(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 2 028 108 A1

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
25.02.2009 Bulletin 2009/09

(51) Int Cl.:
B65B 55/02 *(2006.01)* ***B65B 55/10*** *(2006.01)*

(21) Application number: **08252812.6**

(22) Date of filing: **22.08.2008**

(84) Designated Contracting States:
AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MT NL NO PL PT RO SE SI SK TR
Designated Extension States:
AL BA MK RS

(30) Priority: **22.08.2007 GB 0716374**

(71) Applicant: **Flexifill Ltd**
Bristol BS35 3UT (GB)

(72) Inventors:
- **Shipway, Malcolm Austin**
  Bristol BS35 3UT (GB)
- **Shipway, Clive Antony**
  Bristol BS35 3UT (GB)

(74) Representative: **Cheyne, John Robert Alexander M.**
HASELTINE LAKE
Redcliff Quay
120 Redcliff Street
Bristol BS1 6HU (GB)

(54) Aseptic container filling

(57) Aseptic filling of containers, for example bags 26 of bag-in-box container assemblies is achieved by sealingly engaging an inlet fitting 24 of the bag 26 in a collar 30, which is clamped by a clamp 32 against a housing member 2 to form a sealed chamber 18. Steam under pressure is admitted to the chamber 18 while the inlet fitting 24 is closed, both before and after the contents are dispensed to the bag 26 through a filling tube 6. Because tube 18 is relatively small, the steam pressure and temperature can rise rapidly, enabling the sterilising operations to be of short duration. The incoming steam may be directed at the inlet fitting 24 so as to dislodge accumulated bacteria and other contamination.

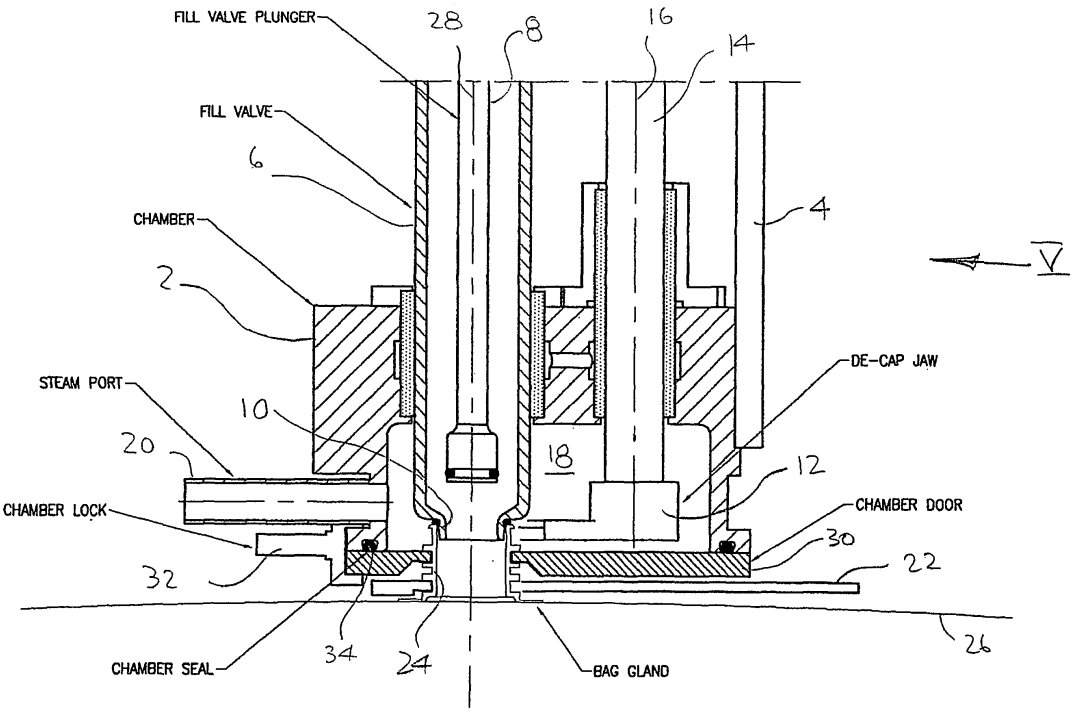

FIG. 1.

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Description

[0001] This invention relates to the filling of containers in an aseptic manner, and is particularly, although not exclusively, concerned with the filling of bag-in-box container assemblies in which the container itself is a flexible bag, usually of plastics material, supported within a box of, for example, cardboard.

[0002] It is known to use bag-in-box container systems for foodstuffs such as wine, edible oils, sauces, fruit juices and dairy products.

[0003] A known aseptic filling system is disclosed in GB 2105291. In that system, bags to be filled are preformed and sterilised internally and externally by appropriate means such as gamma irradiation. Each bag has an inlet fitting which is welded to the bag material. Initially, the inlet fitting is sealed by a membrane.

[0004] At the filling station, the inlet fitting is engaged with a filling head, and the region within the filling head adjacent the membrane is sterilised by the admission of a sterilising fluid. The intended contents of the bag are then supplied to the fitting at a pressure sufficient to rupture the membrane, so that the bag is filled. When filling is complete, the fitting is sealed by another membrane at its end inside the bag. Sterilising fluid is again admitted to the filling head so that the region above the new seal is sterilised.

[0005] In known filling systems; sterilisation is achieved using a liquid chemical such as hydrogen peroxide, or by steam, or by a combination of the two. While the use of chemical sterilising compositions is effective, it is important for all traces of the chemical to be removed after each sterilising step. If this is not done, there is the danger that the chemical will contaminate the contents of the bag, or that residues left in the vicinity of the fitting might contaminate the bag contents as they are drawn off for use or consumption.

[0006] Steam can be used effectively for sterilisation, but requires either long exposure times or high temperatures. Long exposure times slow down the filling process, and are therefore uneconomic. Also, many of the materials used in the manufacture of bags and their associated inlet fittings are liable to deform or degrade if held at elevated temperatures for prolonged periods.

[0007] High steam temperatures can be achieved only by maintaining the steam at elevated pressures. So far, this has been achieved only by conducting the filling process in a sealed chamber which accommodates the entire bag and filling equipment. The chamber thus has a large volume, which takes time to reach the required operating pressure. Also, means has to be provided to enable bags to enter and leave the pressurised chamber, and this entails a loss of steam pressure which must be replaced.

[0008] There is therefore a need for a container filling system which enables steam sterilisation to take place at high temperatures and with rapid response times.

[0009] According to the present invention there is provided a method of filling a container with a fluid, the container comprising an inlet fitting, the method comprising:

(a) actuating a collar to engage the inlet fitting in a fluid-tight manner;

(b) engaging the collar with a housing member in a fluid-tight manner to form a sealed chamber into which the fitting extends;

(c) admitting steam under pressure to the chamber;

(d) dispensing a fluid product into the container through the fitting by dispensing means extending into the chamber;

(e) closing the fitting;

(f) admitting further steam under pressure to the chamber; and

(g) releasing the collar from the housing member and releasing the fitting from the collar.

[0010] The inlet fitting may be provided with a removable cap. If so, means may be provided within the chamber for removing the cap after step (c) to enable filling of the container, and subsequently replacing the cap to close the fitting in step (e).

[0011] In a preferred method, the steam temperature within the chamber in steps (c) and (f) reaches a temperature in excess of 140°C and remains at that temperature for a period not greater than 3 seconds. This entails a steam pressure within the chamber of not less than 400 kPa.

[0012] Improved sterilisation can be achieved if the steam is delivered to the chamber through at least one nozzle directed at the inlet fitting. In particular, if the fitting has surface formations which define crevices, or if a cap is provided and there is a crevice at the junction between the inlet fitting and the cap, it can be advantageous to direct the or each steam nozzle towards the crevice. By subjecting the fitting and/or the cap to a jet of steam in this way can serve to dislodge any accumulated contamination, such as bacteria, from the parts against which the steam impinges. There may be a plurality of the nozzles distributed around the inlet fitting to ensure steam impingement over a wide extent of the fitting and/or the cap.

[0013] The collar may comprise a pair of pivotable jaws which, when closed, define an opening which sealingly receives the inlet fitting.

[0014] The collar may be sealingly engaged with the housing member by clamping means. The clamping means may engage edge regions or flanges of the collar and the housing member so as to retain the collar and the housing member in sealing engagement with each other. The clamping means may comprise arcuate members which are pivotably movable into and out of engage-

ment with the collar and the housing member.
Between steps (c) and (d), the chamber may be evacuated, and subsequently filled with sterilised air which remains in the chamber during dispensing of the fluid product.

