

Aug. 24, 1943.

R. F. MALLINA

2,327,730

SWITCHING MECHANISM

Filed July 12, 1941

2 Sheets-Sheet 1

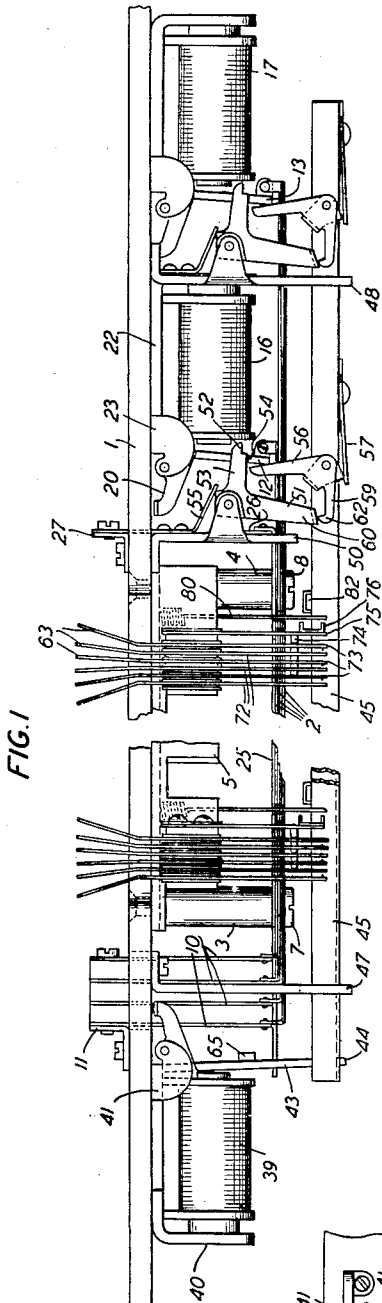


FIG. 6

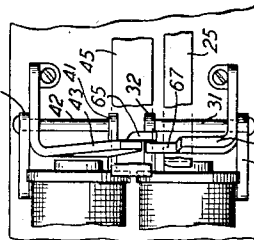
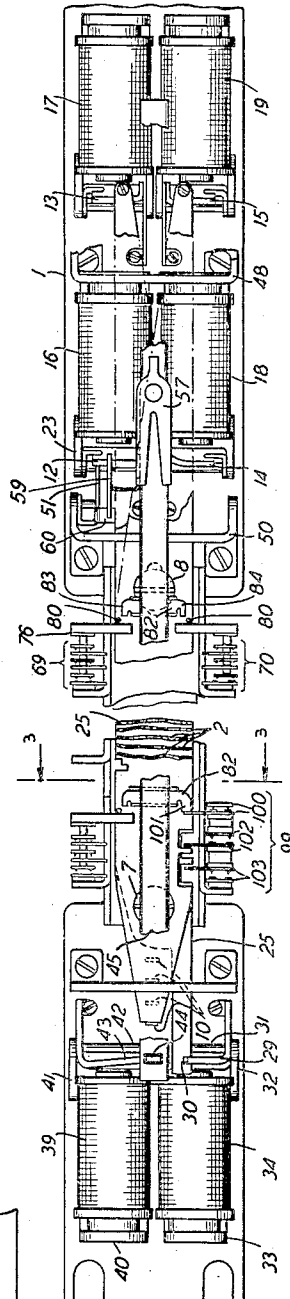


