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

(11) EP 0 879 966 A1

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
25.11.1998 Bulletin 1998/48

(51) Int Cl.[6]: **F04D 13/08**, B63B 27/24

(21) Application number: **98850085.6**

(22) Date of filing: **20.05.1998**

(84) Designated Contracting States:
AT BE CH CY DE DK ES FI FR GB GR IE IT LI LU MC NL PT SE
Designated Extension States:
AL LT LV MK RO SI

(30) Priority: **23.05.1997 NO 972359**

(71) Applicant: **FRANK MOHN FUSA A/S**
N-5670 Fusa (NO)

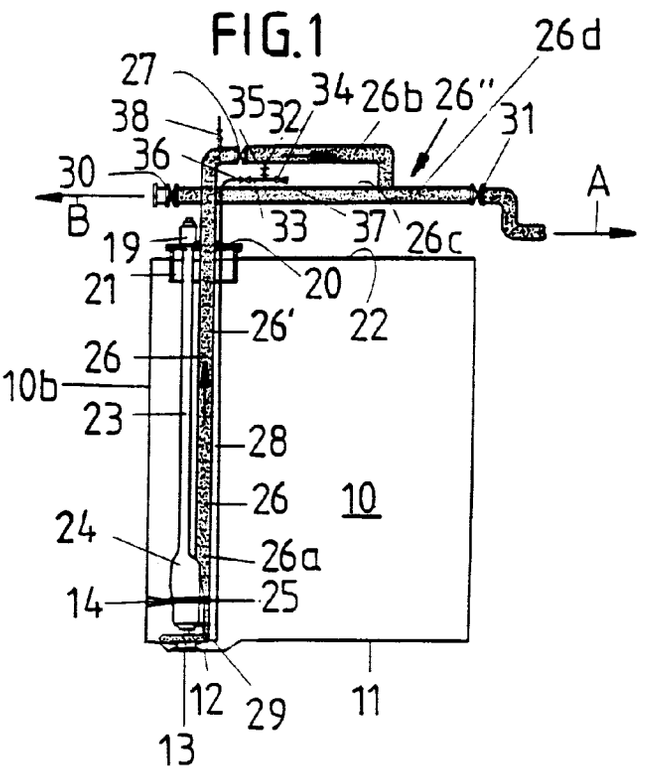
(72) Inventor: **Dalen, Erik**
5043 Hop (NO)

(74) Representative: **Wallin, Bo-Göran et al**
AWAPATENT AB,
Box 5117
200 71 Malmö (SE)

(54) Arrangement of unloading pump which is submersible in the cargo tank of a ship

(57) An unloading pump (14) is submersible in the cargo in a cargo tank (10a) of a ship. A pump inlet (13) is arranged in a well (12) at the bottom (11) of the tank (10a). The pump (14) comprises a main pump (14a) and an auxiliary pump (14b). the pump (14) has a discharge pipe (26), which is equipped with a closing valve (27). The discharge pipe (26) communicates via an outlet (29) with a stripping pipe (28), which communicates with a valve-controlled downstream delivery location (A). The stripping pipe (28) communicates with an outlet (29) in the snail housing-formed discharge portion of the pump housing. The stripping pipe (28) is equipped with a diffusor (44) for the generation of an extra pressure in the stripping pipe (28).

FIG.1



EP 0 879 966 A1

Description

The present invention relates to an arrangement of an unloading pump, which is submersible in the cargo in the cargo tank of a ship and which has a pump inlet arranged in or by a well in the bottom of the tank, where the pump comprises a main pump and an auxiliary pump, which is drive-connected to the impeller of the main pump, and where the discharge pipe of the pump is equipped with a closing valve and at least a regulating valve for the supply of (inert) pressure gas to the discharge pipe, the discharge pipe communicating via an upstream outlet with a stripping pipe, which communicates via an additional regulating valve with a downstream delivery location.

The pump according to the invention is in practice of a corresponding submersible type and has corresponding caulking and a corresponding mode of operation to that which is illustrated and described in NO 123 115.

According to known engineering practice, for example known from NO patent application 960318, cargo residues can be pressed by means of pressure gas, that is to say inert gas, from the discharge pipe via the stripping pipe to a desired delivery location in connection with a stripping function which follows a terminal unloading operation.

By means of the submerged unloading pump in the form of a hydraulic unloading pump it is possible to unload the cargo optimally with step-free capacity control of all kinds of cargo.

In pumps of the afore-mentioned kind there is employed for practical reasons an unloading pump in the form of an elongate, rigid pump arrangement, which is easily demountable, that is to say for one thing readily submergible or upwardly hoistable relative to the well at the bottom of the cargo tank. A pump impeller is employed, which is driven by a hydraulically driven motor via a short drive shaft, the pump impeller and the pump motor being adapted to be arranged just by the bottom of the ship's cargo tank.

In a practical construction the inlet to the pump is defined between the bottom of the cargo tank and the opposite lower portion of the pump arrangement. The distance between the under side of the pump arrangement and the bottom of the well of the cargo tank is adapted according to the cross-section of the flow through the pump. Normally the unloading pump can empty the cargo to a level at the under side of the pump arrangement. Consequently there remains behind a first cargo residue in the well, that is to say at the level below the under side of the pump arrangement, together with a second cargo residue remaining within the pump itself.

In practice special problems are presented in getting the final residue of the cargo emptied out, which is collected between the under side of the pump arrangement and the bottom of the cargo tank and in addition problems are presented in getting the final portions of the cargo removed which are collected in the pump in a terminating phase of the stripping operation.

With the present invention the aim is to arrange the conditions so that there can be removed the largest possible quantity of the cargo residues which have had to remain in the pump arrangement after the conclusion of the usual unloading operation.

There have been employed hitherto, as for example is shown in NO 174 460, separate suction arrangements for the collection of such residues of the cargo, that is to say special suction arrangements, which operate independently of the unloading pump. Consequently it is possible to suck up the residues by means of separate suction arrangements with separate drive means, but this requires extra piping and extra cleaning of this additional equipment, something which creates extra complications. In practice such suction arrangements are placed on the outer side of the pump arrangement as a separate unit. With particular types of cargo, for example with especially poisonous cargo types, such as prussic acid, such separate suction arrangements are complicated in use, as a consequence of the special characteristics of the cargo and the need for protection against poisoning and the need for complete cleaning of the equipment after use.

