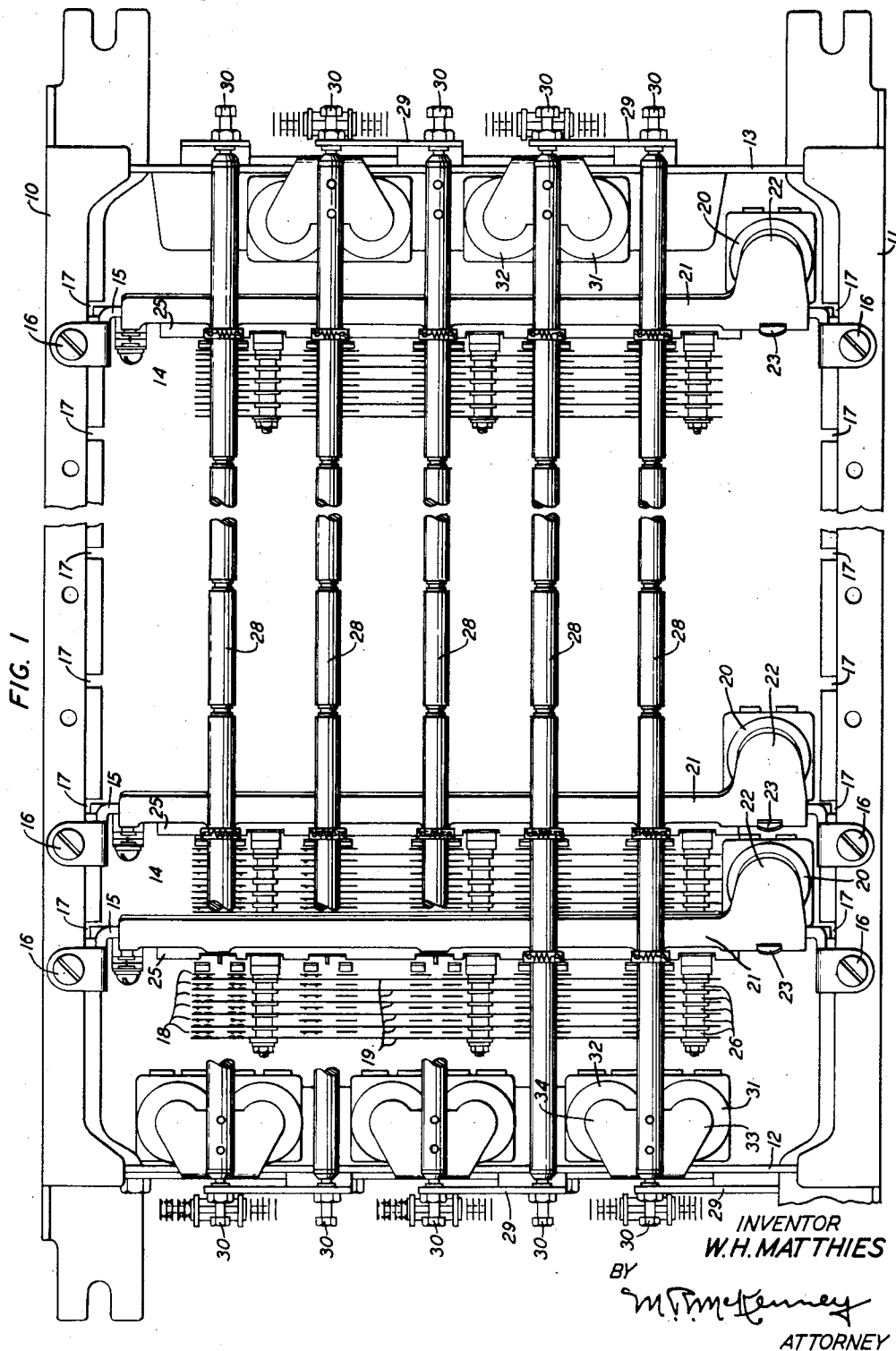
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2,120,413

