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(54) **Cordless electrical connectors**

(57) A cordless electrical connector (2) for fitting into a cordless power base comprises a connector housing and at least one contact assembly for making electrical contact with a terminal member of a complementary connector part. The contact assembly comprises a leaf

spring for making the electrical contact with the terminal member and an intermediate metal mounting member. The leaf spring is mounted to the mounting member and the mounting member is mounted to the connector housing.

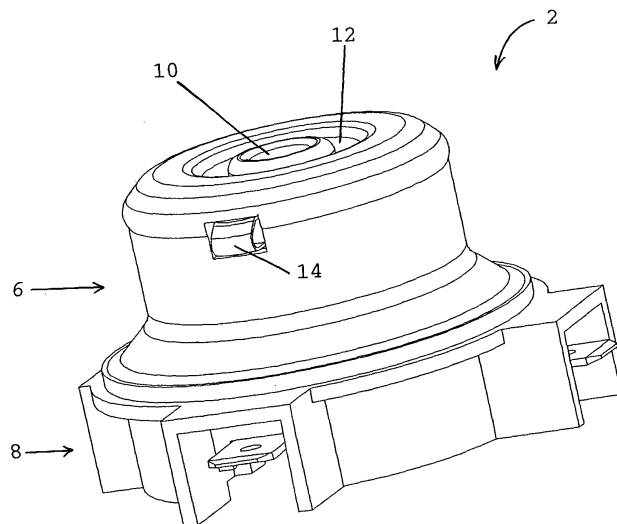


FIG. 1

Description

[0001] This invention relates to certain improvements in cordless mains electrical connectors such as are found in small domestic appliances, particularly those in which electrical connection may be made irrespective of the relative angular orientation of the two connector parts, i.e. so-called 360° connectors.

[0002] Small domestic appliances such as kettles, irons and coffee-makers are nowadays very often provided with a base part connected to the mains electrical supply and a separate appliance-proper part, with cordless electrical connectors provided between them to allow the appliance proper to be powered when it is placed on the cordless base. These cordless appliances offer significantly more convenience to users generally and are thus popular in the market. 360° cordless connectors are perceived to enhance customer convenience even further.

[0003] Some years ago 360° cordless connectors were developed which are suitable for use in these applications. A commercially successful example of such a connector is Applicant's P72 cordless connector which is widely available and described in greater detail in WO 95/08204.

[0004] However, in recent years there has been little significant development in the field of such cordless connectors. It is now an object of this invention to provide some improvement on existing designs.

[0005] When viewed from a first aspect the present invention provides a cordless electrical connector comprising a connector housing and at least one contact assembly for making electrical contact with a terminal member of a complementary connector part, the contact assembly comprising a leaf spring for making the electrical contact with the terminal member and a metal mounting member, wherein the leaf spring is mounted to the mounting member and the mounting member is mounted to the connector housing.

[0006] Thus it will be seen by those skilled in the art that in accordance with the invention rather than simply staking a leaf spring contact member onto a plastic housing, an intermediate metal mounting member is provided which is in turn mounted to the connector housing. One of the principal advantages of this arrangement is that there is no direct path from the (usually plastic) connector housing to the contact leaf spring which reduces the risk of water tracking (whereby water which has inadvertently entered the connector creates an electrically conducting path which leads to shorting and damage to the connector housing).

[0007] Since the risk of tracking is reduced, the connector can be made more compact as compared to known connectors. This has several advantages. Firstly, it gives rise to a saving in material costs, both for the connector itself and also the complementary connector part, especially if this is integrated into a control unit. Secondly, because it allows such a control unit to be smaller

it allows a greater freedom to design such controls, particularly for use in smaller appliances. Thirdly, the more compact appearance of the connector can be considered to have an enhanced visual appeal.

[0008] Another advantage which may be realised in accordance with the invention is that the provision of a metal mounting member means that positioning of the leaf spring within its required tolerance is less dependent upon the tolerance of the connector housing which is usually a plastic moulding. This also helps to reduce cost since it is expensive to mould plastic to a tight tolerance.

[0009] A third advantage of the claimed connector is that if the leaf spring should overheat for any reason there is less danger that it will melt the connector housing locally and stick to it, thereby rendering the connector unusable.

