

April 27, 1943.

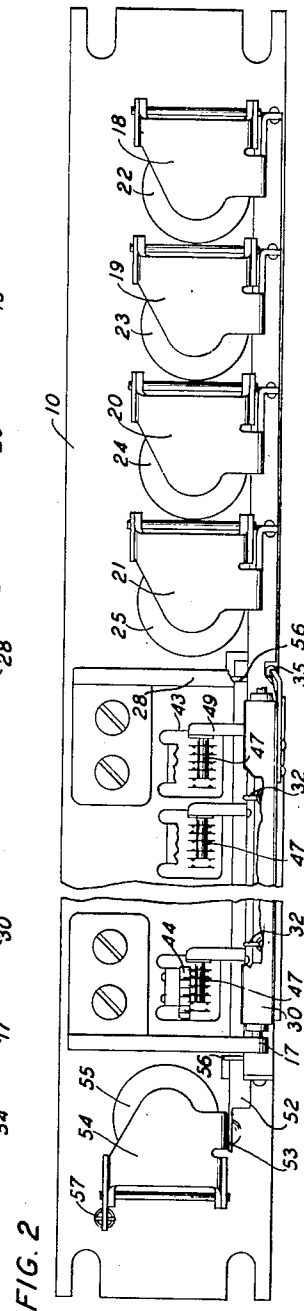
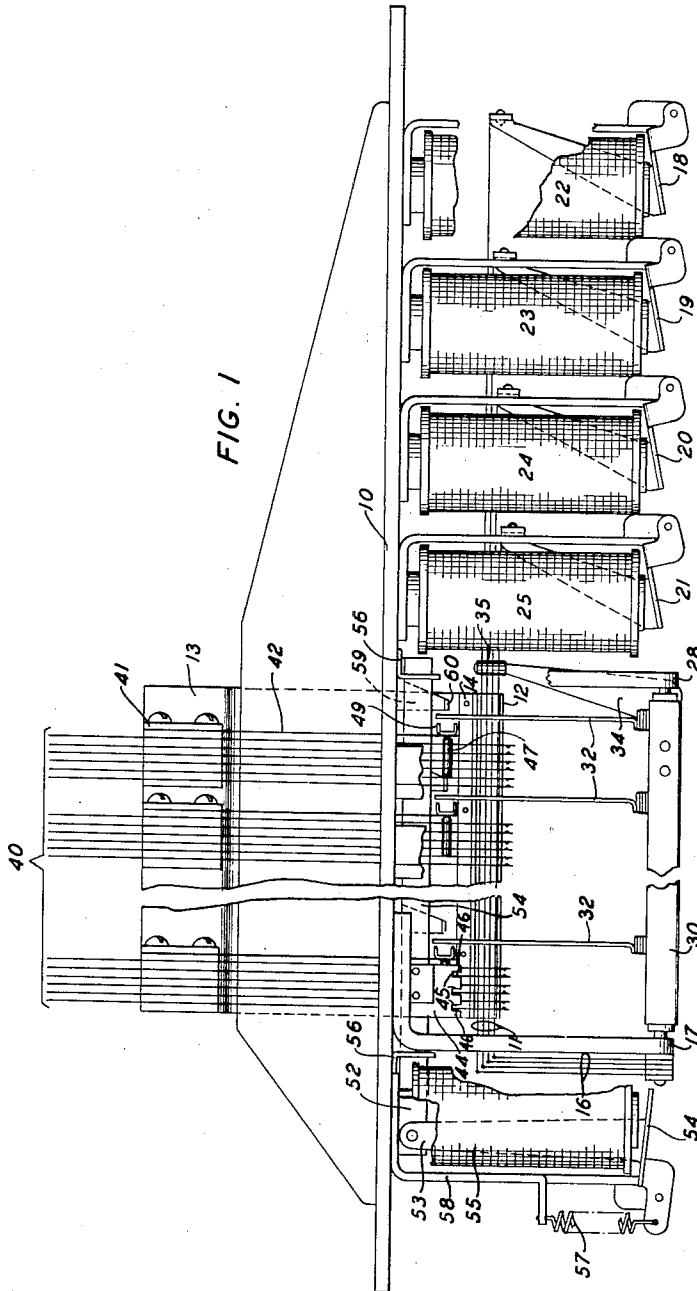
R. F. MALLINA

