

June 14, 1938.

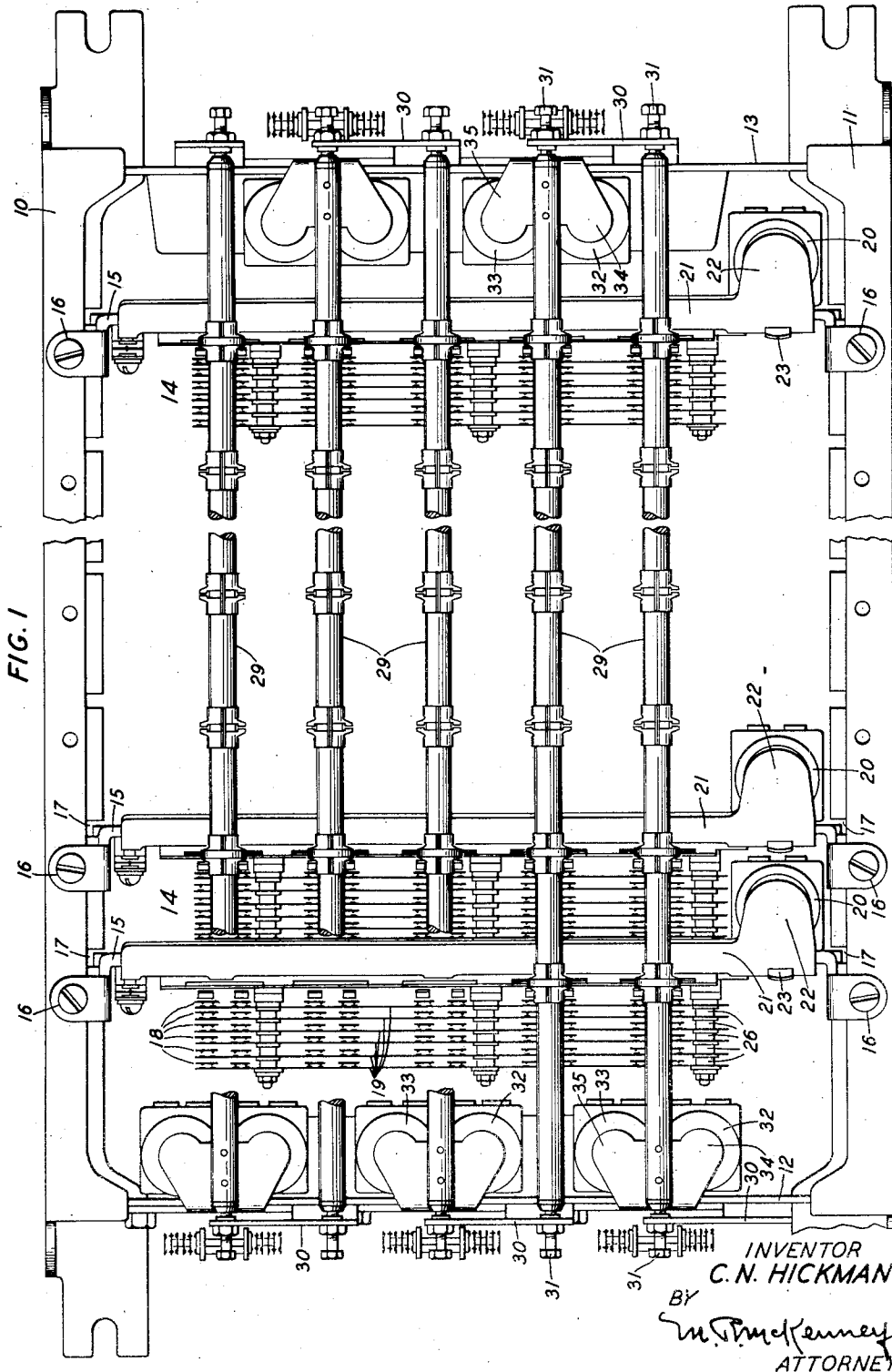
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SELECTIVE SWITCH

