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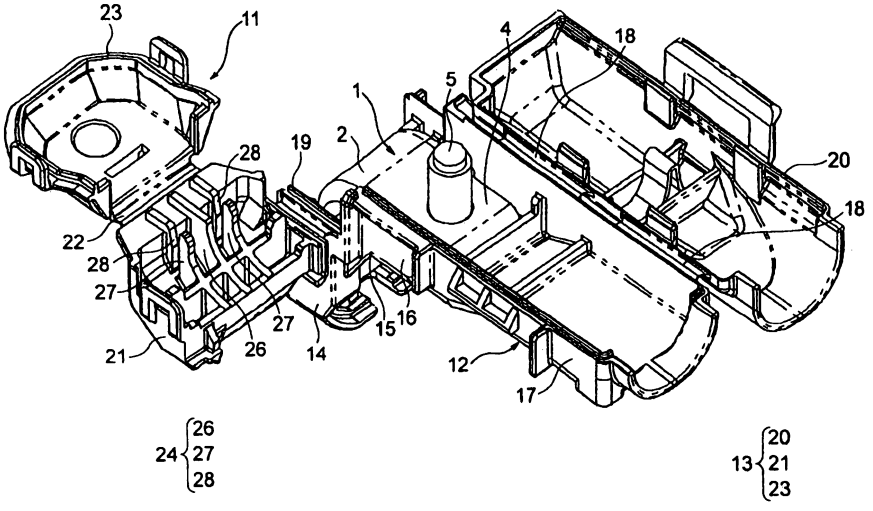
(54) **Terminal cap**

(57) The present invention provides a terminal cap which is capable of suppressing looseness in the twisting direction of a terminal by the structure of a pair of clamping portions. The terminal cap of the invention accommodating a terminal which has bent portion includes a cap body accommodating the terminal and having an opening through which the terminal is accommodated and a second clamping portion, a cap cover covering the opening and including a first clamping portion. The first and the second clamping portion clamp the terminal so as to sandwich the bending portion. The first clamping portion includes a rigid rib aligned to a central axis of the terminal, a pair of flexible arms including a flexible abutting portion overlapping the bending portion, and disposed on both sides of the rigid rib at equal interval, and a space to which the displacement of the flexible arms is absorbed. The second clamping portion includes a rigid mounting wall aligned to the central axis of the terminal and including a mounting surface formed so as to fit the shape of the bending portion.

FIG. 2



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Description

BACKGROUND OF THE INVENTION

[0001] The present invention relates to a synthetic resin-made terminal cap designed for a terminal which is provided at a terminal end of an electric wiring, specifically a terminal which has a bent portion and whose shape in a side view is L-shaped.

[0002] A terminal cap is conventionally known as a cap for covering a terminal which is provided at a terminal end of an electric wiring and is connected to a connecting terminal of an electric apparatus, and whose shape in a side view is L-shaped. The terminal cap has the functions of providing insulation so as to prevent the leakage of electric current and providing protection to prevent attachment of water or dust to the terminal and the connecting terminal of the electric apparatus. The terminal cap is generally formed by injection molding an insulative synthetic resin material.

[0003] The terminal cap disclosed in JP-A-2004-253223 includes a cap body for accommodating a terminal which has a bent portion and whose shape in a side view is L-shaped, and a cover for covering an opening on the terminal-accommodating side of this cap body. A pair of clamping portions for clamping a bent portion of the terminal from obverse and reverse directions thereof are formed on the cap body and the cover. The pair of clamping portions are formed such that one of them is flexible. Alternatively, the pair of clamping portions are formed such that both of them are rigid bodies.

[0004] In the above-described related technique, since the structure provided is such that the bent portion of the terminal is clamped by the pair of clamping portions, it is possible to accommodate the terminal within the terminal cap without looseness. With the above-described related technique, however, there is a possibility that in a case where an external force in the twisting direction is applied to the terminal, the terminal unfavorably rattles in the twisting directing. The inventor of this application believes that a measure against the looseness in this twisting direction should be taken.

SUMMARY OF THE INVENTION

[0005] The invention has been devised in view of the above-described circumstances, and its object is to provide a terminal cap which is capable of suppressing the looseness in the twisting direction of the terminal by the structure of the pair of clamping portions.

[0006] To attain the above object, in accordance with a first aspect of the invention there is provided a terminal cap accommodating a terminal including a bent portion includes a cap body accommodating the terminal and having an opening through which the terminal is accommodated and a second clamping portion a cap cover covering the opening and including a first clamping portion. The first and the second clamping portion clamp the terminal so as to sandwich the bent portion. The first clamping portion includes a rigid rib aligned to a central axis of the terminal, a pair of flexible arms including a flexible abutting portion overlapping the bent portion and disposed on both sides of the rigid rib at equal interval, and a space to which the displacement of the flexible arms is absorbed. The second clamping portion includes a rigid mounting wall aligned to the central axis of the terminal and including a mounting surface formed so as to fit the shape of the bent portion. Especially, the invention is suitable for the terminal having L-shape in side view. Preferably, the flexible abutting potion has a convex shape.

