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

(11) EP 1 479 919 B1

(12) **EUROPEAN PATENT SPECIFICATION**

(45) Date of publication and mention of the grant of the patent:
05.04.2006 Bulletin 2006/14

(21) Application number: **04010771.6**

(22) Date of filing: **06.05.2004**

(51) Int Cl.:
F04D 31/00 *(2006.01)* ***F04D 29/00*** *(2006.01)*
F15D 1/02 *(2006.01)* ***F15D 1/04*** *(2006.01)*

(54) **Convertible transfer pump**

Konvertierbare Förderpumpe

Pompe fluidique convertible

(84) Designated Contracting States:
AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HU IE IT LI LU MC NL PL PT RO SE SI SK TR
Designated Extension States:
HR

(30) Priority: **20.05.2003 IT TV20030077**

(43) Date of publication of application:
24.11.2004 Bulletin 2004/48

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(56) References cited:
CH-A- 237 063
US-A- 3 689 237
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Description

[0001] The present invention refers to apparatuses used to blow gases under pressure into a food-grade liquid during a clarification process. For mere reasons of greater simplicity, reference will be made to must in the following description as a non-limiting example of a food-grade liquid to be clarified.

[0002] The most relevant state of the art to be considered in connection with the present invention may be reasonably assumed to be represented by the disclosure in the Italian patent IT-A-1 279 262, filed on February 3rd, 1995 in the name of the same Applicant. In particular the preferred embodiment considered therein (schematically illustrated in Figure 4 of said prior-art patent publication and reproduced here as Figure 1 with some amendments in the reference numerals) consists of an apparatus comprising :

- a first tank or reservoir 112 containing must, which is conveyed via a conduit 118 to the suction or intake side of a first rotary pump 120;
- a second tank 136 where colloid absorbing and thickening materials 134, such as bentonites are stored under stirring conditions by generally known stirring means 139 driven by a motor 138, the said materials 134 being subsequently transferred into the body of said first rotary pump 120 via a flowpath that is constituted, in the order given below, by
    - a conduit 132 between the second tank 136 and the intake side of a positive-displacement pump 130,
    - a further conduit 146, provided with a check valve 128, which branches off the delivery side of the above-mentioned pump 130, and
    - a nozzle 126 attached to the body of the rotary pump 120, this being effective in ensuring a thorough mixing of the must with the colloid absorbing and thickening materials 134 within said pump body;
- a flow control valve 140 installed on a conduit 141 that branches off the delivery side of the pump 120 and leads to the intake side of a second rotary pump 144 the liquid mixture formed by the must and the materials 134, upon a gas (e.g. air) having been added to the same mixture at an intermediate fitting 146, the gas obviously being added at a pressure equal to the outlet pressure of the valve 140. The gas is intended to facilitate solid or colloidal particles in the must to uprise during the subsequent fermentation phase and is supplied via a conduit 143, from a compressor 160 or, as an alternative thereto, from a gas cylinder 166. The gas needs to be be suitably and correctly metered through a pressure control valve 148 and a flow-rate meter 150, in order to produce bubbles of given, controlled size in the liquid mixture formed by must and colloid absorbing and thickening materials 134 inside a saturation cell 174 that is provided downstream of said second pump 144 and is in communication with the fermentation tank (not shown).

[0003] The above description gives a general idea of the actual complexity, from a construction point of view, of conventional apparatuses used to clarify must and other food-grade liquids through flotation, a complexity that translates, in particular, into the need for a number of dedicated component parts to be used and carried on stock, which do not find any other use except this one. The attention is in particular drawn to those parts of the apparatus, which are used to raise the pressure of the above-mentioned gas to be added to said mixture of must and absorbing and thickening materials, as well as to control the size of the so forming bubbles.

