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(54) **Built-in pump for an airbed with a single valve**

Eingebaute Pumpe für eine Luftmatratze mit einem Einzelventil

Pompe intégrée pour matelas pneumatique avec une seule vanne

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**WO-A-02/082955 DE-U1-202006 000 537
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EP 1 961 335 B1

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Description

BACKGROUND OF THE INVENTION

[0001] An airbed is a large rectangular rubber or plastic (e.g., vinyl or PVC) bag that is filled with air so that it may be used as a bed. Airbeds are well known in the art and have proven themselves to be very useful. On the one hand, an inflatable airbed may be deflated and folded to store the airbed in a closet or basement. On the other hand, when guests arrive or when the owner of the airbed takes a trip to a place where there is no bed, the airbed may be inflated and may be used as a bed.

[0002] One thing airbeds have in common is that they must be inflated for use. To this end, a valve or valves are supplied on an airbed for a user to provide air or another gas into the airbed. As examples, a user may utilize a manual or electric pump or an air compressor to inflate an airbed.

[0003] More recently, some manufacturers have begun incorporating pumps into airbeds as a built in unit on the side of the airbed. Examples can be seen in U.S. Patent Nos. 4,224,706, 5,588,811, and 6,543,073. Incorporating a pump into the airbed or an airbed frame provides a convenient location for storage of the pump, and may provide better fitting of the pump to the airbed valves. WO 02/082955 discloses a pump for an inflatable device. The pump includes an outer housing and an inner housing positioned within the outer housing and defining a fluid conduit between the inner housing and the outer housing. The pump also includes a motor positioned within the inner housing, a vane occupying a majority of the fluid conduit, and an impeller positioned within the fluid conduit and connected to the motor. The motor of the pump disclosed in WO 02/082955 is not a single direction motor.

SUMMARY OF THE INVENTION

[0004] The following presents a simplified summary of some embodiments of the invention in order to provide a basic understanding of the invention. This summary is not an extensive overview of the invention. It is not intended to identify key/critical elements of the invention or to delineate the scope of the invention. Its sole purpose is to present some embodiments of the invention in a simplified form as a prelude to the more detailed description of some embodiments that are presented later.

[0005] The present invention provides for an airbed according to claim 1 including a built-in pump. A receptacle or housing is mounted to the side of the airbed, and the pump is mounted in the receptacle.

[0006] In an embodiment, a single control turns on and off operation of a fan motor and selects whether a fan connected to the fan motor is blowing air into the airbed or is sucking air out of the airbed. The built-in pump is arranged such that a single direction (i.e., non-reversible) fan motor may be used for both purposes. In an embod-

iment, rotation of the control to a first position causes the fan motor to be turned on. The same movement causes rotation of a fan housing, aligning an opening in the fan housing with a valve. The same rotation of the control also causes the valve to open. In this position, air flowing from the fan is directed into the airbed, and the airbed may be inflated. In an embodiment, a cam on the fan housing operates to open the valve when the fan housing is turned to this inflate position. Rotating the control back to the starting position releases and closes the valve, and causes the opening to no longer be aligned with the valve. The motor is also shut off.

[0007] Rotating the control to a different, second position, such as in an opposite direction, causes the motor to be turned on and a second opening to align with the valve. A second cam opens the valve. In this second position, the fan housing is aligned such that the fan draws air through the valve from the airbed.

[0008] In an embodiment, the built in pump includes a single valve on the outside of the receptacle/housing for the pump (i.e., internal to the airbed). This valve is mounted on the side of the housing for the pump. This feature permits the airbed to be folded against the back of the housing, allowing more efficient folding and storage.

[0009] Other features of the invention will become apparent from the following detailed description when taken in conjunction with the drawings, in which:

BRIEF DESCRIPTION OF THE DRAWINGS

[0010] FIGURE 1 is a left side perspective view of a built-in pump in accordance with an embodiment;

[0011] FIG. 2 is a right side perspective view of the built-in pump of FIG. 1, with parts removed for detail;

[0012] FIG. 3 is a bottom side perspective view of a control knob and a micro switch for the built-in pump of FIG. 1;

[0013] FIG. 4 is a front perspective view of a fan housing and motor for the built-in pump of FIG. 1;

[0014] FIG. 5 is a top exploded perspective view for the fan housing of FIG. 4;

[0015] FIG. 6 is a bottom exploded perspective view of the fan housing of FIG. 4;

[0016] FIG. 7 is a bottom exploded perspective view of a fan for the built-in pump of FIG. 1; and

[0017] FIG. 8 is an exploded side perspective view of a valve and valve housing for the built-in pump of FIG. 1.

DETAILED DESCRIPTION

[0018] In the following description, various embodiments of the present invention will be described. For purposes of explanation, specific configurations and details are set forth in order to provide a thorough understanding of the embodiments. However, it will also be apparent to one skilled in the art that the present invention may be practiced without the specific details. Furthermore, well-known features may be omitted or simplified in order not

to obscure the embodiment being described.

[0019] Referring now to the drawings, in which like reference numerals represent like parts throughout the several views, FIG. 1 shows a built-in pump 20 in accordance with an embodiment. The built-in pump 20 includes a housing 22 that may be built into the side of an airbed A (a portion of which is shown in phantom in FIG. 1). In a manner known in the art, the housing 22 for the built-in pump 20 includes a flange 21 that extends adjacent to or just outside of a sidewall for the airbed A. This flange is typically welded into an opening in the airbed. The housing 22 is otherwise located inside the airbed A.