[0007] According to the above-described first aspect of the invention, if the bent portion of the terminal mounted on the mounting wall is clamped by the second clamping portion and the first clamping portion of the cover, the bent portion is set in a state of being clamped by the rigid bent-portion mounting wall and the rigid rib. Hence, the usual looseness is suppressed by the clamping at the first and the second clamping portions. In addition, according to the invention, since the first clamping portion has the pair of flexible arms, even in a case where an external force in the twisting direction is applied to the terminal, the pair of flexible arms follow the twist, with the result that the looseness in the twisting direction is also suppressed.

[0008] In a second aspect of the invention according to the terminal cap of the first aspect of the invention, the flexible arms includes a solid abutting portion which is continuously formed from the convex-shape flexible portion and curved with a suitable curvature radius to a curvature radius of the bent portion.

[0009] According to the above-described second aspect of the invention, each flexible arm has a portion which functions in the same way as the rigid rib in addition to the portion which suppresses the looseness in the twisting direction due to the deflection.

[0010] In a third aspect of the invention according to the terminal cap of the second aspect of the invention, the convex-shape flexible portion has a different curvature radius from the curvature radius of the solid abutting portion.

[0011] According to the above-described third aspect of the invention, it becomes possible to make adjustment by changing the rounded shape, thereby alleviating the stress concentration at a boundary position between a flexible portion and a solid portion in the flexible arm

[0012] According to the above-described first aspect of the invention, an advantage is offered in that even in the case where an external force in the twisting direction is applied to the terminal, it is possible to prevent the looseness of the terminal by virtue of the structure of the pair of clamping portions.

[0013] According to the above-described second aspect of the invention, an advantage is offered in that the looseness can be prevented more reliably.

[0014] According to the above-described third aspect of the invention, an advantage is offered in that it is pos-

sible to alleviate the stress concentration in the flexible arms. According to the invention, an advantage is offered in that even in a case where the terminal cap is subjected to external forces in the twisting direction and deflection is repeated, the terminal cap is able to demonstrate its functions without being damaged.

BRIEF DESCRIPTION OF DRAWINGS

[0015]

Figs. 1A to 1C are diagrams illustrating an embodiment of a terminal cap in accordance with the invention, in which Fig. 1A is a plan view of the terminal cap, Fig. 1B is a cross-sectional view taken alone line A - A in Fig. 1A, Fig. 1C is a cross-sectional view taken alone line B - B in Fig. 1A;

Fig. 2 is a perspective view illustrating a state in which a cover of the terminal cap is open;

Fig. 3 is a perspective view illustrating a first clamping portion in enlarged form;

Fig. 4 is a diagram illustrating a C portion in Fig. 1C in enlarged form;

Fig. 5 is a cross-sectional view illustrating a state in which a pair of flexible arms of the first clamping portion are deflected; and

Figs. 6A and 6B are diagrams corresponding to the position of a G portion in Fig. 5, in which Fig. 6A is an enlarged view illustrating a state before the flexible arms are deflected, and Fig. 6B is an enlarged view illustrating a state in which the flexible arms are deflected.

DETAIL DESCRIPTION OF PREFERED EMBODIMENT

[0016] Hereafter, a description will be given with reference to the drawings. Figs. 1A to 1C are diagrams illustrating an embodiment of a terminal cap in accordance with the invention, in which Fig. 1A is a plan view of the terminal cap, Fig. 1B is a cross-sectional view taken along line A-A in Fig. 1A, Fig. 1C is a cross-sectional view taken along line B - B in Fig. 1A. Fig. 2 is a perspective view illustrating a state in which a cover of the terminal cap is open. Fig. 3 is an enlarged perspective view illustrating a first clamping portion. Fig. 4 is an enlarged diagram illustrating a C portion in Fig. 1. Fig. 5 is a cross-sectional view illustrating a state in which a pair of flexible arms of the first clamping portion are bent. In addition, Figs. 6A and 6B are diagrams corresponding to the position of a G portion in Fig. 5, in which Fig. 6A is an enlarged view illustrating a state before the flexible arms are deflected, and Fig. 6B is an enlarged view illustrating a state in which the flexible arms are bent.

[0017] In Figs. 1 and 2, reference numeral 1 denotes a terminal which is connected to a stud bolt-like connecting terminal of an unillustrated electric apparatus (e.g., a starter of a vehicle). The terminal 1 is formed by bending an electrically conductive and relatively thick metallic plate. A terminal which has a bent portion 2 and whose shape in a side view is L-shaped is applied as the terminal 1 which is used in the invention.

[0018] Although the terminal 1 is not particularly limited, in this embodiment a terminal has a one bent-piece portion serves as an electric contact portion 3 and the other bent-piece portion serves as a relay portion 4. The bent portion 2 is located between these bent-piece portions.

[0019] A stud bolt 5 is inserted in the relay portion 4, and a second terminal (not shown) provided at a terminal end of an electric wiring (electric wire) is adapted to be connected to the terminal 1 through this stud bolt 5. The bent portion 2 is formed so as to be bent with a predetermined radius of curvature.

[0020] A terminal cap 11 in accordance with the invention is formed of an insulative synthetic resin, and comprises a cap body 12 for accommodating the terminal 1 and a cover 13 for covering an opening (an opening constituting the accommodating side of the terminal 1; its reference numeral is omitted) of this cap body 12.