[0015] According to another aspect of the present invention, there is provided apparatus for performing a filling method as defined above, the apparatus comprising:

(a) a collar which is engagable with the inlet fitting of the container;

(b) a housing member which is engagable with the collar in a fluid-tight manner to form a sealed chamber;

(c) means for admitting steam under pressure to the chamber;

(d) dispensing means extending into the chamber for dispensing a fluid product into the container; and

(e) closing means for closing the fitting.

[0016] For a better understanding of the present invention, and to show more clearly how it may be carried into effect, reference will now be made, by way of example, to the accompanying drawings, in which:-

Figure 1 is a sectional view of filling head apparatus;

Figure 2 is a perspective view of components of the filling apparatus of Figure 1, positioned receive a container for filling;

Figure 3 corresponds to Figure 2 but shows an inlet fitting of the container engaged by a collar of the filling apparatus;

Figure 4 corresponds to Figures 2 and 3 but shows a clamp in a clamping position;

Figure 5 is a view taken in the direction of the arrow V in Figure 1, and shows an operative condition corresponding to Figure 3;

Figure 6 corresponds to Figure 5 but shows an operative condition corresponding to Figure 4;

Figure 7 corresponds to Figure 5 but shows removal of a cap from the fitting;

Figure 8 corresponds to Figure 5 but shows filling of the container;

Figure 9 corresponds to Figure 5 but shows replacement of the cap; and

Figure 10 corresponds to Figure 5 but shows release of the filled container.

[0017] Referring to Figure 1, the filling apparatus comprises a housing member 2 which is supported by a fixed support 4 mounted on a machine frame (not shown). A filling tube 6 is mounted in the housing member 2 in a fluid-tight manner, which permits upwards and downwards movement of the filling tube 6, with respect to the orientation shown in Figure 1. Within the filling tube 6 there is a valve plunger 8, which is movable upwards and downwardly within the filling tube 6. In the downwards position, the valve plunger 8 sealingly engages a valve seat 10 of the filling tube 6.

[0018] A cap removal mechanism 12 is mounted on a sliding pillar 14 which can move upwardly and downwardly within the housing member 2, and is also able to rotate about its axis 16.

[0019] The housing member 2 has a chamber 18 formed in its underside, and the lower end of the filling tube 6 and the cap-engaging mechanism 12 are situated within this chamber 18. A steam port 20 opens into the chamber 18. A guide 22 is situated below the housing member 22 for guiding an inlet fitting 24 of a container in the form of a bag 26 (only partially shown in Figure 1) to a position aligned with the centreline 28 of the filling tube 6. Above the guide 22 there is a collar 30 for engagement with the inlet fitting 24. The guide 22 and the collar 30 are mounted on a structure which is movable upwardly and downwardly relatively to the housing member 2.

[0020] In the position shown in Figure 1, the guide 22 and the collar 30 are in their upper position, in which the collar 30 contacts the bottom of the housing member 2, and is clamped in position by clamping means 32. There is a seal (not shown) between the collar 30 and the inlet fitting 24, and there is a sealing ring 34 provided in a groove in the housing member 2, to provide a seal between the housing member 2 and the collar 30. Consequently, in the position shown in Figure 1, the chamber 18 is a closed, sealed chamber, capable of withstanding internal pressure created by incoming steam flowing through the steam port 20.

[0021] The structure comprising the guide 22, the collar 30 and the clamp 32 is shown in more detail in Figures 2 to 4. The guide 22 comprises a pair of arms 36 which are pivotable about rods 50 by actuators (not shown) connected at respective openings 38. In the closed condition shown in Figures 2 to 4, the arms 36 contact each other at a parting line 14 and form between them a parallel-sided slot 42 having a width sufficient to receive the fitting 24 which is closed by a cap 62.

[0022] The collar 30 comprises a pair of jaws 44 which, when closed (Figure 3) meet each other at a parting line 46 to form a substantially closed, circular plate. At the parting line 46, each jaw 44 has a semi-circular recess 48 so that, when the jaws 44 are closed, the recesses 48 form a circular opening sized to be a close fit around the inlet fitting 24. Sealing means may be provided in the

recesses 48 to ensure that the engagement between the jaws 44 and the inlet fitting 24 creates a fluid-tight seal.

[0023] The jaws 44 are supported on the rods 50 for pivotal movement about the axes of the rods, controlled by actuators which are not shown in the Figures. The motion of the jaws 44 is stabilised by arcuate grooves in the arms 36 which receive followers secured to the jaws.

[0024] The clamp 32 comprises a pair of arcuate clamp members 52 which are supported by a common pivot (not shown) passing through aligned apertures 54. At the end of each arcuate clamp member 52 away from the aperture 54, there is a lug 56 coupled to a respective actuator (not shown) for pivoting the clamping members 52 about the pivot between open and closed conditions.

[0025] Operation of the filling device will now be described with reference to Figures 2 to 10.

[0026] Referring first to Figure 5, the guide 22 and the collar 30 are shown in their lowered positions with respect to the housing member 2. The guide 22 is closed, so that the inlet fitting 24 is a close fit between the sides of the slot 42. The collar 30 is open, so that the jaws 44 are pivoted apart from each other. The clamp 32 is also open

[0027] A supply of bags 26 is fed progressively towards the filling head along a feed-in guide (not shown) which has a slot corresponding in width to the closed slot 42 of the guide 22. It will be appreciated from Figure 5 that the inlet fitting 24 has formations on its cylindrical outer periphery which provide annular grooves for cooperation with different components of the filling device. Bags supplied along the feed-in guide transfer to the guide 22, which cooperates with the lowermost groove on the inlet fitting 24. The bag is displaced forwardly (ie downwardly and to the right as shown Figures 2 to 4) along the slot 42 until it is arrested when the slot 42 terminates at the parting line 40. A sensor (not shown) detects when an inlet fitting 24 is in this position, so as to enable initiation of the following steps of the filling process.

[0028] When the inlet fitting 24 is sensed at the end of the slot 42, the jaws 44 of the collar 30 are actuated so as to be pivoted by the rods 50 to close about the inlet fitting 24, to engage the uppermost annular groove of the inlet fitting 24. When this is achieved, and the inlet fitting 24 is held in the recesses 48 of the closed collar 30, the arms 36 of the guide 22 are operated to pivot apart from each other to free the inlet fitting 24 from the guide 22, so its subsequent movement is controlled by the collar 30. The structure carrying the collar 30 and the guide 22 is then moved upwardly until the collar 30 makes contact with the housing member 2, as shown in Figure 6. When contact is made, the arcuate clamp members 52 of the clamp 32 are operated by the actuators connected to the lugs 56 to move inwards to engage the collar 30 and the housing member 2. As can be appreciated from Figure 6, the clamp members 52 have internal grooves 58 having divergent side walls. The housing member 2 has a peripheral flange 60 which, with the periphery of the collar 30, forms a rib having inclined side walls which are complementary to those of the groove 58. Consequently, radial contraction of the clamping members 52 causes the collar 30 to be forced under pressure into sealing contact with the housing member 2 to ensure adequate sealing by means of the sealing ring 34.

[0029] The chamber 18 is thus sealed, and steam is then admitted through the ports 20 to sterilise all of the components within the chamber 18, and in particular the inlet fitting 24 and the cap 62. In order to achieve an adequate sterilising temperature, the pressure within the chamber 18 rises to a pressure in excess of 400 kPa. This results in a steam temperature in excess of 140°C, for example 142°C, and this pressure is maintained for a time sufficient to ensure that substantially all pathogens within the chamber 18 and on the inlet 24 are destroyed. In practice, it has been found that a duration of less than 3 seconds, for example 2 seconds, is sufficient for this purpose.

[0030] In the embodiment shown in Figure 6, the steam ports 20 are disposed to admit steam generally into the chamber 18. However, in a preferred embodiment, for example as shown in Figure 1, the steam ports are positioned so that the incoming steam is directed at the inlet fitting 24. The cap 62 serves to seal the interior of the bag 26 from the chamber 18, so that the pressure in the chamber 18 can be maintained. The steam ports 20 may be directed at the cap 62 as well as the inlet fitting 24, and in particular to the interface between the cap 62 and the inlet fitting 24, where bacteria and other pathogens can accumulate. The ports 20 may be configured as nozzles so that the steam jets enter the chamber 18 at high velocity so as to ensure that accumulated bacteria are dislodged from the inlet fitting 24 and the cap 22 to ensure that they are destroyed. The nozzles may be distributed around the chamber 18 to ensure that steam impinges on the inlet fitting 24 and the cap 62 substantially all over their surfaces.

