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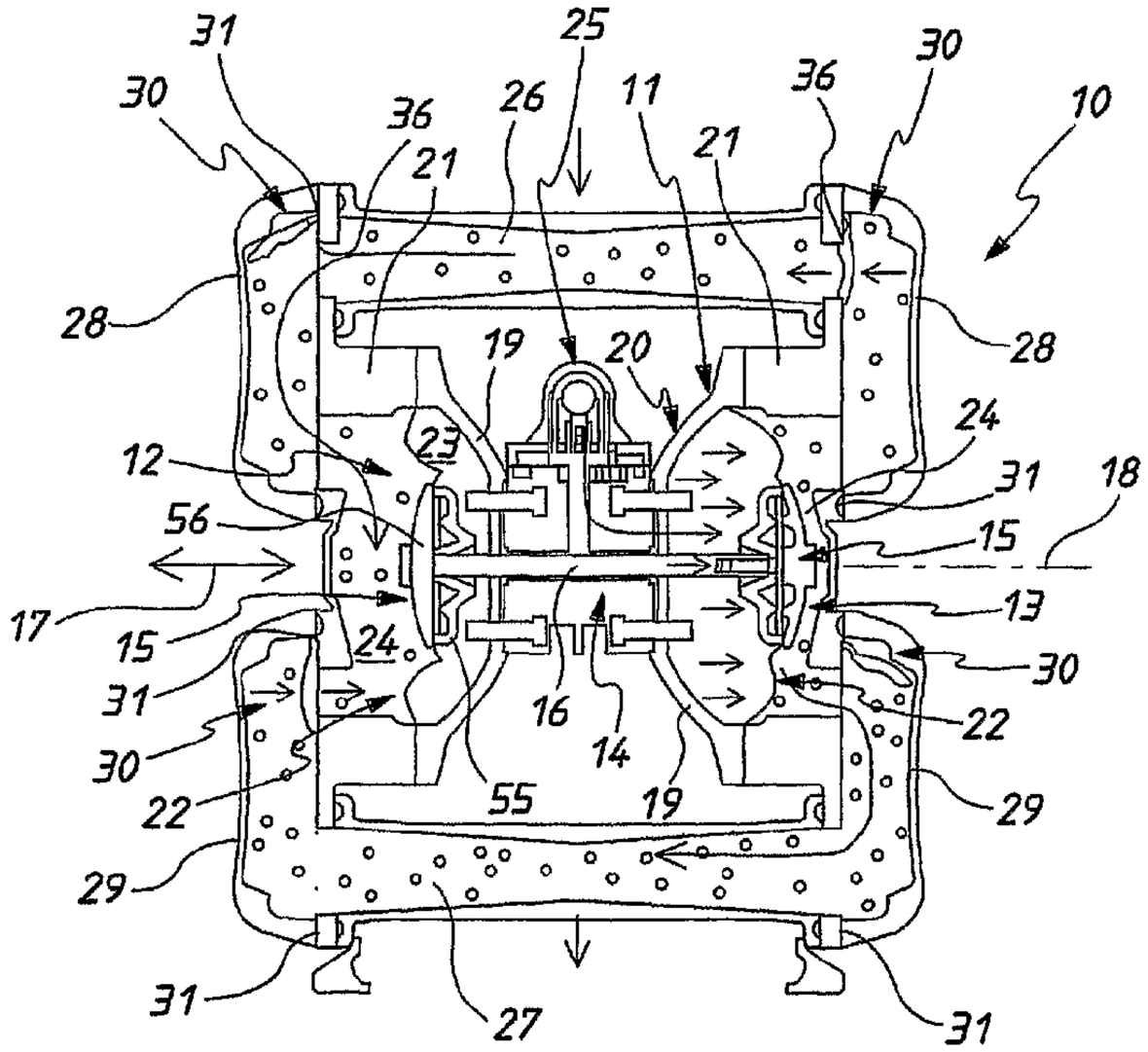
(54) **Titre : SOUPAPE ET DIAPHRAGME POUR UNE POMPE**
(54) **Title: A VALVE AND DIAPHRAGM FOR A PUMP**



(57) **Abrégé/Abstract:**
A diaphragm pump (10) having a pump body (11) providing opposing pump chambers (12, 13). Mounted in the body is a piston assembly (14) having pistons (15) joined by a piston rod (16). Each piston (15) is sealingly connected to the body (11) by means of a diaphragm (22) so that each of the chambers (12, 13) is divided into a first a a second sub-chamber, with the flow of fluid being pumped is governed by a pair of valves (30). Each valve (30) includes a base (31) to which there is movably attached a movable valve member (35).

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(54) **Title**: A VALVE AND DIAPHRAGM FOR A PUMP

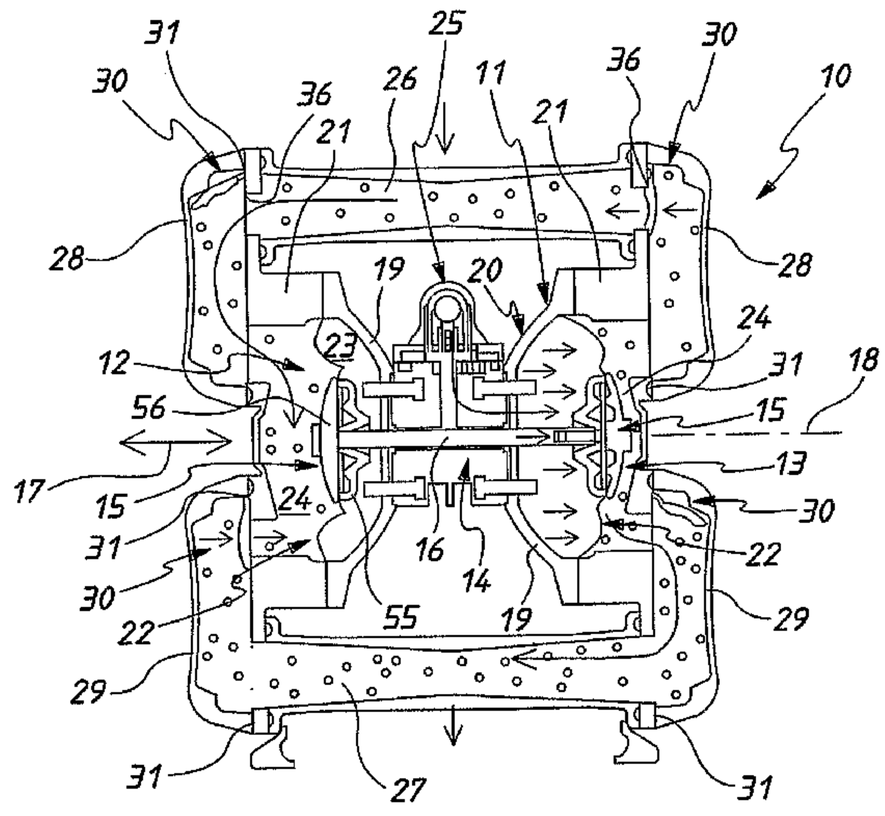

FIG. 1

(57) **Abstract**: A diaphragm pump (10) having a pump body (11) providing opposing pump chambers (12, 13). Mounted in the body is a piston assembly (14) having pistons (15) joined by a piston rod (16). Each piston (15) is sealingly connected to the body (11) by means of a diaphragm (22) so that each of the chambers (12, 13) is divided into a first a a second sub-chamber, with the flow of fluid being pumped is governed by a pair of valves (30). Each valve (30) includes a base (31) to which there is movably attached a movable valve member (35).