[0010] The metal mounting member may simply play a mechanical role in mounting and supporting the leaf spring contact. Preferably however it serves also to provide electrical connection to the leaf spring. For example in preferred embodiments the mounting member comprises a spade terminal for connecting a corresponding spade connector.

[0011] The leaf spring contact may simply be connected to the mounting member at one end i.e. a proximal or root end. However, in accordance with a preferred feature, the mounting member is arranged also partially to pre-load the leaf spring - that is to hold the leaf spring away from its natural rest position. This gives rise to a greater contact force and also means that the leaf spring is more accurately positioned within the connector. In preferred embodiments the mounting member comprises a restraint portion acting on the leaf spring at a point spaced from the point at which the leaf spring is attached to the mounting member.

[0012] The leaf spring contact could be arranged to make a point or end-on contact with the corresponding terminal member. For example, where as is preferred, the connector parts are 360° connector parts the terminal member will either be arcuate or fully circular and the contact could be made against the arcuate or circular edge.

[0013] In preferred embodiments however the leaf spring contact is arranged so as to contact a radially facing surface of the terminal member i.e. a so-called side-swipe contact. This is advantageous because it lessens the tolerance to which the appliance as a whole must conform and therefore reduces the burden on the appliance manufacturer. The reason for this is that the electrical contact is not dependent upon the vertical positioning of the terminal member relative to the leaf spring which can be affected by either of the vessel body or cordless base mouldings not being sufficiently flat.

[0014] The connector part of the invention may be provided either in the appliance proper or the cordless base or both. In other words both appliance and base connector parts could have contact assemblies as claimed. Preferably at least the base connector part has such a contact

assembly since this is the most prone to the ingress of water.

[0015] The connector may have a single contact assembly of the type claimed - for example other spring contacts may be provided in the complementary connector part or may be of known type. Preferably, however the connector part is provided with two such contact assemblies, preferably corresponding to the mains live and neutral poles. Most preferably the two contact assemblies are identical. This is beneficial as reducing the number of different parts reduces manufacturing costs.

[0016] The leaf spring contact and metal mounting member may be made of any suitable materials consistent with those constraints. Preferably, the leaf spring is made substantially of copper, although the actual contact point may be coated e.g. with silver or even provided with a separately fixed contact member. The mounting member is preferably substantially of brass.

[0017] A preferred embodiment of the present invention will now be described, by way of example only, with reference to the accompanying drawings in which:

Fig. 1 is a perspective view of a cordless connector base part in accordance with the invention;

Fig. 2 is a perspective view showing a complementary male connector part integrated into a control unit;

Fig. 3 is a view from beneath of the connector part of Fig. 1;

Fig. 4 is a view corresponding to Fig. 2 with the connector housing removed;

Fig. 5 is a view from beneath of the connector housing with the three contact assemblies removed; and

Fig. 6 is a plan view of the connector.

[0018] The Figures show a cordless electrical connector arrangement comprising a female base part 2 (Fig. 1) for fitting into a cordless power base and a male connector part 4 (Fig. 2) which is integrated into a control unit for a liquid heating vessel (details of the control unit are not required for an understanding of the present invention). The connection arrangement is one which permits electrical connection to be made at any relative angular orientation - i.e. it is a so-called 360° connection arrangement.

[0019] The female connector part 2 broadly comprises an approximately cylindrical upper portion 6 which in use stands proud of the upper surface of the cordless base (not shown) and a lower portion 8 which is concealed from view within the base housing. As may be seen particularly from Figs. 1 and 6, the female connector part 2 has two apertures defined in its upper surface - namely a circular central aperture 10 and a concentric annular aperture 12. Projecting from an aperture in the side wall of the connector is an earth contact tab 14.

[0020] The corresponding terminals of the complementary male connector part 4 may be seen in Figure 2. Thus there will be seen a central terminal pin member

16 and a concentric annular terminal member 18 which are received in use into the circular and annular apertures 10,12 respectively. There is also a further annular terminal member 20 against which the earth tab 14 bears when the two connector parts 2,4 are brought together. As may be seen from the plan view of Fig. 6, a contact member 22 is provided beneath the central aperture 10 for engaging the central pin terminal member 16; and another contact member 24 is provided beneath the annular aperture for engaging the annular contact member 18. The earth tab contact 14 may also be seen in this view. All three contacts 14,22,24 are of the side swipe variety so that they engage the corresponding radially facing surface of the respective contact members 16,18,20.