[0020] The built-in pump 20 shown in the drawings is a dry cell battery operated pump, but features of the invention may be used with a rechargeable battery operated pump or a pump powered in another manner, such as by AC power. The built-in pump 20 includes an optional speaker 24 and air inlet holes 25 on an outer face of the housing 22. A control knob 26 is mounted so that it may be accessed on the outside of the housing 22.

[0021] As can be seen in FIG. 2, the control knob 26 is attached to a shaft 27. A small gear 28 is positioned at a lower portion of the shaft 27. The small gear 28 is positioned so that teeth on the small gear may engage teeth on a larger gear 30. The larger gear 30 is mounted over a motor 32 for the built-in pump 20. The motor 32 is centrally mounted on a fan housing 34. A valve housing 36 is mounted adjacent to the fan housing 34. The valve housing 36 extends out of the side of the housing 22 for the built-in pump 20, as shown in FIG. 1.

[0022] As can be seen in FIG. 3, a micro switch 38 is mounted adjacent to the shaft 27 that extends downward from the control knob 26. The micro switch 38 includes a switch plunger 39. The shaft 27 includes two protrusions 40, 41 located on the shaft so that they may engage the switch plunger 39 upon rotation of the control knob 26. Thus, by rotating the control knob 26 in one direction, the first protrusion 40 engages the switch plunger 39. Rotating the control knob 26 in an opposite direction causes the second protrusion 41 to engage the switch plunger 39 for the micro switch 38. If one of the protrusions 40, 41 is not engaged with the switch plunger 39, then the switch plunger 39 is in an outer, "off" position. In an embodiment, the micro switch 38 is utilized to turn on and off operation of the motor 32. Thus, by rotating the control knob 26 to the two positions where either of the protrusions 40, 41 engages the switch plunger 39, the motor 32 is turned on. The use of the micro switch 38 and the protrusions 40, 41 shown in FIG. 3 is one way to control operation of the motor, and other mechanisms or arrangements may be used to control operation of the motor.

[0023] The motor 32 is a single direction motor. Such a motor is less expensive than a reversible motor. Features of the built-in pump 20 permit utilization of a single direction motor to inflate and deflate an airbed utilizing a single valve, as will be described in more detail below.

[0024] Details of the fan housing 34 can be seen in

FIGS. 4-6. The fan housing 34 includes a top plate 42 having a motor mount 43 positioned at its center. The motor 32 is mounted in the motor mount 43.

[0025] As best shown in FIG. 5, a middle plate 44 is positioned below the top plate 42, and a bottom plate 46 is positioned below the middle plate 44. The fan housing 34 and the motor 32 are positioned to rotate within the housing 22 about a central axis 48. In an embodiment, the fan housing 34 and the motor 32 are positioned so that weight for the two items is evenly distributed about the axis 48. The function of this feature is described below.

[0026] A fan 52 (FIG. 7) is positioned between the top plate 42 and the middle plate 44. In an embodiment, the fan 52 is similar to the fan disclosed in U.S. Publication No. 2000/0073040, published April 6, 2006, although different fans may be used.

[0027] Although a reader may refer to the above publication for features of a fan for use in the built-in pump 20, some details are given here for the benefit of the reader. As can be seen in FIG. 7, where the fan 52 is turned upside down to show detail, the fan includes an upper wall 56 and a lower cover 58. The lower cover 58 serves as a bottom wall for the fan 52. This lower cover 58 extends adjacent to the lower portion of the middle plate 44 of the fan housing 34. Blades 60 extend between the upper wall 56 and the lower cover 58 from a position spaced from a central axis of the fan 52 outward to outer edges or tips of the fan 52. An air inlet 62 is positioned centrally in the cover 58 and is in fluid communication with the blades 60. In operation, the motor 32 rotates the fan 52 and air is drawn into the air inlet 62 of the fan and is blown through the blades 60 and out of the tips of the fan 52. The upper wall 56 and the lower cover 58 direct the majority of the air outward in an efficient manner.

[0028] A valve 68 (shown best in FIG. 8) is mounted in the valve housing 36 and includes a valve plunger 70. The valve plunger 70 is arranged so that it engages a cam surface 72 (e.g., FIG. 2) that is positioned along the top plate 42 of the fan housing 34. The cam surface 72 can be seen in more detail in FIG. 4. The cam surface 72 includes an inflate portion 74, a central closed portion 76, and an outer deflate portion 78. The inflate and deflate portions 74, 78 extend adjacent to and along an outer perimeter of the top plate 42. The closed portion 76 includes a concave portion that extends inward from the outer perimeter of the top plate 42.

[0029] As shown in FIG. 4, positioned just below the cam surface 72 are an inflate opening 80 and a deflate opening 82. As can best be seen in FIG. 6, the inflate opening 80 opens directly into a fan chamber 84 formed between the top plate 42 and the middle plate 44. The fan 52 is mounted in this fan chamber 84.

