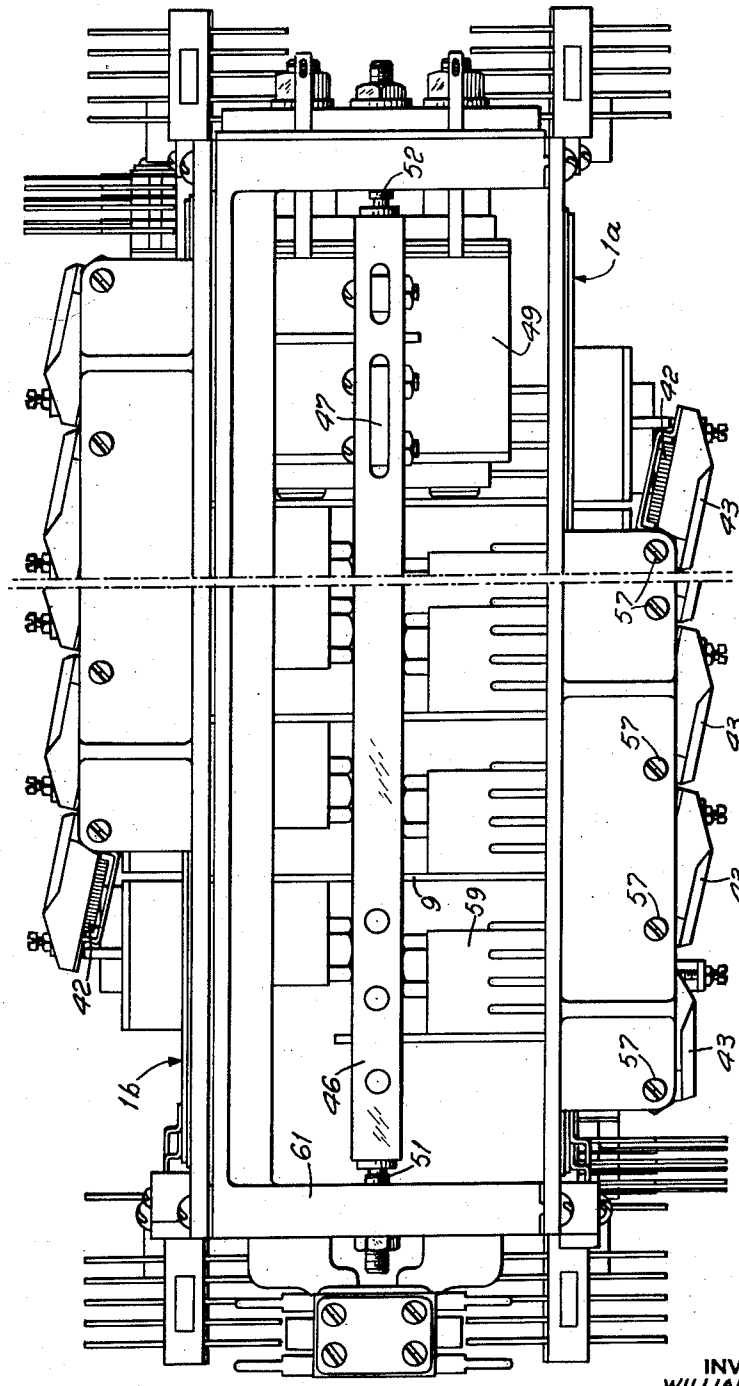
Dec. 13, 1960 W. HATTON ET AL 2,964,591

COORDINATE SWITCHING SYSTEM

Filed Oct. 4, 1955 4 Sheets-Sheet 1

Fig. 1



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