

June 27, 1939.

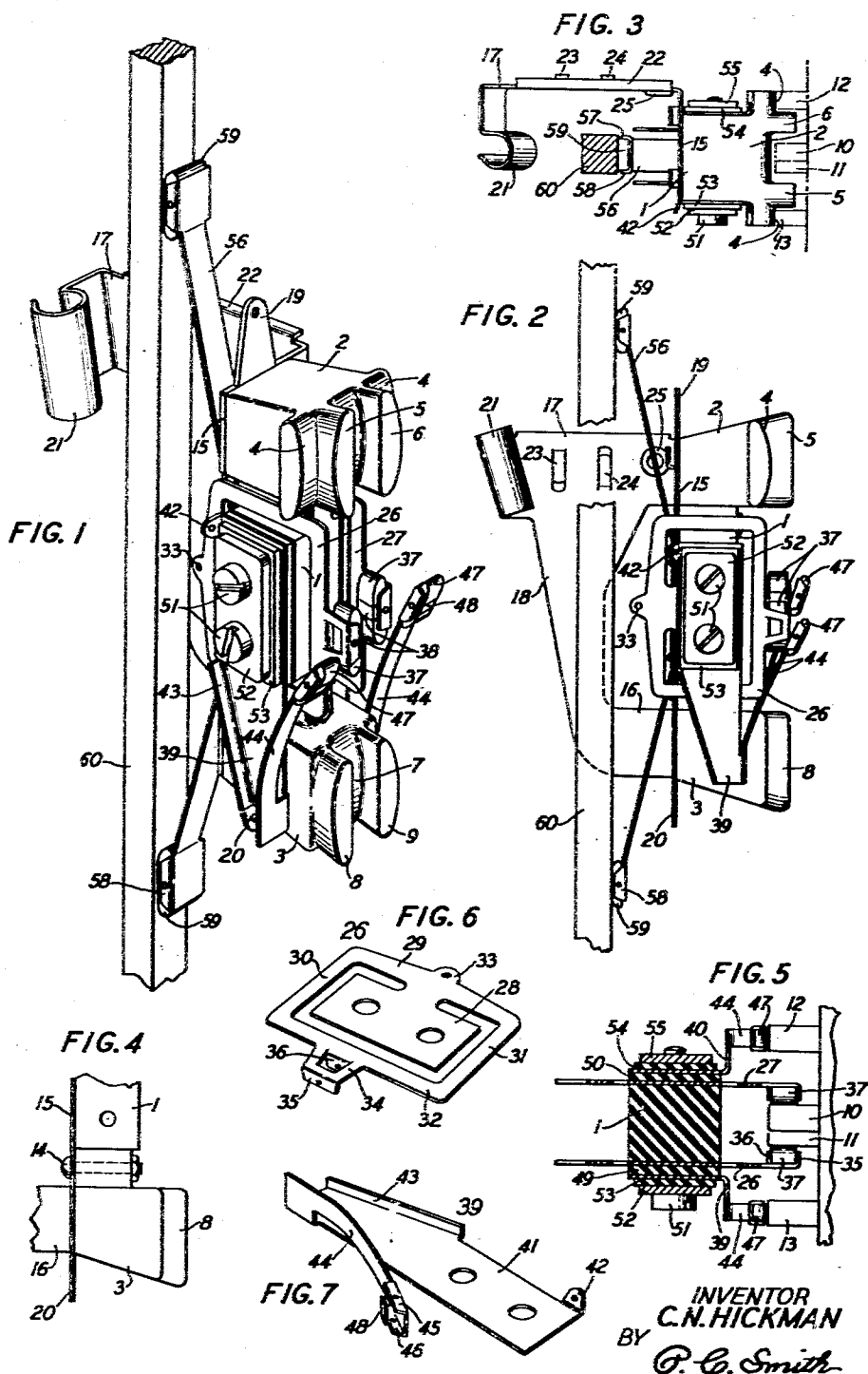
C. N. HICKMAN

2,164,034

SELECTOR SWITCH

Filed Aug. 4, 1938

2 Sheets-Sheet 1



INVENTOR  
C. N. HICKMAN  
BY  
P. C. Smith

ATTORNEY

June 27, 1939.