[0030] A wall 86 (see FIG. 6) is positioned on the top plate 42 just behind the deflate opening 82. An opening 88 (best seen in FIG. 5) is positioned just ahead of the wall 86 and extends through the middle plate 44. In this manner, the deflate opening 82 is in fluid communication

with an area underneath the middle plate 44. This area is closed by the bottom plate 46 to form a lower chamber 90. A central opening 92 in the middle plate 44 fluidly connects the lower chamber 90 with the air inlet 62 of the fan 52. The fan 52 is seated against the central opening 92 to ensure air flow from the lower chamber into the fan.

[0031] Details of the valve 68 and the valve housing 34 are shown in FIG. 8. The valve housing includes a rear plate 100 having openings 101 therein. A front plate 102 is positioned between the rear plate 100 and the fan housing 34. The valve 68 is positioned between the rear plate 100 and the front plate 102. The plunger 70 for the valve 68 extends through an opening 103 in the front plate 102. A spring 104 is positioned between the rear plate 100 and the valve 68, and biases the valve 68 toward the front plate 102. In the embodiment shown in the drawings, in a normally closed position forced by the spring 104, the valve 68 seats against the front plate 102 to close the valve housing 34.

[0032] A director plate 106 is mounted on the front of the valve housing 34. The director plate 106 closes the front end of the valve housing, with the exception of an opening 108 positioned at a lower portion of the director plate. The opening 108 includes a front concave edge 110 that matches the outer circumference of the fan housing 34. This front concave edge 110 is positioned tightly against the outer circumference of the fan housing, as shown in FIG. 2.

[0033] To operate the built-in pump 20, a user rotates the control knob 26 to change the operation from an inflate mode to a deflate mode or to an off position. In the embodiment shown in the drawings, a central position is the off position, and a deflate position is obtained by rotating the control knob 26 in a counterclockwise direction, and an inflate position is obtained by rotating the control knob in a clockwise direction.

[0034] When the user rotates the control knob 26 to the inflate position, the protrusion 41 engages the switch plunger 39 on the micro switch 38, and turns on the operation of the motor 32. The same movement causes the small gear 28 to rotate the larger gear 30, with mechanical advantage. This rotation causes the motor 32 and the fan housing 34 to rotate, aligning the inflate opening 80 with the opening 108 on the director plate 106. Rotation is aided by the mechanical advantage of the small gear 28 over the large gear 30, and the central mounting of the motor 32 and the fan housing 34 relative to the axis 48. By balancing the weight of the motor 32 and the fan housing 34 about the axis 48, the amount of force needed to rotate the assembly is minimized.

[0035] The same movement of the fan housing 34 causes the plunger 70 for the valve 68 to move along the cam surface 72 to the inflate portion 74 of the cam surface. At this position, the valve plunger 70 is driven backward against the resistance of spring 104, unseating the valve 68 from the front plate 102 of the valve housing 36. Air may thus flow from the fan 52 out the inflate opening

80 through the opening 108 in the director plate 106, around the valve 68 and through the valve housing 36 and into the airbed. When the airbed is inflated to an appropriate pressure, the user may turn the control knob 26 back to the central, off position.

[0036] To deflate an airbed using the built-in pump 20, the user rotates the control knob 26 to the deflate position. In this position, the protrusion 40 engages the switch plunger 39 for the micro switch 38, turning on the motor 32. In the same operation, the small gear 28 rotates the larger gear 30, causing the motor 32 and the fan housing 34 to rotate. The plunger 70 moves along the cam surface 72 to the deflate portion 78. In this position, the cam surface 72 pushes the plunger 70 rearward, opening the valve 68.

[0037] When the fan housing 34 rotates, the opening 108 on the director plate 106 aligns with the deflate opening 82 on the fan housing 34. This arrangement puts the valve housing 36 in fluid communication with the air inlet 62 of the fan 52 via the lower chamber 90 of the fan housing 34. Rotation of the fan 52 by the motor 32 causes air to flow from the airbed, through the valve housing 36, into the fan 52, and out of the built-in pump 20. In this manner, the airbed is deflated.

[0038] The built in pump 20 provides many advantages over prior art pumps. A single valve 68 is used to inflate and deflate the pump 20. The valve 68 is opened and closed by a manual, mechanical function (i.e., rotation of the control knob 26), so a solenoid is not needed to open the valve. A single knob 26 controls operation of the motor and the valve, and aligns the valve with the appropriate inlet or outlet of the fan 52. By rearranging the fan housing 34, a single direction fan 52 and motor 32 may be used, saving expense.

[0039] In addition, the single valve 68 and valve housing 36 are mounted on one side of the housing 22, whereas most prior art built-in pumps include one or more valves on the back of the pump housing. Mounting the valve 68 on the side of the housing permits the airbed to be stored adjacent to the rear of the housing, allowing more efficient folding and storing of the airbed.

[0040] Other variations are within the spirit of the present invention. Thus, while the invention is susceptible to various modifications and alternative constructions, a certain illustrated embodiment thereof is shown in the drawings and has been described above in detail. It should be understood, however, that there is no intention to limit the invention to the specific form or forms disclosed, but on the contrary, the intention is to cover all modifications, alternative constructions, and equivalents falling within the scope of the invention, as defined in the appended claims.

