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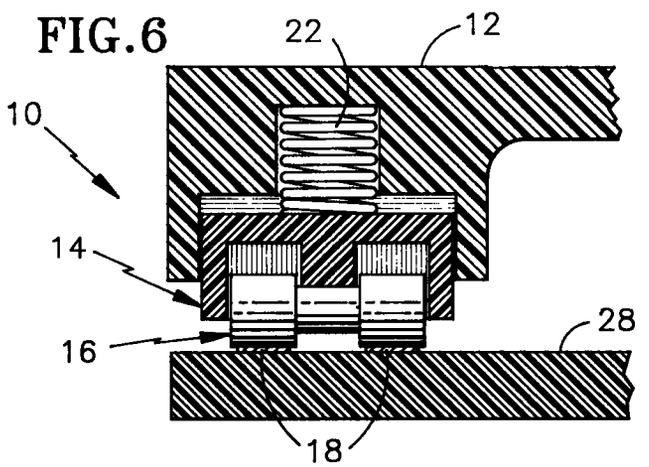
(54) Electrical roller contactor

(57) Disclosed is a contact assembly (10) having a contact roller (16) for electrically coupling two conductive surfaces (18). A feature of the contact assembly (10) is a carrier (12), wherein the carrier (12) controllably guides the contact roller (16) relative to the conductive surfaces (18). Another feature of the contact assembly (10) is a carrier adaptor (14), wherein the carrier adaptor is resiliently supported by the carrier (12), and wherein the contact roller (16) is rotatably supported by the carrier adaptor (14). The use of the carrier adaptor (14) to rotatably support the contact roller (16) provides for rotation of the contact roller (16) during movement of the carrier relative to the conductive surfaces, thereby promoting smooth operation of the contact assembly while maintaining electrical coupling of the conductive surfaces.

FIG.6



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Description

Technical Field

This invention relates generally to electrical contacting devices, and more particularly, to an electrical contact assembly having a rotatable contact roller resiliently biased against first and second conducting surfaces.

Background of the Invention

Electrical contacting devices are used in a number of electro-mechanical applications to make and break electrical circuits. Typically, electrical contacting devices have two conductive surfaces and a contact member formed of a conductive material, wherein at least one of the conductive surfaces is attached to an electrical source. When the contact member is positioned such that it makes contact with both of the conductive surfaces, it electrically couples the two conductive surfaces, thereby making an electrical circuit. Conversely, when the contact member no longer makes contact with both conductive surfaces, then it no longer electrically bridges the conductive surfaces and the circuit is broken.

Electrical contacting devices are commonly used in switches such as a rheostat. In operation, mechanical or electro-mechanical means are used to move the contact member in and out of contact with both of the conductive surfaces, thereby varying the electrical output of the switch. It is common in the design of switches to slide a contact member along either a linear or arcuate path, wherein the conductive surfaces are disposed at discrete locations along these paths. When the contact member reaches a point in the path where both of the conductive surfaces are disposed such that the contact member makes contact with both conductive surfaces, a circuit is made. It is also typical for some switches to have a stationary contact member, wherein the conductive surfaces translate along a linear or arcuate path, thereby forming electrical circuits in a like manner.

The prior art discloses various embodiments of electrical contacting devices. One type of electrical contacting device uses a metal plate as the contact member, wherein the metal plate is biased against the conductive surfaces with a spring. A drawback with this type of contacting device lies in the friction generated as the metal plate slides against the conductive surfaces. This friction may detract from the smooth operation of the contacting device, and may eventually wear down both the metal plate and the conductive surfaces.

In an attempt to alleviate these friction problems, the prior art discloses another type of electrical contacting device wherein a metal roller serves as the contact member. In this type of contacting device, the metal roller is biased against the conductive surfaces by a spring pressing against the central shaft of the roller. A drawback with this type of contacting device lies in the inability of the metal roller to rotate smoothly when pressed between the spring and the conductive surfaces. The positioning of the metal roller causes forces between the spring and the roller such that the rotation of the roller may catch the end of the spring pressed against the roller, thereby tangling the spring with the roller and locking-up the roller's rotation. Under these conditions, the roller would not be able to rotate, thereby causing the locked-up roller to slide along the conductive surfaces and creating the same frictional problems found with the metal plate contacting devices.