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A VALVE AND DIAPHRAGM FOR A PUMP

Technical Field

The present invention relates to valves and diaphragms for diaphragm pumps that are operated by a working fluid under pressure.

Background of the Invention

Diaphragm pumps include a pump chamber that is divided by a piston or diaphragm so as to provide a first sub-chamber that receives a working fluid (liquid or gas) under pressure, and a second sub-chamber that receives the fluid being pumped. A working fluid under pressure is delivered to the first sub-chamber to cause reciprocation of the piston and diaphragm to vary the volume of the second sub-chamber and thereby pump a fluid therethrough. These diaphragm pumps have an inlet and an outlet that communicate with the second sub-chamber via one-way valves so that the fluid being pumped passes in a predetermined direction through the pump. A first manifold joins the inlet with the second sub-chamber while a second manifold joins the second sub-chamber is with the outlet.

The above manifolds are sealingly connected to the pump body by a means of seal.

The above mentioned one-way valves are mounted on the body.

A disadvantage of the above described pump is that it is typical to sealingly connect the manifolds to the pump body while the one-way valves are separately mounted to engage the associated valve seat.

The above-mentioned diaphragm when performing at pumping action is caused to undergo substantial elastic deformation. A disadvantage of these known diaphragms is that they are prone to failure.

Object of the Invention

It is the object of the present invention to overcome or substantially ameliorate at least one of the above disadvantages.

Summary of the Invention

There is disclosed herein a pump including:

a pump body providing a pump chamber through which a fluid being pumped passes;

a manifold through which the fluid flows;

a seal, including a valve, integrally formed of plastics material and including:

an elongated seal having a base fixed between the body and manifold sealingly connecting the manifold and body, the base being of a loop configuration so as to have a pair of transversely spaced elongated side portions joined by longitudinally spaced end portions;

a movable valve member located adjacent one of said end portions and configured to sealingly cooperate with a valve seat to close a valve opening provided by the seat; and

a flexible bridge pivotally coupling the movable valve member with said one end portion providing for movement of the valve member by resilient deformation of the bridge.

Preferably, said bridge includes a first bridge portion and a second bridge portion, the bridge portions being transversely spaced.

Preferably, said side portions are substantially co-extensive and said end portions are substantially co-extensive.

Preferably, said end portions are arcuate in configuration.

Preferably, said base in transverse cross-section is arcuate so as to provide a concave surface and a convex surface.

Preferably, said base in transverse cross-section is of a "C" configuration.

Preferably, said bridge provides a pivot axis extending generally transverse relative to said base.

Preferably, the pump further includes a pump piston that is reciprocated relative to the body along a longitudinal axis;

a piston diaphragm fixed to the body and piston so as to extend between said piston and said body, said diaphragm including:

a base fixed to the piston;

a radially outer peripheral portion fixed to the body;

a flexible diaphragm portion extending between the base and said peripheral portion, said diaphragm portion having a first set of segments and a second set of segments alternately spaced with respect to the first set segments, the segments each extending angularly about and radially relative to said axis, and wherein

the first segments are spaced longitudinally relative to said axis from the second segments.

Preferably, said diaphragm is integrally formed from flexible plastics material.

Preferably, said first segments are attached to said second segments by hinge portions, the hinge portions having a thickness less than thicknesses of the first and second portions to provide for relative movement between the first and second segments by resilient deformation of the hinge portions.

Preferably, said first segments have a thickness greater than the second segments so that the second segments during operations of the diaphragm move relative to the first segments by resilient deformation at and adjacent hinge lines separating the first and second segments.

Preferably, said seal is a first seal, and said manifold is a first manifold, and said pump further includes:

an inlet through which the fluid is delivered to said chamber via the first manifold;

an outlet via which fluid from the chamber passes; and

a second manifold via which fluid flows to the outlet from the chamber;

a second elongated seal, said second seal including:

a base fixed between the body and second manifold sealingly connecting the second manifold and body, the base of the second seal being of a loop configuration so as to have a pair of transversely spaced elongated side portions joined by longitudinally spaced end portions;

a movable valve member located adjacent one of said end portions of the second seal and configured to sealingly cooperate with a further valve seat to close a further valve opening provided by the further seat; and

a flexible bridge pivotally coupling the movable valve member of the second seal with said one end portion of said second seal providing for movement of the valve member of said second seal by resilient deformation of the bridge of said second seal.

Brief Description of the Drawings

A preferred form of the present invention will now be described, by way of an example only, with reference to the accompanying drawings wherein:

Figure 1 is a schematic sectioned side elevation of a diaphragm pump;

Figure 2 is a schematic further sectioned side elevation of the pump of Figure 1;

Figure 3 is a schematic plan view of a valve employed in a pump of Figure 1;

Figure 4 is a schematic sectioned side elevation of the valve of Figure 3;

Figure 5 is a schematic sectioned end elevation of the valve of Figure 3;

Figure 6 is a schematic plan view of a diaphragm employed in a pump of Figure 1;

Figure 7 is a schematic sectioned side elevation of the diaphragm of Figure 6;

Figure 8 is a schematic enlarged sectioned elevation of portion of the diaphragm as shown in Figure 7; and

Figure 9 is a schematic enlarged sectioned elevation of portion of the diaphragm as shown in Figure.

Detailed Description of the Preferred Embodiments

In the accompanying drawings, there is schematically depicted a diaphragm pump 10. The pump 10 includes a pump body 11 that provides a pair of opposed pump chambers 12 and 13. Mounted in the body 11 is a piston assembly 14 providing a pair of pistons 15 joined by a transverse piston rod 16 so that the pistons 15 are caused to reciprocate in unison linearly in the direction 17 along the axis 18. The piston rod 16 and pistons 15 have as their longitudinal axis the longitudinal axis 18. The body 11 includes a base 20 providing a pair of cup portions 19. Secured to each cup portion 19 is a sleeve 21, with the cup portions 19 and associated sleeves 19 cooperating to provide the chambers 12 and 13.

