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(54) **ACCESSORY FOR HAIR TREATMENT DEVICE**

ZUBEHÖRTEIL FÜR HAARBEHANDLUNGSVORRICHTUNG

ACCESSOIRE POUR DISPOSITIF DE TRAITEMENT CAPILLAIRE

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(73) Proprietor: **Sun Luen Electrical Manufacturing Company Limited**
Kowloon, Hong Kong (CN)

(72) Inventors:
- **YEUNG, Ki Cheong**
  Hong Kong (CN)
- **CHEUNG, Wah Hing**
  Hong Kong (CN)

(74) Representative: **Ward, David Ian**
Marks & Clerk LLP
Alpha Tower
Suffolk Street
Queensway
Birmingham B1 1TT (GB)

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Description

[0001] This invention relates to an accessory for a hair treatment device, such as a hair dryer or a diffuser, and a hair treatment device: incorporating such an accessory.

[0002] There are in existence various hair treatment devices, such as hair dryers and curl diffusers, which are usually electrically operated. Such hair treatment devices usually generate heated air flow to dry or heat up the hair of a user, e.g. for styling purposes. Such conventional hair treatment devices usually have a handle: portion adjoining a barrel through which air exits the devices. The air (whether heated or not) exits the device in one direction only, usually along a longitudinal direction of the barrel. If the user would like to dry or heat up the hair of a larger area, he/she has to oscillate the device. In addition, if hot air is (e.g. inadvertently) only applied on a small portion of the hair of the user, that portion of the user's hair may be over-heated, thus damaging the hair.

[0003] US Patent Application Publication No. US 2005/0072019 A1 discloses an oscillating hair dryer nozzle assembly which attaches to a hand held electric hair dryer. An oscillating nozzle is pivoted back and forth by forced air generated by an electric motorized fan within the hair dryer. A propeller receives the forced air and rotates a propeller shaft which is coupled to a gear reduction assembly. The gear reduction assembly converts the rotational motion of the propeller shaft into respective pivotal movement of the oscillating nozzle. The oscillating nozzle automatically redirects the air flow in a plane. In one embodiment, the nozzle assembly is rotatably attached to the output barrel of a hair dryer body so that the oscillating nozzle can be rotated to pivot and redirect air flow in a different plane.

[0004] It is thus an object of the present invention to provide an accessory for a hair treatment device and a hair treatment device with such an accessory in which the aforesaid shortcomings are mitigated or at least to provide a useful alternative to the public.

[0005] According to the present invention there is provided a hair treatment accessory in accordance with claim 1 and a hair treatment device incorporating said accessory.

[0006] Embodiments of an accessory for a hair treatment device and a hair treatment device with such an accessory according to the present invention will now be described, by way of examples only, with reference to the accompanying drawings in which:

Fig. 1 shows a perspective view of an electric hair dryer, being a hair treatment device, arid
an air deflector, being an accessory for a hair treatment device according to an embodiment of the present invention, detached from each other;
Fig. 2 shows a perspective view of the electric hair dryer and air deflector of Fig. 1 engaged with each other;
Fig. 3 shows a perspective view of the air deflector of Fig. 1;
Fig. 4 shows a front view of the air deflector of Fig. 3;
Fig. 5 is a top view of the air deflector of Fig. 3;
Fig. 6 is a side view of the air deflector of Fig. 5;
Fig. 7 is a perspective view of a nozzle in the air deflector of Fig. 3;
Fig. 8 is a front view of the nozzle of Fig. 7;
Fig. 9 is a top view of the nozzle of Fig. 7;
Fig. 10 is a side view of the nozzle of Fig. 9;
Fig. 11 is a sectional view taken along the line A-A in Fig. 9;
Fig. 12 is a sectional view taken along the line B-B in Fig. 10;
Fig. 13 is a perspective view of the air deflector of Fig. 3 with part of the housing removed;
Fig. 14 is another perspective view of the air deflector of Fig. 3 with another part of the housing removed;
Fig. 15 is an exploded perspective view of the parts forming the air deflector of Fig. 3;
Fig. 16 is a sectional exploded perspective of the parts forming the air deflector taken along the line C-C in Fig. 5;
Fig. 17 is a perspective view of a further air deflector, being an accessory for a hair treatment device according to another embodiment of the present invention, with part of the housing removed;
Fig. 18 is a side view of the air deflector of Fig. 17;
Fig. 19 is a top view of the air deflector of Fig. 17;
Fig. 20 is a front view of the air deflector of Fig. 17;
Fig. 21 is a top: view of the air deflector of Fig. 17, in which a locking plate is in an unlocked position and the nozzle of the air deflector is at a left-most position;
Fig. 22 is a top perspective view of the air deflector of Fig. 21;
Fig. 23 is a top view of the air deflector of Fig. 17, in which the locking plate is in a locking position and the nozzle of the air deflector is at a centre position;
Fig. 24 is a top perspective view of the air deflector of Fig. 23;
Fig. 25 is a top view of the air deflector of Fig. 17, in which the locking plate is in an unlocked position and the nozzle of the air deflector is at a righ-most position;
Fig. 26 is a top perspective view of the air deflector of Fig. 25;
Fig: 27 is a sectional view of the air deflector of Fig. 3 or of Fig. 17 in which the nozzle is at a left-most position;
Fig. 28 is a sectional view of the air deflector of Fig. 3 or of Fig. 17 in which the nozzle is at a centre position; and
Fig. 29 is a sectional view of the air deflector of Fig. 3 or of Fig. 17 in which the nozzle is at a right-most position.

[0007] Figs. 1 and 2 show a hair treatment device, being an electric hair dryer, and generally designated as

10, and an air deflector, being an accessory for a hair treatment device according to an embodiment of the present invention, and generally designated as 12. In Fig. 1, the air deflector 12 is detached from the hair dryer 10; and in Fig. 2, the air deflector 12 is releasably engaged with the hair dryer 10. The hair dryer 10 and the air deflector 12 may collectively form a hair treatment device set, or part of a hair treatment device set including one or more other accessories which are selectively releasably engageable with the hair dryer 10.

[0008] The hair dryer 10 has an air entrance 14 and an air exit 16 defining an air passage therebetween. An electrically operated air flow generator (e.g. a fan) is provided within the hair dryer 10 for drawling air from the outside environment into the hair dryer 10 *via* the air entrance 14 and driving the air through the air passage between the air entrance 14 and the air exit 16, and subsequently out of the hair dryer 10 to the outside environment via the air exit 16. A heating element (e.g. heating filaments) is also provided in the air passage and downstream of the air flow generator such that, in operation, the heating element raises the temperature of the air entering the hair dryer 10 before exiting the hair dryer 10, e.g. for drying or heating up the hair of a user. The hair dryer 10 has a number of buttons 18a, 18b, 18c for controlling, e.g. the on and off of the hair dryer 10, the speed of operation of the air flow generator (and in turn the rate of flow of air out from the hair dryer 10), and the temperature of the heating element (and in turn the temperature of air flow exiting the hair dryer 10).

[0009] The air deflector 12 has an air ingress 20 at one longitudinal end and an air egress 22 at an opposite longitudinal end. The air ingress 20 and the air egress 22 define an air passageway (not shown) therebetween. The longitudinal end of the air deflector 12 with the air ingress 20 is threaded, for releasable threaded engagement with the air exit 16 of the hair dryer 10. By way of such an arrangement, air exiting the air exit 16 of the hair dryer 10 will enter the air ingress 20 of the air deflector 12. It is possible to have the air deflector 12 releasably engageable with the air exit 16 of the hair dryer 10 in other manners, e.g. by force fit or friction fit.

[0010] As shown in Figs. 3 to 6, the air deflector 12 has a generally cylindrical housing 24 and a switch 26 the manner of operation and function of which will be discussed below. A nozzle 28 is provided within the air deflector 12.

