

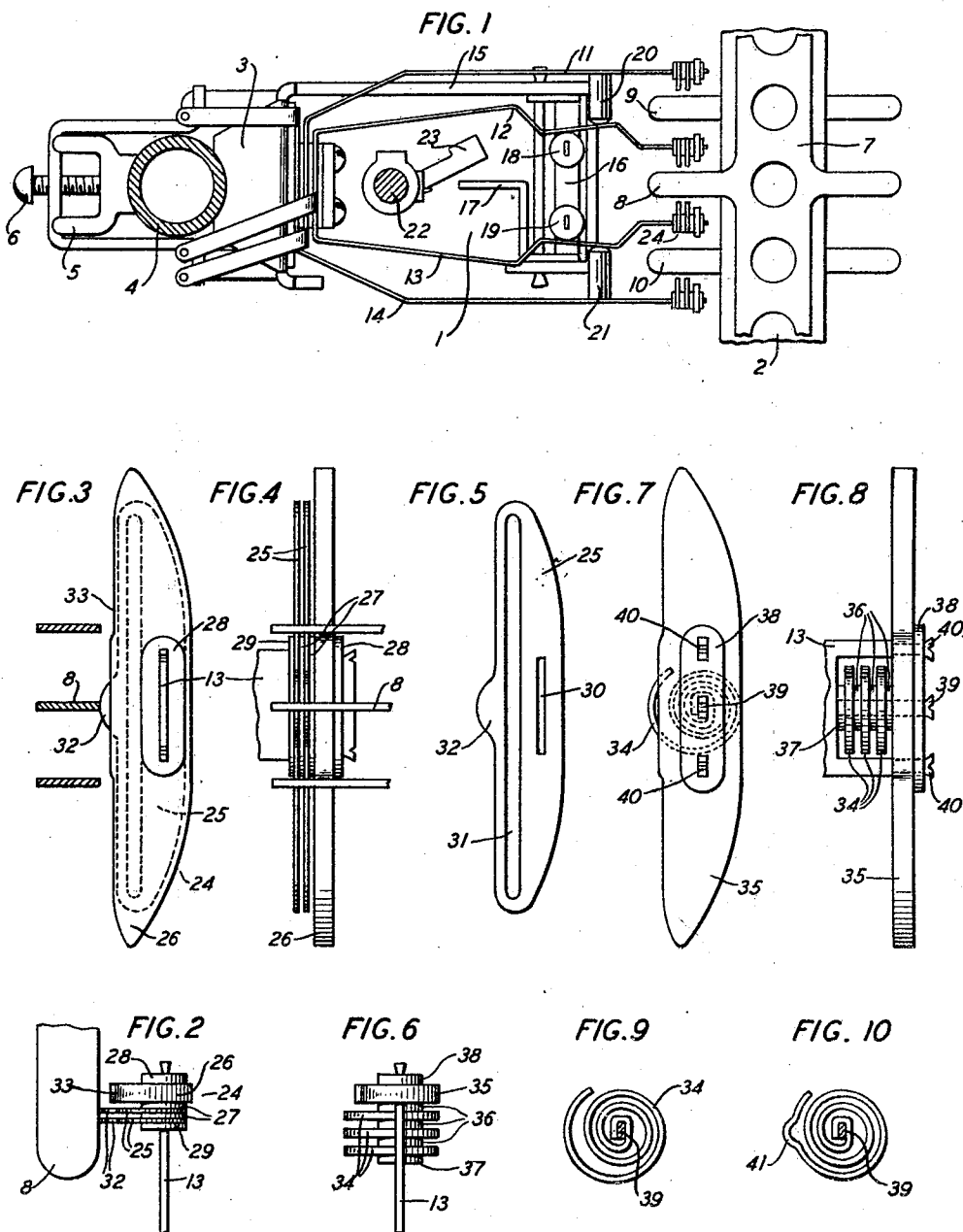
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ELECTRICAL CONTACT

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ELECTRICAL CONTACT

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This invention relates to a contact structure and more particularly to a contact brush for use in selector switches employed in machine switching telephone systems. The object of the invention is the production of a brush contact which shall be effective to make a firm, noiseless contact in a circuit extending thereover.

In the well known machine switching telephone systems connections are established between subscribers' lines over a train of selector switches, the talking circuit between two subscribers' lines extending, in many instances, over the brushes and associated bank terminals of five or more selector switches. Since the talking circuit comprises two conductors, if for example five selector switches are employed in the established connection, there would be therefore ten selector brush contacts involved in the talking circuit, or ten points at which faulty brush contacts might set up noise in the connected subscribers' receivers to impair the efficiency of the transmission of voice currents.