Claims

1. An airbed (A), comprising:

a receptacle mounted in the airbed;
a built-in pump (20) mounted in the receptacle,
the built-in pump comprising:

- one and only one single direction motor (32);
a fan (52) connected to the motor;
one and only one valve (68) for opening a passage from the receptacle into the airbed; and
a fan routing system that, in a inlet configuration, directs air blown by the fan (52) into the airbed (A) through the valve (68), and in an outlet configuration directs air blown by the fan (52) out of the airbed (A) through the valve (68). 5
2. The airbed (A) of claim 1, further comprising a control (26), the movement of which is mechanically linked to movement of the fan routing system between the inlet configuration and the outlet configuration. 10
3. The airbed (A) of claim 2, wherein operation of the control (26) turns on and off the motor (32). 15
4. The airbed (A) of claim 3, wherein movement of the control (26) is mechanically linked to opening of the valve (68). 20
5. The airbed (A) of claim 2, wherein movement of the control (26) is mechanically linked to opening of the valve (68). 25
6. The airbed (A) of claim 2, wherein the fan routing system comprises a fan housing (34) in which the fan (52) is mounted. 30
7. The airbed (A) of claim 6, wherein the fan housing (34) comprises a motor mounting (43) on which the motor (32) is mounted. 35
8. The airbed (A) of claim 7, wherein the motor (32) and the fan housing (34) are mounted for rotation about an axis (48), and wherein rotation about the axis (48) causes the fan routing system to move between the inlet configuration and the outlet configuration. 40
9. The airbed (A) of claim 8, wherein the fan housing (34) comprises a cam (72) for engaging and moving the valve (68) to an open position upon rotation of the fan housing (34). 45
10. The airbed (A) of claim 8, wherein the fan housing (34) and motor (32) are substantially weight balanced about the axis (48). 50

Patentansprüche

1. Luftbett (A), umfassend:

ein Behältnis, das in dem Luftbett angebracht ist; eine eingebaute Pumpe (20), die in dem Behältnis angebracht ist, wobei die eingebaute Pumpe umfasst:

- einen und nur einen Einzelrichtungsmotor (32);
ein Gebläse (52), das mit dem Motor verbunden ist;
ein und nur ein Ventil (68) für das Öffnen eines Durchgangs von dem Behältnis in das Luftbett; und
ein Gebläseführungssystem, das in einer Einlasskonfiguration Luft, die von dem Gebläse (52) geblasen wird, durch das Ventil (68) in das Luftbett (A) hineinführt und in einer Auslasskonfiguration Luft, die von dem Gebläse (52) geblasen wird, durch das Ventil (68) aus dem Luftbett (A) herausführt.
2. Luftbett (A) nach Anspruch 1, wobei das Luftbett ferner eine Steuerung (26) umfasst, deren Bewegung mechanisch mit der Bewegung des Gebläseführungssystems zwischen der Einlasskonfiguration und der Auslasskonfiguration verknüpft ist.
3. Luftbett (A) nach Anspruch 2, wobei die Betätigung der Steuerung (26) den Motor (32) einschaltet und ausschaltet.
4. Luftbett (A) nach Anspruch 3, wobei die Bewegung der Steuerung (26) mechanisch mit dem Öffnen des Ventils (68) verknüpft ist.
5. Luftbett (A) nach Anspruch 2, wobei die Bewegung der Steuerung (26) mechanisch mit dem Öffnen des Ventils (68) verknüpft ist.
6. Luftbett (A) nach Anspruch 2, wobei das Gebläseführungssystem ein Gebläsegehäuse (34) umfasst, in dem das Gebläse (52) angeordnet ist.
7. Luftbett (A) nach Anspruch 6, wobei das Gebläsegehäuse (34) eine Motoranbringung (43) umfasst, auf der der Motor (32) angebracht ist.
8. Luftbett (A) nach Anspruch 7, wobei der Motor (32) und das Gebläsegehäuse (34) für eine Rotation um eine Achse (48) angebracht sind und wobei die Rotation um die Achse (48) bewirkt, dass sich das Gebläseführungssystem zwischen der Einlasskonfiguration und der Auslasskonfiguration bewegt.
9. Luftbett (A) nach Anspruch 8, wobei das Gebläse-

gehäuse (34) eine Nockenscheibe (72) für die Ineingriffnahme und das Bewegen des Ventils (68) in eine offene Position bei einer Rotation des Gebläsegehäuses (34) umfasst.

10. Luftbett (A) nach Anspruch 8, wobei das Gebläsegehäuse (34) und der Motor (32) hinsichtlich der Achse (48) im Wesentlichen gewichtsbalanciert sind.

Revendications

1. Matelas pneumatique (A), comprenant :

un réceptacle monté dans le matelas pneumatique ;
une pompe intégrée (20) montée dans le réceptacle, la pompe intégrée comprenant :

un seul et même moteur de direction (32) ;
un ventilateur (52) raccordé au moteur ;
une seule et même valve (68) pour ouvrir un passage du réceptacle dans le matelas pneumatique ; et
un système d'acheminement de ventilateur qui, dans une configuration d'entrée, dirige l'air soufflé par le ventilateur (52) dans le matelas pneumatique (A) par le biais de la valve (68), et dans une configuration de sortie, dirige l'air soufflé par le ventilateur (52) à l'extérieur du matelas pneumatique (A) par le biais de la valve (68).

