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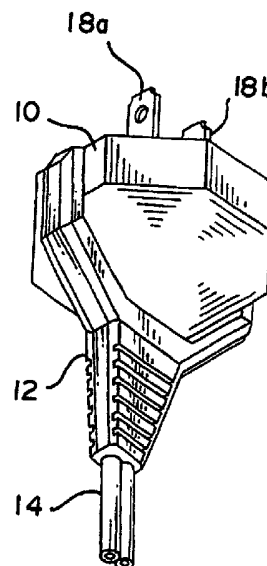
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(54) Title: PIVOTING ELECTRICAL PLUG

(57) Abstract

An electrical plug is disclosed in which the plug body (10) having the electrically conductive pins (18) is pivotally attached to an attachment body (12) such that the plug body and attachment body may pivot with respect to each other about a pivot axis (16). The attachment body (12) is connected to an electrical wire (14) and the electrical conductors in the wire are connected to each of the conductive pins (18) at the pivot axis (16) so as not to interfere with the pivoting motion between the plug body (10) and the attachment body (12). Such pivoting movement enables the plug body to be oriented in substantially any fashion with respect to the electric wire (14). The wire may extend from a side of the plug body (10), or outwardly from the plug body opposite the electrically conductive pins (18). Such pivoting movement enables the electrical device to which the wire (14) is connected to be located virtually anywhere with respect to an electrical outlet. The plug body (10) may be oriented to engage the outlet irrespective of the direction in which the electric wire must proceed from the plug.



PIVOTING ELECTRICAL PLUG

The present invention relates to an electrical plug, more particularly such an electrical plug in which the plug body having electrically conductive pins extending therefrom is pivotable with respect to an attachment body connected to the electrical wire.

Electrical plugs are, of course, well known in the art and typically comprise a plug body having electrically conductive pins extending therefrom connected to an electrical wire through the plug body. The plug body is usually fixedly connected to the electrical wire such that the electrical wire extends directly outwardly from the plug body, or outwardly through a side of the plug body. The location of the electrical socket into which the electrical plug is placed and the electrical device connected to the electrical wire may necessitate a specific relationship between the electrically conductive wire and the plug body. If the electrical outlet has limited access, it may be necessary to use a plug body having the electrical wire extending

out the side of the plug, or, in the alternative, the location of the electrical device in front of the electrical outlet may necessitate for the electrical wire to extend directly outwardly from the plug body.

An example of an electrical plug, the pins of which are pivotable about the plug body, is disclosed in US Patent No. 3,474,376. This arrangement only allows limited rotation to a maximum of 90°.

The electrical plugs attached to the wires of electrical devices, such as lamps, stereos, kitchen appliances, and extension cords typically are fixed relative to the electrical wire preventing any change in the relative orientation of between the electrical wire and the plug body. Depending upon the location in which the electrical device is utilized, this fixed relationship between the plug body and the electrical wire may prevent usage of the electrical device, or may be inconvenient to the user.

It is an object of the present invention to overcome or ameliorate at least one of the disadvantages of the prior art, or to provide a useful alternative.

According to the invention there is provided a pivoting electrical plug comprising: a plug body having at least one electrically conductive pin extending therefrom; means for connecting an electrically conductive wire to the at least one conductive pin; and

characterised by an attachment body being pivotally connected to the plug body such that the plug body and attachment body may pivot with respect to each other about a pivot axis, said electrically conductive wire being located in said attachment body and passing into the plug body along the axis of pivotal connection between said plug body and said attachment body.

The attachment body is preferably connected to an electrical wire and the electrical conductors in the wire extend into the plug body along the pivot axis so as not to interfere with the pivoting motion between the plug body and the attachment body. Such pivoting movement enables the plug body to be oriented in substantially any fashion with respect to the electrical wire. The wire may extend from a side of the plug body, or outwardly from the plug body opposite the electrically conductive pins. Such pivoting movement enables the electrical device to which the wire is connected to be located virtually anywhere with respect to an electrical outlet. The plug body may be oriented to

engage the outlet irrespective of the direction in which the electric wire must proceed from the plug.

In a preferred embodiment, the pivoting electrical plug may be utilized with a two conductor electrical wire in which the plug body has two conductive pins extending therefrom, or with a three conductor electrical wire in which one of the conductors is a ground conductor and which has three conductive pins extending from the plug body. In a two conductor electrical plug, the conductors from the electric wire are connected to each of the conductive pins extending from the plug body. The wires may be directly attached to each of the conductive pins, or may be connected thereto via an electrical contact formed on the conductive pin and an electrical contact connected to one of the conductors of the electrical wire. The electrical contact formed on the conductive pin assumes a concave, generally hemispherical configuration with the concave surface in physical and electrical contact with either an elongated member spring biased into physical contact with the concave surface and connected to one of the electrical conductors, or by a convex, generally hemispherical contact formed as part of a resilient member which, in turn, is physically connected to the electrical wire conductor.

In a three wire plug, the ground conductor may be directly attached to the conductive ground pin extending from the plug body, or the conductive pin may be attached to a ground plate having generally cylindrical ground contacts which are engaged by arcuate contact formed on a separate ground plate physically attached to the ground conductor in the electrical wire. The conductive pin contacts, as well as the ground contacts are located on the pivot axis between the plug body and the attachment body while maintaining electrical contact between the conductive pins and the electrical wire.

Unless the context clearly requires otherwise, throughout the description and the claims, the words 'comprise', 'comprising', and the like are to be construed in an inclusive sense as opposed to an exclusive or exhaustive sense; that is to say, in the sense of "including, but not limited to".

Some embodiments of the invention will now be described by way of example only and with reference to the accompanying drawings, in which:-



Figures 1A-1C are perspective views of the pivoting electric plug according to the present invention illustrating various respective positions of the plug body and the attachment body.

Figure 2 is a cross-sectional view of a first embodiment of the pivoting electrical
5 plug according to the present invention.

Figure 3 is a schematic, perspective view of the electrical plug illustrated in Figure
2.

Figure 4 is a top view of a convex contact and a connecting member utilized in the
plug illustrated in Figures 2 and 3.

10 Figure 5 is a side view of the convex contact and the connecting member
illustrated in Figure 4.

Figure 6 is a cross-sectional view of the embodiment of Figure 2 having three
conductive pins including a ground pin.

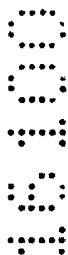


Figure 7 is a schematic, perspective view of the electrical plug illustrated in Figure 6.

Figure 8 is a cross-sectional view taken along line VIII-VIII in Figure 6.

Figure 9 is a cross-sectional view taken along line IX-IX in Figure 6.

5 Figure 10 is a cross-sectional view taken along line X-X in Figure 6.

Figure 11 is a cross-sectional view taken along line XI-XI in Figure 6.

Figure 12 is a rear view of a first ground plate utilized in the plug illustrated in Figure 6.