C. N. HICKMAN

2,164,034

SELECTOR SWITCH

Filed Aug. 4, 1938

2 Sheets-Sheet 2

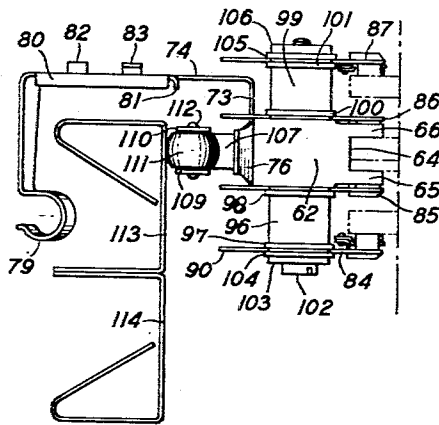


FIG. 9

FIG. 8

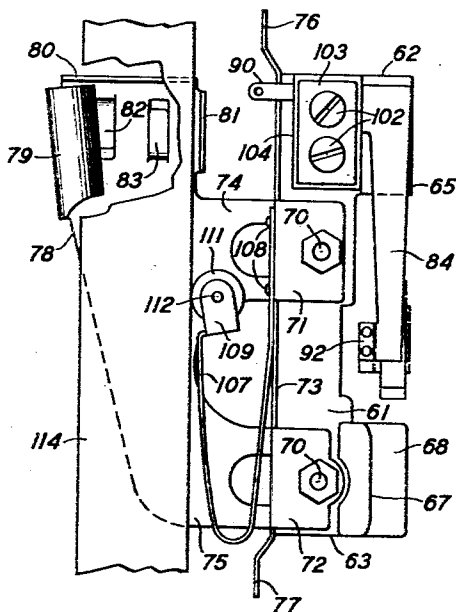


FIG. 10

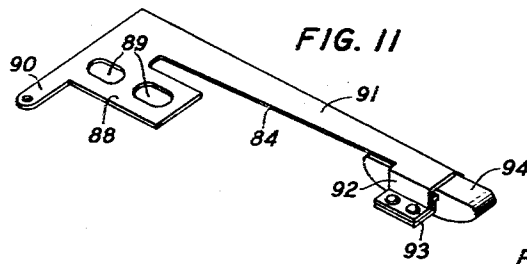
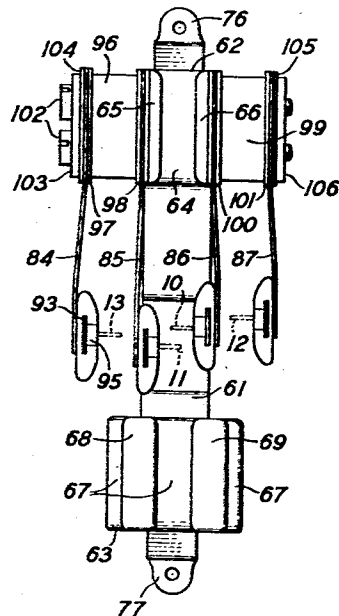


FIG. 11

INVENTOR  
C. N. HICKMAN  
BY *P. C. Smith*

ATTORNEY

## UNITED STATES PATENT OFFICE

2,164,034

## SELECTOR SWITCH

Clarence N. Hickman, Jackson Heights, N. Y., assignor to Bell Telephone Laboratories, Incorporated, New York, N. Y., a corporation of New York

Application August 4, 1938, Serial No. 222,974

14 Claims. (Cl. 179—27.53)

This invention relates to selector switches for establishing connections in machine switching telephone systems and more particularly to a brush carriage for a selector switch of the type having access to panel banks of terminals.

