Jan. 5, 1937. P. W. SHEATSLEY 2,066,490

SWITCH

Filed Nov. 8, 1935 3 Sheets-Sheet 1

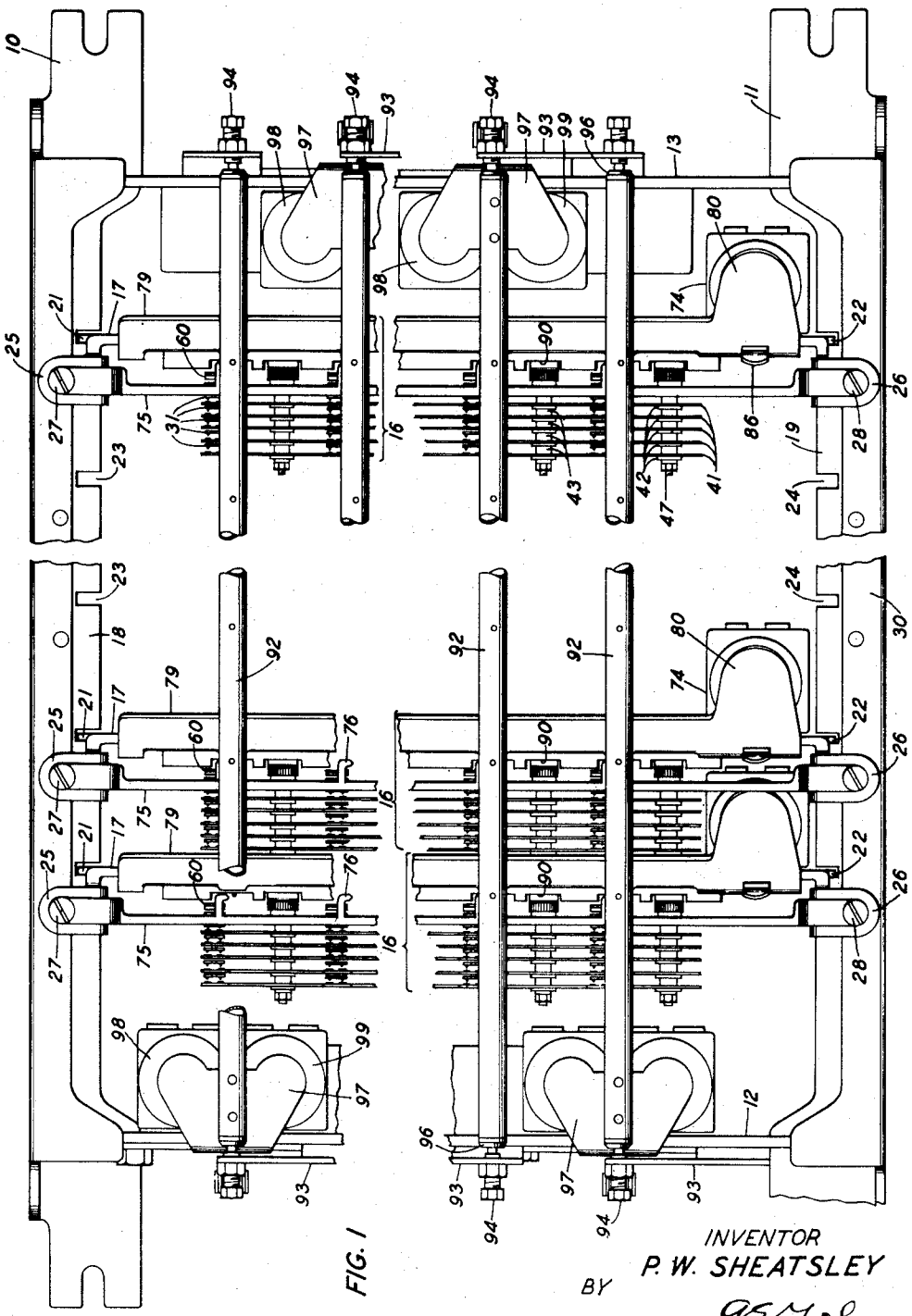


FIG. 1

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Jan. 5, 1937. P. W. SHEATSLEY 2,066,490