[0021] The contact assemblies may be seen in greater detail in Figs. 3 and 4. Here may be seen the three contact assemblies 26,28,30 which provide earth, live and neutral connections respectively. Each contact assembly comprises a leaf spring contact 14,22,24 mounted to a respective metallic mounting member 32,34,36. The connector members 14,22,24 are made of copper and are broadly L-shaped with a rounded kink portion at the lower end which forms the actual point of contact between the contact member and the corresponding terminal member. The kinked portions face radially inwardly in the case of the two current carrying contact members 22,24 and radially outwardly in the case of the earth contact member 14.

[0022] All three contact members 14,22,24 are staked to their respective mounting members 32,34,36 by means of pins 38. Of course any other form of fixing can be used such as soldering, brazing, riveting, crimping, clipping, twist-locking etc. The two current carrying contact assemblies 28,30 are in fact identical which reduces the cost of manufacture. In fact, including the connector housing moulding shown in Fig. 5, only five different pieces are required to make the connector and only seven pieces in total.

[0023] As will be seen, the mounting members 34,36 have a stepped portion in which an aperture 34a,36a is defined. The corresponding contact members 22,24 pass through the respective apertures 34a,36a. The contact members 22,24 are shaped prior to being fixed to the mounting members 34,36 such that they must be bent in the acute direction in order to pass through the apertures 34a,36a and be staked at the top by the pins 38. This means therefore that the front portions 34b,36b of the respective mounting members bear against the leaf springs 22,24 so as to pre-load them from their natural shape. This helps to locate the contacts within the connector housing more accurately.

[0024] The earth contact assembly 26 is somewhat similar to the current carrying contact assemblies 28,30 but in reverse so that the contact member 14 is pre-loaded away from a more acute natural shape by the vertical arm of the L-shaped mounting member 32.

[0025] The ends of the mounting members 32,34,36 are each formed as spade terminals 40 to facilitate rapid

and secure connection to the mains electrical supply.

[0026] The vertically extending side edges 32c,34c, 36c of the respective mounting members are each formed with serrations which engage in corresponding pairs of vertical slots 42,44,46 formed in the moulded plastics connector housing (see Fig. 5) which allows the respective contact assemblies 26,28,30 simply to be pressed into the underside of the connector housing and thereafter to be securely retained in the slots. It will be appreciated that since the contact leaf springs 14,22,24 are rated from the brass mounting members 32,34,36 rather than directly from the plastics housing, the tolerance requirement placed on the moulding is less stringent. It can also be seen that there is no direct path from the top of the connector housing through the apertures 10,12 to the current carrying contacts 22,24 which means that the risk of water tracking is very much reduced.

[0027] Although the invention has been described with reference to a particular embodiment, it will be understood that the invention is not limited to this embodiment and many variations and modifications are possible within the scope of the invention. For example, the connector part is showing as being that for a cordless base, but equally it could be provided on the appliance proper. Indeed, contact assemblies of the kind described may be provided on both connector parts. Also, although a 360° connector is shown the principles of the invention are equally applicable to non-360° cordless connectors. Similarly, although the connector has been described in the context of a cordless liquid heating vessel it may equally be used in other cordless appliances.