[0004] In the introductory part of the description of the above-mentioned patent IT-A-1 279 262, reference is made to a prior use of ejector-type aspirators to introduce gas in the liquid mixture formed by the must and the thickening and absorbing materials. This use has not proven very successful, indeed, since scarcely effective in enabling the gas bubbles to be formed to be controlled in their size, unless very long ejectors are used, which have the obvious drawback of being quite inconvenient to use.

[0005] Worth mention is also patent CH-A-237 063 which claims a general method and Installation for simultaneously sucking air and water upstream of a rotary pump.

[0006] It has now been surprisingly found that the use of a pump capable of ensuring a head of at least 3 kg/cm^2, preferably a pump comprised of two or more stages in series, and provided with a convergent diffuser on the intake conduit thereof, enables the air - to form the bubbles required to ensure the clarification by flotation of the liquid mixture of must and thickening and absorbing materials - to be taken in directly from the surrounding ambient in an adequate amount by connecting a point situated between the diffuser and the pump body with the surrounding ambient.

[0007] In the first place, this enables an effective clarification by flotation of the must, or any other food-grade liquid undergoing such process, to be obtained with an apparatus that is extremely simple in its construction. Moreover, by omitting the use of said convergent diffuser and of said means for connection with the surrounding ambient the same pump can also be used as a transfer pump.

[0008] The characteristics defined in the appended claims, as well as the advantages of the present invention shall anyway be more readily understood from the description given below by way of non-limiting example of a preferred, although not sole embodiment of the present invention, in which reference is solely made to must for reasons of greater simplicity, whereas it shall be understood that the invention can of course be used also with

any other food-grade liquid containing colloids. Throughout the same description reference is made to the accompanying drawing, which, further to the afore described Figure 1 concerning the state of the art, includes

- Figure 2 showing a side view of a transfer pump used to the purpose of the present invention;
- Figure 3 showing a top view of the pump illustrated in Figure 2;
- Figure 4 showing a diagrammatical illustration of the manner in which the same pump works and can be used in accordance with the present invention.

[0009] In Figures 2-4 a transfer pump is shown having a pump body 2, two or more horizontal-axis centrifugal impellers in series (not shown) and a drive motor 4, which are all mounted on a platform 6 provided with wheels 12 for permitting a displacement of the pump, a base 14 for resting on the ground, as well as a handlebar 16 (see in particular Figure 2). Along the intake conduit 20, starting from the outside (i.e. from the zone in which the must, as previously mixed with colloid absorbing and thickening materials, such as bentonite, for instance in the manner explained above in connection with the description of the afore-noted prior-art Figure 1, is produced and/or stored) and following the direction shown by the arrow indicated at IN, there are successively installed a manually operated gate valve 22 and a filter block 24, as this can be best seen in Figure 3. Along the delivery conduit 25, which starts from the pump body 2 and, as shown by the arrow indicated at OUT, directly or indirectly communicates with a fermentation apparatus (not shown), there are generally mounted at least a pressure gauge 50 and an adjustable valve 52, the purpose of which is to ensure that the delivery head of the pump is kept at a value of at least 3 kg/cm^2 that is considered as being absolutely necessary in view of achieving the desired effect.

[0010] According to the present invention, the transfer pump can be advantageously used for the clarification of the must by first of all providing for a frusto-conical diffuser 30, i.e. a convergent diffuser, to be inserted upstream of the pump body 2. In the diffuser 30 the cross-section area of the inlet section 32, i.e. the section facing the filter block 24, is in fact larger than the cross-section area of the outlet section 34, i.e. the section facing the pump body 2. For example, the convergent diffuser may be inserted between a first branch 26 of the intake conduit 20, downstream of the filter block 24, and a second branch 28 thereof. In the second place, further to said diffuser 30, also a conduit 42 is provided to suck air from the surrounding ambient into the intake conduit 20. Actually, the air conduit 42 ends at a point 40 of the intake conduit 20 which is situated beyond the outlet section 34 of the diffuser 30 and, anyway, upstream of the pump body 2 and, more specifically, in said second branch 28 of the conduit 20 through which the liquid being treated is caused to flow. As best represented in Figure 4, along the air conduit 42 there are successively inserted, starting from the outside (i.e. from the zone that is in communication with the surrounding ambient, which, by definition, lies at atmospheric pressure), an air filtration unit 44, a flowmeter 46 (wherein the term flowmeter is intended to mean any volume measuring and/or flow-rate transmitting instrument), and an one-way valve 48 that is intended to prevent any must from leaking into the surrounding ambient in the case that the pump impellers suddenly stop rotating and get stalled. The way in which the whole assembly operates is readily understood : the negative pressure brought about by the convergent diffuser 30 in the flow of must causes the air that is needed for carrying out the clarification-by-flotation process to be sucked from the surrounding ambient in an adequate amount and to form the bubbles required to ensure the clarification. The high head (at least 3 kg/cm^2) of the pump is in turn effective in avoiding undesired cavitation effects.