SELECTIVE SWITCH

Filed Aug. 18, 1936

2 Sheets-Sheet 1



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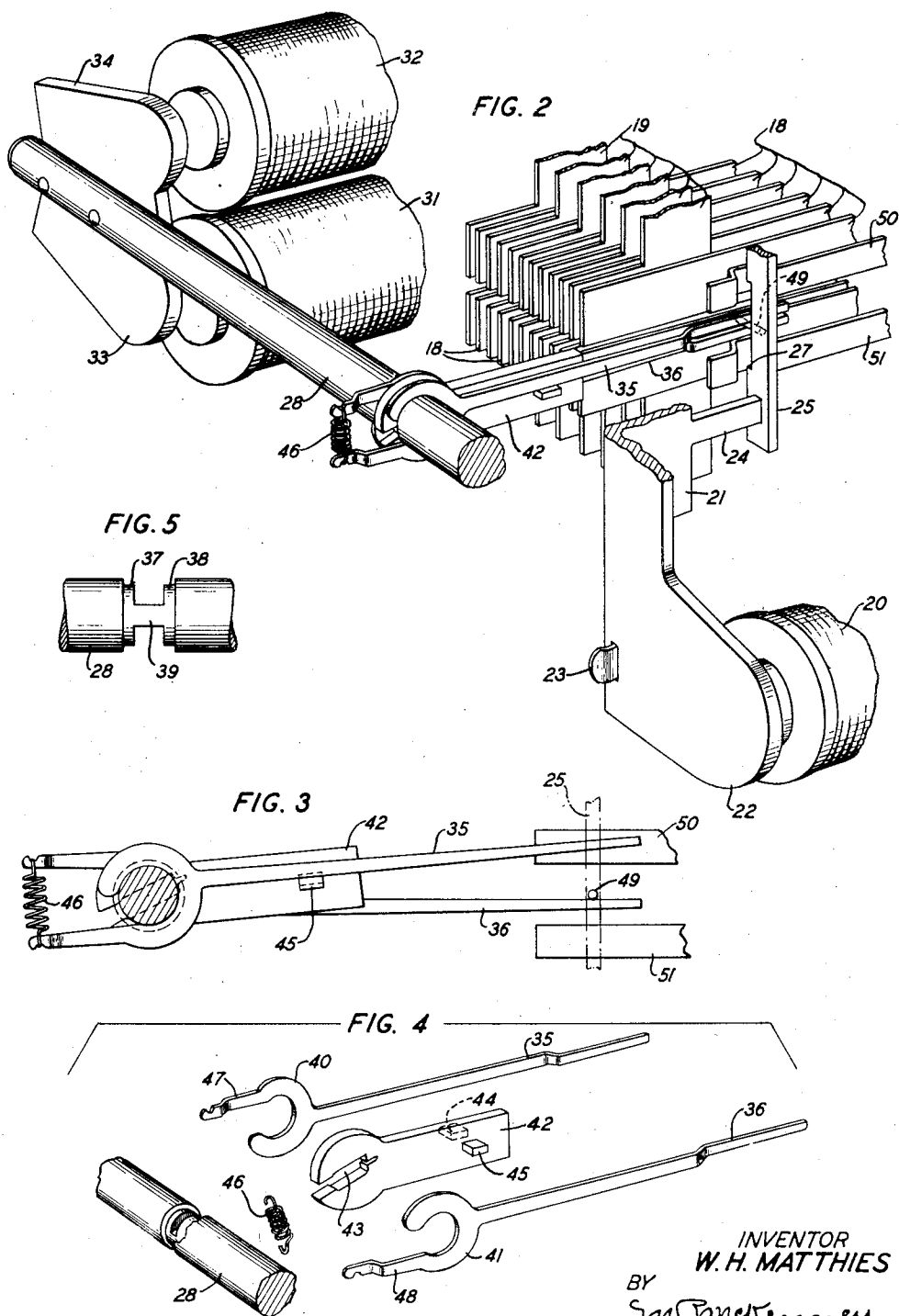
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SELECTIVE SWITCH

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This invention relates to selective switching mechanisms and particularly to those used for the establishment of connections in telephone systems.

