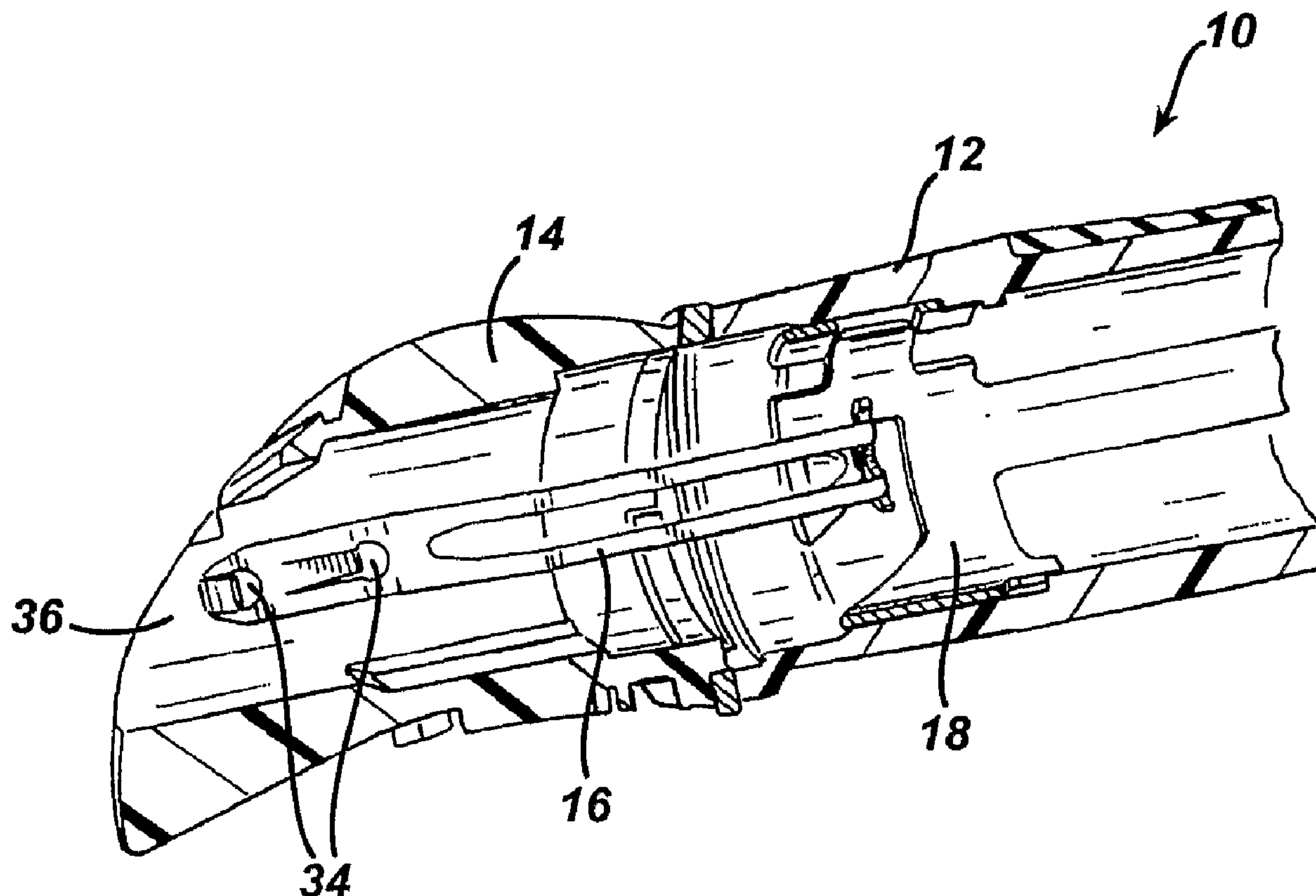




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Battery operated appliances are provided. Some appliances include a housing defining a chamber having an interior wall, electronics within the chamber, a battery cover, and a closing system including (a) a first electrically conductive member secured to the battery cover, and (b) a second electrically conductive member secured to the interior wall of the housing and configured to engage the first electrically conductive member and thereby mechanically secure the battery cover to the housing while also establishing electrical contact between the first and second electrically conductive members.