SWITCH

Filed Nov. 8, 1935 3 Sheets-Sheet 2

FIG. 2

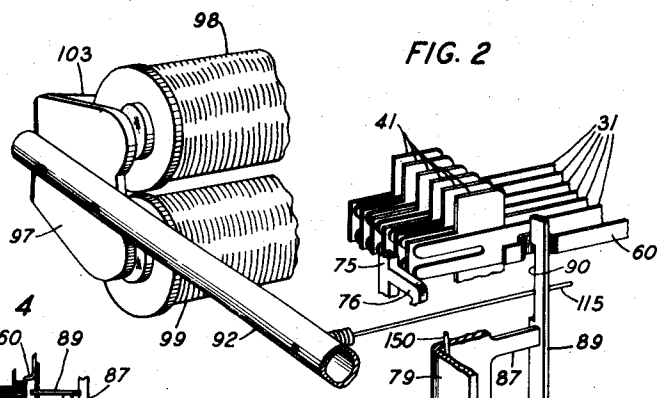


FIG. 4

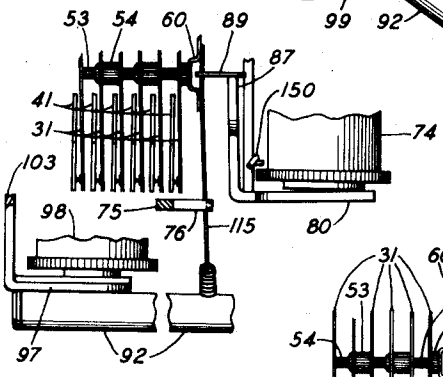


FIG. 3

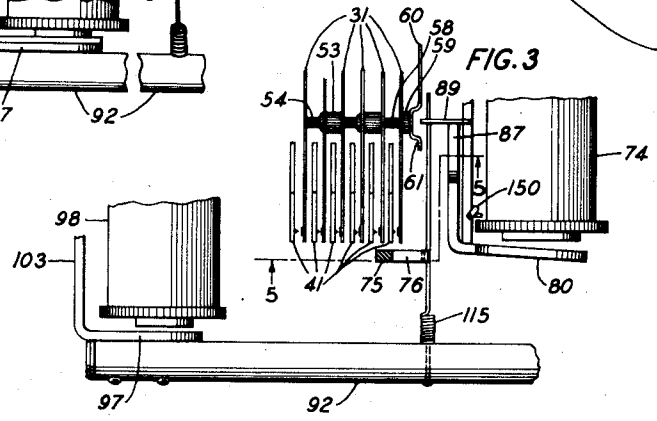


FIG. 8

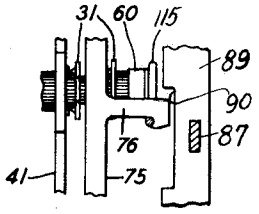


FIG. 5

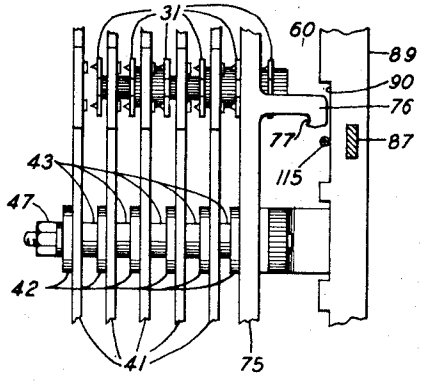


FIG. 6

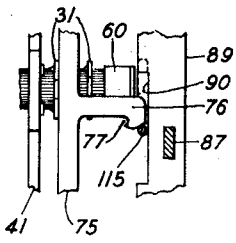
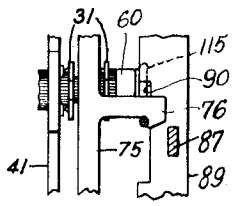