Alternatively stripping arrangements have been employed, corresponding to the stripping arrangement which is applied according to the invention. Such stripping arrangements operate partially together with and partially independently of the unloading pump. By means of such stripping arrangements it has been possible to effect the cleaning in a controlled accurate and effective manner together with the unloading pump.

By means of such stripping arrangements per se it has been usual, while the pump is kept in operation at a certain pump pressure against residual cargo internally in the pump, to blow the remains of the cargo by means of pressure gas (inert gas) from the discharge pipe of the pump via an associated stripping pipe to a suitable delivery location via the upper deck of the ship. This requires especially in the closing phase of the stripping operation that the pump pressure is balanced relative to the supply of inert gas (pressure gas). Such balancing of the pressure conditions becomes the more difficult the closer the pump housing one places the outlet from the discharge pipe to the stripping pipe.

The present invention takes particular aim to apply a stripping technique known per se for removing the residues of cargo from the pump and during this remedy the problem with balancing the pressure conditions at the outlet to the stripping pipe, including the supply of inert gas and the supply of pressure medium from the impeller of the pump.

It is proposed in NO patent application 960318 to arrange the outlet from the discharge pipe to the stripping pipe at a height level just above the pump, that is to say in the discharge pipe just above its joint with two branch pipes, which extend obliquely upwards from their

respective diametrically opposite sides of a snail housing-shaped pump housing. In a stripping phase the stripping pipe can hereby be supplied pump medium collected from each of the branch pipes at said height level above the pump.

In order to ensure that a largest possible quantity of the pump medium can be supplied from the well in the bottom of the cargo space to the main pump there is employed in NO patent application 960318 an auxiliary pump which projects a distance below the under side of the impeller of the main pump and which delivers pump medium to a level above the under side of the impeller of the main pump.

With the present invention the aim is to fetch out the pump medium from a lower level in the discharge pipe than proposed according to the afore-mentioned patent application 960318. This involves certain problems in connection with the conditions of flow occurring in the gas/fluid mixture in the snail housing-formed passage portions of the pump housing and following from this, pressure conditions specifically occurring in and at the pump housing. The pressure conditions in and at the pump housing are influenced to a decisive degree by the excess pressures which arise in the discharge pipe in front of the closing valve or in the discharge pipe behind the closing valve.

With the present invention the aim is to relieve the afore-mentioned problems.

The arrangement according to the present invention is characterised in that the outlet of the stripping pipe, which is arranged at a first, lower height level, communicates with the discharge pipe just by the pump housing or with the pump housing in the snail housing-formed discharge portion of the pump housing, and that the stripping pipe is equipped at a second height level just above the first height level with a diffusor for the generation of an extra pressure in the upstream end of the stripping pipe downstream of the diffusor.

By arranging according to the invention the outlet of the stripping pipe at a first, rather low level in the pump arrangement, that is to say in or just by the snail housing-formed discharge portion of the pump housing, there is the possibility to limit the residual amount of pump medium in the discharge pipe to a minimum in the last phase of the stripping phase. In the final phase of the stripping operation one has thereby been able to work with a relatively small quantity of pump medium and in the final phase one has been able to limit the stripping to a local, smaller region of the pump housing and by the immediately adjacent portion of the discharge pipe. Even by arranging the outlet from the discharge pipe to the stripping pipe at a low level in the pump arrangement, this involves having been able to ensure an effective emptying of pump medium which finds itself internally in the pump arrangement.

The afore-mentioned effective emptying of pump medium which finds itself internally in the pump arrangement is made possible by generating extra pressure in the stripping pipe via the upper conical portion of said diffusor.

In said portion the speed is reduced by virtue of an increase of the cross-section. The reduced speed causes the pressure to rise, the product of the pressure and the speed being approximately constant. In this way a pressure-controlled inlet of pump medium can be ensured from the low level in the pump arrangement to the stripping pipe in a simple and ready manner, in spite of the excess pressure which prevails beforehand partly in the discharge pipe of the pump upstream relative to the stripping pipe and partly in the stripping pipe downstream of the diffusor.

By generating extra pressure in the stripping pipe, it has been found surprisingly that significant portions of the remainder of the pump medium in the discharge pipe can be emptied more or less independently of how low down towards the pump housing the discharge from the discharge pipe to the stripping pipe is arranged. This means that in practice the last-mentioned discharge can be arranged at the constructional and operatively advantageous location in the pump arrangement as required.

The pump arrangement according to the invention is further characterised in that the stripping pipe communicates only with the one of two separate branch pipes of the discharge pipe from the snail housing-formed discharge portion of the pump housing.

According to NO patent application 960318 the outlet to the stripping pipe was localised just above the location of the connection between the two separate branch pipes for emptying these all together. It has been found surprisingly, according to the invention, that the stripping pipe can be connected with only the one of the two branch pipes which connect the pump housing with the discharge pipe, without this having significant consequences for the stripping effect.

In practice it has been found to be of significance that an outlet from the discharge pipe is arranged in the pump housing in a convexly curved portion of the snail housing-formed passage of the pump housing, so that the relatively heavy fluid portions of the gas/fluid mixture are adapted to be slung against said convexly curved portion and via this portion are led via the outlet to the stripping pipe. However it has also been found that even at a level just above such a convexly curved portion a correspondingly effective effect can be obtained.

By the last-mentioned solution it can be ensured at the same time that the gas/fluid mixture can have a relatively short route from the impeller of the pump via said outlet to the stripping pipe.

Further features will be evident from the following description having regard to the accompanying drawings, in which:

Fig. 1 shows schematically a pump arrangement according to the invention submerged in the cargo of a ship's tank, illustrated in connection with a usual unloading operation.

Fig. 1a - 1c show different stripping phases in continuation of the unloading operation as indicated in Fig. 1.

Fig. 2 shows in side view a section of a lower portion of the pump arrangement according to Fig. 1.

Fig. 3 shows in vertical section the pump rotor of the pump arrangement and illustrates in addition details according to the present invention.