FIG. 2



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

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R. F. MALLINA

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2 Sheets-Sheet 2

FIG. 3

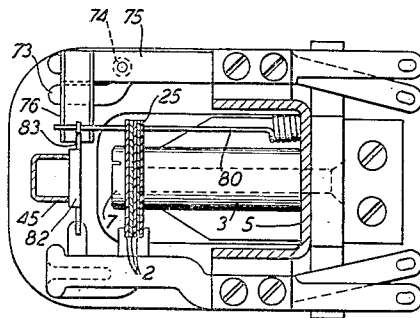


FIG. 4

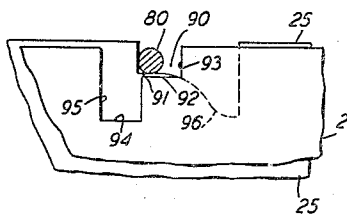


FIG. 5

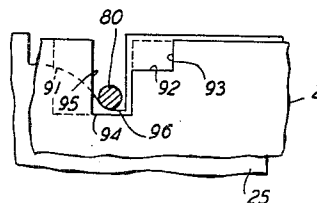
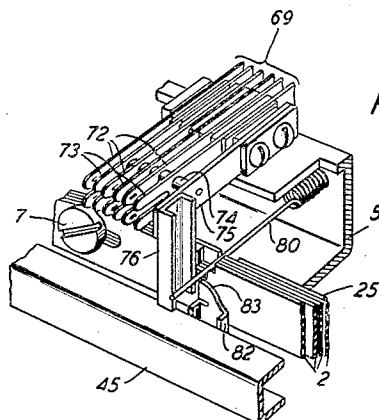


FIG. 7



INVENTOR
R. F. MALLINA
BY
W. McKenney
ATTORNEY

UNITED STATES PATENT OFFICE

2,327,730

SWITCHING MECHANISM

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

Application July 12, 1941, Serial No. 402,224

10 Claims. (Cl. 179—27.54)

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

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

Heretofore such small capacity switches have generally been of the so-called rotary type in which a set of wipers are rotated in steps to establish connections with terminals in semi-circular banks. Other types of switches have also been employed in which code bars are actuated in combination to select and establish electrical connection between sets of contacts. Such switches sometimes partake of the principles embodied in the well-known cross-bar switches. One of my copending applications Serial No. 402,223, filed July 12, 1941, discloses a switching mechanism of this general type in which the operation of the code bars followed by the operation of a holding bar causes connections to be established by a selected set of contacts.

The present invention relates to a switch of this latter type and a feature thereof is an arrangement comprising a series of core bars in the shape of tapes arranged for movement longitudinally, a select bar in the shape of a tape located alongside of the code tapes and arranged to be moved longitudinally, a series of select fingers arranged across said two types of tapes normally engaging the select tape, a set of contact springs associated with each finger, a hold bar and a magnet for operating it. Said elements are so arranged that on the operation of a combination of code tapes slots in the code tapes are aligned for the subsequent entry therein of a particular corresponding select finger and on the operation of the select tape all of the fingers are released so that the said selected finger will enter the aligned slots to occupy a position where the subsequent operation of the hold bar will actuate said finger to operate an associated set of contact springs.

A special feature is an arrangement whereby the hold bar locks the select tape in operated position and whereby the shape of the slots in the select tape are such that, when the hold bar releases the select tape, the select finger released by the hold bar and all other fingers are returned by said slots to a normal position.

Another special feature is a locking arrangement whereby the selected code tapes are locked in operated position and released when the hold bar is released.

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

Fig. 1 shows a top view of a mechanism in accordance with the applicant's invention;

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

Fig. 3 is a cross section taken on line 3—3 of Fig. 2;

Figs. 4 and 5 are fragmentary views showing the relative positions and shapes of the slots in the code tapes and select tape in accordance with the applicant's invention;

Fig. 6 is a fragmentary front view of a portion of the mechanism relating to the locking of the select tape by the hold bar in accordance with the applicant's invention; and,

Fig. 7 is a fragmentary perspective view of a set of contact springs and the mechanism for operating them in accordance with the applicant's invention.

Referring now the drawings and particularly to Figs. 1, 2, 3 and 6. The mechanism is mounted on the mounting plate 1 and consists of the following parts. Four code bars or tapes marked 2 are mounted alongside of each other. Stud 3 and 4 secure a U-shaped frame member or bracket 5 to plate 1. The code tapes are slidably mounted on studs 3 and 4 by means of screws 7 and 8 entering slots in the tapes so that the tapes may be shifted longitudinally from a normal position towards the right, as shown in Fig. 1. The left-hand ends of these tapes are riveted to restoring springs 10 mounted on a bracket 11 secured to plate 1 to hold the tapes in the normal position towards the left. The opposite ends of these tapes are connected respectively to armatures 12, 13, 14 and 15 controlled by magnets 16, 17, 18 and 19. These armatures and code tapes are held in normal position by the tension of springs 10 and the armatures have projections or backstops such as, for example, 20 for armature 12 pressing against the plate 1. The magnets are mounted on the usual return pole-pieces such as, for example, 22 for magnet 16. These pole-pieces have bent-over ears such as 23 for magnet 16 between which the armature 12 for this magnet is mounted. Alongside the code tapes on the upper side looking at Fig. 1 is mounted a select tape 25 in the same manner as the code tapes except that it is held in normal position towards the right by a spring 26 secured to a bracket 27 mounted on plate 1. The opposite end of the select tape 25 is secured to the armature 29 at 30 to be moved by this armature towards the left looking at Figs. 1 and 2. This armature 29 is mounted on a pin 31 which in turn is mounted between ears 32 extending from the return pole-piece 33 on which the magnet 34 is mounted so that when this magnet is energized, the armature 29 moves the tape 25 towards the left looking at Figs. 1, 2 and 6.