Disclosure of the Invention

It is therefore one object of the present invention to provide an electrical contact assembly that uses a contact roller of conductive material to electrically couple two conductive surfaces.

Another object of the present invention is to provide an electrical contact assembly that resiliently supports the contact roller against the conductive surfaces.

Another object of the present invention is to provide an electrical contact assembly that uses a carrier adaptor to rotatably support the contact roller, wherein the carrier adaptor is in turn resiliently supported by a carrier.

Yet another object of the present invention is to provide an electrical contact assembly that reduces wear on both the contact member and the conductive surfaces.

These objects are achieved in the present invention, a contact assembly having a contact roller for electrically coupling two conductive surfaces.

A feature of the contact assembly is a carrier, wherein the carrier controllably guides the contact roller relative to the conductive surfaces.

Another feature of the contact assembly is a carrier adaptor, wherein the carrier adaptor is resiliently supported by the carrier, and wherein the contact roller is rotatably supported by the carrier adaptor.

Still other objects and advantages of the present invention will become readily apparent to those skilled in the art from the following detailed description, wherein only the preferred embodiments of the invention are shown and described, simply by way of illustration of the best mode contemplated of carrying out the invention. As will be realized, the invention is capable of modifications in various respects, all without departing from the invention. Accordingly, the drawings and description are to be regarded as illustrative in nature, and not as restrictive.

Brief Description of the Drawings

FIG. 1 is a perspective, exploded view of an electrical contact assembly embodying features of the present invention;

FIG. 2 is a side view, partly broken away, of the assembled electrical contact assembly of FIG. 1;

FIG. 3 is a top view of a carrier adaptor from the electrical contact assembly of FIG. 1;

FIG. 4 is a side view of the carrier adaptor of FIG. 3;

FIG. 5 is a perspective view of a switch featuring the electrical contact assembly of FIG. 1; and

FIG. 6 is a cross-sectional view, partly broken away, of the electrical contact assembly, taken along line 6-6 of FIG. 5.

Best Mode for Carrying Out the Invention

An electrical contact assembly 10 embodying features of the present invention is depicted in FIGS. 1 and 2. A carrier 12 resiliently supports a carrier adaptor 14, which in turn, rotatably supports a contact roller 16. The contact roller 16 is located proximal to two conductive surfaces 18, such that the contact roller 16 electrically couples the conductive surfaces, and maintains the electrical coupling as the contact roller 16 rotates due to movement of the carrier 12 relative to the conductive surfaces 18. Advantageously, a recess 20 may be provided in the carrier 12 for receiving the carrier adaptor 14.

In a preferred embodiment, the carrier 12 contains a parallelepipedic recess 20 for receiving the carrier adaptor 14, which is of a corresponding parallelepipedic configuration. The recess 20 has a base 20a, and an open face 20b, wherein the base 20a and open face 20b have length and width dimensions which are slightly greater than the length and width dimensions of the carrier adaptor 14. This construction facilitates the ability of the carrier adaptor 14 to be placed within the recess 20 and smoothly slide within the recess 20 both towards and away from the base 20a of the recess 20. The carrier adaptor 14 has a top portion 14a and a bottom portion 14b, such that the bottom portion 14b of the carrier adaptor 14 is proximal to the base 20a of the recess 20 when the carrier adaptor 14 is placed into the recess 20.

In a preferred embodiment, the carrier adaptor 14 is resiliently supported within the recess 20 of the carrier 12 by a helical spring 22 interposed between the bottom portion 14b of the carrier adaptor 14 and the base 20a of the recess 20. The spring 22 is located in the center of the base 20a of the recess, and may be held in that location by means of a shallow spring recess 20c in the base 20a of the recess 20. By placing the spring 22 within the spring recess 20c, the portion of the spring 22 placed in the spring recess 20c is prevented from movement along the base 20a of the recess 20.