Fig. 4 shows in a side view, correspondingly as shown in Fig. 2, an alternative placement of the outlet from the discharge pipe to the stripping pipe.

Fig. 5 shows in a side view correspondingly as shown in Fig. 2, a further construction with the alternative placement of the outlet from the discharge pipe to the stripping pipe.

By way of introduction there shall be described with reference to Fig. 1 and Figs. 2 and 3, a pump arrangement of known construction, which constitutes the position of engineering practice relative to the present invention and thereafter the solution according to the invention shall be described with reference to the same Figures.

The pump according to the present invention is of a corresponding submersible type and has corresponding caulking and a corresponding mode of operation to that which is illustrated and described in NO 123 115.

In Fig. 1 a cargo tank 10 is shown in a ship, where the bottom 11 of the tank 10 is illustrated, which is equipped with locally defined tank well 12, in which there is submerged a lower end of a pump 14, that is to say inlet end 13 of the pump 14. The pump 14 is adapted to operate submerged in the cargo in the tank 10 in a relatively free downwardly hanging condition, with local, centering side supports, not shown further, which are arranged at suitable height levels in the cargo tank, for example along the one tank wall 10b.

The tank well 12 is given an optimal design with respect to the collection of and flow of cargo to the pump. In this connection the well 12 is given a concavely rounded form, such as shown in Fig. 2.

According to the invention weight is placed on the usual unloading operation taking place under optimal conditions and the remaining, following operations having to be adapted to existing unloading equipment. The stripping operation is consequently undertaken in a manner which is adapted to the equipment and the arrangement which is used in the preceding unloading operation.

In Fig. 2 and 3 a pump 14 is shown in the form of a main pump 14a and an auxiliary pump 14b. The main pump 14a comprises an impeller 15, which is received in a snail housing-like pump housing 16. The auxiliary pump 14b is fastened in drive connection to impeller 15 of the main pump.

The pump housing 16 is freely axially movable relative to the well 12 and is centered relative to this by means of a combined support/guide ring and splash shield 16a, which is fastened with lugs 16b to bottom 11 of the tank 10 just by the tank well 12. At 16c there is illustrated an inverted funnel-shaped guide shield fastened to the pump housing 16 just beneath the lower edge 15a of the impeller 15.

The impeller 15 is driven via a short drive shaft 17 by means of a high pressure hydraulic drive motor. The drive motor is connected to a remotely disposed source of pressure medium (not shown) via a coupling means 19 on the deck 22 of the ship, by means of supply and discharge conduits (not shown further) for hydraulic drive medium. The coupling means 19 is placed on a hatch cover 20, which covers a hatch opening 21 on the deck 22 of the ship. The supply and discharge conduits in the illustrated embodiment are surrounded by a common shield pipe 23, while the drive motor is surrounded by an outer shield housing 24, in order to prevent any form of leakage of drive medium into the cargo, and vice versa, such as shown in NO 123 115. The combination of main pump and auxiliary pump is moreover based on a corresponding arrangement as illustrated in NO patent application 960318.

From two diametrically opposite sides of the pump housing 16 there converges a respective one of two branch pipes 25 upwardly towards a transition portion 26a of a common cargo discharge pipe 26. Also this arrangement is correspondingly as shown in NO patent application 960318. In Fig. 2 there is only illustrated the one 25 of the two branch pipes, the other branch pipe being arranged in a manner not shown further on the diametrically opposite side of the pump 14.

The discharge pipe 26 and the shield pipe 23 of the hydraulic supply and discharge conduits separately pass through the cover 20. The discharge pipe 20 extends further to a suitable discharge location, as shown by an arrow A, on deck 22 of the ship.

In the discharge pipe 26 there is inserted a first closing valve 27, which is closed on the termination of the usual unloading operation. The discharge pipe 26 becomes hereby closed off into two separate portions 26', 26", comprising a first portion, that is to say an upstream portion 26', which is mainly arranged in the cargo tank 10, and a second portion, that is to say a downstream portion 26b, which is arranged over deck 22 of the ship. On turning off the valve 27 a certain amount of cargo is thereby held back in the discharge pipe 26 on the upstream side of the valve 27 in the pipe portion 26' to just above the impeller 15. Correspondingly there is held back a remaining amount of cargo in the discharge pipe 26 on the downstream side of the valve 27 in the pipe portion 26".

In Fig. 1 the pipe portion 26" is shown in the form of a three branched conduit comprising a first, upper, horizontal section 26b, a second, lower horizontal section 26c and a third, lower horizontal section 26d, which join in a T-shaped connection.

The first section 26b is defined relative to the pipe portion 26' by means of the first closing valve 27. The second section 26c is defined by means of a second

closing valve 30 relative to a reject tank or like delivery location, as shown by an arrow B.

The third section 26d is defined by means of a third closing valve 31 relative to a goose neck-formed discharge section, which extends to the delivery location, as shown by the arrow A.

Just behind the first closing valve 27 the first section 26b is branched off via a T-shaped transition portion with a vertical branch portion 32 and two horizontal branch portions 33,34. The branch portion 33 is adapted to communicate with a source of pressure gas, that is to say an inert gas source, as indicated by an arrow C, while the branch portion 34 is adapted to communicate with the stripping pipe 28. A first regulating valve 35 is arranged in the branch portion 32, a second regulating valve in the branch portion 33 and a third regulating valve 37 in the branch portion 34.

The cargo residue which remains behind in the portion 26" is removed separately to a remotely disposed discharge location, as indicated by the arrow A, by opening the valves 35 and 37 and pressing the cargo residue to the discharge location by means of inert gas.

As long as the pump goes, the impeller 15 will provide for a sufficient pump pressure against the cargo residue in the pipe portion 26', in order to counteract emptying of this cargo residue back to the tank well 12.

The cargo residue which remains behind in the pipe portion 26' when the valve 27 is closed, or the cargo residue, which remains behind in the tank well 12, is thereafter removed by means of a stripping operation.

In order to supply extra cargo residue from the well 12 to the impeller 15 of the main pump 14a provision is made for said auxiliary pump 14b to project downwards in the well 12 a distance below impeller 15 of the main pump 14.