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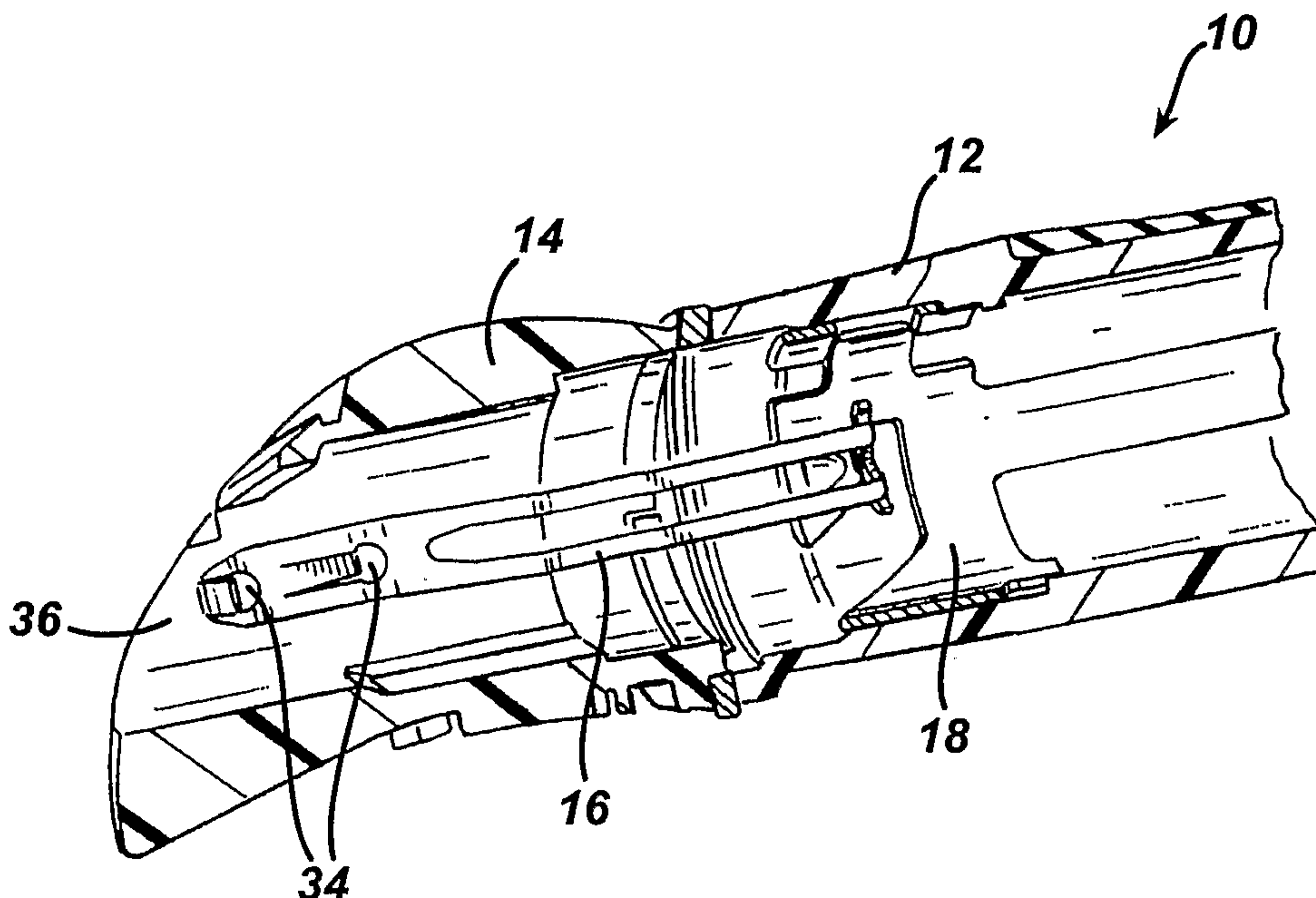
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(57) Abstract: Battery operated appliances are provided. Some appliances include a housing defining a chamber having an interior wall, electronics within the chamber, a battery cover, and a closing system including (a) a first electrically conductive member secured to the battery cover, and (b) a second electrically conductive member secured to the interior wall of the housing and configured to engage the first electrically conductive member and thereby mechanically secure the battery cover to the housing while also establishing electrical contact between the first and second electrically conductive members.

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BATTERY-OPERATED APPLIANCES

This invention relates to battery-operated appliances, such as personal care appliances, and more particularly to battery case covers for such appliances.

In many small battery-operated devices, the batteries are replaceable by the user, and are inserted and removed from a battery compartment through an opening having a cover. It is necessary to mechanically secure the cover in place, so that the batteries do not fall out and the cover is not lost. It is also necessary to make electrical contact between the batteries and the electrical circuit within the device.

The present invention provides a simple, efficient mechanism for both securing a battery cover to the housing of a small appliance and at the same time providing a high reliability electrical contact between the battery and electronics of the appliance. Preferred closing systems include very few parts and thus are easy and economical to manufacture and assemble. Moreover, some preferred closing systems are suitable for use with small, space saving housing designs and/or designs that includes non-linear seam lines between the battery cover and housing.

In one aspect, the invention features a battery operated appliance including a housing defining a chamber having an interior wall, electronics within the chamber, a battery cover, the battery cover and/or the housing being configured to contain one or more batteries, and a closing system. The closing system includes a first electrically conductive member secured to the battery cover, and a second electrically conductive member secured to the interior wall of the housing and configured to engage the first electrically conductive member and thereby mechanically secure the battery cover to the housing while also establishing electrical contact between the first and second electrically conductive members.