10 Figure 13 is a side view of the ground pin and the first ground plate illustrated in Figure 12.

Figure 14 is a rear view of a second ground plate utilized in the embodiment illustrated in Figure 6.

Figure 15 is a side view of the second ground plate illustrated in Figure 14.

15 Figure 16 is a cross-sectional view of a second embodiment of the electrical plug according to the present invention.

Figure 17 is a schematic, perspective view of the electrical plug illustrated in Figure 16.

Figure 18 is a cross-sectional view taken along line XVIII-XVIII in Figure 16.

Figure 19 is a cross-sectional view taken along line XIX-XIX in Figure 16.

5 Figure 20 is a cross-sectional view taken along line XX-XX in Figure 16.

Figure 21 is a cross-sectional view of the elongated contact member utilized with the embodiment of the plug illustrated in Figure 16.

Figure 22 is an end view of the elongated contact member illustrated in Figure 21.

10 Figure 23 is a cross-sectional view of a third embodiment of the pivoting electrical plug according to the present invention.

Figure 24 is a cross-sectional view of the electrical plug illustrated in Figure 23.

Figure 25 is a cross-sectional view taken along line XXV-XXV in Figure 23.

Figure 26 is a cross-sectional view of the embodiment illustrated in Figure 23 with a ground pin connected to a ground wire.

Figure 27 is a cross-sectional view taken along line XXVII-XXVII in Figure 26.

Figure 28 is a perspective view of the electrical plug illustrated in Figures 26 and

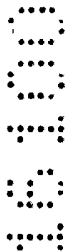
5 27.

Figure 29 is a cross-sectional view taken along line XXIX-XXIX in Figure 27.

Figure 30 is a schematic perspective view showing a variation in the third embodiment according to the present invention.

Figure 31 is a schematic perspective view showing a second variation of the third
10 embodiment according to the present invention.

The electrical plug has a plug body 10 pivotally attached to an attachment body 12 which is, in turn, connected to an electrical wire 14. As can be seen in Figures 1A-1C, the plug body 10 is pivotally attached to the attachment body 12 such that the elements are relatively pivotable with respect to each other about pivot axis 16. Although Figures
15 1A-1C illustrate the electrical plug body having an octagonal configuration, it is to be understood that the



plug body can assume other configurations without exceeding the scope of this invention. As will be described in more detail, the invention encompasses a pivoting electrical plug having two conductive pins connected to an electrical wire having two conductors, as illustrated in Figures 1A-1C, as well as the plug body having three
5 conductive pins, including a ground pin, connected to a three conductor electrical wire. Additional pins may be included as necessary without exceeding the scope of the invention. When the plug body 10 has "low profile", or a relatively small thickness, the attachment body 12 may be used to pull the plug from a socket, as illustrated in Fig. 1B.

10 A first embodiment of the pivoting electrical plug according to the present invention is illustrated in Figures 2-15. This embodiment may be utilized with a two conductor electrical wire, as illustrated in Figures 2 and 3, or a three conductor electrical wire as illustrated in Figures 6 and 7. The two conductor electrical wire embodiment comprises a plug body 10 and an attachment body 12, connected to the
15 dual conductor electrical wire 14. Plug body 10 has coaxial openings on either side into which are inserted arms 12a and 12b of attachment body 12 such that plug body 10 and attachment body 12 are pivotable with respect to each other about pivot axis 16. For use with the dual conductor electrical wire 14, plug body 10 will have two conductive pins 18a, 18b extending therefrom. Although the conductive pins 18a, 18b
20 will be described and illustrated as comprising generally flat, planar pins configured to engage a standard wall socket, the concepts according to this invention may be utilized with conductive pins having any configuration and located so as to engage any socket configuration. Conductive pins 18a and 18b have concave, generally hemispherical electrical contacts 20a and 20b, either formed integrally therewith (as

illustrated) or electrically attached to the conductive pins. The concave, generally hemispherical contacts 20a and 20b each have an axis of symmetry that is coaxial with the pivot axis 16.

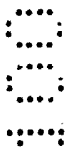
5 Second contacts 22a, 22b, in this particular embodiment having a convex, generally hemispherical configuration, are in physical and electrical contact with the concave surfaces of the concave contacts 20a and 20b, respectively. As can be seen in Figures 4 and 5, the convex contacts 22a, 22b are attached to a connecting member, 24a, 24b, each of which is, in turn, connected to a conductor 14a, 14b of the electric wire 14. The convex contacts 22a and 22b each have an axis of symmetry
10 that is coaxial with the pivot axis 16. The connecting members 24a, 24b may be formed of resilient material so as to bias the convex contacts 22a, 22b into physical and electrical contact with concave contacts 20a, 20b. Thus, during the relative pivoting movement between the plug body and the attachment body 12, electrical contact is maintained between the concave contacts 20a and 20b, and the convex
15 contacts 22a and 22b.

The aforementioned embodiment may also include a plug body having three conductive pins electrically connected to a three conductor electrical wire, as illustrated in Figures 6-15. In these figures, portions of the pivoting electrical plug identical to those in the previously described embodiment illustrated in Figures 2-5
20 have been given the same identifying numerals. The plug body 10 also includes a ground pin 26 extending therefrom which is electrically connected to a first ground plate 28. First ground plate 28 has on either lateral side generally cylindrical first

ground contacts 30a, 30b. The ground contacts 30a, 30b have axes of symmetry that are located coaxially with the pivot axis 16. A second ground plate 32 is located within the attachment body 12 with second ground contacts 32a and 32b extending into the plug body. The second ground contacts 32a and 32b have an arcuate configuration, as best
5 illustrated in Figure 15, and are sized so as to physically and electrically contact the inner surface of one of the cylindrical ground contacts 30a, 30b. Again, the second ground contacts 32a, 32b are coaxially located with respect to the pivot axis 16 such that electrical contact is maintained as the plug body 10 and attachment body 12 are pivoted with respect to each other. The second ground plate 32 is connected to the ground
10 conductor 36c of electric wire 36. The two other conductors 36a, 36b of the electric wire 36 are connected to the connecting members 24a and 24b as previously described.

A second embodiment of the pivoting electric plug is illustrated in Figures 16-22.

In this embodiment, the plug body 10, the conductive pins 18a, 18b and 26, the attachment body 12, the concave contacts 20a, 20b are the same as in the previously
15 described embodiment. The second embodiment may also be utilized with a three conductor plug body, in which case the first ground plate 28 with contacts 30a and 30b, as well as the second ground plate 32 with contacts 32a and 32b are also exactly the same as in the previously described three conductor wire embodiment. As illustrated in Figure 16, in this embodiment, the convex contacts 22a and 22b and the connecting
20 members 24a and 24b have been eliminated and have been replaced by elongated contact members 38a and 38b directly connected to a conductor 40a, 40b of the electric wire 40. The elongated contact



members 38a and 38b each comprise an elongated body having an arcuate front section and a hollow rear portion that is connected to a conductor of the wire 40. The elongated contact members 38 have their longitudinal axes of symmetry coaxial with the pivot axis 16 and are urged into physical and electrical contact with the concave surfaces of contacts 20a and 20b by springs 42a and 42b interposed between the contact members 38a and 38b and a portion of the attachment body 12. As best seen in Figure 16, an insulated portion of the conductors 40a, 40b extend into a portion of the attachment body 12 with the conductor continuing on further and being electrically and physically attached to one of the elongated contact members 38a, 38b. Since the elongated contacts 38a, 38b are located coaxially with respect to the pivot axis, electrical contact is maintained between the wire and the conductive pins as the plug body 10 and the attachment body 12 are pivoted with respect to each other.