[0021] The cap body 12 includes an electric-contact-portion corresponding portion 14 corresponding to the electric contact portion 3 of the terminal 1, a bent-portion corresponding portion 15 corresponding to the bent portion 2 of the terminal 1, a relay-portion corresponding portion 16 corresponding to the relay portion 4 of the terminal 1, and an electric-wire-connecting-portion corresponding portion 17 corresponding to an electric-wire corresponding portion of the unillustrated second terminal.

[0022] The cover 13 includes a first cover 20 and a second cover 21 which are formed in such a manner as to be connected to the cap body 12 via hinges 18 and 19, respectively, and a third cover 23 which is formed in such a manner as to be connected to the second cover 21 via a hinge 22.

[0023] The first cover 20 is formed so as to cover opening portions of the relay-portion corresponding portion 16 and the electric-wire-connecting-portion corresponding portion 17, and is formed so as to be retained at a side wall of the electric-wire-connecting-portion corresponding portion 17. The second cover 21 is formed so as to cover an opening portion of the bent-portion corresponding portion 15, and is formed so as to be retained at a side wall of the bent-portion corresponding portion 15. The third cover 23 is formed so as to cover an opening portion of the electric-contact-portion corresponding portion 14, and is formed so as to be retained at a side wall of the electric-contact-portion corresponding portion 14.

[0024] The second cover 21 is provided with a first clamping portion 24 which is a characteristic portion of the invention. Further, the bent-portion corresponding portion 15 of the cap body 12 which is covered by the second cover 21 is provided with a second clamping portion 25 which is also a characteristic portion of the invention. The first clamping portion 24 and the second clamp-

ing portion 25 are formed as portions for suppressing the looseness of the bent portion 2 of the terminal 1 by clamping the bent portion 2 from both obverse and reverse directions thereof. In other words, the bent portion 2 is sandwiched by the first clamping portion 24 and the second clamping portion 25.

[0025] The first clamping portion 24 and the second clamping portion 25 possess the function of preventing the looseness in the twisting direction of the terminal in addition to the function of preventing the looseness which the related terminal cap has, which has been described in the section on the background of the invention. Hereafter, a description will be given of the first clamping portion 24 and the second clamping portion 25.

[0026] In Figs. 1 to 3, the first clamping portion 24 includes a rigid fixed rib 26; a pair of flexible arms 27 which are respectively disposed on both sides of the rigid fixed rib 26 at equal intervals thereto; and a pair of deflection absorbing spaces 28 for absorbing the displacement of the pair of flexible arms 27. The rigid fixed rib 26 and the pair of flexible arms 27 are formed in such a shape that, when the second cover 21 is closed, they are, in conjunction therewith, brought into sliding contact with the bent portion 2. It should be noted that although reference numerals are not particularly given here, tapers for rendering smooth the sliding contact with the bent portion 2 are respectively formed on a distal end of the fixed rib 26 and distal ends of the pair of flexible arms 27.

[0027] The fixed rib 26 is a rib-like portion and is formed and disposed in alignment with the position of a central axis of the terminal 1. A rounded abutment portion 29, which is curved in conformity with the radius of curvature of the surface of the bent portion 2, is formed in this fixed rib 26.

[0028] In Figs. 3 and 4, each of the flexible arms 27 is an arm-like portion which is partly flexible. Each flexible arm 27 has a flexible abutment portion which positionally overlaps on the position of the bent portion 2 as well as a solid abutment portion 31 continuing from the flexible abutment portion 30. The flexible abutment portion has a convex-shape. The solid abutment portion 31 is formed in round shape which is curved so as to correspond to the radius of curvature of the surface of the bent portion 2 (see the radius of curvature RZ in Fig. 4). The flexible abutment portion 30 is formed in such a manner as to continue from the nonflexible abutment portion 31 with round shape different from the round shape of the nonflexible abutment portion 31 (see the radii of curvature RZ and RY in Fig. 4).

[0029] In Figs. 1 and 4, the second clamping portion 25 has a rigid bent-portion mounting wall 32 and a rigid supporting rib 33 for supporting this bent-portion mounting wall 32. The bent-portion mounting wall 32 is a portion for mounting the bent portion 2 thereon, is formed and disposed in alignment with the position of the central axis of the terminal 1, and is formed so as to have a predetermined width. Further, the bent-portion mounting wall 32 is formed so as to have a mounting surface 34 conforming to the shape of the reverse surface of the bent portion 2. The supporting rib 33 is formed in such a rib shape as to connect the bent-portion mounting wall 32 and the bent-portion corresponding portion 15 at the aforementioned position of the central axis.

[0030] In the above-described configuration and structure, the terminal 1 is accommodated in the cap body 12 in such a manner that the bent portion 2 is mounted on the bent-portion mounting wall 32 of the second clamping portion 25, and the second terminal (not shown) provided at the terminal end of the electric wiring (electric wire) is also accommodated in the cap body 12. Further, after the first cover 20 is closed, the second cover 21 is also closed. In conjunction with this closing operation of the second cover 21, the first clamping portion 24 is brought into sliding contact with the surface of the bent portion 2, so that the bent portion 2 is clamped by the first clamping portion 24 and the second clamping portion 25.