[0011] Figs. 7 to 12 show various views of the nozzle 28. The nozzle 28 has an air inlet 30 at one longitudinal end and an air outlet 32 at an opposite longitudinal end, defining an air conduit 34 therebetween. It: should be noted that:

a. the area of the air outlet 32 is smaller than the area of the air inlet 30;

b. when the nozzle 28 is assembled to the air deflector 12, it can oscillate to and fro about an axis of oscillation L-L. When the nozzle 28 is assembled with the air deflector 12, the axis of oscillation L-L is fixed relative to the housing 24;

c. as shown more clearly in Fig. 8, a right side 36 of the air outlet 32 (in the sense as shown in Fig. 8) is thicker than the left side 38 of the air outlet 32. The weight of the nozzle 28 is therefore not symmetrically distributed about a longitudinal plane containing its central longitudinal axis A-A as shown in Fig. 9 and its axis of oscillation L-L as shown in Fig. 8. Put another way, the centre of gravity of the nozzle 28 lies away from the longitudinal plane containing its central longitudinal axis A-A and its axis of oscillation L-L. More particularly, the centre of gravity of the nozzle 28 lies rightward of the longitudinal plane containing its central longitudinal axis A-A and its axis of oscillation L-L, again in the sense as shown in Fig. 8; and

d. two narrow rims 40 are provided along the inner edge of the air outlet 32 of the nozzle 28. Both rims 40 extend inwardly towards the central longitudinal axis A-A of the nozzle 28.

[0012] As shown in Figs. 13 and 14, when the nozzle 28 is assembled within the air deflector 12, the nozzle 28 is freely hinged to the housing 24 for to-and-fro oscillation relative to the housing 24 about the axis of oscillation L-L within the confines of the housing 24, and within an angle of less than 180°.

[0013] As shown more clearly in Figs. 15 and 16, the air deflector 12 includes a housing 24 comprising a front cover 42, a body 44 and an end piece 46, with a common ventral longitudinal axis M-M. The nozzle 28 includes two diametrically opposite pins 48, 50. The pin 48 is received within an upper hole 52 of the body 44 and the pin 50 is received within a lower hole 53 (see Fig. 16) of the body 44. The nozzle 28 can thus freely oscillate: relative to the body 44 of the housing 24 about the axis L-L which joins the pins 48, 50. The switch 26 is slidable to and fro along a slot 54 on an outer surface 56 of the body 44 in a direction along the bi-directional arrow G-G in Fig. 15, which is parallel to the central longitudinal axis M-M of the housing 24.

[0014] In operation, when the air deflector 12 is engaged with the air exit 16 of the hair dryer 10, air (heated or otherwise) exiting the air exit 16 of the hair dryer 10 will be received through the air ingress 20 of the air deflector 12, through the air inlet 30 of the nozzle 28, through the air conduit 34, out of the air outlet 32 of the nozzle 28, and out of the air egress 22 of the air deflector 12. It is found that passing of air from the air inlet 30 to the air outlet 32 of the nozzle 28 (and thus through the nozzle 28) will set the nozzle 28 into to-and-fro oscillating movement about its axis L-L, thus continuously changing the direction of the air exiting the nozzle 28, and thus exiting the air deflector 12. The fact that the weight of the nozzle 28 is asymmetrically distributed about the longitudinal plane containing its central longitudinal axis A-A and its axis of oscillation L-L ensures that even when the nozzle 28 is at its centre position, the reaction force of air im-

pinging on the inner surface of the nozzle 28 is not balanced, thus ensuring continuous oscillating movement of the nozzle 28. It is found in practice that the presence of the two rims 40 along the inner edge of the air outlet 32 of the nozzle 28 enhances the oscillating movement.

[0015] It can be seen from Fig. 16 that the end piece 46 includes an outer shell 64 and an inner funnel 66 which are integrally formed with each other. An inner opening end 67 of the funnel 66 is received into the nozzle 28 through the air inlet 30 of the nozzle 28. By way of such an arrangement, all air from the hair dryer 10 will enter the end piece 46 (and thus the housing 24 of the air deflector 12) through the funnel 66. This also means that all air from the hair dryer 10 will enter the nozzle 28, to cause the nozzle 28 to oscillate. All such air will subsequently exit the air outlet 32 of the nozzle 28 and eventually the air egress 22 of the air deflector 32

[0016] The switch 26 is engaged with a wire spring 58 with a bent recess 60. In operation, when the nozzle 28 is in a centre position, the switch 26 may be moved, e.g. manually by a user, to push the spring 58 so as to have the recess 60 engaged with a protrusion 62 extending upwardly from the nozzle 28, so as to prevent oscillation of the nozzle 28, thus locking the nozzle 28, even upon passing of air through the nozzle 28. The user may subsequently move the switch 26 away from the protrusion 62 so as to disengage the wire spring 58 from the protrusion, thus unlocking the nozzle 28, allowing it to oscillate upon passing of air therethrough.

[0017] In the above discussion and the relevant drawings, the air deflector 12 is discussed and shown as being engageable with the air exit 16 of the hair dryer 10 in a configuration in which the axis of oscillation L-L of the nozzle 28 is vertical (in the sense of Fig. 4), such that the nozzle 28 can oscillate horizontally (again in the sense of Fig. 4). It is envisaged that the air deflector 12 may be engaged with the air exit 16 of the hair dryer 10 in more than one configuration. In an alternative configuration, the air deflector 12 is engaged with the air exit 16 of the hair dryer 10 such that the axis of oscillation L-L of the nozzle 28 is rotated by 90°, and is thus horizontal (in the sense of Fig. 4), in which case the nozzle 28 can oscillate up and down (again in the sense of Fig. 4). In a still further configuration, the axis of oscillation L-L of the nozzle 28 may be slanted (in the sense of Fig. 4) such that the nozzle 28 can oscillate in a slanted manner (again in the sense of Fig. 4). In a yet further configuration, the air deflector 12, when engaged with the air exit 16 of the hair dryer 10, may be freely rotatable relative to the hair dryer 10 about an axis substantially parallel to the central longitudinal axis M-M of the air deflector 12, including the central longitudinal axis M-M of the air deflector 12, thus bringing about simultaneous corresponding rotation of the nozzle 28.

[0018] A second exemplary air deflector, being an accessory for a hair treatment device according to another embodiment of the present invention, is shown Figs. 17 to 26, generally designated as 12a. The structure of the air deflector 12a is very similar to that of the air deflector 12 discussed above.

[0019] One difference between the air deflector 12a and the air deflector 12 is that, in the air detector 12a, an air outlet 32a of a nozzle 28a hinged with and within the air deflector 12a for to-and-fro oscillation about an axis L_a-L_a relative to and within the confines of a housing 24a and within an angle of less than 180° is thicker on its left side 38a (in the sense of Fig. 20) than its right side 36a (again in the sense of Fig. 20).

[0020] A more important difference between the air deflector 12a and the air deflector 12 resides in the locking mechanism. As shown more clearly in Figs. 21 to 26, a switch 26a engaged with the air deflector 12a has a locking plate 68a with a recess 70a facing a protrusion 62a of and fixed to the nozzle 28a. Figs. 21, 22, 25 and 26 show the switch 26a. in an outer position in which the protrusion 62a of the nozzle 28a is clear of the recess 70a of the locking plate 68. When the switch 26a is in this unlocked position, the nozzle 28a can oscillate within the housing 24a of the air deflector 12a and about its axis L_a-L_a upon passing of air therethrough. When the switch 26a is moved towards the nozzle 28a to its inner locking position, and when the nozzle 28a is in its centre position (as shown in Figs. 23 and 24), the protrusion 62a is received within the recess 70a. In such a scenario, the nozzle 28a cannot oscillate about the axis L_a-L_a relative to the housing 24a even upon passing of air therethrough.