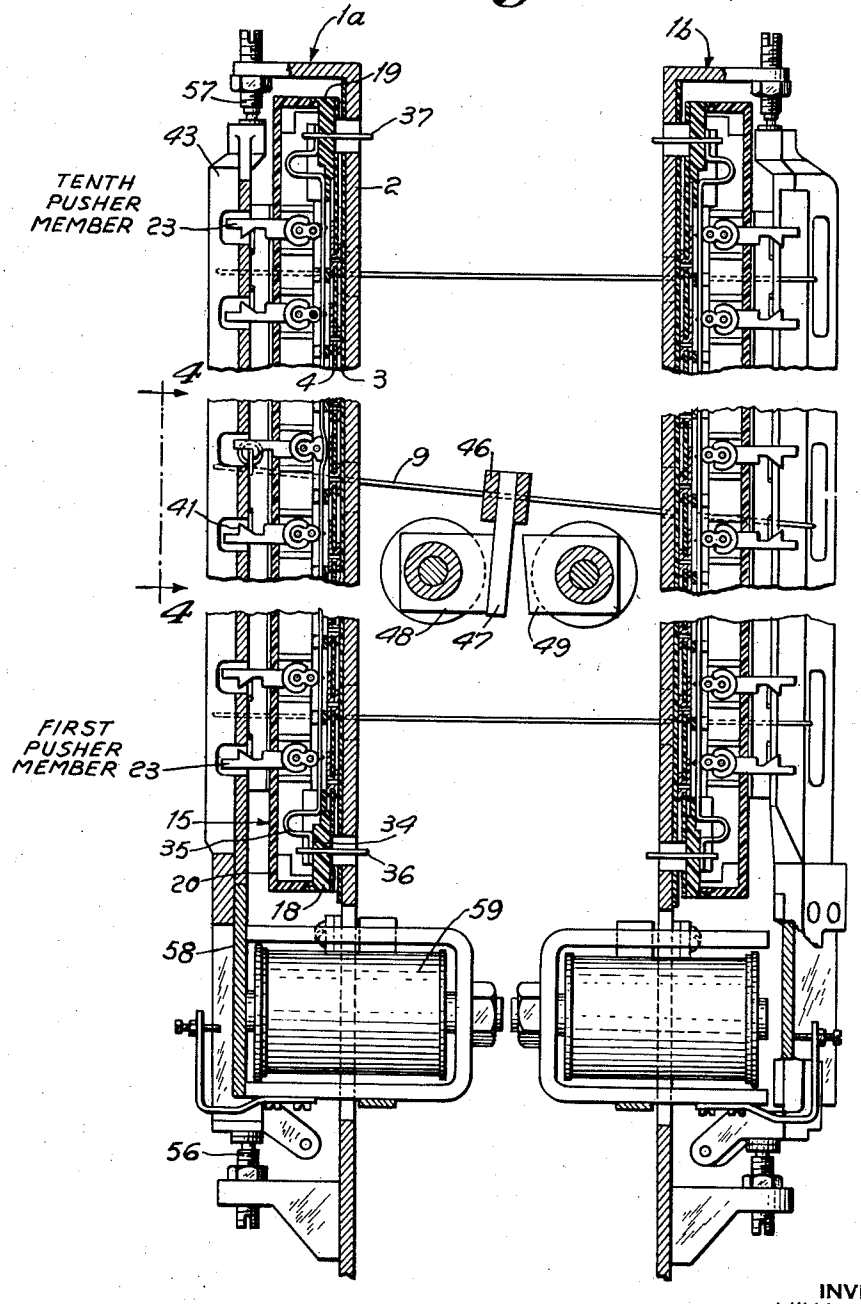
Filed Oct. 4, 1955 4 Sheets-Sheet 2

Fig. 2



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Filed Oct. 4, 1955 4 Sheets-Sheet 3

