

March 12, 1968

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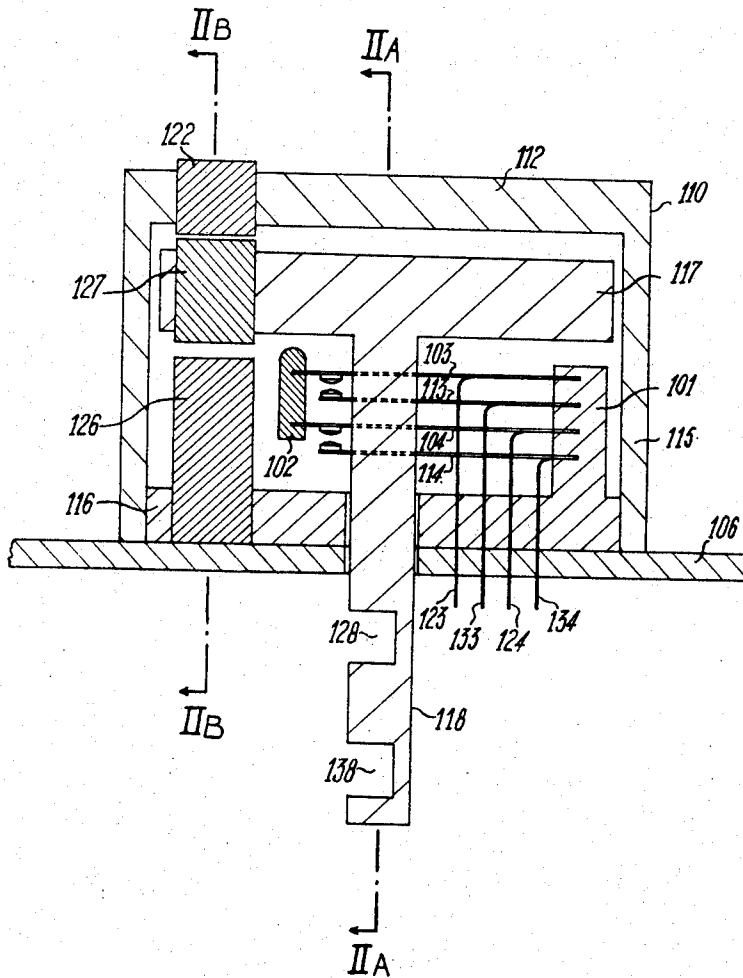
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CO-ORDINATE SELECTION SWITCHES

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Fig. 3



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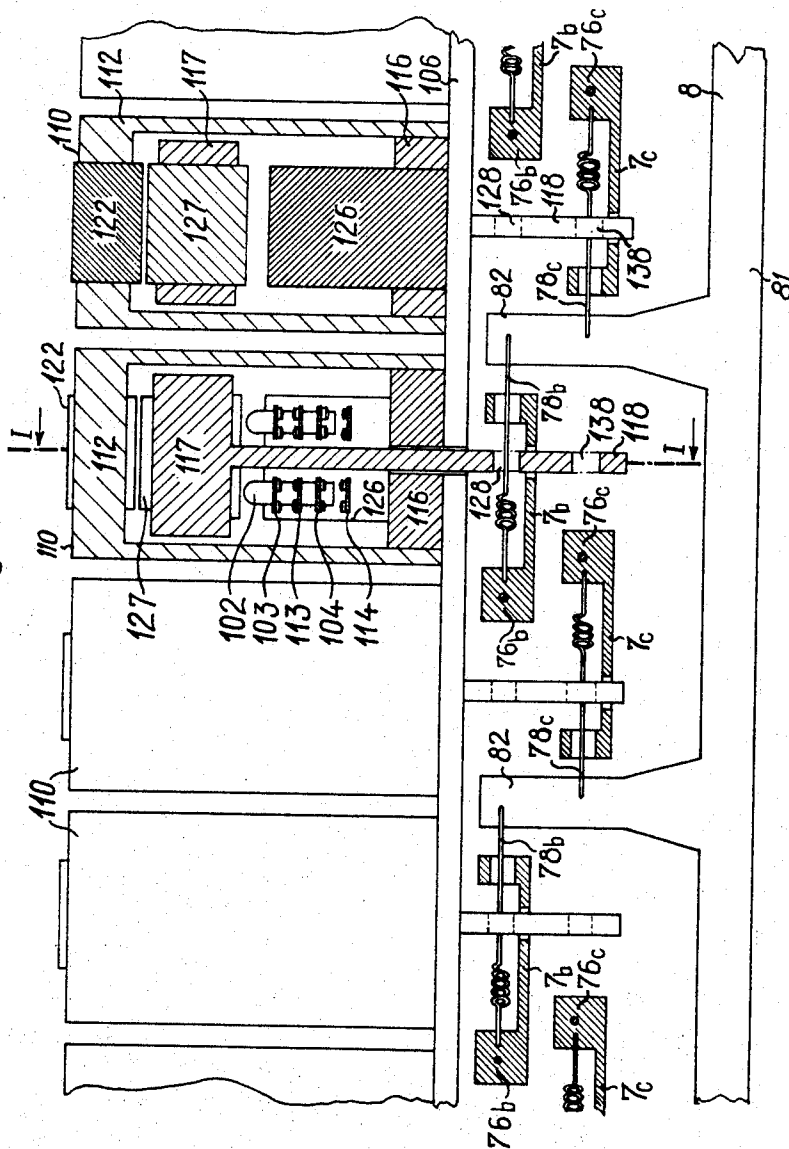
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Fig. 4