[0031] When the bent portion 2 assumes the state of being clamped by the first clamping portion 24 and the second clamping portion 25, the bent portion 2 is fixed by the clamping by the rigid bent-portion mounting wall 32 and the rigid fixed rib 26. Hence, the usual looseness is suppressed by the clamping at these two portions (clamping by the bent-portion mounting wall 32 and the fixed rib 26) (the looseness is suppressed in the same way as the conventional art). In addition, since the pair of flexible arms 27 press the bent portion 2 while deflecting the flexible abutment portion 30, as shown in Figs. 5 and 6, even in a case where an external force in the twisting direction is applied to the terminal 1, the pair of flexible arms 27 follow the twist, with the result that the looseness in the twisting direction is also suppressed.

[0032] As described above with reference to Figs. 1 to 6, according to the invention, an advantage is offered in that even in the case where an external force in the twisting direction is applied to the terminal 1, it is possible to prevent the looseness of the terminal 1 by virtue of the structure of the pair of clamping portions.

[0033] It goes without saying that various modifications can be implemented without departing from the spirit of the invention.

Claims

1. A terminal cap accommodating a terminal including a bent portion comprising:

a cap body accommodating the terminal and having an opening through which the terminal is accommodated and a second clamping portion;

a cap cover covering the opening and including a first clamping portion; wherein

the first and the second clamping portion clamp the terminal so as to sandwich the bent portion;

the first clamping portion comprises:

a rigid rib aligned to a central axis of the terminal;
a pair of flexible arms including a flexible abutting portion overlapping the bent portion, and disposed on both sides of the rigid rib at equal interval; and
a space to which the displacement of the flexible arms is absorbed; and

the second clamping portion comprises:

a rigid mounting wall aligned to the central axis of the terminal and including a mounting surface formed so as to fit the shape of the bent portion.

2. The terminal cap according to claim1, wherein the terminal has L-shape in side view.

3. The terminal cap according to claim2, wherein the flexible abutting portion has a convex shape.

4. The terminal cap according to claim3, wherein the flexible arms includes a solid abutting portion which is continuously formed from the convex-shape flexible portion and curved with a curvature radius so as to correspond to a curvature radius of the bent portion.

5. The terminal cap according to claim4, wherein the convex-shape flexible portion has a different curvature radius from the curvature radius of the solid abutting portion.