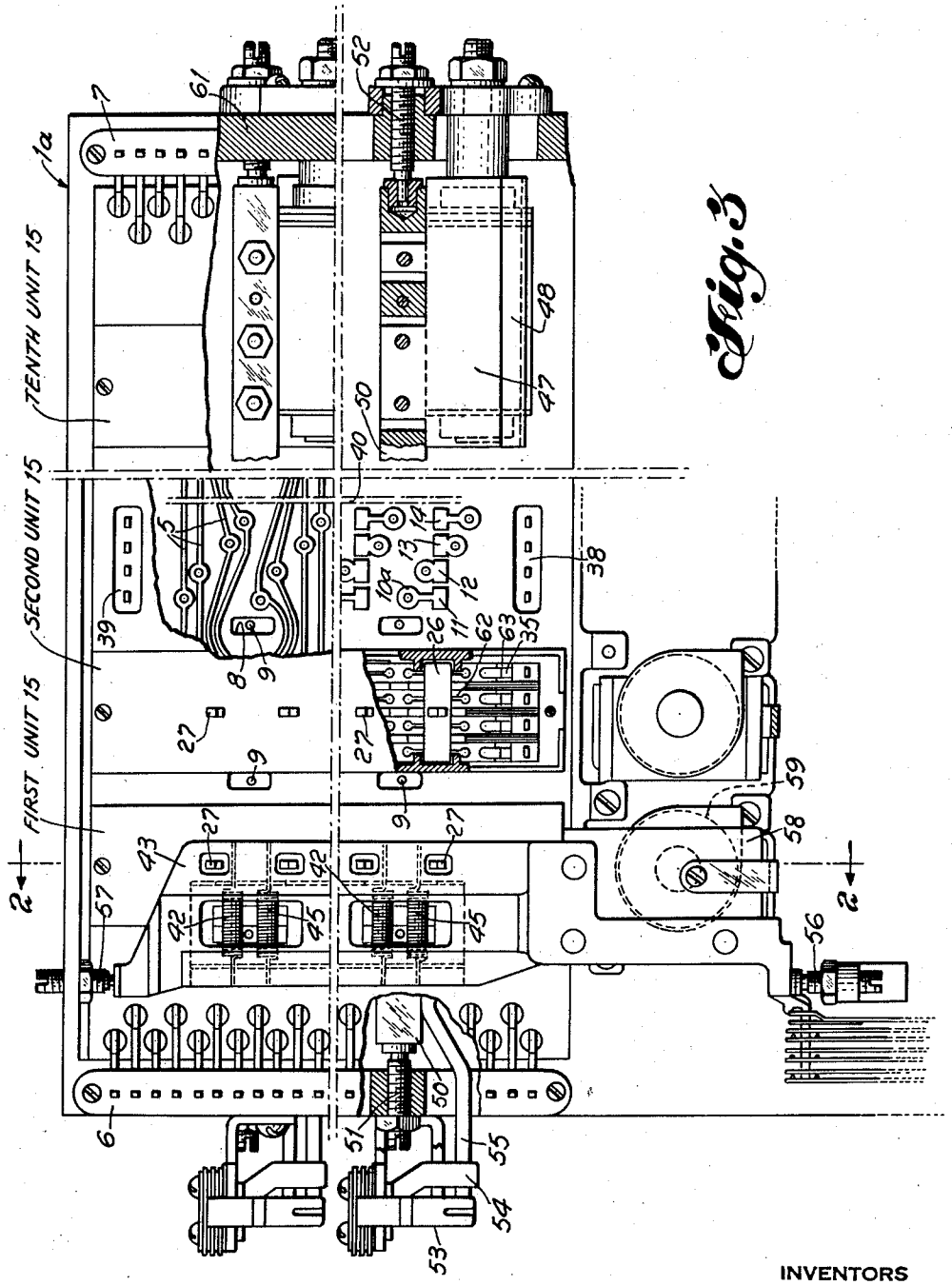

Fig. 3

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Filed Oct. 4, 1955 4 Sheets-Sheet 4