Some implementations may include one or more of the following features. The first and second electrically conductive members may be configured to engage each other by rotation of the battery cover relative to the housing. For example, the second electrically conductive member may include a circumferentially extending slot having an open end and the first electrically conductive member may include a hook configured to slide into the slot through the open end during rotation. The interior wall of the housing may be generally cylindrical, and/or outer surfaces of the housing and battery cover may

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be generally cylindrical. By “generally cylindrical” we mean that the housing and battery cover may each include non-cylindrical elements, e.g., ridges, protrusions, or recesses, and/or may include regions along its length that not cylindrical.

The first electrically conductive member may include a spring element configured to apply an axial force between the housing and battery cover when the first and second electrically conductive members are engaged. The first electrically conductive member includes two or more spring elements, and each spring element may provide an electrical contact between the first and second electrically conductive members.

The first and second electrically conductive members may be secured to the battery cover and housing, respectively, by a snap fit. For example, the second electrically conductive member may include a spring portion that is compressed prior to insertion into the housing and that engages the interior wall of the housing with a radial spring force. The spring portion may be generally ring-shaped. The second electrically conductive element may also include one or more undercuts configured to engage corresponding undercuts on the interior wall of the housing.

The second electrically conductive member may include a portion configured to make electrical contact with an electronic sub-assembly of the appliance, e.g., one or more power rails. Each power rail may include a clip constructed to engage the sub-assembly, and this engagement may mechanically secure the second electrically conductive member to the sub-assembly.

The second electrically conductive member may include engagement regions configured for mechanical engagement with corresponding regions on the first electrically conductive member, and each undercut on the second electrically conductive element may be generally axially aligned with one of the engagement regions.

The appliance may be, for example, a power toothbrush or a razor having an electrically-activated function. Thus, the electronics may be configured to drive a toothbrush head or to drive a vibrating function of a razor for wet shaving.

In another aspect, the invention features a battery operated appliance, such as a razor or power toothbrush, including a generally cylindrical housing defining a chamber having a generally cylindrical interior wall, electronics within the chamber, a

generally cylindrical battery cover, the battery cover and/or the housing being configured to contain one or more batteries, and a closing system including a first electrically conductive member secured to the battery cover, and a second electrically conductive member secured to the interior wall of the housing and configured to engage the first electrically conductive member during rotation of the battery cover relative to the housing, thereby mechanically securing the battery cover to the housing while also establishing electrical contact between the first and second electrically conductive members.

In accordance with another aspect of the invention, there is provided a battery operated appliance comprising

a housing defining a chamber having an interior wall,
electronics within the chamber,

a battery cover, the battery cover and/or the housing being configured to contain one or more batteries, and

a closing system, including a first closing member secured to the battery cover, and a second closing member secured to the interior wall of the housing and configured to engage the first closing member and thereby mechanically secure the battery cover to the housing while also establishing electrical contact between the first and second electrically conductive members.

The details of one or more embodiments of the invention are set forth in the accompanying drawings and the description below. Other features, objects, and advantages of the invention will be apparent from the description and drawings, and from the claims.

FIG. 1 is a perspective view of a closing system according to one embodiment of the invention, with the front portion of the housing and battery cover cut away to show the internal components.

FIG. 2 is an enlarged exploded perspective view showing two components of the closing system of FIG. 1.

FIG. 3 is an enlarged perspective view of one of the components shown in FIG. 2, rotated to a different position.

FIG. 4 is a perspective view showing the components of FIG. 2 in an assembled state.

FIG. 5 is an enlarged detail view of a portion of the assembly shown in FIG. 4.

FIG. 6 is a perspective view showing one of the components of FIG. 2 assembled with a further sub-assembly.

FIG. 7 is an enlarged detail view of a portion of the assembly shown in FIG. 6.

Like reference symbols in the various drawings indicate like elements.

Referring to FIG. 1, a battery powered device 10 includes a cylindrical housing 12 and a generally cylindrical battery cover 14. The battery cover 14 is mounted on the housing 12 by the connection of one or more metal spring element(s) 16 to a generally cylindrical metal receiving part 18. Spring elements 16 and receiving part 18 will now be discussed in detail, with reference to FIGS. 2-4.

Two spring elements are shown in FIGS. 2-4. However, more or fewer may be used, as will be understood by those skilled in the art. Generally, the more spring elements used, the higher the electrical reliability and the stronger the connection between the battery cover and the housing.

Referring to FIG. 2, each spring element 16 has a hook 20 at one end. Each hook includes one or more protrusions 22. The hooks are constructed to be received and retained in corresponding slots 24 in the receiving part 18, as shown in FIGS. 1, 4 and 5, with protrusions 22 facilitating insertion, removal, and retention of the hooks. Each slot 24 includes a lead-in 25 having angled walls 26, 28, to guide the hook into the slot as the battery cover is rotated relative to the housing. The engagement of the hooks in the slots provides a secure, twist-on mechanical connection of the battery cover to the housing.