[0011] The same pump can of course be used to also perform as a conventional pump for the transfer of the must. In this case, it may be preferable for the convergent diffuser 30 and the air conduit 42 (jointly with the members 44, 46 and 48 installed along the same conduit) to be removed, while of course providing for the hole (not shown) existing at the same point 40 in which the conduit 42 joins with the branch 28 of the conduit 20 to be duly plugged.

[0012] Fully apparent from the description given above are the advantages offered by the present invention in terms of simplicity from a construction point of view, versatility of use, as well as low costs as far as both manufacturing and operation are concerned.

[0013] It will also be readily appreciated that the present invention may be developed and implemented in a number of different embodiments and variants thereof without departing from its scope as defined in the appended claims.

Claims

1. Rotary pump for liquids comprising a pump body (2) with a rotary portion that may include one or more stages to the purpose of attaining a head of at least 3 kg/cm^2, a drive motor (4), an intake conduit (20) and a delivery conduit (25), **characterized in that** it is provided with both a convergent diffuser (30) installed upstream of the pump body (2) and means (42, 44, 46, 48) for the connection thereof with the surrounding ambient air at a point (40) situated between the outflow section (34) of said diffuser (30) and the rotary portion of the pump body (2), to the purpose of blowing air at a lower pressure than the surrounding ambient air into said liquids.

2. Rotary pump according to claim 1, **characterized in that** the rotary portion thereof is of the type including at least two stages.

3. Rotary pump according to claim 1 or 2, **characterized in that** it is not fitted with said convergent diffuser (30) and said means (42) for connecting it with the surrounding ambient when the same pump is used to simply transfer a liquid.

4. Rotary pump according to claim 1 or 2, **characterized in that** said convergent diffuser (30) is installed within the intake conduit (20) in such position as to be able to be quickly and conveniently removed when the same pump is used to simply transfer a liquid.

5. Use of a rotary pump according to any of the preceding claims, for transferring into a fermentation tank a food-grade liquid, such as must and the like, containing colloids and previously mixed with colloid absorbing and thickening materials, **characterized in that** in a portion (27) of the intake conduit (20) of the pump there is inserted a convergent diffuser (30) having a wider inlet section (32) and a narrower outlet section (34), and **in that** at a point (40) of the same conduit (20) that is situated between the outlet section (34) of said convergent diffuser (30) and the rotary portion of the pump body (2) there are inserted means (42, 44, 46, 48) for the connection thereof with the surrounding ambient to the purpose of introducing air into said liquid at a lower pressure than the pressure of the surrounding ambient air.

6. Use of a rotary pump according to claim 5, **characterized in that** said means for connection with the surrounding ambient successively include air filtration means (44), one-way valve means (46) and, preferably in an intermediate position between said air filtration and valve means, but anyway along a same conduit (42), flow-rate measuring and/or indicating means (46).

7. Use of a rotary pump according to claim 5 or 6, **characterized in that** in the intake conduit (20) of the pump, in a position located upstream of said convergent diffuser (30), there are inserted means (24) for filtering said food-grade liquid mixed with colloid absorbing and thickening materials.