Panel type selector switch frames are provided with one or more flat or panel banks of terminals with which the brush sets of a plurality of selector switches cooperate. These banks may be mounted either one above another or side-by-side. In some types of selector switches the brush sets are rigidly mounted on elevator rods which are guided in supports mounted on the switch frame and in other types they are slidably mounted on guide rods which are rigidly secured at their ends to end members of the frame. In either case, due to the extensive area of the bank, there may be a tendency of the brush supporting rod or the banks to vibrate laterally with respect to each other thereby causing a lateral sliding movement of the brushes on the terminals of the banks with which they are engaged. The vibratory movement imparted to the brush rod or to the bank may be due to building vibrations or due to the operation of other switches mounted on the same frame. This vibration, if imparted to brushes which are included in an established talking circuit, is very undesirable since it may impose objectionable noise on the speech transmission circuit. In some types of panel switches the brushes are driven at very high speeds thereby increasing the possibility of introduction of vibration to the banks through the engagement of the brushes with bank terminals and through the switch frame.

It is therefore the object of the present invention to nullify the effects of bank vibration by providing a brush carriage which is so firmly pressed against the face of the terminal banks that it may partake of any lateral vibratory movement of the face of the banks and as a consequence eliminate any tendency of the brushes to slide in any direction with respect to the bank terminals.

In accordance with the invention, this object is obtained by mounting the brushes on a sled which rests on the ends of the terminals of the rows of bank terminals with which the switch is assigned to cooperate and is provided with parallelly disposed portions or ribs which enter between the edges of adjacent rows of terminals whereby the sled is guided in its movement over the rows of terminals. The sled is arranged for movement longitudinally over the rows of terminals and is held pressed against the banks by

sliders or a roller spring-supported on the sled which engage against a member secured between the end brackets of the switch unit and positioned parallel to the face of the banks.

In accordance with one embodiment of the invention, four brush springs are attached to the sled each terminating in a contact shoe, the shoes of the two inner springs serving to engage the edges of the two inner rows of terminals, for example the test and metering terminals, and the shoes of the two outer springs serving to engage the ends of the two outer rows of terminals, or the tip and ring terminals. The inner springs are so formed as to have flexibility in a direction perpendicular to the edges of the terminals with which their shoes engage and the outer springs are so formed as to have flexibility in a direction perpendicular to the ends of the terminals with which their shoes engage and thus perpendicular to the face of the banks, whereby the shoes are forced into solid contact with the terminals. The outer springs having flexibility in a direction at right angles to the face of the banks, enable their contact shoes which are included in the communication circuit established over the tip and ring terminals of the banks to move with the banks on any lateral vibratory movement of the banks thus further insuring that there will be no sliding movement of the contact shoes on such terminals which might introduce noise into the communication circuit.

For a more complete understanding of the invention, reference may be had to the following detailed description taken in connection with the accompanying drawings in which:

Fig. 1 is a perspective view of a brush carriage constructed in accordance with the invention;

Fig. 2 is a side elevational view of the brush carriage;

Fig. 3 is a top end view of the brush carriage with portions thereof omitted for clarity of disclosure;

Fig. 4 is a detail of one end of the brush carriage sled showing the manner in which the sled is attached to the supporting frame;

Fig. 5 is a cross-sectional view of the sled showing the manner in which the brush spring shoes engage the rows of terminals of terminal sets;

Fig. 6 is a perspective view of one of the inner brush springs;

Fig. 7 is a perspective view of one of the outer brush springs;

Fig. 8 is a side elevational view of a modified form of the brush carriage;

Fig. 9 is a top end view of the brush carriage disclosed in Fig. 8;

Fig. 10 is a rear elevational view of the brush carriage of Fig. 8; and

- 5 Fig. 11 is a perspective view of one of the brush springs of Fig. 8.

The brush carriage has been disclosed as of a type particularly adapted for use in a selector switch of the character disclosed in the application of W. W. Carpenter and R. F. Mallina, Serial No. 213,743, filed June 15, 1938, but it will be apparent that the invention is equally applicable to other well-known types of selector switches.