Alongside magnet 34 is mounted a hold magnet 39 on the return pole-piece 40 having ears 41 which serve as supporting bearings for a pinion 42 on which an armature 43 is mounted for this hold magnet 39. This armature is connected at 44 to a hold bar 45 which is located in front of the code tapes as shown in Fig. 1. The hold bar is slidably mounted in the brackets 47 and 48 secured to plate 1 for movement towards the left when the hold magnet 39 operates. The hold bar is U-shaped in cross section.

The locking mechanisms for maintaining the code tapes in actuated position and for releasing them when the hold bar is released are arranged as follows. The locking mechanism for each tape is identical. Referring to the locking mechanism for the tape controlled by magnet 16, the pawl 51 thereof is mounted on a bracket 50 secured to plate 1. When armature 12 operates, the notch 52 on arm 53 of pawl 51 engages a projection 54 on armature 12 on the left-hand side thereof as the arm 53 is pressed downwardly by a spring 55. Thus the armature 12 is held in operated position to hold the associated tape in actuated position. It will be noted that the hold bar 45 is provided with a pawl 56 (for releasing armature 12). This pawl 56 is normally tensioned by spring 57 to engage the armature 12 so that when the hold bar is moved towards the left, the pawl 56 is rotated on its pivots to raise the arm 59 thereof upwardly. The arm 59 normally engages a bevel surface on the arm 60 of pawl 51 so that when the hold bar 45 is operated, the arm 59 will pass by this surface without interfering with the locking of armature 12 by the pawl 51. Then when the hold bar 45 is returned to normal, the hook 62 on arm 59 will engage the left-hand edge of the arm 60 and cause pawl 51 to be rotated back to normal position and thereby release or unlock the armature 12. Then slightly before the hold bar 45 has returned to normal, the pawl 56 will be engaged by the armature 12 on its return to normal to cause the hook 62 to free itself from the arm 60 thus permitting the pawl 51 to return to normal position. The corresponding locking mechanisms for the other tapes will operate in the same manner whenever the associated armatures 13, 14, 15 of magnets 17, 18 and 19 are operated to maintain the associated code tapes in operated position until the hold bar 45 returns to normal when the locking mechanisms are operated to permit the release of the associated tapes.

It should be observed in connection with the select tape 25 and the hold bar 45 and their operating magnets 34 and 39 as shown in Fig. 6 in particular that the armature 29 for the magnet 34 is maintained in operated position by the armature 43 for the magnet 39 by means of a projection 65 on armature 43 engaging a projection 67 on armature 29. The purpose of this arrangement is to lock the select tape under control of the hold bar magnet and permit the magnet 34 to be deenergized to save operating current.

On the opposite side members of the U-shaped member 5 are mounted rows of sets of select springs, for example, the set 69 is one of the sets in the row on the upper side and 70 is one of the sets in the row on the lower side as shown in Fig. 2. Each of these sets of select springs may consist of three stationary springs 72 and three movable springs 73. The movable springs 73 are associated for making contact respectively with