FIG. 1C

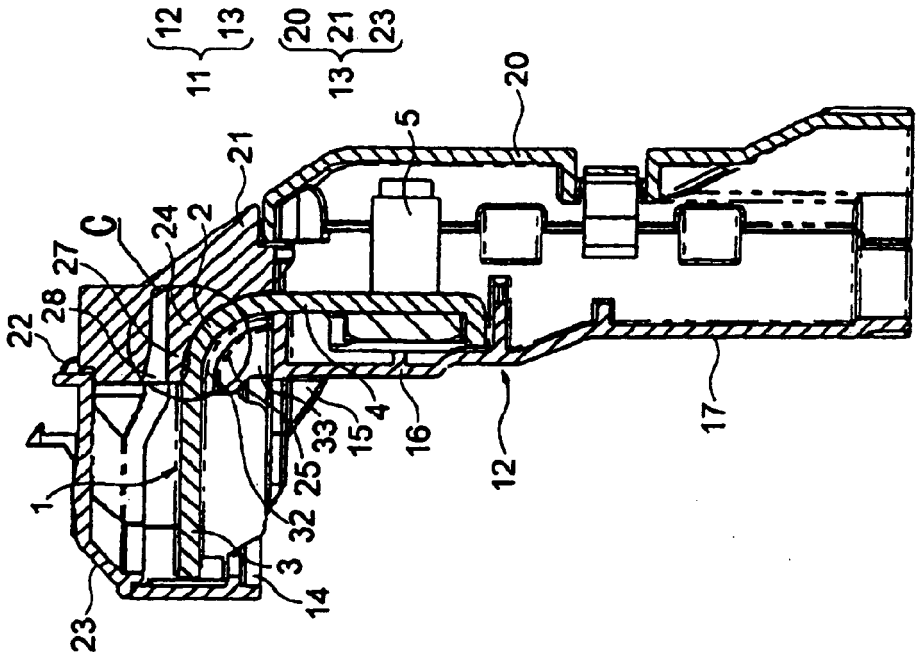

FIG. 1A

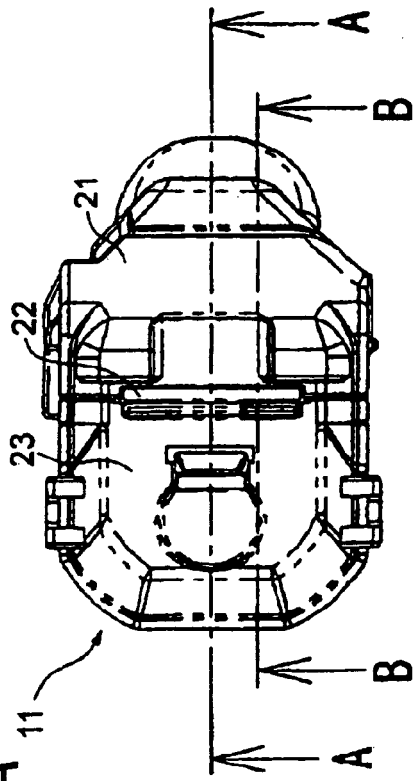

FIG. 1B

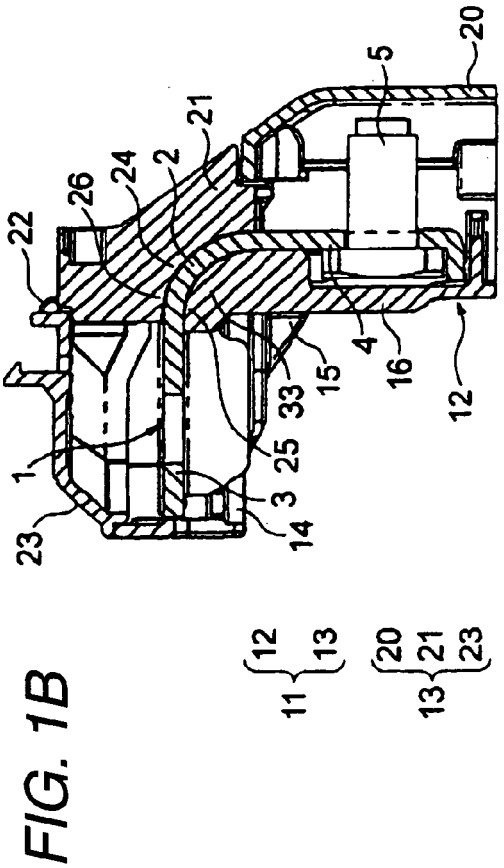

FIG. 2

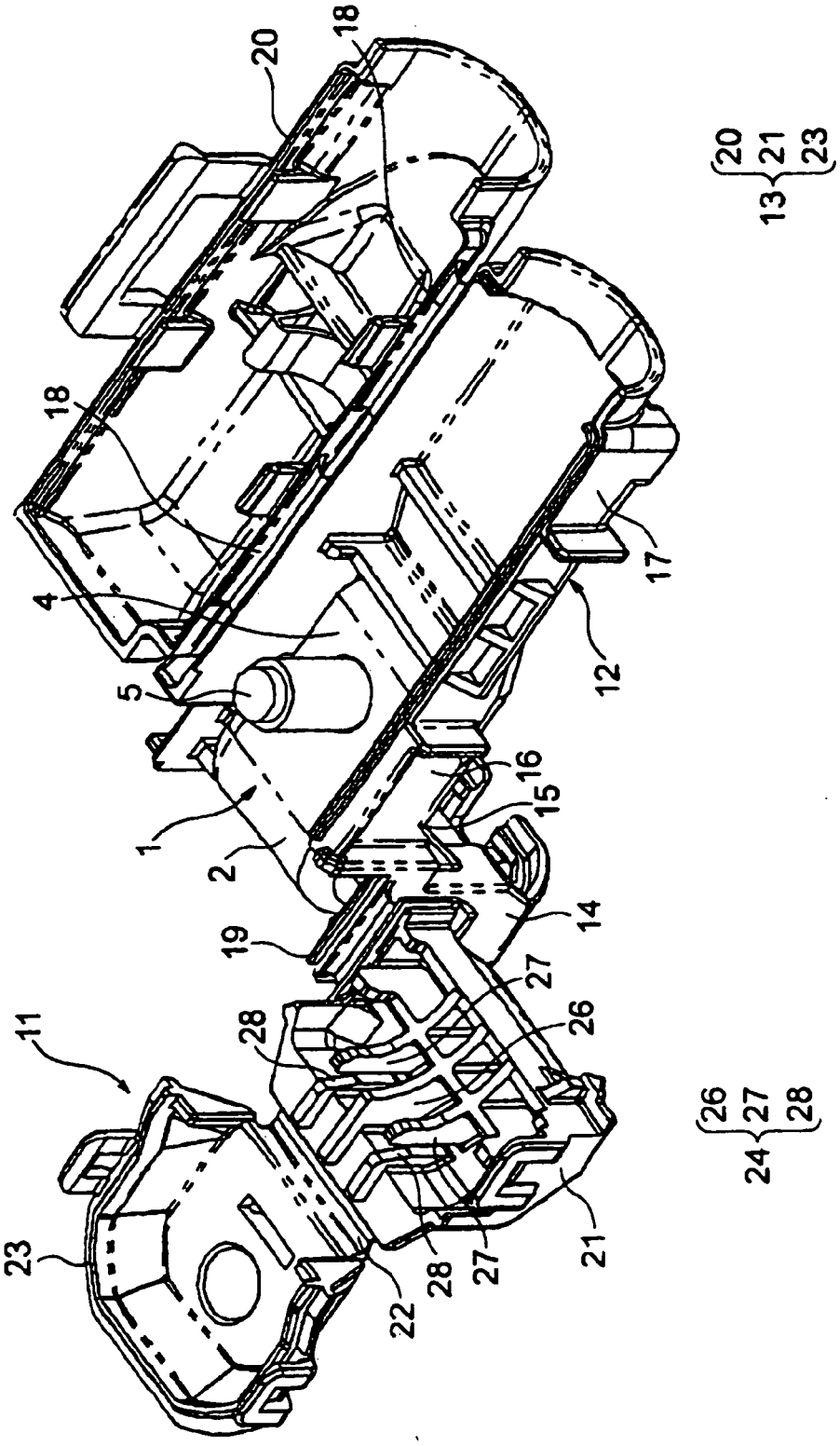
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FIG. 3