10 In accordance with one embodiment of the invention disclosed in Figs. 1 to 7, inclusive, the carriage comprises a body portion 1 of suitable insulating material having a shoe 2 formed on the upper end thereof and a shoe 3 formed on the lower end thereof. The upper shoe 2 is provided with two convex outer surfaces 4 from which two parallel guide ribs 5 and 6 extend. The lower shoe 3 is similarly provided with a convex outer surface 7 from which two parallel guide ribs 8 and 9 extend. The body portion with its two shoes constitutes a sled which is adapted to be moved over four rows of bank terminals with the surfaces 4 and 7 of its shoes in engagement with the ends of the terminals of the rows and with the guiding ribs of its shoes guided between the inner edges of the two outside rows of terminals. The manner in which the upper shoe 2 engages the ends of the bank terminals and is guided along the rows of terminals is best illustrated in Fig. 3.

35 It will be noted that the convex formation of the surfaces 4 and 7 of the shoes insures that as the shoes move along the rows of terminals the edges of the shoes will not snag on the terminals. The space between the ribs 5 and 6 of shoe 2 and between ribs 8 and 9 of shoe 3 is slightly greater than the combined width of the inner rows of terminals 10 and 11 and the distance between the outer faces of the ribs 5 and 6 and the ribs 8 and 9 is only slightly less than the distance between the inner edges of the outer rows of terminals 12 and 13 as most clearly disclosed in Fig. 3. The outer faces of the ribs are thus enabled to slide over the inner edges of the outer rows of terminals and thereby guide the shoes along the rows of terminals. To prevent snagging on the terminals the outer faces of the ribs are made convex as disclosed in Fig. 1.

50 The body portion 1 of the sled is secured by bolts 14 to a frame 15 having two forwardly extending arms 16 and 17, the ends of which are united at 18. The ends of the frame 15 are provided with ears 19 and 20 to which the ends of a tape belt may be attached for moving the brush carriage along the rows of terminals to which the switch is assigned. The outer end of the upper arm 17 of the frame is bent at right angles and formed with a cylindrical sleeve 21 to which the end of a cable of flexible conductors (not shown) for making connection with the brush springs mounted on the brush carriage may be secured. For adding rigidity to the upper arm 17 of the frame the upper edge thereof is provided with a rib 22 bent at right angles therefrom. This arm is also provided with tabs 23 and 24 struck therefrom, and an eyelet 25 engaged therein for holding the conductors extending from the flexible cable to the soldering lugs of the brush springs in position.

75 Secured on the side faces of the body portion 1 of the sled are four brush springs, two on each

side thereof. The two inner brush springs 26 and 27 are of the type disclosed in Fig. 6, each being of substantially rectangular outline and stamped out to form a central supporting section 28, a rear arm 29 joined at its mid-portion to the section 28, two end arms 30 and 31 and a front arm 32. The rear arm of the spring is formed with a soldering lug 33 and the forward arm is provided with a forwardly extending tab 34 the end of which is bent at right angles to form an ear 35 and from which a second ear 36 is struck out and bent at right angles parallel to the ear 35. The ears 35 and 36 serve to support a contact shoe 37 which is secured therebetween by a rivet. The contact shoe has a body of insulating material in one face of which a contact member 38 is imbedded.

Each of the outer brush springs 39 and 40, one of which is disclosed most clearly in Fig. 7, comprises a supporting portion 41 having a soldering lug 42 bent up therefrom at its upper end, a stiffening rib 43 bent up at right angles along one edge and having its other edge near the outer end thereof bent at right angles and terminating in a flexible arm 44 for supporting a contact shoe. The outer end of the arm 44 is formed with two ears 45 and 46 bent at right angles thereto and parallel with each other between which a contact shoe 47 is riveted. The body of the shoe is of insulating material and one of the ears 46 is bent over the outer surface of the shoe to form a contact surface 48. Springs 26 and 39 are assembled on one side face of the body portion 1 of the sled with an insulating separator 49 disposed between them as best shown in Fig. 5 and the springs 27 and 40 are similarly assembled on the other side face of the body portion with an insulating separator 50 between them. The assembled springs are all clamped in position by screws 51 which extend through holes in the outer clamping plate 52, the insulating plate 53, spring 39, insulating separator 49, spring 26, body portion 1, spring 27, insulating separator 50, spring 40, insulating plate 54, into threaded holes in the clamping plate 55. For insulating the springs from the screws the screws may be surrounded in the usual manner by sleeves of insulating material.