2,317,469

SWITCHING DEVICE

Filed July 12, 1941

3 Sheets-Sheet 1



INVENTOR
R. F. MALLINA
BY *W. J. McNamee*
ATTORNEY

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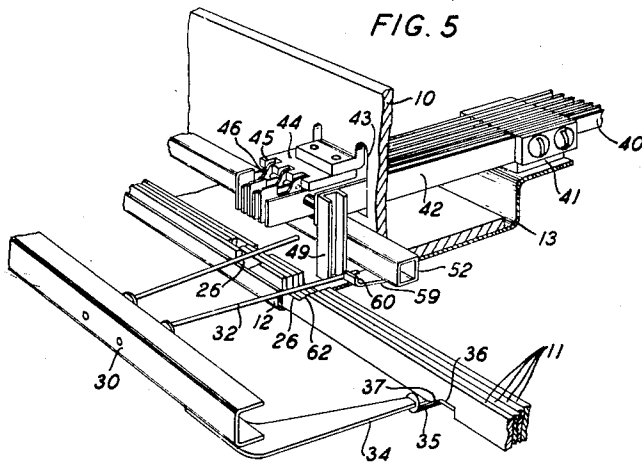
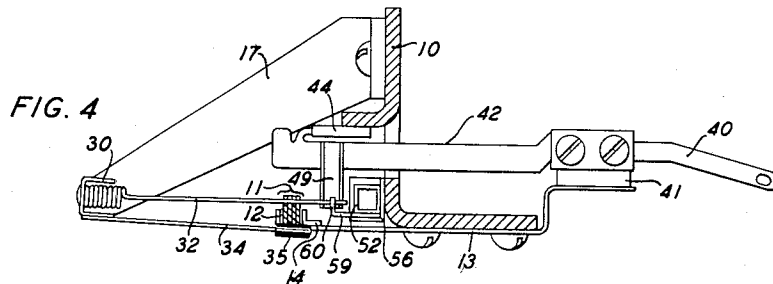
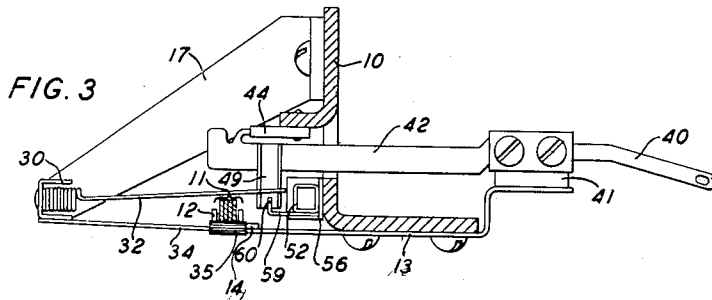
R. F. MALLINA

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SWITCHING DEVICE

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3 Sheets-Sheet 2



INVENTOR
R. F. MALLINA
BY *W. R. McKenney*
ATTORNEY

April 27, 1943.