[0031] After steam sterilisation is complete, the steam is extracted from the chamber 18 through exit ports (not shown). Subsequently, as shown in Figure 7, the cap 62 is removed by the cap engaging mechanism 12. This mechanism comprises an arm 64 extending laterally from the operating rod 16, which arm carries a pair of cap-engaging jaws 66. By appropriate control of the rod 14, the jaws 64 are brought into position over the inlet fitting 24, and the jaws 64 are closed to engage the cap 62. The rod 14 is then raised and rotated to remove the cap 62 and to pivot it within the chamber 18, to a position out of alignment with the inlet fitting 24.

[0032] Subsequently, sterile air is passed through the chamber 18 through ports which are not shown in the Figures. While this takes place, the filling tube 6 is lowered into contact with the now open inlet fitting 24. It will be appreciated that, throughout the process so far, the valve plunger 8 has remained in its lowered position, in which it engages the valve seat 10 to close the filling tube 6.

[0033] Once the filling tube 6 makes sealing contact with the inlet fitting 24, the valve plunger 8 is raised (Fig-

ure 1) to allow the intended contents of the bag 26 to flow through the filling tube 6 and the inlet fitting 24 into the bag 26.

[0034] Once filling is complete (Figure 9), the valve plunger 8 is lowered again to close the filling tube 6, and the filling tube is then raised from the inlet fitting 24. The cap-engaging mechanism 12 is then operated to replace the cap 62, after which the jaws 64 are released and the mechanism 12 returns to the rest position shown in Figure 6.

[0035] Subsequently, the steam ports 20 are opened again, to repeat the sterilising operation. The pressure, temperature and duration of the sterilisation operation at this stage may be the same as that described with reference to Figure 6, but in some circumstances it may be appropriate for different parameters to be used. Once the sterilising operation is complete, and the steam has been removed from the chamber 18, the clamp 32 is released and the filled bag 26 is lowered by operation of the collar 30 and the guide 22. As shown in Figure 10, the jaws 44 of the collar 30 are then released from the inlet fitting 24. Since the arms 36 of the guide 22 remain open, the bag 26 can be moved away from the filling head for subsequent operations such as packaging in a suitable box.

[0036] It will be appreciated that the relatively small size of the chamber 18 enables the steam pressurisation within the chamber 18 to occur rapidly, so that the sterilisation process takes very little time. Since the collar 30 engages the cylindrical periphery of the inlet fitting 24, it is possible for the cap 62 to be removed and replaced within the chamber 18. The engagement between the collar 30 and the inlet fitting 24, and the clamping of the collar 30 to the housing member 2 by means of the clamp 32, means that the inlet fitting 24 is exposed to the interior of the chamber 18 in a manner which enables the pressure within the chamber 18 to be supported adequately without leakage.

[0037] It will be appreciated that the various steps of the process are controlled by a control system, for example a computer which receives inputs from sensors which are responsive to positional information of the bag 26 and the components of the filling mechanism, and which controls the operation of various actuators which move the components in the required manner.

Claims

1. A method of filling a container with a fluid, the container comprising an inlet fitting, the method comprising:

(a) actuating a collar to engage the inlet fitting in a fluid-tight manner;
(b) engaging the collar with a housing member in a fluid-tight manner to form a sealed chamber into which the fitting extends;
(c) engaging a clamping means with the housing member and the collar to retain the housing member and the collar in sealing engagement with each other;
(d) admitting steam under pressure to the chamber;
(e) dispensing a fluid product into the container through the fitting by dispensing means extending into the chamber;
(f) closing the fitting;
(g) admitting further steam under pressure to the chamber; and
(h) releasing the collar from the housing member and releasing the fitting from the collar.

2. A method as claimed in claim 1, in which the inlet fitting comprises a removable cap, the cap being removed after step (d) and before step (e), and being replaced to close the fitting in step (f).

3. A method as claimed in claim 1 or 2, in which the pressure achieved in the chamber in steps (d) and (g) is not less than 400 kPa.

4. A method as claimed in any one of claims 1 to 3, in which the steam temperature achieved within the chamber in steps (d) and (g) is not less than 140°C.

5. A method as claimed in any one of the preceding claims, in which the chamber is maintained under steam pressure in steps (d) and (g) for a duration not greater than 5 seconds.

6. A method as claimed in any one of the preceding claims, in which, in steps (d) and (e), steam is delivered to the chamber through at least one nozzle directed at the inlet fitting.

7. A method as claimed in claim 6, in which steam is delivered to the chamber through a plurality of nozzles distributed around the inlet fitting.

8. A method as claimed in any one of the preceding claims, in which the collar comprises pivotable jaws which, when closed together, define an opening which sealingly receives the inlet fitting.

9. A method as claimed in any one of the preceding claims, in which the clamping means comprises pivotable arcuate members having internal grooves for engaging mating flanges on the housing member and the collar.

10. A method as claimed in any one of the preceding claims, in which sterile air is admitted to the chamber during step (h).

11. A method of filling a container with a fluid substan-

tially as described herein with reference to the accompanying drawings.

12. Apparatus for performing a filling method in accordance with any one of the preceding claims, the apparatus comprising:

(a) a collar which is engagable with the inlet fitting of the container;
(b) a housing member which is engagable with the collar in a fluid-tight manner to form a sealed chamber;
(c) clamping means for clamping the collar to the housing member;
(d) means for admitting steam under pressure to the chamber;
(e) dispensing means extending into the chamber for dispensing a fluid product into the container; and
(f) closing means for closing the fitting.

13. Apparatus as claimed in claim 12, in which the collar comprises a pair of pivotable jaws which, when closed, define an opening for sealingly engaging around the inlet fitting.

14. Apparatus as claimed in claims 12 or 13, in which the clamping means comprises arcuate members provided with internal grooves for clamping engagement with peripheral regions of the housing member and the collar.

15. Apparatus as claimed in any one of claims 12 to 15, in which a cap-engaging mechanism is disposed within the chamber for removing and replacing a cap of the inlet fitting.