FIG. 7



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Jan. 5, 1937. P. W. SHEATSLEY 2,066,490

SWITCH

Filed Nov. 8, 1935 3 Sheets-Sheet 3

FIG. 9

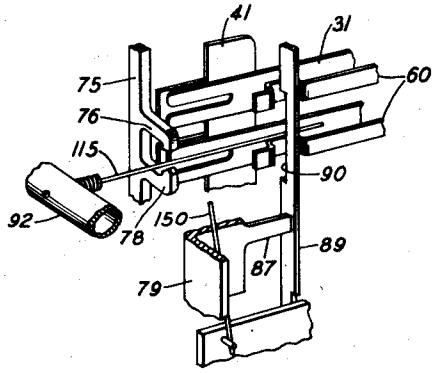


FIG. 13

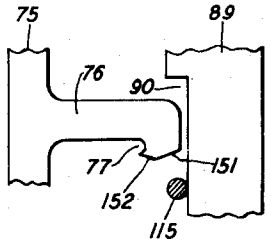


FIG. 10

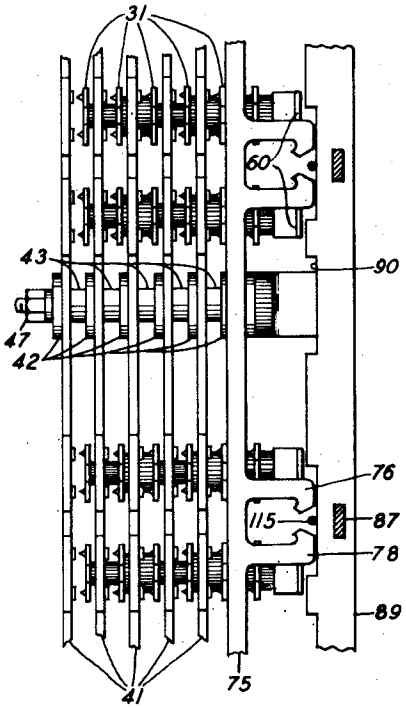


FIG. 11

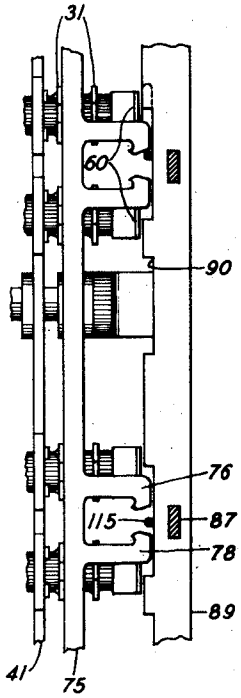
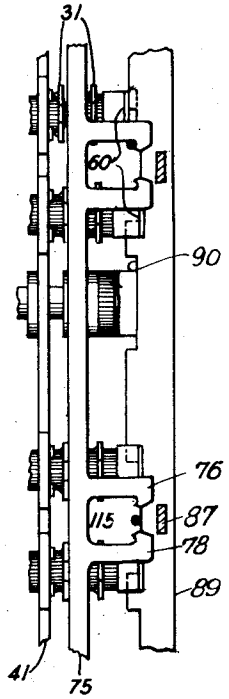


FIG. 12



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UNITED STATES PATENT OFFICE

2,066,490

SWITCH

Paul Weidner Sheatsley, Mountain Lakes, N. J., assignor to American Telephone and Telegraph Company, a corporation of New York

Application November 8, 1935, Serial No. 48,905

8 Claims. (Cl. 179—27.54)

This invention relates to switching devices and particularly to selective switches for use in automatic telephone systems.

The objects of the invention are to enlarge the capacity of automatic switches for making selective connections without increasing their size or complicating the apparatus involved; to improve their releasing operation; to reduce the current consumption required for the operation of such switches, and to otherwise effect improvements therein.