The piston rod 16 is slidably mounted in the cup portions 19.

Fixed to each piston 15 is a diaphragm 22 that together with the associated piston 15 divides the respective chamber 12 or 13 into a first sub-chamber 23 and a second sub-chamber 24. A working fluid (liquid or gas) under pressure is alternately delivered to the sub-chambers 23 to cause reciprocation of the piston assembly 14. Accordingly the pump 10 could be hydraulically or pneumatically driven.

Schematically depicted is a control valve 25 and associated ducting that delivers the working fluid to the sub-chambers 23 and provides for drainage of the working fluid therefrom as the chambers 23 are varied in volume.

The pump 10 has an inlet 26 to which a fluid being pumped is delivered, and an outlet 27 to which the fluid being pumped is delivered under pressure by the pump 10. The inlet 26 communicates with both sub-chambers 24 while the outlet 27 also communicates with both sub-chambers 24. More particularly, the inlet 26 is joined to the sub-chamber 24 by a manifold 28. While each outlet 27 is joined to the sub-chamber 24 by a manifold 29.

To ensure that the fluid being pumped passes in a predetermined direction through the pump 10 there is provided one-way valves 30.

One of the one-way valves 30 is best seen in Figures 3 to 5. Each one-way valve 30 is integrally formed of resilient plastics material and provides for the control of fluid being pumped through the valve 10 while also sealingly connecting the associated manifold 28/29 with the body 11. Each valve 30 includes an elongated base 31 that has a longitudinal axis 32. The base 31 has a pair of longitudinally extending side portions 33 that are substantially co-extensive and are transversely spaced relative to the axis 32. Joining the side portions 33 are end portions 34 that are spaced longitudinally relative to the axis 32 and extend generally transverse of the axis 32. Each end portion 34 is generally arcuate in configuration.

The base 31 provides a seal between the associated manifold 28 and sleeve 21.

Each valve 30 further includes a movable valve member 35 that is caused to move relative to an associated valve seat 36 providing a valve opening 37. In particular, each member 35 is caused to move between an opened position providing for flow through the associated valve opening 37, and a closed position preventing flow through the valve opening 37 in the reverse direction.

Each valve member 35 is generally circular in configuration and has an annular convex surface 38 that engages the associated valve seat 36. Generally centrally of the valve member 35 and surrounded by the surface 38 is a depression 57. When the valve member 35 is in an open position, the depression 57 aids in providing a bigger aperture for fluid flow. Each member 35 is attached to an adjacent end portion 34 by a bridge 39. By resilient deformation of the bridge 39 the member 35 is able to move relative to the associated valve seat 36. Each bridge 39 includes a pair of transversely spaced elongated bridge portions 40 that extend generally parallel to the axis 32 and provide for angular movement of the valve member 25 about a transverse axis 41.

Preferably, the base 31 in transverse cross-section is arcuate, and more particularly is of a "C" configuration. Accordingly, the base 33 provides a convex surface 42 and a concave surface 43.

As best seen in Figure 3 the base 33 is a closed loop surrounding an aperture 44 within which the member 35 is located.

The diaphragm 22 is illustrated in Figures 6, 7, 8 and 9.

The diaphragm 22 includes a central base 45 that is of an annular configuration so as to provide a central aperture 46. The base 45 has a plurality of ribs 47 that aid in securing and sealing the diaphragm 22 to the associated piston 15. In particular, the base 45 extends radially from and angularly about the axis 18 and is generally planar. The base 45 is of an annular configuration so that its longitudinal axis is also the axis 18.

The diaphragm 22 has a peripheral portion 48 fixed to the body 20. Extending between the base 45 and periphery 48 is a diaphragm portion 49. The diaphragm portion 49 is also annular and has first radially and angularly extending segments 50 and second radially and angularly extending segments 51. The segments 51 are further displaced from the base 45 in the direction of the axis 18 than the segments 50.

The segments 50 have a greater width 52 than the corresponding width 53 of the segments 51. The segments 50 and 51 are joined by hinge portions 54 that separate the segments 50 and 51. The hinge portions 54 provide for relative movement between the segments 50 and 51 by resilient deformation of the hinge portions 54. This relative movement is provided by resilient deformation of the diaphragm portion 49 adjacent the5 hinge lines 54.

As best seen in Figure 6, the segments 51 also extend angularly about the axis 18.

Each diaphragm 22 is integrally formed from the resiliency plastics material.

Preferably, each valve 30 and each diaphragm 22 is molded from resilient plastics material.

In operation of the above described pump 10 a working fluid under pressure is alternatively delivered to the first sub-chambers 23 by operation of a valve 25. This causes reciprocation of the piston assembly 14 thereby varying the volume of the sub-chambers 23 as well as the sub-chambers 24. A fluid being pumped is delivered to the inlet 26 wherefrom it flows to the sub-chambers 24 from the one-way valves 30. The fluid being pumped is drawn into each sub-chamber 24 as the volume thereof is being increased. As the volume of each sub-chamber 24 decreases the fluid being pumped is delivered to the outlet 27 again via the associated one-way valve 30.

The one-way valves 30 are located at an appropriate orientation to provide for flow in an inlet direction or an outlet direction depending on their location for the purposes of providing for fluid through the pump 10.

Each piston 15 includes a mounting flange 55 and an associated clamp plate 56 secured thereto so that the base 45 of the associated diaphragm is clamped between the associated mounting flange 55 and clamp plate 56.

Although the invention has been described with reference to specific examples, it will be appreciated by those skilled in the art that the invention may be embodied in many other forms.

The claims defining the invention are as follows:

1. A pump including:

a pump body providing a pump chamber through which a fluid being pumped passes;

a manifold through which the fluid flows;

a seal, including a valve, integrally formed of plastics material and including:

an elongated seal having a base fixed between the body and manifold sealingly connecting the manifold and body, the base being of a loop configuration so as to have a pair of transversely spaced elongated side portions joined by longitudinally spaced end portions;

a movable valve member located adjacent one of said end portions and configured to sealingly cooperate with a valve seat to close a valve opening provided by the seat; and

a flexible bridge pivotally coupling the movable valve member with said one end portion providing for movement of the valve member by resilient deformation of the bridge.

2. The pump of claim 1, wherein said bridge includes a first bridge portion and a second bridge portion, the bridge portions being transversely spaced.

3. The pump of claim 1 or 2, wherein said side portions are substantially co-extensive and said end portions are substantially co-extensive.

4. The pump of claim 1, 2 or 3, wherein said end portions are arcuate in configuration.

5. The pump of any one of claims 1 to 4, wherein said base in transverse cross-section is arcuate so as to provide a concave surface and a convex surface.

6. The pump of claim 5, wherein said base in transverse cross-section is of a "C" configuration.

7. The pump of any one of claims 1 to 6, wherein said bridge provides a pivot axis extending generally transverse relative to said base.