In alternative embodiments, the bottom portion 14b of the carrier adaptor 14 may also contain a spring recess for receiving the portion of the spring 22 proximal to the carrier adaptor 14. In addition, the number of springs 22 used to support the carrier adaptor 14 may be greater than the preferred one spring. In yet other embodiments, springs other than helical springs may be used to support the carrier adaptor 14. For example, a leaf spring interposed between the base 20a of the recess 20 and the bottom portion 14b of the carrier adaptor 14 would also provide resilient support for the carrier adaptor 14. In some embodiments, the carrier adaptor 14 may be resiliently supported by the carrier 12 with means other than springs. In these embodiments, elastomeric or other forms of resilient material may be used alone or in combination with springs to provide a similar resilient support as found with springs alone. Although in a preferred embodiment, the carrier adaptor 14 and recess 20 are both parallelepipedic in shape, in alternative embodiments, both the carrier adaptor 14 and the recess 20 may have any type of size or shape, so long as the sizes and shapes correspond such that the carrier adaptor 14 and the recess 20 can be mated properly.

In a preferred embodiment, as depicted in FIGS. 3 and 4, the carrier adaptor 14 has two chambers 14c,14d, wherein the two chambers 14c,14d are separated by a dividing wall 14e. The two chambers 14c,14d have a generally U-shaped cross-section, wherein the open portion of the U-shaped cross-section is located proximal to the top portion 14a of the carrier adaptor 14. The dividing wall 14e is located at a position substantially near the center of the longitudinal length of the carrier adaptor 14, such that the two chambers 14c,14d are of substantially equal sizes. The upper portion of the dividing wall 14e near the top portion 14a of the carrier adaptor 14 has a slot 14f, wherein the slot 14f facilitates the rotational support the contact roller 16.

In a preferred embodiment, the contact roller 16 has a centrally located shaft 16a, with roller ends 16b disposed about both sides of the shaft 16a. Both the shaft 16a and the roller ends 16b should be formed from conductive material, such that an electrical charge would be capable of travelling from one roller end 16b to the other roller end 16b. The shaft 16a should be cylindrical in shape, and accordingly, the slot 14f in the dividing wall 14e of the carrier adaptor 14 should have a semi-circular cross-section such that it can rotatably support the contact roller 16 when the shaft 16a is placed within the slot 14f. When the shaft 16a is placed within the slot 14f, the roller ends 16b are each disposed partially within each of the chambers 14c,14d of the carrier adaptor 14 such that contact roller 14 can rotate freely.

In operation, the carrier 12 is positioned proximal to the conductive surfaces 18 such that each roller end 16b of the contact roller 16 is in contact, respectively, with each of the conductive surfaces 18. In this configuration, if either of the conductive surfaces 18 is connected to an electrical source, then the electrical current will be conducted through the contact roller 16 and into the other conductive surface 18, thereby electrically coupling the two conductive surfaces 18. Upon movement of the carrier 12 relative to the conductive surfaces 18, the contact roller 16 will rotate and maintain electrical coupling of the conductive surfaces 18 while also providing smoother operation and a reduction in contact frictional forces as compared to the prior art contactors. The spring 22 acts to resiliently bias the carrier adaptor

14 towards the conductive surfaces 18, thereby biasing the contact roller 16 against the conductive surfaces 18. Therefore, taking into account the possibility that the distance between the carrier 12 and the conductive surfaces 18 may not always remain constant as the carrier 12 moves relative to the conductive surfaces 18, the use of the spring 22 ensures that the contact roller 18 maintains electrical coupling of the conductive surfaces 18.

