Nov. 29, 1966 J. E. SLACK 3,289,140

SLIP RING ASSEMBLY

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Fig. 1

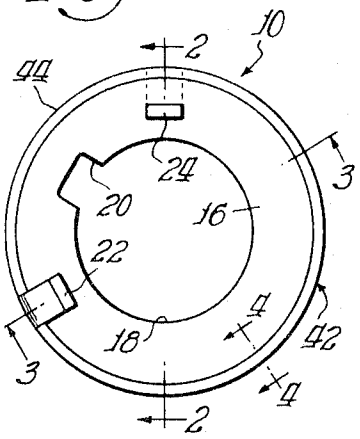


Fig. 2

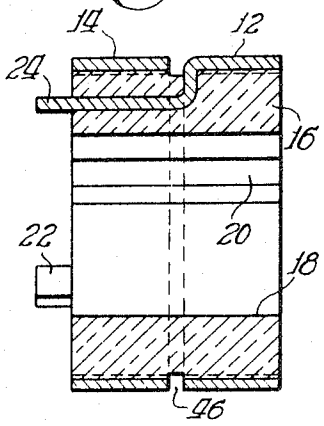


Fig. 3

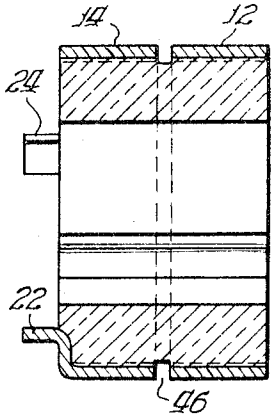


Fig. 4

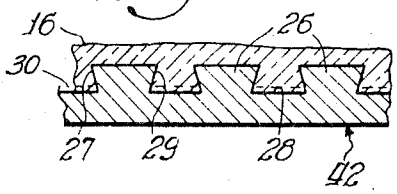


Fig. 5

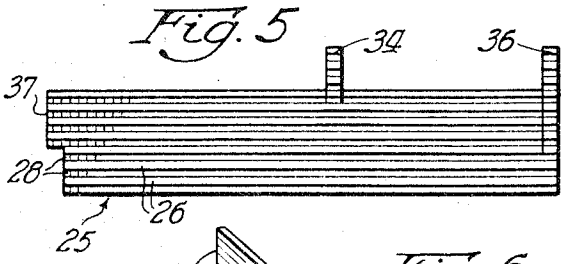


Fig. 7

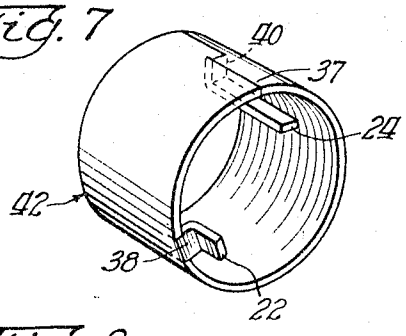


Fig. 6

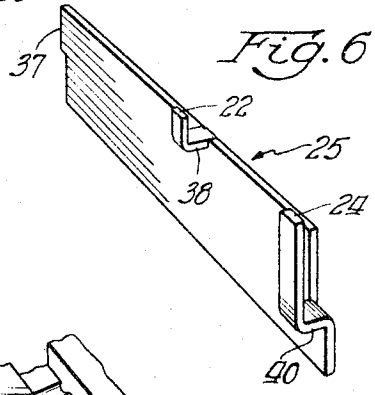
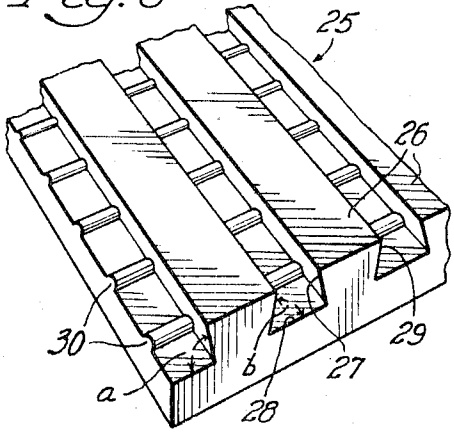