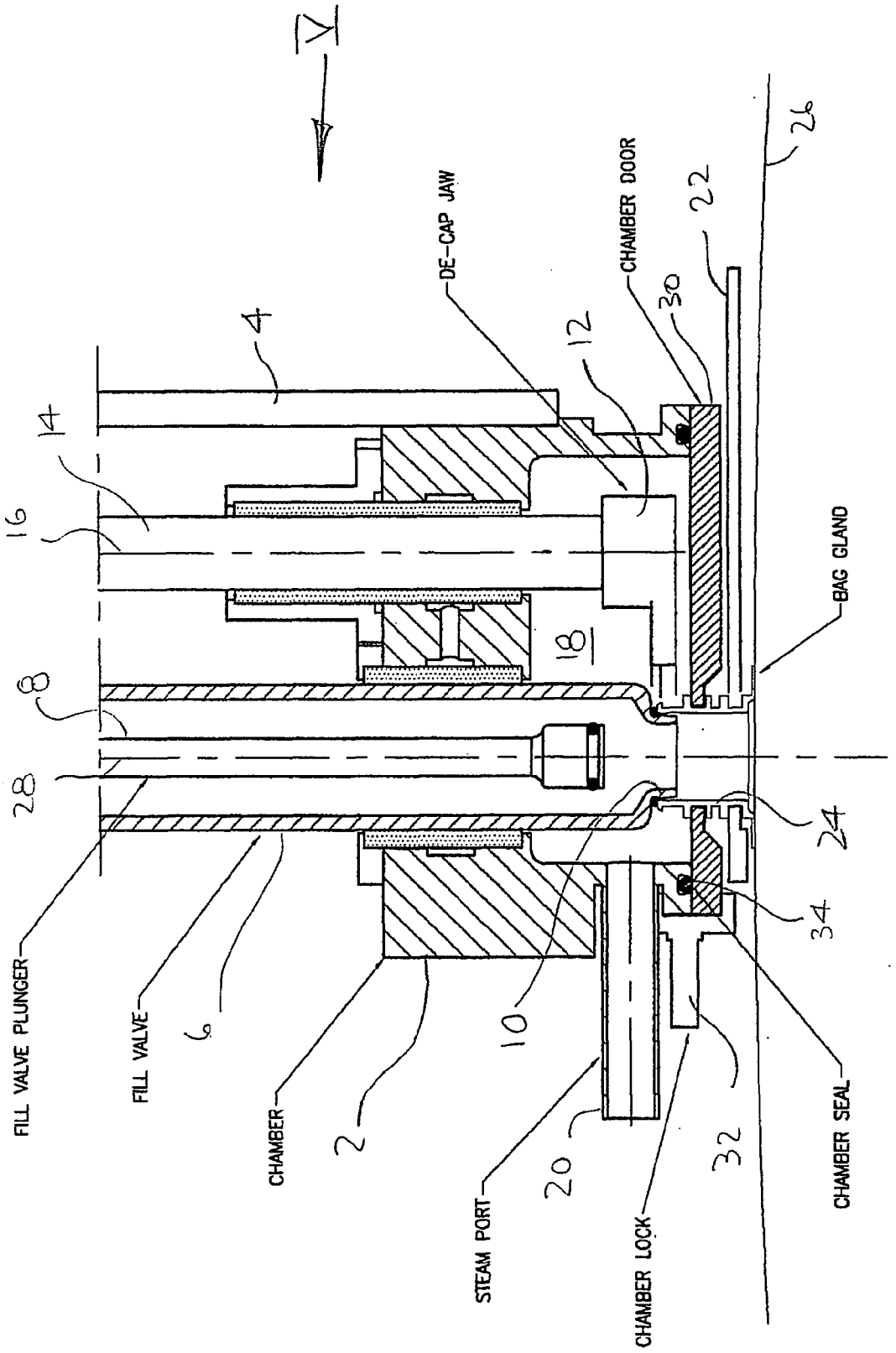
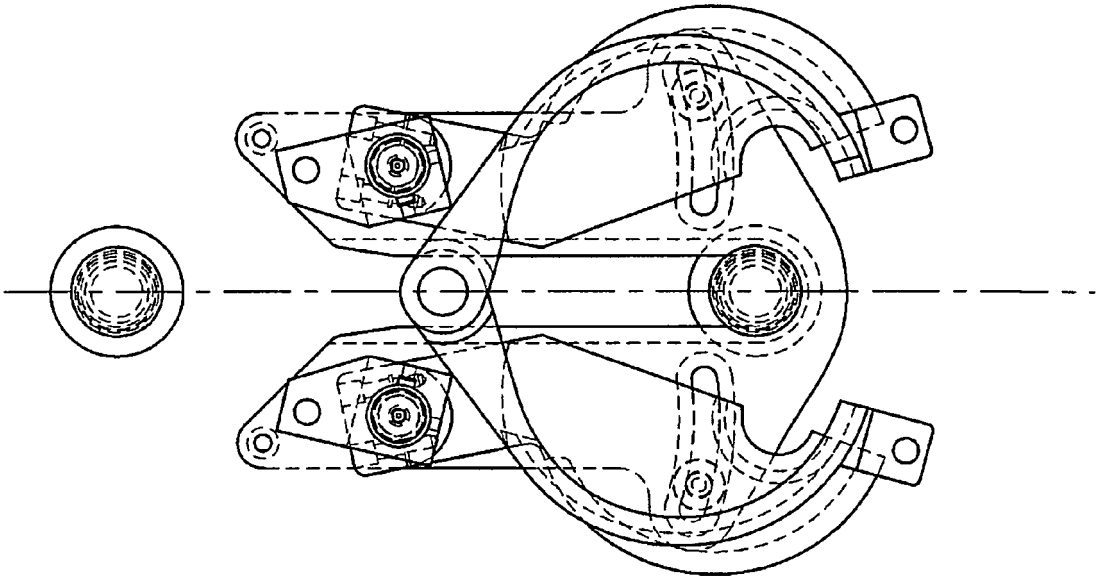

V
DE-CAP JAW
CHAMBER DOOR
4
12
30
22
26
14
16
18
BAG GLAND
8
28
24
34
FILL VALVE PLUNGER
FILL VALVE
6
CHAMBER
2
10
STEAM PORT
20
CHAMBER LOCK
32
CHAMBER SEAL

FIG. 1



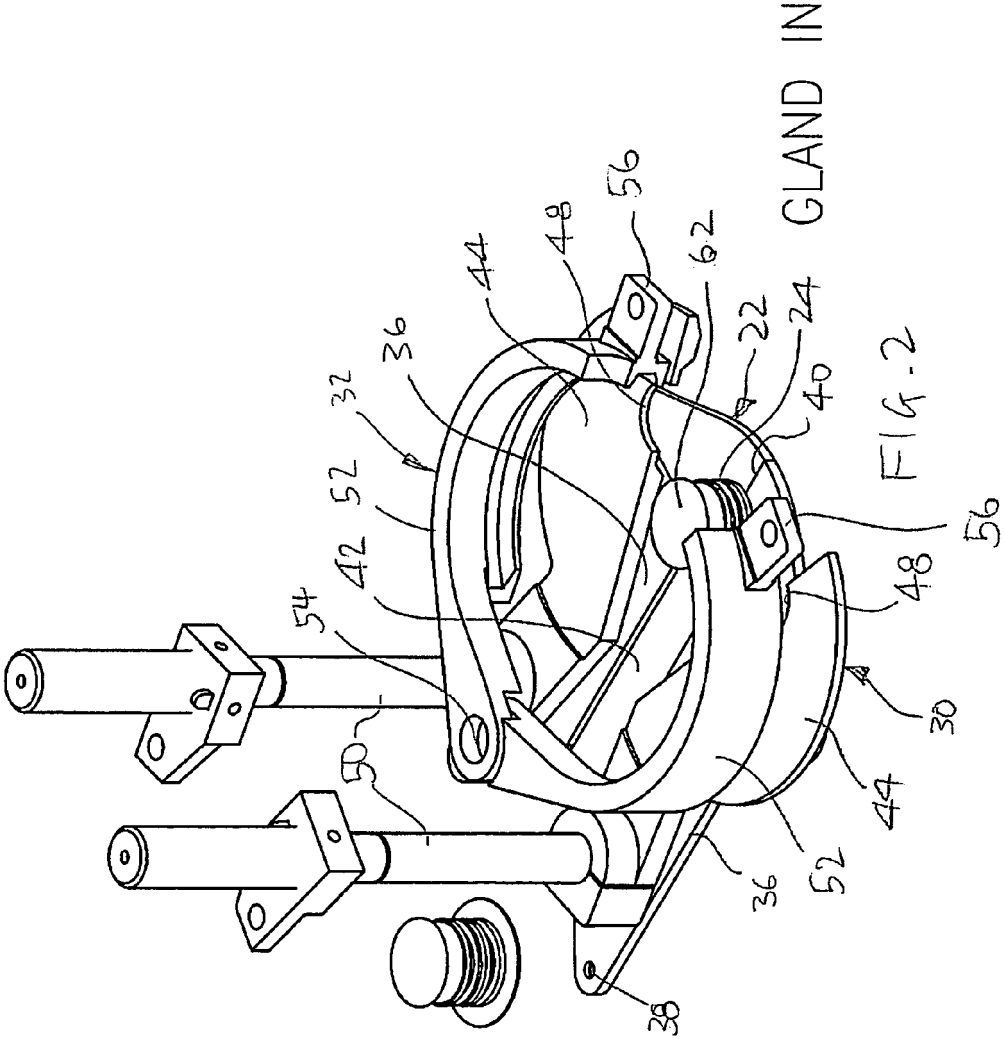
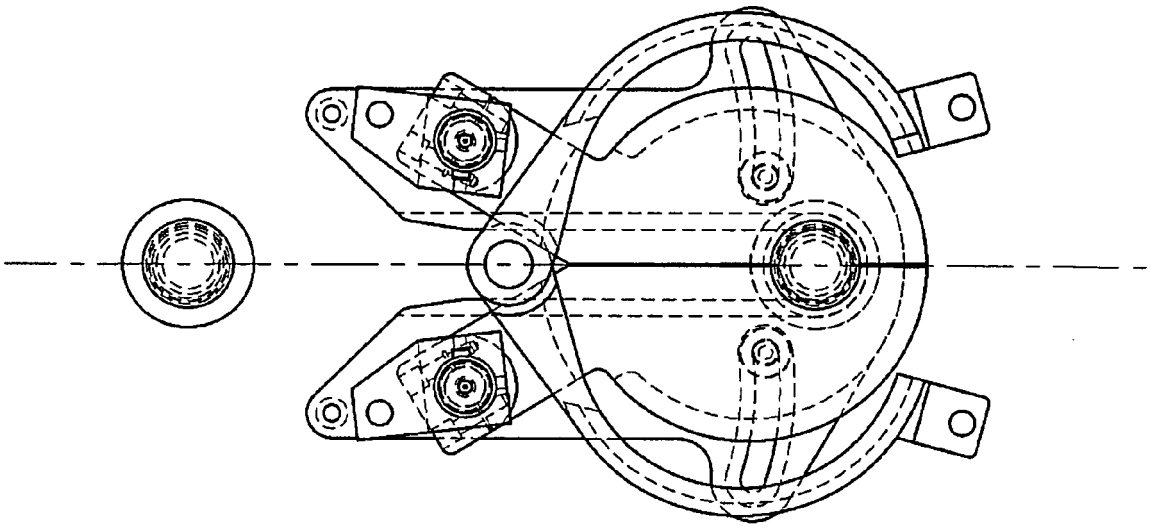