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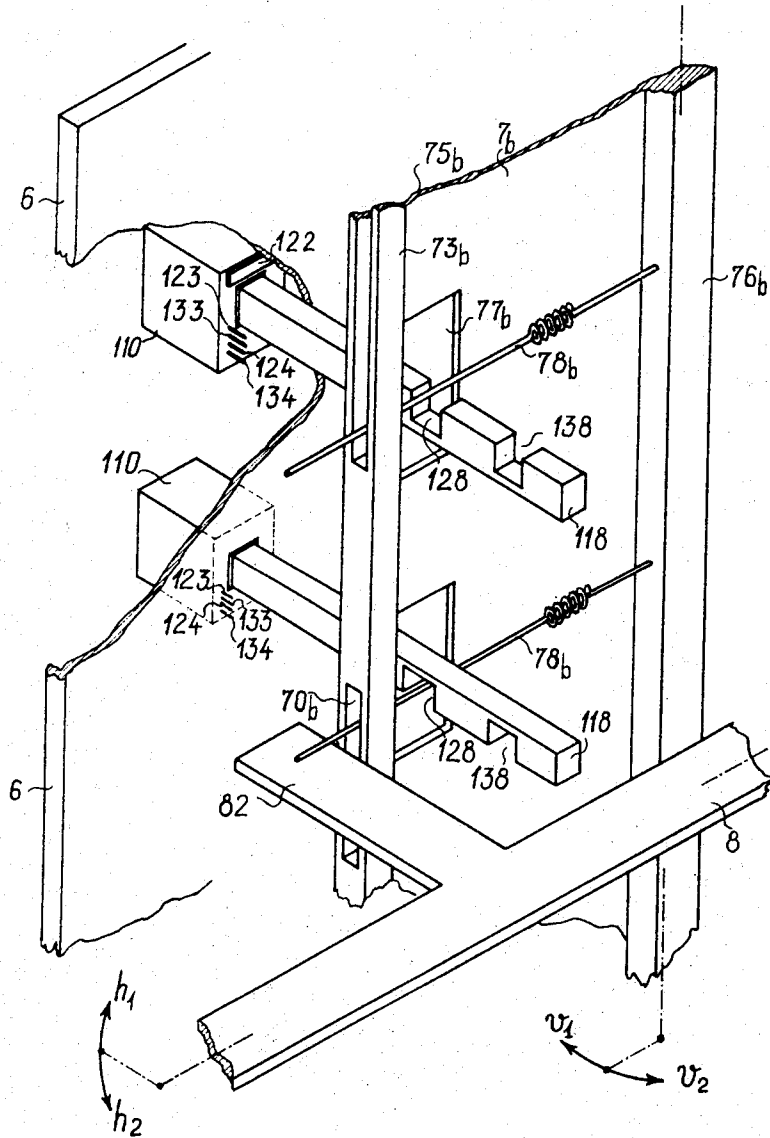
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CO-ORDINATE SELECTION SWITCHES

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Fig.5



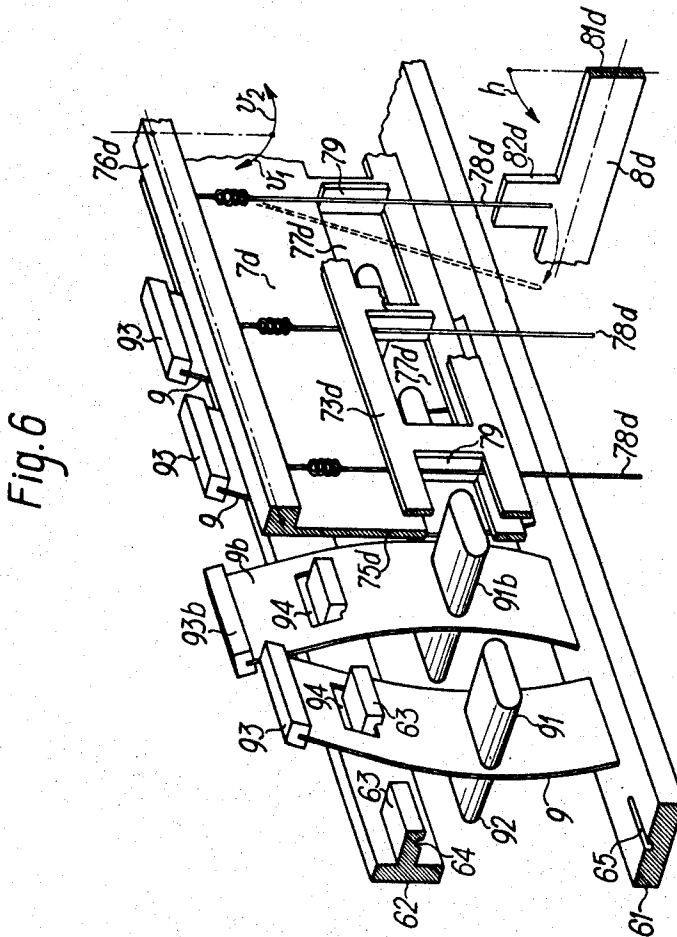
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CO-ORDINATE SELECTION SWITCHES