Fig. 8



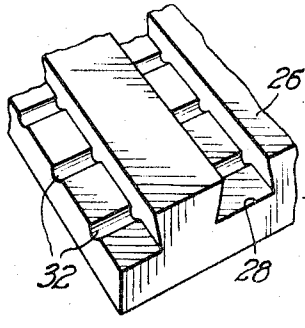


Fig. 9

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Fig. 11

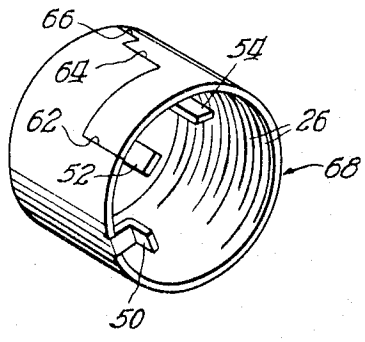


Fig. 10

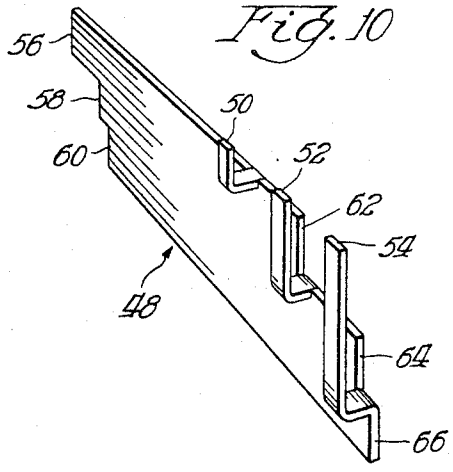


Fig. 12

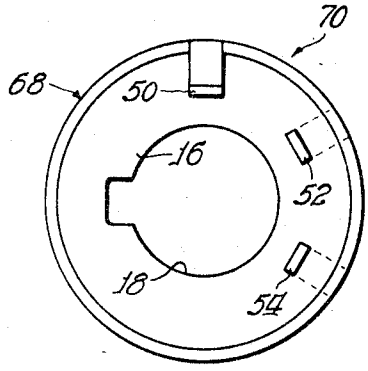
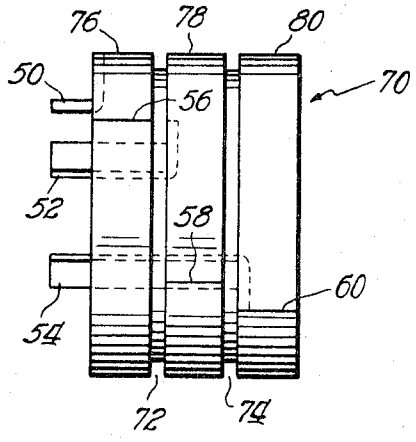


Fig. 13



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SLIP RING ASSEMBLY

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Filed Feb. 26, 1962, Ser. No. 176,869
2 Claims. (Cl. 339—5)

This invention relates to current collecting and distribution devices and more particularly to molded slip ring assemblies.

A number of problems have existed up to the present time in making current-collecting and distributing devices. For example, it has often been a problem to secure slip rings to insulation material in a manner such that they will not tear loose easily from the insulation material. Controlling the relative location of slip rings and conductor leads other than those to which a particular slip ring is attached has also posed a problem. Difficulties have also been encountered where too large a number of parts have gone into slip ring assemblies. This has caused endless difficulty both in the original assembly and later in the actual operation of the device.

One of the objects of this invention is to provide a unitary molded slip ring assembly of simple inexpensive construction. Another object is to provide such as assembly wherein each of the slip rings and its respective conductor lead is integral, that is, both the slip ring and conductor lead being formed from the same material. Thus, no operation is required to connect the conductor lead to the slip ring. A further object is to eliminate the problem of loose parts.

Another object is to provide an assembly in which the construction is such that contact between the conductor leads and either the non-associated slip rings or the shaft upon which the slip ring assembly is mounted will not occur.