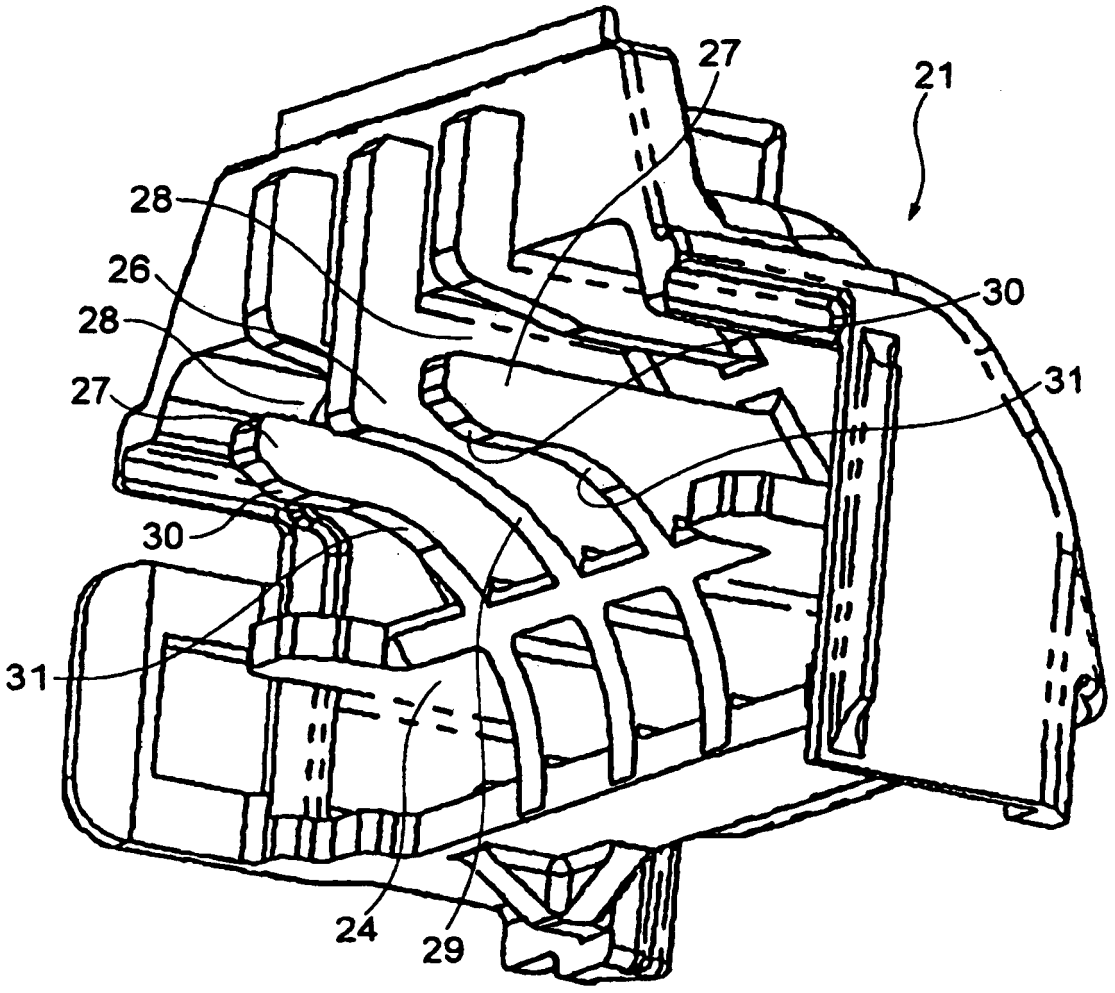

FIG. 4

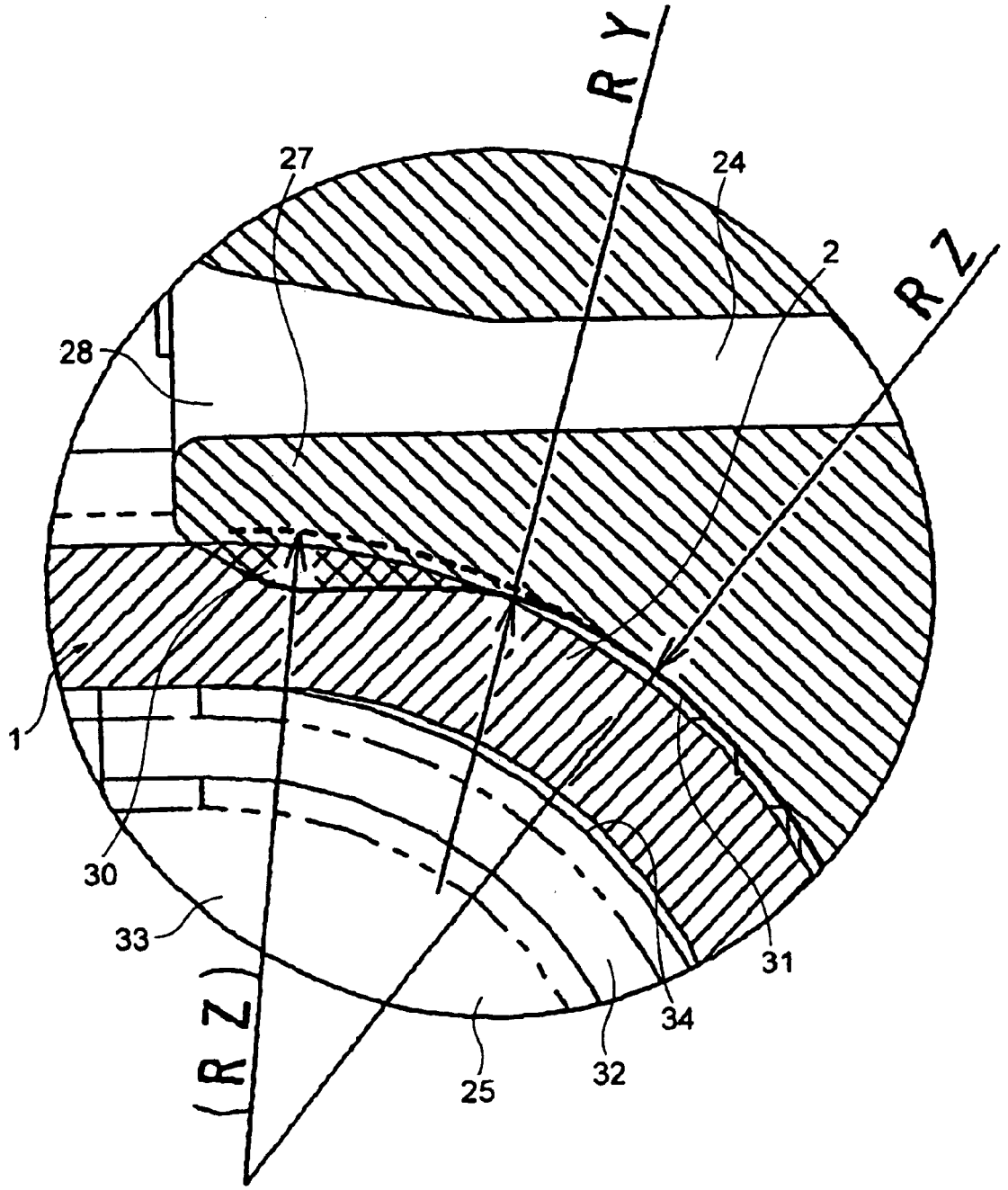

FIG. 5