Although the embodiment has been described in conjunction with a plug body having three conductive pins and the plug attached to a three conductor electric wire, it is to be understood that this may also be utilized with a two conductor electric wire which would eliminate the ground pin 26 and its associated connection with the ground wire 40c. Otherwise, the structure is exactly the same as described for the three conductor electric wire attachment.

A third embodiment of the pivoting electrical plug according to the present invention is illustrated in Figures 23-31. In this embodiment, plug body 10 is pivotally connected to attachment body 12 by a pair of ball and socket joints. A ball portion is formed on ends of the arms 12a and 12b such that they may "snap" into a

corresponding recess formed in plug body 10. In this embodiment, the conductors 14a, 14b of the electric wire 14 extend into the attachment body 12, with a conductor extending through each of the arms 12a and 12b and into the plug body 10. The conductors are directly attached to conductive pins, 18a, 18b such as by crimping tabs 18c, 18d around the respective conductors, or by soldering, etc. The portions of the conductors extending through the arms 12a and 12b are coaxial with the pivot axis 16 so as not to impede the pivoting ability between the plug body 10 and the attachment body 12.

When this embodiment is utilized with a three conductor electric wire, the plug body 10 has three conductive pins extending therefrom, as illustrated in Figures 26-29. The conductive pins 18a, 18b and the ground pin 26 extend from one side of the plug body 10 and a groove 44 extends across the opposite side of the plug body 10. The ground conductor 40c extends from the attachment body 12 into a portion of the groove 44 and passes into the plug body 10 at the pivot axis 16. The ground conductor 40c is then physically attached to the ground pin 26 via crimping, soldering, or the like.

Figures 30 and 31 illustrate variations in the connections between the conductive pins 18a, 18b, 26 and the conductors 40a, 40b, 40c of wire 40. In each of these variations, the ground conductor 40c extends through the attachment body 12 along one of the conductors 40a, or 40b and passes into the plug body 10 along with the respective conductor coaxially with the pivot axis 16 so as to enable smooth pivoting of the plug body 10 relative to the attachment body 12 and, at the same time,

to minimize the potential damage of the electrical conductors due to the pivoting motion. In Figures 30 and 31, the attachment body 12 has not been illustrated for the purposes of clarity, but it is to be understood that the physical structure of the attachment body 12, the plug body 10 and their connecting relationships are the same as previously described in relation to the third embodiment illustrated in Figures 26-29, except for the groove 44 formed in the plug body 10. In the variations illustrated in Figures 30 and 31, since the ground conductor 40c passes through the attachment body 12 and into the plug body 10 along the pivot axis 16, groove 44 in the plug body 10 is not necessary.

In Figure 30, the ground conductor 40c extends through the attachment body 12 adjacent to the conductor 40a and is attached to ground conductor 26 via crimping, soldering, or the like. In Figure 31, the ground conductor extends through the attachment body 12 adjacent to conductor 40b and, again, passes into the plug body 10 along the pivot axis 16 and is attached to ground pin 26. In this variation, conductor 40a enters the plug body 10 on the side of the conductive pin 18b, passes over the pin 18b and is attached to pin 18a via crimping of the tab 18c, soldering, or the like. Similarly, conductor 40b enters the plug body 10 from the side closest to conductive pin 18, passes over conductive pin 18a and is attached to conductive pin 18b via clamping of the tab 18d, soldering, or the like. This variation of the third embodiment minimizes the turns and curves of the conductors 40a, 40b and 40c both within the plug body 10 and at the pivoting connection between the plug body 10 and the attachment body 12 so as to promote smooth pivoting between the plug body 10 and the attachment body 12 and to minimize potential damage to the electrical wires.

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The foregoing description is provided for illustrative purposes only and should not be construed as in any way limiting this invention, the scope of which is defined solely by the appended claims.

THE CLAIMS DEFINING THE INVENTION ARE AS FOLLOWS:

1. A pivoting electrical plug comprising:
a plug body having at least one electrically conductive pin extending therefrom;
means for connecting an electrically conductive wire to the at least one conductive
5 pin; and
characterised by an attachment body being pivotally connected to the plug body
such that the plug body and attachment body may pivot with respect to each other about
a pivot axis, said electrically conductive wire being located in said attachment body and
passing into the plug body along the axis of pivotal connection between said plug body
10 and said attachment body.
2. A pivoting electrical plug as claimed in claim 1 further comprising a pair of ball
and socket joints pivotally connecting the plug body and the attachment body.
3. A pivoting electrical plug as claimed in claim 2 wherein a portion of the
electrically conductive wire passes through at least one of the pair of ball and socket
15 joints along the pivot axis.
4. A pivoting electrical plug as claimed in any of claims 1 to 3 wherein the plug body
has a face and opposite side edges through which the pivot axis extends and further
comprising:
first and second electrically conductive pins extending from the face of the plug
20 body;
a first electrically conductive wire located in the attachment body passing into the
plug body through one of the opposite side edges along the pivot axis and connected to
the first electrically conductive pin; and
a second electrically conductive wire located in the attachment body, passing into
25 the plug body through another of the opposite side edges along the pivot axis and
connected to the second electrically conductive pins.
5. A pivoting electrical plug as claimed in claim 4 wherein the first electrically
conductive pin is located adjacent to a first opposite side edge of the plug body and the
second electrically conductive pin is located adjacent, to a second opposite side edge of
30 the plug body.

6. A pivoting electrical plug as claimed in claim 5 wherein the first electrically conductive wire passes through the first opposite side edge and the second electrically conductive wire passes through the second opposite side edge.
7. A pivoting electrical plug as claimed in claim 5 wherein the first electrically conductive wire passes through the second opposite side edge and the second electrically conductive wire passes through the first opposite side edge.
8. A pivoting electrical plug as claimed in any of claims 5 to 7 further comprising:
a third electrically conductive pin extending from the face of the plug body; and a third electrically conductive wire located in the attachment body, passing into the plug body through one of the opposite sides and connected to the third electrically conductive pins.
9. A pivoting electrical plug as claimed in any preceding claim further comprising:
a ground pin extending from a first side of the plug body;
a groove formed in the plug body in a second side opposite the first side; and
a ground wire connected to the ground pin and extending at least partially along the groove.
10. A pivoting electrical plug as claimed in any preceding claim wherein the plug body has a pair of electrically conductive pins extending therefrom.
11. A pivoting electrical plug as claimed in any preceding claim wherein the means for connecting an electrically conductive wire to the at least one conductive pin comprises:
a first concave generally hemispherical contact in electrical communication with the at least one conductive pin;
a second contact bearing against the first contact; and
means electrically connecting the second contact to an electrically conductive wire.
12. A pivoting electrical plug of claim 11 further comprising biasing means acting on the second contact so as to bias the second contact into physical and electrical contact with the first contact.
13. A pivoting electrical plug of claim 12 wherein the second contact comprises an elongated member.
14. A pivoting electrical plug as claimed in any of claims 11 to 13 wherein the first contact has an axis of symmetry substantially coaxial with the pivot axis.