In one embodiment of the present invention, as depicted in FIGS. 5 and 6, the contact assembly 10 is part of an electrical switch 24 wherein the contact surfaces 18 are stationary within the switch 24, and the carrier 12 moves relative to the contact surfaces 18. In this embodiment, the carrier 12 movement is facilitated through the attachment of the carrier 12 to a conventional thumbwheel 26, wherein the thumbwheel 26 is rotatably supported by a base portion 28. When the thumbwheel 26 is urged into rotational movement through physical, mechanical, or electro-mechanical means, the carrier 12 is correspondingly urged into motion along an arcuate path. The conductive surfaces 18 are disposed upon the base portion 28 of the switch 24 such that as the carrier 12 moves along the arcuate path, the carrier 12 passes over the conductive surfaces 18 thereby enabling the contact roller 16 to electrically couple the conductive surfaces 18.

In alternative embodiments, a linear guide (not shown) or any other means known in the art for moving a contact member relative to conductive surfaces in electrical switches may be used for moving the carrier 12 along a path. The contact assembly 10 in the switch 24 may be used to make or break electrical circuits, or in the alternative, to decrease or increase electrical output such as in a conventional dimmer switch.

In another embodiment of the present invention, the contact assembly 10 may be part of an electrical switch (not shown) wherein the carrier 12 is stationary and the conductive surfaces 18 move relative to the carrier 12. In this embodiment, the conductive surfaces 18 would be disposed along a path at discrete locations such that at predetermined locations in the movement of the conductive surfaces 18, the contact roller 16 would electrically couple the conductive surfaces 18, thereby making an electrical circuit. The contact assembly 10 in this embodiment may be used to make or break electrical circuits, or in the alternative, to decrease or increase electrical output such as in a conventional dimmer switch (not shown).

In yet another embodiment, both the carrier 12 and the conductive surfaces 18 may experience movement, thereby moving the carrier 12 and the conductive surfaces 18 relative to each other. In all of the various embodiments of the present invention, the carrier 12 and the conductive surfaces 18 may be urged into relative movement through mechanical means, electrical means, magnetic means, hydraulic means, or any combination thereof that would produce the desired relative movement.

It will be readily seen by one of ordinary skill in the art that the present invention fulfills all the objects set forth above. After reading the foregoing specification, one of ordinary skill will be able to effect various changes, substitutions of equivalents, and various other aspects of the invention as broadly disclosed herein. It is intended that the protection granted herein be limited only by the definition contained in the appended claims and equivalents thereof.

Claims

1. An electrical contact assembly for electrically coupling a first conductive surface with a second conductive surface, said electric contact assembly comprising:

   (a) a carrier;
   (b) a carrier adaptor resiliently supported by said carrier; and
   (c) a contact roller rotatably supported by said carrier adaptor, said contact roller being formed of conductive material, said contact roller being disposed proximal to said first and said second conductive surfaces, said contact roller being biased by said carrier adaptor to contact and electrically couple said first conductive surface with said second conductive surface, whereby said contact roller rotates and maintains electrical coupling between said first and said second conductive surfaces upon movement of said carrier through a predetermined distance relative to said first and said second conductive surfaces.

2. An electrical contact assembly for electrically coupling a first conductive surface with a second conductive surface, said electrical contact assembly comprising:

   (a) rotatable conductive contact roller for electrically coupling said first conductive surface with said second conductive surface;
   (b) a carrier for controllably directing said contact roller relative to said first and said second conductive surfaces; and
   (c) a carrier adaptor for rotatably supporting said contact roller, said carrier adaptor facilitating rotation of said contact roller upon movement of said carrier relative to said first and second conductive surfaces, thereby maintaining electrical coupling between said first and said second conductive surfaces.

3. An electrical contact assembly for electrically coupling a first conductive surface with a second conductive surface, said electric contact assembly comprising:

   (a) a carrier;

(b) a carrier adaptor resiliently supported by said carrier; and

(c) conductive means rotatably supported by said carrier adaptor, said conductive means being disposed proximal to said first and said second conductive surfaces, said conductive means being biased by said carrier adaptor to contact and electrically couple said first conductive surface with said second conductive surface, whereby said conductive means rotates and maintains electrical coupling between said first and said second conductive surfaces upon movement of said carrier through a predetermined distance relative to said first and said second conductive surfaces.