The spring elements are designed to apply a spring force axially along the long axis of the housing. In the embodiment shown, the S-shaped profile of the springs (Fig. 4), along with stretching of the springs during operation, generates this spring force. Thus, as the spring element moves into the slot it is stretched, pulling the battery cover and housing together. This resilient engagement of the battery cover with the housing compensates for non-linear seam lines between the battery cover and housing and other geometry issues such as tolerances.

The spring members and the receiving part are both made of metal, and thus engagement of the hooks with the slots also provides electrical contact between the spring members and the receiving part. The receiving part is in turn in electrical contact with circuitry of the device, as will be discussed below, and the battery is in contact with the spring members, and thus contact of the spring members and electrical part ultimately results in contact between the battery and the circuitry of the device. Accordingly, the spring function of the spring elements is also advantageous because it serves to provide solid and reliable electrical contact between the spring elements and the receiving part.

The spring members and receiving part are easily assembled into the device. The spring members are retained permanently on the battery cover by press-fitting protrusions 34 on the inner wall 36 of the battery cover into slotted openings 32 on each spring member (see FIGS. 1 and 4). The receiving part 18 is retained permanently in the housing 12 by engagement of undercuts 30 on the receiving part with corresponding undercuts (not shown) on the inner wall of housing 12. The engagement of the receiving part and housing is achieved by a spring action of the receiving part. The receiving part has a diameter that, in an uncompressed state, is greater than the inner diameter of the housing 12. During assembly, the receiving part is compressed until its outer diameter, including undercuts 30, is less than the inner diameter of the housing 12. The receiving part is then inserted into the housing, and allowed to spring back to its normal, uncompressed diameter. If desired, the receiving part can be heated, e.g., by inductive heating, prior to insertion into the housing, so that the hot undercuts will dig themselves into the plastic of the housing as the receiving part springs back to its uncompressed state.

Preferably, the undercuts 30 are relatively close to the slots 24, and more preferably are axially aligned therewith, as shown. Alignment of the undercuts with the slots allows forces applied to the slot during and subsequent to closing to be transmitted directly to the attachment points of the receiving part (the undercuts). This arrangement provides an assembly that is very rigid and that is relatively insensitive to tolerances.

Referring now to FIGS. 6 and 7, the receiving part 18 may be used to make electrical connection with a sub-assembly A, for instance a device that causes the appliance to vibrate. In this case, the receiving part 18 includes arms 50 which act as power rails, providing an electrical connection to sub-assembly A. Each arm 50 includes a terminal hook 52, which engages a corresponding structure on sub-assembly A (FIG. 7), typically by press-fitting or snapping the hooks into a groove or recess of the sub-assembly. As is the case with the engagement of the spring elements with the receiving part, discussed above, the engagement of the hooks 52 with the sub-assembly A serves two functions: (a) mechanically securing the sub-assembly in place, and (b) providing electrical connection between the arms 50 (and ultimately the battery) and the sub-assembly A. This dual functionality reduces the number of parts required, saves space, and simplifies assembly of the appliance.

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A number of embodiments of the invention have been described. Nevertheless, it will be understood that various modifications may be made without departing from the spirit and scope of the invention. For example, while razors and toothbrushes are mentioned above, the closing systems discussed herein may be used with many other types of appliances, for example flashlights, battery powered scrub-brushes, and cameras. Moreover, while in the embodiments shown in the figures, the battery cover carries a "male" engagement member and the housing carries a corresponding "female" engagement member, this arrangement may be reversed so that the battery cover carries the female engagement member and the housing carries the male engagement member, or other types of cooperative engagement may be used.

THE EMBODIMENTS OF THE INVENTION IN WHICH AN EXCLUSIVE PROPERTY OR PRIVILEGE IS CLAIMED ARE DEFINED AS FOLLOWS:

1. A battery operated appliance comprising:
a housing defining a chamber having an interior wall,
electronics within the chamber,
a battery cover, the battery cover and/or the housing being configured to contain one or more batteries, and
a closing system, including a first electrically conductive member secured to the battery cover, and a second electrically conductive member secured to the interior wall of the housing and configured to engage the first electrically conductive member and thereby mechanically secure the battery cover to the housing while also establishing electrical contact between the first and second electrically conductive members; wherein the first and second electrically conductive members are configured to engage each other by rotation of the battery cover relative to the housing, and the second electrically conductive member includes a circumferentially extending slot having an open end and the first electrically conductive member includes a hook configured to slide into the slot through the open end during rotation.
2. The appliance of claim 1 wherein the interior wall of the housing is generally cylindrical.
3. The appliance of claim 1 wherein outer surfaces of the housing and battery cover are generally cylindrical.
4. The appliance of claim 1 wherein the first electrically conductive member includes a spring element configured to apply an axial force between the housing and battery cover when the first and second electrically conductive members are engaged.
5. The appliance of claim 4 wherein the first electrically conductive member includes two or more spring elements.

