Oct. 13, 1964 R. M. JOP 3,153,164

COMMUTATOR BRUSH AND CONNECTION

Filed May 15, 1961 2 Sheets-Sheet 1

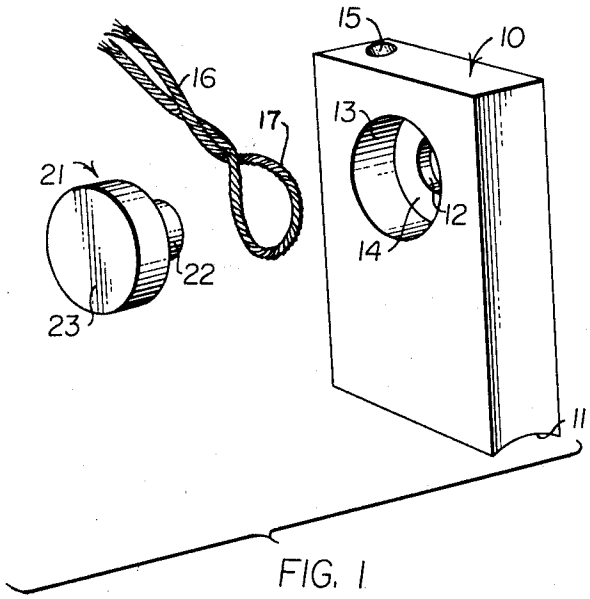


FIG. 1

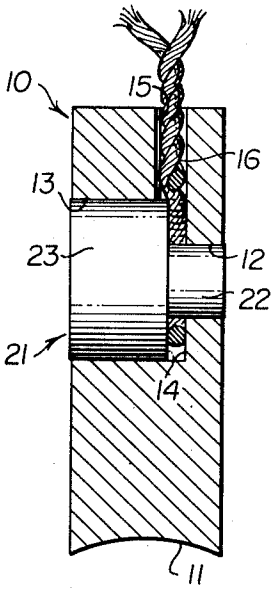


FIG. 3

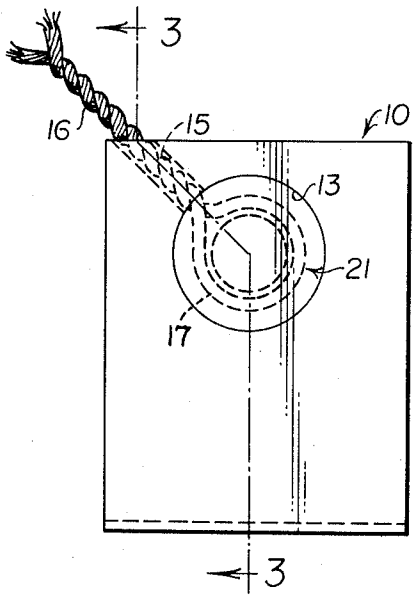


FIG. 2

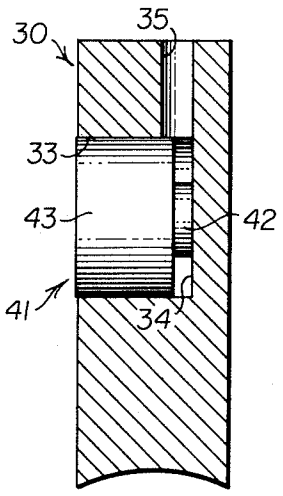


FIG. 4

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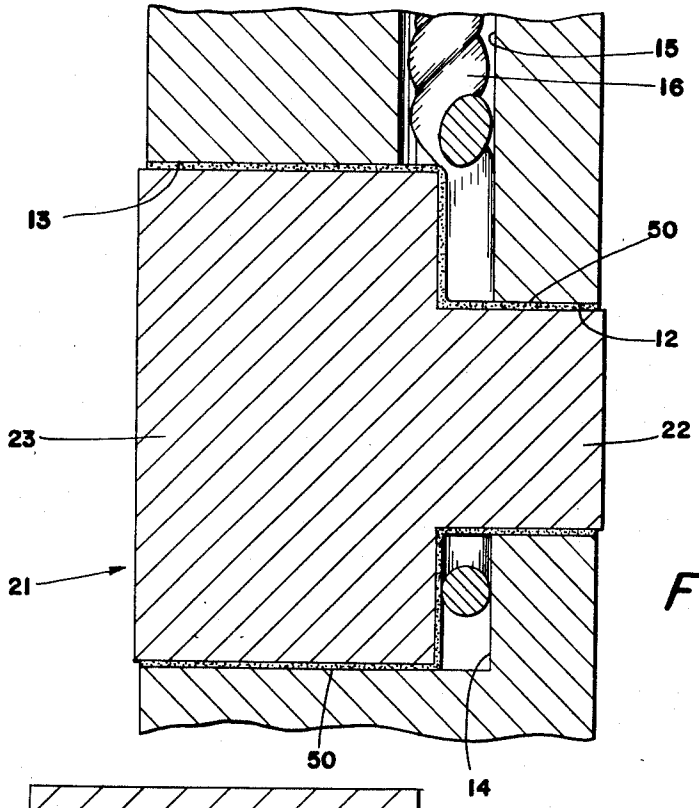