15. A pivoting electrical plug as claimed in any of claims 11 to 14 wherein the second contact has a convex, generally hemispherical configuration.
16. A pivoting electrical plug as claimed in claim 15 wherein the first and second contacts have axes of symmetry substantially coaxial with the pivot axis.
- 5 17. A pivoting electrical plug as claimed in claim 15 or 16 wherein the means to electrically connect the second contact to an electrically conductive wire comprises a connecting member connected to the second contact and to the electrical wire.
18. A pivoting electrical plug as claimed in claim 17 wherein the connecting member is resilient such that the resilient connecting member biases the second contact against
- 10 the first contact.
19. A pivoting electrical plug as claimed in claim 11 further comprising:
a ground pin extending from the plug body;
a first ground plate electrically connected to the ground pin and having a first ground contact; and
- 15 a second ground plate having connecting means for connection to a ground wire and a second ground contact bearing against and in electrical communication with the first ground contact.
20. A pivoting electrical plug as claimed in claim 19 wherein the first ground contact is substantially cylindrical and has an axis of symmetry coaxial with the pivot axis.
- 20 21. A pivoting electrical plug as claimed in claim 20 wherein the second ground contact has an arcuate configuration.
22. A pivoting electrical plug as claimed in claim 21 wherein the second ground contact is configured to physically contact an inner surface of the substantially cylindrical first ground contact.
- 25 23. A pivoting electrical plug as claimed in claim 1 further comprising:
a ground pin extending from the plug body;
a first ground plate electrically connected to the ground pin and having a first ground contact; and
- 30 a second ground plate having connecting means for connection to a ground wire and a second ground contact bearing against and in electrical communication with the first ground contact.

24. A pivoting electrical plug as claimed in claim 23 wherein the first ground contact is substantially cylindrical and has an axis of symmetry coaxial with the pivot axis.

25. A pivoting electrical plug as claimed in claim 24 wherein the second ground contact has an arcuate configuration.

5 26. A pivoting electrical plug as claimed in claim 25 wherein the second ground contact is configured to physically contact an inner surface of the substantially cylindrical first ground contact.

27. A pivoting electrical plug substantially as herein described with reference to any one of the embodiments of the invention illustrated in the accompanying drawings.

10 DATED this 9th Day of February 1999

KOONTAT DEVELOPMENT COMPANY LTD

Attorney: JOHN B. REDFERN
Fellow Institute of Patent Attorneys of Australia
of BALDWIN SHELSTON WATERS

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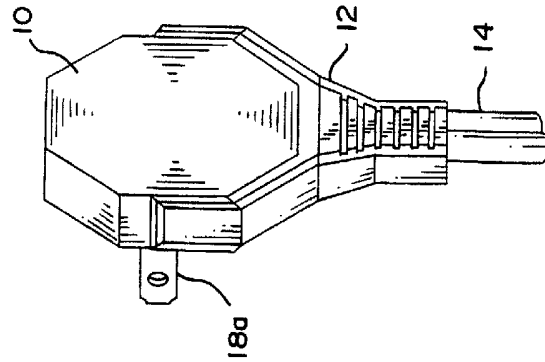