Patentansprüche

1. Rotationspumpe für Flüssigkeiten, aufweisend ein Pumpengehäuse (2) mit einem Rotationsabschnitt, der eine oder mehrere Stufen für den Zweck beinhaltet, eine Druckhöhe von mindestens 3 Kg/cm^2 zu erreichen, einen Antriebsmotor (4), eine Ansaugleitung (20) und eine Auslassleitung (25), **dadurch gekennzeichnet, dass** sie sowohl mit einem konvergentem Diffusor (30), der stromaufwärts des Pumpengehäuses (2) eingebaut ist, als auch mit Mitteln (42, 44, 46, 48) zu deren Verbindung mit der umgebenden Außenluft an einem Punkt (40), der sich zwischen dem Ausflussbereich (34) des Diffusors (30) und dem Rotationsabschnitt des Pumpengehäuses (2) befindet, zu dem Zweck versehen ist, Luft mit einem niedrigeren Druck als die umgebende Außenluft in die Flüssigkeiten zu blasen.

2. Rotationspumpe gemäß Anspruch 1, **dadurch gekennzeichnet, dass** der Rotationsabschnitt derselben von einer Art ist, die mindestens zwei Stufen umfasst.

3. Rotationspumpe gemäß Anspruch 1 oder 2, **dadurch gekennzeichnet, dass** sie nicht mit dem konvergenten Diffusor (30) und den Mitteln (42) zu deren Verbindung mit der umgebenden Außenluft ausgerüstet ist, wenn die gleiche Pumpe dafür verwendet wird, einfach eine Flüssigkeit zu übertragen.

4. Rotationspumpe gemäß Anspruch 1 oder 2, **dadurch gekennzeichnet, dass** der konvergente Diffusor (30) innerhalb der Ansaugleitung (20) in so einer Position eingebaut ist, dass es möglich ist, ihn schnell und bequem zu entfernen, wenn die gleiche Pumpe dazu verwendet wird, einfach eine Flüssigkeit zu übertragen.

5. Verwendung einer Rotationspumpe gemäß einem der vorhergehenden Ansprüche zur Übertragung einer lebensmitteltauglichen Flüssigkeit, wie Most und dergleichen, die Kolloide enthält und zuvor mit kolloidaufnehmenden und verdickenden Materialien gemischt wurde, in einen Fermentierungstank, **dadurch gekennzeichnet, dass** in einem Abschnitt (27) der Ansaugleitung (20) der Pumpe ein konvergenter Diffusor (30) eingefügt ist, der einen größeren Einlassbereich (32) und einen engeren Auslassbereich (34) hat, und **dadurch**, dass es an einem Punkt (40) derselben Leitung (20), der sich zwischen dem Auslassbereich (34) des konvergenten Diffusors (30) und dem Rotationsabschnitt des Pumpengehäuses (2) befindet, eingefügte Mittel (42, 44, 46, 48) zu deren Verbindung mit der umgebenden Außenluft für den Zweck gibt, Luft in die Flüssigkeit mit einem niedrigeren Druck, als dem Druck der umgebenden Außenluft einzuführen.

6. Verwendung einer Rotationspumpe gemäß Anspruch 5, **dadurch gekennzeichnet; dass** die Mittel zur Verbindung mit der umgebenden Außenluft nacheinander Luftfiltermittel (44), Einwegventilmittel (46) und, vorzugsweise in einer dazwischenliegenden Position zwischen dem Luftfilter und dem Ventilmittel aber jedenfalls entlang derselben Leitung (42), Fließgeschwindigkeitsmess- und/oder -anzeigemittel (46) beinhalten.

7. Verwendung einer Rotationspumpe gemäß Anspruch 5 oder 6, **dadurch gekennzeichnet, dass** es in der Ansaugleitung 20 der Pumpe an einer Position, die sich stromaufwärts des konvergenten Diffusors (30) befindet, eingefügte Mittel (24) zur Filterung der nahrungsmitteltauglichen Flüssigkeit, die mit kolloidaufnehmenden und verdickenden Materialien gemischt ist, gibt.