the stationary springs 72 and are for this purpose connected together by means of stud 74 which will be controlled by an operating spring 75 to establish the connections. This operating spring 75 is provided with a U-shaped member 76 which is located, as shown in Fig. 7 in particular, to extend downwardly for the set 69. The U-shaped members for other groups in the upper row extend downwardly in the same manner while the U-shaped members for the lower row extend upwardly. These U-shaped members are located slightly in front of the code tapes looking at Figs. 1 or 7. On the right-hand side of each U-shaped member 76 is located a select finger 80 of the usual type consisting of a straight portion and a coil portion, the coil portion being connected to the bottom member of the U-shaped member 5. Towards the right of each select finger 80 is mounted on the hold bar 45, a member 82 projecting on opposite sides of the hold bar 45. The upper end 83 of the member 82 is on the right-hand side of the associated select finger 80 of the upper row and the lower projection 84 is located on the right-hand side of the associated select finger 80 of the lower row. These select fingers, however, are normally located above the projections 83 for the upper row and below the projections 84 for the lower row so as not to be in a position to be operated upon normally by the projection 83 or 84. Any one of these select fingers, may, however, be lowered as will hereinafter be described to pass in between the associated projections 83 or 84 and the associated U-shaped member 76.

The various locations of the select fingers 80 are shown in connection with Figs. 4 and 5. In Fig. 4 it will be noted that, with select tape 25 and the code tapes 2 in normal position, the select finger 80 rests against the left-hand edge of a slot 90. This locates the select finger 80 slightly above the bottom surface 92 of the right-hand portion 93 of the slot 94 in the code tapes 2. The slot 94 in the code tapes 2 is shaped to have besides its right-hand portion 93 also a left-hand portion 95 which is cut considerably deeper into the tape, while the slot 90 in the select tape 25 is shaped to have a downwardly extending cam-shaped bottom surface 96. If one or more of the code tapes 2 are moved towards the right, slots 94 are aligned for the subsequent dropping of a finger 80 into the lower left-hand portions 95 of the shifted code tapes. This is possible as it should be observed that normally some of the code tapes 2 are in positions so that this select finger 80 may be dropped down in the slots of such tapes even though such tapes are not moved, that is, such tapes may, for this purpose, be cut for their entire width to the depth of the portion 95. If then the select tape 25 is shifted towards the left, the select finger 80 opposite the aligned slots 94 will, due to the downwardly slanting surface 96 in slot 90, be permitted to drop into the deeper portion 95 of the aligned slots 94, and come to rest on the bottom surface 96 of slot 90. In Fig. 5 a select finger 80 is shown dropped down into this deeper portion 95 of slots 94 and resting on the surface 96.

A description will now be made of a selective operation to select a particular set of contact springs such as 69, 70 or others in connection with Fig. 7. The first operation that takes place will be the operation of a combination of magnets 16 to 19, to shift the associated code tapes towards the right. This will align slots 94 oppo-

site a particular select finger 80 for the subsequent dropping of the finger 80 into the deeper portions 95 of these aligned slots 94 of the actuated code tape and into corresponding slots in code tapes that were not operated. If now the select tape 25 is moved toward the left, all the select fingers 80 will be released from the surfaces 91 and all but the selected finger 80 will now come to rest on the surfaces 92 of the associated slots 94. This single one of fingers 80 is, however, free to drop into the deeper portion 95 as determined by the combination of code tapes operated. This will place the selected select finger 80 opposite a projection such as 83 of a member 82 and between this projection and the associated U-shaped member 76. If now the hold bar 45 is operated towards the left, the projection 83 will engage the finger 80 and press it against the U-shaped member 76 and this member will actuate the corresponding operating spring 75 to act on the associated stud 74 to cause the associated movable springs 73 to engage the stationary springs 72, respectively, and thus close a desired connection.

As the armatures of the operated code tape magnets 16 to 19 are locked by the pawls 51, these magnets may be deenergized at this time and when the holding bar has come to rest in its operated position the select magnet 34 may also be deenergized as the select tape 25 is held in operated position, due to the armature 43 of the holding magnet 39 locking the armature 29 of the select tape. Therefore during the maintenance of this established connection, the only magnet that is continuously energized is the hold magnet 39.