FIG. 1C

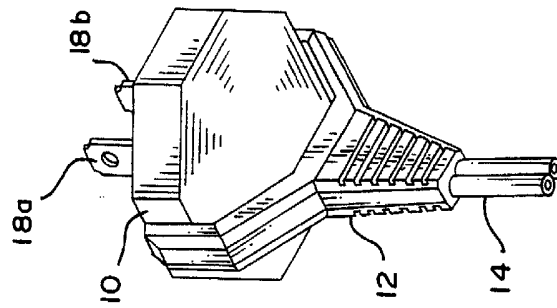


FIG. 1B

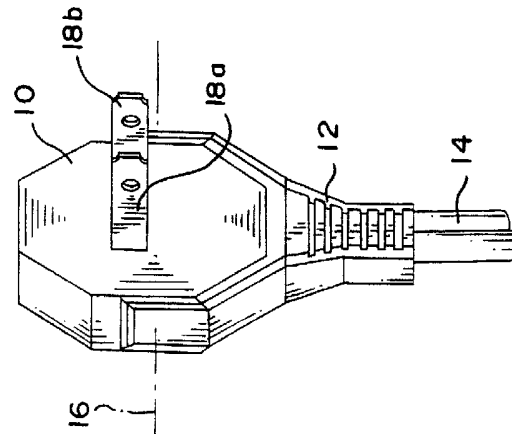


FIG. 1A

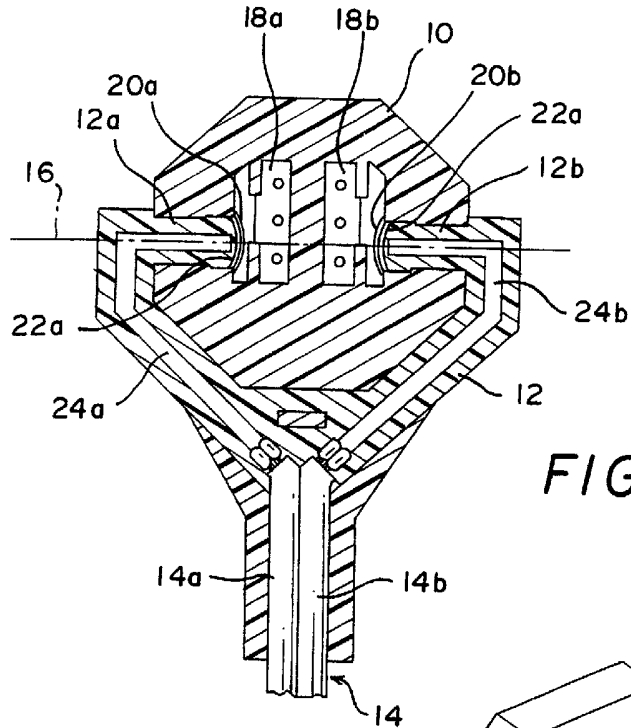


FIG. 2

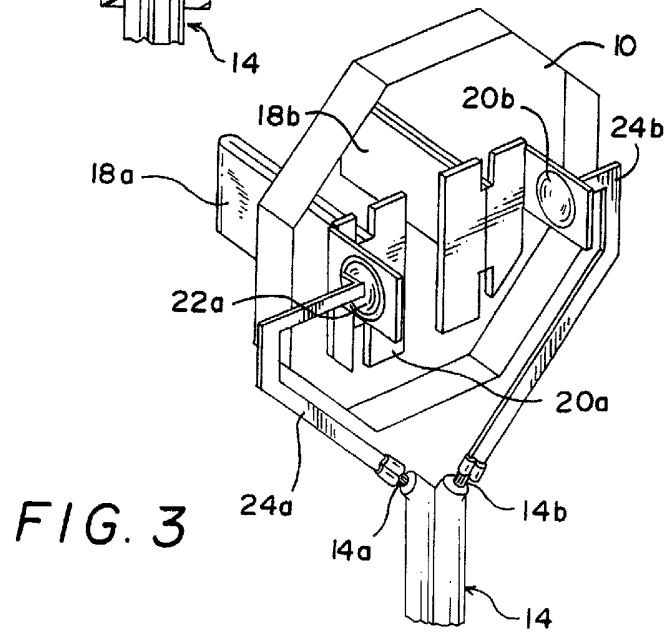


FIG. 3

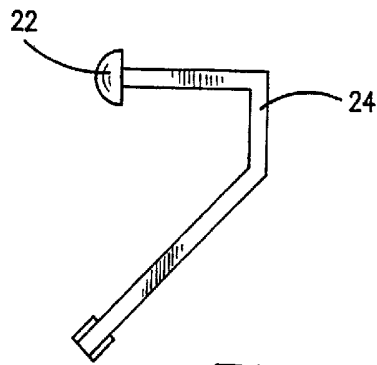


FIG. 4

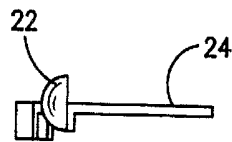


FIG. 5

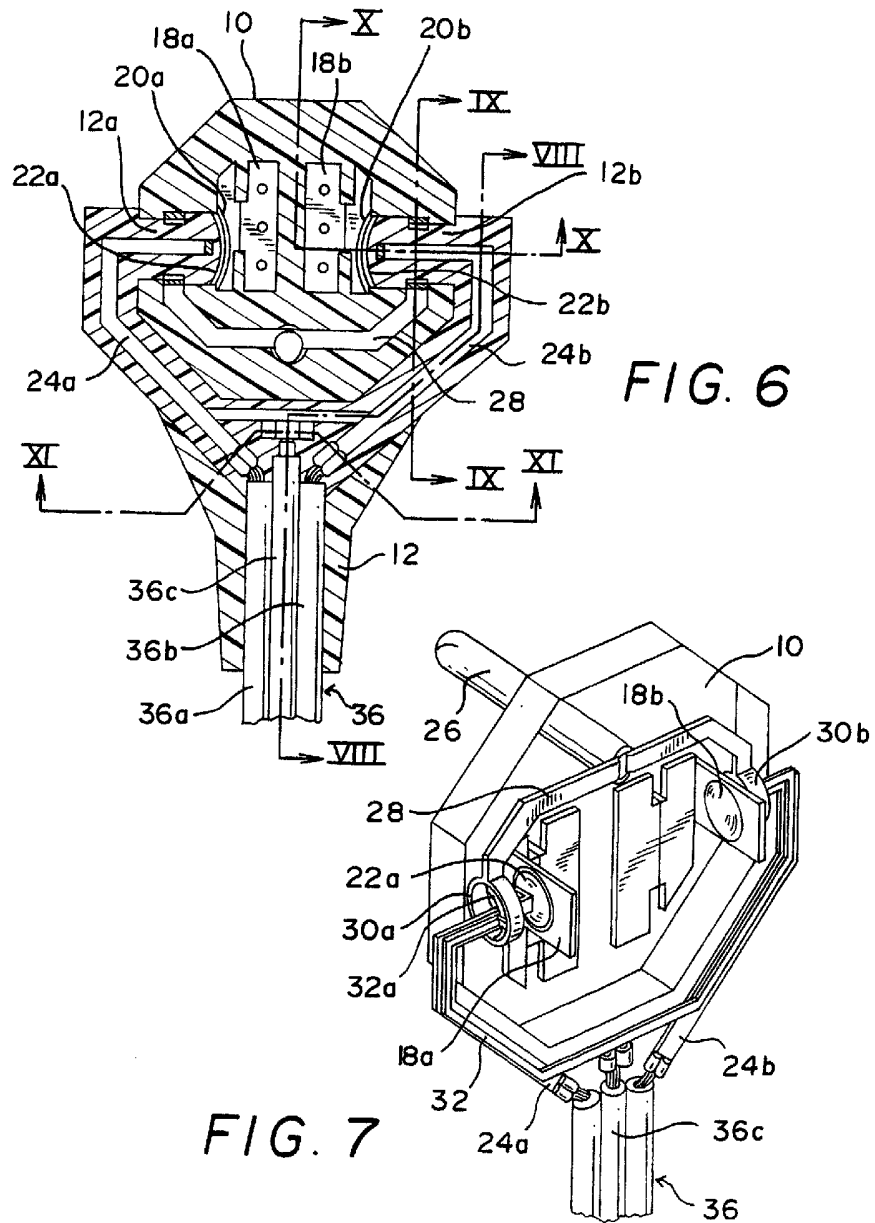


FIG. 8

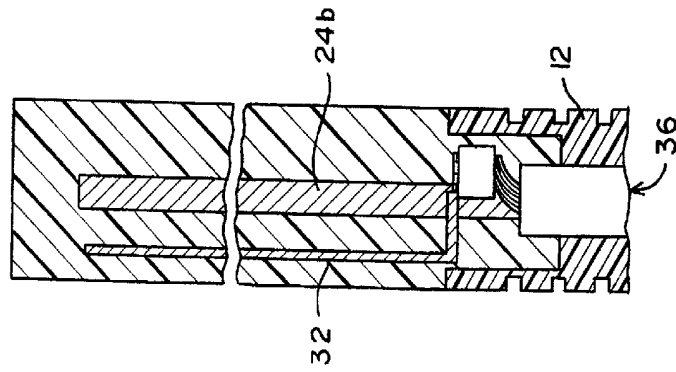


FIG. 9

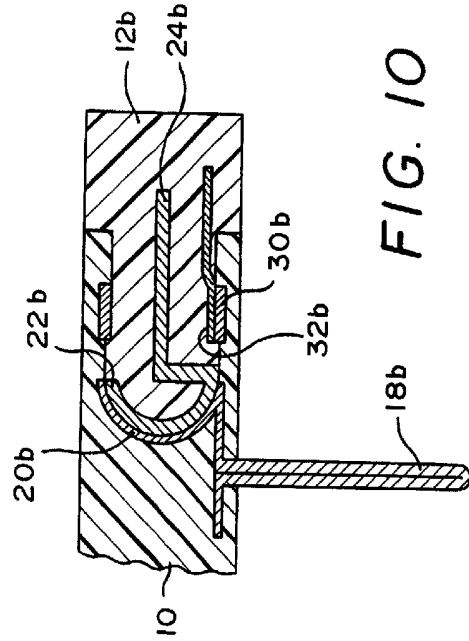
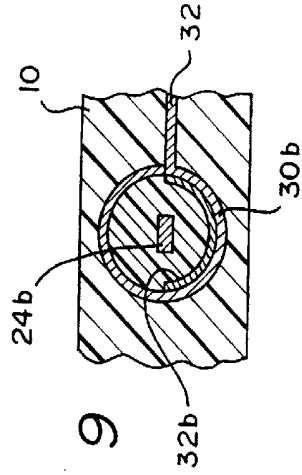