Filed Aug. 18, 1936

2 Sheets-Sheet 1



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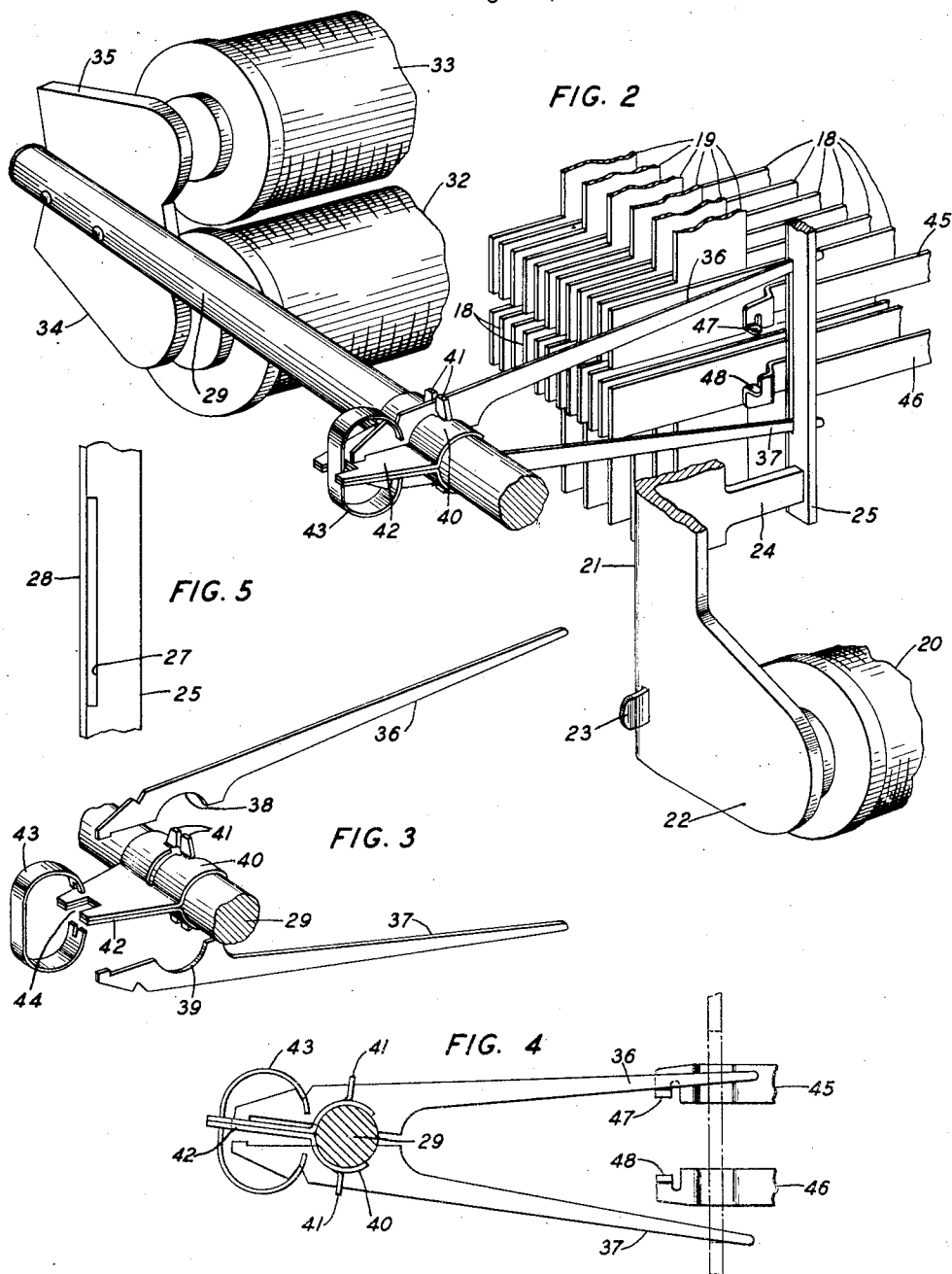
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SELECTIVE SWITCH

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8 Claims. (Cl. 179—27.54)

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 then 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, switches of this kind are provided with a select mechanism in which two non-flexible fingers, one for each of the two contact sets at a cross-point, are removably mounted on the select bar and are held in place thereon by a small retaining spring in such a way that both fingers rotate as a unit with the select bar so long as they are both free. As soon as either of the fingers is taken in use and its free end is trapped by a hold bar to close a contact set, the retaining spring then serves to hold the fingers and to permit rotation of the select bar independently of the trapped finger. Moreover, the mounting of the fingers is such that the free end of either one may be moved laterally under the force of the hold bar to close the contact set, the other end of the finger being held by the retaining spring in proper working relation with the select bar. The free ends of the fingers play up and down in a guide, and with

the select bar in its normal, central position the two fingers are urged by the retaining spring with a certain force against the stop surfaces of the guide member and out of the trapping zones. The rotation of the select bar in one direction brings one of the fingers into the trapping zone for its set of contacts and against a forward stop member which accurately fixes its forward position. Similarly rotation of the select bar in the opposite direction positions the other finger.