When the desired connection is ready for release, all that remains to be done is to deenergize the magnet 39 for the hold bar 45 to release the armature 43 which causes the release of the armature 29 which in turn causes the return of the select tape 25 to normal. It should be noted that on the return of tape 25 to normal, that is, when it is moved towards the right, the finger 80 will, of course, as soon as it has been released by the return of the hold bar, be lifted up out of the lower left-hand portions 95 of the associated slots in the code tapes by riding on the upwardly slanting surface 96 of the slot 90 in the select tape and come to rest on the surface 91 against the left-hand side of this slot 90. The return of the select tape to normal will, of course, also at this time reengage all the other select fingers 80, that is, these fingers will be lifted from engagement with the bottom surfaces 92 of the right-hand positions 93 of the corresponding slots 94 in the code tapes and come to rest on the surfaces 91 of the slots 90 in the select tape. The return of the hold bar 45 to normal will now cause the locking mechanisms for the actuated code tapes to function to release these tapes for return to normal by having the hooks 62 on pawls 56 engage the left-hand edges of arms 60 and restore the pawls 51 back to normal and thereby release the engaged armatures by lifting the arms 53 to free the projections 54 and while the armatures are releasing they will move the pawls 56 to release the pawls 51 to normal.

It should be noted that at the position 99 looking at Fig. 2, a special group of contact springs are provided, one pair of these contact springs 100 being associated with the lower projection 101 of the first member 82 so that when the hold bar is operated towards the left, these contact springs 100 are separated. These contact

springs 100 may be used for any purpose such as for example to open the energizing circuit for the magnet 34 controlling the select tape. Another set of contact springs 102 is shown. One of these contact springs extends into slots in the code tapes so that when any of the code tapes are operated towards the right, these contact springs will be closed. These contact springs may be termed off-normal contacts and used for any purpose desired such as closing the circuit for the select magnet. A similar set of contacts 103 may be arranged with one of them engaging a slot in the select tape 25 so that when the select tape is operated towards the left, a connection between these two contacts is made. These may also be off-normal contacts and used for any desired purpose such as closing the circuit for the hold magnet.

What is claimed is:

1. In a switching device, a select bar, a plurality of code bars having slots therein, a series of select fingers tensioned only against said select bar, a set of contacts associated with each finger, means for shifting said select bar, means for shifting said code bars, the slots in said code bars being so arranged that the shifting of any combination of said bars aligns the slots for the subsequent free entry therein of a corresponding finger and the select bar being so shaped that on the subsequent shifting thereof, the selected finger is released and enters into the aligned slots, and means thereafter operative through the medium of said finger for causing the actuation of the associated contacts.
2. In a switching device, a select bar, a plurality of code bars having slots therein, a series of select fingers tensioned only against said select bar, a set of contacts associated with each finger, means for shifting said select bar, means for shifting said code bars, the slots in said code bars being so arranged that the shifting of any combination of said bars aligns the slots for the subsequent free entry therein of a corresponding finger and the select bar being so shaped that on the subsequent shifting thereof this selected finger is released and enters into the aligned slots, and means for causing said finger to actuate the associated contacts, said select bar being further so shaped that on the release of said finger by said last-mentioned means and on the release of the select bar to normal said finger is restored to normal.
3. In a switching device, a select bar in the shape of a tape having slots therein, a plurality of code bars in the shape of tapes having slots therein, a series of select fingers located across all of said tapes and tensioned only against the select tape, a set of contacts associated with each finger, means cooperating with said tapes and fingers for shifting any combination of code tapes so that slots in said code tapes are aligned for the subsequent entry therein of a corresponding finger and for shifting said select tape so that a slot in said select tape permits the selected finger to enter into the aligned slots in the code tapes, and means thereafter operative through the medium of said finger to actuate the corresponding set of contacts.
4. In a switching device, a select bar in the shape of a tape having slots therein, a plurality of code bars in the shape of tapes having slots therein, a series of select fingers located across all of said tapes and tensioned only against said select tape, a set of contacts associated with each

finger, means cooperating with said tapes and fingers for shifting any combination of code tapes so that slots in said code tapes are aligned for the subsequent entry therein of a corresponding finger and for shifting said select tape so that a slot in said select tape is aligned with the aligned slots in the code tapes to permit the selected finger to drop into said aligned slots; means then operative for causing said finger to actuate the corresponding set of contacts; said slots in said select tape being further so shaped that on the release of the finger by said last-mentioned means and on the release of the select tape the selected finger is returned to normal position.

5. In a switching device, a select bar in the shape of a tape having slots therein; a plurality of code bars in the shape of tapes having slots therein, magnets for actuating said two types of tapes longitudinally, a series of select fingers located across all of said tapes and tensioned only against said select tape, a set of contacts associated with each select finger, said select fingers and said slots being so located that on the longitudinal movement of any combination of code tapes, slots are aligned for the subsequent entry therein of a corresponding finger and so that on the longitudinal movement of said select tape a slot is shifted to permit the selected finger to enter therein and into the aligned slots in the code tapes, a hold bar, a magnet for operating said hold bar, said hold bar being arranged and associated with the selected finger when said hold bar is actuated to operate a corresponding set of contacts.