It is the usual practice in telephone exchange systems to mount a large number of equivalent selectors at each switching stage upon a single steel frame. In the panel type system, for example, separate mounting frames would be provided for the line finders, district selectors, office selectors, incoming selectors and final selectors. Each frame is equipped with a driving motor and driving clutch rolls common to all of the selectors mounted on the frame. It has been found that even with the exercise of due care in the design and mounting of the driving motor and other driving mechanism and by making the frames rigid there is some vibration imparted between brushes of selectors that are at the time associated with selectors and the associated banks and consequently the production of some noise in the circuits established over such brushes. The brush shafts of panel selectors are, of necessity, of considerable length and of relatively light mass, whereas the frames and terminal banks rigidly mounted thereon have relatively heavy mass. Thus any vibration due to the operating mechanism or due to the vibration

of the building tends to cause the brush shaft to move toward and away from the terminal face of the terminal banks, thus causing a slight dragging of the contact brushes carried by the shaft along the terminals with which they contact.

In accordance with the present invention this tendency of the brushes to move laterally with respect to the bank terminals is obviated by making the contact portion of the brushes resilient in a direction perpendicular to the face of the bank, or in a direction in which the terminals extend from the face of the bank. This is accomplished in accordance with the preferred form of the invention by constructing the contact portion of each brush as thin, elliptical springs, each spring being attached by one edge to the support extending from the brush shaft and engaging the bank terminal along its other free edge. With this construction if the brush shaft moves toward or away from the bank thus moving the brush support in a line parallel with the contact face of a bank terminal, the elliptical spring structure of the brush permits the contact edge of the contact spring to remain in firm contact with the terminal. Each brush is also equipped with an insulating shoe mounted on the support parallel with the contact springs for guiding the contact springs into engagement with the terminals and for preventing them from snagging thereon as the brush advances from one terminal to an adjacent terminal. Due to the parallel arrangement of the shoe with respect to the contact springs it does not engage that portion of a bank terminal with which the contact springs engage and there is therefore no tendency for chips of insulation to rub off from the shoe to foul that portion of the bank terminals with which the contact springs make contact.

Instead of employing a plurality of flat, elliptical springs for the contact portion of the brush structure, springs in the form of spirals attached at their inner ends to the brush supports and arranged to contact with bank terminals at their free ends may be employed in accordance with a further embodiment of the invention. The spiral spring

formation, in the same manner as the elliptical spring, permits the brush structure to have resiliency in the direction of the brush support, or in a direction parallel to the contact edge of the bank terminal with which it is in engagement.

Although certain embodiments of the invention have been disclosed by way of example, other forms of contact springs which would possess resiliency in the direction necessary to maintain a firm contact irrespective of vibration will readily suggest themselves to those skilled in the art. Also it will be obvious that the invention is equally applicable to other types of selector switches and to other apparatus where it is desired to maintain a firm contact irrespective of vibration, the application of the invention to a panel type selector having been chosen only by way of illustration.

For a clearer understanding of the invention reference may be made to the accompanying description and the attached drawing in which:

Fig. 1 is a plan view of a portion of a terminal bank with a brush set for cooperation therewith;

Fig. 2 is an enlarged plan view of one of the contact brushes shown in the brush set of Fig. 1;

Fig. 3 is an end view of the brush shown in Fig. 2;

Fig. 4 is a side view of the brush;

Fig. 5 is a detail view of one of the contact springs;

Fig. 6 is an enlarged plan view of a modified type of contact brush;

Fig. 7 is an end view of the brush shown in Fig. 6;

Fig. 8 is a side view of the brush shown in Fig. 7;

Fig. 9 is a detail view of one of the contact springs shown in Figs. 6, 7 and 8; and

Fig. 10 is a detail of a modified form of contact spring which may be used in the brush assembly of Figs. 6, 7 and 8.

The invention has been embodied in a switch of the type disclosed in Patent No. 1,123,696, granted January 5, 1915 to E. B. Craft and J. N. Reynolds. In switches of this character a vertical brush shaft suitably disposed to slide in guide members attached to the switch frame is arranged to be driven upwardly or downwardly by power-driven clutch rolls. The brush shaft supports five brush set carriers each carrier having attached thereto a brush set. Mounted on the switch frame in parallel relation to the switch shaft is a panel of five banks of terminals, there being a bank of terminals for each of the five brush sets carried by the switch shaft. Each bank of terminals comprises superimposed metal strips suitably insulated from each other having contact terminals extending therefrom for engagement by the brushes

of the brush set which is arranged for cooperation therewith, the contact strips being arranged in sets of three constituting the tip, ring and sleeve terminals of trunks or lines terminating in the terminal bank. Normally the brushes of each brush set are held deflected laterally so that upon the vertical movement of the switch shaft the brushes will not make contact with the vertical rows of terminals of the banks. Suitable tripping mechanism including a vertically disposed trip rod is provided for permitting the brushes to spring into a position in which they may make contact with terminals of the terminal bank.