[0021] In the embodiments discussed above, the effect of the weight of the nozzle 28,28a being asymmetrically distributed about the longitudinal plane containing its central longitudinal axis A-A and its axis of oscillation L-L, L_a-L_a is brought about by having one side of the nozzle 28, 28a thicker than the other side. It is envisaged that such an effect can also be brought about in the following manners:

a. the nozzle is made by joining two body halves of symmetrical outer shapes, but of materials of different densities. The nozzle so formed is thus symmetrical in outer shape about the longitudinal plane containing its central longitudinal axis and its axis of oscillation, but its centre of gravity lies away from this plane and towards the body half made of the material with a higher density; for

b. while the outer shape of the nozzle is symmetrical about the longitudinal plane containing its central longitudinal axis and its axis of oscillation, part of the material in one side of the nozzle is removed, so that the centre of gravity of the nozzle lies away from this plane and towards the side of the body from which no material is removed.

[0022] Each of Figs. 27 to 29 is a cross sectional view of the air deflector 12, 12a, in which Fig. 27 shows the nozzle 28, 28a in a left-most position, Fig. 28 shows the nozzle 28, 28a in a centre position, and Fig. 29 shows

the nozzle 28, 28a in a right-most position. Upon pissing of air from the hair dryer 10 through the nozzle 28, 28a, the nozzle 28, 28a will oscillate about the axis L_a-L_a and within the confines of the housing 24a so as to continuously change the direction in which the air exits the air deflector 12, 12a, as shown by the arrows T, S, R in Figs. 27, 28 and 29 respectively. It can be seen that the air exiting the air deflector 12, 12a (and thus exiting the hair dryer 10) covers a wider area and a wider angle than in the absence of the air deflector 12, 12a.

[0023] Experiments have been carried out to assess the performance of an electric hair dryer attached with an air deflector according to the present invention, with the following basic experiment parameters:

Input Voltage: 220 volts
Output Wattage/Full Power: 1875 watts

[0024] The electric hair dryer has a High-Speed mode of operation and a Low-Speed mode of operation.

Frequency of Oscillation of Sample Air Deflector

Mode of Operation	Frequency of Oscillation
High Speed	402 rounds per minute
Low Speed	125 rounds per minute

[0025] Given the very high speed of oscillation of the air deflector, the user will not feel pulses of air flow from the hair dryer, but a continuous stream of air flow of an even temperature and of a wider area of coverage than with the hair dryer alone and without the air deflector.

[0026] The present invention has so far been discussed in the context of the hair treatment device being an electric hair dryer. It is of course readily apparent to a person skilled in the art that the hair treatment device may be in other nature or forms, e.g. a diffuser.

[0027] In the foregoing discussion of the present invention, the air deflector is disclosed as being releasably engageable with the air exit of the electric hair dryer. It is envisaged that the present invention also encompasses the arrangement in which a built-in air deflecting mechanism is provided in the air passageway way of an electric hair treatment device, such as a hair dryer or diffuser.

[0028] In such an alternative arrangement, the hair treatment device (e.g. a hair dryer or diffuser) includes an air entrance and an air exit defining an air passageway therebetween, an air flow generator to draw air into the device through the air entrance and to drive the air out of the device through the air exit, and a nozzle in the air passageway downstream of the air flow generator. The nozzle includes an air inlet and an air outlet, the air inlet being configured to receive all or at least part of the air flowing in the air passageway from the air flow generator, and thus from the air entrance, and the air outlet allows exit of the air received by the air inlet. The nozzle is engaged with (e.g. being freely hinged to) the hair treatment device for to-and-fro oscillation about an axis of oscillation and within an angle of less than 180° relative to and within the passageway to continuously change the direction of the air exiting the nozzle, and thus the hair treatment device. The nozzle is preferably positioned close to the air exit of the hair treatment device. All other features of the air deflector discussed above (e.g. the locking/unlocking mechanism, the shapes and construction of the nozzle, and different possible orientations of the nozzle relative to the hair treatment device) may also be incorporated in this arrangement. It is also envisaged that the nozzle may be freely rotatable relative to the passageway about an axis substantially parallel to the central longitudinal axis A-A of the nozzle, including the central longitudinal axis A-A of the nozzle.

[0029] It should be understood that the above only illustrates examples whereby the present invention may be carried out, and that various modifications and/or alterations may be made thereto without departing from the scope of the appended claims.

Claims

1. An accessory (12, 12a) for a hair treatment device, said accessory including:

   a housing (24, 24a) having an air ingress (20) and an air egress (22) defining an air passage therebetween;
   and
   a nozzle (28, 28a) in said air passage, said nozzle having a central longitudinal axis (A-A);
   wherein said nozzle includes an air inlet (30) and an air outlet (32, 32a); and
   wherein said nozzle is oscillatable relative to said passage about an axis of oscillation (L-L, L_a-L_a) to continuously change the direction of the air exiting said nozzle in use;
   characterized in that the centre of gravity of said nozzle lies away from the longitudinal plane containing said central longitudinal axis and said axis of oscillation of said nozzle.

2. An accessory (12) according to Claim 1 wherein said nozzle is positionable relative to said air passage in at least two configurations, and wherein said axis of oscillation of said nozzle differs by substantially 90° between said two configurations.

3. An accessory (12) according to Claim 1 wherein said nozzle is rotatable relative to said passage about an axis substantially parallel to said central longitudinal axis of said nozzle.

4. A hair treatment device (10) comprising
   an air entrance (14) and an air exit (16) defining an air passage therebetween;

an air flow generator adapted to draw air into said device through said air entrance and to drive air out of said device through said air exit; and
an accessory in accordance with any one of claims 1 to 3.

5. A hair treatment device (10) according to Claim 4 wherein said air inlet of the accessory receives substantially all air flowing from said air flow generator.

Patentansprüche

1. Zubehörteil (12, 12a) für eine Haarbehandlungsvorrichtung, wobei das Zubehörteil Folgendes einschließt:

ein Gehäuse (24, 24a), das einen Lufteintritt (20) und einen Luftaustritt (22) aufweist, die einen Luftdurchgang zwischen denselben definieren, und
eine Düse (28, 28a) in dem Luftdurchgang, wobei die Düse eine Mittellängsachse (A-A) aufweist,
wobei die Düse einen Lufteinlass (30) und einen Luftauslass (32, 32a) einschließt und
wobei die Düse im Verhältnis zu dem Durchgang um eine Schwingungsachse (L-L, L_a-L_a) schwingfähig ist, um die Richtung der Luft, die bei Betrieb aus der Düse austritt, kontinuierlich zu ändern,
dadurch gekennzeichnet, dass der Schwerpunkt der Düse entfernt von der Längsebene liegt, welche die Mittellängsachse und die Schwingungsachse der Düse enthält.

2. Zubehörteil (12) nach Anspruch 1, wobei die Düse im Verhältnis zu dem Luftdurchgang in wenigstens zwei Konfigurationen positionierbar ist und wobei sich die Schwingungsachse der Düse zwischen den zwei Konfigurationen um im Wesentlichen 90° unterscheidet.

3. Zubehörteil (12) nach Anspruch 1, wobei die Düse im Verhältnis zu dem Durchgang um eine Achse, im Wesentlichen parallel zu der Mittellängsachse der Düse, drehbar ist.

4. Haarbehandlungsvorrichtung (10), die Folgendes umfasst:

einen Lufteingang (14) und einen Luftausgang (16), die einen Luftdurchgang zwischen denselben definieren,
einen Luftstromerzeuger, der dafür eingerichtet ist, Luft durch den Lufteingang in die Vorrichtung zu ziehen und Luft durch den Luftausgang aus der Vorrichtung zu treiben, und
ein Zubehörteil nach einem der Ansprüche 1 bis 3.