6. In a switching device, a select bar, a plurality of code bars, a series of select fingers, a set of contacts associated with each finger, a hold bar, means for shifting any combination of code bars, means for shifting said select bar, means for shifting the hold bar, means controlled by the shifting of the select bar and any combination of code bars for locking the shifted code bars in actuated position and causing a corresponding finger to be selected, and means controlled by said selected finger and the shifting of the hold bar for actuating the set of contacts associated with said selected finger, and means controlled by the release of the select bar and the hold bar for unlocking said code bars to release them and to restore the selected finger to normal.

7. In a switching device, a select bar, a plurality of code bars, a series of select fingers, a set of contacts associated with each finger, a hold bar, means for shifting any combination of code bars, means for shifting said select bar, means for shifting the hold bar, means controlled by the shifting of the hold bar for locking the select bar in shifted position, means controlled by the shifting of any combination of code bars for locking the shifted code bars in actuated position, means controlled by the shifting of the select bar and any combination of code bars for selecting a corresponding finger, means controlled by said select finger and the shifting of the hold bar for actuating the set of contacts associated with said selected finger, and means controlled by the release of said hold bar for releasing the select bar and for unlocking said code bars to release them and to restore the selected finger to normal.

8. In a switching device, a select bar in the shape of a tape, a plurality of code bars in the shape of tapes, a series of select fingers, a set of

contacts associated with each finger, a hold bar, means for shifting any combination of code bars, means for shifting said select tape, means for shifting said hold bar, means controlled by the shifting of the select tape, any combination of code tapes and the hold bar for locking the select tape and the shifted code tapes in actuated position and causing a corresponding finger to be selected, means controlled by the selected finger and the shifting of the hold bar for actuating the set of contacts associated with said selected finger, and means controlled by the release of the hold bar for unlocking said select tape and said code tapes to release them and to restore the selected finger to normal.

9. In a switching device, a select bar in the shape of a tape having slots therein, a plurality of code bars in the shape of tapes having slots therein, a magnet for actuating each of said two types of tapes longitudinally, a series of select fingers located across all of said tapes, a set of contacts associated with each select finger, said select fingers and said slots being so located that on the longitudinal movement of any combination of said code tapes slots in the code tapes are aligned for the subsequent entry therein of a corresponding finger and on the longitudinal movement of the select tape, all fingers are released so that said corresponding finger will enter into the aligned slots in the code tapes, a pawl associated with each code tape to lock said code tape in actuated position when said code tape is moved longitudinally, a hold bar, a magnet for operating said hold bar longitudinally, said hold bar being arranged and associated with the selected finger to operate a corresponding set of contacts when said hold bar is moved longitudinally, said slots in said select tape being so shaped that on the release of the selected finger by the hold bar and on the subsequent release of the select tape all of said fingers will be actuated upon by inclined surfaces in said slots in the select tape to return to normal position and pawls associated with said hold bar operating on the pawls associated with the selected code tapes to release said tapes from their locked position for return to normal positions.

10. In a switching device, a select bar having slots therein, a plurality of code bars having slots therein, a series of select fingers, a set of contacts associated with each finger, a hold bar, magnets for shifting said select bar and each of said code bars and said hold bar, a pawl associated with each code bar for locking it in its shifted position, said fingers and said select bar and code bars being so arranged in relation to each other that on the shifting of any combination of code bars slots in the code bars are aligned for the subsequent entry therein of a particular corresponding one of said fingers and on the shifting of the select bar all of the fingers are freed so that the said particular selected finger will enter the aligned slots in the code bars and in a slot in the select bar, means operative on the subsequent shifting of the hold bar for causing it to cooperate with the selected finger to actuate the associated set of contacts, and a pawl on said hold bar for each code bar operative to actuate the pawls of said shifted code bars to unlock said code bars on the release of said hold bar, said slots in the select bar being so shaped that on subsequent release of the select bar to normal all of the fingers are restored to normal positions.