Referring now to the drawing one of the brush sets 1 of a switch of the type above described and a portion of the terminal bank 2 with which the brush set cooperates is disclosed in Fig. 1. The brush set 1 is supported on a carrier 3 which is secured to the switch shaft 4 by a clamp 5 and clamping screw 6. One of the metal strips of the terminal bank 2 is shown at 7 having a contact terminal 8. Beneath the strip 7 are superimposed other similar strips insulated from each other and having contact terminals 9 and 10.

Insulatedly mounted on the carrier 3 are four brush supporting springs 11, 12, 13 and 14, the springs 12 and 13 being united. Each of these supporting springs carries at its free end a contact brush embodying the present invention and described more in detail hereinafter. Pivotaly supported on the end of arm 15 of the carrier 3 is a member 16 having a trip finger 17 and two rollers 18 and 19 of insulating material. Normally the member 16 assumes such a position that the rollers 18 and 19 bear upon the springs 12 and 13 to flex them away from each other and through the insulating pins 20 and 21 carried by the springs 11 and 14 to also flex springs 11 and 14. In their flexed condition when the switch shaft 4 is moved vertically the contact springs carried by the springs 11, 12, 13 and 14 can not engage the contact terminals 8, 9, 10 of the terminal bank.

For the purpose of permitting the contact brushes to engage the bank terminals at the proper time in the operation of the switch, a trip rod 22 is provided which carries a trip finger 23. When the trip rod is rotated by a suitable magnet the trip finger 23 is positioned in the path of the finger 17 and when thereafter the brush shaft 4 moves the carrier upwardly the member 16 is rotated moving the rollers 18 and 19 toward the switch shaft 4 thereby permitting the supporting springs 11, 12, 13 and 14 to move the contact brushes carried thereby into engagement with the corresponding terminals of the terminal bank.

Each contact brush, for example the brush 24, which cooperates with the vertical row of bank terminals including terminal 8, com-

prises an assembly including two contact springs 25 and a shoe 26 of insulating material separated from each other by spacing washers 27 and held upon the staked end of the supporting spring 13 between two washers 28 and 29. The shoe 26 is tapered at either end to guide the brush assembly between parallel rows of bank terminals, such as 8 and 10, in such a manner that there may be no tendency for the brush assembly to snag on the terminals.

Each of the elliptical contact springs 25, one of which is shown in detail in Fig. 5 is stamped from thin phosphor bronze or other suitable spring metal having good electrical contact characteristics. The contact spring is slotted at 30 for engagement over the end of the supporting spring 13, is provided at 32 with a contacting portion extending beyond the edge of the spring for engagement with bank terminals and is provided at 31 with an elongated slot whereby the contacting portion 32 is rendered extremely resilient in a direction perpendicular to the plane of the spring 25 or in the direction along the edge of the bank terminals with which the contact portion 32 engages as viewed in Figs. 1 and 2.

Referring more particularly to Fig. 1 and assuming that the tripping mechanism has been operated to release the brush 24 into engagement with terminal 8, the contact portions 32 of the contact springs 25 of brush 24 will be in electrical engagement with the edge of terminal 8. Should, therefore, a vibration be set up in the switch whereby a relative movement between the switch shaft 4 and the face of bank 2, ensues in such a direction as to tend to drag the contact springs 25 back and forth along the edge of terminal 8, then due to the flexibility of the contacting portions 32 of the springs 25 with respect to the supporting spring 13, the contacting portions 32 will remain in firm contact with the terminal 8 and, therefore, noise which might be otherwise set up in the electrical circuit extending through the brush and terminal, is eliminated.

It will be noted that due to the parallel arrangement of the contact springs 25 and insulating shoe 26 the edge 33 of shoe 26 cannot engage the same portion of the edges of bank terminals with which the contact portions 32 of springs 25 engage so that the possibility of particles of insulation being scraped from the shoe 26 and deposited in the path of contact portions 32 is eliminated. There is, therefore, no tendency for the insulating shoe to foul the bank terminals in such a manner as to reduce the efficiency of the electrical contact between the brush and bank terminals.