Fig. 5

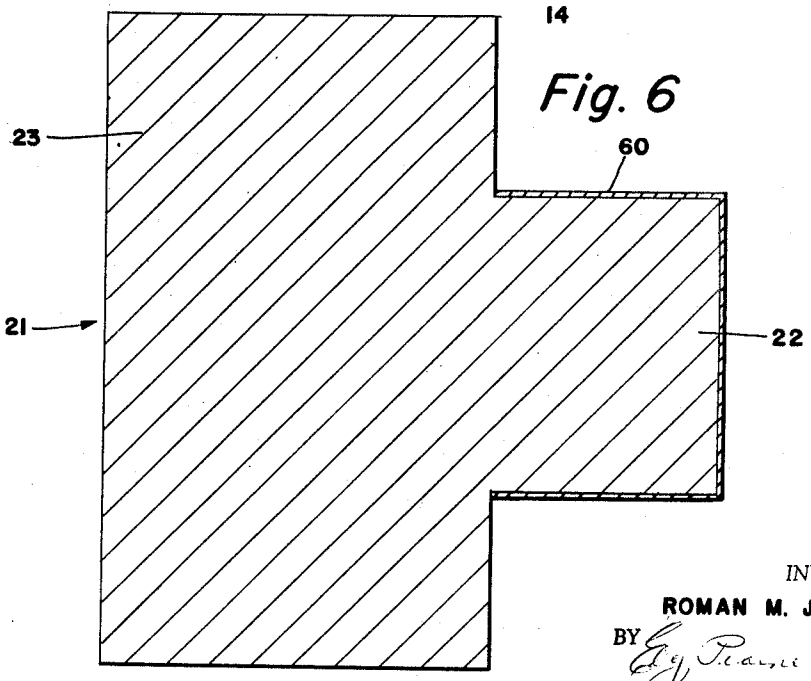


Fig. 6

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COMMUTATOR BRUSH AND CONNECTION

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This invention relates generally to contact brushes for use in electrical apparatus, and more specifically to improved connections between such brushes and the flexible conductors which conduct electric current to and from the brushes.

Heretofore, it has been conventional practice to either fasten an end of the conductor (commonly referred to as a shunt or pig-tail) to a metal rivet or bolt which is secured in the body of the brush, or to insert the end of the shunt into a hole drilled in the brush and then tamp into the hole suitable metal powder. However, neither of these common constructions has been wholly adequate in maintaining a tight, low resistance shunt connection under the continuous vibration to which the brushes are normally subjected, and in resisting failure under adverse operating conditions, such as overload, high temperatures, and the like, which cause high brush temperatures.

For example, in the conventional rivet-type brush construction, the metal rivet expands and contracts in response to temperature variations more rapidly than will the brush, which usually is composed of graphite or carbon, or a mixture thereof with a metal such as copper. The resulting movement of the rivet relative to the brush causes the connection to loosen, thereby producing increased electrical resistance and undue heating of the brush.

Prolonged vibration of tamped shunt constructions usually loosens the metal powder and produces increased electrical resistance. Moreover, when the compacted powder of the connection loosens, air is able to penetrate into the interstices to cause deleterious oxidation of the powder at elevated temperatures.

Prior attempts to overcome the foregoing difficulties, such as using a silver powder to form tamped shunt connections and metallizing the brush around the rivet in the rivet-type brush constructions, have been largely unacceptable from a commercial standpoint because of the high manufacturing costs which are entailed.

An object of the present invention is to provide an improved shunt connection for electrical brushes.