Revendications

1. Pompe rotative pour liquides comprenant un corps de pompe (2) avec une partie rotative qui peut comprendre un ou plusieurs étages afin d'obtenir une charge d'au moins 3kg/cm^2, un moteur d'entraînement (4), un conduit d'entrée (20) et un conduit d'administration (25), **caractérisée en ce qu'**elle est prévue à la fois avec un diffuseur convergent (30) installé en amont du corps de pompe (2) et des moyens (42, 44, 46, 48) pour son raccordement avec l'air ambiant environnant en un point (40) situé entre la section de sortie (34) dudit diffuseur (30) et la partie rotative du corps de pompe (2), afin de souffler de l'air à une pression inférieure à celle de l'air ambiant environnant dans lesdits liquides.

2. Pompe rotative selon la revendication 1, **caractérisée en ce que** sa partie rotative est du type comprenant au moins deux étages.

3. Pompe rotative selon la revendication 1 ou 2, **caractérisée en ce qu'**elle n'est pas montée avec ledit diffuseur convergent (30) ni avec lesdits moyens (42) pour son raccordement à l'air ambiant, lorsque la même pompe est utilisée pour transférer simplement un liquide.

4. Pompe rotative selon la revendication 1 ou 2, **caractérisée en ce que** ledit diffuseur convergent (30) est installé dans le conduit d'entrée (20) dans une position telle qu'il peut être rapidement et facilement retiré lorsque la même pompe est utilisée pour transférer simplement un liquide.

5. Utilisation d'une pompe rotative selon l'une quelconque des revendications précédentes, pour transférer dans un réservoir de fermentation un liquide alimentaire, tel que du moût et similaire, contenant des colloïdes et préalablement mélangé avec matières épaississantes et absorbant les colloïdes, **caractérisée en ce que** dans une partie (27) du conduit d'entrée (20) de la pompe, on insère un diffuseur convergent (30) ayant une section d'entrée (32) plus large et une section de sortie (34) plus étroite, et **en ce qu'**en un point (40) du même conduit (20) qui est situé entre la section de sortie (34) dudit diffuseur convergent (30) et la partie rotative du corps de pompe (2), on insère des moyens (42, 44, 46, 48) pour son raccordement avec l'air ambiant environnant afin d'introduire l'air dans ledit liquide à une pression inférieure à la pression de l'air ambiant environnant.

6. Utilisation d'une pompe rotative selon la revendication 5, **caractérisée en ce que** lesdits moyens pour le raccordement avec l'air ambiant environnant comprennent successivement des moyens de filtration d'air (44), des moyens de soupape unidirectionnelle (46) et de préférence dans une position intermédiaire entre lesdits moyens de filtration d'air et de soupape, mais de toute façon le long d'un même conduit (42), des moyens de mesure et/ou d'indication de débit (46).

7. Utilisation d'une pompe rotative selon la revendication 5 ou 6, **caractérisée en ce que** dans le conduit d'entrée (20) de la pompe, dans une position située en amont dudit diffuseur convergent (30), on insère des moyens (24) pour filtrer ledit liquide alimentaire mélangé avec les matières épaississantes et absorbant les colloïdes.