5 The objects of the invention are to effect economy and simplification in the construction, assembly, and maintenance of selective switches; to secure greater efficiency in their operation; to reduce the possibility of false operations, such as double connections; and otherwise to secure improvements in devices of this character.

Automatic selective switches of the kind generally known as cross-bar switches have, heretofore, been provided with various forms of mechanisms for operating the individual contact sets when the corresponding pair of bars are moved. In some of these prior structures the select mechanisms consist of flexible fingers, one for each set of contacts, so located on the select bar that all of these select fingers are advanced to the operative or trapping zone when the bar is operated, and, if any operating and holding bar is now rotated, it engages the corresponding positioned finger and causes it to close the contact set to which this finger is individual. In a modified form of these prior switches each select bar serves two rows of contact sets instead of one. By rotating the bar a small distance in one direction, all select fingers are positioned with respect to the contact sets of one row, and by rotating the bar in the opposite direction, the fingers are positioned with respect to the other row. In all of these modifications the bars are usually restored to their normal positions by some form of restoring spring.

According to the present invention advantages over the switches heretofore devised are obtained by the use of a contact operating mechanism including a pair of operating fingers pivotally mounted on the select bar and held in their normal positions against a stop member by means of a spring inter-connecting the two fingers. When the bar is rotated in one direction, it causes one of the fingers to rotate therewith to its set position independently of the other finger. Likewise, when the bar is rotated in the opposite direction the other finger is caused to rotate therewith to its set position. With either of said fingers in its set position, the associated operating bar, when rotated, engages the positioned finger and flexes it laterally against the particular contact set to which the finger is individual. This effects the desired closure of the contact set.

A feature of the invention is a select mechanism of the kind above described in which the

retaining springs individual to the several sets of select fingers on a bar exert their forces through the fingers and the normal stop members to restore the bar and to hold it in its neutral position when the force operating the bar is withdrawn.

These and other features of the invention will be described more fully in detail in the following specification.

The invention is illustrated in the accompanying drawings, in which:

Fig. 1 is a front view illustrating the general construction of a cross-bar switch to which the invention is applicable;

Fig. 2 is a perspective view showing the contact operating mechanism;

Fig. 3 is a side view illustrating a set of the contact operating fingers;

Fig. 4 is a perspective view of one of the contact operating mechanisms with the several parts of the mechanism disassembled to illustrate more clearly their detail construction; and

Fig. 5 is a detail of one of the select bars.

There are in the prior art many types of cross-bar switches to which the present invention is applicable. One such type, for example, is disclosed in the patent to Reynolds, 2,021,329 of November 19, 1935, and reference is made to this patent for a detailed description of the construction and operation of such a switch.

Referring now to the drawings and first to Fig. 1 thereof, the structure of the switch disclosed herein comprises a frame including a U-shaped upper horizontal frame member 10 and a U-shaped lower horizontal member 11 and vertical side frame members 12 and 13, said side members being welded to the horizontal frame members 10 and 11. Between the horizontal frame members 10 and 11 are mounted a number of vertical assembly units 14, three of which are illustrated in the drawings. Each of these assembly units comprises a vertical plate 15 secured to the upper and lower frame members by means of screws 16. The rear sides of the plates 15 enter notches 17 in the rear sides of the channel members 10 and 11, and the plates are secured in place by screws 16 which engage tapped holes in the front sides of the frame members 10 and 11.

Suitably mounted on the rear portion of each of the plates 15 is a series of ten sets of contact strips 18. These contact strips 18 are spaced and insulated from one another. Toward the front of the plate 15 there is secured a second group of contact strips 19 separated by intermediate insulating washers 20. The contact sets 18 are

multiplied horizontally in any suitable manner and serve when moved by the contact operating mechanism at a corresponding cross-point to establish connection with the vertically multiplied contact strips 19.