A more specific object of the invention is to provide a mechanically strong, low resistance shunt connection which will withstand prolonged vibration without loosening and which will not deteriorate under severe operating conditions such as heat, overload and the like.

Another object of the invention is to provide a shunt connection having the above described advantages which may be inexpensively manufactured without requiring the high degree of operator skill necessary in forming the prior tamped metal powder type of connections.

Other objects and advantages of the invention will become apparent from the following detailed description and the accompanying drawings.

In the drawings:

FIGURE 1 is an exploded view illustrating a preferred manner of forming a shunt connection in accordance with the present invention.

FIGURE 2 is a front elevational view of the preferred embodiment of the invention.

FIGURE 3 is a cross-sectional view taken along the line 3—3 of FIG. 2.

FIGURE 4 is a cross-sectional view of another embodiment of the invention.

FIGURE 5 is a cross-sectional view of a brush having a button inserted therein and showing a cement bond between the brush and button.

FIGURE 6 is a cross-sectional view of a button having a portion provided with a thin metal coating according to this invention.

Referring first to FIGS. 1, 2 and 3, reference numeral **10** designates a brush which consists essentially of carbon or graphite, or a mixture thereof with metal. The brush **10** is shown as having a concave end surface **11** which may be held by conventional means in sliding contact with the commutator or contact ring of an electrical apparatus.

In accordance with the preferred embodiment of the invention, a hole **12** is drilled through the brush from its front to back surface. The hole **12** is counterbored from one surface of the brush for approximately three-quarters of the brush thickness to form an enlarged recess **13**. The bottom of the recess **13** defines a shoulder **14**. A second hole or passage **15** is angularly drilled through the top surface of the brush **10** into communication with the recess **13** at the shoulder **14**.

A shunt or pig-tail **16**, which is usually formed of twisted or braided copper wires, is doubled on itself within the recess **13** to form a loop **17** and is there securely clamped by a button **21** to form a tight electrical connection with the brush. The free ends of the shunt are fed out of the brush body through the passage **15** and may be twisted together in the manner illustrated in FIGS. 2 and 3.

As shown, the button **21** has stem **22**, which is formed to fit tightly into the hole **12**, and a head **23** of approximately the same diameter as the recess **13**. The axial length of the head **23** is less than the depth of the recess **13** so that the button stem **22** can be inserted through the looped portion **17** of the shunt and the loop **17** tightly compressed between the head and the recess shoulder **14**. As may be seen in FIG. 5, the button **21** is fixedly secured in its assembled position within the brush by a suitable cement **50**, which perferably is conductive.

Instead of being formed of metal, as are the rivets in conventional, rivet-type brush constructions, the button **21** consists of the same material as the body of the brush **10**. By reason of this construction, the button will experience the same degree of expansion as the body of the brush when it is heated, and therefore will have no tendency under severe operating conditions to loosen and produce a defective connection of high electrical resistance.

As is illustrated in FIG. 6 of the drawings, the invention contemplates a slightly modified button construction in which the stem **22** is provided with a thin metal coating **60** consisting of copper, silver or the like. In addition to having substantially the same rate of thermal expansion and contraction as the body of the brush, this latter construction of the button **21** results in the formation of an optimum electrical connection between the shunt **16** and the brush. As distinguished from the relatively expensive prior art practice of metallizing the brushes around the rivets in conventional rivet-type brush constructions, the button stems **22** of the present invention may be inexpensively electroplated by well-known procedures.

Another important advantage of the illustrated construction is the simplicity and ease with which the reliable, mechanically strong and low resistance shunt connection of the invention can be formed. When preparing the connection, all that is necessary is to drill the holes **12** and **15** and the counterbore **13** and separately form the button **21**. The shunt **16** may be then doubled on itself in the recess **13** to form the loop **17** around the side wall of the recess and the free ends of the shunt fed radially outwardly through the passage **15**. The connection is completed by forcing the button stem **22** through the loop **17** into the hole **12** until the head **23** is constrained within the recess **13**, and the loop is slightly flattened against

the recess shoulder 14. Alternatively, the shunt 16 may be wrapped around the stem of the button and the button then inserted into the recess to compress the shunt between the head of the button and the shoulder of the recess. Preferably the cement 50 is applied to the button stem before inserting it into the hole 12. As a final step, the outer surfaces of the button stem and head may be machined to insure that they are flush or slightly recessed from the respective back and front faces of the brush.