Switches of the cross-bar type have been devised heretofore in which a set of cross-point contacts, once operated by the conjoint action of the two associated operating magnets, are held in operated condition independently of either magnet, thus permitting the deenergization of the operating magnets while the connection is held. When the connection is no longer required the cross-point contacts are released by reoperating one of the magnets that originally caused the closure of these contacts. A switch of this kind is shown in the patent to Clark 1,572,380 of February 9, 1926. In this patent the contacts at a cross-point are operated by the rotation of the horizontal bar, which is latched in its rotated position to hold the contacts closed and to permit the magnet to be deenergized. To release the bar and thus open the contacts, the magnet is again energized to trip the latch mechanism.

It has also been proposed to hold the contacts at a cross-point operated independently of either of the coordinate bars or their operating magnets. A switch of this character is shown in the patent to J. G. Ferguson, No. 2,055,656, granted Sept. 29, 1936. Here the contacts, once operated, are held by an auxiliary magnet individual to the contact set, and the operating bars are both released for further operation to control other contact sets.

According to a feature of the present invention the contacts of a cross-point are closed by the conjoint operation of two bars, which act on a flexible selecting finger, and the contacts are maintained in their closed condition by a mechanical holding device that holds the finger in its adjusted position. Thus, the bars and their magnets may be released and reoperated to close other cross-point contacts without disturbing the set already closed. When it is desired to release a contact set, the selecting bar, which was previously operated in a particular direction to cause the closure of said contact set, is now operated in a different direction to disengage the selecting finger from the holding device and permit the restoration of the associated contact set. In this way the selecting bar may be reoperated in its contact-closing direction to set up several successive connections without releasing the previously closed contact sets.

Another feature of the invention is a switch in which the operating bar is movable in either of two directions to cause the selection and operation of either one of two contact sets and in which the same bar is movable in either of said directions to cause the release of said contact sets. In this case the bar, having been moved in either direction to cause the selection and closure of the corresponding set of contacts, is later moved in the other direction to cause the release of that contact set.

These and other features of the invention will be more fully set forth in the following detailed description and also in the appended claims.

The invention is illustrated in the accompanying drawings in which:

Figure 1 shows a front view of a cross-bar switch embodying the features of the invention;

Fig. 2 is a fragmentary perspective of the cross-bar switch showing a holding device, portions of a horizontal bar and a vertical bar, their operating magnets, and a contact set controlled by said bars;

Fig. 3 is a top plan view of the structure shown in Fig. 2;

Fig. 4 is a view similar to Fig. 3, except that the contacts are in operated condition;

Figs. 5, 6, 7, and 8 are views taken along line 5—5 of Fig. 3 showing the mechanism in the various stages of operation;

Fig. 9 is a fragmentary perspective of the cross-bar switch showing an alternative construction of the holding devices;

Figs. 10, 11, and 12 are enlarged details of the alternative construction and show different positions of the contact-operating mechanism;

Fig. 13 is an enlarged view of the holding mechanism shown in Figs. 2 to 10, inclusive.

For a more complete description of a switch of the kind to which this invention is particularly applicable reference is made to the patent application of J. N. Reynolds, Serial No. 702,453, filed December 15, 1933, granted as Patent 2,021,329, Nov. 19, 1935. The invention is not limited to the specific construction shown in said patent nor to the specific embodiments herein described and shown but may be applied generally to switching devices in which contact sets are selectively operated and held.

Referring now to the drawings and primarily to Fig. 1, the structure comprises a frame including a U-shaped upper horizontal frame member 10 and a U-shaped lower horizontal frame member 11 and vertical side frame members 12 and 13, said side members being of L-shaped cross-section with their upper and lower ends welded to the horizontal frame members 10 and 11, respectively. The sides of the horizontal frame members 10 and 11, and the one side of the L-shaped vertical frame members 12 and 13 are turned inward towards the center of the switch structure. Between the horizontal frame members 10 and 11 are mounted a number of vertical assembly units 16. Each of these units comprises a vertical plate 17 secured to the rear sides 18 and 19 of the upper and the lower horizontal frame members 10 and 11 by means of lugs 21 and 22 engaging slots 23 and 24, respectively, in the rear sides 18 and 19. The plate 17 is securely fastened in the front to the front sides 29 and 30 of the horizontal frame members 10 and 11 by means of screws 27 and 28 inserted through the bent lugs 25 and 26, respectively, forming part of said plate 17.