R. F. MALLINA

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SWITCHING DEVICE

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3 Sheets-Sheet 3

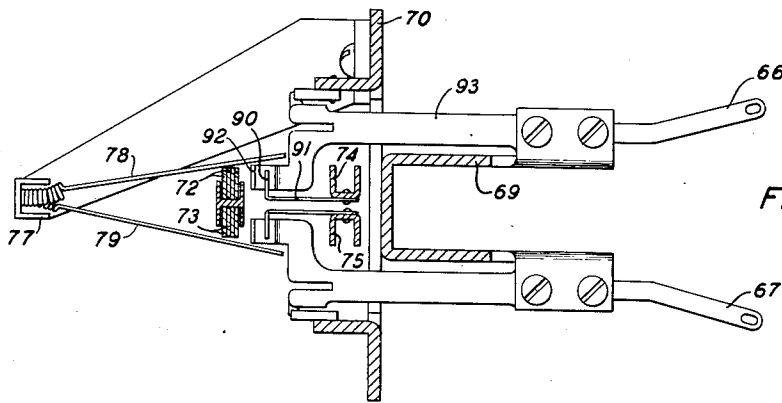


FIG. 6

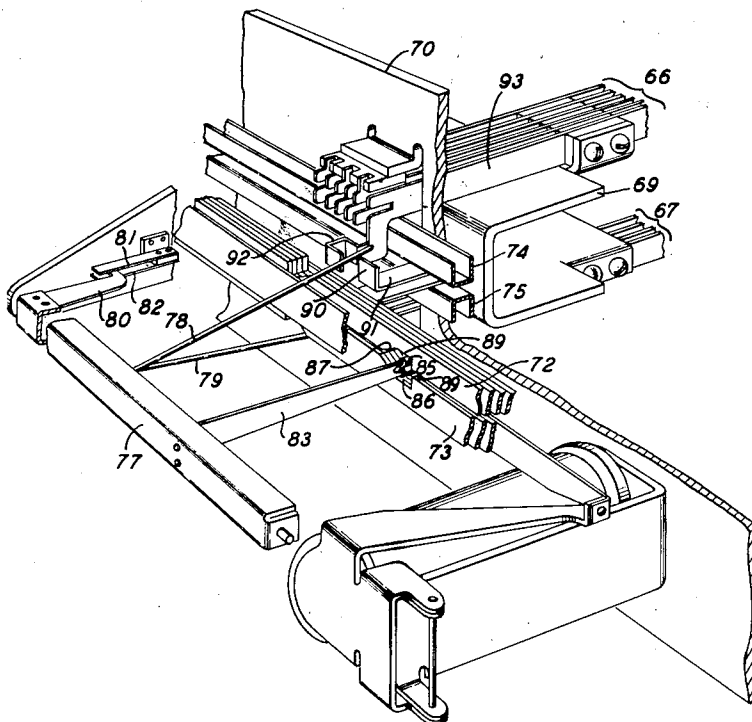


FIG. 7

INVENTOR
R. F. MALLINA
BY *M. R. McKenney*
ATTORNEY

UNITED STATES PATENT OFFICE

2,317,469

SWITCHING DEVICE

Rudolph F. Mallina, Hastings on Hudson, N. Y.,
 assignor to Bell Telephone Laboratories, In-
 corporated, New York, N. Y., a corporation of
 New York

Application July 12, 1941, Serial No. 402,223

10 Claims. (Cl. 179—27.54)

This invention relates to switching devices and particularly to improvements in switching devices suitable for use in telephone or other communication systems.

An object is to simplify the operating characteristics and reduce the cost of switching devices of the type in which a comparatively small number of automatically established electrical connections are desired.

Heretofore such minor switches were generally of the so-called rotary type in which a set of wipers were rotated in steps to establish connections with terminals in a semicircular bank. Other types of minor switches have also been employed in which selections to establish connections between sets of contacts were attained by the use of so-called code bars operated by code impulses. Such switches generally partake of the principles embodied in the well-known crossbar type of switches.

The present invention relates to this latter type of switching mechanisms and a feature thereof is an arrangement comprising a series of select fingers, a series of code bars, a set of contact springs associated with each finger, means operative in response to the operation of any combination of code bars for selecting a corresponding select finger, and means thereafter operative for actuating said select finger to control a corresponding set of contacts. This switching mechanism may take the form of an arrangement in which magnets controlled by code impulses are arranged to shift series of code bars, in which the select fingers are connected to a select bar and arranged across the code bars, a set of contact springs associated with each finger and a hold bar operated by a magnet, these elements being so arranged that on the operation of any combination of code bars, the select bar is actuated by said operated code bars to tension the fingers against the code bars, and one of said fingers is permitted to enter slots in the code bars aligned by the selected code bars. The selected finger is by this entry into slots positioned so that the subsequent operation of the hold bar will act on said finger to operate the associated contact springs. A special feature of this invention is an arrangement whereby the operation of any of the code bars causes the select bar to be actuated by a cam arrangement to tension the fingers against the code bars.

A modified form of the invention is to have two sets of code bars, two hold bars and two sets of contact springs in combination with a single select bar having two sets of select fingers where-

by the operation of one or the other set of code bars in combinations causes the select bar to tension the fingers against the operated set of code bars and one of the fingers to enter aligned slots for the operation of an associated set of contact springs by an associated hold bar.

The invention has been illustrated in the accompanying drawings, in which:

Fig. 1 is a top view of a mechanism embodying the applicant's invention;

Fig. 2 is a front view of the mechanism shown in Fig. 1;

Figs. 3 and 4 are fragmentary side views of the mechanism shown in Fig. 1 with Fig. 4 showing a select finger in operated position;

Fig. 5 is a fragmentary perspective view of the mechanism shown in Fig. 1 with code bars, the select bar, the hold bar and a set of select springs in actuated positions; and

Fig. 6 is a fragmentary side view of a modified form of the switch structure in accordance with the applicant's invention;

Fig. 7 is a fragmentary perspective view of the modified form shown in Fig. 6.