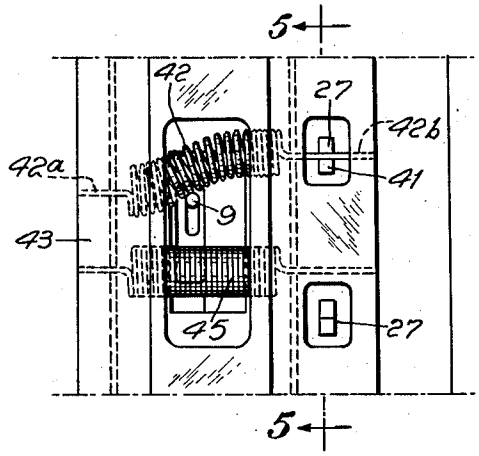

Fig. 4

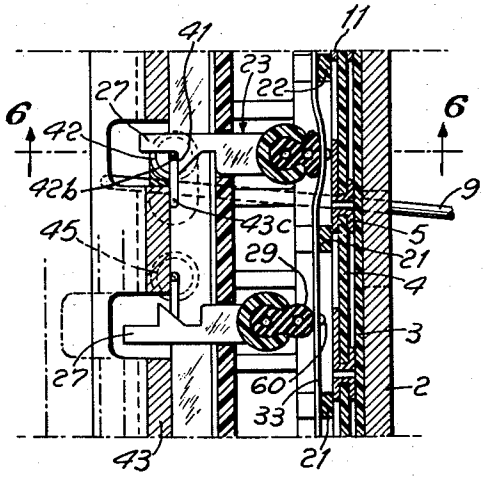

Fig. 5

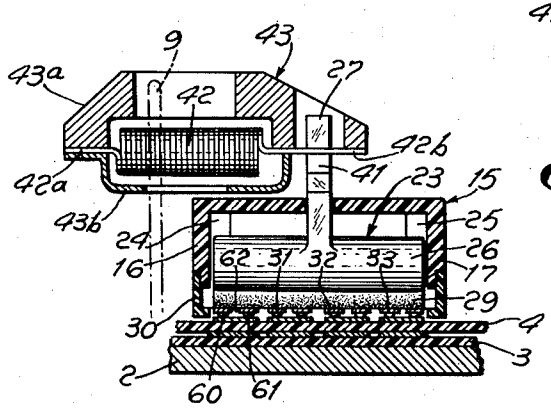

Fig. 6

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COORDINATE SWITCHING SYSTEM

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3 Claims. (Cl. 179—27.54)

This invention relates to electrical switching systems and more particularly to a coordinate contact or "cross-bar" type of switching system.

The coordinate or "cross-bar" switch heretofore commonly used in automatic telephone switching systems is a rather delicately adjusted instrument requiring numerous parts assembled in a compact arrangement. The numerous contacts and selective actuating mechanism must, after assembly, be carefully adjusted for proper operation and since the switch is compact, this calls for painstaking manipulation in order not to disturb other adjusted parts. Where a part becomes worn or otherwise inoperative, the switch assembly usually requires a major disassembling job before the particular part can be repaired or replaced.

One of the objects of this invention is to provide an improved coordinate contact switching system which overcomes the above-mentioned and many other disadvantages of prior coordinate switches. Another object is to provide a simplified, sturdier and more compact switching mechanism.

One of the important features of this invention is the arrangement of the panels containing the passive contacts of the horizontal multiples. The panels are arranged back-to-back with the selector bars for the active contacts of the verticals disposed between the panels. Each selector bar is provided with a plurality of selector rods the opposite ends of which extend through the two panels for simultaneous operation of corresponding contact selectors in the two panel sections. Another feature is the provision of openings through each panel to accommodate the selector rods carried by the selector bars disposed on the back side of the panels. This structural arrangement avoids the practice of placing the selector bars and relays in overlying relation to the contact mechanism.