The auxiliary pump 14b is made with an especially simple construction and is manufactured from a plane steel plate, which is press-formed to a part-conical outline, As shown in Fig. 3 there is formed a part-conical casing having a substantially uniform wall thickness. In the finally fashioned casing there are drilled in the upper portion of the casing a number (for example six or seven) of flow through openings 18 (of which only two are shown in Fig. 3). During rotation of the impeller 15 pump medium will be led internally in the auxiliary pump 14b, that is to say along the upwardly diverging inner surface of the casing and further outwards through the openings 18, correspondingly as illustrated and described in NO patent application 960318. The openings 18 extend obliquely upwards and outwards to a level above the lower portion 15a of the impeller 15, so that the pump medium which is delivered from the auxiliary pump 14a with certainty can be caught by impeller blades 15b of the main pump 14.

It is preferred in practice to carry out the stripping operation in the following phases in continuation of the unloading phase, as shown in Fig. 1 :

1) At the close of the usual unloading operation the closing valve 27 in the discharge pipe 26 is closed, so that this is divided into a first discharge portion 26' and a second discharge portion 26", such as shown in Fig. la. Thereafter the pump is stopped. The pump medium, which then finds itself in the first discharge portion 26' is thereafter emptied from the pump outwards at the bottom 11 of the tank 10. This occurs by supplying inert gas to the discharge pipe 26 just in front of the closing valve 27 via a fourth regulating valve 38.

2) The pump medium, which then finds itself in the second discharge portion 26", is thereafter emptied to the discharge location, as shown by the arrow A, by the supply of inert gas via the valves 37 and 35 to the pipe portion 26b just behind the closing valve 27. Thereafter the second discharge portion 26" - with the closing valve 31 in the closed position - becomes vented and pressure - relieved to the tank 10 via the stripping pipe 28, such as shown by an arrow D in Fig. 1b. Meanwhile provision is made for the valve 37 to be closed and the valves 35,36 to be open.

3) Thereafter the pump 14 is started anew with the valves 35 and 36 in the open position. On opening the valve 38 inert gas is supplied to the vertical portion 26' of the discharge pipe 26 just in front of the closing valve 27. Thereby provision is made for pressing the pump medium, as shown by an arrow E, from the vertical portion 26' of the discharge pipe 26 via the discharge 29 to the stripping pipe 28 and therefrom further, as shown by an arrow F, to the discharge location A.

As shown in Fig. 3 outlet 29 of the stripping pipe 28 is designed according to a first embodiment in a convexly curved portion 39 in the snail housing - formed pump housing, that is to say in a radially outer wall portion 40 of a housing portion which extends obliquely upwards in a helical contour. Consequently the outlet 29 is arranged in a portion of the pump housing 16 where the pump medium (gas/fluid mixture) is slung with great force radially outwards and obliquely upwards, by means of the feeding pressure from the impeller 15.

The outlet 29 is localised to a first level just above the impeller 15. The outlet 29 is illustrated with a cross-sectional area, which is correspondingly large or larger than the internal pipe cross-section of the stripping pipe 28. However the outlet 29 can have a cross-sectional form deviating from the general cross-sectional form of the stripping pipe, and for example the outlet 29 can have a larger dimension in the lateral direction than in the height direction, or vice-versa, the cross-sectional form being dependent upon the exact placement in the snail housing-formed pump housing. From the outlet 29 the stripping pipe 28 extends with a slightly curved contour 41 obliquely upwards to and through an anchoring plate 42. Just above the anchoring plate 42, that is to

say at a second level above the first level a diffusor 44 is inserted in the stripping pipe 28.

The diffusor 44 is shown with a relatively short upstream portion 45 having an upwardly converging wall surface, a subsequent relatively short middle portion 46 having a cylindrical wall surface and an elongate downstream portion 47 having an upwardly diverging wall surface. The pump medium achieves as a consequence of the local narrowing of the pipe cross-section in the upstream portion 45 an equivalent increase in the speed of movement in the transition portion 46 and simultaneously a pressure drop following from this. In the continuation there will be generated in the downstream portion 47 an extra pressure or an equivalently reduced speed of movement in the pump medium, as a consequence of the gradually increasing pipe cross-section in the portion 47. By means of the pressure which is generated in the diffusor portion 47, one hereby has the possibility of ensuring that the pump medium is led in a pressure-controlled manner from the discharge pipe inwardly into the stripping pipe and further to the downstream portion 26" of the discharge pipe against the static pressure which prevails in this portion.

Gradually as the stripping operation proceeds forward the supply of inert gas from the valve 38 can be throttled. After the termination of the stripping operation the valve 36 is closed and the valve 37 is opened in order to blow the cargo residues from the downstream portion 26" to the discharge location as shown by the arrow A.

In practice the pump impeller has been allowed to rotate with an optimal rotational speed, especially in the final phase of the stripping operation, in order to ensure thereby that sufficient pressure medium is supplied inwardly into the pump housing to be able to balance inert gas supplied from the valve 38 and the counter - pressure which prevails in the downstream portion 26" of the discharge pipe 26. This gives an extra pump effect, as a consequence of the short distance from the pump housing 16 to the stripping pipe 28. In practice there is a question of a time aspect in connection with the stripping process and a question of a suitable use of inert gas relative to the use of pressure medium which is supplied from the impeller of the pump. During the stripping process there is established a certain overheating of the pump medium.

If desired the pressure from the downstream portion 26" of the discharge pipe can be diverted to the tank 10 or to the discharge location A by means of an extra (not shown further) valve arranged in the downstream portion 26" of the discharge pipe 26.

In Fig. 4 there is shown in an alternative construction an outlet 29' arranged at a somewhat higher level than the outlet 29 as shown in Fig. 2 and 3. More specifically the outlet 29' is placed in one branch pipe 25a of the discharge pipe 26 just above a flange joint 50 between upwardly curved portion 39 of the pump housing 16 and the branch pipe 25a flush therewith. Peripherally relative to the discharge pipe 26 the outlet is arranged vertically above the convexly curved portion 40 of the pump housing 16. Practical tests have shown that as regards arrangement an advantageous placement of the outlet 29' can be obtained, such as shown in Fig. 4, without this significantly influencing the emptying effect relative to that which is achieved according to the construction according to Fig. 2 and 3.