Referring now to the drawings, and particularly to Figs. 1 to 5, the mechanism may consist of a mounting frame 10 which may be secured in any suitable manner to supporting members (not shown). On plate 10 are arranged all the various parts of a switching mechanism embodying the applicant's invention. Four code bars indicated by the numeral 11 and in the shape of flat narrow tapes are located close together and supported for longitudinally slidable movements in a channel or U-shaped runway which is formed with one side member 12 bent up from the mounting plate 13 secured on the underside of plate 10 and another L-shaped side member 14 secured to plate 13, with the plate 13 serving as the bottom member of this runway. These tapes are secured at one end individually to springs 16 mounted on a frame member 17 secured to plate 10 and at the opposite ends these tapes are connected individually to extensions on the armatures 18, 19, 20 and 21 which are controlled by the code magnets 22, 23, 24 and 25, respectively. These magnets are mounted on plate 10. This arrangement is such that when the magnets are energized the armatures are attracted and move the code tapes towards the right looking at Fig. 1 against the tension of springs 16. These tapes are provided with slots such as are shown at 26, for example, in Fig. 5 in various positions to permit selections as will be hereinafter described. Between the support-

ing member 17 and a similar supporting member 23 also secured to plate 10 is rotatably mounted a select bar 30. This bar is provided with select fingers 32. In Fig. 1 three of these fingers have been shown. These fingers extend across the tapes 11 for purposes as will hereinafter be described. To the select bar 30 at the right-hand end thereof looking at Fig. 1 is connected an arm 34 which is provided at its free end with a roller 35 located in depressions 36 on the lower side of the tapes 11 so that when one or more of these tapes are shifted longitudinally toward the right looking at Fig. 1, the roller 35 will ride down on the left-hand sides 37 of these depressions which are slanted or cam-shaped and thereby cause the select bar 30 to rotate and tension the springs 32 against the tapes 11. At the rear of the structure series of contact springs are mounted in groups, one group for each finger 32. In Fig. 1 three of these groups have been shown and indicated in general by the numeral 40. These groups of select springs are mounted on individual brackets 41 secured to the plate 13. Associated with each group of select springs is an operating spring 42 which extends with the associated select springs through an opening 43 in the mounting plate 10 towards the front of the mechanism. Every other one of these select contact springs in a group is held stationary by an individual stop plate 44 (insulated) mounted on plate 10 and which is provided with slots 45 against one side of which these stationary springs are tensioned towards the left as shown in Figs. 1 and 5 by means of upwardly extending projections 46. The associated movable springs are connected together through an insulation stud 47 which extends through openings in the stationary springs except for the last spring toward the left shown in Fig. 1. This stud 47 is also connected at its right-hand end to the operating spring 42 so that on the shifting of the operating spring 42 towards the left (looking at Fig. 1 or 5), the movable springs are moved toward the left and engage corresponding stationary springs. At the free end of the operating spring 42 is connected transversely a U-shaped member 49 which extends downwardly looking at Figs. 1 and 5 to a position opposite a corresponding select finger 32 but not normally in engagement with this finger. Between the U-shaped members 49 and the mounting plate 10 is located a longitudinally extending hold bar 52. This hold bar as shown consists of a tube of square cross section and is mounted to be shifted toward the left by being connected at one end to an extension 53 on an armature 54 which is controlled by a hold magnet 55. This hold bar 52 is slidably mounted in the brackets 56 secured to the mounting plate 10. The hold bar is restored to a normal position by a spring 57 attached to the armature 55 and to the yoke-piece 58 for the hold magnet which yoke-piece is in turn secured to plate 10. The hold bar is provided, adjacent each U-shaped extension 49 and opposite the fingers 32, with forwardly extending brackets 59 which are bent upward to form an extension 60 for engagement with the associated finger 32 when the latter is lowered between this extension 60 and the U-shaped member 49 to actuate the connected operating spring 42 and the associated select springs as will hereinafter be described.