5. Haarbehandlungsvorrichtung (10) nach Anspruch 4, wobei der Lufteinlass des Zubehörteils im Wesentlichen alle Luft, die aus dem Luftstromerzeuger strömt, aufnimmt.

Revendications

1. Accessoire (12, 12a) pour dispositif de traitement capillaire, ledit accessoire comportant :

une enveloppe (24, 24a) présentant une entrée d'air (20) et une sortie d'air (22) définissant un passage d'air entre elles ;
et
une buse (28, 28a) dans ledit passage d'air, ladite buse présentant un axe longitudinal central (A-A) ;
dans lequel ladite buse comporte une admission d'air (30) et un échappement d'air (32, 32a) ; et
dans lequel ladite buse peut osciller par rapport audit passage autour d'un axe d'oscillation (L-L, L_a-L_a) pour faire varier continuellement la direction de l'air sortant de ladite buse à l'usage ;
caractérisé en ce que le centre de gravité de ladite buse est éloigné du plan longitudinal contenant ledit axe longitudinal central et ledit axe d'oscillation de ladite buse.

2. Accessoire (12) selon la revendication 1, dans lequel ladite buse peut être disposée par rapport audit passage d'air selon au moins deux configurations, et dans lequel ledit axe d'oscillation de ladite buse diffère d'un angle sensiblement de 90° entre lesdites deux configurations.

3. Accessoire (12) selon la revendication 1, dans lequel ladite buse peut tourner par rapport audit passage autour d'un axe sensiblement parallèle audit axe longitudinal central de ladite buse.

4. Dispositif de traitement capillaire (10) comprenant :

une bouche d'entrée d'air (14) et une bouche de sortie d'air (16) définissant un passage d'air entre elles ;
un générateur de flux d'air apte à attirer de l'air dans ledit dispositif par ladite bouche d'entrée d'air et à expulser de l'air hors dudit dispositif par ladite bouche de sortie d'air ; et
un accessoire selon l'une quelconque des revendications 1 à 3.

5. Dispositif de traitement capillaire (10) selon la revendication 4, dans lequel ladite admission d'air de l'ac-

cessoire reçoit sensiblement l'intégralité de l'air provenant dudit générateur de flux d'air.