FIG. 10

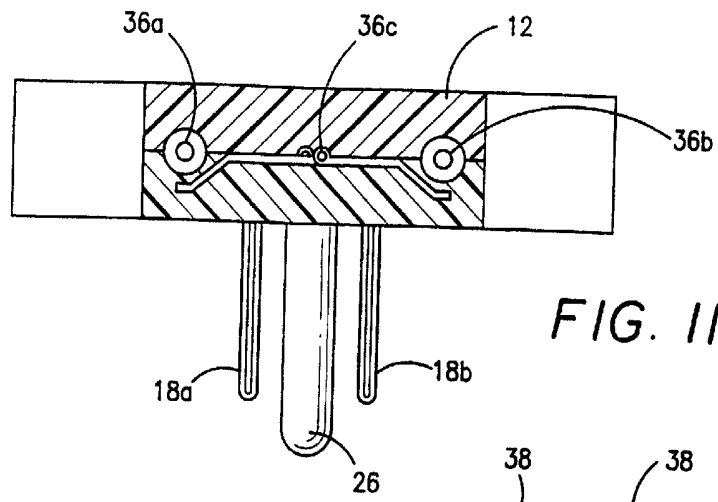


FIG. 11

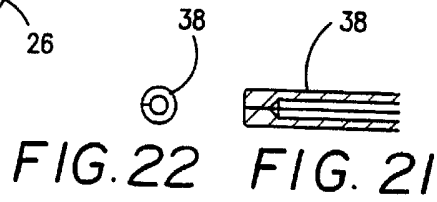


FIG. 22

FIG. 21

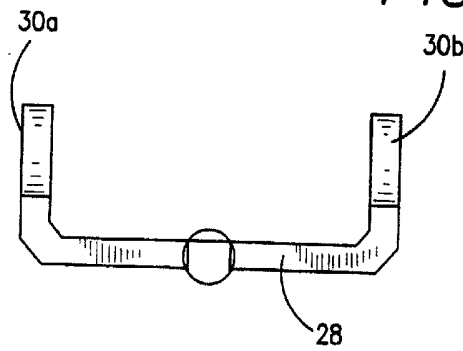


FIG. 12

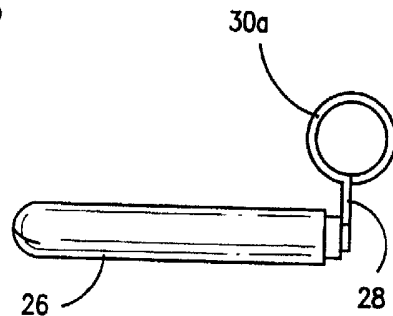


FIG. 13

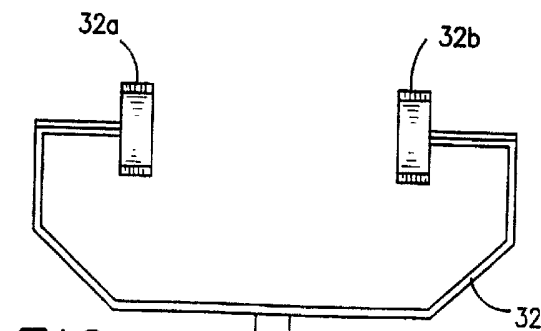


FIG. 14

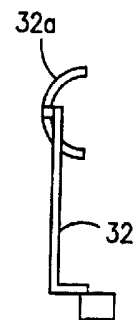


FIG. 15

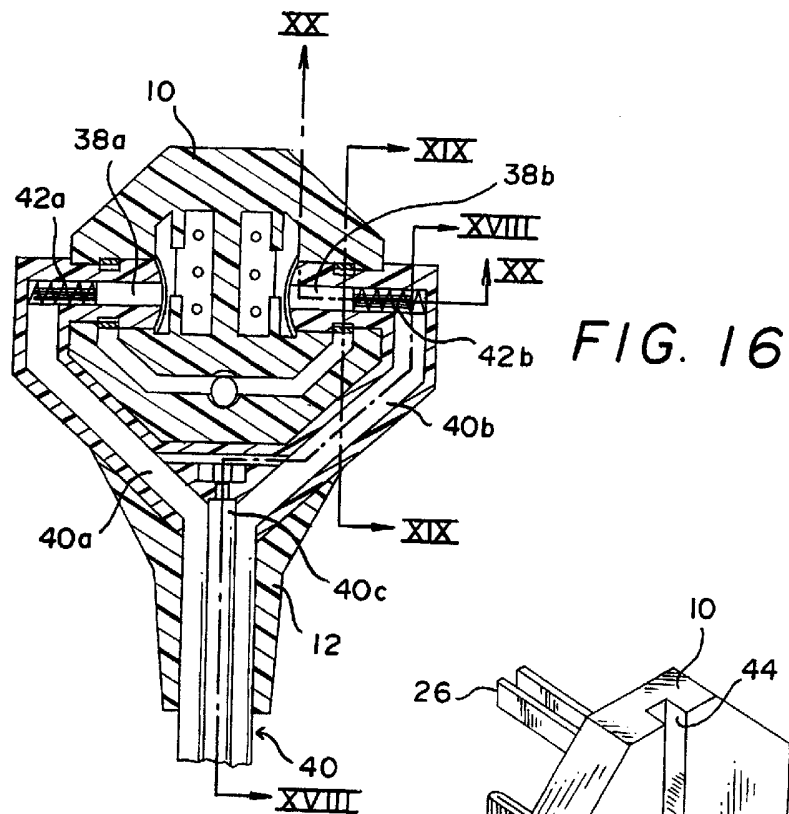


FIG. 16