One of the advantageous features of this invention is a select mechanism of the kind above described in which rigid contact-operating fingers are loosely and detachably fixed on the bar by means of retaining springs which permit the fingers to engage in universal movement about their fixed ends.

Another feature is a select mechanism comprising rigid, non-flexible fingers which have no inherent tendency to vibrate either when moved to the operate position or when restored to the normal position, and which cooperate with stop members to prevent any vibration that the retaining spring might tend to set up in these fingers when they are moved from one position to the other.

A further feature is a select mechanism so constructed that the several mechanisms associated with a given bar can be mounted thereon, adjusted in place, and then secured to the bar permanently with a minimum of effort. Because the select fingers of this mechanism are rigid, they need practically no further attention after they are properly located on the bar.

These and other features of the invention will be described more fully in detail in the following specification, which should be taken in connection with the accompanying drawings.

In these drawings:

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 of one of the contact-operating mechanisms including the operating bars and magnets;

Fig. 3 is a perspective view of one of the contact-operating mechanisms with the several parts of the mechanism disassembled;

Fig. 4 is a side view showing the positions of the different parts of the mechanism when the select bar is in its operated position; and

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

There are in the prior art numerous types of cross-bar switches to which the present invention is applicable. One such type 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 construction and operation of such a switch.

Referring now to the drawings and first to Fig. 1, thereof, the structure of the switch disclosed therein comprises a frame including U-shaped upper and lower horizontal frame members 10 and 11 and vertical side frame members 12 and 13, said members being secured together to form the frame in any suitable manner, as by the use of welded joints. 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 in the rear of the channel members 10 and 11, and the plates are secured in place by the screws 16, which engage tapped holes in the front side of the frame members 10 and 11.

On the rear portion of each of plates 15 is mounted in any suitable manner 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 26. 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.

Each of the vertical units is equipped with an operating magnet 20. Magnet 20 is mounted on the corresponding vertical plate 15 near the bottom thereof. Also each vertical unit 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 (see Fig. 2) is provided with prongs or projections 24, which are connected to a vertical operating member 25. The operating member 25 is secured at right angles to the projections 24, and its edge is equipped with a series of notches 27, one for each of the cross-points in the vertical row to which the member 25 is individual. A thin strip 28 is secured to the edge of the member 25 by rivets, or screws, or welding, and encloses the successive notches 27 to form a corresponding series of guide slots, the purpose of which will be described presently.

The horizontal bars 29 are mounted in front of the vertical units 14 on brackets 30 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 31 which project through the brackets 30 into bearing sleeves in the ends of the bars. The bars 29 are rotatable through a short distance in either direction, and for this purpose each bar is provided with two select magnets 32 and 33. The magnets 32 and 33 when energized attract either the armature 34 or the armature 35 to rotate the bar in the corresponding direction. It will be noted that the operating magnets of the select

bars are mounted on both of the end frame members 12 and 13, that is, the first and alternate succeeding bars have their magnets mounted on the left-hand side of the switch, and the remaining bars have their magnets mounted on the opposite side of the switch. This alternate arrangement conserves space.