8. The pump of any one of claims 1 to 7, further including a pump piston that is reciprocated relative to the body along a longitudinal axis;

a piston diaphragm fixed to the body and piston so as to extend between said piston and said body, said diaphragm including:

a base fixed to the piston;

a radially outer peripheral portion fixed to the body;

a flexible diaphragm portion extending between the base and said peripheral portion, said diaphragm portion having a first set of segments and a second set of segments alternately spaced with respect to the first set segments, the segments each extending angularly about and radially relative to said axis, and wherein

the first segments are spaced longitudinally relative to said axis from the second segments.

9. The pump of claim 8, wherein said diaphragm is integrally formed from flexible plastics material.

10. The pump of claim 8 or 9, wherein said first segments are attached to said second segments by hinge portions, the hinge portions having a thickness less than thicknesses of the first and second portions to provide for relative movement between the first and second segments by resilient deformation of the hinge portions.

11. The pump of claim 8, 9 or 10, wherein said first segments have a thickness greater than the second segments so that the second segments during operations of the diaphragm move relative to the first segments by resilient deformation at and adjacent hinge lines separating the first and second segments.

12. The pump of any one of claims 1 to 11, wherein said seal is a first seal, and said manifold is a first manifold, and said pump further includes:

an inlet through which the fluid is delivered to said chamber via the first manifold;

an outlet via which fluid from the chamber passes; and

a second manifold via which fluid flows to the outlet from the chamber;

a second elongated seal, said second seal including:

a base fixed between the body and second manifold sealingly connecting the second manifold and body, the base of the second seal being of a loop configuration so as to have a pair of transversely spaced elongated side portions joined by longitudinally spaced end portions;

a movable valve member located adjacent one of said end portions of the second seal and configured to sealingly cooperate with a further valve seat to close a further valve opening provided by the further seat; and

a flexible bridge pivotally coupling the movable valve member of the second seal with said one end portion of said second seal providing for movement of the valve member of said second seal by resilient deformation of the bridge of said second seal.

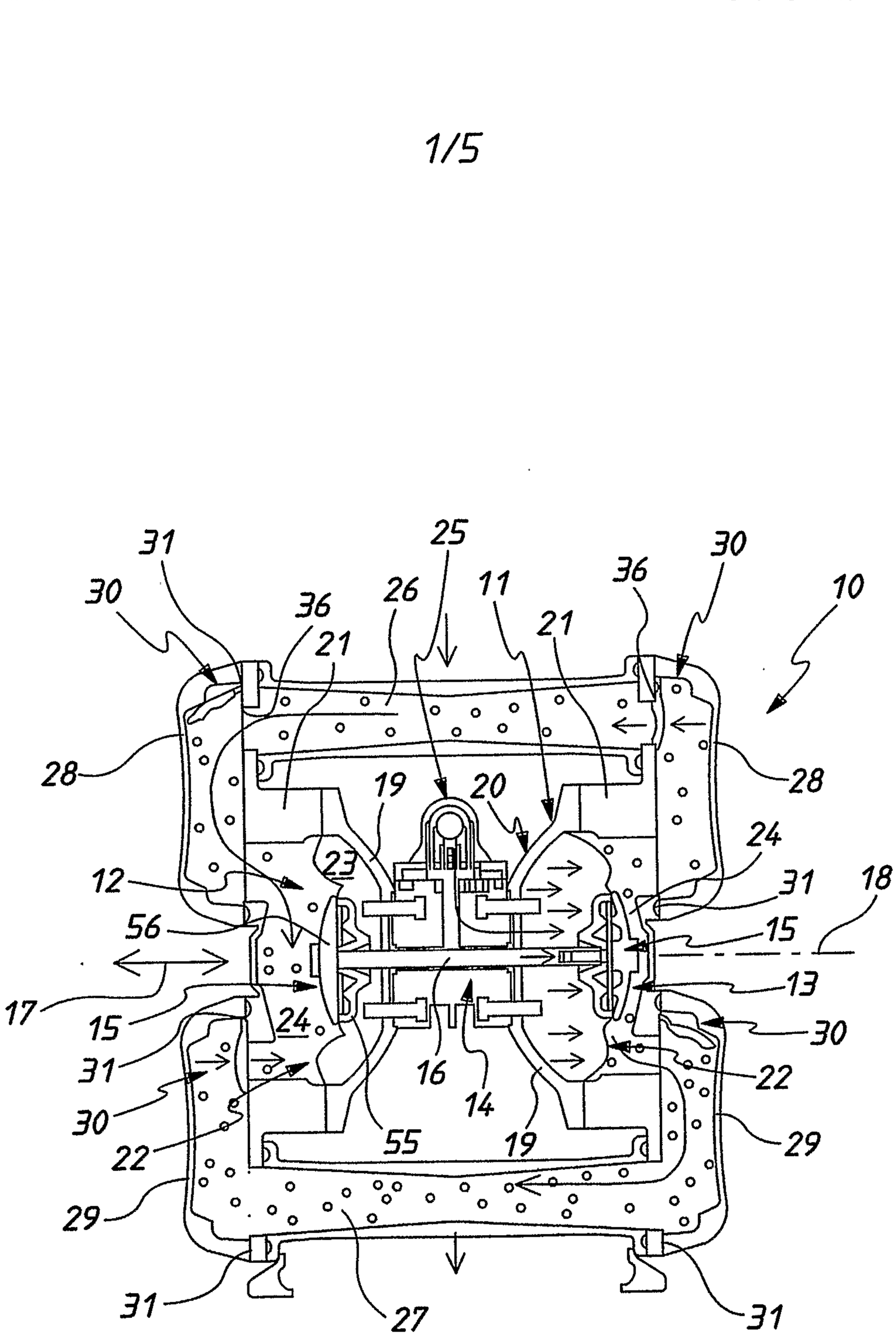
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FIG. 1