2. Matelas pneumatique (A) selon la revendication 1, comprenant en outre une commande (26), dont le mouvement est mécaniquement lié au mouvement du système d'acheminement de ventilateur entre la configuration d'entrée et la configuration de sortie.
3. Matelas pneumatique (A) selon la revendication 2, dans lequel le fonctionnement de la commande (26) met en marche et arrête le moteur (32).
4. Matelas pneumatique (A) selon la revendication 3, dans lequel le mouvement de la commande (26) est mécaniquement lié à l'ouverture de la valve (68).
5. Matelas pneumatique (A) selon la revendication 2, dans lequel le mouvement de la commande (26) est mécaniquement lié à l'ouverture de la valve (68).
6. Matelas pneumatique (A) selon la revendication 2, dans lequel le système d'acheminement de ventilateur comprend un boîtier de ventilateur (34) dans lequel le ventilateur (52) est monté.
7. Matelas pneumatique (A) selon la revendication 6,

dans lequel le boîtier de ventilateur (34) comprend une structure de montage de moteur (43) sur laquelle le moteur (32) est monté.

8. Matelas pneumatique (A) selon la revendication 7, dans lequel le moteur (32) et le boîtier de ventilateur (34) sont montés pour une rotation autour d'un axe (48), et dans lequel la rotation autour de l'axe (48) amène le système d'acheminement de ventilateur à se déplacer entre la configuration d'entrée et la configuration de sortie.

9. Matelas pneumatique (A) selon la revendication 8, dans lequel le boîtier de ventilateur (34) comprend une came (72) pour mettre en prise et déplacer la valve (68) dans une position ouverte suite à la rotation du boîtier de ventilateur (34).

10. Matelas pneumatique (A) selon la revendication 8, dans lequel le boîtier de ventilateur (34) et le moteur (32) sont sensiblement équilibrés autour de l'axe (48).