On each of the mounting plates 15 and secured in a suitable manner to said plate there is mounted near the bottom an operating magnet 20. Also, each plate 15 is provided with a vertical bar 21 having an L-shaped cross-section and a projecting armature 22 positioned to be attracted by the core of the magnet 20 to rotate the bar 21. The bar 21 is held in position on the mounting plate 15 and is maintained in its normal position by means of a spring 23. The bar 21, being mounted in this manner, rocks about the edge of the plate 15 as a fulcrum. The side of the vertical bar 21 projecting inwardly in a position parallel to the plate 15 is provided with prongs or projections 24 (see Fig. 2) which are connected to a vertical operating member 25. The operating member 25 is secured at right angles to the projections 24 and is provided on its inner edge with a series of notches 27, one for each of the cross-points in the vertical row to which the member 25 is individual.

The horizontal bars 28 are mounted in front of the vertical units 14 on brackets 29 which are suitably secured to the vertical frame members 12 and 13. These horizontal or select bars are pivoted for rotary movement on bearing screws 30 which project through the brackets 29 into bearing sleeves in the ends of the bars. The bars 28 are rotatable through a short distance in either direction. For this purpose each bar is provided with two select magnets 31 and 32. The magnets 31 and 32 when energized attract either the armature 33 or the armature 34 to rotate the bar 28 in the corresponding direction. It will be noted that the operating magnets of the bars are mounted on both of the end frame members 12 and 13, that is, the first and alternate succeeding bars having their magnets mounted on the left-hand side of the switch and the remaining bars have their magnets on the opposite side of the switch. This alternate arrangement conserves space.

The contact operating mechanisms are mounted on the select bars 28 and are controlled by both the select bars 28 and the holding bars 21. These contact operating mechanisms, one of which is shown in detail in Figs. 2, 3 and 4, are provided at each of the several cross-points of the switch. A cross-point of the switch is formed by the intersection of any select bar 28 and any one of the hold bars 21. The contact strips 18 and 19 previously described are multiplied respectively horizontally and vertically. At each cross-point or point of intersection between a select bar and a hold bar there are provided two separate sets of circuit making contacts. The movable springs of these two sets are connected respectively to two separate horizontal multiples and the cooperating stationary contacts are formed on the vertically multiplied strips 19. Thus it is possible to connect at any cross-point either of two horizontally multiplied circuits to the vertically multiplied circuit individual to the vertical row containing that cross-point. The two sets of contact springs constituting a cross-point are seen more clearly in Fig. 2 of the drawings. The vertical contact springs 19 are common to both the upper and lower sets of movable contacts 18 at this cross-point and also to both sets of movable contacts at each of the other cross-points in

the same vertical row. The movable contact springs 18 extend to the rear of the switch where they are multiplied in any suitable manner to the corresponding movable contact sets at other cross-points in the same horizontal row. The contact operating mechanism, which serves to select and operate a desired set of contacts, comprises essentially a pair of select and operating fingers 35 and 36 mounted on the select bar 28. To receive the select mechanism the bar 28 is shaped, as seen in Figs. 4 and 5, to give two reduced cylindrical bearing sections 37 and 38 and a still further reduced flat section 39 intermediate the cylindrical sections 37 and 38. The fingers 35 and 36 are provided at their fixed ends respectively with circular shaped yokes 40 and 41. These yokes extend over an arc substantially greater than a semi-circle; so that when they are fixed in position on the bearing surfaces 37 and 38 they are held firmly against detachment. The contact operating mechanism further comprises an operating arm 42 having a slot 43 cut at an angle in its fixed end and provided at its free end with lugs 44 and 45. To assemble the parts of the select finger mechanism, the yokes 40 and 41 of the fingers 35 and 36 are passed on over the reduced section 39 of the bar and then fitted in place on their respective bearing surfaces 37 and 38. Next the operating arm 42 is forced into position with the slot 43 embracing the flat section 39 of the bar 28. To this end the material adjacent the slot 43 is cut to give the necessary resiliency to the prongs formed by the slot. With the parts thus installed on the select bar 28 a retaining spring 46 is attached to the projections 47 and 48 extending to the rear from the yokes 40 and 41, respectively. The spring 46 draws the projections 47 and 48 together, likewise urging the free ends of the fingers 35 and 36 toward each other until these fingers come to rest in engagement with the stop lugs 44 and 45 respectively. With this arrangement any rotary movement of the bar causes the operating finger 42 to rotate therewith either downwardly or upwardly, and one or the other of the lugs 44 and 45, depending upon which way the bar is rotating, moves the free end of the corresponding finger away from its normal position.