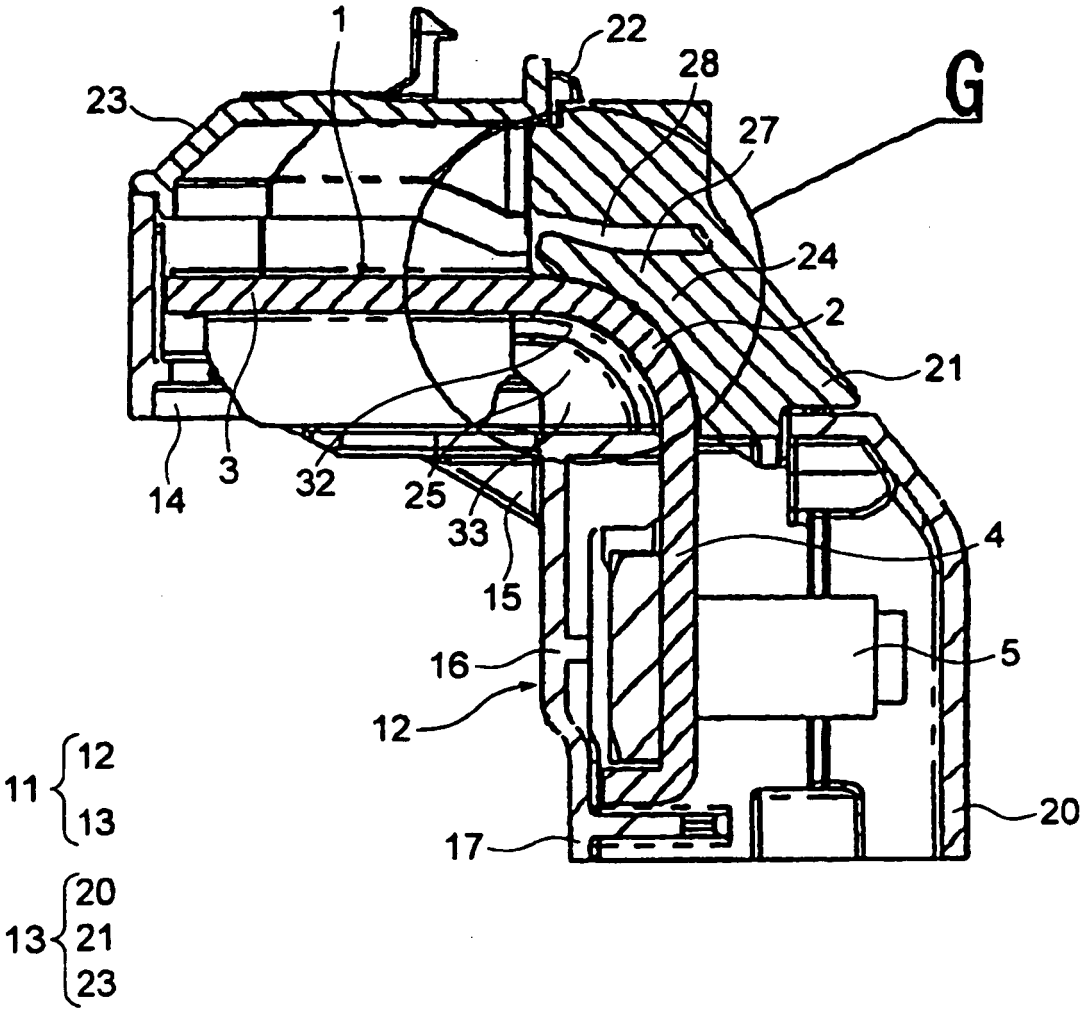
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FIG. 6A