6. The appliance of claim 5 wherein each spring element provides an electrical contact between the first and second electrically conductive members.
7. The appliance of claim 1 wherein the first and second electrically conductive members are secured to the battery cover and housing, respectively, by a snap fit.
8. The appliance of claim 1 wherein the second electrically conductive member includes a portion configured to make electrical contact with an electronic sub-assembly of the appliance.
9. The appliance of claim 8 wherein the portion comprises one or more power rails.
10. The appliance of claim 9 wherein each power rail includes a clip constructed to engage the sub-assembly.
11. The appliance of claim 11 wherein each clip is configured to mechanically secure the second electrically conductive member to the sub-assembly.
12. The appliance of claim 7 wherein the second electrically conductive element includes one or more undercuts configured to engage corresponding undercuts on the interior wall of the housing.
13. The appliance of claim 12 wherein the second electrically conductive member includes engagement regions configured for mechanical engagement with corresponding regions on the first electrically conductive member, and each undercut on the second electrically conductive element is generally axially aligned with one of the engagement regions.
14. The appliance of claim 1 wherein the electronics are configured to drive a toothbrush head.

15. The appliance of claim 1 wherein the electronics are configured to drive a vibrating function of the appliance.
16. The appliance of claim 15 wherein the housing comprises the handle of a razor.
17. The appliance of claim 1 wherein the open end of the slot includes a lead-in configured to guide insertion of the hook into the slot.
18. A battery operated appliance comprising:
 - a generally cylindrical housing defining a chamber having a generally cylindrical interior wall,
 - electronics within the chamber,
 - a generally cylindrical battery cover, the battery cover and/or the housing being configured to contain one or more batteries, and
 - a closing system, including a first electrically conductive member secured to the battery cover, and a second electrically conductive member secured to the interior wall of the housing and configured to engage the first electrically conductive member during rotation of the battery cover relative to the housing, thereby mechanically securing the battery cover to the housing while also establishing electrical contact between the first and second electrically conductive members, wherein the second electrically conductive member includes one or more circumferentially extending slots.
19. The appliance of claim 18 wherein the second electrically conductive member includes a circumferentially extending slot having an open end and the first electrically conductive member includes a hook configured to slide into the slot through the open end during rotation.
20. The appliance of claim 18 wherein the first electrically conductive member includes a spring element configured to apply an axial force between the housing and battery cover when the first and second electrically conductive members are engaged.

21. The appliance of claim 20 wherein the first electrically conductive member includes two or more spring elements.
22. The appliance of claim 21 wherein each spring element provides an electrical contact between the first and second electrically conductive members.
23. The appliance of claim 18 wherein the first and second electrically conductive members are secured to the battery cover and housing, respectively, by a snap fit.
24. The appliance of claim 18 wherein the second electrically conductive member includes a portion configured to make electrical contact with an electronic sub-assembly of the appliance.
25. The appliance of claim 24 wherein the portion comprises one or more power rails.
26. The appliance of claim 25 wherein each power rail includes a clip constructed to engage the sub-assembly.
27. The appliance of claim 26 wherein each clip is configured to mechanically secure the second electrically conductive member to the sub-assembly.
28. The appliance of claim 18 wherein the second electrically conductive element includes one or more undercuts configured to engage corresponding undercuts on the interior wall of the housing.
29. The appliance of claim 28 wherein the second electrically conductive member includes engagement regions configured for mechanical engagement with corresponding regions on the first electrically conductive member, and each undercut on the second electrically conductive element is generally axially aligned with one of the engagement regions.

30. The appliance of claim 18 wherein the electronics are configured to drive a toothbrush head.

31. The appliance of claim 18 wherein the electronics are configured to drive a vibrating function of the appliance.

32. The appliance of claim 31 wherein the housing comprises the handle of a razor.

33. The appliance of claim 19 wherein the open end of the slot includes a lead-in configured to guide insertion of the hook into the slot.