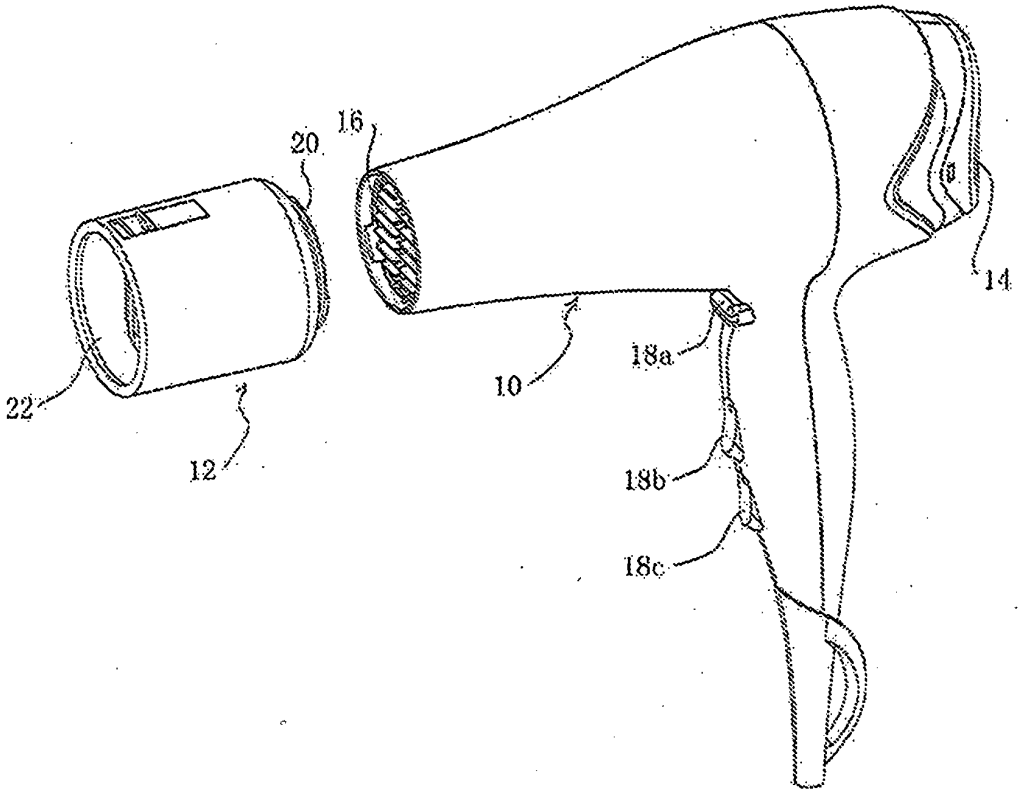


Fig. 1

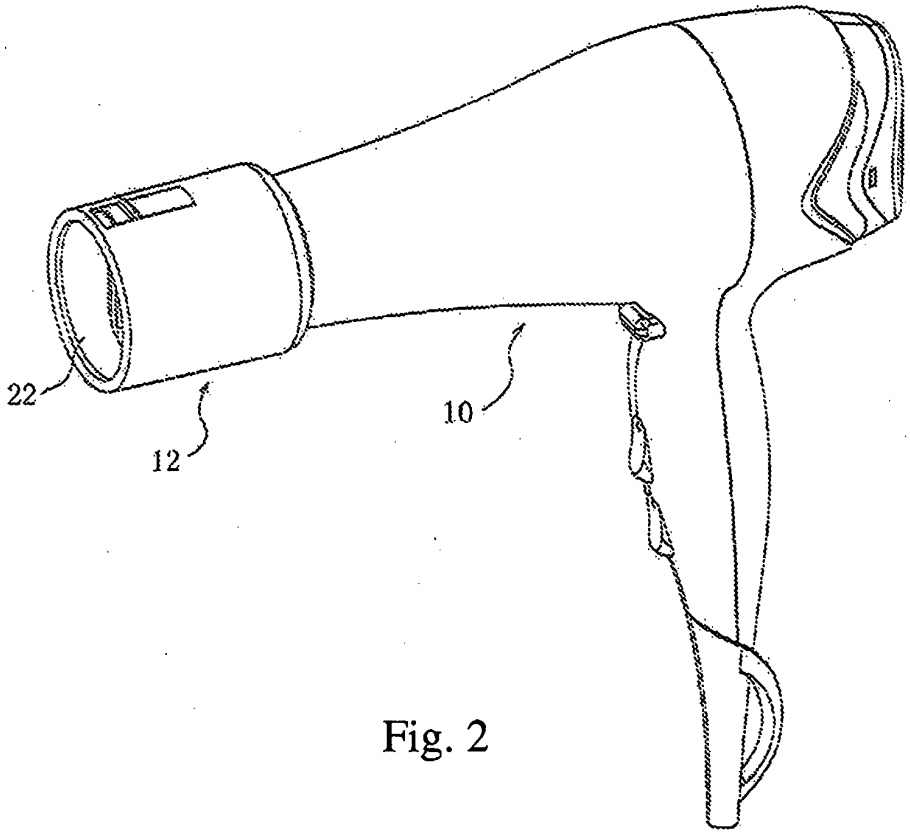


Fig. 2

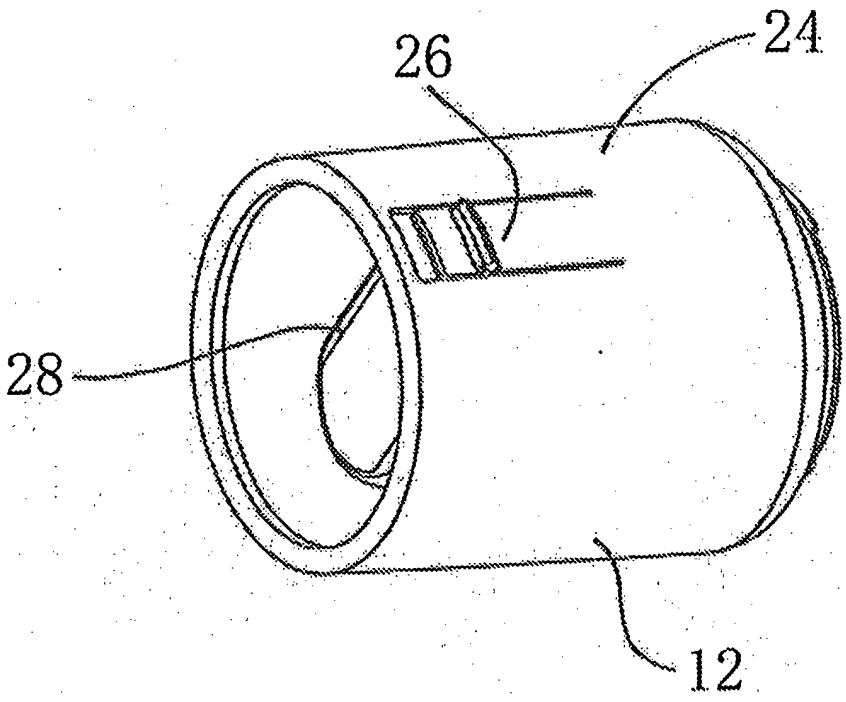


Fig. 3

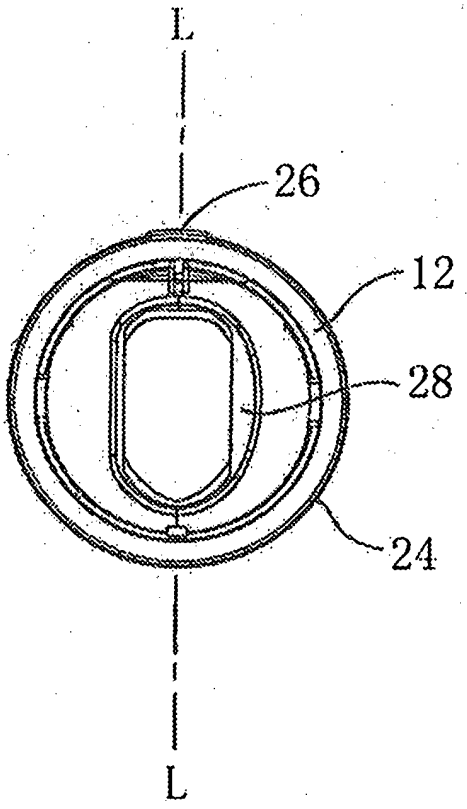


Fig. 4

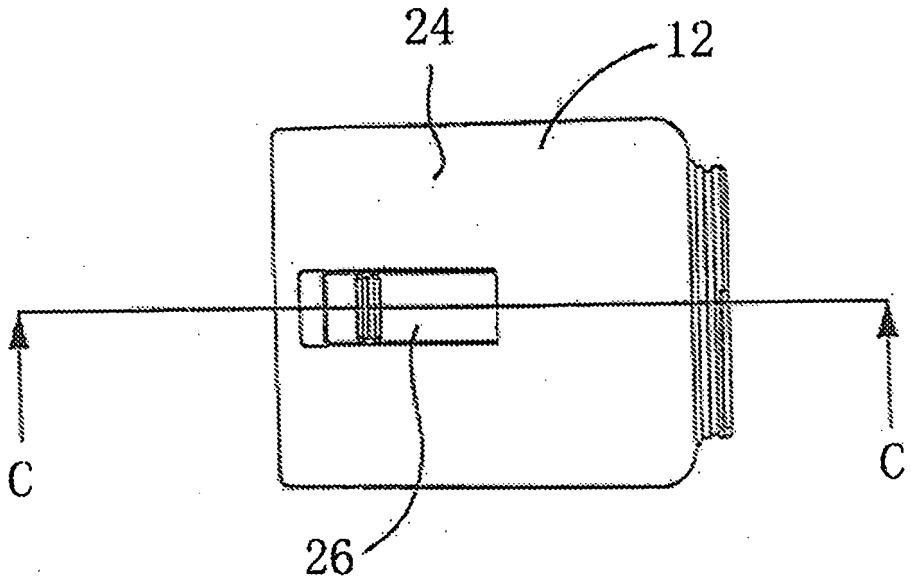


Fig. 5

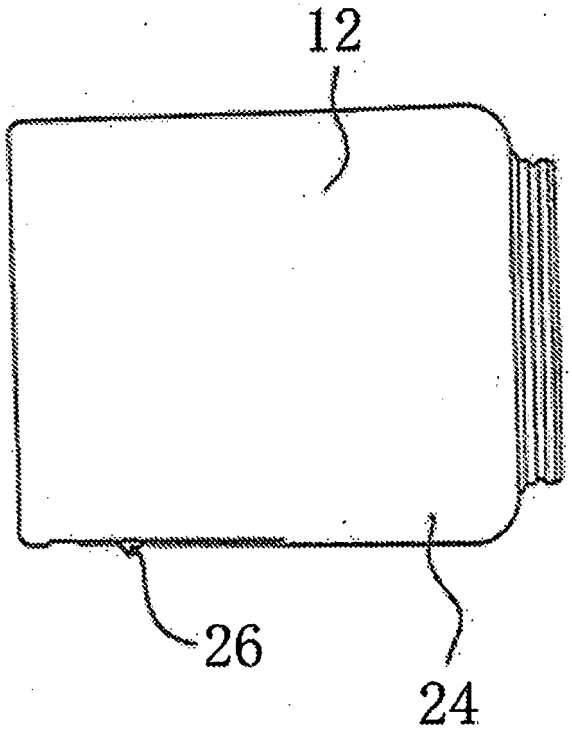


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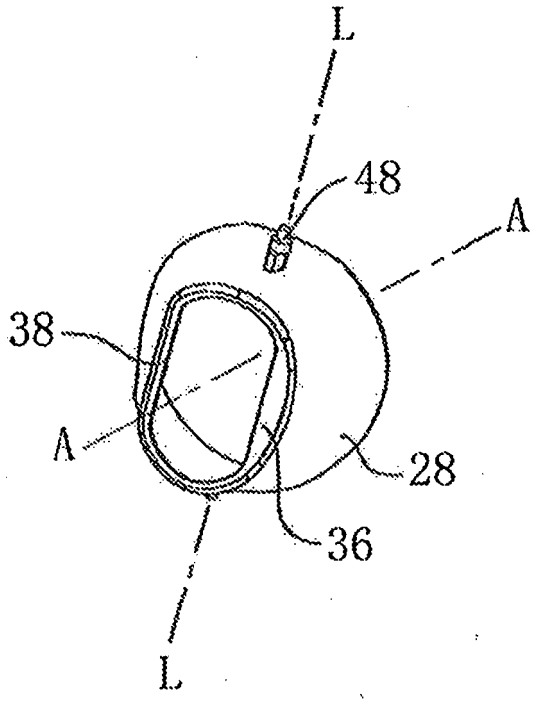