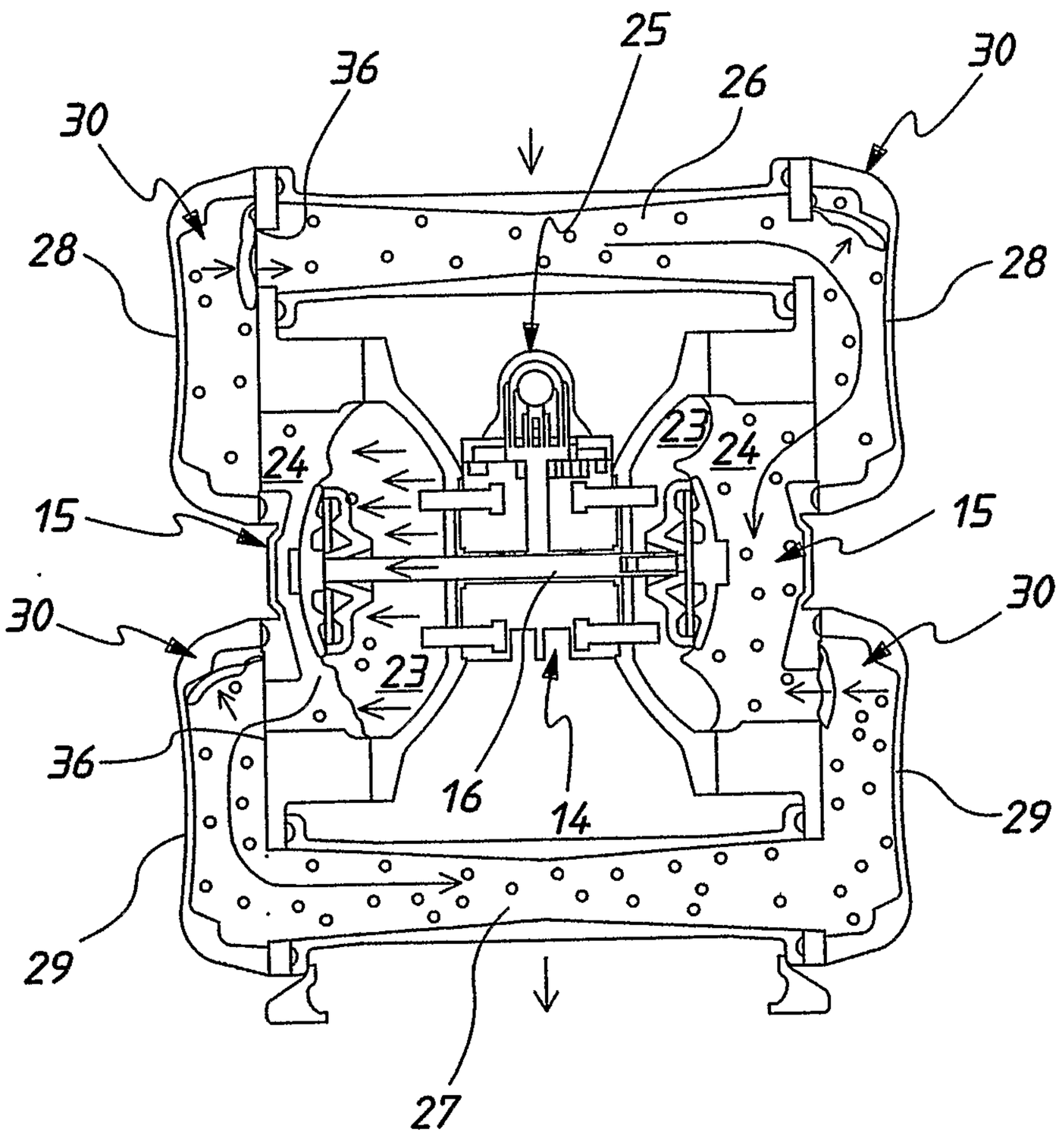

FIG.2

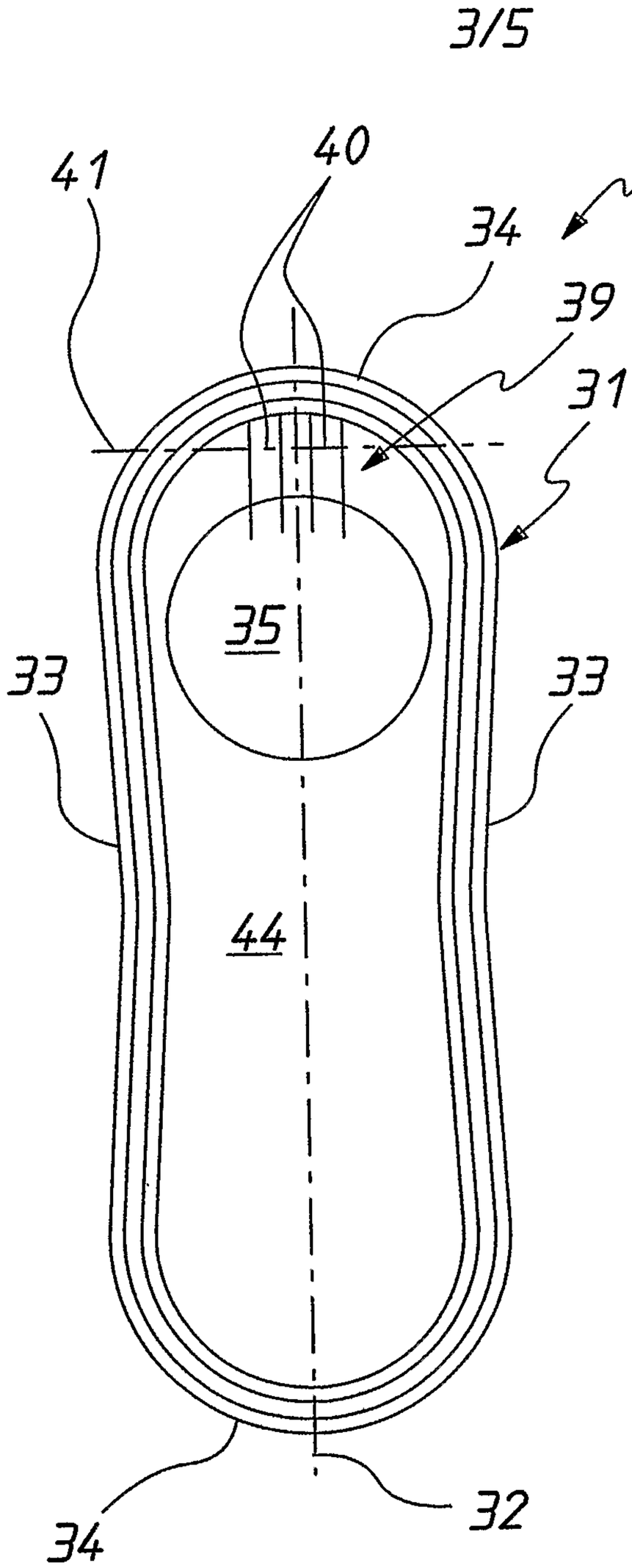

FIG.3

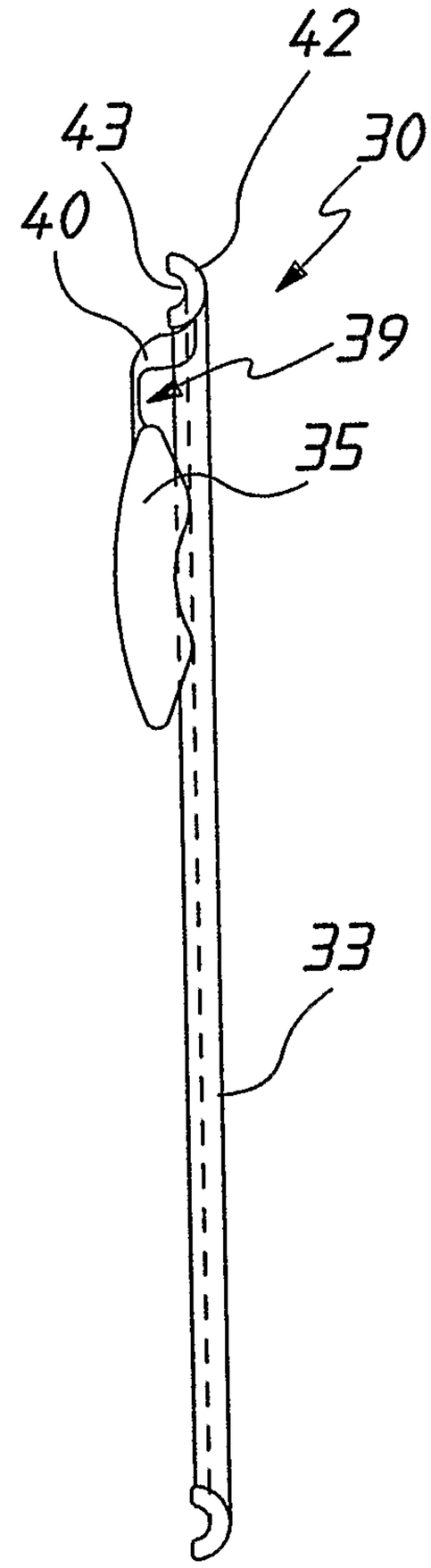