FIG. 1

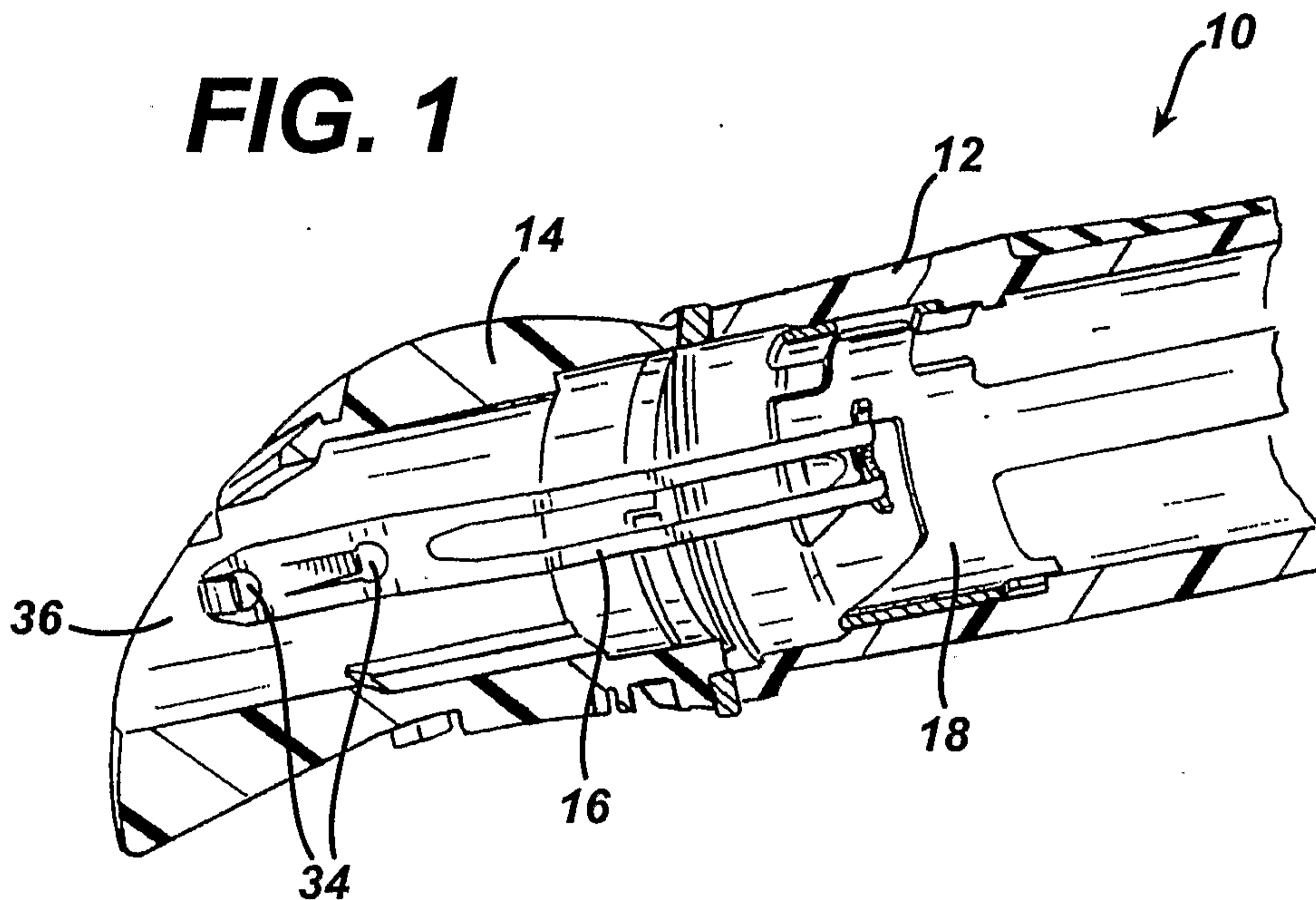


FIG. 2

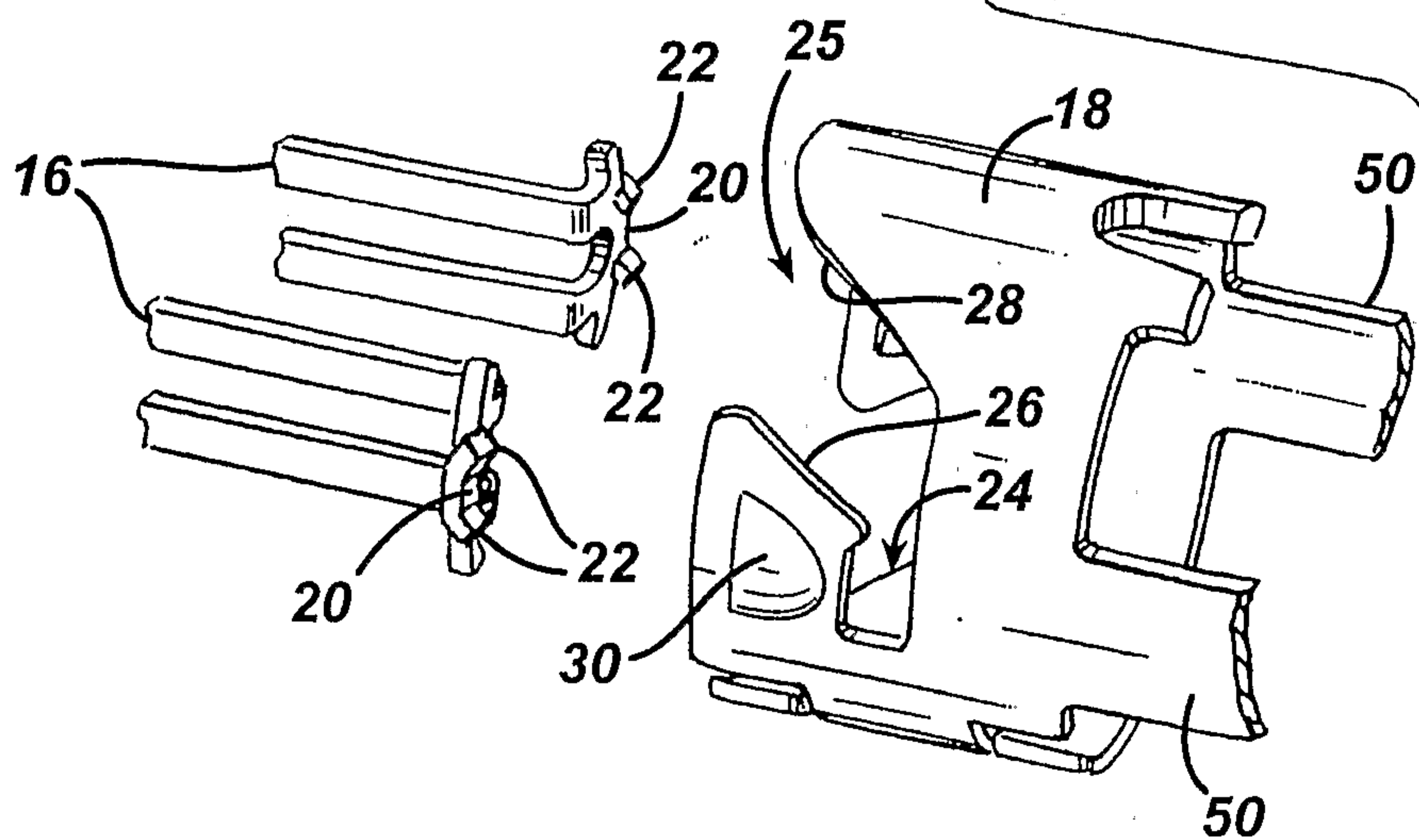