FIG. 2



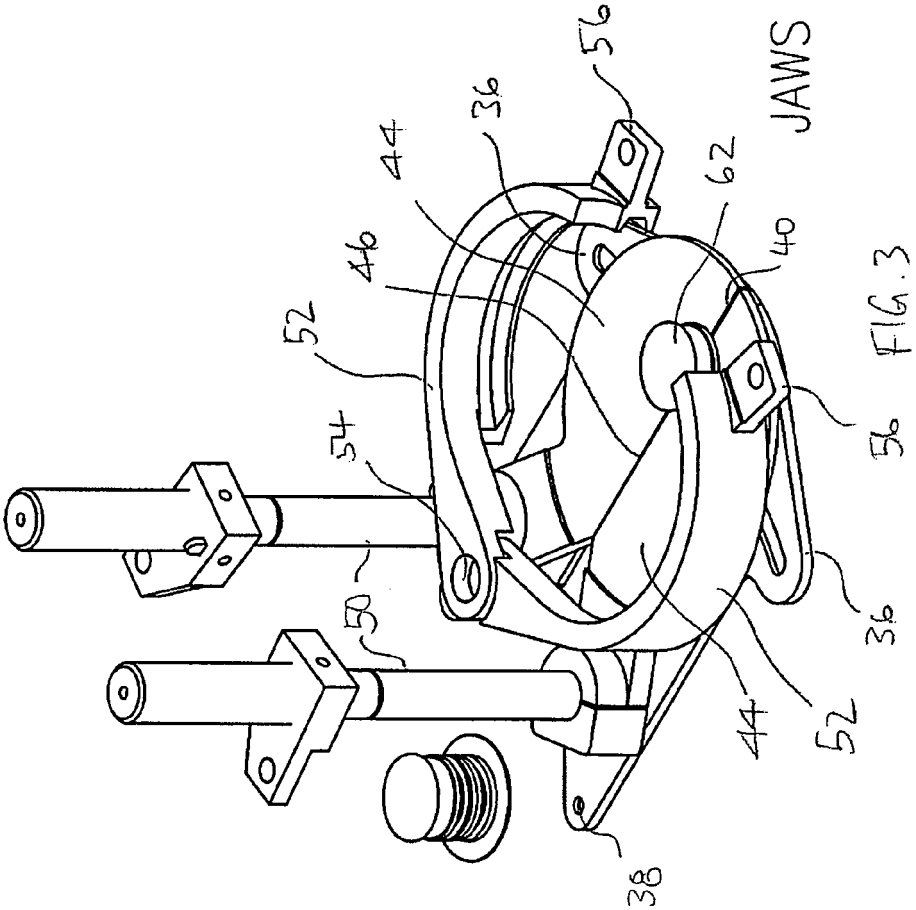


FIG. 3

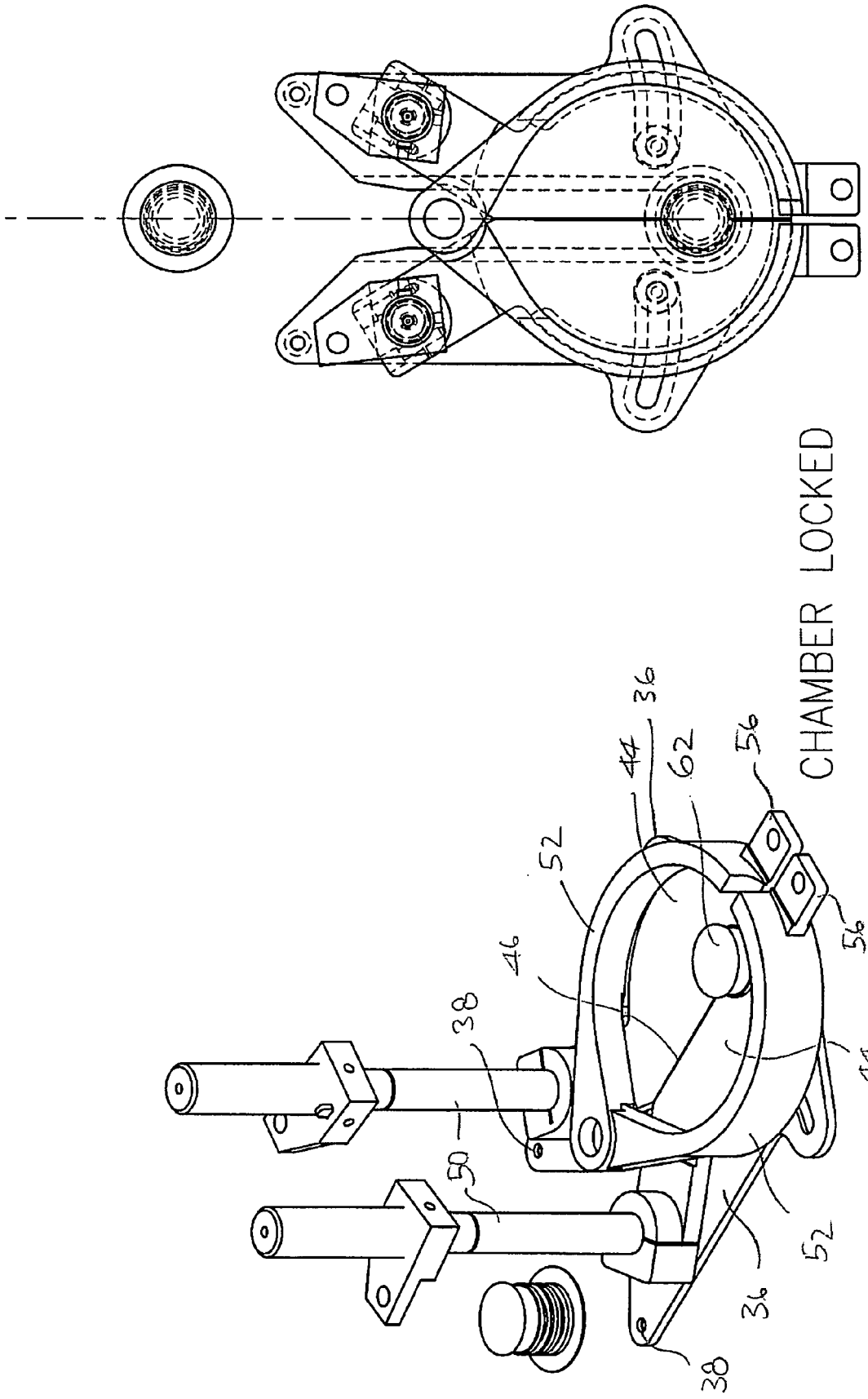