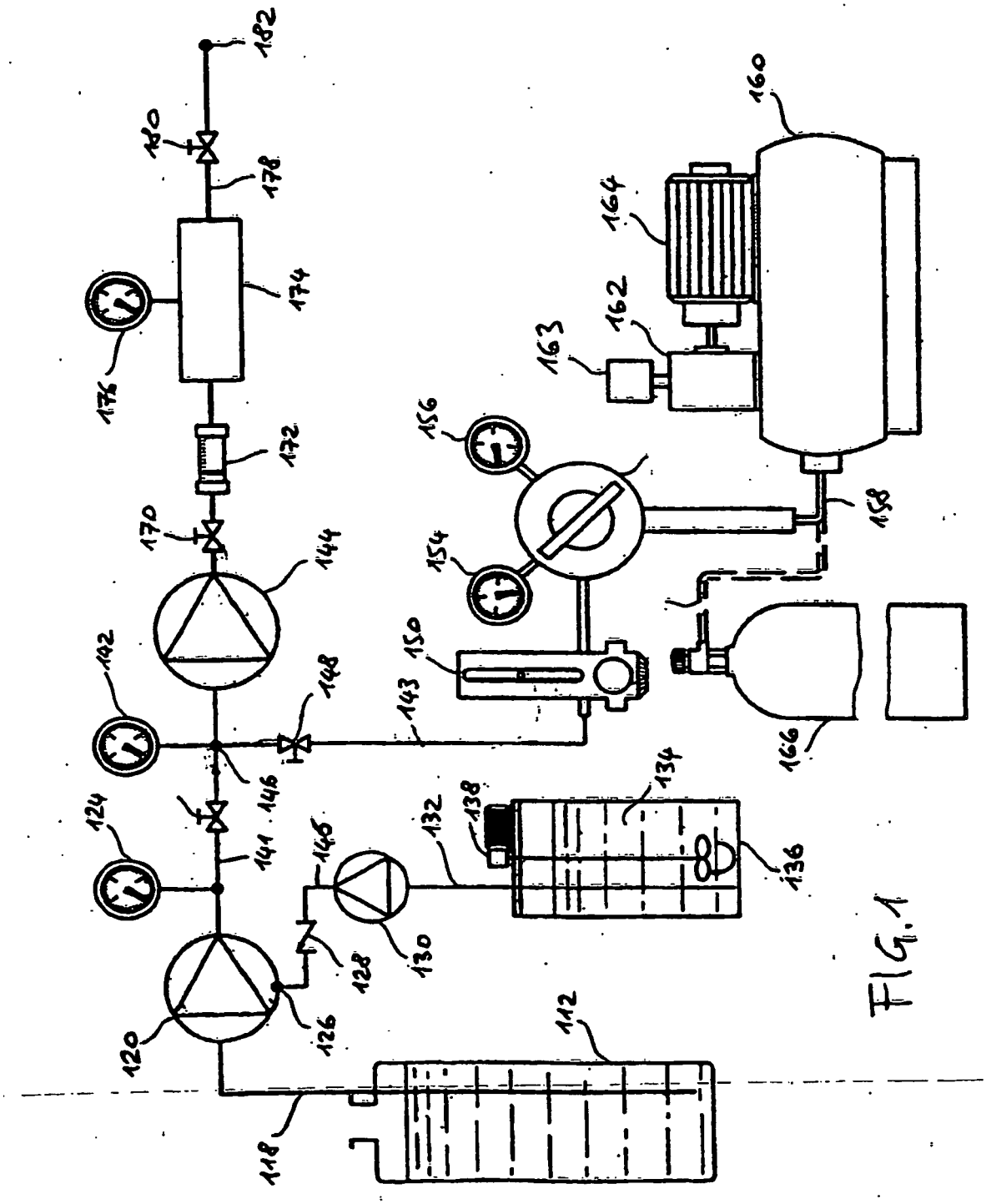
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FIG. 1