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CO-ORDINATE SELECTION SWITCHES

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Fig. 7

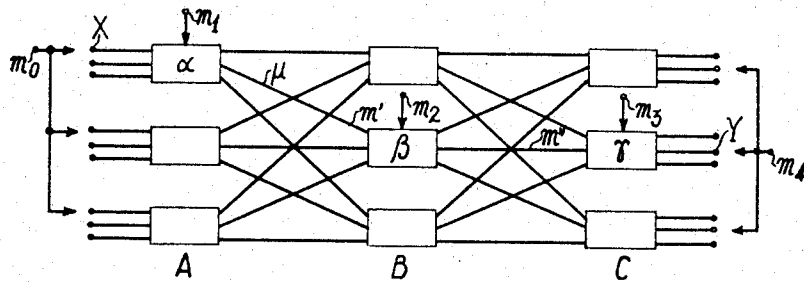
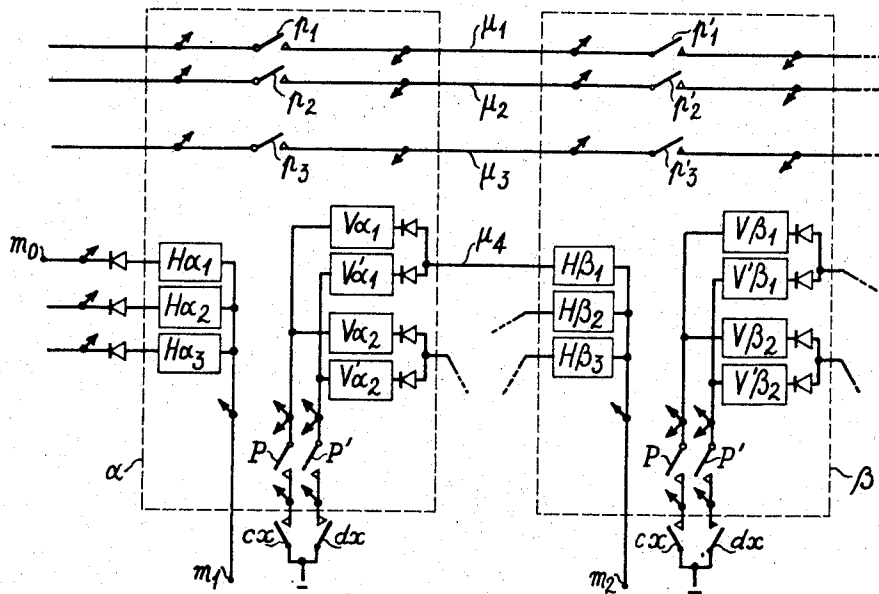


Fig. 8



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CO-ORDINATE SELECTION SWITCHES

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6 Claims. (Cl. 335—112)

The present invention relates to improvements to crosspoint assemblies with co-ordinate selection.

It is known that a co-ordinate-selection switching stage, for example of the crossbar type, appears in the form of a rectangular matrix of crosspoints constituted by sets of make contacts between fixed blades which are multiplied vertically for example and movable blades which are then multiplied horizontally and with each of which there is associated a flexible finger enabling it to be controlled individually by successive manoeuvres of a horizontal selection bar and of a vertical holding bar, the first of which guides the control fingers for the sets of contacts from a given level between these and the vertical bars in such a manner that the operation of a vertical bar which has no effect on the crosspoints of the unselected levels closes the set of contacts of the selected level and holds it by wedging of its control finger when the horizontal selection bar returns to normal, the connection thus remaining in existence until the vertical holding bar is restored to normal.

This arrangement leads to the necessity of maintaining the energizing current for the electro-magnets controlling the vertical bars for the whole duration of the calls established by means thereof.

Co-ordinate selection switches are likewise known comprising crosspoints which are equipped with devices for locking in the operating position in such a manner that holding them in operation does not consume any power but these switches generally comprise fragile or complicated selection or interlocking members.

Finally, co-ordinate selection switches are known, the crosspoints of which have two positions of mechanical stability, one inoperative and the other operative, in which contacts mounted round a movable part are respectively opened and closed, the changeover from one of these stable positions of equilibrium to the other being effected by a movement of translation of the movable part under the action of a selection rod which is controlled to render it operative by the manipulation of two coordinate bars and which remains imprisoned in the selection position when the crosspoint is operative in such a manner that the manipulation of one of the co-ordinate bars is sufficient to restore it to rest.

One object of the invention is to permit the control of a bistable crosspoint, both to render it inoperative and to render it operative, through the combined action of two co-ordinate bars, these being in their position of rest at all other times.