In Fig. 4 there is indicated by arrows 51 a counterpressure which is exerted by inert gas, which is supplied from the upper end of the discharge pipe 26, for balancing the pressure of the pump medium which is generated by the impeller of the pump. By an arrow 52 the flow direction of the pump medium is illustrated upwardly through the stripping pipe.

In Fig. 5 there is illustrated a further alternative construction where the outlet 29' is arranged in the branch pipe 25a correspondingly as shown in Fig. 4. In Fig. 5 the diffusor 44 is arranged closely up to the outlet 29' and extends relatively steeply upwards from the outlet 29', that is to say at a relatively acute angle to the adjacent branch pipe 25a, so that the stripped medium can be led relatively unhindered inwardly into the stripping pipe and be subjected to minimum deflection from the branch pipe 25a to the stripping pipe 28'.

Claims

1. Arrangement of unloading pump (14), which is submersible in the cargo in a cargo tank (10a) of a ship and which has a pump inlet (13) arranged in or at a well (12) at the bottom (11) of the tank (10a), where the pump (14) comprises a main pump (14a) and an auxiliary pump (14b), which is drive-connected to impeller (15) of the main pump (14a), and where discharge pipe (26) of the pump is equipped with a closing valve (27) and at least a regulating valve (38) for the supply of (inert) pressure gas to the discharge pipe (26), the discharge pipe (26) communicating via an upstream outlet (29) with a stripping pipe (28), which communicates via an additional regulating valve (35) with a downstream delivery location (A),
characterised in that

   outlet (29,29') of the stripping pipe (28), which is arranged at a first, lower height level, communicates with the discharge pipe (26) just by the pump housing (16) or with the pump housing (16) in the snail housing-formed discharge portion (39) of the pump housing, and
   that the stripping pipe (28) at a second height level, just above the first height level, is equipped with a diffusor (44) for the generation of an extra pressure in the stripping pipe (28) downstream of the diffusor (44).

2. Arrangement in accordance with claim 1,

characterised in that the stripping pipe (28) communicates only with the one of two separate branch pipes (25) of the discharge pipe (26) from the snail housing-formed discharge portion of the pump housing (16).

3. Arrangement in accordance with claim 1, characterised in that the outlet (29) is arranged in the pump housing (16) in a convexly curved portion (39) of the snail housing-formed discharge portion of the pump housing, so that relatively heavy fluid portions of the gas/fluid mixture are adapted to be slung against said convexly curved portion (39) and via said curved portion (39) are led via the outlet to the stripping pipe (28).

4. Arrangement in accordance with claim 3, characterised in that the outlet (29) is arranged in a radially outer wall portion (40) of said curved portion (39).

5. Arrangement in accordance with claim 1, characterised in that the outlet (29') is arranged just above the pump housing (16) substantially vertically above a convexly curved portion (39) of the snail housing-formed discharge portion of the pump housing, so that relatively heavy fluid portions of the gas/fluid mixture are adapted to be slung against said convexly curved portion (39) and via said curved portion (39) are led via the outlet to the stripping pipe (28) .

FIG.1

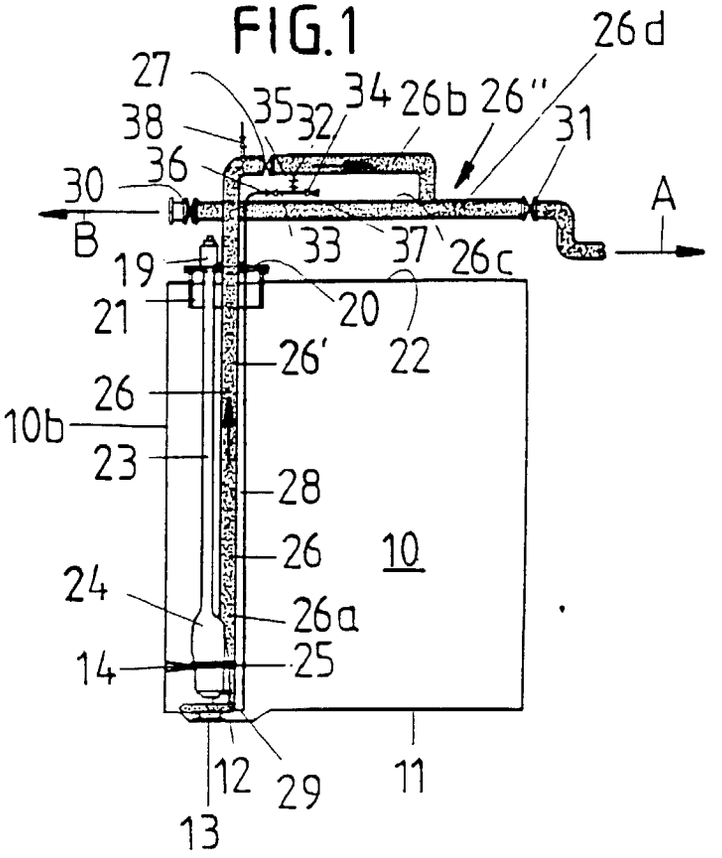

26d
27
35
34
26b
26''
38
32
31
36
30
A
B
33
37
26c
19
20
21
22
26'
26
10b
23
28
26
10
24
26a
14
25
12
29
11
13