Due to the construction of the inner springs 26 and 27, they have flexibility in a direction at right angles to their planes and are so pretensioned as to tend to force the contact shoes carried thereby toward each other for engagement with the outer edges of the inner rows of bank terminals 10 and 11 as disclosed in Fig. 5 and the arms 44 of the two outer springs 39 and 40 have flexibility in a direction at right angles to the face of the banks and are pretensioned to force the contact shoes carried thereby against the ends of the two outer rows of bank terminals 13 and 14 as disclosed in Fig. 5.

For maintaining the brush carriage sled in engagement against the ends of the terminals of the rows of the banks with which it is assigned to cooperate, a spring 56 is riveted or otherwise secured at its mid-portion to the frame 15, each end of the spring being formed with two parallel ears 57 and 58 between which is riveted a slider or shoe 59. The sliders 59 engage the inner face of a bar 60, the ends of which are secured to the end brackets of the switch unit in such a manner as to position the bar parallel to the face of the terminal banks. The ends of the spring 56 are pretensioned to force the sled toward the face of the banks.

When, therefore, the brush carriage is moved in either direction by the tape belt secured to the ears 19 and 20, the sled of the brush carriage is held against the ends of the rows of bank terminals by the sliders 59 on the ends of spring 56 engaging the inner face of bar 60 and is guided along the rows of terminals by the ribs 5 and 6 of shoe 2 and the ribs 8 and 9 of shoe 3. Should the bank vibrate laterally toward the bar 60 the whole brush carriage will move laterally with the bank against the tension of the spring 56 and there will be no tendency for the brush shoes carried by the brush springs to slide with respect to the terminals with which they are at the time engaged. Furthermore, since the outside springs 39 and 40, through which the talking circuit is established, are capable of flexing in the direction of the bank vibration, they further insure that there will be no sliding movement between their contact shoes and the tip and ring terminals 13 and 12 which might introduce noise into the talking circuit.

In Figs. 8 to 11, inclusive, a further embodiment of the brush carriage is disclosed. In accordance with this embodiment, the carriage comprises a body portion 61 of suitable insulating material having a shoe 62 formed on the upper end thereof and a shoe 63 formed on the lower end thereof. The upper shoe 62 is provided with a convex surface 64 from which two parallel guide ribs 65 and 66 extend. The lower shoe is similarly provided with convex surfaces 67 from which two parallel guide ribs 68 and 69 extend. The body portion with its two shoes constitutes a sled which is adapted to be moved over four parallel rows of bank terminals with the surfaces 64 and 67 of its shoes in engagement with the ends of the terminals of the rows and with the inner surfaces of the ribs of both shoes guided by the outer edges of the two inner rows of terminals and the outer surfaces of the ribs 68 and 69 of the lower shoe 63 guided by the inner edges of the two outer rows of terminals. The surfaces 64 and 67 of the shoes and the guiding surfaces of the ribs 65, 66, 68 and 69 are made convex to insure that the shoes will not snag on the ends or edges of the terminals as the shoes move along the rows of terminals.

The body portion 61 of the sled is secured by bolts 70 between ears 71 and 72 bent at right angles from one edge of a supporting frame 73 to overlie one side face of the body portion 61 and other ears struck out of the forwardly extending arms 74 and 75 of the frame and bent to overlie the other side face of the body portion 61. The ends of the frame are provided with ears 76 and 77 to which the ends of a tape driving belt may be attached. The outer ends of the arms 74 and 75 are united at 78 to add rigidity to the frame and the outer end of the upper arm 74 is bent at right angles and formed with a cylindrical sleeve 79 to which the end of a cable of flexible conductors may be secured. For adding rigidity to the upper arm 74 the edges of the arm are provided with ribs 80 and 81 bent at right angles therefrom. This arm is also provided with tabs 82 and 83 struck therefrom which serve for holding in place the conductors extending from the flexible cable to the soldering lugs of the brush springs.