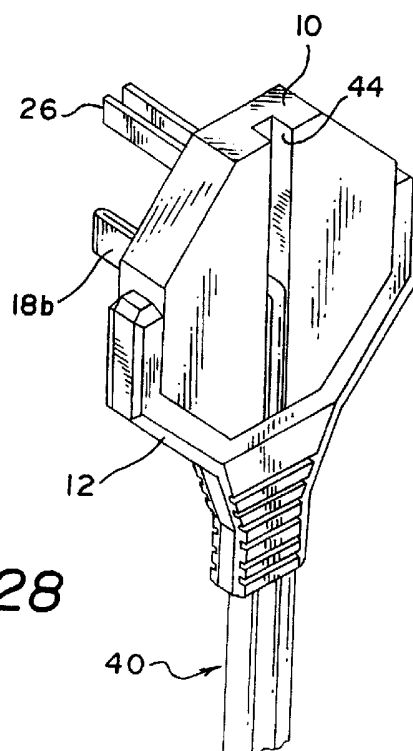


FIG. 28

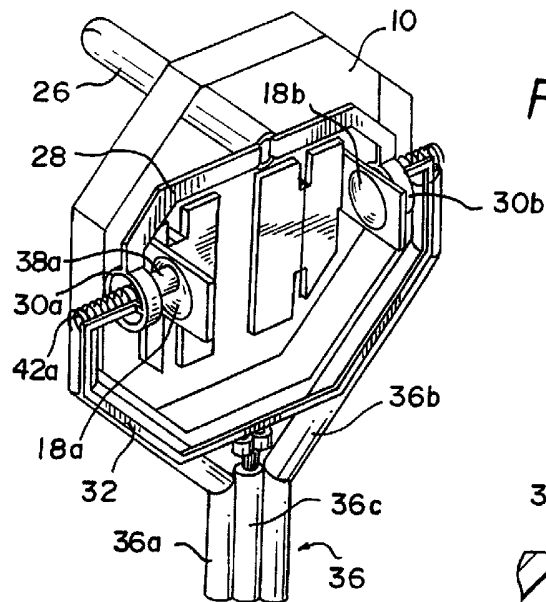


FIG. 17

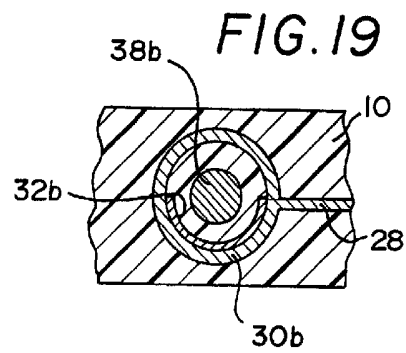


FIG. 19

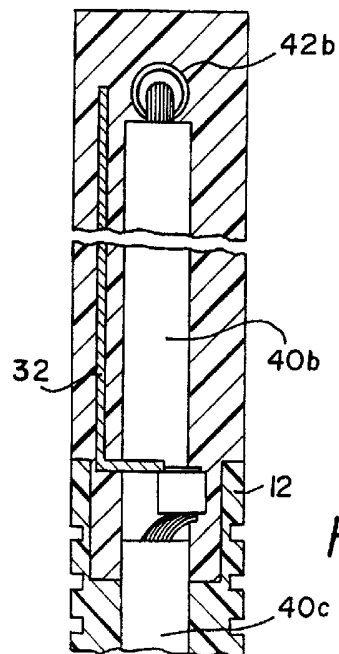


FIG. 18

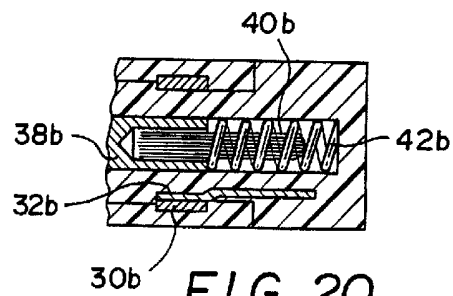
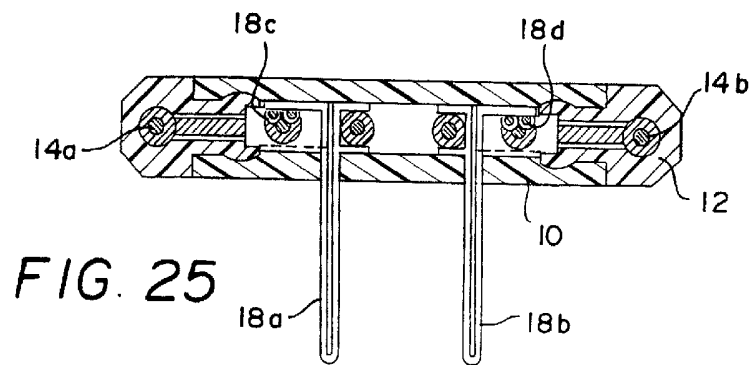
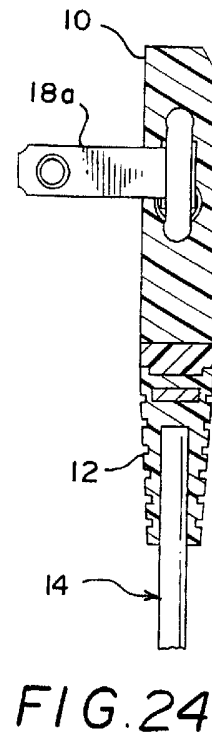
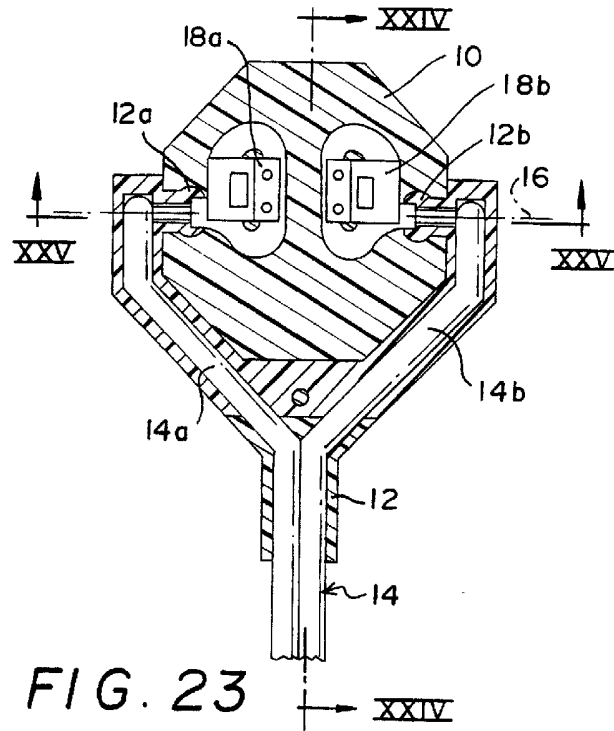