Claims

1. A cordless electrical connector (2) comprising a connector housing and at least one contact assembly (26,28,30) for making electrical contact with a terminal member (16,18,20) of a complementary connector part (4), the contact assembly (26,28,30) comprising a leaf spring (14,22,24) for making the electrical contact with the terminal member (16,18,20) and a metal mounting member (32,34,36), wherein the leaf spring (14,22,24) is mounted to the mounting member (32,34,36) and the mounting member (32,34,36) is mounted to the connector housing.
2. A cordless electrical connector as claimed in claim 1 wherein the metal mounting member (32,34,36) provides electrical connection to the leaf spring (14,22,24).
3. A cordless electrical connector as claimed in claim 1 or 2 wherein the mounting member (32,34,36) is arranged partially to pre-load the leaf spring (14,22,24) by holding the leaf spring (14,22,24) away from its natural rest position.
4. A cordless electrical connector as claimed in any preceding claim wherein the mounting member (32,34,36) comprises a restraint portion acting on the leaf spring (14,22,24) at a point spaced from the point at which the leaf spring (14,22,24) is attached to the mounting member (32,34,36).
5. A cordless electrical connector as claimed in any preceding claim adapted to make said electrical contact irrespective of the relative angular orientation of the connector (2) and said complementary connector part (4).
6. A cordless electrical connector as claimed in claim 5 wherein the leaf spring contact (14,22,24) is arranged so as to contact a radially facing surface of the terminal member (16,18,20).
7. A cordless electrical connector (2) as claimed in any preceding claim comprising two contact assemblies (26,28,30) for making electrical contact with a terminal member (16,18,20) of a complementary connector part (4), each contact assembly (26,28,30) comprising a leaf spring (14,22,24) for making the electrical contact with the terminal member (16,18,20) and a metal mounting member (32,34,36), wherein the leaf spring (14,22,24) is mounted to the mounting member (32,34,36) and the mounting member (32,34,36) is mounted to the connector housing.
8. A cordless electrical connector as claimed in claim 7 wherein the contact assemblies (28,30) correspond to the mains live and neutral poles, respectively.
9. A cordless electrical connector as claimed in claim 7 or 8 wherein the two contact assemblies (28,30) are identical.
10. A cordless electrical connector as claimed in any preceding claim wherein the leaf spring (14,22,24) is made substantially of copper.
11. A cordless electrical connector as claimed in any preceding claim wherein the mounting member (32,34,36) is made substantially of brass.
12. A base connector part for a liquid heating vessel comprising a cordless electrical connector as claimed in any preceding claim.
13. A cordless electrical liquid heating vessel comprising an appliance part and a base part, and further comprising a cordless electrical connector as claimed in any preceding claim on one of said base and appliance parts.