FIG. 4

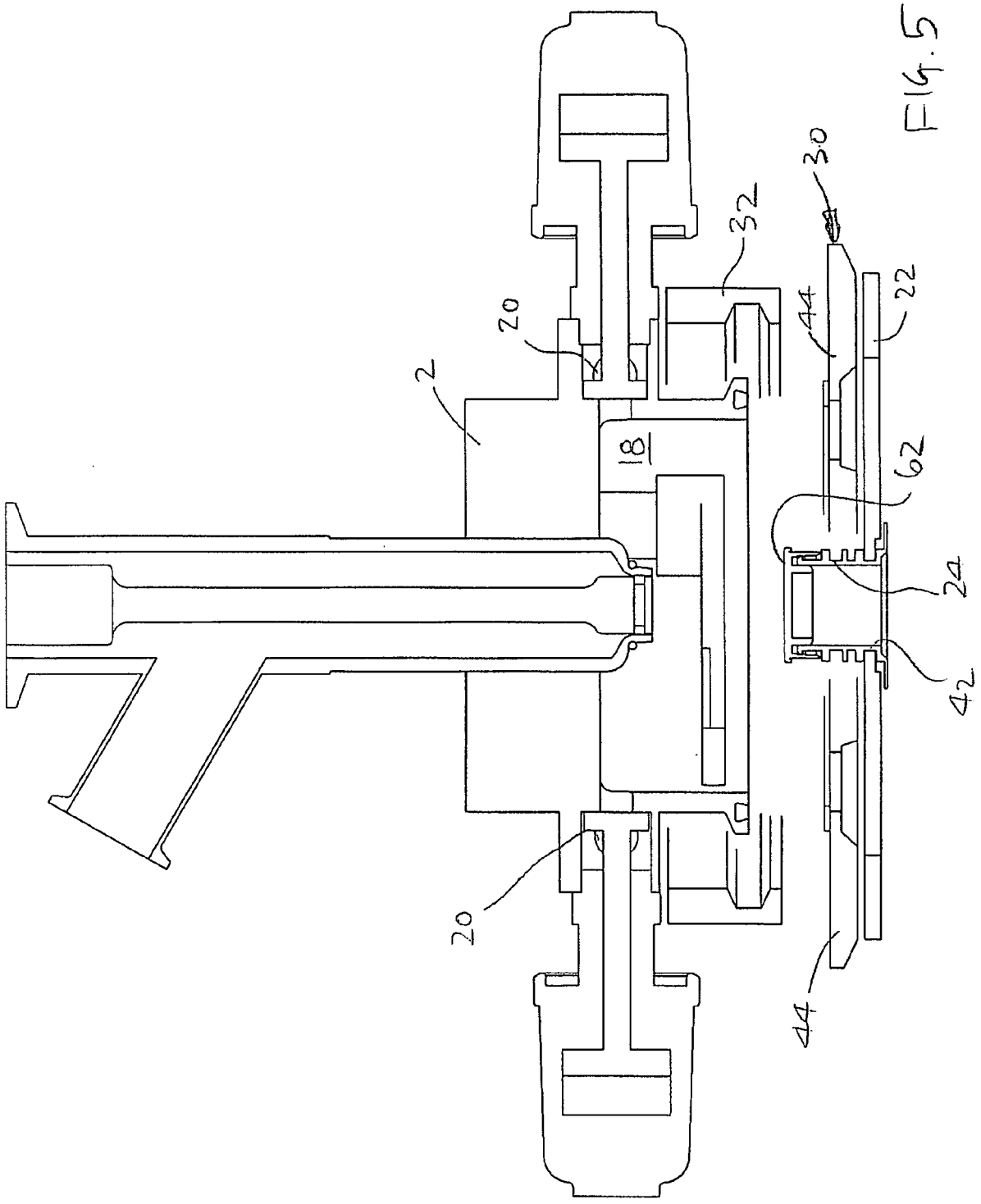
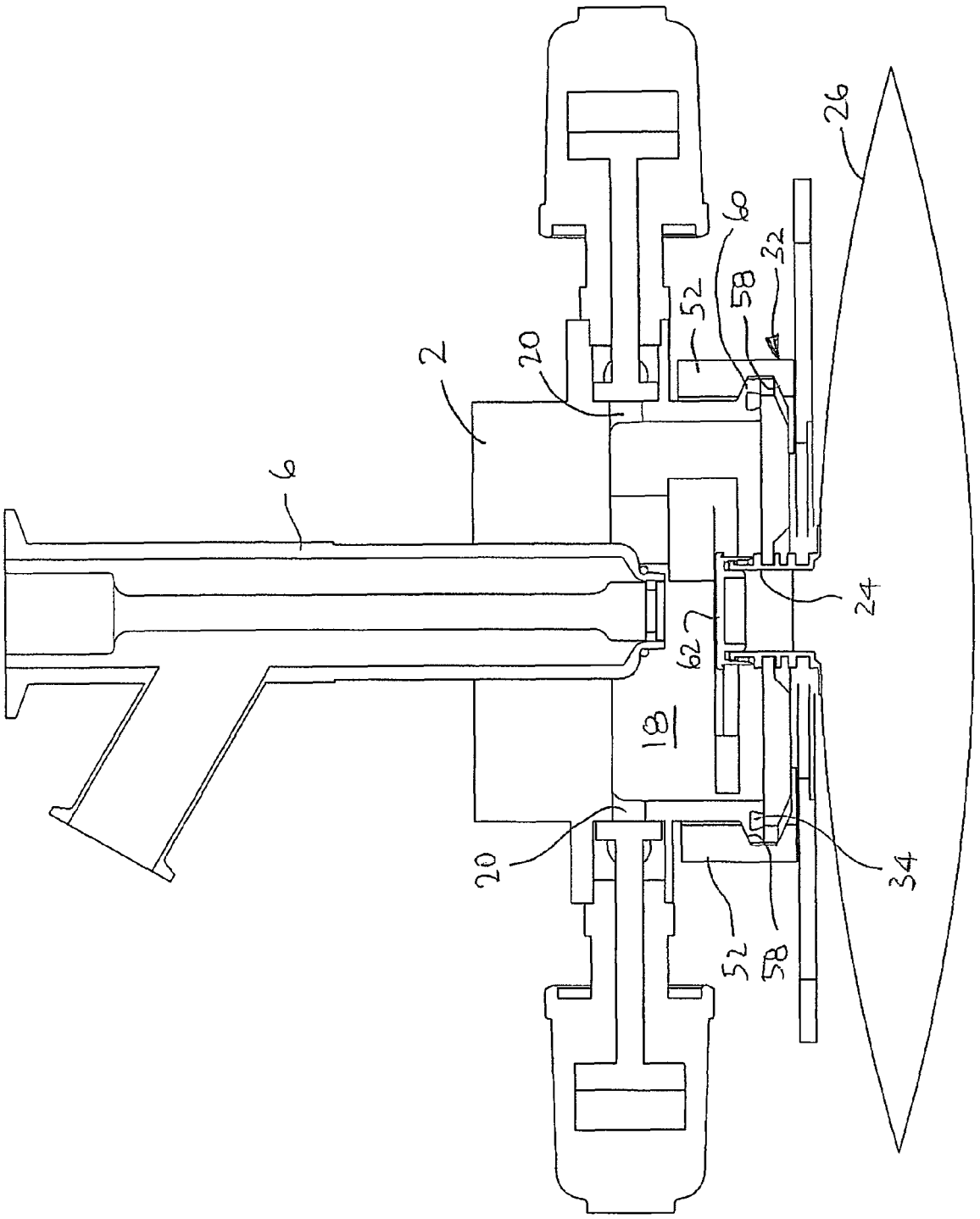