A further object of the invention is to obtain complete independence between the co-ordinate selection mechanism of a switch of the kind in question and the multiples between the contacts of the crosspoints.

A further object of the invention is to increase the reliability and the duration of operation of crosspoint manipulated by translation of a movable part having two stable positions of equilibrium.

According to the invention, in a co-ordinate selection switch comprising horizontal selection bars, vertical control bars and crosspoints arranged along the horizontal rows and the vertical columns of a rectangular matrix, and each of which comprises at least one set of contacts and one intermediate part equipped with an operating

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member, under the action of which it can be subjected to a movement of translation between two stable end positions of equilibrium in which said contacts are respectively opened and closed, each of said vertical bars being in the form of a rectangular panel capable of pivoting in one direction and in the other about one of its large vertical sides, pierced with apertures allowing free passage to the operating members of the crosspoints of a vertical column and carrying selection fingers individually associated with said crosspoints, said selection fingers having one of their ends resiliently embedded in a flange of the vertical bar which carries them in the vicinity of its pivotal axis and their other end engaged in a vertical slot in the opposite flange of said panel in such a manner that in the position of rest they are not in engagement with the operating members for the crosspoints and that their only possible movement is a bending movement in a plane parallel with said panel, and each of said horizontal bars enables the selection fingers of a horizontal row of crosspoint to be displaced in such a manner as to cause them to come into engagement with said operating members whereby the selection of a horizontal row of crosspoints being effected by the manipulation of a horizontal bar, the rendering operative and the rendering inoperative of a given crosspoint in said row is effected by the manipulation of the appropriate vertical bar in one direction and in the other respectively.

The invention will be better understood on reading the following description and examining the accompanying drawings in which:

FIG. 1 is a basic diagram showing, in perspective, the arrangement of the co-ordinate bars enabling a crosspoint to be caused to operate which has two positions of mechanical stability in accordance with the first embodiment of the invention;

FIG. 2 shows diagrammatically and in partial section a modification of the device of FIG. 1;

FIG. 3 is a diagram of a crosspoint with two positions of magnetic stability in accordance with the second embodiment of the invention seen in section on the line I—I of FIG. 4 in the direction indicated by the arrow;

FIG. 4 is a diagram of a portion of an automatic switch comprising crosspoints in accordance with FIG. 3, two of which are seen in section along the lines IIA—IIA and IIB—IIB in FIG. 3 respectively;

FIG. 5 is a perspective view showing the arrangement of two of the co-ordinate bars of the automatic switch of FIG. 4;

FIG. 6 is a diagram showing, in perspective, a mechanism enabling crosspoints without any inherent stability to be operated in accordance with the invention;

FIG. 7 is a basic diagram of a multi-stage switching network; and

FIG. 8 is a basic diagram of an example of using switches in accordance with the forms of construction of FIGS. 1 to 6 in the network of FIG. 7.

The crosspoints 10, the external shape of which is only visible in FIG. 1, one of them being illustrated in axial section in FIG. 2, are adapted to establish and interrupt the contact between resilient wires such as 3, 4 passing through an insulating plate 5 and fixed blades 11 to 14 carried by an insulating supporting plate 6. The multiplying of the contacts may be effected, for example, by means of printed circuits in the vertical direction on the plate 6 for the fixed contacts 11 to 14 and in the horizontal direction on the rear plate 5 for the connections of the four corresponding movable contacts, only two of which 3 and 4 are visible on the drawings, of each crosspoint 10. Each of these comprises a cylindrical or prismatic sleeve 15 which passes through the supporting plate 6 and is fixed thereto. The sleeve 15 is closed at one

end by an insulating stopper 16 through which there penetrate the wires such as 3 and 4. An intermediate member 17, of moulded insulating material, is threaded into the sleeve 15 by its end opposite to the stopper 16 and can slide in this under the action of a hook 18 which extends beyond the sleeve 15 in the general axial direction. The intermediate member 17 comprises a cylindrical or prismatic portion in which there is fitted the hook 18 and which is extended, at the opposite side to this, by a portion with a frusto-conical section adapted to urge outwards, the ends of the wires such as 3 and 4 which are bent in consequence, when the member 17 is driven into the sleeve 15. The latter is drilled, opposite the ends of the wires such as 3 and 4, with elongated apertures allowing them to come into contact with the fixed blades such as 13 and 14.

Referring in particular to FIG. 1, it will be seen that the vertical wires 7 are elongated rectangular panels of which the central portion 75 is bounded on the one hand by an upright 76, pivoting about itself in one direction or the other under the action of two electro-magnets, not illustrated, about a mid position in which the panel 75 is parallel with the supporting plate 6, and on the other hand by a flange 73 pierced by apertures 70. Opposite each of the crosspoints 10 controlled by a vertical bar 7, the panel 75 of this is pierced, in the vicinity of the flange 73, with an aperture 77 through which the hook 18 of the corresponding crosspoint passes freely. Each aperture 77 is traversed by a flexible selection finger 78 consisting, for example, of a steel wire, one end of which is embedded in the upright 76 and which comprises, in the vicinity of this, a spiral-wound spring section adapted to urge it resiliently towards a horizontal position of rest parallel with the panel 75 in which it passes close to the notched side of the corresponding hook 18 without penetrating into its notch 180. The free end of each selection finger passes through an aperture 70 which holds it in a plane parallel with the panel 75 while leaving it free for displacement in this plane.