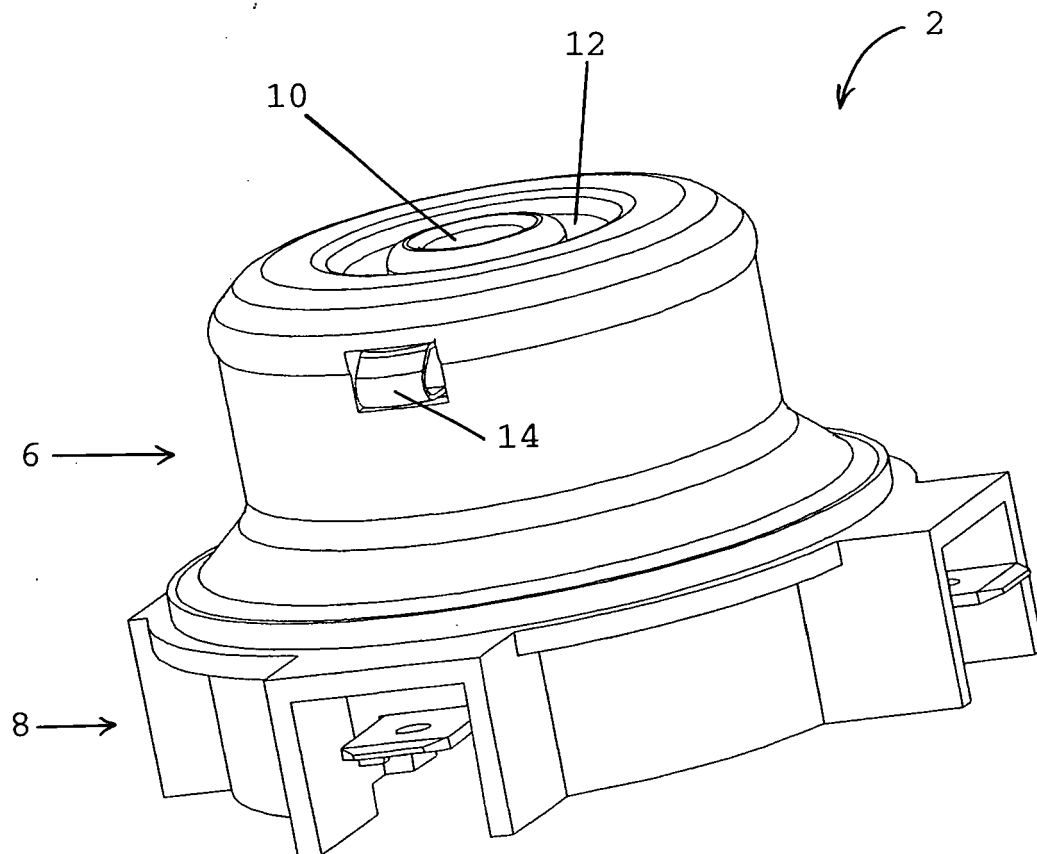


FIG. 1

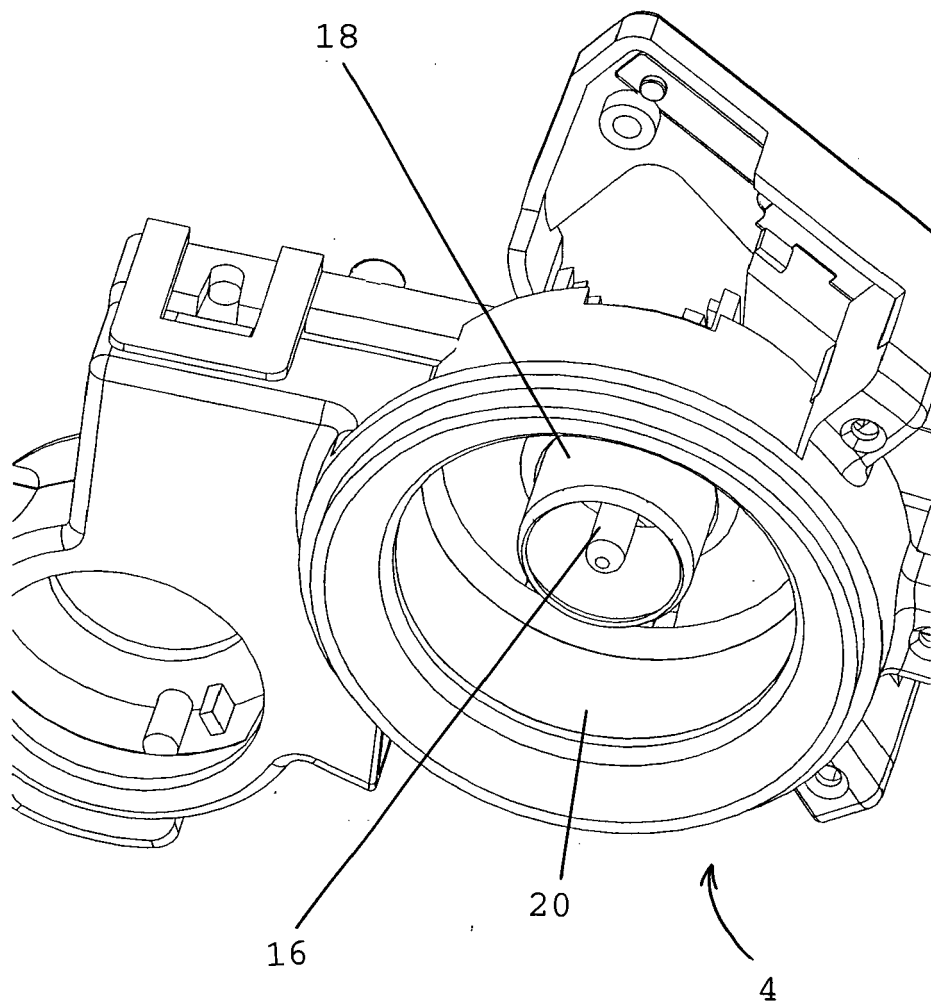


FIG. 2