Referring now to Figs. 6, 7, 8 and 9 in which a modified form of the invention has been disclosed the contact brush comprises an

assembly including three spirally wound springs 34 and a shoe 35 of insulating material separated from each other by spacing washers 36 and held upon the extension 39 of supporting spring 13 by washers 37 and 38. Two further extensions 40 of spring 13 also extend through the shoe 35 and washer 38 and are headed over on the washer 38 to hold the brush assembly securely on the end of spring 13. Each contact spring 34 is constructed from phosphor bronze spring wire and formed as a spiral, the inner end of which embraces the extension 39 of supporting spring 13. The free end of the contact spring extends beyond the face of the shoe 35 and serves as a contact for engagement with the edges of the bank terminals. Due to the spiral formation of the contact spring its free end is rendered extremely resilient in the direction of the spring support 13 and thus the contact portion of the brush may be maintained in firm contact with a bank terminal irrespective of vibrations in the switch structure.

In Fig. 10 a further modified form of contact spring is disclosed. This spring is similar to the springs 34 disclosed in Figs. 7, 8 and 9 but differs therefrom in that the contact portion 41 is so formed that as the contact spring moves off a bank terminal it snaps from the edge of the terminal thereby quickly breaking any arc resulting from the contact carrying current and thus tending to increase the life of the contact.

Although only certain preferred forms of contact springs embodying the invention have been disclosed herein it will be apparent to those skilled in the art that other shapes and forms of springs having lateral resiliency might be designed which would be embraced within the scope of the appended claims and that while the invention has been described as applied to a panel type selector switch the invention is equally applicable to other well known types of selectors and to other types of electrical apparatus in which it would be desirable to maintain steady vibrationless contacts.

What is claimed is:

1. In a contact brush the combination of a support, a contact member, and a shoe of insulating material, said contact member and said shoe being mounted on said support in parallel with each other and in an angular relation with said support, said contact member having resiliency in the direction of said support.

2. In a contact brush the combination of a support, and an elliptical contact member mounted thereon in an angular relation therewith, said contact member being slotted lengthwise to render it resilient in the direction of said support.

3. In a contact brush, the combination of a support and an elliptical contact member

mounted thereon in an angular relation therewith, said contact member being formed of thin spring phosphor bronze and having a contact portion extending from one edge thereof and being slotted lengthwise to render said contact portion resilient in the direction of said support.

4. In a contact brush, the combination of a support and an elliptical contact member mounted thereon near one of its lateral edges and in an angular relation to said support, said contact member being formed with a contact portion extending from its other lateral edge and being slotted lengthwise to render said contact portion resilient in the direction of said support.

5. In a contact brush, the combination of a support, contact members, a shoe of insulating material and washers for spacing said contact members and said shoe from each other, said contact member and said shoe being mounted on said support in parallel with each other and in an angular relation with said support, said contact members having resiliency in the direction of said support.

6. In a contact brush, the combination of a support, contact member, a shoe of insulating material and washers for spacing said contact members and said shoe from each other, said contact members and said shoe being mounted on said support in parallel with each other and in an angular relation with said support, each contact member being elliptical in shape and having a contact portion extending from one edge thereof beyond the edge of said shoe and being slotted lengthwise to render said contact portion resilient in the direction of said support.

7. In a selector switch, a terminal bank having terminals extending at right angles to the face of said bank, a brush shaft mounted parallel to the face of said bank, a brush support carried by said shaft, and a brush carried upon said support for engagement with the edges of the terminals of said bank, said brush being mounted in an angular relation with said support and having resiliency in a direction at right angles to the face of said bank whereby vibratory movement of said shaft toward or away from the face of said bank will not disturb the contact between said brush and the bank terminal upon which it is resting.

8. In a contract brush the combination of a support, and a contact member mounted on said support in an angular relation therewith, said contact member comprising a spirally wound spring connected at one end to said support and its free end serving as a contact brush, said spiral formation of said member rendering said member resilient in the direction of said support.

9. In a contact brush the combination of a support, and a plurality of parallel contact members mounted thereon in an angular re-

lation therewith, each of said contact members comprising a spirally wound spring connected at one end to said support and its free end serving as a contact brush, said spiral formation of each of said members rendering said members resilient in the direction of said support.

10. In a contact brush the combination of a support, and a contact member mounted thereon in an angular relation therewith, said contact member comprising a spirally wound spring connected at its inner end to said support and having its free outer end formed with an outwardly extending portion serving as a contact area, said spiral formation rendering said member resilient in the direction of said support.

In witness whereof, I hereunto subscribe my name this 3rd day of October, 1930.

JOSEPH T. BUTTERFIELD.