FIG. 3

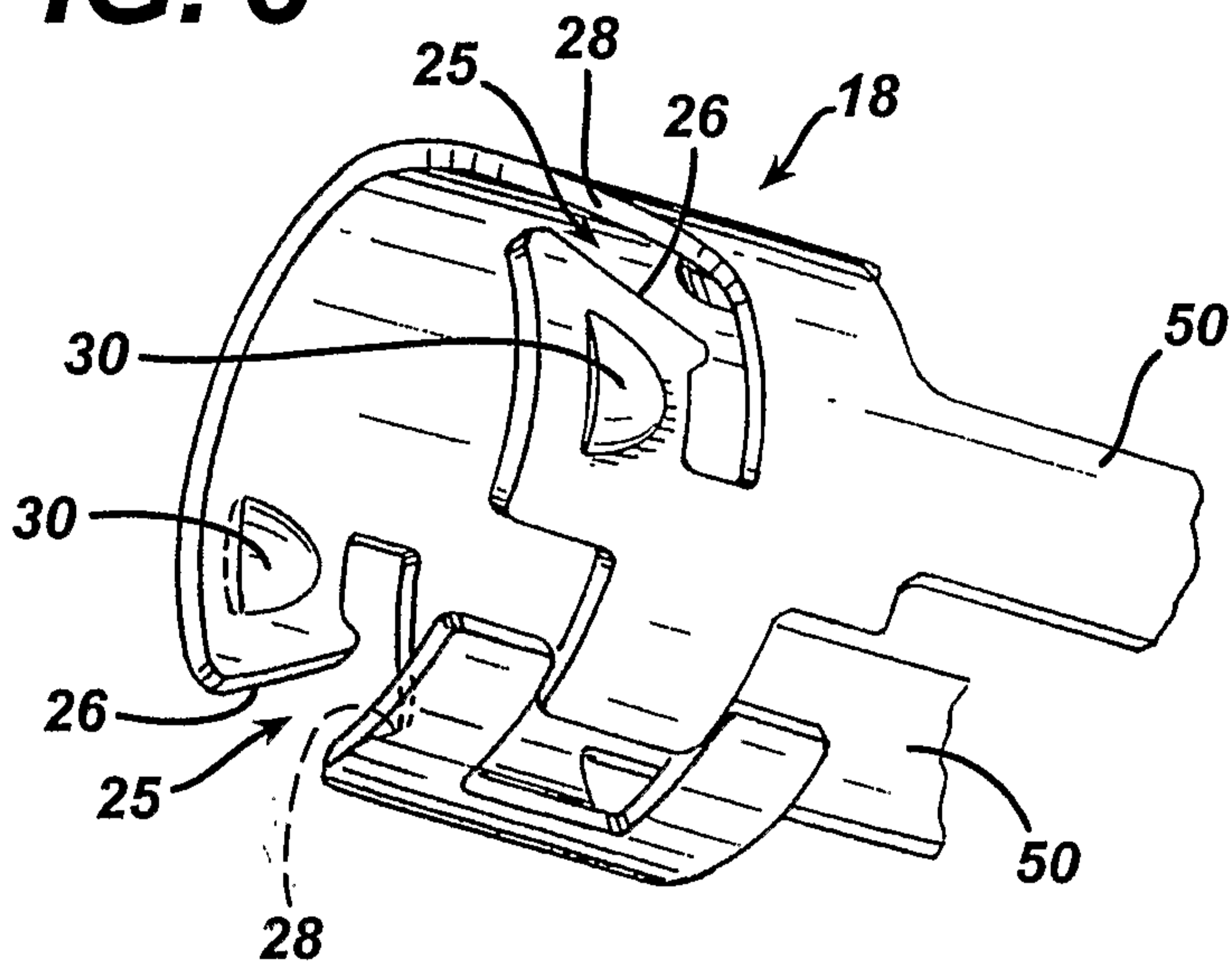