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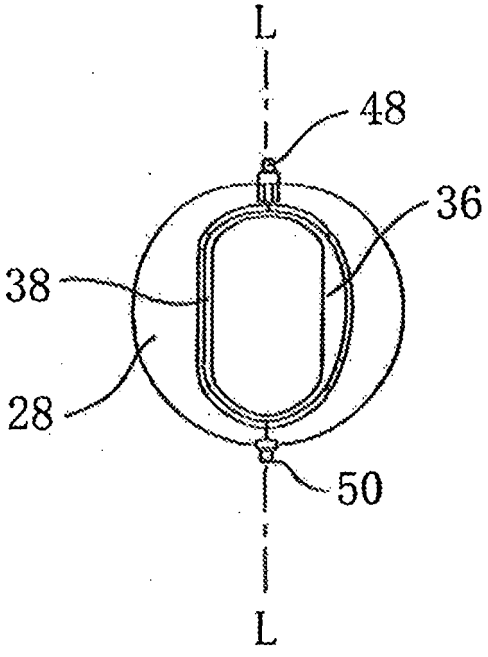


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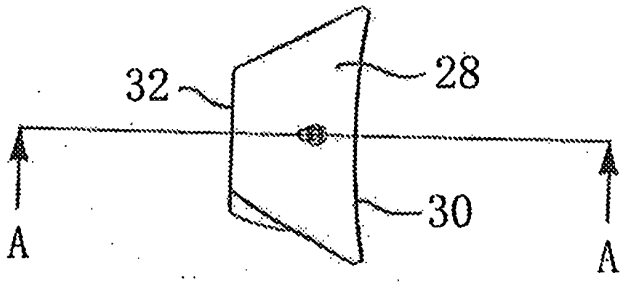


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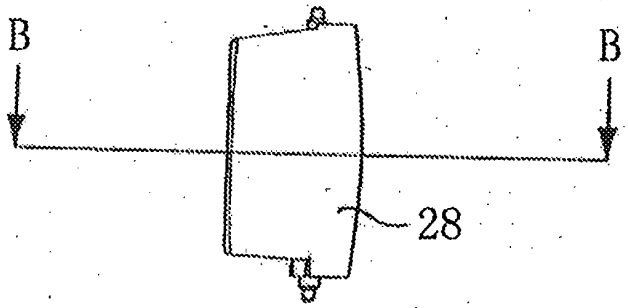


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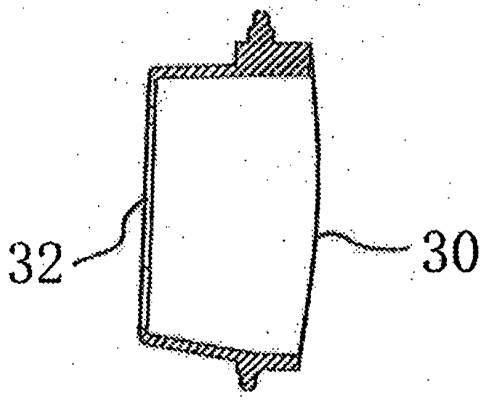


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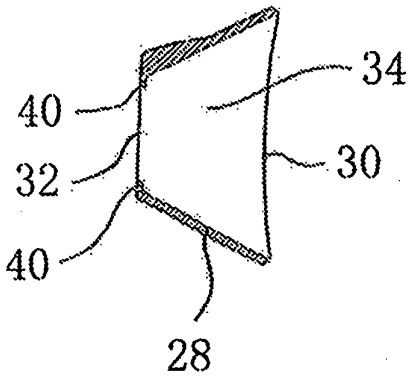


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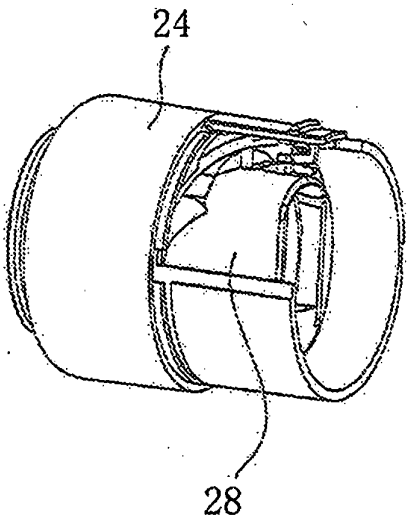


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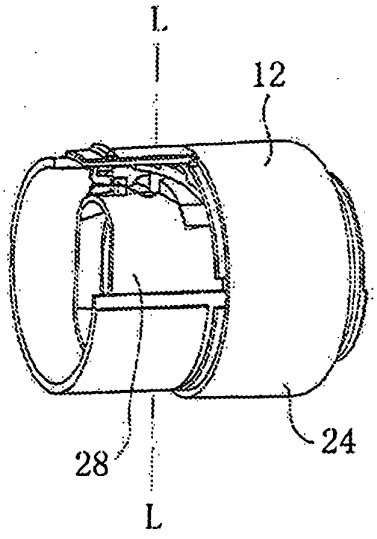


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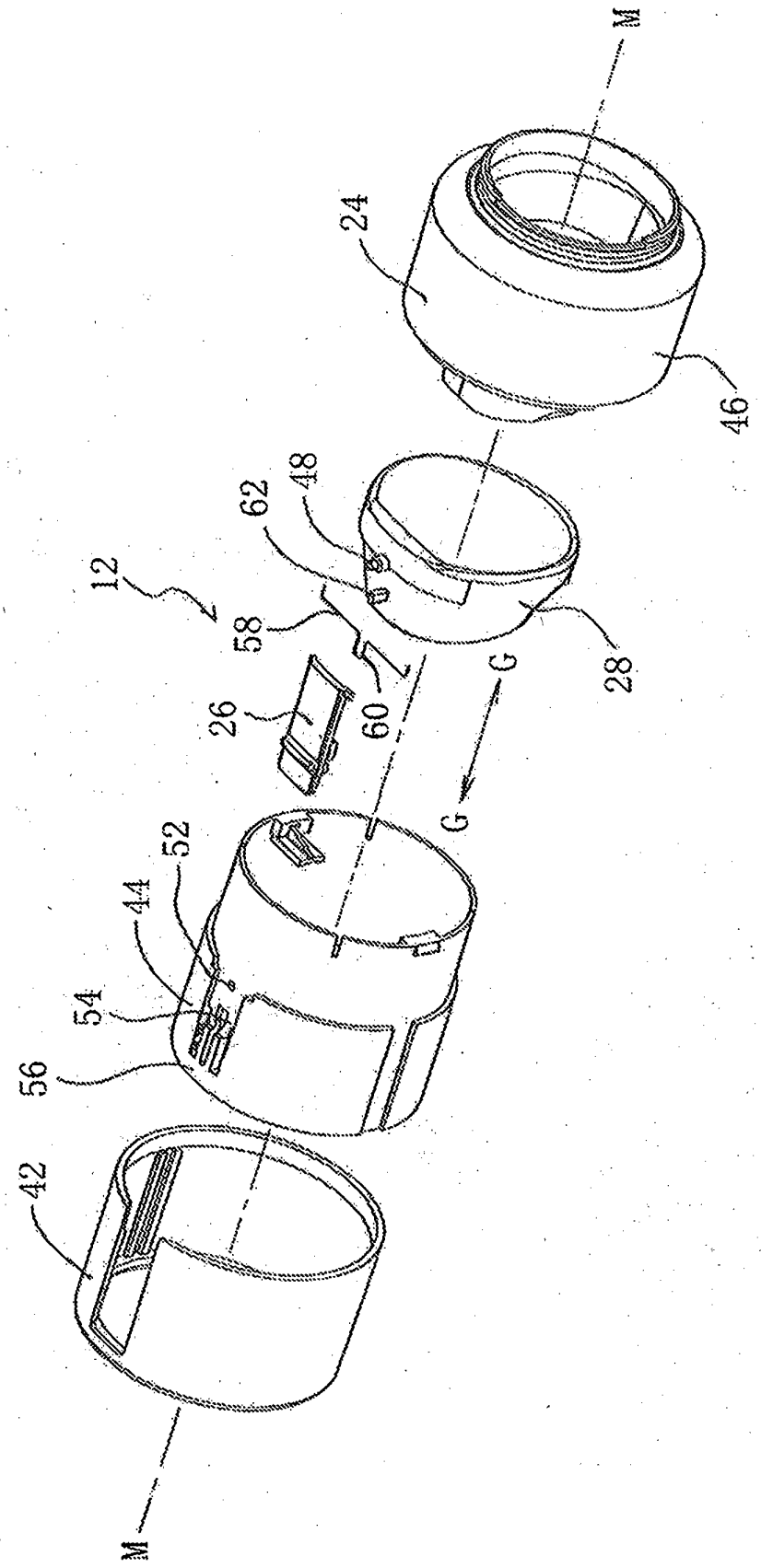