FIG. 5

FIG. 6



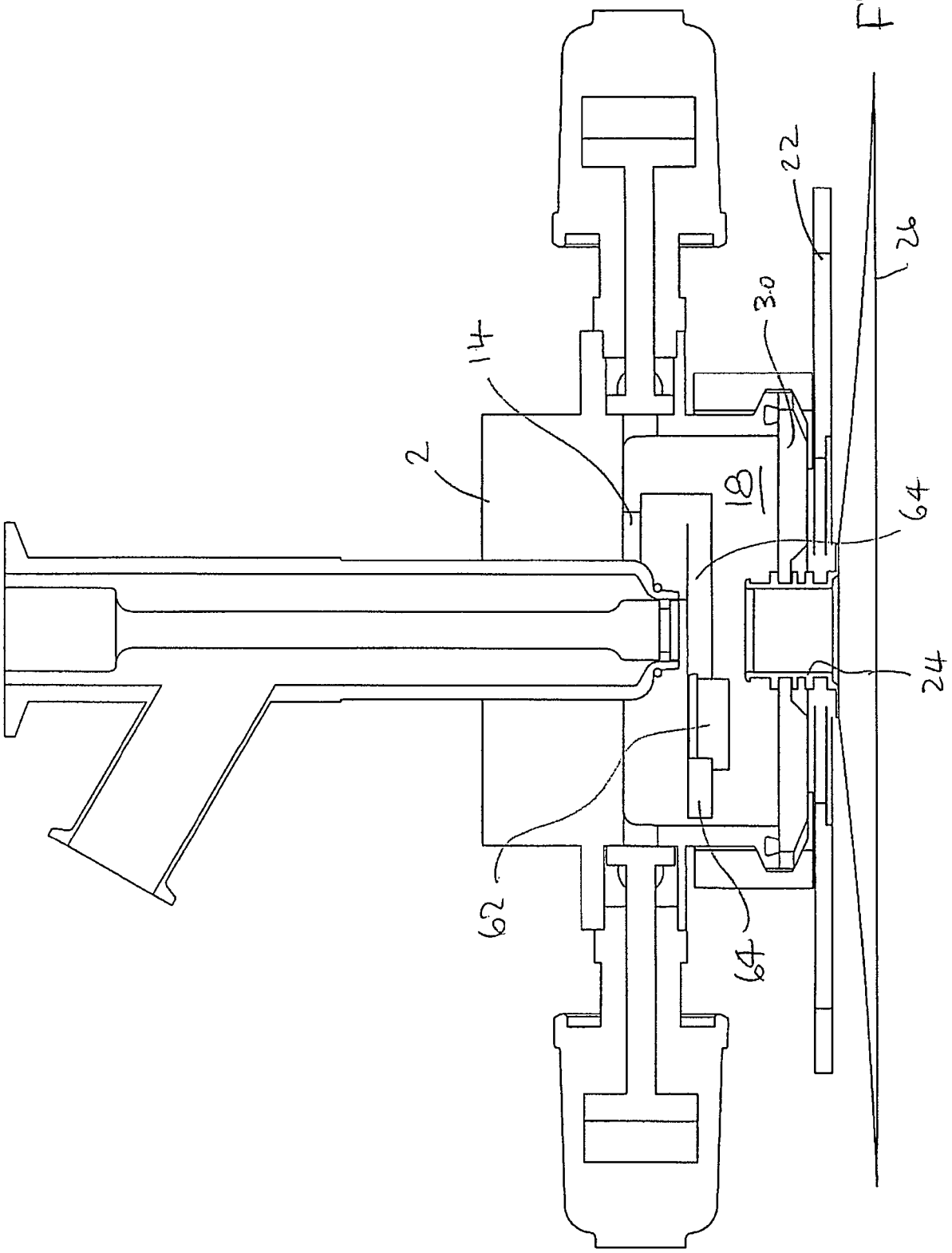


FIG. 7

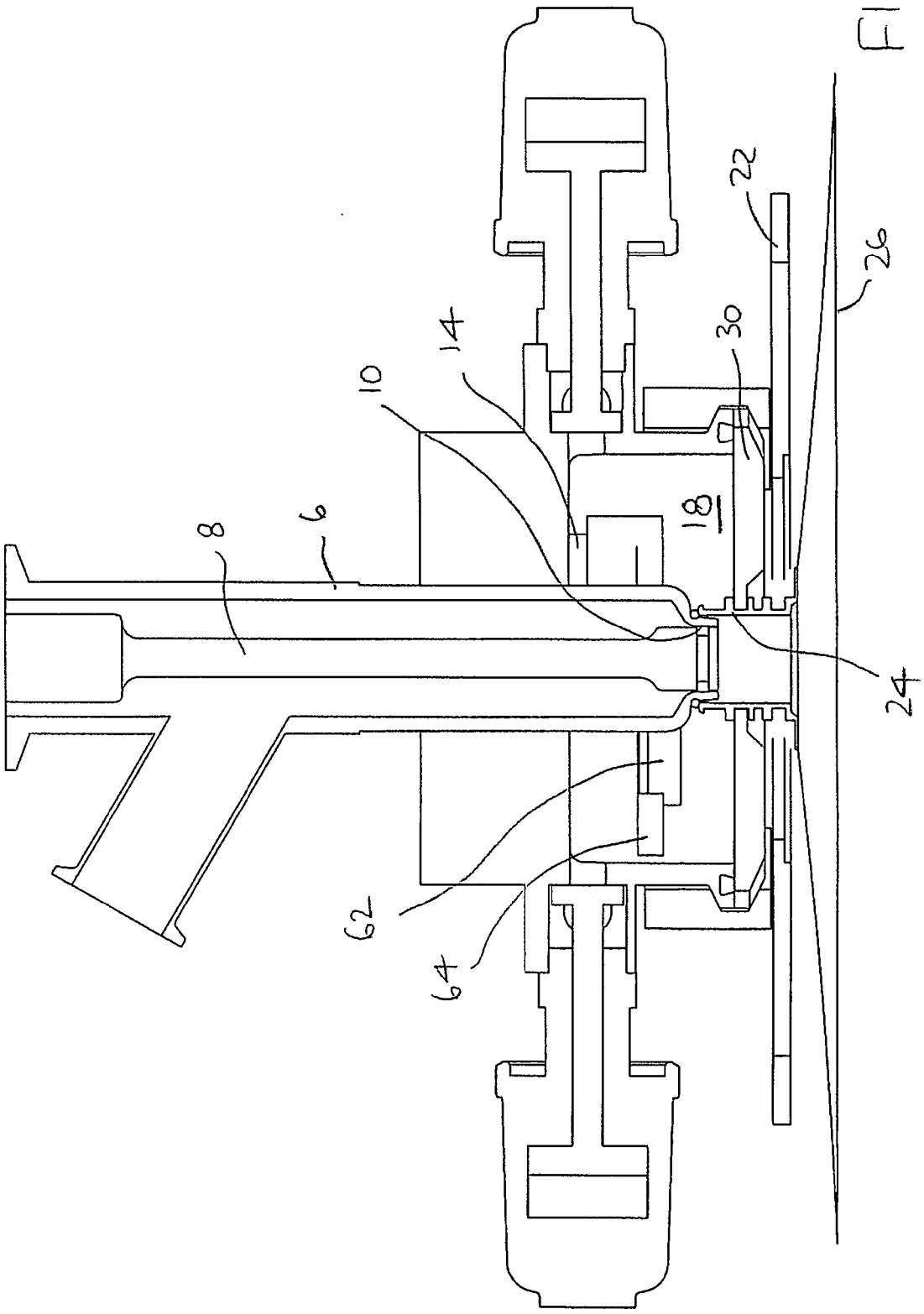
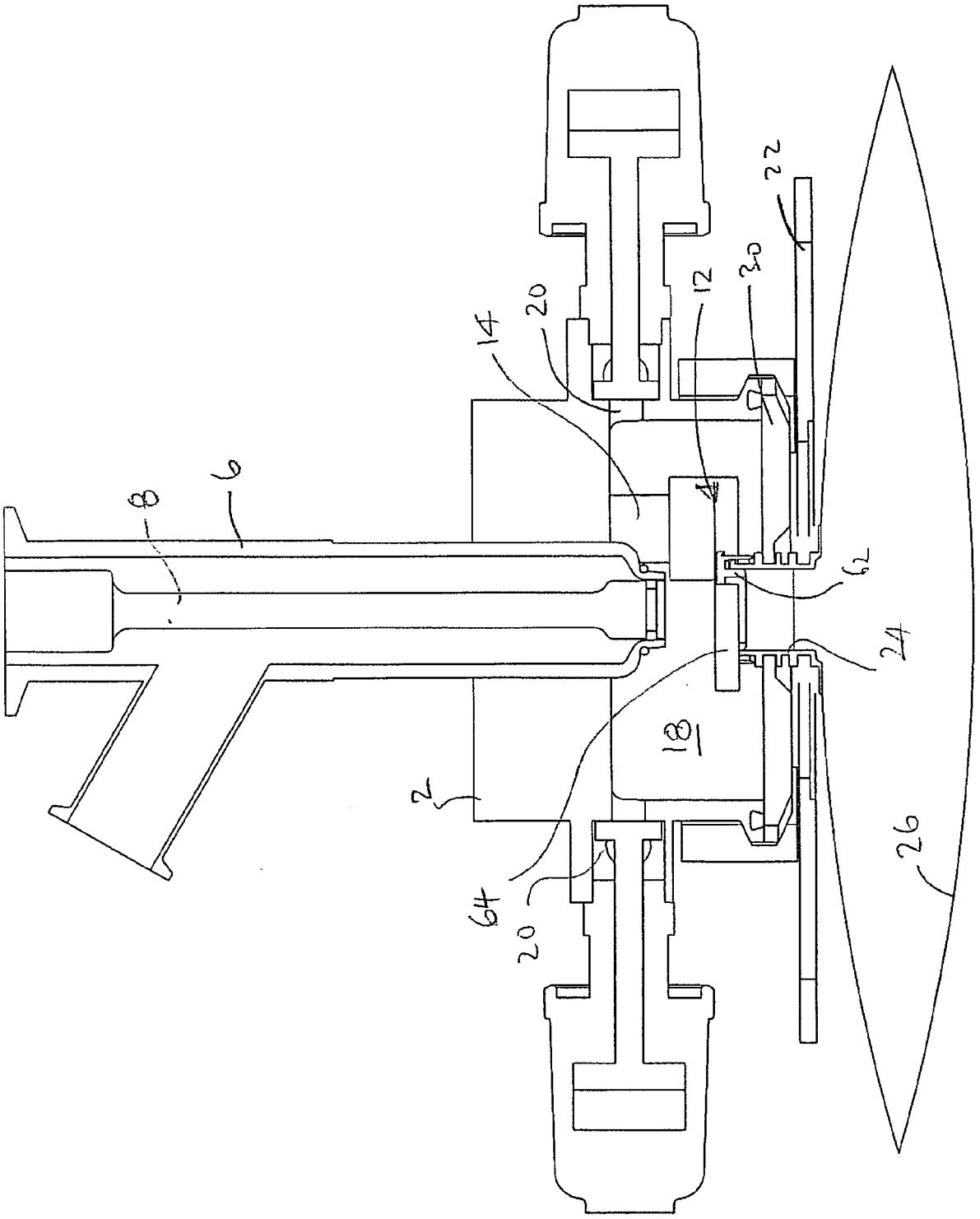