The contact operating mechanisms are mounted on the select bars 29 and are controlled by both the select bars 29 and the hold 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 29 and any one of the hold bars 21. The contact strips 18 and 19 previously described are multiplied, respectively, in horizontal and vertical directions. 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 vertical multiple 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 19 extend to the rear of the switch where they are multiplied as explained 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 36 and 37 mounted on the select bar 29. The fingers 36 and 37 are sufficiently rigid to resist flexing either laterally or vertically when subjected to force by the operating bar. These fingers are provided with semi-circular notches 38 and 39 which engage the select bar 29 and serve to locate the fingers on the bar for pivotal movement with respect thereto. To hold the fingers 36 and 37 in position on the bar a saddle 40 is provided for each contact-operating mechanism. The saddle 40 is formed of two pieces of thin stock welded or otherwise secured to each other and slides on over the bar 29 with a snug fit. The saddle is provided with upper and lower cuts and upturned lugs 41 arranged on either side of the cuts. The fingers 36 and 37 fit in between the lugs 41 and the semi-circular notches 38 and 39 rest loosely in the corresponding cuts in the saddle 40 and on the bearing surface of the bar 29. With the two fingers in position between the lugs 41 the rear ends of the fingers rest against the wing portion 42 of the saddle 40. Finally the retaining spring 43 is clipped on over the rear ends of the fingers 36 and 37, engaging notches therein and resting in the notch 44 in the wing member 42. The spring 43 thus holds the two fingers firmly in position with respect to the bar and the saddle 40 and permits either of the fingers to be moved relative to the bar in any direction. When the free end of the finger is moved vertically, the finger rotates about the bar in a direction at right angles thereto. When the free end of the finger is moved

laterally, the finger pivots in a horizontal plane, the clearance between lugs 41 being sufficient to permit this movement. Regardless of the direction of motion imparted to the finger the spring 43 yields sufficiently to permit the finger to move and yet holds the two fingers in their assembled relation on the bar.

The free ends of the fingers 36 and 37 of the contact-operating mechanism project into the guide slot 27 in the operating bar 25. When the horizontal bar 29 is in its neutral position, the retaining spring 43 urges the free ends of the fingers 36 and 37 against the upper and lower edges, respectively, of the retaining slot 27, as seen more clearly in Fig. 2. The guide slot 27 therefore serves to define the normal positions of the fingers 36 and 37. The select fingers 36 and 37 cooperate, respectively, with contact-operating springs 45 and 46. The spring 45 has a projecting stop lug 47 which extends into the vertical path of the finger 36 and serves to determine the stop position of this finger when moved downwardly. Similarly the contact-operating spring 46 is provided with a stop lug 48 which lies in the path of the finger 37 and serves as a stop to limit the upward movement of said finger. The contact-operating springs 45 and 46 when operated horizontally in a manner to be described hereinafter cause the movement, respectively, of the upper and lower contact springs 18 into closing relation with the stationary springs 19.

In a similar manner the horizontal select bar 29 is equipped with other contact-operating mechanisms like the one shown in Fig. 2, one of these mechanisms being provided at each of the cross-points of the switch. To assemble the several mechanisms on any particular select bar 29, the saddles 40 are slipped on over the end of the bar, moved along the bar to their proper positions, and rotated with respect to the bar until the desired alignment of the wing members 42 is secured. Thereupon the several saddles 40 are securely fixed to the bar in any suitable way, such as spot welding. The operating fingers are fixed in place on the saddles, and ordinarily no further adjustment is necessary. However, if further adjustment is desired, the two parts of which the wing 42 is formed may be separated slightly by means of a tool to alter correspondingly to normal position of the fingers.

A description will now be given of the operation involved in the selection and closure of the contacts in any desired set at any cross-point. Assume for this purpose that it is desired to effect the closure of the upper set of contacts at the cross-point shown in Fig. 2. To accomplish this the select magnet 33 is first energized to attract its armature 35 and rotate the bar 29 in a clockwise direction as viewed in Figs. 2, 3 and 4. As the bar 29 rotates, the wing member 42 of the saddle 40 engaging the rear end of the finger 36 causes the free end of the finger to move downward in a vertical direction until it encounters the stop lug 47. The lug 47 stops and holds the finger 36 opposite the contact-operating spring 45. The lower finger 37, being constrained by the lower edge of the slot 27 against any further downward movement, remains stationary and the bar 29 rotates relative thereto, the wing member 42 moving away from the rear end of the finger 37 as seen in Fig. 4, and the spring 43 being subjected to tension by the separation of the rear ends of the fingers 36 and 37. Next the vertical magnet 20 is energized to attract its armature 22 and rotate the vertical bar 21 and the attached

operating bar 25 toward the contact sets. As the bar 25 moves laterally the position finger 36 engages the flat surface of the spring 45 and forces this spring against the movable contacts 18, and in turn forces these movable contacts into engagement with the stationary contact springs 19. Thus the desired set of contacts are selected and closed. The bar 25 at the same time pivots the other finger 37, and the fingers of all other sets associated with this vertical bar, laterally. Since, however, the finger 37 and all other non-positioned fingers are not opposite their respective contact-operating springs, such as spring 46, no other set of contacts is selected. Following this the select magnet 33 is deenergized to remove the operating force from the bar 29. The bar 29 is now restored to its neutral position by the force of the retaining springs 43 of all contact-operating mechanisms on the bar. The finger 36, however, is held in its operated position by the continued displacement of the vertical bar 25. Although the spring 43 tends to restore the finger 36 the force with which the bar 25 holds the finger against the spring 45 is sufficient to overcome the tendency of the spring 43 to restore the finger.