The horizontal bars 8 comprise an actual bar 81 arranged at the side of the vertical bars opposite to the crosspoints, adapted to pivot about itself and carrying, for each column of crosspoints, a cross-piece 82 extending beyond the corresponding vertical bars close to its flange 73 and capable of acting on the selection finger 78 of one or two of them according to their arrangement and the number of electro-magnets controlling the horizontal bar. The arrangement illustrated in FIG. 1 in which the hooks of the crosspoints of each column are alternately directed upwards and downwards enables each horizontal bar to control two rows of crosspoints, the one under the action of a first electro-magnet causing the cross-pieces 82 to pivot upwards as indicated by the arrow h_1 , and the other under the action of a second electro-magnet causing them to pivot downwards as indicated by the arrow h_2 .

When the horizontal bars 8 are in the state of rest, since the selection fingers 78 are not engaged in the notches 180 of the hooks 18, the movements v_1 and v_2 of the vertical bars 7 have no effect on the crosspoints 10 and furthermore the mechanism constituted by the vertical bars 7 and horizontal bars 8 with their control electro-magnets can be withdrawn through a movement of translation perpendicular to the supporting plate 6 of the crosspoints 10 without any displacement of the intermediate members 17 which remain in their housing 15.

When the horizontal bar 8 effects the movement h_1 , the end of the cross-piece 82 acting on the end of the finger 78 pushes this to the bottom of the notch 180 in the hook 18. According to whether the crosspoint 10 is then in the state of connection or of disconnection, that is to say according to whether the intermediate member 17 has been brought into the pushed or pulled state by the previous operation, the finger 78 is then against the outer or inner edge of the notch 180.

If the crosspoint 10 is in the state of disconnection for

example, the movement of the vertical bar 7 adapted to cause it to change over into the state of connection takes place in the direction of the arrow v_1 . The finger 78, driven by the bar 73, bears against the edge of the slot 180 closest to the intermediate member 17 and urges this in the direction of the arrow x_1 until the end of its travel in which the connection is effected. The return to rest of the bars 8 and 7 releases the finger 78 from the notch 180 without any effect on the member 17 which remains in its pushed state.

In order to open the contacts of the crosspoint 10, the horizontal bar 8 is restored by the movement h_1 into the same operating position as for the previous operation, the finger 78 then coming against the outer edge of the notch 180, then the vertical bar 7 is driven in rotation in the direction of the arrow v_2 . The finger 78, driven by the edge of the aperture 70 reaching to the panel 75, thus pulls the intermediate member 17 and causes it to execute the movement x_2 which brings it to the end of its travel in which the disconnection is effected. The return to rest of the bars 8 and 7 releases the finger 78 from the notch 180 without any effect on the member 17 which remains in its pulled state.

The movement of the bar 7 returning to rest is sufficiently dampened for this not to pass substantially beyond its position of equilibrium which enables the return to rest of the bars 7 and 8 to be controlled simultaneously without risk of entraining the intermediate member 17.

FIG. 2 is a partial view in plan, partially in section, of a switch, the operation of which is identical with that in FIG. 1 but the structure of which is more compact as a result of a particular arrangement of its vertical bars. These are oriented alternately towards the right and towards the left and arranged slightly obliquely in such a manner as to be able to overlap without their movements being hampered, in such a manner that each cross-piece 82 of a horizontal bar acts simultaneously on the fingers of the same level 78b, 78c of two vertical bars 7b, 7c. In order to facilitate the comparison between the bars 7b orientated in one direction and the bars 7c orientated in the other with the bars 7 of FIG. 1, the same reference numerals with the letters b or c as an index designate the corresponding portions thereof.

FIGS. 3, 4 and 5 relate to the case where the stability of the crosspoints in each of their positions of equilibrium is afforded by magnetic means.

The crosspoints 110 comprise, as can be seen in particular in FIGS. 3 and 4, a casing, which may be parallelepiped for example, consisting of a base 116 fixed to an insulating plate 106, of a head 112 and of lateral walls 115 between which a piston 117 can slide over a short stroke under the action of a control rod 118 which is rigidly connected thereto and which passes through the base 116 and the supporting plate 106. The control rod 118 may be rectangular in section for example and deeply notched at one of its faces, with two notches 128, 138 which form two hooks with parallel faces by either of which it can be pushed or pulled parallel to its axis. Embedded in the piston head 117 is a permanent magnet 127 in the extension of which, parallel with the axis of the piston rod 118, two ferromagnetic members 122 and 126 are fitted respectively into the head 112 and the base 116 of the casing of the crosspoint 110. The member 122 may be of soft iron for example and the member 126 is preferably a permanent magnet having the opposite orientation to the magnet 127. The members 122 and 126 serve as end stops for the magnet 127 and thus ensure the stability of the piston 117 in two end positions.