FIG. 8

FIG. 9



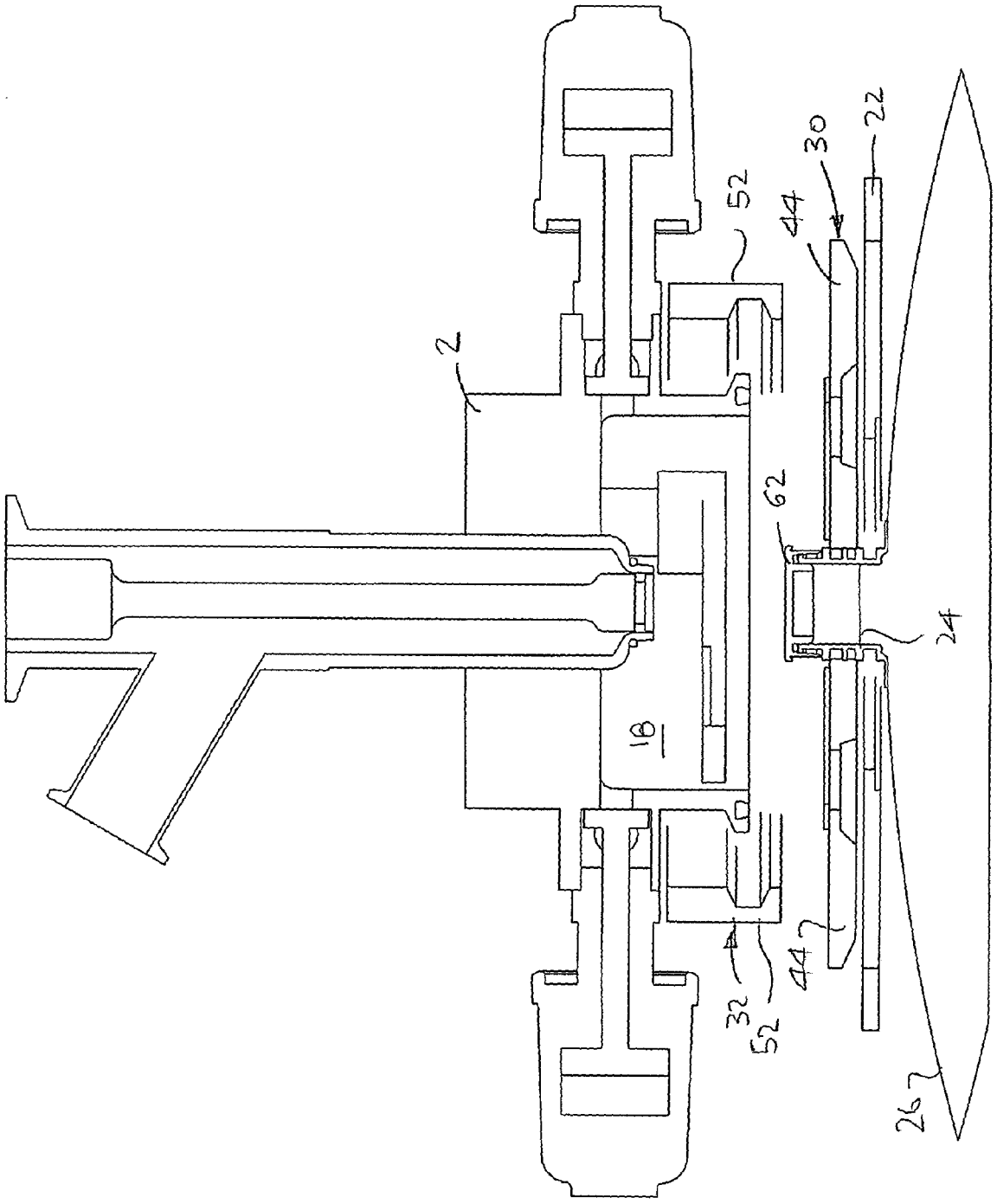


FIG. 10

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PARTIAL EUROPEAN SEARCH REPORT

Application Number EP 08 25 2812

which under Rule 63 of the European Patent Convention shall be considered, for the purposes of subsequent proceedings, as the European search report

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	EP 0 911 260 A (SASIB PROCESSING & SEAMING MAC [IT] SIG MANZINI S P A [IT]) 28 April 1999 (1999-04-28) * paragraphs [0008], [0018], [0021], [0024], [0026] - [0028]; figures *	1-10, 12-15	INV. B65B55/02 B65B55/10
X	EP 1 067 052 A (SMITH DAVID S PACKAGING [GB]) 10 January 2001 (2001-01-10) * paragraphs [0031] - [0041]; figures *	12-15	
A	US 2 787 875 A (JOHNSON ROBERT A) 9 April 1957 (1957-04-09) * the whole document *	1-10, 12-15	
A	EP 0 115 963 A (SCHOLLE CORP [US]) 15 August 1984 (1984-08-15) * the whole document *	1-10, 12-15	
A	EP 0 088 735 A (EL SRL [IT]) 14 September 1983 (1983-09-14) * the whole document *	1-10, 12-15	
	-/--		TECHNICAL FIELDS SEARCHED (IPC) B65B

INCOMPLETE SEARCH

The Search Division considers that the present application, or one or more of its claims, does/do not comply with the EPC to such an extent that a meaningful search into the state of the art cannot be carried out, or can only be carried out partially, for these claims.

Claims searched completely :

Claims searched incompletely :

Claims not searched :

Reason for the limitation of the search:

see sheet C

Place of search	Date of completion of the search	Examiner
The Hague	20 October 2008	Vigilante, Marco

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
P : intermediate document

T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
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& : member of the same patent family, corresponding document

EPO FORM 1503 03.82 (P04E07)

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PARTIAL EUROPEAN SEARCH REPORT

Application Number
EP 08 25 2812

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim
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A	DE 35 10 859 A1 (NILGEN ELMAR [DE]) 2 October 1986 (1986-10-02) * the whole document * -----	1-10, 12-15

CLASSIFICATION OF THE APPLICATION (IPC)

TECHNICAL FIELDS SEARCHED (IPC)

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EPO FORM 1503 03.82 (P04C10)

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INCOMPLETE SEARCH
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Application Number
EP 08 25 2812

Claim(s) not searched:
11

Reason for the limitation of the search:

claim refers to drawings contrary to Art.84 EPC

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 08 25 2812

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20-10-2008

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