Secured on the side faces of the upper shoe 72 of the sled are four downwardly extending brush springs 84 to 87, inclusive. Each spring is substantially L-shaped as disclosed most clearly in Fig. 11, and comprises an upper rectangular

supporting portion 88 having elongated openings 89 therein through which clamping screws may extend, a forwardly extending soldering lug 90 and a downwardly extending arm 91. The end of arm 91 is provided with an L-shaped laterally extending ear 92 to which is riveted a contact shoe supporting member 93 having its free end extending parallel to the face of the brush spring arm 91. Positioned on the end of the member 93 with one of its surfaces engaged against one face of the brush spring arm 91 is a contact shoe having a body portion of insulating material. For its support on the member 93 the shoe is provided with a suitable slot through which the member 93 extends. The outer face of the shoe is laterally grooved to support a contact member 95, most clearly shown in Fig. 10, the ends of which are soldered or otherwise secured to the member 93.

The four brush springs are all similar in construction except that the two which are secured on one face of the sled shoe 62 have their ears 92 bent therefrom in one direction and the two which are mounted on the other face of the sled shoe 62 have their ears 92 bent therefrom in the opposite direction, as most clearly shown in Fig. 9.

Springs 84 and 85 are assembled on one side face of the shoe 62, separated by a metal block 96 and two insulating plates 97 and 98 and the springs 86 and 87 are similarly assembled on the other face of shoe 62 separated by a metal block 99 and two insulating plates 100 and 101. The assembled springs are all clamped in position by screws 102 which extend through holes in the outer clamping plate 103, insulating plate 104, spring 84, insulating plate 97, block 96, insulating plate 98, spring 85, shoe 62, spring 86, insulating plate 100, block 99, insulating plate 101, spring 87 and insulating plate 105 into tapped holes in the clamping plate 106. For insulating the springs from the screws 102, the screws may be surrounded in the usual manner by sleeves of insulating material.

By the provision of the elongated openings 89 in the brush springs through which the insulated clamping screws 102 extend, the positions of the contact members 95 of the contact shoes of the four brush springs with respect to the terminals 10 to 13, inclusive, of a terminal set may be accurately adjusted as disclosed in Fig. 10.

For maintaining the brush carriage sled in engagement against the ends of the terminals of the rows of the banks with which it is assigned to cooperate, a U-shaped spring 107 is provided, one arm of which is secured to the frame 73 by rivets 108 and the other arm of which terminates in two ears 109 and 110 between which a roller 111 is rotatably secured by the pivot rivet 112. The roller 111 engages the inner face of the channel member 113, the ends of which are secured to plates (not shown) secured to the end brackets of the switch unit in such a manner as to position the face of the channel member parallel to the face of the terminal bank. The roller end of spring 107 is so pretensioned that with the roller engaged on the face of the channel member 113, the sled is firmly forced against the face of the bank. The channel member 113 also serves as a guide for the depending loop of the flexible cable (not shown) one end of which is secured in the sleeve 79 of the brush carriage frame. The channel member 114 serves the same purpose in connection with the

brush carriage of a second switch of the same switch unit.

When the brush carriage is moved in either direction by the tape belt attached to ears 76 and 77, the sled of the brush carriage is held firmly against the ends of the rows of bank terminals by the engagement of the roller 111 with the inner face of channel member 113 and is guided along the rows of terminals by the ribs 65 and 66 of shoe 62 and the ribs 68 and 69 of shoe 63. Should there be any vibratory movement of the face of the bank or of the channel member 113 toward or away from each other, the brush carriage will, due to the tension of spring 107, be so held against the face of the bank that there will be no tendency for the brush shoes carried by the brush springs to slide with respect to the bank terminals with which they are at the time engaged. Furthermore, due to the U-shape of the spring 107, the spring is enabled to flex sideways so that any side vibration of the channel member 113 imparted to the roller 111 will be ineffective to rock the sled, which rocking motion might otherwise cause a sliding movement of the brush shoes on the bank terminals.