If reference is now made particularly to Fig. 5, a description will be made of the operation of this mechanism. The first operations that take

place are the energizing of a combination of the code magnets 22 to 25 to shift the associated tapes 11 towards the right looking at Fig. 5. Depending on the particular combination of tapes shifted, slots in the tapes will be aligned transversely opposite one of the fingers 32. The shifting of these tapes also causes the cam-shaped sides 37 of the depressions 36 on the underside of the tapes to act on the roller 35 to move it downwardly and thereby cause the rotation of the select bar 30 and in turn move the select fingers to tension them against the upper surfaces of the tapes 11. As stated, slots in the tape will now be aligned as shown, for example, at 26 in Fig. 5, for the first corresponding finger 32 which will therefore drop into these slots across the tapes. The free end of this finger 32 will thereby be placed between the upwardly extending projection 60 of the associated extension 59 on the hold bar 52 and the U-shaped member 49 on the operating spring 42 and the associated set of contact springs. If now the hold bar 52 is operated by the armature 54 through the energization of magnet 55 to shift towards the left, the projection 60 will engage the finger 32 and press it against the U-shaped member 49 and thereby cause this member to be shifted towards the left and cause the corresponding shifting of the operating spring 42 and through the stud 47 shift the movable contact springs towards the left to engage the associated stationary springs. The hold magnet will now hold this finger and the associated springs in this operated position, while, of course, the operated code magnets may be deenergized and the selected tapes returned to normal. The return of the tapes to normal will restore the select bar 30 to normal by means of the cam surfaces 37 operating on roller 35. This restoring of the bar 30 will restore all the fingers 32 to normal except the one engaged in slots 26 although this finger will be bent to move out of the slots 26 due to the cam surfaces 37 on the right side of the slots 26 looking at Fig. 5 forcing this finger out of the slots. However, the finger is flexible enough to permit the free end of the finger to remain clamped between the projection 60 and the U-shaped member 49. The hold magnet 54 will remain energized until the connection between the set of contact springs is no longer desired when it is deenergized to return the hold bar to normal position and thereby release the finger 32.

In the modified form of the applicant's invention as disclosed in Figs. 6 and 7, arrangements may be such that two rows of select springs indicated respectively and in general by the numbers 66 and 67 may be located on opposite sides of a U-shaped supporting plate 69 mounted on the mounting plate 10 corresponding to mounting plate 10 in Fig. 1 and the mechanism is such that selections may be made from either one of these groups of contact springs by having duplicate sets of code tapes such as 72 for the springs set in the upper row and code tapes 73 for the springs in the lower row and corresponding hold bars 74 and 75. A common select bar 77 is provided with select fingers 78 for the upper row of springs and select fingers 79 for the lower row of contact springs. The select bar 77 is in this case held in the neutral position by a projection 80 being engaged by opposing springs 81 and 82 for movement in either direction against the tension of these springs. The select bar 77 is also provided with an extension 83 having two rollers 85 and 86 engaging respectively slots in the upper group of

select tapes 72 and lower group of select tapes 73. In operating this mechanism, the code tapes in either of the groups 72 or 73 may be actuated in combination to start the selection. If, for example, the code tapes in the upper group 72 are operated, fingers such as 78 will then be pressed against the code tapes and corresponding slots in the code tapes will be aligned opposite one of these fingers for the lowering of this finger in said slots. The select bar will in this case be rotated in a clockwise direction by the roller 85 riding down on the cam surfaces 87 of the slots 89 in tapes 72 thereby causing the finger 78 to enter the aligned slots. The finger 78 will thereby be passed between the upwardly bent extension 90 of the projection 91 connected to hold bar 74 and the U-shaped projection 92 on the operating spring 93 which controls the movable springs in the group 66 to connect with the stationary springs in the same manner as described in connection with the preceding figures. This operation will take place when the hold bar 74 is moved toward the left to press the finger 78 against the U-shaped portion 92 of the operating spring 93. Similarly in case a selection is desired from among the lower groups of springs 67, the tapes 73 will be operated in combination to cause corresponding slots to be aligned in front of a particular finger such as for example finger 79, and the select bar 77 will be rotated in the opposite direction to raise the finger 79 to pass between the projection on the hold bar 75, similar to 90 and 91, and a U-shaped projection on the associated operating spring and when this hold bar is then operated, finger 79 will cause the operation of the contact springs 67 in the same manner as the springs 66 were operated.

What is claimed is:

1. A switching device comprising a series of select fingers, code bars, a set of contacts associated with each finger, means controlled by the operation of any of said code bars for tensioning all of said fingers and for causing a particular one of said fingers to be moved into a selected position, said movement being due to the tensioned condition of said finger and depending on the particular combination of code bars operated, and means thereafter operative for actuating said selected finger to control a corresponding set of contacts.

2. In a switching device, a series of code bars in the shape of tapes located alongside of each other, a select bar, select fingers on said bar crossing said tapes, a set of contacts associated with each finger, means operatively responsive to the operation of any combination of code tapes for actuating said select bar and for selecting a corresponding finger to enter into slots in said operated code tapes, means thereafter operating for actuating said selected finger to control a corresponding set of contacts.