Between the piston head 117 and the base 116 there are arranged sets of contacts conventionally stacked and mounted as shown in FIG. 3 on a contact block 101 rigidly connected to the base 116 and comprising, for example, two fixed blades 113, 114 and two movable blades 103, 104 connected at their opposite end to the block 101 by an insulating member 102 which is extended axially in

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the direction of the piston head 117 by a length such that when this is in its position of equilibrium known as the operating or connection position in which the magnet 127 is in abutment against the magnet 126, the contacts between the movable blades 103, 104 and fixed blades 113, 114 are respectively closed and when the piston 117 is in a position of rest with the magnet 127 in abutment against the soft iron member 122 these contacts are open. The blades 103, 104, 113, 114 are respectively equipped with connecting conductors 123, 124, 133, 134 which pass through the base 116 and the insulating plate 106 to be appropriately multiplied, for example by means of printed circuits, on said insulating plate. The arrangement of the stacks of contact blades and the number thereof in each stack are selected as a function of the number of circuits to be switched simultaneously, the example given in FIGS. 3 and 4 being in no way limiting.

FIG. 4 also shows a modification of the compact structure of an automatic switch with bistable crosspoints illustrated in FIG. 2. In order to facilitate the comparison between FIGS. 2 and 4 the selection bars are designated by the same reference numerals there. This modification has the advantage of avoiding the obliqueness of the vertical bars 7b, 7c in the position of rest with respect to the supporting plate 106 as a result of the alternate use of the hook 128 or of the hook 138 of the cross-points 110 of one level. The cross-pieces 82 of the horizontal bars 8 consequently have the required length for each of them to act simultaneously on the selection fingers 78b and 78c of two contiguous vertical bars 7b, 7c having their axes of rotation respectively comprised in their up-rights 76b, 76c which are furthest from the cross-piece 82 in question.

FIG. 5, which is similar to FIG. 1, shows two cross-points 110 corresponding to FIGS. 3 and 4 which are controlled by one and the same vertical bar 7b and selected by two different horizontal bars, only one of which 8 is illustrated for the sake of clarity in the drawing. Comparing this partial illustration with that in FIG. 4 it will be seen that the vertical bar 7b of which the selection fingers 78b are associated with the notches 128 of the operating rods 118 of the crosspoints 110, is framed by two vertical bars 7c, the selection fingers 78c of which are associated with the notches 138 of the operating rods of the adjacent crosspoints.

FIG. 6 shows a mechanism enabling crosspoints to be operated which have no inherent stability, in the same manner as the bistable crosspoints described above.

Associated with each of the crosspoints is a blade 9 carrying, substantially one third along its length, a pair of opposite transverse push-pieces 91, 92, at its opposite end an insulating push-piece 93 and about half-way between this and the pair of push-pieces 91, 92 an aperture 94. The blades 9 are mounted on parallel cross-pieces 61, 62 of a supporting frame connected to the main frame, of which the first, 61, comprises grooves or channels 65 in which are engaged the ends of the blades 9 opposite to their push-piece 93, and the second 62 carries lugs 63 which are engaged in the apertures 94 and constitute a shoulder out of which is hollowed a groove 64 in which there is engaged the edge of the aperture 94 closest to the end of the blade engaged in the groove 65. The distance between the bottom of this and the bottom of the groove 64 being slightly less than the length of the blade between the edges which are engaged therein, the blade 9 is held with resilient bending in one or the other of two stable positions of equilibrium 9a, 9b which are symmetrical with respect to the plane of the grooves 64, 65 and in which its terminal push-piece 93 respectively occupies a first position 93a in which the associated crosspoint is inoperative and a second position 93b in which it is operative.

Vertical bars 7d, only one of which is illustrated, are arranged one at each side of each frame such as 61, 62 carrying a series of aligned blades 9, such frames alter-

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nating with the vertical bars 7d. These are elongated rectangular panels, of which the central portion 75d is, on the one hand, bounded by a reinforced portion 76d the axis of which is parallel with the cross-pieces 62 and 63, and on the other hand pierced by apertures 77d opposite the transverse push-pieces 91 or 92 of the blades 9. Selection fingers 78d are resiliently fitted into the reinforced portion 76d in such a manner that, in the position of rest, each of them is perpendicular to the axis thereof and is directed parallel with the panel 75d along one edge of an aperture 77 provided with a reinforced portion 79 adapted to serve as a stop. Frames 73d framing the apertures 77d and fixed parallel to the panel 75d at a short distance therefrom only allow the fingers 78d a single degree of freedom in a plane parallel with the panel 75d. Each vertical bar 7d can effect two movements of rotation in opposite directions v_1 and v_2 about the axis of its reinforced portion 76d under the action of two electromagnets not illustrated. When the selection fingers 78d are at rest, the transverse push-pieces 91 or 92 of the blades 9 pass freely through the apertures 77d.