FIG.4

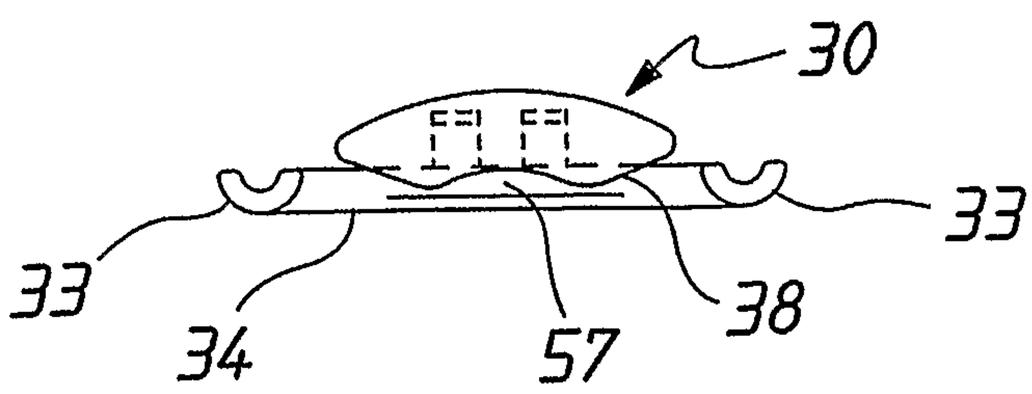

FIG.5

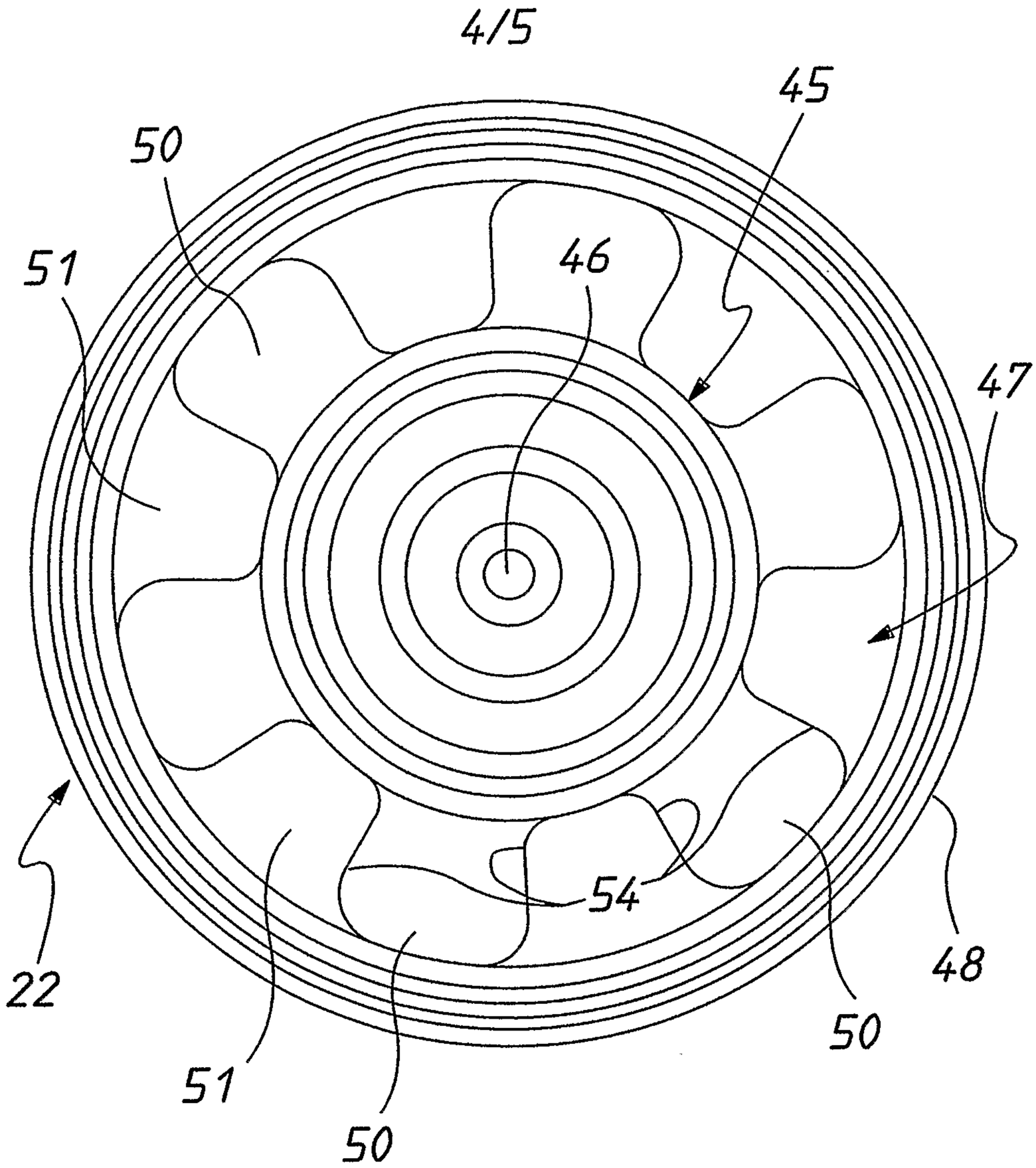

FIG.6