The above-mentioned and other features and objects of this invention will become more apparent by reference to the following description taken in conjunction with the accompanying drawings, in which:

Fig. 1 is a view in plan of a two panel coordinate switch in accordance with the principles of this invention;

Fig. 2 is a horizontal cross-sectional view of the switch, the section being taken along line 2—2 shown in Fig. 3;

Fig. 3 is a fragmentary view in side elevation of one of the panels;

Fig. 4 is an enlarged view in plan of one section of the switch, the view being taken along line 4—4 of the central portion of one of the panels shown in Fig. 2;

Fig. 5 is a sectional view taken along line 5—5 of Fig. 4; and

Fig. 6 is a cross-sectional view taken along line 6—6 of Fig. 5.

While this invention is shown as a part of an automatic telephone switching system, it will be understood, however, that the invention is also useful in other switching systems wherever selective switching is required.

Referring to the drawings, it will be observed that the switching system comprises two switching panels 1*a* and 1*b* disposed back-to-back with the selector mechanism located therebetween. Each panel includes a frame member 2 and two layers or cards of insulating material 3 and 4. Card 3 has thereon printed circuitry 5, Fig. 3, which constitutes horizontal multiples having terminals at each end of the panel as indicated at 6 and 7. The circuitry 5 may be formed on the card 3 by any one of the many different printed circuit techniques, the circuitry being so arranged as to avoid the openings 8 through which selector rod-like fingers 9 extend, and to provide groups of junctions 10. The card 4 overlies the printed horizontal circuitry 5 and contains thereon in groups passive contacts 11, 12, 13 and 14 each of which is connected by a junction tab 10*a* to a corresponding junction of circuitry 5. Each such group of passive contacts is arranged in horizontal alignment and constitutes with adjacent groups of passive contacts a vertical row across the panel. The flat contact surface of the passive contacts is preferably flashed with nickel and plated with rhodium. While each group of passive contacts is shown to comprise four contacts, it will be recognized by those skilled in the art that each group may be less than four or greater than four depending upon the circuitry associated with each group.

From the foregoing description and reference to the drawing, it is clear that the groups of passive contacts of each panel are arranged in ten vertical rows and that each row has in overlying relation thereto a contact unit 15. Each contact unit 15 comprises a housing having side walls 16 and 17, end walls 18 and 19 and a cover plate 20. The bottom side of the housing is open so that when placed on the panel 1, it encloses a vertical row of passive contact groups. The open side, however, has bridge elements as indicated at 21 and 22, Fig. 5, so arranged as to lie at least between certain groups, or as shown, between adjacent groups of passive contacts. In overlying relation to each horizontal group of passive contacts is a contact pusher member 23 guided by two ribs 24 and 25 contained on the side walls 16 and 17, Fig. 6. The pusher member comprises a semi-tubular frame 26 which has a stem 27 adapted to extend through an opening 28 in the cover plate 20. The semi-tubular frame member is provided with a resilient pad 29, of double tubular stock preferably of silicon rubber for engaging the ribbon contact strip.

Each unit 15 is also provided with four ribbon contact strips 30, 31, 32 and 33. Each strip is preformed by a stamping or other shape forming operation and is mounted at its ends on the step portions 34 of the end walls 18 and 19, the strip overlying the bridge elements such as 21 and 22 and being slotted lengthwise thereof at least in the portions between adjacent bridge elements. Each strip is also provided with U-shaped portions 35 adjacent its ends which enhances the flexibleness of the strip to permit movement of the strip by any one or more of the pusher members. As shown in Fig. 2, the ends of the strips are provided with terminals 36 and 37 which are receivable in the sockets 38 and 39 of each panel.

Referring to Fig. 3, each panel is normally chosen of a size such that ten vertical rows of horizontal contact groups and ten units 15 of active contact strips are employed. Each contact unit 15 has ten pusher members and each vertical row has ten groups of horizontal passive contacts. This provides for a possible selection of 100 different switching connections per panel between the horizontal lines represented by the horizontal groups of passive contacts and those lines represented by the ribbon strips of each of the contact units. Panels having still larger or a smaller number of switching connections are, of course, contemplated. The horizontally disposed con-

ductors which are connected to the passive contacts may be connected from the panel to each of the terminal blocks 6 and 7 or if desired they may be divided between the two terminal blocks. In Fig. 3 such a division is indicated at 40 simply by severing circuitry 5 between the third and fourth units. In such a division, 30 switch connections are associated to terminal block 6 and 70 switch connections are associated with terminal block 7. Other ratios such as 40–60 or 50–50 etc., may be provided by suitably severing the circuitry 5.