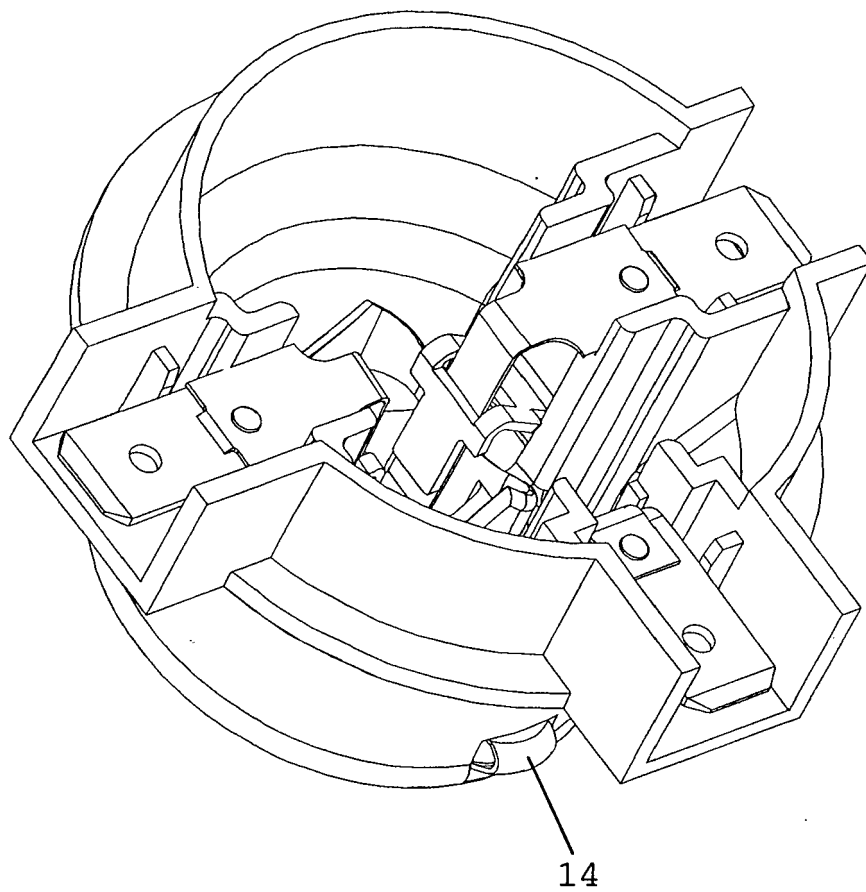


FIG. 3

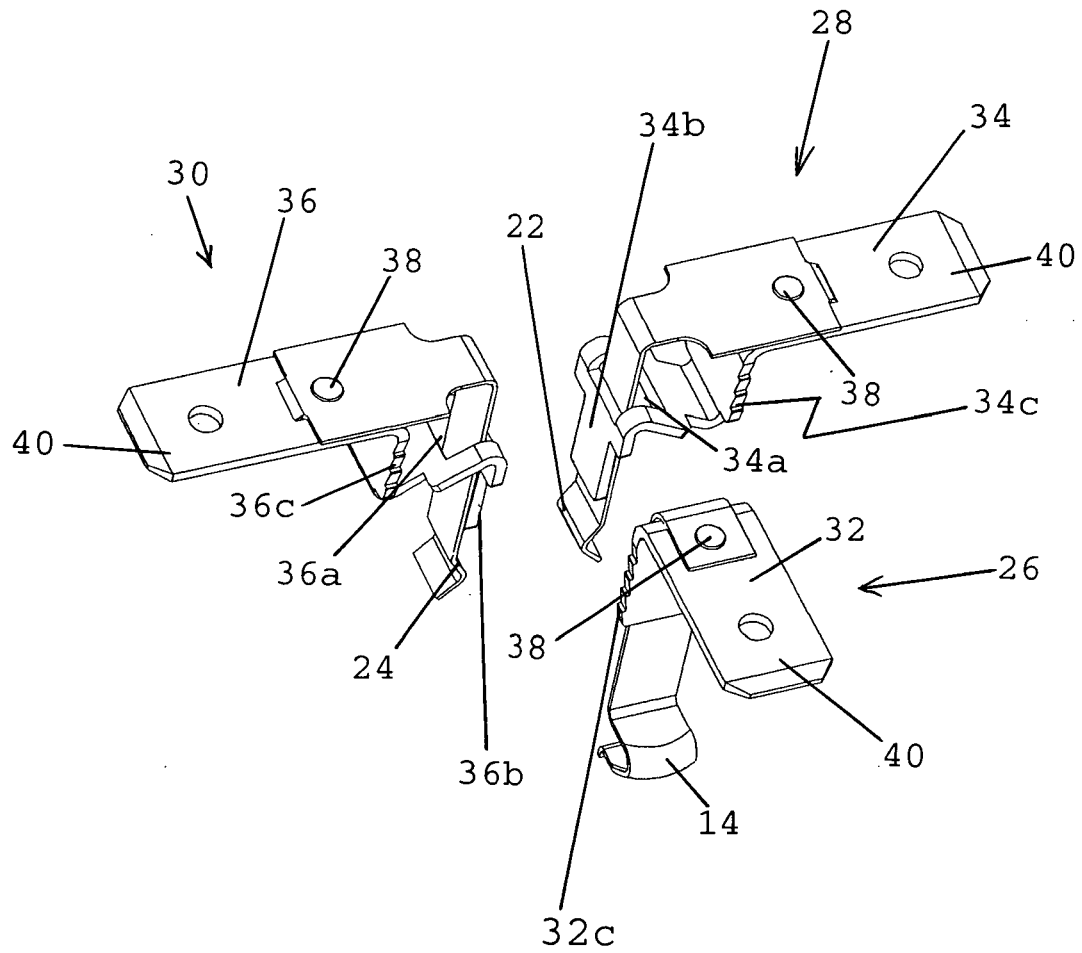


FIG. 4