Other objects and advantages will be apparent as the description of certain embodiments of the invention proceeds, taken in connection with the accompanying drawings in which:

FIG. 1 is a view in elevation of one embodiment of a unitary molded slip ring assembly;

FIG. 2 is a view in section of the slip ring of FIG. 1 taken along the line 2—2 of FIG. 1;

FIG. 3 is a sectional view taken along the line 3—3 of FIG. 1;

FIG. 4 is an enlarged partial sectional view taken on line 4—4 of FIG. 1;

FIG. 5 is a plan view of a flat metal stamping from which the slip rings and connector leads are made;

FIG. 6 is a perspective view of the stamping of FIG. 5 after conductor leads have been formed from the stamping;

FIG. 7 is a perspective view showing the stamping of FIG. 6 bent into annular form;

FIG. 8 is an enlarged perspective of a portion of the stamping showing a dovetail groove and rib pattern with projections formed in the groove portion;

FIG. 9 is an enlarged perspective of a portion of the stamping showing an alternative construction with depressions formed in the groove portion;

FIGS. 10–13 illustrate a second embodiment of the invention wherein a slip ring assembly has 3 slip rings.

Referring now to FIGS. 1–3, there is shown a unitary molded slip ring assembly **10** comprising slip rings **12** and **14** formed on molded insulation material **16**. The slip ring assembly **10** is adapted to be mounted on a rotating shaft (not shown) so that an inner surface **18** of the molded insulation material will be in contact with said shaft. The assembly **10** may be secured to the shaft by means of a key (not shown) and keyway **20**, for

example. The slip rings **12** and **14** have formed thereon respectively conductor leads **24** and **22** by a method hereinafter to be described. It will be noted from FIG. 2 that the lead **24** is embedded within the molded material.

The method of making the unitary slip ring assembly will now be described. Slip rings **12** and **14** are made from an electrically conductive material such as copper, for example. Initially, a blank **25** (see FIG. 5) is stamped from whatever kind of material which is to be used for the slip rings and conductor leads. This material has been previously roll-formed to provide the dovetailed cross-section shown in FIG. 4. A pattern comprising ribs **26** and grooves **28** is formed in one surface of the blank **25** in a longitudinal direction as shown in FIG. 5. During the forming of the grooves **28** small deformations such as projections **30**, or in the alternative, indentations **32** are formed therein for a purpose to be hereinafter described. The tops of the ribs **26** have been flattened to expand the metal sidewise into the adjacent grooves **28** to leave a dovetailed cross-section as shown in FIGS. 8 and 9. Thus, the sides **27** and **29** of a rib form acute angles *a* and *b* with the bottom of an adjacent groove **28**. This is a continuously extending dovetailed cross-section. Conductor leads **22** and **24** are then formed from the tabs **34** and **46** respectively. The end of the blank **25** opposite the end having the tab **36** is formed with a projecting portion **37** for reasons to become later apparent. The leads **22** and **24** are substantially L-shaped portions. The lead **22** remains connected to the slip ring blank **25** by the portion **38** and the lead **24** remains connected to the slip ring blank by the portion **40**, as seen in FIG. 6. It will be appreciated that in offsetting the lead **24** from the blank **25**, a shearing operation is necessary, as well as a bending operation to form the portion **40** at substantially right angles to the blank **25**. A bending operation is also necessary to offset the lead **22** from the blank **25** as shown in FIG. 6. After all this is done the blank is ready for bending into the annular form **42** shown in FIG. 7.

It will be noted in FIG. 7 that the projecting portion **37** of the blank **25** fits together with the portion of the blank **25** remaining after the lead **24** has been sheared therefrom.

After forming the blank **25** into the annular form **42**, molded insulation material is applied to the inside surface of the blank. The molded material may comprise, for example, a thermo-reactive phenolic resin in combination with a heat-resistant filler such as asbestos fiber, both of these items being commercially available. It will be appreciated that the lead **24** becomes firmly embedded in the molded material after the latter has set.

When the assembly is ready for use, it is mounted, for example, on the rotary member to which it is to be secured. A slight cut may be taken over the outer surface **44** to true this surface with respect to the rotating member. It is at this juncture that the blank **24** in its annular form **42** is separated into the individual slip rings **12** and **14** by merely cutting groove **46** in the assembly and through the annular form. This leaves two separate slip rings **12** and **14** with their respectively integral conductor leads **24** and **22**.

It will also be noted that the slip rings **12** and **14** are tightly secured to the molded material by virtue of the dovetail arrangement as illustrated in FIG. 4. In addition, the projections **30** or in the alternative, the indentations **32**, prevent relative rotary movement between the molded material and the slip rings.