As previously mentioned the pusher members 23 are provided with stems 27 which extend through openings 28 in the cover plate of the contact unit. The fit between the stem and the opening is close so that there is little chance of dust working into the contact unit by way of the openings 28. The stem 27 is provided with a shoulder 41 which is adapted to be engaged by a selecting spring 42, Figs. 4 and 5. The spring 42 is anchored on a holding or vertical bar 43 as indicated at 44. While the spring 42 is preferably a simple helical coil to insure proper resilience and durability, it may take any one of several different forms so long as it is sufficiently resilient and yet provide the desired interlocking operation between the stem of the pusher member 23 and the vertical bar 43. As shown in Fig. 6, one end 42*a* is clamped between the two parts 43*a* and 43*b* while the other end 42*b* is free for limited movement in the slot 43*c*, Fig. 5. The position of the selecting spring 45 represents the normal position of the selecting springs while the position of the spring 42 is that assumed upon actuation by a selecting finger 9. It will be understood by those skilled in the art that the sequence of operation is first the movement of the selecting finger 9 to move one or the other of the springs 42 or 45 to a selecting position overlying the shoulder 41 on the associated pusher member. The next movement is that of the vertical bar 43 which pivots downwardly against the end 42*b* of the actuated spring 42, thereby forcing the pusher member 23 against the ribbon contacts. These two movements are caused by electromagnets, the selecting finger 9 being connected to a selecting horizontal bar 46 which in turn is connected to an armature 47 adapted to be attracted by one or the other of magnets 48 and 49. The horizontal bar 46 is pivoted by journals 51 and 52. As shown in Fig. 2, the magnet 48 has attracted the armature 47, thereby causing the selecting finger 9 to move to the right, Figs. 2 and 5, thereby actuating the spring 42 to engage the shoulder 41 of pusher member 23. Should the magnet 49 attract the armature 47, the selector finger 9 would then move to the left and engage the spring 45. In association with each of the horizontal bars 46 is a horizontal normal contact unit 53 and a restoring spring 54 which are engaged by an arm 55 carried by the bar 46. The vertical bar 43 is pivoted on the frame of the panel 1 as indicated at journals 56 and 57, Figs. 2 and 3. Each of the bars 43 is provided with an armature 58 which is associated with an electromagnet 59 whereby the bar 43 is pivotally actuated in a clockwise direction as viewed in Figs. 3 and 6 to actuate any pusher member that may be engaged by a selecting spring.

Each of the ribbon contact strips 30—33 is provided with longitudinal slots to render the strip more flexible and also to provide the strip with a pair of relatively independent contact dimples in overlying relation to the adjacent passive contact. Two such dimple contacts are shown at 60 and 61 in Fig. 6. The strip is divided between the two dimple contacts by the slot 62. The slot adds independent resilience to the contact points. It is also preferred to have the U-shaped portion 35 slotted as indicated at 63. The material for the ribbon strips is preferably copper or brass clad at least on the contact side with a flash of nickel and coated in the area of the dimple contact with a layer of rhodium. The passive contacts 11 to 14 as well as the dimpled portions of the strip are plated and coated with rhodium to insure durable pressure type contacts. If desired, the dimpling effect may be provided on the passive contacts 11—14 instead of on the strips 30—33, although the latter is preferred.