On the rear portion of each of the plates 17 is suitably mounted a series of ten sets of contact strips 31. These contact strips 31 are suitably spaced and insulated from one another. At the front portion of each plate 17 is secured a group of contact strips 41 separated by intermediate insulation washers 42 and metal spacing bushings 43. An outer insulation washer and metal spacing washer are provided in the pile, and all these parts are connected together and secured to the plate 17 by means of a bolt 47 screwed into the plate 17 and a nut screwed on the bolt 47. Three of these bolts 47 and associated spacing and insulation parts are provided for each pile of strips 41 as shown in Fig. 1. The horizontal strips 31 extend between the adjacent vertical strips 41 and are arranged to make connections between corresponding vertical and horizontal strips when the horizontal strips are operated. The horizontal strips 31 are spaced apart by means of studs 53 (Fig. 3). Each of these studs 53 is secured to one horizontal strip and spaces the strips on either side thereof. Each of these studs 53 has a turned-down portion 54 which projects through a hole in the strip 31 and the stud 53 is suitably attached to the strip 31. The inside strip of the group 31 is provided with a special stud 58 which is similar to the stud 53 except that its enlarged portion 59 engages an additional strip member 60 secured to the plate 17 in the same pile as strips 31. A bent-in U-shaped portion 61 of strip 60 is engaged by this portion 59. The purpose of this strip 60 and its U-shaped portion 61 will become apparent hereinafter in connection with the description of the operation of the switch.

On each plate 17 and secured in a suitable manner to said plate there is mounted near the bottom an operating magnet 74. On the plate 17 is also mounted the corresponding vertical bar 79 having an L-shaped cross-section and a projecting armature 80 positioned to be attracted by the core of magnet 74 to rotate the bar 79. The vertical bar 79 is mounted to rock with the edge of plate 17 as a fulcrum. The vertical bar 79 is held in place on the vertical unit 16 by suitable means, such as spring 150, shown in Figs. 2, 3 and 4. Also a spring member 86 is secured on the back of plate 17 to engage one side of the L-shaped vertical bar 79 at its lower end and to hold it in the normal or non-operated position. The side of the vertical bar 79 projecting inwardly in a more or less parallel position in relation to the plate 17 is provided with prongs or projections 87 which are connected to a vertical member 89. This member 89 is secured at a right angle to the projections 87 and is provided with slots 90 for the operation of the switch as will presently be described. This construction is particularly shown in Figs. 2, 3, and 9. In front of and to the left of plate 17 is mounted a holding device 75 which is suitably mounted at the top and the bottom by the screws 27 and 28. This holding device 75 has a projection 76 extending from its right side for each set of contact springs.

The horizontal bars 92 are mounted in front of the vertical units 16 on brackets 93 which are suitably secured to the vertical L-shaped side members 12 and 13 of the frame. Bearing screws 94 secured in the brackets 93 extend into bearing sleeves 96 secured to the ends of the selecting bars 92 for the rotation of the bars 92. The upper horizontal bar 92, referring to Fig. 1, has its armature 97 secured at its left-hand end while the remaining bars 92 have their armature secured at alternate opposite ends, that is, the second bar from the top has its armature on the right-hand end and the third bar has its armature on the left-hand end, etc. This armature 97 extends upwardly and downwardly from the bar 92 in front of the cores of upper and lower magnets 98 and 99 to cause the selecting bar 92 to be rotated in one direction by the magnet 98 and in the other direction by the magnet 99. Each selecting bar 92 is therefore controlled by the magnets 98 and 99. These magnets 98 and 99 are mounted in pairs on the inwardly projecting side of the L-shaped vertical frame members 12 and 13 in a suitable manner. Each armature 97 has a projection or member 103 bent at practically right angles to the armature proper and extending toward the rear of the structure outside of the respective frame members 12 and 13. An illustration of the projection is shown in Figs. 2 and 3. The horizontal bars 92 carry a plurality of flexible operating fingers 115, one for each set of cross-point contacts.