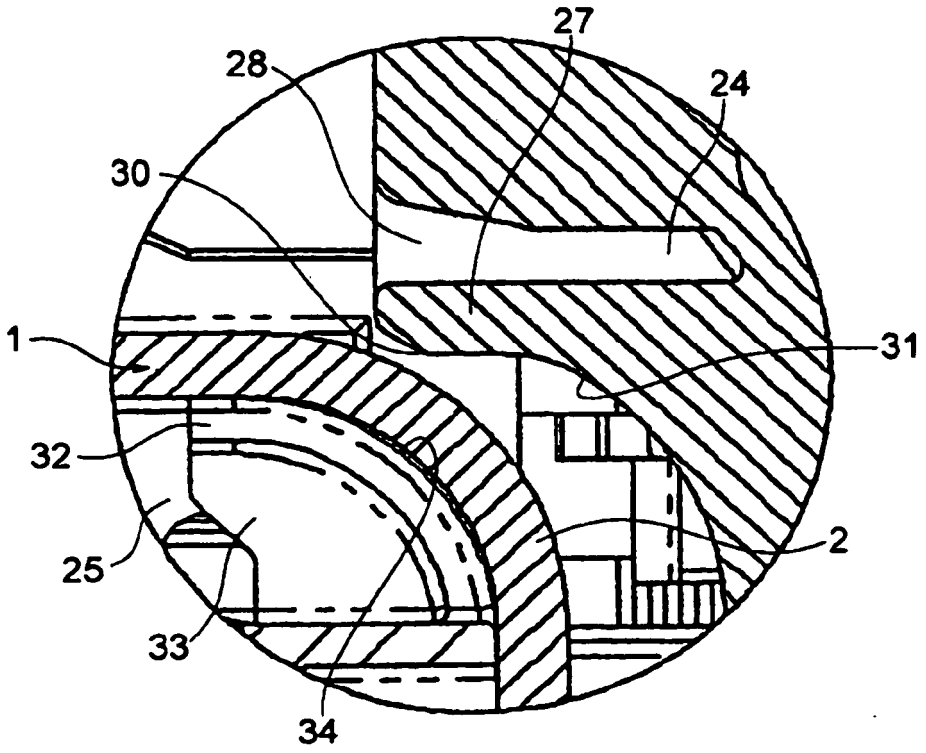
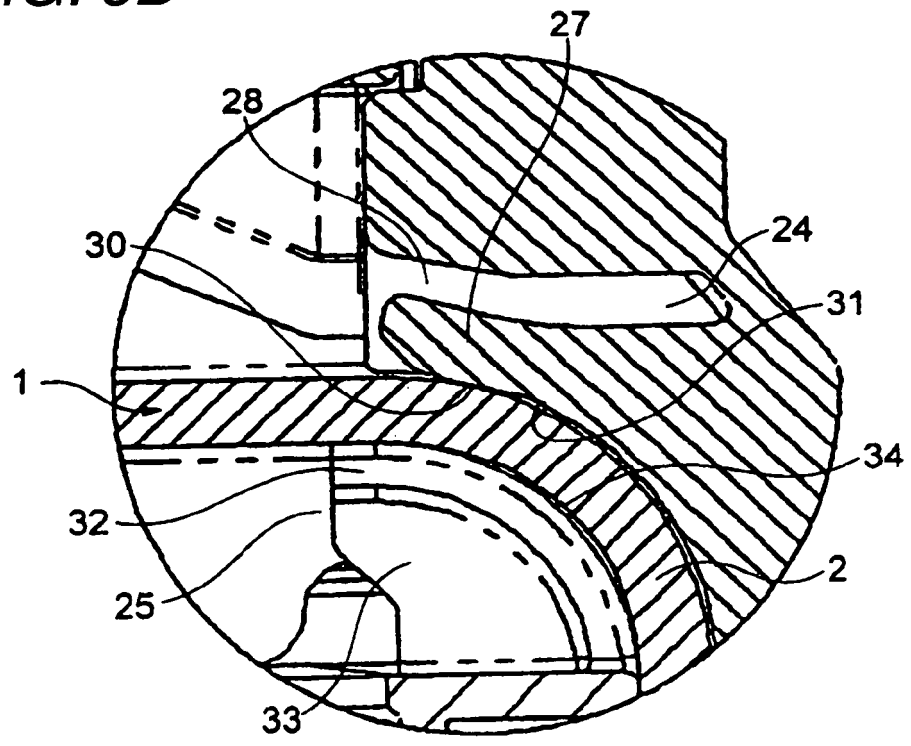


FIG. 6B



REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

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