A second embodiment of the invention is shown in FIGS. 11–13 wherein the molded slip ring assembly has three slip rings each having an integral conductor lead. A blank **48** is formed from electrically conductive mate-

rial in which has been impressed the same rib and groove pattern of FIG. 5. By a shear forming operation two conductor leads **52** and **54** are sheared from the blank **48** and the three leads **50**, **52**, and **54** are offset in the same direction from the plane of the blank **48** as shown in FIG. 10. At the left end of the blank 48 as shown in FIG. 10 portions are sheared therefrom so that when the blank is bent into the annular shell form of FIG. 11 the edges **56**, **58**, and **60** will substantially mate with the edges **62**, **64**, and **66**. Insulation material **16** is then molded on the inside of the annular shell **68** to form a molded assembly **70** having an inner surface **18** for positioning on a shaft or other rotary member. When positioned on such rotary member grooves **72** and **74** are cut in the molded assembly **70** through the conductive material leaving insulated slip rings **76**, **78**, and **80** with their respectively attached conductor leads. A truing cut may be taken on the assembly **70** either before or after the grooves **72** and **74** are cut therein. It will be appreciated that the slip ring assemblies having a greater number of slip rings and attached conductor leads may be formed in substantially the same manner by following the teaching herein.

It will be observed that these devices can be relatively simply manufactured. In the slip ring assembly, for example, there are no loose parts, and contact of the conductor leads with either the shaft upon which the assembly is mounted or with a slip ring to which it is not attached is absolutely prevented. In the manufacture of the slip ring assembly, there are no complicated operations such, for example, as matching up apertures in separate slip ring mountings designed to receive conductor leads.

This integral construction of slip rings and conductor leads also eliminates the problem of lack of control in positioning the slip rings with respect to the leads.

In addition, since the slip rings and leads are necessarily of the same material no differences of electrical potential can be set up to cause deterioration of the insulation material.

The dovetailed rib and groove pattern advantageously provides means for solidly securing the slip rings in the molded material. In addition the deformations made in the bottom of the grooves help to prevent relative circumferential movement between the slip rings and the insulation material.

While certain preferred embodiments of the invention have been specifically disclosed, it is understood that the invention is not limited thereto as many variations will be readily apparent to those skilled in the art, and the invention is to be given its broadest possible interpretation within the terms of the following claims.

I claim:

1. A unitary molded slip ring assembly comprising a plurality of substantially cylindrically shaped spaced-apart circumferentially extending electrically conductive strips forming a plurality of slip ring elements and defining a circumferentially extending annular groove between adjacent cylindrically shaped spaced-apart circumferentially extending strips, a substantially cylindrical core of molded insulating material circumscribed by and supporting each slip ring element and being provided with a peripheral surface portion defining a part of said circumferentially extending annular groove, each slip ring element being provided with an integral extension struck out and offset from said structure and extending radially inwardly and axially of a respective element to define an integral conductor lead for a respective slip ring element, each of said slip rings being provided with an internal circumferential portion having plurality of alternating dove-tailed ribs and grooves, and said core having an outer circumferential portion having a plurality of alternating dove-tailed ribs and grooves in complemental axially keyed locking relation with the ribs and grooves of each slip ring.

2. A unitary molded slip ring assembly comprising a plurality of substantially cylindrically shaped spaced-apart circumferentially extending electrically conductive strips forming a plurality of slip ring elements and defining a circumferentially extending annular groove between adjacent cylindrically shaped spaced-apart circumferentially extending conductive strips, a substantially cylindrical core of molded insulating material circumscribed by and supporting each slip ring element and being provided with a peripheral surface portion defining a bottom portion of said circumferentially extending annular groove, each slip ring element being provided with an integral extension struck out and offset from said structure and extending radially inwardly and axially of a respective element to define an integral conductor lead for a respective slip ring element, each of said slip rings being provided with an internal circumferential portion having plurality of alternating dove-tailed ribs and grooves, said core having an outer circumferential portion having a plurality of alternating dove-tailed ribs and grooves in complemental axially keyed locking relation with the ribs and grooves of each slip ring, and each of said grooves of the circumferential portion of the slip rings including a bottom portion having a plurality of deformations for preventing relative circumferential movement between said slip rings and said core.

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