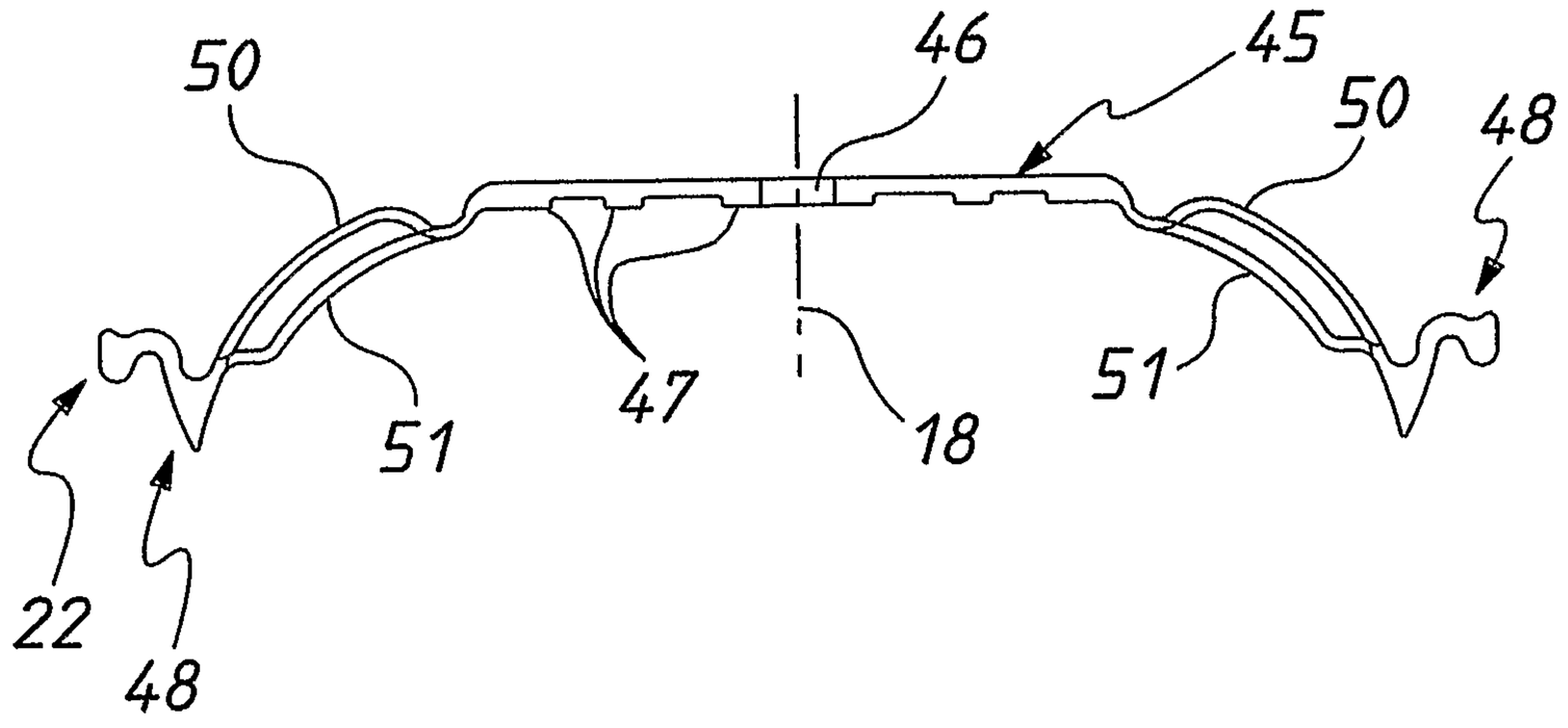

FIG.7

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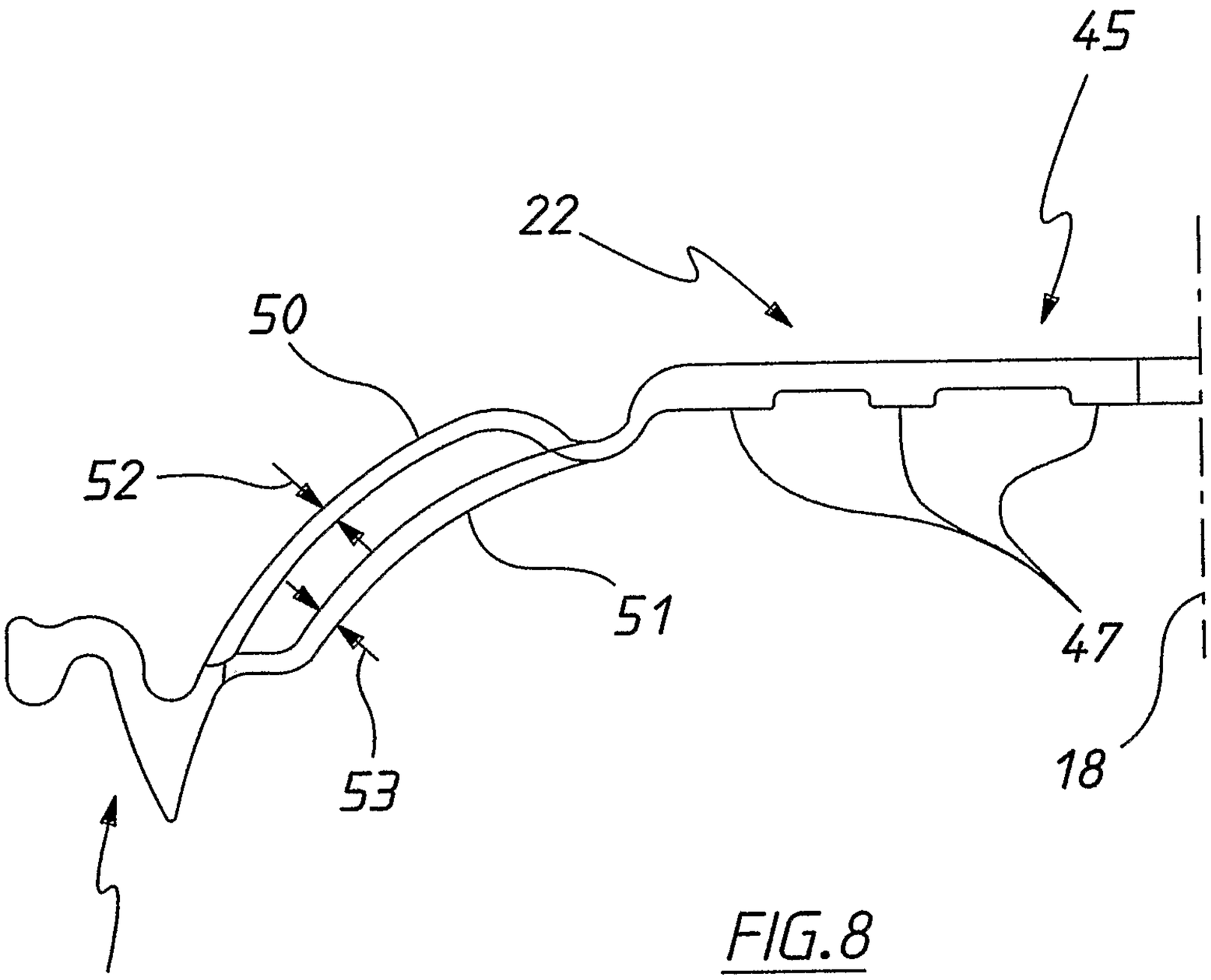