3. In a switching device, a select bar, select fingers associated with said bar, a set of code bars, an operating magnet for each code bar, a set of contacts associated with each finger, a hold bar, an operating magnet therefor, said elements being so arranged in relation to each other that the operation of any combination of code magnets will operate the associated code bars and the operated code bars will operate the select bar, said operated code bars and select bar causing the shifting of a corresponding select finger in a selected position and the operation of the hold bar by its magnet will thereafter actuate the

shifted finger to operate the associated set of contacts.

4. In a switching device, a select bar, select fingers on said bar, a series of code bars, an operating magnet for each code bar, a set of contacts associated with each finger, a hold bar, an operating magnet therefor, said elements being so arranged that the operation of any combination of code magnets followed by the operation of the hold magnet causes the select bar to tension the select fingers across the code bars, cause a certain one of said fingers, depending on the combination of code bars operated, to enter into slots in said selected code bars and to thereafter cause the hold bar to cooperate with said certain finger to actuate the associated set of contacts.

5. In a switching device, a select bar, select fingers on said bar, a series of code bars, an operating magnet for each code bar, a set of contacts associated with each finger, arranged so that the operation of any combination of said code bars by the associated magnets will operate said select bar to place all of said fingers in connection with said code bars and one of said fingers further actuated to drop into slots in the operated code bars to cause said finger to come in operative relation with the corresponding set of contacts, a hold bar and a magnet for operating said hold bar arranged so that the operation of the hold bar will actuate it to engage said selected finger to operate the associated contacts.

6. In a switching device, a select bar, select fingers associated with said bar, a row of code bars, an operating magnet for each code bar, said select fingers and code bars being so arranged that the operation of any combination of said code bars by their respective magnets causes said select bar to be actuated to preselect the fingers and to further select a particular finger depending on the combination of code bars actuated, a set of contacts associated with each select finger, an operating spring associated with each set of contacts, a hold bar, a magnet for operating said hold bar, said hold bar being associated with said operating springs to cooperate with the selected finger and the associated operating spring to actuate the associated set of contacts when said hold bar is actuated by its magnet.

7. A switching device comprising a select bar, a series of select fingers on said bar, a series of code bars, means for shifting said code bars in any combination, a set of contacts associated with each finger, a hold bar, means for shifting said hold bar, a projection on said select bar, a cam on each code bar, said projection being so arranged in relation to said cams that on the shifting of any combination of code bars the cams thereon engage said projection to actuate said select bar to cause one of said fingers, depending on the code bars shifted to enter the slots in the shifted code bars, and means thereafter responsive to the shifting of the hold bar for engaging said selected finger and cause it to actuate the associated set of contacts.

8. A switching device comprising a select bar, a series of select fingers on said bar, a series of code bars, means for shifting said code bars in any combination, a set of contacts associated with each finger, a hold bar, means for shifting said hold bar, a projection on said select bar, a cam on each code bar, said projection and cams being so arranged in relation to each other that on the shifting of any combination of code bars the associated cams thereon engage said projec-

tion to actuate said select bar to select one of said fingers, depending on the code bars shifted, to enter slots in the shifted code bar, means responsive to the shifting of the hold bar for engaging said selected finger and cause the actuation of the associated set of contacts, and means for restoring said select bar to normal when the code bars are released to restore all of the fingers to normal position except the selected finger while this selected finger is engaged.

9. A switching device comprising two series of code bars, a select bar, two series of select fingers, one of said series of fingers associated with each series of code bars, a set of contacts associated with each finger, a hold bar for each series of code bars, said elements being so arranged in relation to each other that the operation of any combination of code bars in one series or the other will operate the select bar to select a corresponding finger of the series associated with the operated code bars and the operation of the hold bar

associated with the operated code bars will thereafter actuate the selected finger to operate the associated set of contacts.

10. A switching device comprising two series of code bars, a select bar, two series of select fingers, one of said series of fingers associated with each series of code bars, a set of contacts associated with each finger, a hold bar for each series of code bars, a projection on said select bar, a cam on each code bar, said projection being so arranged in relation to said cams that on the shifting of one or more code bars in one series or the other the cam or cams thereon will engage said projection to actuate said select bar to cause one of said fingers depending on the code bars shifted to enter slots in the shifted code bars, and means thereafter responsive to the shifting of the hold bar associated with the shifted code bars for engaging the selected finger and causing it to actuate the associated set of contacts.

RUDOLPH F. MALLINA.