When it is desired to release the operated set of contacts, the hold magnet 20 is deenergized and the bar 25 restores to its normal position. The restoral of the operating bar 25 moves the free end of the finger 36 away from the spring 45, and the retaining spring 43 rotates the free end of this finger back to its normal position in the slot 27. The removal of the operating force from the spring 45 permits the contact springs 18 to disengage the cooperating stationary contact strips 19.

What is claimed is:

1. The combination in a switch of a set of contacts, a rotatable bar, a non-flexible contact-operating finger having one end loosely engaging said bar to permit universal movement of its free end relative to said bar, means for causing said finger when unrestrained to participate in the movements of said bar and for permitting the bar to move independently of the finger when the latter is under restraint, and means acting on the free end of said finger to cause the operation of said contacts.

2. The combination in a switch of a set of contacts, a rotatable bar, a non-flexible contact-operating finger loosely and detachably fixed on said bar to permit the finger to pivot freely in all directions about its fixed end, means for causing said finger when unrestrained to participate in the movements of said bar and for permitting the bar to move independently of the finger when the latter is under restraint, and means acting on the free end of said finger to cause the operation of said contacts.

3. In a switch, a set of contacts, a rotatable bar, a non-flexible contact-operating finger having one end yieldably fixed on said bar to participate in the movement of said bar and to permit movement of the bar relative thereto, a stop member engaged by the free end of said finger to determine the normal position thereof, means for causing said finger when unrestrained, to participate in the movement of said bar, resilient means urging the free end of said finger against said stop member and serving to hold the fixed end of said finger in place on the bar when the finger is under restraint, and means controlled by said finger for operating said contacts.

4. In a switch, a frame, a set of contacts, a bar

mounted for movement in said frame, a rigid contact-operating finger having one end loosely fixed on said bar to permit the free end of the finger to pivot in a plurality of directions about its fixed end, a stop member engaged by the free end of said finger for determining the normal position thereof, means responsive to the movement of said bar for causing said finger when unrestrained to move into its operative position with respect to said contacts, means controlled by said finger for operating said contacts, and resilient means for holding said finger in its fixed position on said bar and for exerting a force through said finger and stop member to restore said bar to its normal position in said frame.

5. The combination in a switch of a set of contacts, a movable bar, a non-flexible contact-operating finger having one end loosely and detachably fixed on said bar to permit the finger to pivot freely in all directions about its fixed end, a normal stop for determining the normal position of said finger, a forward stop for determining the set position of said finger, means for causing said finger to participate in the movement of said bar, means controlled by said finger for operating said contacts, and a spring acting on said finger to hold it against either one of the stop members whenever it is moved into engagement with such stop member.

6. The combination in a switch of sets of contacts, a movable bar, a pair of contact-operating fingers supported on said bar in cooperative relation to each other, each finger having one of

its ends loosely fixed on the bar, means including a spring element acting on the fixed ends of each of said pairs of fingers for causing said fingers to participate in the movement of said bar and for permitting said bar to move independently of said fingers, and means controlled by said fingers for closing said contact sets.

7. The combination in a switch of sets of contacts, a rotatable bar, a mounting member secured to said bar, a contact operating mechanism including two rigid operating fingers supported by said bar and loosely fixed in position thereon by said mounting member, a spring engaging both fingers and holding them in yieldable engagement with said bar and with said mounting member, and means controlled by said fingers for operating said contact sets.

8. The combination in a cross-bar switch of a set of contacts, a select bar, a rigid contact-operating finger having one end loosely fixed on said bar, a guide and stop member cooperating with the free end of said finger to determine its normal position and to guide its movement, means for operating said select bar to move said finger and said guide member to its operative position, an operate bar, means for moving said operate bar to cause the positioned finger to close said contact set, and resilient means for engaging the fixed end of said finger to permit the select bar to move independently of said finger and for restoring said finger to its normal position against the stop member.

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