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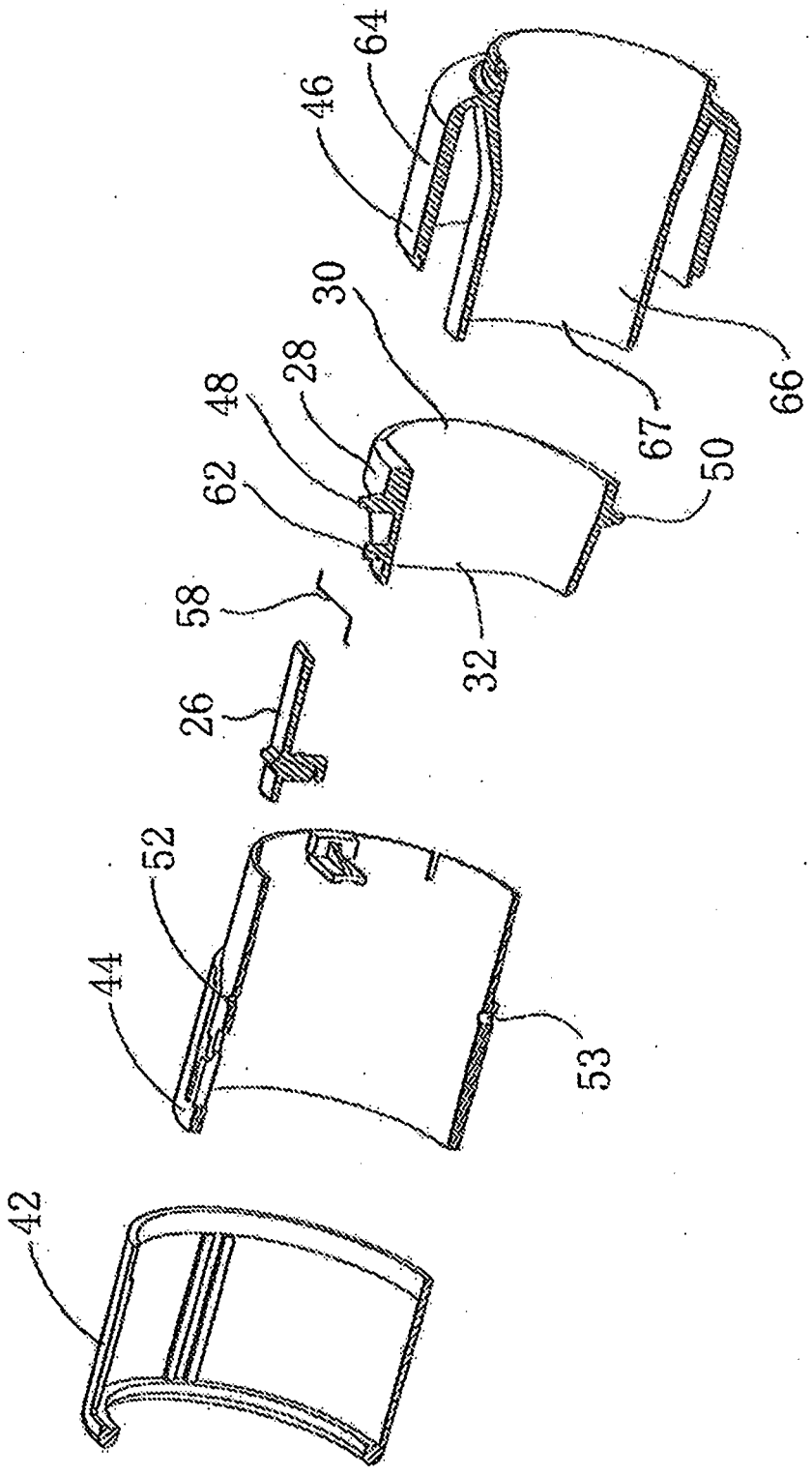


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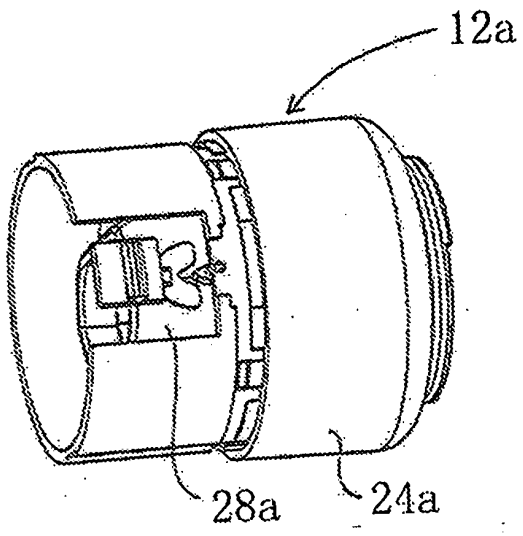


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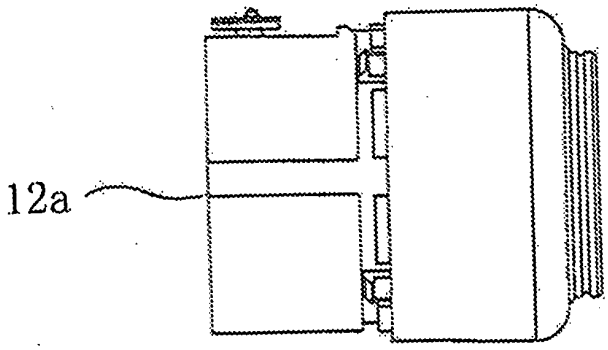


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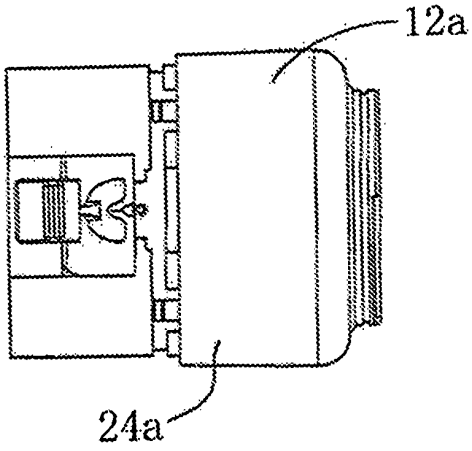