The free ends of the fingers 35 and 36 extend to a position where they lie within the notch 27 in the operating bar 25. Centrally located in this notch is a stop pin 49 which defines the normal position of the fingers when the horizontal bar 28 is in its neutral position. If the horizontal bar 28 is rotated in a counter-clockwise direction as seen in Figs. 2, 3 and 4 the operating arm 42 is lifted upwardly and through the lug 45 lifts the operating finger 35 up away from the normal stop 49 and against the tension of the spring 46. Although the tension of spring 46 is increased, the other finger 36 is still held in its normal position by the stop pin 49. The fingers 35 and 36 are so proportioned that they do not flex in a vertical direction when force is exerted on them by the rotation of the bar 28 and the action of the spring 46. When the finger 35 is rotated to its uppermost position as seen in Fig. 3 the free end thereof lies directly opposite the operating spring 50 which is individual to the upper set of movable contact springs 18. If the vertical or hold bar 21 is now rotated, the operating bar 25 moves the free end of the positioned finger 35 against the spring 50, which in turn forces the movable contact springs 18 into engagement with their cooperating sta-

tionary springs 19. To this end the finger 35 is flexible when moved in a horizontal direction.

In a similar manner if the select bar 28 is rotated in the other direction (clockwise) the operating arm 42 and the lug 44 moves the select finger 36 downwardly away from its normal stop pin 49 and into operative position opposite the operating spring 51 individual to the movable contacts 18 of the lower set at the cross-point. And, if the vertical bar 21 is now rotated, the finger 36 forces the spring 51 to close the contacts of the lower set.

When the vertical bar is operated to urge either of the positioned fingers 35 or 36 against the corresponding operating spring 50 or 51, the remaining finger is also flexed horizontally. The latter finger, however, passes by its operating spring and does not cause the closure of the corresponding set of contacts. Similarly, if a vertical bar is moved at a time when both the fingers 35 and 36 are in their normal positions against the stop pin 49 both fingers are flexed horizontally and pass between the springs 50 and 51 without engaging them.

A brief description will now be given of the sequence of operation involved in the selection and closure of the contacts of any desired set at any cross-point. Assume for this purpose that it is desired to effect closure of the upper set of contacts at the cross-point shown in Fig. 2. To do this the select magnet 31 is first energized. Magnet 31 attracts its armature 33 and rotates the select bar 28 in a counter-clockwise direction. The rotation of the bar 28 lifts the arm 42 and the select finger 35 to the operative position opposite the operating spring 50. In a similar manner the rotation of the bar positions the upper select finger of all other select finger mechanisms mounted on the same bar. Next the hold magnet 20 is energized to attract its armature 22 and rotate the bar 21 and the operating bar 25. The bar 25 moves both fingers 35 and 36 to the left as seen in Fig. 2. The finger 35 engages the contact operating spring 50 and the corresponding set of contacts is closed. The finger 36, however, is ineffective at this time. In a similar manner the bar 25 flexes the fingers of all other sets in the same vertical row, except those which may already be engaged in established connections. The flexing of other fingers in the same vertical row is without effect since only one of the horizontal bars is positioned at the moment. Following this the select magnet 31 is deenergized. Upon deenergization of the select magnet 31 the tensioned springs 46 of all finger mechanisms on the bar 28 act to restore the bar to its neutral position, bringing the displaced select fingers of all other sets back to their normal positions against their individual stop pins 49. The select finger 35, however, which has been engaged by the operating bar 25 is held in its set position against the operating spring 50 and this is permitted by the rotary movement that takes place between the yoke of the finger 35 and the bar 28.