FIG.2

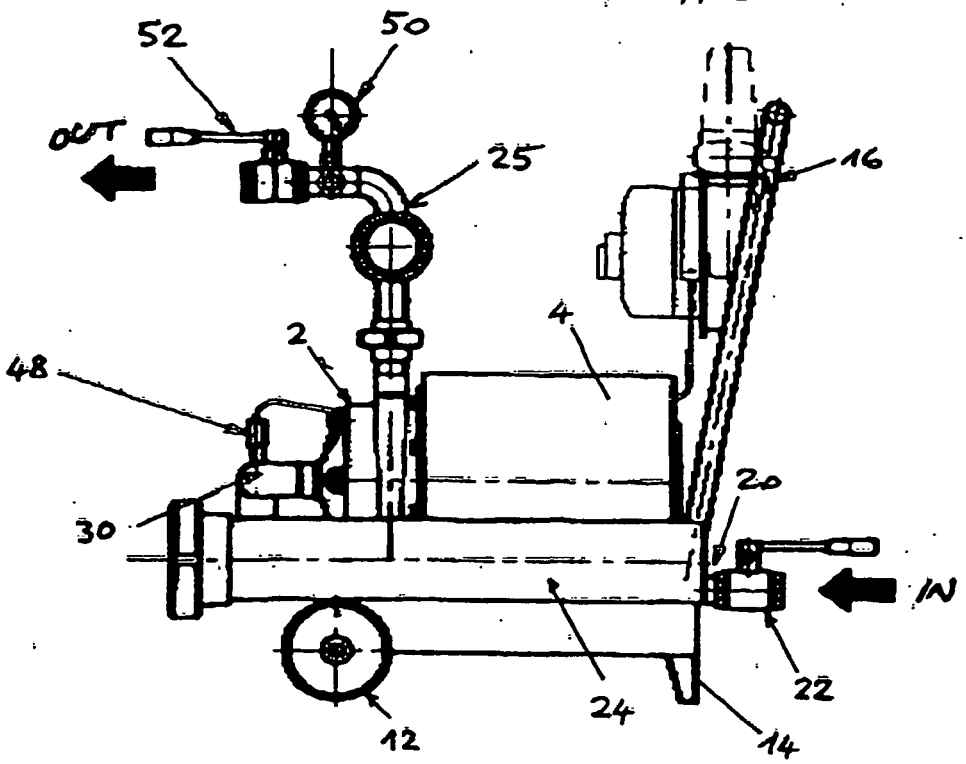
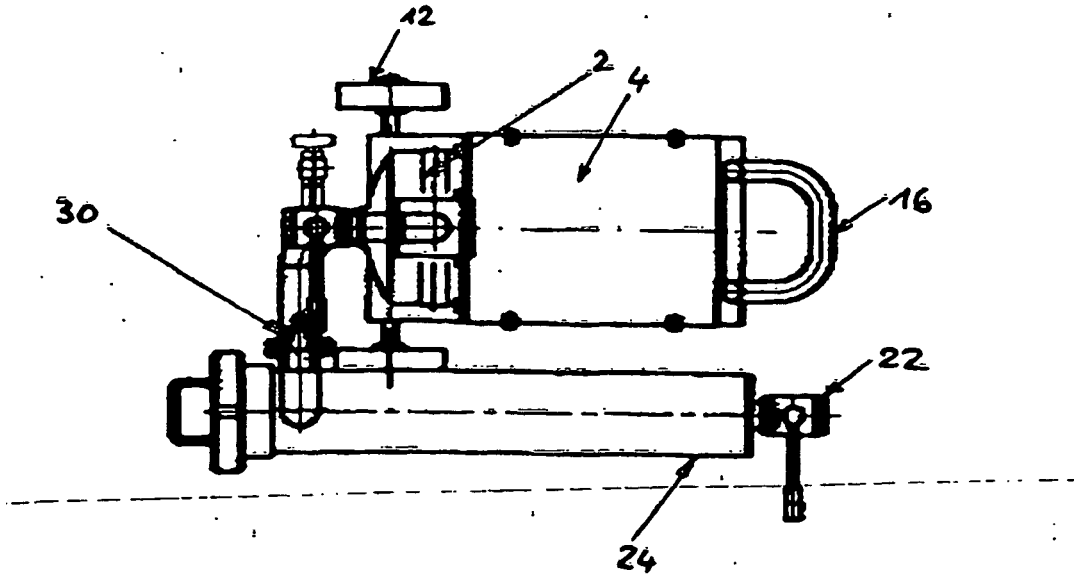