What is claimed is:

1. In a selector switch, a terminal bank having rows of terminals, said rows of terminals being grouped to form rows of terminal sets, a brush carriage associated with a row of terminal sets comprising a sled of insulating material engageable against the ends of said terminals and having portions extending therefrom between the rows of terminals serving to guide said sled in its movement along a row of terminal sets, brushes resiliently secured to said sled for engagement with said terminals, and means for resiliently holding said sled against the ends of said terminals.

2. In a selector switch, a terminal bank having rows of terminals, said rows of terminals being grouped to form rows of terminal sets, a brush carriage associated with a row of terminal sets comprising a sled of insulating material having a shoe on each end thereof engageable against the ends of said terminals, each shoe being provided with parallel ribs extending therefrom for engagement between the rows of terminals to guide said shoe in its movement along a row of terminal sets, brushes resiliently secured to said sled for engagement with said terminals, and means for resiliently holding the shoes of said sled against the ends of said terminals.

3. In a selector switch, a terminal bank having rows of terminals, said rows of terminals being grouped to form rows of terminal sets, a brush carriage associated with a row of terminal sets comprising a sled of insulating material having a shoe on each end thereof, each shoe having a convex surface slidably engageable against the ends of said terminals and parallelly disposed ribs extending therefrom for engagement between the rows of terminals to guide said shoe in its movement along a row of terminal sets, brushes resiliently secured to said sled for engagement with said terminals, and means for resiliently holding the shoes of said sled against the ends of said terminals.

4. In a selector switch, a terminal bank having rows of terminals, said rows of terminals being grouped to form rows of terminal sets, a brush carriage associated with a row of terminal sets comprising a sled of insulating material having a shoe on each end thereof, each shoe having a convex surface slidably engageable against the ends

of said terminals and parallelly disposed ribs extending therefrom having outer convex surfaces engageable with the inner edges of the terminals of the outer rows of terminals for guiding said shoe in its movement along a row of terminal sets, brushes resiliently secured to said sled for engagement with said terminals, and means for resiliently holding the shoes of said sled against the ends of said terminals.

5. In a selector switch, a terminal bank having rows of terminals, said rows of terminals being grouped to form rows of terminal sets each comprising three or more terminals, a brush carriage associated with a row of terminal sets comprising a sled of insulating material having a shoe on each end thereof, each shoe having a convex surface slidably engageable against the ends of said terminals and parallelly disposed ribs extending therefrom between the inner and outer rows of terminals of said terminal sets, out of engagement with the inner rows of terminals and in slidable engagement with the inner edges of the terminals of the outer rows, brushes resiliently secured to said sled for engagement with said terminals, and means for resiliently holding the shoes of said sled against the ends of said terminals.

6. In a selector switch, a terminal bank having rows of terminals, said rows of terminals being grouped to form rows of terminal sets, a brush carriage associated with a row of terminal sets comprising a sled of insulating material engageable against the ends of said terminals and having portions extending therefrom between the rows of terminals serving to guide said sled in its movement along a row of terminal sets, brushes resiliently secured to said sled for engagement with said terminals, a member supported parallel to the face of said bank, and means resiliently secured to said sled and engaging said member to hold said sled against the ends of said terminals.

7. In a selector switch, a terminal bank having rows of terminals, said rows of terminals being grouped to form rows of terminal sets, a brush carriage associated with a row of terminal sets comprising a sled of insulating material engageable against the ends of said terminals and having portions extending therefrom between the rows of terminals serving to guide said sled in its movement along a row of terminal sets, brushes resiliently secured to said sled for engagement with said terminals, a member supported parallel to the face of said bank and sliders resiliently secured to said sled and engaging said member to hold said sled against the ends of said terminals.

8. In a selector switch, a terminal bank having rows of terminals, said rows of terminals being grouped to form rows of terminal sets, a brush carriage associated with a row of terminal sets comprising a sled of insulating material engageable against the ends of said terminals and having portions extending therefrom between the rows of terminals serving to guide said sled in its movement along a row of terminal sets, brushes resiliently secured to said sled for engagement with said terminals, a member supported parallel to the face of said bank and a roller resiliently secured to said sled and engaging said member to hold said sled against the ends of said terminals.