FIG.8

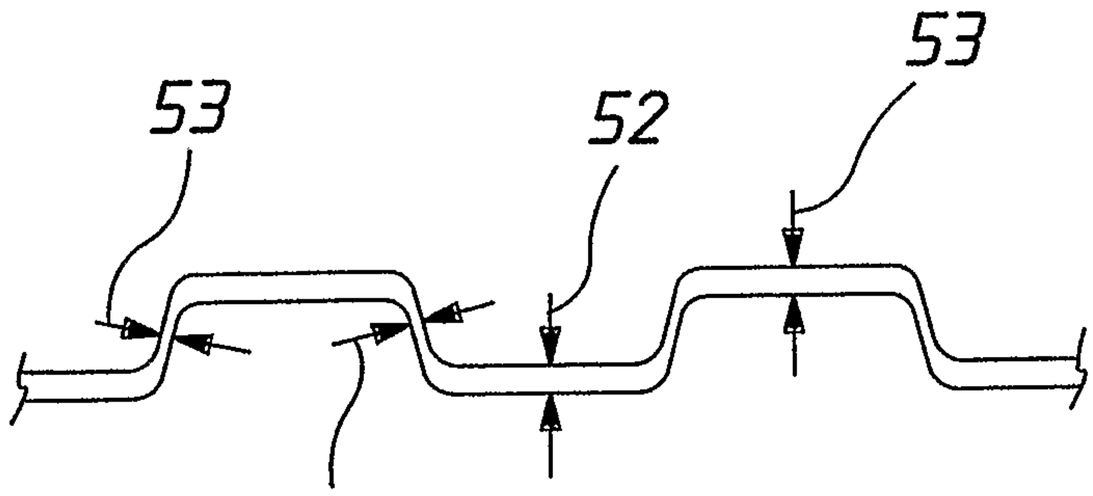
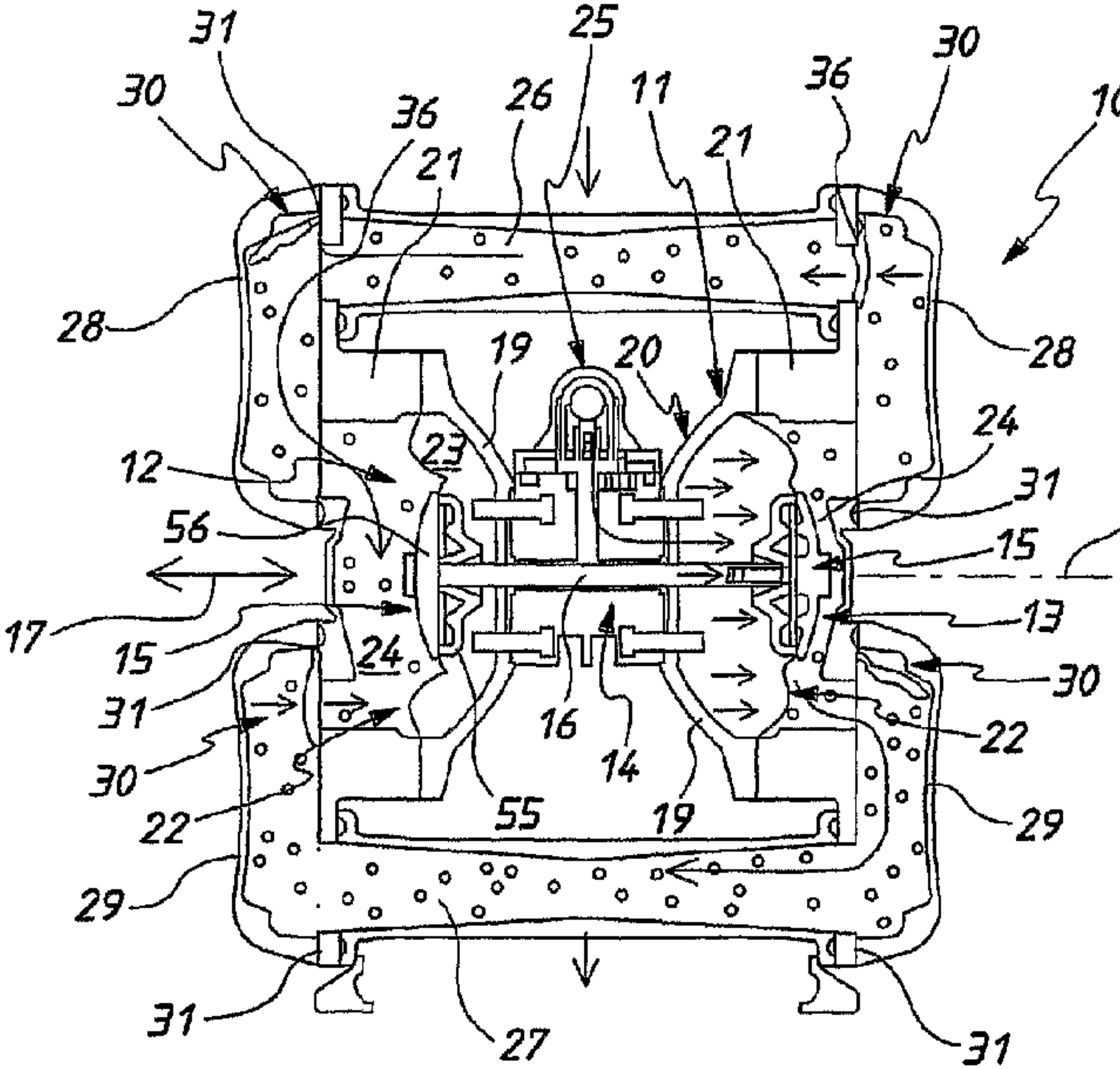


FIG.9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