Referring now to the operation of the switch, to establish a connection between the individual vertical strips 41 in a vertical row and the corresponding set of horizontal contact strips 31 in the switch shown in Figs. 1 to 8, inclusive, requires the operation of a corresponding horizontal bar 92 in a counter-clockwise direction (viewed from the right) and the operation of a corresponding vertical bar 79. The operation of the switch is best described in connection with Fig. 2 which shows a portion of a horizontal bar 92, a portion of a vertical bar 79, a portion of the holding device 75 and portions of a corresponding set of contact strips in the two adjacent rows controlled by the horizontal bar 92. A connection, for example, with the set of horizontal strips 31 and the vertical strips 41 may be established by first operating the horizontal bar 92 in the counter-clockwise direction by the energizing of magnet 99. The selecting finger 115 on bar 92 is moved from the normal position shown in Fig. 5 to a position in front of the spring 60 of the set of horizontal contact strips and across the U-shaped portion 61 of spring 60 as shown in Fig. 6. As the flexible finger 115 moves to the position shown in Fig. 6, it engages the cam surface 151 (Fig. 13) of the stationary holding arm 76. The arm 76 is so positioned that the finger 115 engages

said arm slightly before the bar 92 reaches its fully operated position. This relation causes the finger 115 to flex slightly. Next the vertical bar 79 is rotated by the energization of the associated vertical magnet 74. The rotation of the bar 79 causes the member 89 to press the free end of the selecting finger 115 against the contact operating spring 60 and to move both finger and spring 60 to the left as viewed in Figs. 5, 6, 7, and 8. As the finger 115 is flexed to the left it rides along the cam surface 151 of the holding arm 76, and the associated set of contacts are closed by the movement of the spring 60 under the force exerted by the finger 115. When the vertical bar 79 reaches its fully operated position the member 89 has moved through a distance just sufficient to cause the finger 115 to pass the apex of the cam surface 151 on the holding arm 76. The tension stored in the finger 115 by the rotary bar 92, which is still operated, now causes the finger to slide along the cam surface 152 and into the holding recess 77 of the arm 76. The relative positions of the different parts at this stage of the operation are seen in Fig. 7. The vertical magnet 74 is released first and is followed by the release of the selecting magnet 99. The flexible selecting finger 115 remains in the position shown in Fig. 8 and thereby keeps the associated cross-point operated. Bar 92 returns to its normal position, and both vertical and horizontal bars may now be used to initiate connections at other cross-points. A reoperation of vertical bar 79 for setting some other cross-point contacts does not disturb the contacts already closed because the finger 115 holding these closed contacts is beyond the reach of the member 89 of the reoperated vertical bar 79. In moving into the recess 77, finger 115 slides along cam surface 152 to a point where it is not touched by member 89.

When it is desired to release a contact set, the horizontal bar 92, which was previously operated in a counter-clockwise direction to cause the closure of said contact set, is now operated in a clockwise direction by magnet 98 to disengage the selecting finger 115 from the projection 76 of holding device 75 and permit the restoration of the associated contact set.

With the structure described the selecting bar 92 may be reoperated in its contact closing direction to set up several successive connections on adjacent cross-points without releasing the previously closed contact sets. The finger 115 is tensioned to bear against the edge of member 89 in the slot 90 and the slot 90 is of such width that it will confine the upward and downward movements of the finger 115 to the proper upper and lower position in front of the springs 60 of the corresponding groups of contact strips.