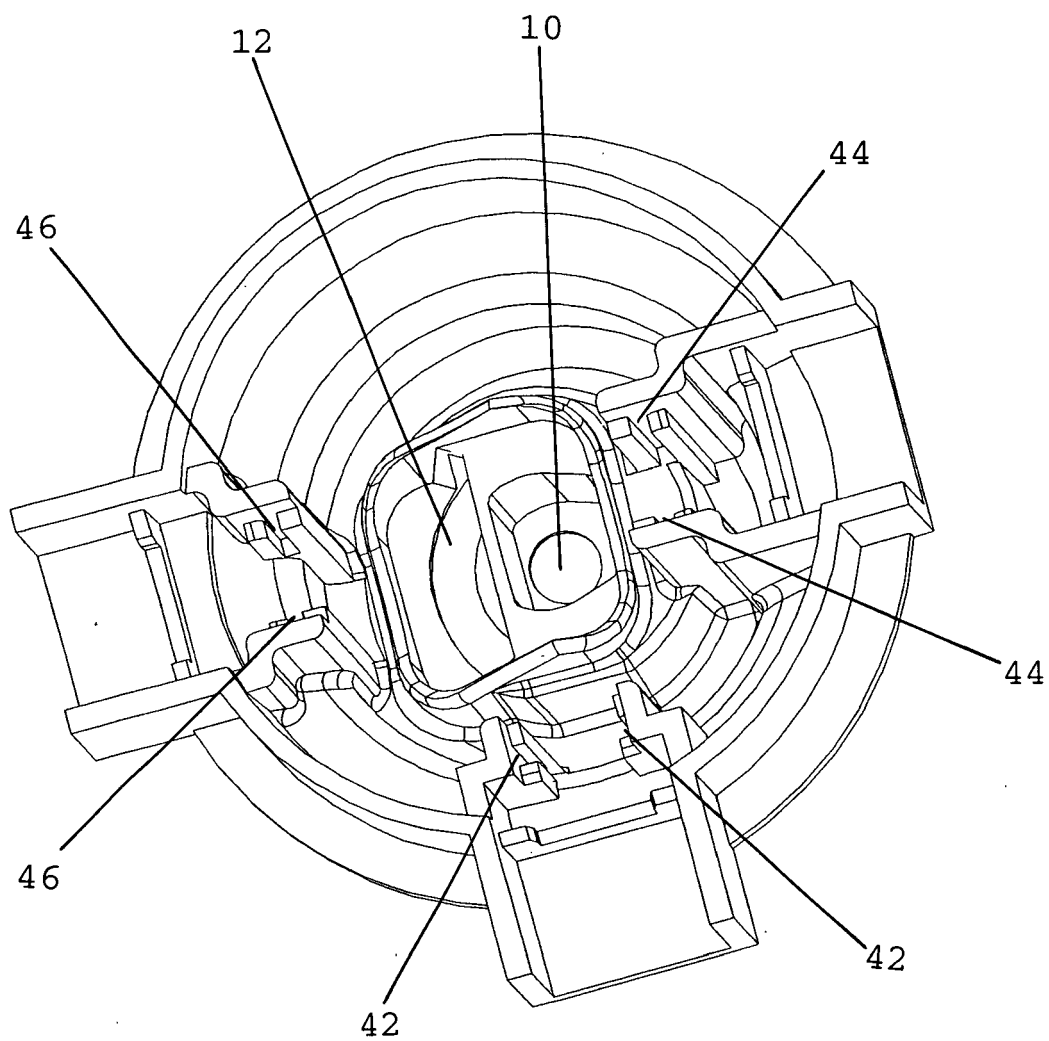


FIG. 5

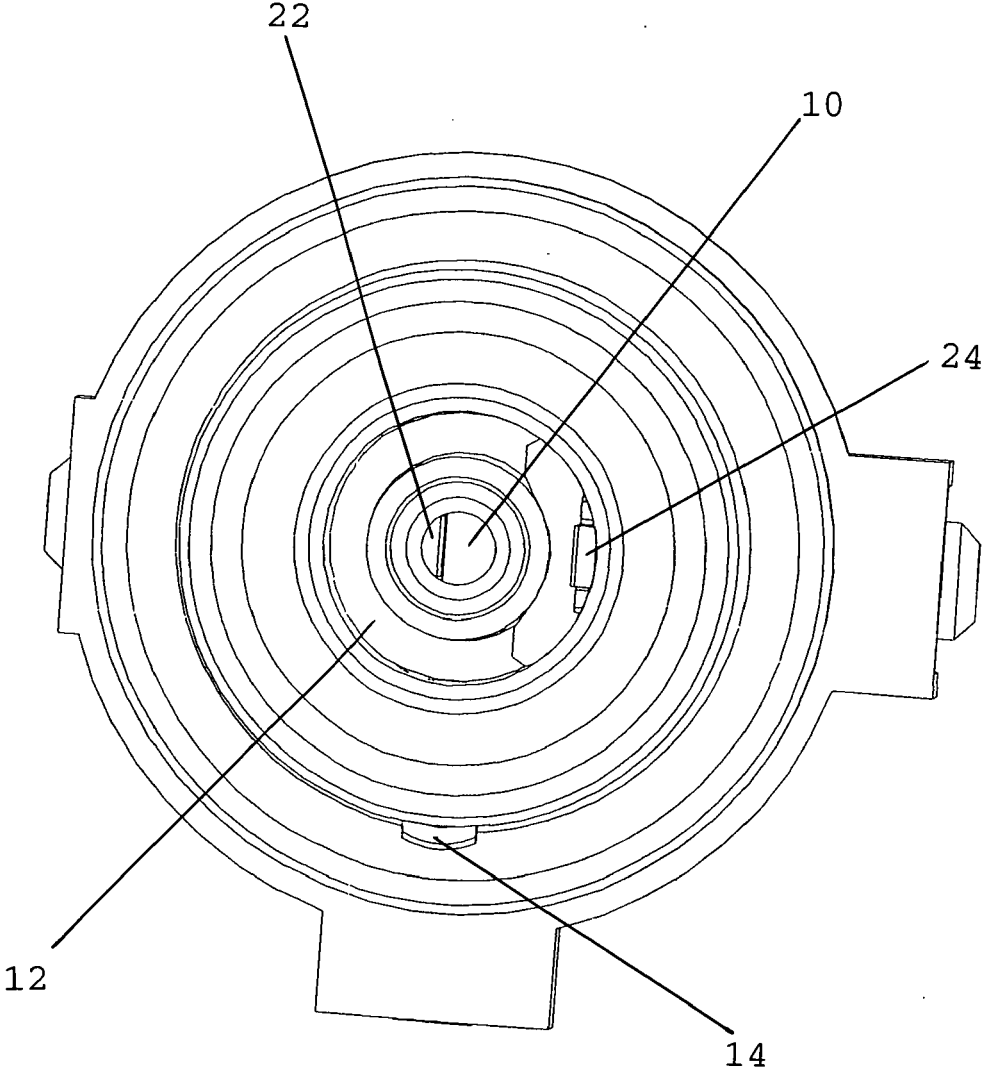


FIG. 6

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

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