To summarize the operation of the switching action per panel it may be assumed that the electromagnet 48 is energized to rock the selecting horizontal bar 46 causing finger 9 to move the spring 42 in overlying relation to the shoulder 41 of pusher member 23. The next energization of the electromagnet 59 rocks the vertical holding bar 43 clockwise to engage spring portion 42*b* and force the pusher member against the associated ribbon contact strips 30—33. The resilience of the foot pad 29 of the pusher member 23 insures distributed contact pressure for each of the ribbon strips 30—33 forcing the contact dimples 60 thereof into pressure engagement with the associated group of passive contacts 11—14. The holding bar 43 remains in a holding position until its associated magnet 49 is deenergized whereupon the bar rotates counterclockwise to another position thereby releasing spring 42 and pusher member 23 to return to their normal positions. While the vertical bar 43 is in holding position, the selecting finger 9 is left free to move for selective actuation of the spring 45.

The structural features of the units 15 including the housing thereof in combination with the pusher members and the active conductor strips and also the details of the pusher members per se and the rhodium coating of the contact points comprise the subject matter of the copending application of G. F. McCarthy and A. N. Gulnick Serial No. 482,806, filed January 19, 1955. The broad features of switch operation from the electromagnets through the selecting fingers, vertical bars, pusher members, conductor strips and the passive contacts of the printed panel, also the details of the vertical bar and helical springs carried thereby, the conductor strip configuration and certain details of the panel, per se, comprise the subject matter of copending application of W. Hatton and G. F. McCarthy, Serial No. 532,719, filed September 6, 1955.

The present invention is directed to the provision of the double, compact back-to-back panel arrangement and the location of selector bars and electromagnets common to the two panels between the panels with selector rods or fingers extending through openings in the printed panels for simultaneous actuation of corresponding select springs of the two panel sections of the switching system. Referring particularly to Figs. 1, 2 and 3 the two back-to-back panel sections are indicated at 1*a* and 1*b*. A U-shaped frame 61 (Fig. 1) supports the two panels and also the selector bars 46 and the electromagnets 48 and 49. The bars 46 are each journalled on bearing pins 51 and 52 adjustably supported on the frame 61, Fig. 3. This arrangement not only makes for a compact arrangement but the same bars 46 are utilized for both panels. This location of the bars 46 leaves the face of each panel exposed for inspection and easy access.

While we have described above the principles of our invention in connection with specific apparatus, it is to be clearly understood that this description is made only by way of example and not as a limitation to the scope of our invention as set forth in the objects thereof and in the accompanying claims.

We claim:

1. A coordinate switching system comprising two panels arranged back-to-back, each of said panels having on the front side thereof a plurality of passive contacts interconnected in groups to form horizontal multiples, parallel ribbon-like strips overlying said passive contacts a plurality of active contacts interconnected in groups to form verticals, contact actuating means for each of said verticals, and a plurality of contact selectors one for each of said active contacts, said contact actuating means being selectively operable to force any selected active contact in their associated verticals into engagement with a

corresponding passive contact; a selector conditioning means common to both of said panels disposed between said panels, each of said panels having openings therethrough, said selector conditioning means having fingers extending through at least certain of the openings in each of said panels in coactive relation with at least one of said contact selectors per vertical, and means to actuate said selector conditioning means to condition a contact selector in each of the verticals of said panels.

2. A coordinate switching system according to claim 1, wherein said selector conditioning means include rocking members, and each of said fingers is disposed between two adjacent contact selectors for alternate conditioning thereof depending upon the direction of movement of said rocking members.

3. A coordinate switching system comprising a frame, two cross-bar switching panels each having on the front side thereof contiguous flexible, ribbon-like strips providing active contacts and rows of passive contacts and mechanism to effect selective closure between said active and passive contacts, means mounting said panels in a back-to-back relation on opposite sides of said frame, contact selector means disposed between said panels for rocking movement on said frame, each of said panels having openings therethrough, said contact selector means having fingers extending through the openings of each panel in coactive contact selecting relation with said mechanism, and means to rock said means to control selective contact closure by said mechanism.

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