FIG. 20



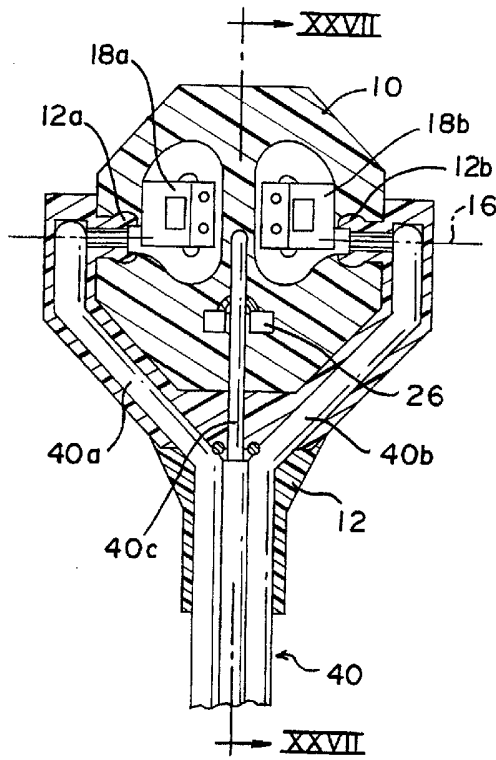


FIG. 26

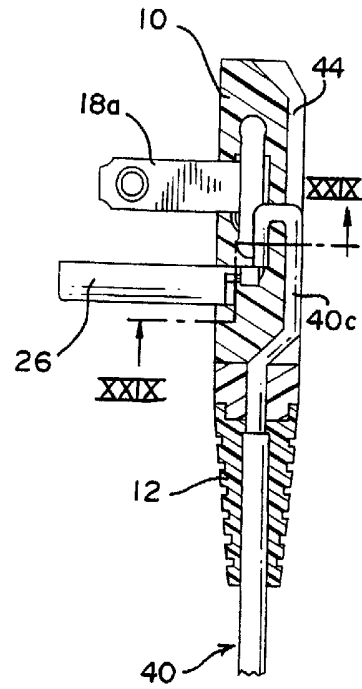


FIG. 27

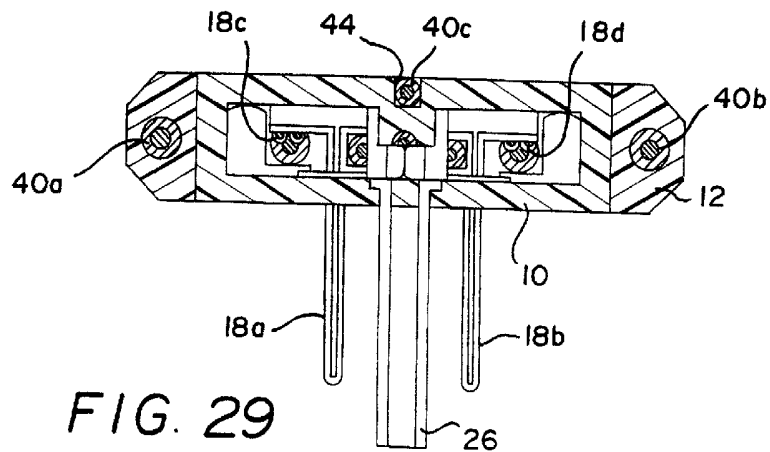
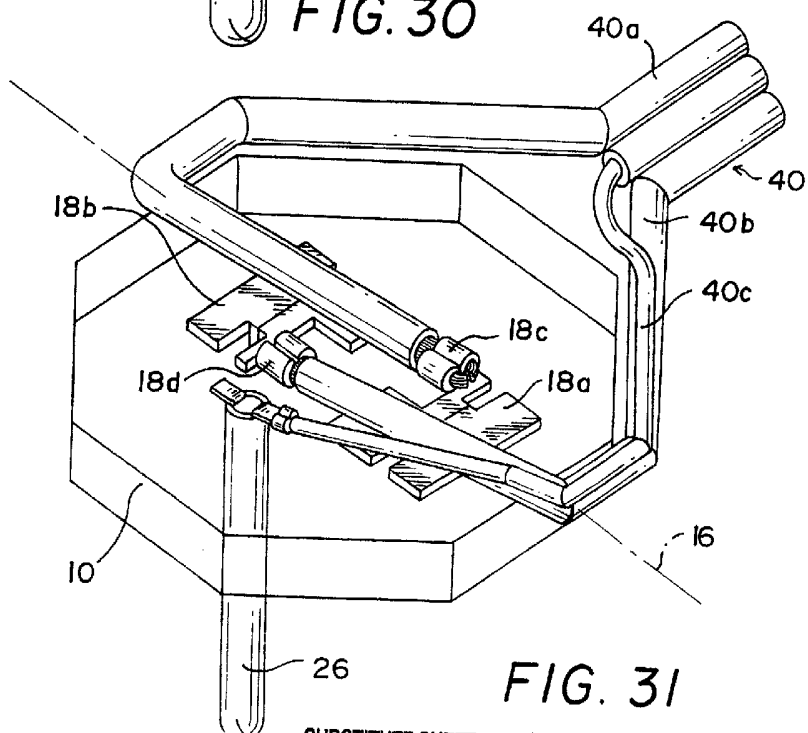
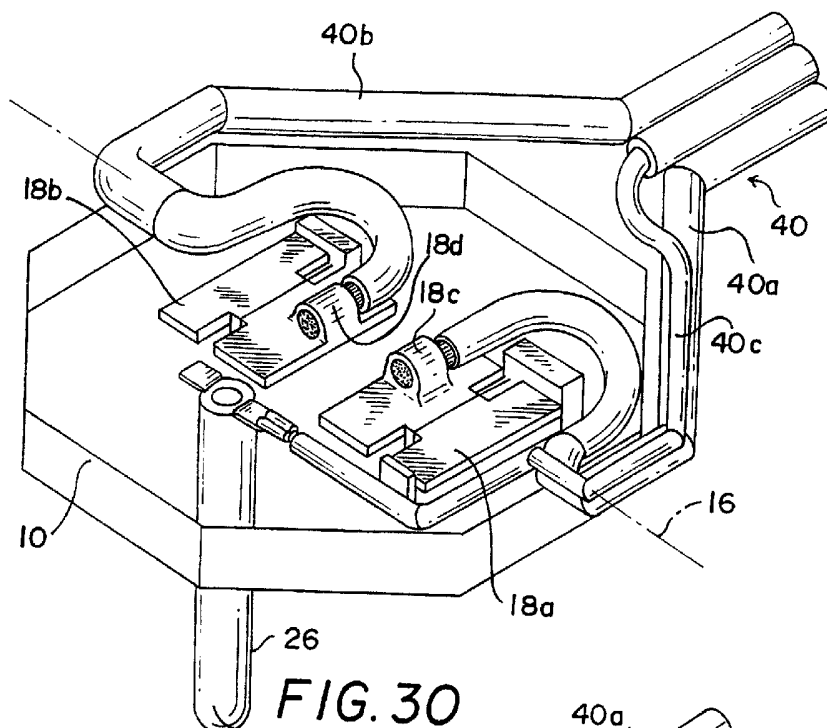


FIG. 29



SUBSTITUTE SHEET (RULE 26)