FIG. 1

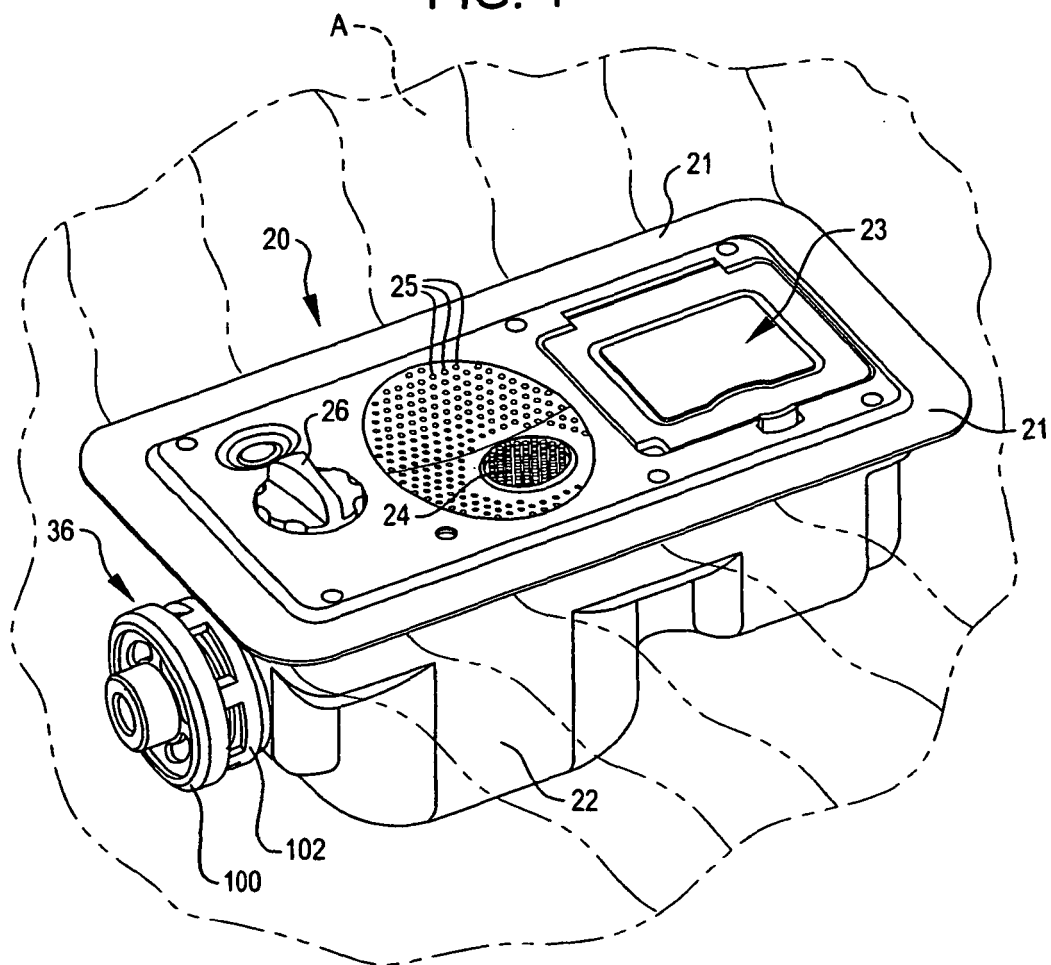


FIG. 2

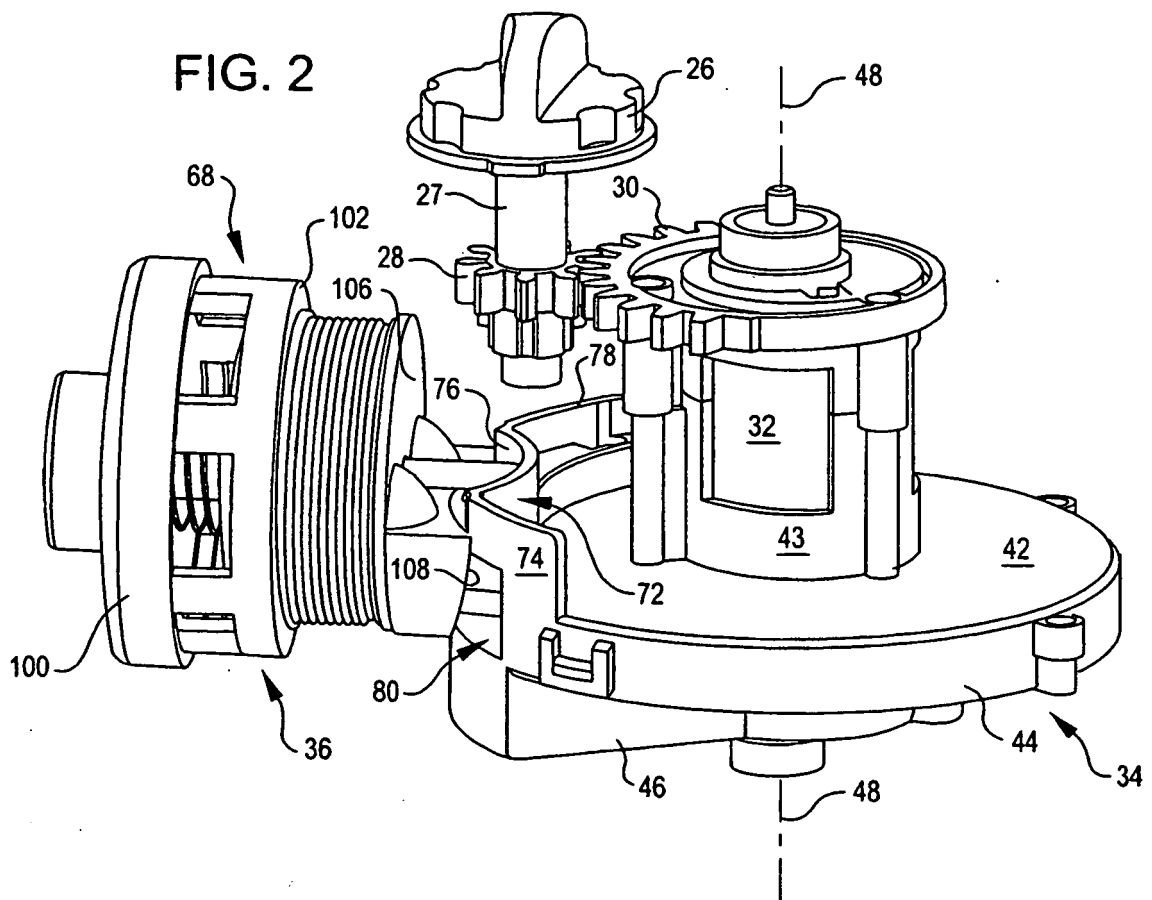


FIG. 3

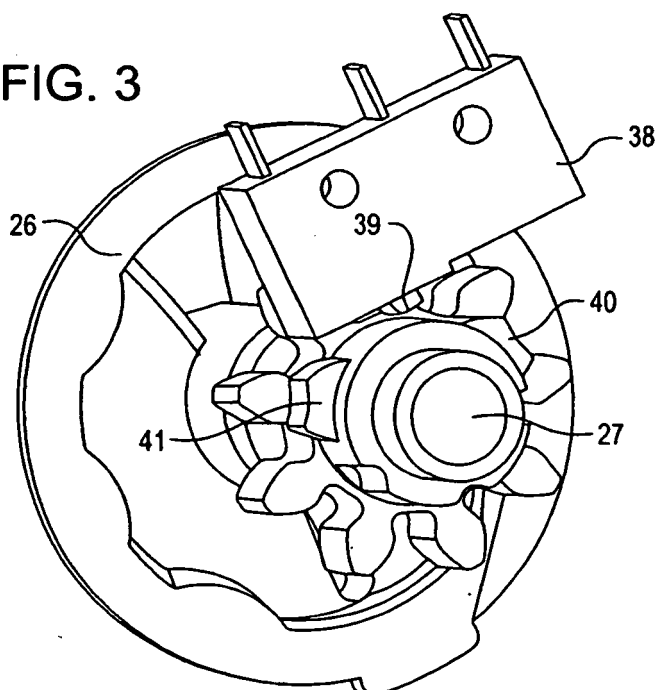


FIG. 4