Referring to Figs. 9 to 12, there is here shown a variation in the type of holding bar. The holding device 75 shown in these figures is similar to the holding device 75 described previously herein on Figs. 2 to 8, inclusive, except that the holding device 75 has an additional projection 78 for holding the finger 115. The addition of this projection 78 permits holding a cross-point operated when the horizontal bar 92 is operated in either the clockwise or the counter-clockwise direction. The double sets of contacts at each cross-point controlled by a single operating finger 115 are shown in detail in Figs. 10 to 12. Thus the capacity of the switch may be increased.

When the horizontal bar 92 is operated in the clockwise direction by the energization of magnet 98, the selecting finger 115 moves to the upper position as shown in Fig. 11. When the horizontal bar 92 is operated in a counter-clockwise direction by the energization of magnet 99, the selecting finger 115 moves to the lower position. When the vertical bar 79 is operated by the energization of the corresponding magnet 74, the selecting finger 115 on horizontal bar 92 is moved so as to engage the projection 76 or the projection 78 on the holding device 75, depending on whether the magnet 99 or 98 is energized. The particular cross-point having been operated remains in this position, being held there by the associated selecting finger 115, which is latched in the recess 77 of the corresponding projection. Operating the horizontal bar 92 in a direction opposite to that in which it was previously operated releases the cross-point as described heretofore.

What is claimed is:

1. The combination in a switching mechanism of a set of circuit making contacts, operating bars, means responsive to the conjoint action of two of said bars for operating said contact set, holding means for maintaining said contact set in operated condition following the release of said bars, and means for operating one of said bars to effect the release of said contact set.

2. The combination in a switching mechanism of a set of circuit making contacts, operating bars, means responsive to the operation of said bars for operating said contact set, locking means for holding the contacts of said set in their operated condition following the release of said bars, and means for reoperating one of said bars to disable said locking means and effect the restoration of said contacts.

3. The combination in a switch of a set of circuit making contacts, operating bars, a flexible element responsive to the operation of said bars for closing the contacts of said set, holding means for holding said flexible element in its actuated position to maintain said contacts closed after said bars have been restored to normal, and means for operating one of said bars to effect the release of said flexible element and the restoration of said contact set.

4. In an automatic switch, a set of circuit contacts, a first bar, a second bar, means for operating said bars, a flexible selecting element on said first bar responsive to the action of both said bars to close said contacts, holding means for maintaining said contacts closed following the release of said bars, and means to reoperate said first bar to cause the restoration of said contacts.

5. The combination in a switch of a set of contacts, a first bar having a flexible element thereon for causing the closure of said contacts, means for operating said bar in one direction, a second bar and means for operating it to move said flexible element, means to hold said contacts closed following the release of said bars, and means for operating said first bar in a second direction to cause the release of said contacts.

6. The combination in an automatic switch of a plurality of circuit making contacts, a first operating bar having a flexible element thereon for causing the closure of one of said sets of contacts, means for rotating said bar in one direction to position said flexible element, a second bar and means for operating it to further position said flexible element, a locking member for locking said flexible element in its adjusted position to hold said operated contacts in their closed condition following the restoration of said first and

second operating bars, and means for rotating said first bar in the other direction to disengage said flexible element from said holding means to permit the restoration of said operated set of contacts.

7. The combination in a selective switch of a first set of contacts, a second set of contacts, an operating bar for causing the operation of either set of contacts, means to hold the contacts of either set in their operated condition while said bar is in its normal position, means to operate said bar in one direction to cause the operation of said first set of contacts and the release of said second set of contacts, and means to operate said bar in the other direction to cause the operation of said second set of contacts and the release of said first set of contacts.

8. The combination in an automatic switch of a first set of contacts, a second set of contacts, an operating bar for causing the operation of the contacts of either set, means to hold either set of contacts in operated condition independently of the position of said bar, means to operate said bar in one direction either to cause the operation of said first set of contacts or the release of said second set of contacts, and means to operate said bar in another direction either to cause the operation of said second set of contacts or the release of said first set of contacts.

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