The horizontal bars 8d are arranged perpendicular to the plane of the frames 61, 62 and comprise an actual bar 81d which can effect a single movement of rotation h about itself and which carries, opposite each vertical bar which it crosses, a crosspiece 82d in engagement with the free end of a selection finger 78d. When the horizontal bar 8d effects the movement h , it pushes all the selection fingers in one horizontal row in such a manner as to move them away from the supporting reinforcement 79 and to cause them to block the central portion of the aperture 77 level with the lateral push-pieces 91, 92 as indicated in broken lines in FIG. 6. After this selection, for a disconnection, the vertical bar 7d situated at the same side as the lateral push-piece 91, of the blade 9b which is operated and has to be restored to normal, is actuated in the direction v_1 , and for a connection, the vertical bar symmetrical therewith with respect to the frame 61, 62 is actuated in the direction v_2 . After each actuation, the coordinate bars are restored to rest.

It will be seen that the crosspoints controlled by the push-pieces 93 of the blades 9 may be of very different types and in particular may consist of stacks of conventional contacts which their own resilience holds open when the corresponding blade 9 is in a disconnection position 9a and which are held in the closed position by the terminal push-piece 93b of a blade in the connection position 9b. The assemblies of contact stacks thus actuated may be mounted in a totally independent manner above the control mechanism of FIG. 6.

FIG. 7 illustrates diagrammatically, in the form of single lines, a simplified example of a switching network with three stages of switches A, B, C. A path between an incoming line X connected to a switch α of the stage A and an outgoing line Y connected to a switch γ of the stage C is defined when a switch β of the stage B is selected. The crosspoints of these switches being assumed to be bistable by nature or through use of the mechanism of FIG. 6, their operation, like their return to rest, requires the operation of a horizontal and a vertical bar of each switch and the links constituting the selected route are designated by the coincidence of two markings. The three switches α , β , γ used by the route are designated by three individual markings m_1 , m_2 , m_3 which characterize them among the switches of their stage. Moreover end markings m_0 and m_4 designate the rank of the input X and of the output Y in question. Thus the input link X is designated by the markings m_0 and m_1 , the link μ connected the stages A and B by the markings m_1 and m_2 , the link connecting the switches β and γ by m_2 and m_3 and the output link Y by m_3 and m_4 .

FIG. 8 illustrates two switches α and β in each of which there is only illustrated a single crosspoint with three contacts p_1 , p_2 , p_3 and p'_1 , p'_2 , p'_3 three electromagnets of horizontals $H_{\alpha 1}$, $H_{\alpha 2}$, $H_{\alpha 3}$ and $H_{\beta 1}$, $H_{\beta 2}$, $H_{\beta 3}$

and two pairs of electro-magnets of verticals $V_{\alpha 1}$, $V'_{\alpha 1}$ and $V_{\alpha 2}$, $V'_{\alpha 2}$ on the one hand, $V_{\beta 1}$, $V'_{\beta 1}$ and $V_{\beta 2}$, $V'_{\beta 2}$ on the other hand. The electro-magnets which may concern the crosspoint $p_1 p_2 p_3$ illustrated are, for example, the electro-magnet of horizontal $H_{\alpha 1}$ and the electro-magnets of vertical $V_{\alpha 1}$ and $V'_{\alpha 1}$. Similarly, those which may concern the point $p'_1 p'_2 p'_3$ may be for example $H_{\beta 1}$, $V_{\beta 1}$ and $V'_{\beta 1}$.

A link such as μ between two switches α and β comprises four wires, three of which are switched over by the contacts such as p_1 , p_2 , p_3 of the corresponding crosspoint, two line wires μ_1 , μ_2 , a third wire μ_3 devoted to the busy tests for the links and to the identification of routes, and a fourth wire μ_4 serving for the coincidence marking.

The electro-magnets of horizontals $H_{\alpha 1}$, $H_{\alpha 2}$, $H_{\alpha 3}$ of the switch α are connected on the one hand, in parallel, to the marking point m_1 , on the other hand individually to the marking points such as m_0 of the various input links of the switch α by means of diodes which avoid mixing through return circuits.

The electro-magnets of vertical $V_{\alpha 1}$, $V'_{\alpha 1}$ are connected, on the one hand in parallel, by means of diodes and of the wire μ_4 , to the electro-magnet of horizontal $H_{\beta 1}$ of the switch β , on the other hand to a negative source, the first by means of a make contact P, symbolizing connection in parallel of make contacts carried by all the horizontal bars of the switch α , and of a contact cx , the closing of which characterizes a connection instruction, the second by means of a contact P' similar to P and to the contact dx , the closing of which characterizes a disconnection instruction.

The electro-magnets of vertical $V_{\alpha 2}$ and $V'_{\alpha 2}$ are similarly connected on the one hand to a horizontal electro-magnet of a switch of the stage B other than switch α , and on the other hand respectively to the same contacts P and cx in series and P' and dx in series as the electro-magnets $V_{\alpha 1}$ and $V'_{\alpha 1}$.

The electro-magnets of horizontals $H_{\beta 1}$, $H_{\beta 2}$, $H_{\beta 3}$ are connected on the one hand in parallel to the marking point m_2 , on the other hand, the first to the switch by the link μ_4 and the others to different switches in the stage A in the same manner. The connections of the electro-magnets of verticals of the switch β may be deduced from the connections of the electro-magnets of verticals of the switch α by simple offsetting of the stages concerned.