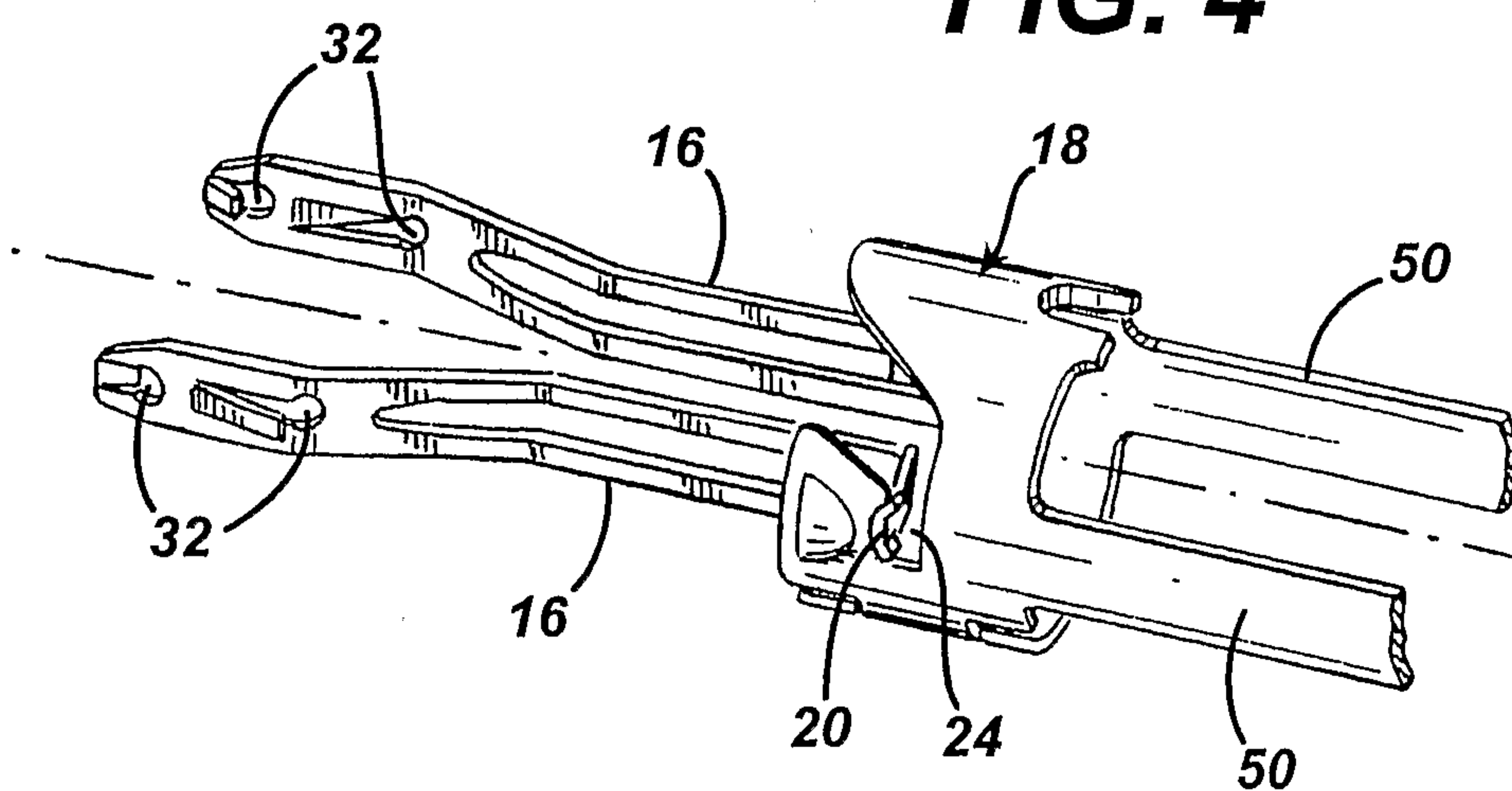


FIG. 4



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