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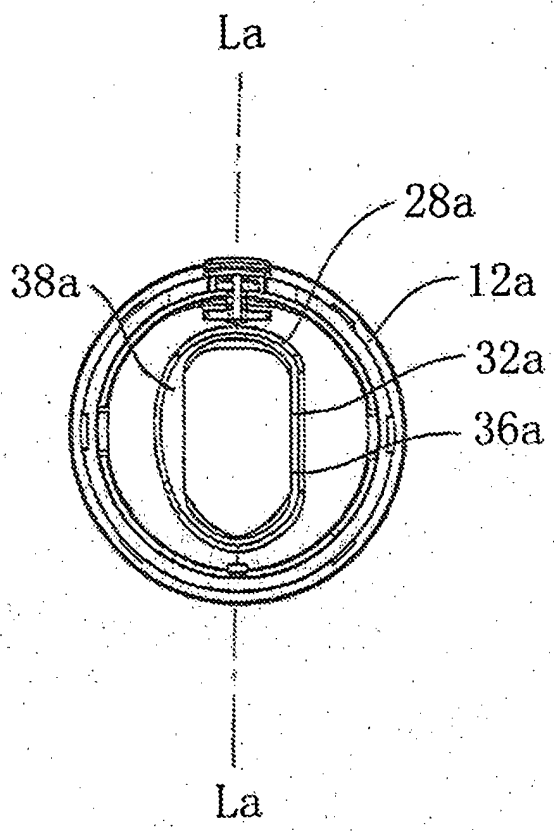


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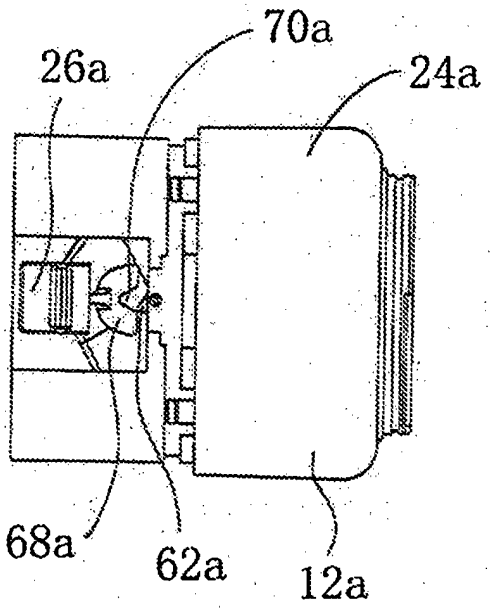


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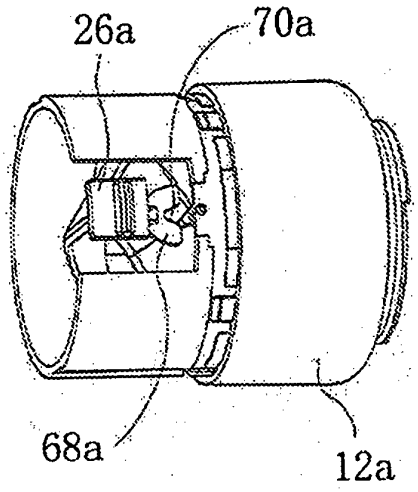


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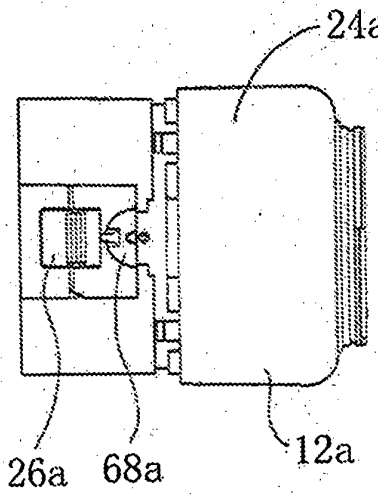


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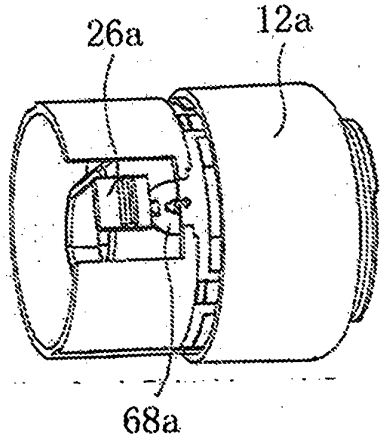


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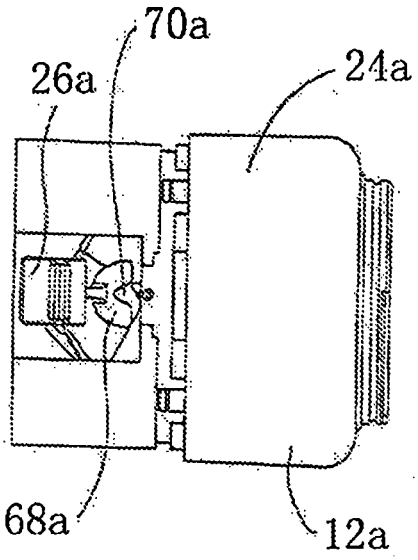


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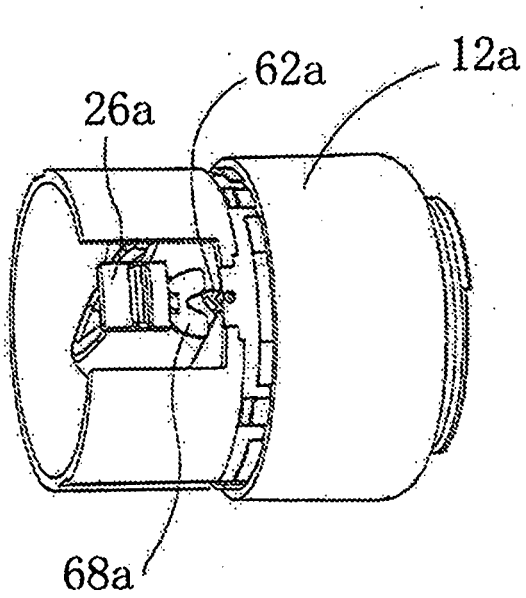


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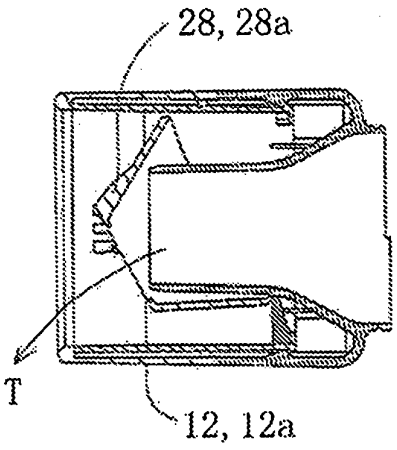


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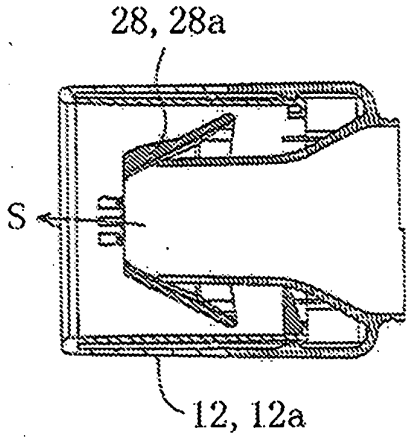


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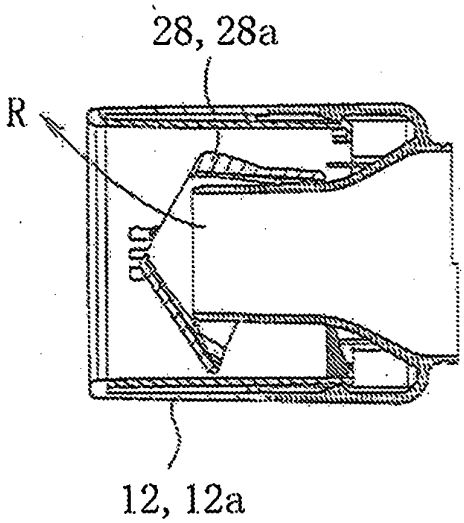


Fig. 29

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Patent documents cited in the description

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