When it is desired to restore the operated set of contacts the hold magnet 20 is deenergized and the bar 25 rotates back to its normal position releasing the finger 35. Thereupon the tension of the spring 46 which has been acting against the set finger 35 serves to restore the finger back to its normal position against the stop pin 49.

What is claimed is:

1. The combination in a switch of contact sets, a rotatable bar, a pair of contact-operating fin-

gers supported on said bar, and means for rotating said bar to move either one of said fingers to its operative position without moving the other finger.

2. The combination in a switch of contact sets, a rotatable bar, a pair of contact operating fingers supported on said bar, and means depending on the direction of rotation of said bar for causing either one of said fingers to rotate with said bar independently of the other finger.

3. The combination in a switch of contact sets, a rotatable bar, a pair of contact-operating fingers supported on said bar, means for rotating said bar in one direction to move a particular one of said fingers to its operative position independently of the second finger, and means for rotating said bar in the opposite direction to move said second finger to its operative position independently of the first-mentioned finger.

4. The combination in a switch of contact sets, a rotatable bar, a pair of contact-operating fingers supported on said bar, resilient means inter-connecting said fingers for holding them in their normal relative positions, and means responsive to the movement of said bar for advancing either one of said fingers to its operative position independently of the other finger.

5. The combination in a switch of contact sets, a rotatable bar, a pair of contact-operating fingers loosely mounted on said bar to permit relative rotary movement between the bar and said fingers, and means responsive to the direction of rotation of said bar for moving either one or the other of said fingers with the bar to its operative position.

6. The combination in a switch of contact sets, a rotatable bar, a pair of contact-operating fingers loosely mounted on said bar for pivotal movement relative thereto, a spring acting on said fingers to hold their free ends together, and means responsive to the rotation of said bar for moving either one of said fingers with the bar and against the tension of said spring.

7. The combination in a switch of a rotatable bar, a pair of contact-operating fingers supported by said bar for pivotal movement thereon, a stop member for defining the normal positions of said fingers, resilient means acting on said fingers to hold their free ends against said stop member, and means for causing one of said fingers to rotate with said bar to advance the finger to its operative position.

8. The combination in a switch of a rotatable bar, a pair of contact-operating fingers supported by said bar for pivotal movement thereon, a stop member for defining the normal positions of said fingers, resilient means acting on said fingers to hold their free ends against said stop member, means for rotating said bar in either direction, and an arm on said bar for engaging one or the other of said fingers dependent on the direction of rotation to move the engaged finger to its operative position against the force of said resilient means.

9. In a switch, sets of contacts, a select bar, an operate bar, two contact-operating fingers loosely mounted on said select bar to permit relative rotary movement between the fingers and the bar, a normal-position stop member on said operate bar, a spring acting on said fingers to hold their free ends against said stop member while the select bar is in its normal position, means for rotating said select bar in either direction, and means effective to move either one or the other of said fingers away from said stop member to

its operative position according to the direction of rotation of the select bar, and means for causing said operate bar to flex the positioned finger to operate a corresponding one of said contact sets.

5 sets.
10 10. In a switch, a frame, contact sets, a bar mounted on said frame and having a neutral position, means for rotating said bar away from its neutral position, a contact-operating element pivotally mounted on said bar, and resilient means acting on said element to maintain said bar in its neutral position.

15 11. In a switch, contact sets, a bar having a normal position, means for rotating said bar away from its normal position, a contact-operating finger pivotally mounted on said bar, and resilient means for maintaining both said finger and said bar in their normal positions.

12. In a switch, contact sets, a bar having a

normal position, means for moving said bar away from its normal position, a plurality of pairs of contact-operating elements, each element mounted on said bar for relative movement with respect thereto, and spring members individual respectively to each pair of said contact-operating elements, each of which serves to maintain its individual contact-operating element in normal position and also acts to restore said bar to its normal position.

10 13. In a switch, contact sets, a bar having a neutral position, means for rotating said bar in either of two directions away from its neutral position, a pair of contact-operating fingers supported on said bar, and a spring acting on said fingers to maintain them in their normal positions and acting to restore said bar to its neutral position.

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