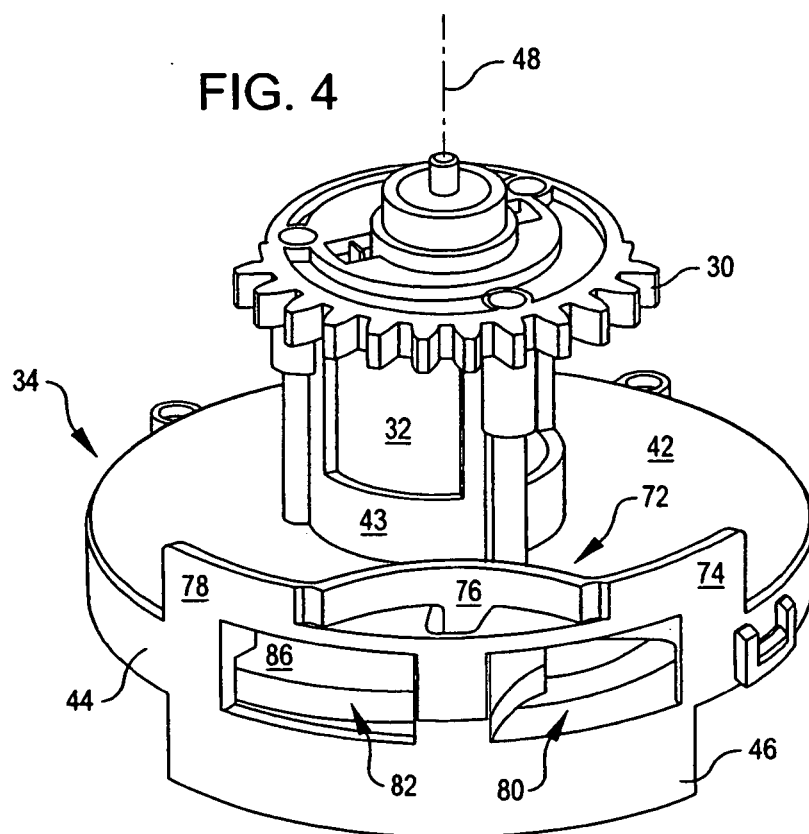


FIG. 5

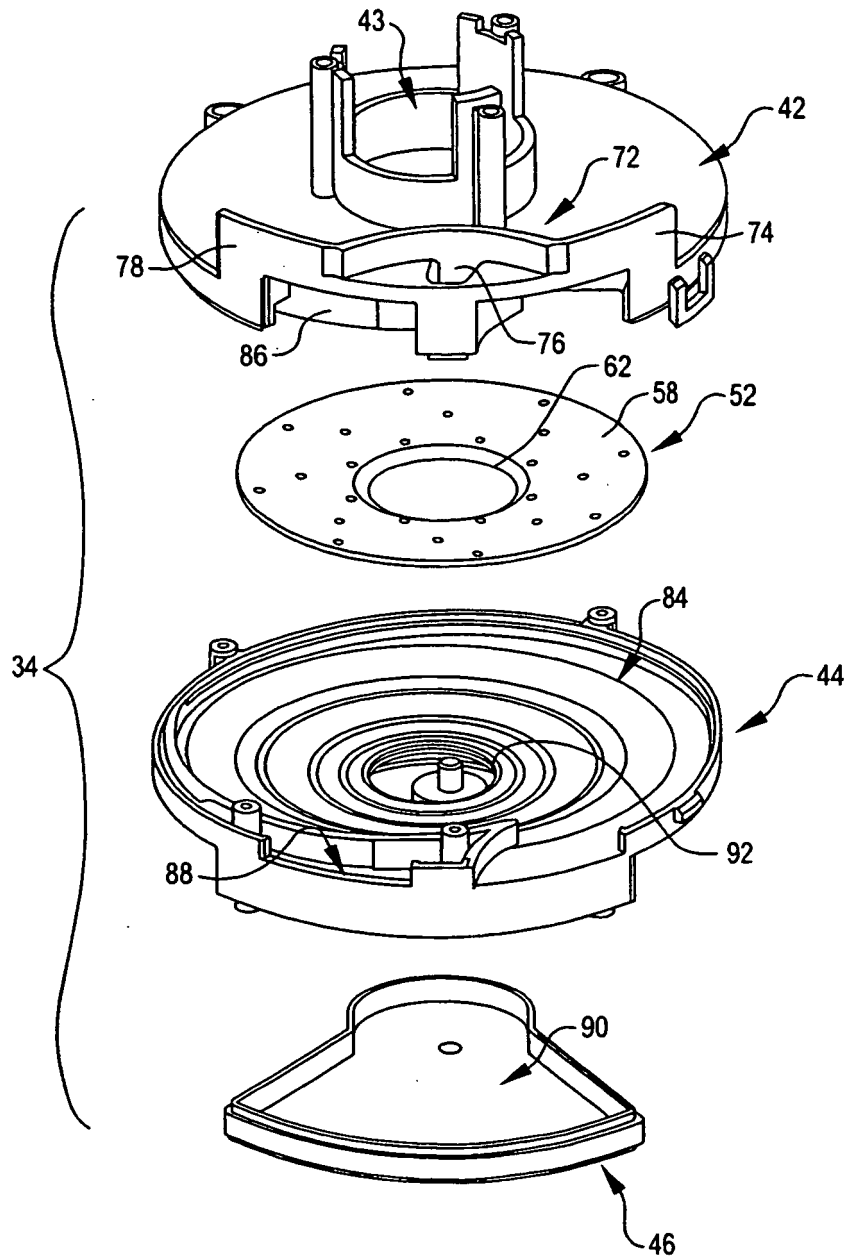


FIG. 6

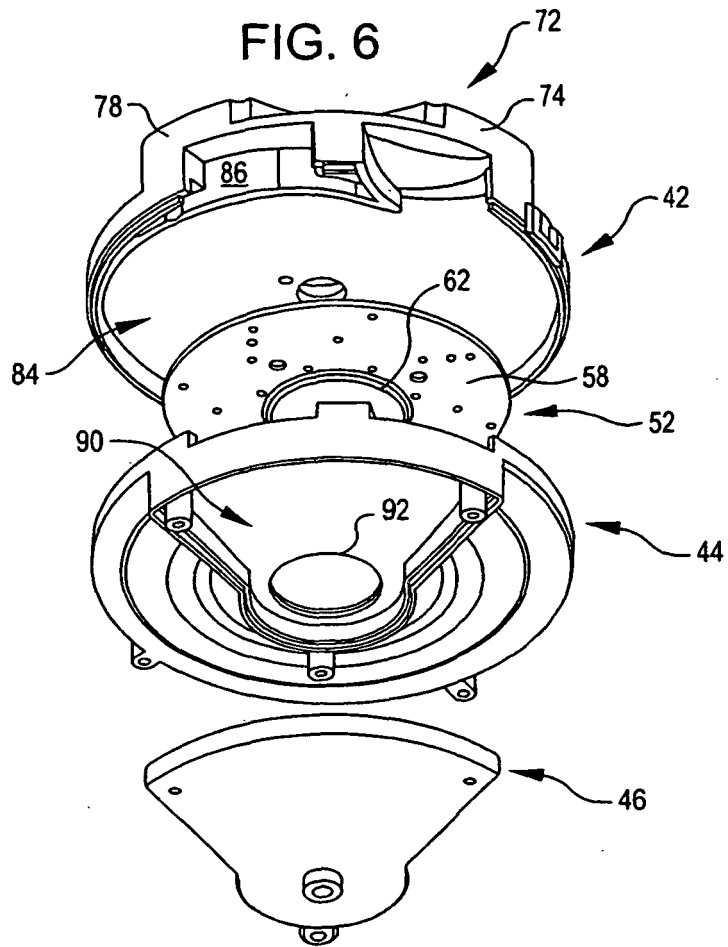


FIG. 7