9. In a selector switch, a terminal bank having rows of terminals, said rows of terminals being grouped to form rows of terminal sets, a brush carriage associated with a row of terminal sets comprising a sled of insulating material engageable against the ends of said terminals and hav-

ing portions extending therefrom between the rows of terminals serving to guide said sled in its movement along a row of terminal sets, brushes resiliently secured to said sled for engagement with said terminals, a member supported parallel to the face of said bank, and means for holding said sled against the ends of said terminals comprising a U-shaped spring having one arm secured to said sled and having a roller rotatably mounted on the end of its other arm for engagement with said member.

10. In a selector switch, a terminal bank having rows of terminals, said rows of terminals being grouped to form rows of terminal sets, a brush carriage associated with a row of terminal sets comprising a sled of insulating material having a shoe on each end thereof engageable against the ends of said terminals, each shoe having parallel ribs extending therefrom for engagement between rows of terminals to guide said shoe in its movement along a row of terminal sets, a pair of brush springs mounted on each side face of one of said shoes extending parallel to said sled and having contact shoes on their free ends, said springs being flexible in a direction at right angles to their planes whereby their contact shoes are forced into engagement with the edges of the terminals of said rows, and means for resiliently holding the shoes of said sled against the ends of said terminals.

11. In a selector switch, a terminal bank having rows of terminals, said rows of terminals being grouped to form rows of terminal sets, a brush carriage associated with a row of terminal sets comprising a sled of insulating material having portions extending therefrom between the rows of terminals serving to guide said sled in its movement along a row of terminal sets, brushes resiliently secured to said sled, certain of said brushes engaging the edges of the terminals of certain rows and other of said brushes engaging the ends of the terminals of other rows, and means for resiliently holding said sled against the ends of said terminals.

12. In a selector switch, a terminal bank having rows of terminals, said rows of terminals being grouped to form rows of terminal sets, a brush carriage associated with a row of terminal sets comprising a sled of insulating material having a shoe on each end thereof engageable against the ends of said terminals, each shoe having parallel ribs extending therefrom for engagement between rows of terminals to guide said shoe in its movement along a row of terminal sets, a pair of brush springs having contact shoes thereon mounted on each side face of said sled between

said shoes, the inner ones of said springs being flexible in a direction at right angles to their planes whereby their contact shoes are forced into engagement with the edges of the inner rows of terminals and the outer ones of said springs being flexible in a direction perpendicular to the face of said bank whereby their brush shoes are forced into engagement with the ends of the terminals of the outer rows of terminals, and means for resiliently holding the shoes of said sled against the ends of said terminals.

13. In a selector switch, a terminal bank having rows of terminals, said rows of terminals being grouped to form rows of terminal sets, a brush carriage associated with a row of terminal sets comprising an insulating support and a pair of brush springs mounted on each side face of said support, the inner ones of said springs each comprising a frame having a rear member attached to said support, laterally extending end members rigid in the direction of travel of said brush carriage, but flexible in a direction at right angles to its plane and a front member having a contact shoe attached thereto whereby the contact shoes of said inner springs are held in engagement with the edges of the inner rows of terminals and the outer ones of said springs comprising a rigid body portion attached to said support and an arm extending from the end thereof disposed to have flexibility in a direction perpendicular to the face of said bank and having a contact shoe on the end thereof whereby the contact shoes of said outer springs are held in engagement with the ends of the outer rows of terminals.

14. In a selector switch, a terminal bank having rows of terminals, said rows of terminals being grouped to form rows of terminal sets, a brush carriage associated with a row of terminal sets comprising a sled of insulating material engageable against the ends of said terminals and having ribs extending therefrom between the rows of terminals serving to guide said sled in its movement along a row of terminal sets, brushes resiliently secured to said sled for engagement with said terminals, a U-shaped frame secured by its inner arm to said sled and having a sleeve on its outer arm in which a cable of flexible conductors may be secured, a member supported parallel to the face of said bank and positioned between the arms of said frame, a spring secured to the inner arm of said frame and a slider secured to each end of said spring for engaging the inner face of said member to hold said sled against the ends of said terminals.

CLARENCE N. HICKMAN,