FIG.1a

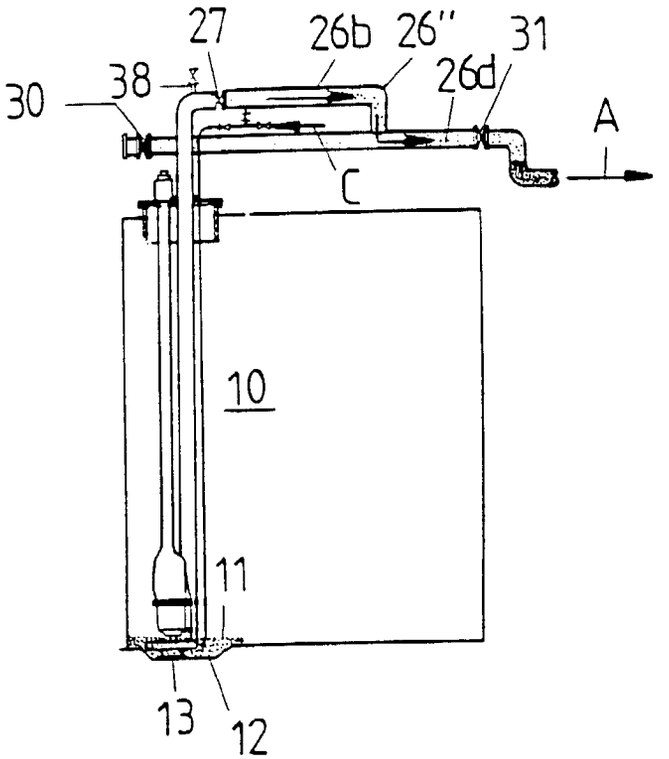

27
26b
26''
31
38
26d
30
A
C
10
11
13
12

FIG.1b

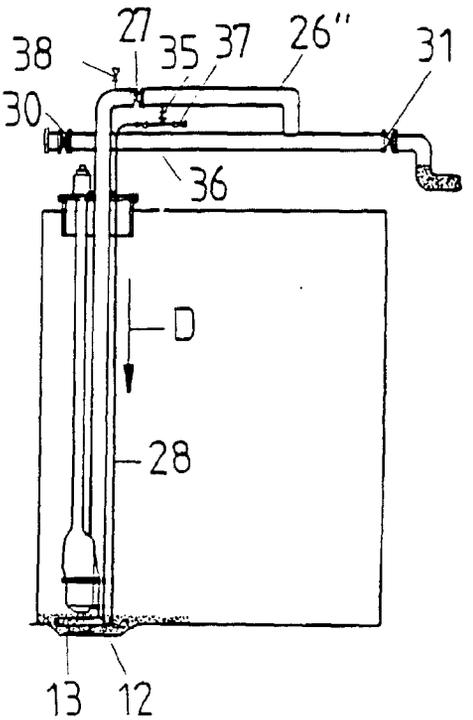

38
27
35
37
26''
31
30
36
D
28
13
12

FIG.1c

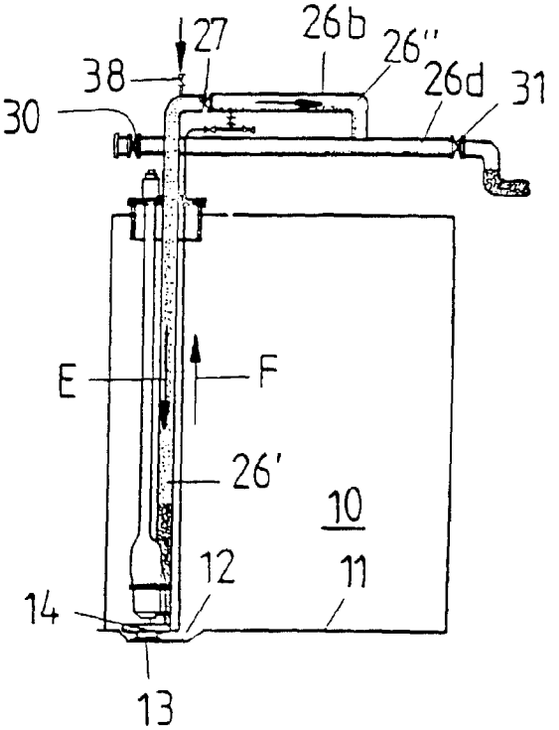

27
26b
26''
38
26d
31
30
E
F
26'
10
11
12
14
13

FIG. 2

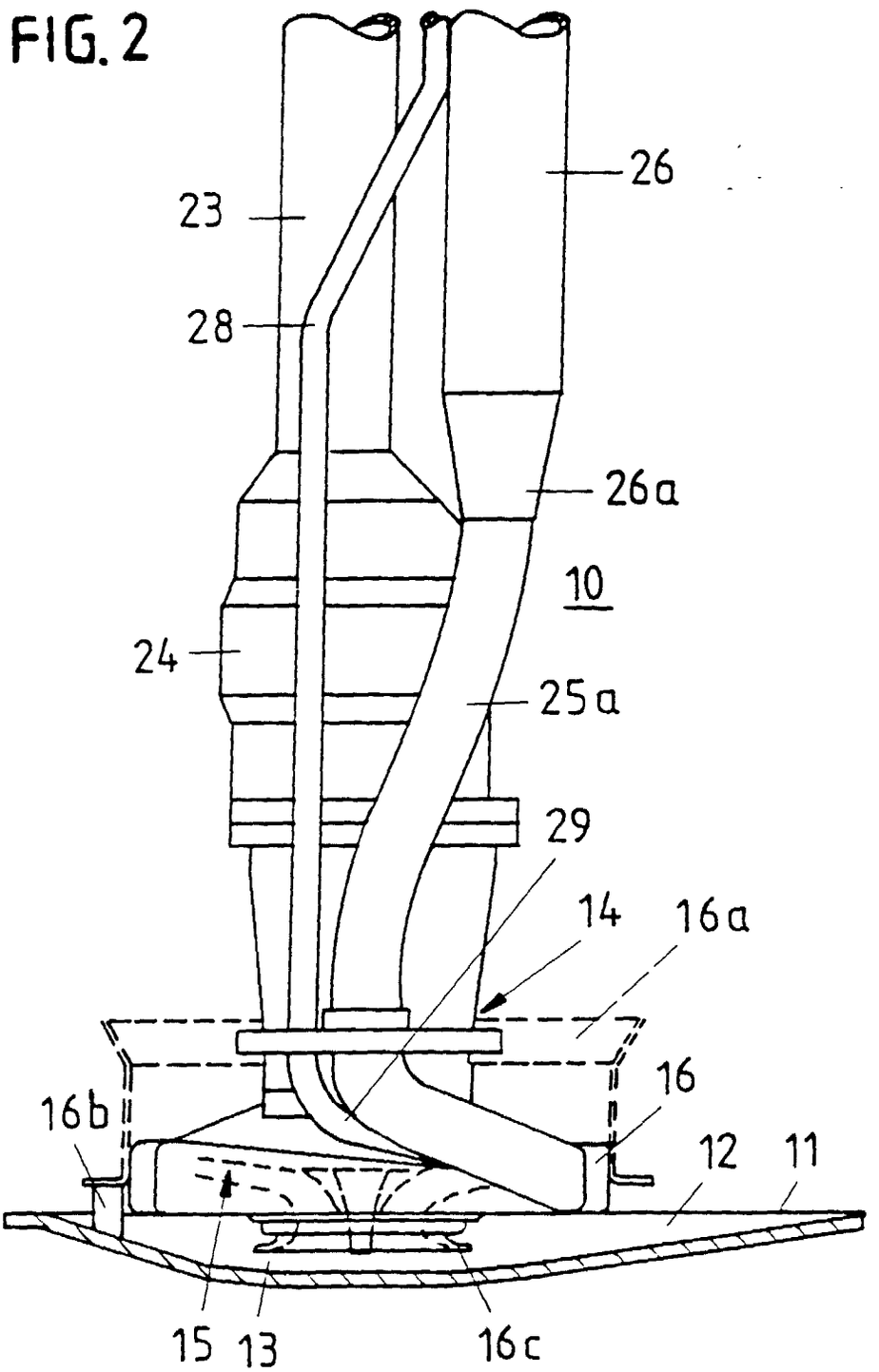


FIG. 3

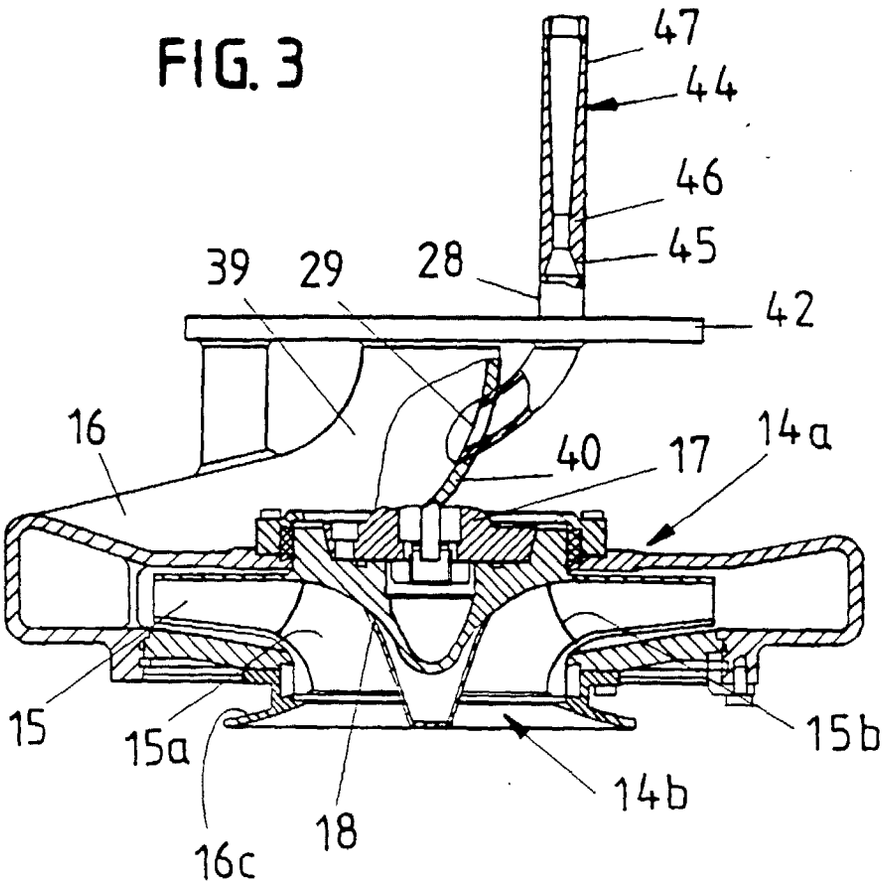


FIG. 4

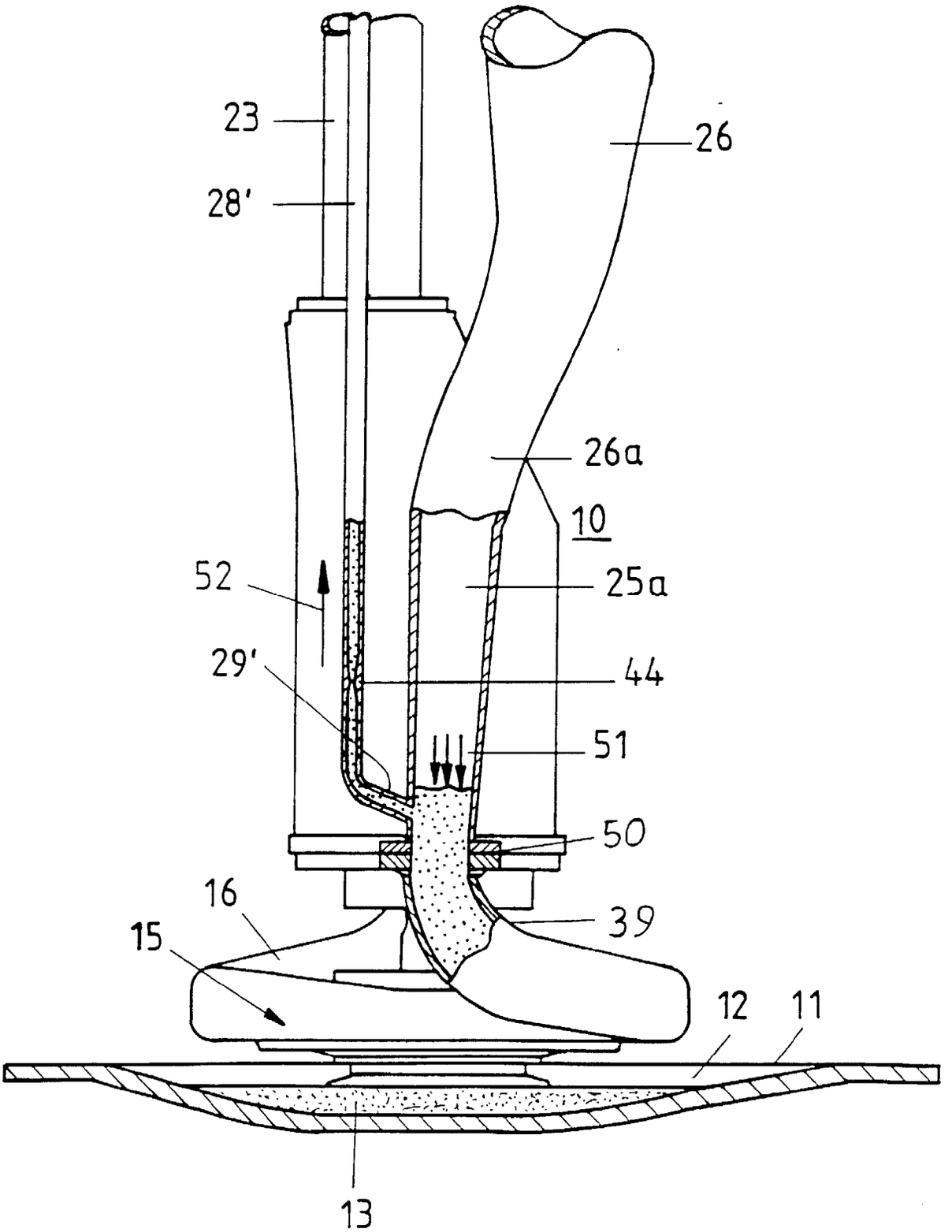