4. An electrical contact assembly as claimed in Claim 3, wherein;

said contact roller has a shaft, said carrier adaptor has means for receiving said shaft, said contact roller being rotatably supported by said carrier adaptor when said shaft is received by said means for receiving said shaft.

5. An electrical switch for providing a variable electrical output, said electrical switch having an electrical contact assembly, a first conductive surface, and a second conductive surface, said electrical contact assembly being capable of electrically coupling said first conductive surface with said second conductive surface, said electric contact assembly comprising:

(a) a carrier;

(b) a carrier adaptor resiliently supported by said carrier; and

(c) a contact roller rotatably supported by said carrier adaptor, said contact roller being formed of conductive material, said contact roller being disposed proximal to said first and said second conductive surfaces, said contact roller being biased by said carrier adaptor to contact and electrically couple said first conductive surface with said second conductive surface, whereby said contact roller rotates and maintains electrical coupling between said first and said second conductive surfaces upon movement of said carrier through a predetermined distance relative to said first and said second conductive surfaces.

6. An electrical contact assembly as claimed in any one of Claims 1 to 3 and 5, further comprising:

means for resiliently biasing said carrier adaptor away from said carrier.

7. An electrical contact assembly as claimed in Claim 6, wherein said means for resiliently biasing said carrier adaptor away from said carrier comprises a spring interposed between said carrier and said carrier adaptor.

8. An electrical contact assembly as claimed in any one of Claims 1, 2 and 5, wherein:

said contact roller has a shaft, said carrier adaptor has a slot to receive said shaft, said contact roller being rotatably supported by said carrier adaptor when said shaft is disposed within said slot.