When the button is forced into assembled position, the looped portion 17 of the shunt is tightly pressed against the shoulder 14 with the high degree of uniform pressure necessary to provide an optimum conducting path of low resistance between the brush and the shunt. Since the button will expand and contract with temperature changes the same as the body of the brush, the clamping pressure exerted on the shunt will remain constant regardless of changes in the brush temperature, thereby assuring a uniform, optimum conducting path under all operating conditions.

FIGURE 4 illustrates a modified form of the invention. In this embodiment of the invention, a hole or recess 33, which corresponds to the recess 13 shown in FIGS. 1–3, is drilled into the brush 30 from one face thereof. A slanting hole or passage 35 is drilled through the top of the brush into communication with the recess 33 at its bottom surface 34.

A shunt (not shown) is looped within the recess 33 in the same manner as was the shunt 16 in the preferred embodiment of the invention and the free ends of the shunt fed radially outwardly through the hole or passage 35. The looped portion of the shunt is then securely clamped within the recess by inserting the button 41.

The button 41 substantially corresponds to the previously described button 21 except for a relatively short stem 42 which, during the assembly operation, is cemented to the bottom of the recess. The length of the stem 42 is such that the loop of the shunt will be slightly flattened against the bottom 34 of the recess and tightly clamped with a uniform pressure by the button head 43 when the stem 41 is assembled against the bottom of the recess. As in the case of the preferred embodiment of the invention, the button 41 is formed of the same material as the brush so that it will have the same rate of thermal expansion and contraction, and, if desired, may be coated with a suitable metal around its stem 42.

The connection may be prepared by applying a drop of cement to the bottom of either the button stem 42 or the bottom 34 of the recess, inserting the stem through the looped portion of the shunt, and finally forcing the head of the button into the conforming recess until the end of the stem is against the surface 34. As noted above, the length of the stem is such that the shunt will be pressed against the surface 34 by the head of the button to form a satisfactory conducting path. As a final step, the outer surface of the button head 43 may be machined so that it is flush or slightly recessed from the surrounding surface of the brush.

In both embodiments of the invention, the shunt connections are sealed within the brushes by the buttons which, as noted above, remain tightly fixed in their assembled positions. As a result, there is little chance that oxidation or contamination of the connection will occur when the brushes are exposed to elevated temperatures and deleterious atmospheric conditions.

Many other modifications and variations of the invention will obviously be apparent to those skilled in the art in view of the foregoing detailed disclosure. Therefore, it is to be understood that, within the scope of the appended claims, the invention may be practiced otherwise than as specifically shown and described.

What is claimed is:

1. An electrical contact brush comprising a solid body having a recess formed in one side and a separate passage extending into said recess from another side of the body, a shunt extending through said passage into said recess, a shunt-securing button formed of the same material as said body, said button having a head tightly constrained within said recess and a stem extending toward the bottom of said recess, said shunt being looped around said stem and pressed against the bottom of said recess by the head of said button to form a tight, mechanically strong, electrical connection of low resistance between the shunt and the body of the brush.

2. The brush as claimed in claim 1 wherein said body and button consist essentially of a carbonaceous material.

3. An electrical contact brush comprising a solid body having a hole extending therethrough from one side to an opposite side, said hole being counterbored partially through said body from said one side to form an enlarged recess, said body being further provided with a separate passage extending into said recess from another side of the body, a shunt extending through said passage into said recess, a button formed of the same material as said body, said button having a head constrained within said recess and a stem tightly fitted within said hole, said shunt being looped around a portion of said stem and pressed against the bottom of said recess by said head to form a tight, mechanically strong electrical connection of low resistance.

4. The brush as claimed in claim 3 wherein said brush and button consist essentially of a carbonaceous material.

5. An electrical brush comprising a solid body having a recess formed in one side and a separate passage extending radially outwardly from said recess to another side of said body, and a button formed of the same material as said body, said button including a head tightly constrained within said recess and a stem extending toward the bottom of said recess into engagement with said body, said head having an axial length less than the depth of said recess so that a shunt can be looped around said stem and clamped with uniform pressure against the bottom of said recess to form a tight, mechanically strong electrical connection of low resistance.

6. The brush as claimed in claim 4 wherein the carbonaceous material is graphite.

7. The brush as claimed in claim 6 wherein the button stem has a thin coating of metal selected from the group consisting of copper and silver.

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