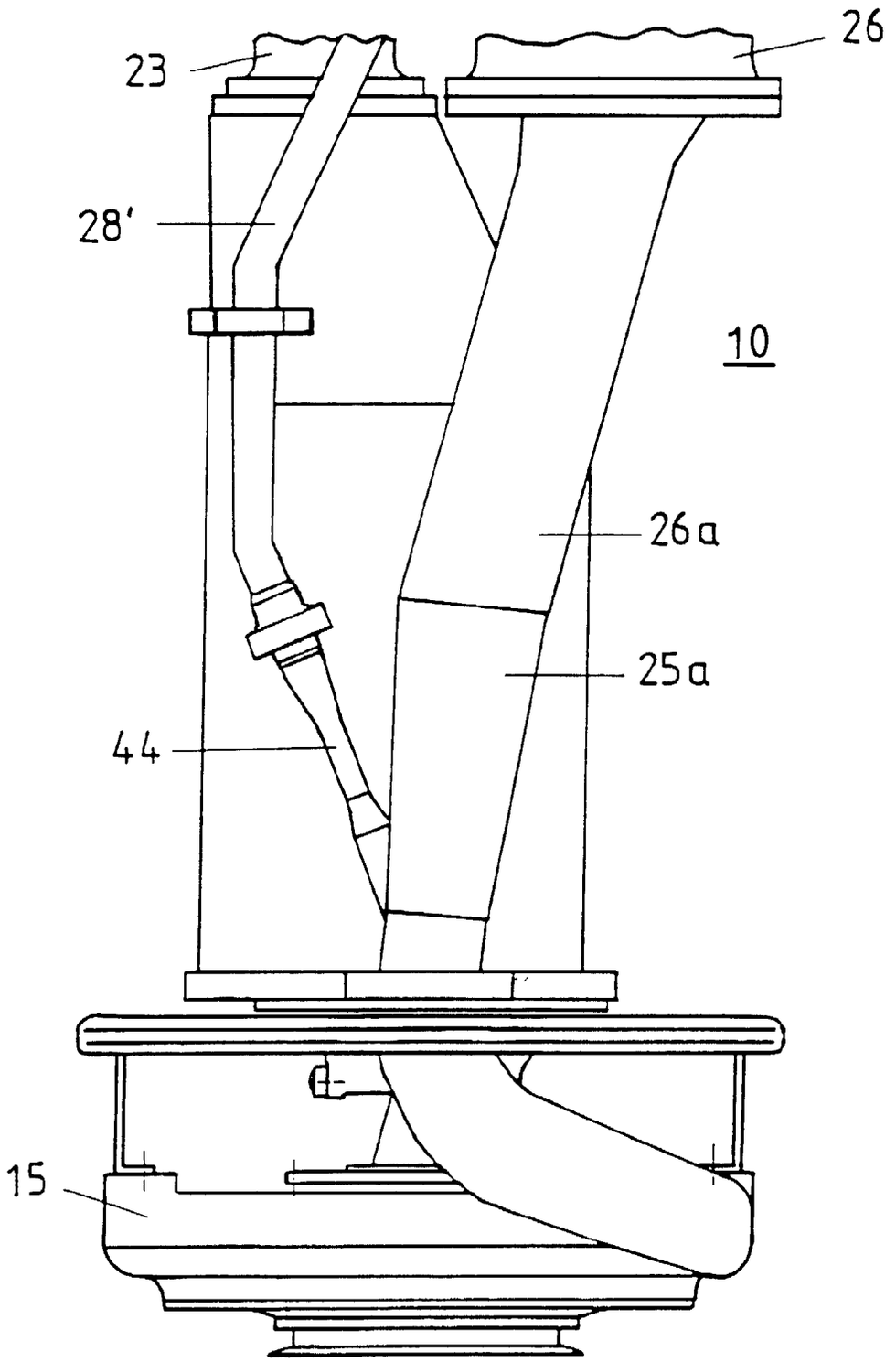


FIG. 5



European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 98 85 0085

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
A	WO 97 06050 A (FRANK MOHN FUSA A S ;FAEREVAAG GORM (NO)) 20 February 1997 * page 6, line 21 - page 11, line 37 * * page 12, line 27 - line 36; figure 5 *	1-5	F04D13/08 B63B27/24
A	"Liquid cargo handling - a trend towards submerged pumps" THE MOTOR SHIP, vol. 68, no. 810, 1 January 1988, pages 40-41, XP002075796 * figures P40,TRIGHT *	1-5	

TECHNICAL FIELDS SEARCHED (Int.Cl.6)

F04D
B63B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	28 August 1998	Ingelbrecht, P

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
L : document cited for other reasons

& : member of the same patent family, corresponding document

EPO FORM 1503 03.82 (P04C01)