When a route to be connected or to be disconnected is determined, the appropriate markings m_0 , m_1 , m_2 . . . are applied and according to whether it is a question of connection or disconnection, the common contacts cx or dx are established. The coincidence of m_0 and m_1 permits the energizing of the electro-magnet of horizontal $H_{\alpha 1}$, for example, thus designated. The operation of the horizontal bar 8 causes the engagement of the selection finger 78 which it controls and the closing of the contacts P and P'.

If it is a question of a connection, since the contact cx is closed, a circuit is established through the marking m_2 and the wire μ_4 as soon as P is closed, from which it follows that the electro-magnets $V_{\alpha 1}$ and $H_{\beta 1}$ come into operation simultaneously. The crosspoint of the switch corresponding to $H_{\alpha 1}$ and to $V_{\alpha 1}$ is then operated. At the same time, the marking m_2 is transferred from the vertical side of the matrix β by the closing of the contact P associated with the electro-magnet $H_{\beta 1}$. Propagation of the marking results and the crosspoints of the route are established in cascade.

For a disconnection, the process is identical except that, since the contacts dx are closed, it is the disconnection electro-magnets such as $V'_{\alpha 1}$, $V'_{\beta 1}$ which function.

What is claimed is:

1. A crossbar switch comprising a rectangular matrix, crosspoints arranged along the horizontal rows and vertical columns of said matrix, horizontal selection bars and vertical control bars, each of said crosspoints comprising at least one set of contacts and one intermediate

member equipped with an operating member under the action of which it can be subjected to a movement of translation between two stable end positions of equilibrium in which said contacts are respectively opened and closed, each of said vertical bars being in the form of a substantially rectangular panel adapted to pivot in one direction and in the other about one of its large vertical sides, pierced with apertures affording free passage to the operating members for the crosspoints of a vertical column and carrying selection fingers individually associated with said crosspoints, said selection fingers having one of their ends resiliently fitted into an edge of the vertical bar which carries them in the vicinity of its pivotal axis and their other end engaged in a vertical slot in the opposite edge of said panel in such a manner that, in the position of rest they are not in engagement with the operating members of the crosspoints and that their only possible movement is bending in a plane parallel with said panel, and each of said horizontal bars allows the selection fingers of a horizontal row of crosspoints to be displaced in such a manner as to cause them to come into engagement with said operating members whereby the selection of a horizontal row of crosspoints is effected through the operation of a horizontal bar, and the rendering operative and inoperative of a given crosspoint in said row is effected through the operation of the appropriate vertical bar in said one direction and in said other direction respectively.

2. A crossbar switch as claimed in claim 1, in which said horizontal bars have two opposite movements enabling them to serve two adjacent rows of crosspoints, and said vertical bars have alternate orientation and are overlapping whereby a compact arrangement is obtained.

3. A crossbar switch as claimed in claim 1, comprising three parts which are easily assembled, the first of which comprises the movable contacts and their multiplying, the second of which comprises the guide cylinders or prisms for the intermediate members, the associated fixed contacts and their multiplying, and the third of which comprises the co-ordinate bars and their control electro-magnets.

4. A crossbar switch comprising a rectangular matrix, crosspoints arranged along the horizontal rows and vertical columns of said matrix, horizontal selection bars and vertical control bars, each of said crosspoints comprising at least one set of contacts and one intermediate member equipped with an operating member under the action of which it can be subjected to a movement of translation between two end positions in which said contacts are respectively opened and closed, magnetic means ensuring the stability of said intermediate member in each of said end positions, each of said vertical bars being in the form of a substantially rectangular panel adapted to pivot in one direction and in the other about one of its large vertical sides, pierced with apertures affording free passage to the operating members for the crosspoints of a vertical column and carrying selection fingers individually associated with said crosspoints, said selection fingers having one of their ends resiliently fitted into an edge of the vertical bar which carries them in the vicinity of its pivotal axis and their other end engaged in a vertical slot in the opposite edge of said panel in such a manner that, in the position of rest they are not in engagement with the operating members of the crosspoints and that their only possible movement is bending in a plane parallel with said panel, and each of said horizontal bars allows the selection fingers of a horizontal row of crosspoints to be displaced in such a manner as to cause them to come into engagement with said operating members whereby the selection of a horizontal row of crosspoints is effected through the operation of a horizontal bar, and the rendering operative and inoperative of a given crosspoint in said row is effected through the operation of the appropriate vertical bar in said one direction and in said other direction respectively.

5. A crossbar switch as claimed in claim 4, in which said crosspoints comprise a piston composed of a head in which is incorporated a permanent magnet and a rod equipped with two operating hooks, said piston head being adapted to slide inside a casing between two stops constituted by ferro-magnetic pieces, in such a manner that said piston has two stable positions of equilibrium in which said contacts are open and closed, said permanent magnet being respectively in abutment against the first and the second of said ferro-magnetic pieces.

6. A crossbar switch as claimed in claim 1, in which the stability of said intermediate member in each of its end positions is ensured by means of a spring leaf in a

state of compression with two stable positions of equilibrium by means of which the movement of translation which causes it to pass from one to the other of said end positions is transmitted thereto.

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