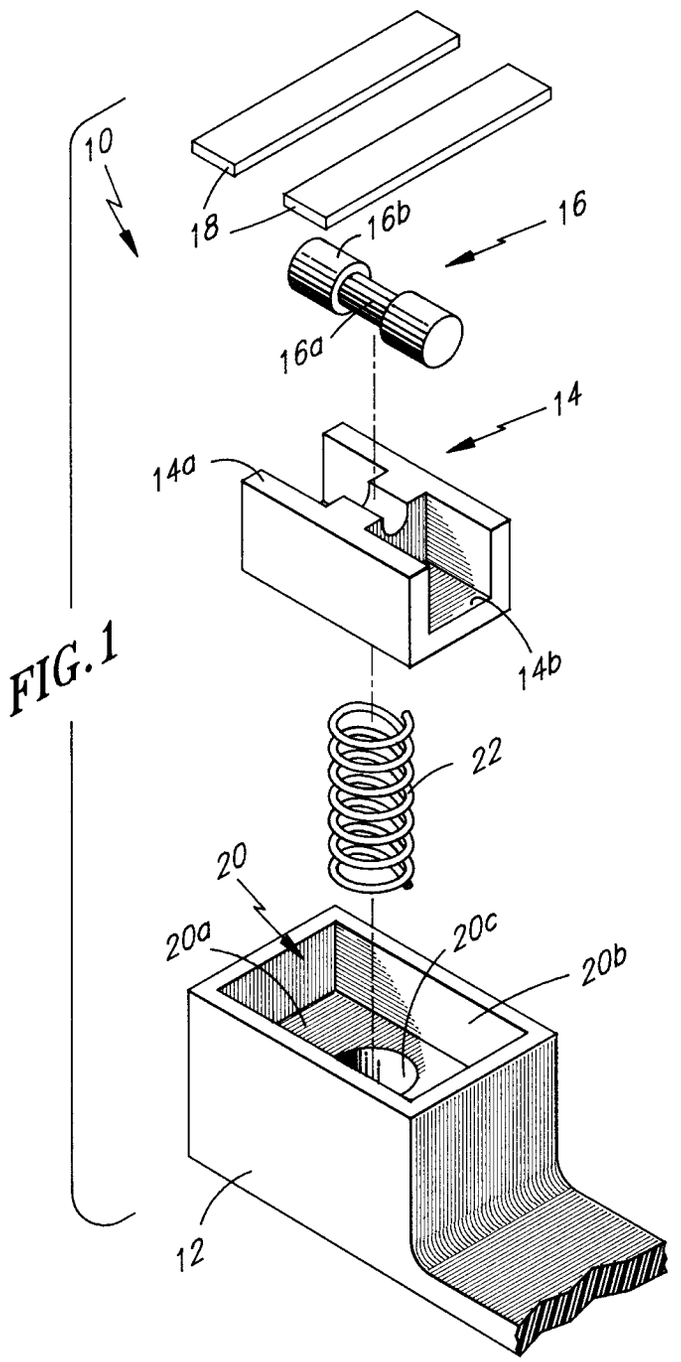

FIG.1

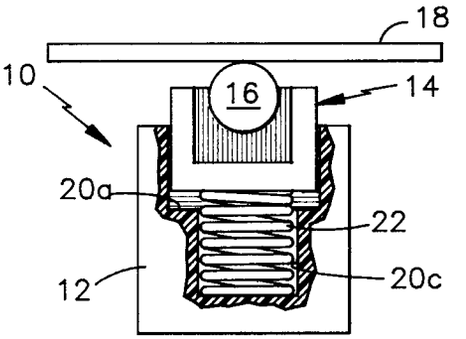

FIG.2

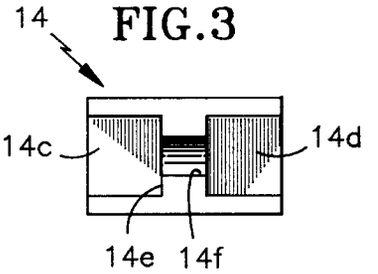

FIG.3

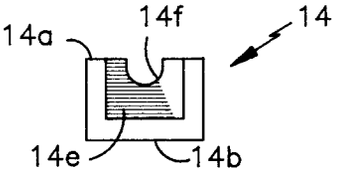

FIG.4

FIG.5

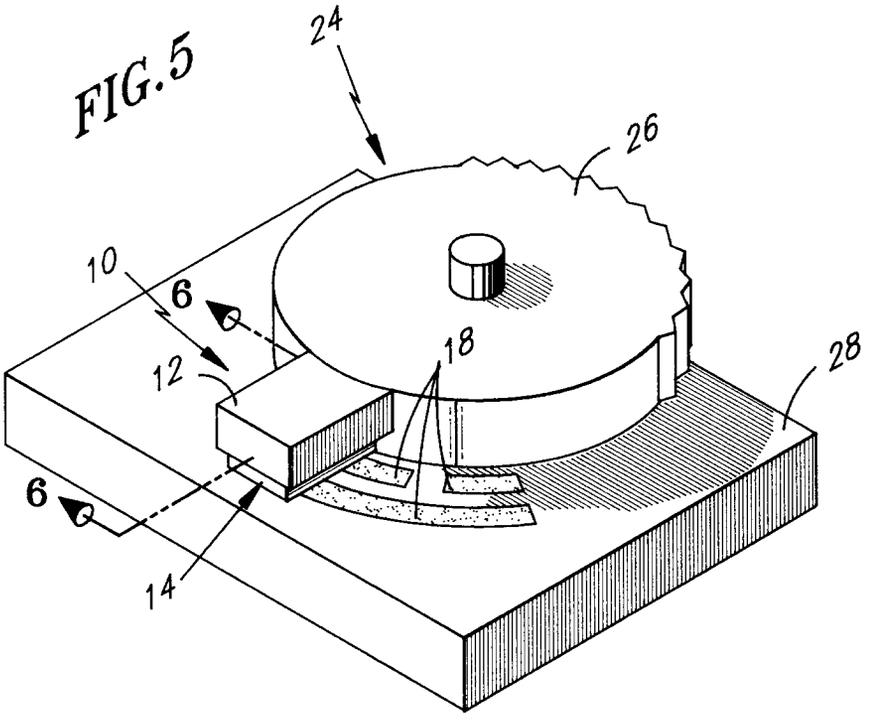

FIG.6