FIG.3



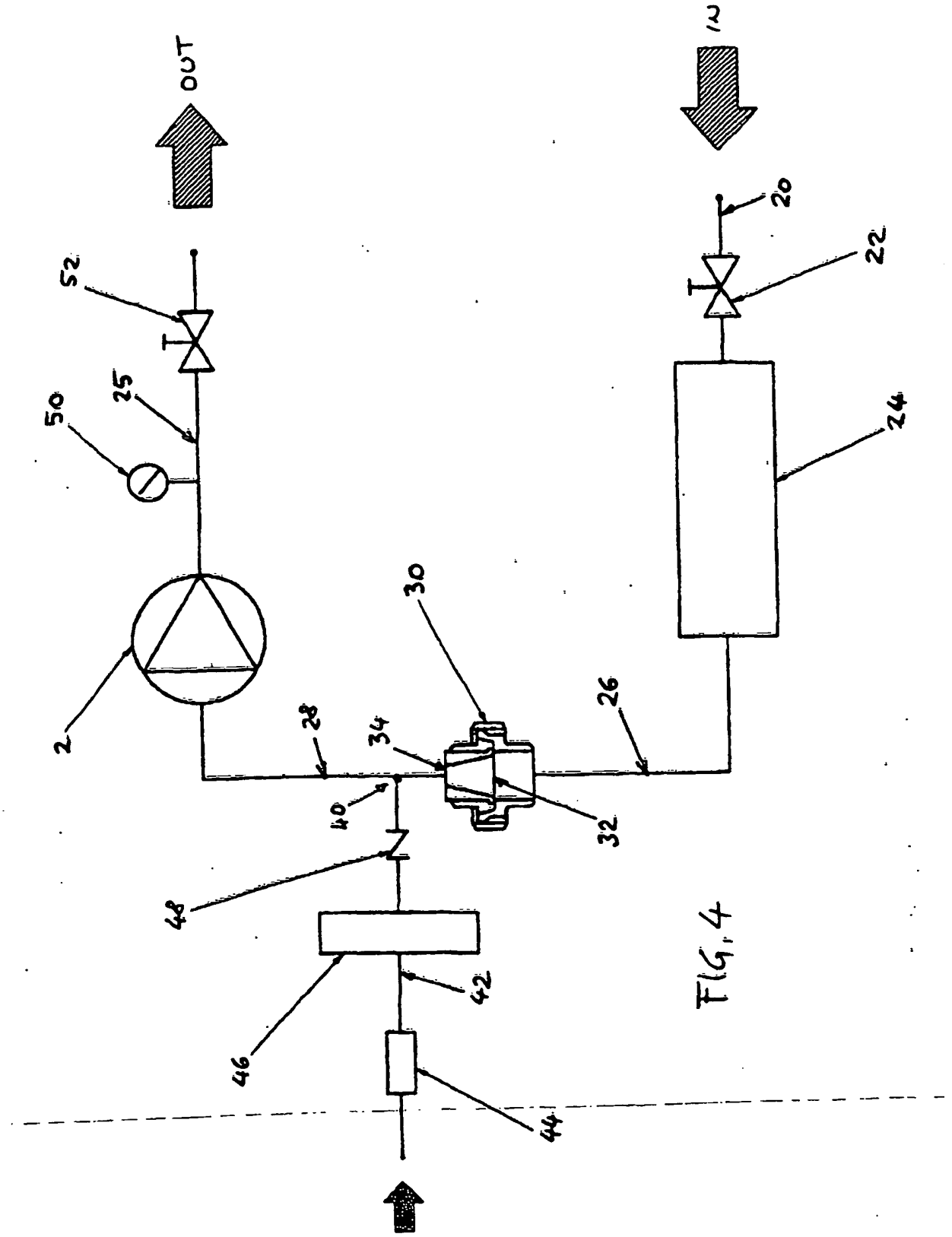


FIG. 4