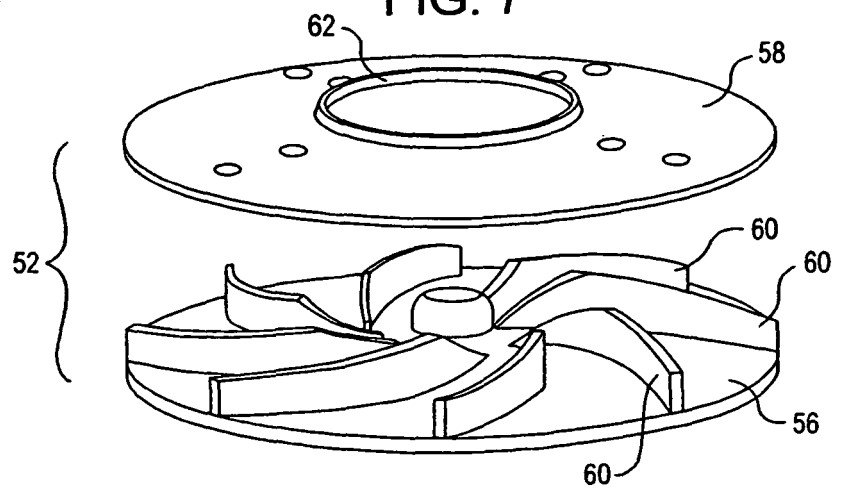
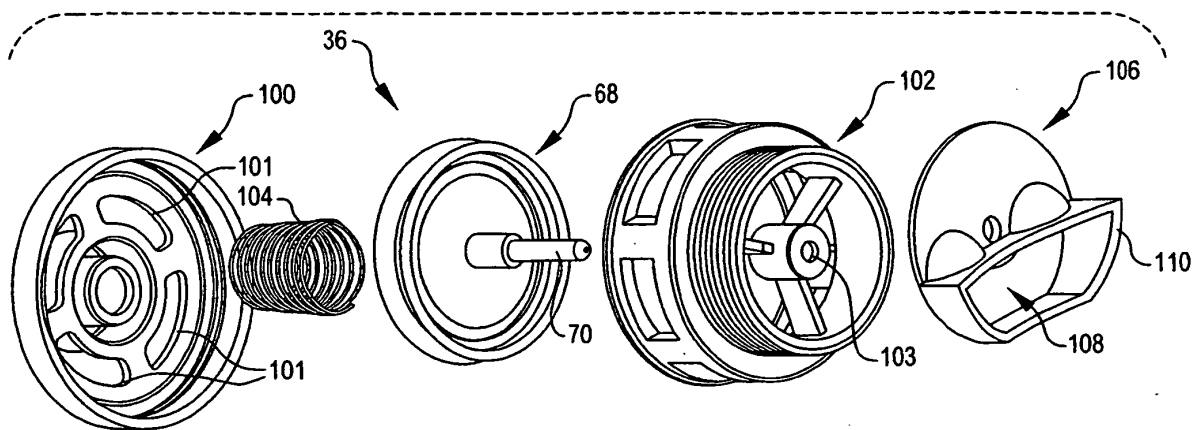


FIG. 8



REFERENCES CITED IN THE DESCRIPTION

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