

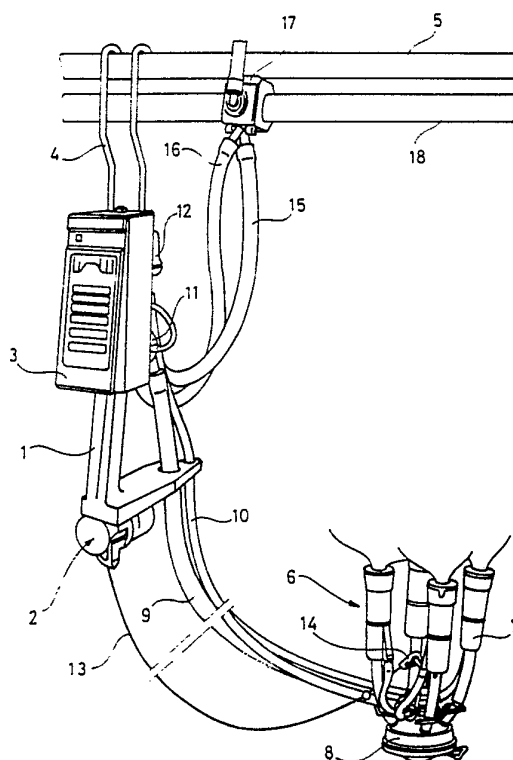
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(54) Title: A DEVICE FOR AUTOMATIC REMOVAL OF MILKING MEANS

(57) Abstract

A device for automatic removal of a milking means (6) comprises an operating unit (2) having a cord drum with a cord (13), and a driving means for turning the cord drum for winding the cord on the latter. The free end of the cord is connected to the milking means, whereby the cord pulls the milking means off the teats of the animal, as the cord drum is turned by the driving means. According to the invention the driving means comprises a pneumatically operated motor. The advantage is that the operating unit can be made compact and with a low weight, and that the milker can unwind the cord without any substantial resistance from the motor, when the motor is inactivated.



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A DEVICE FOR AUTOMATIC REMOVAL OF MILKING MEANS.

The present invention relates to a device for automatic removal of a milking means from the teats of an animal after finished milking. The removal device comprises a frame, and an operating unit carried by the frame. The
5 operating unit has a rotatable cord drum, a cord, which is windable on the cord drum and provided with a connection member at its free end for connection to the milking means to be removed, and a driving means arranged to turn the cord drum for winding up the cord, so that
10 the milking means is pulled off the teats of the animal.

A removal device of this kind is known from DD 233 480. The known device is compact and therefore especially suited for portable milking equipments for serving tied
15 up cows. However, it has a serious drawback, since the driving means for winding up the cord is constituted by a relatively strong spiral spring. As a consequence, the milker has to tighten the spiral spring when unwinding the cord to connect the connection member to a milking
20 means which previously has been applied on the teats of a cow. The reason why a spiral spring has to be relatively strong is due to the fact that a modern milking means comprising teat cups, hoses and a teat cup claw, has a weight of about three kg. Therefore, the spiral
25 spring should be able to generate a pulling power corresponding to at least five kg. The frequent tightenings of a spiral spring against the action of said pulling power, when applying the milking means on the cows to be milked, of course will be laborious for the milker.

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The object of the present invention is to provide a compact low-weight device for automatic removal of a milking means, which device is easy to connect to a milking means applied on the teats of a cow.

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This object is obtained by means of a device of the kind described initially, which primarily is characterized in that the driving means comprises a pneumatically operated motor. As a result the cord can be easily unwinded
5 without any substantial resistance from the motor, when this is inactivated. The motor is suitably connectable to the necessary air conducting vacuum conduits for providing the pulsating pressure in the teat cups of the milking means.

10

Preferably, the pneumatically operated motor is a rotating sliding vane motor, whereby the automatic removal device can be designed particularly compact. (As an alternative the motor may comprise a number of small
15 piston-cylinder means, for instance of the well-known arrangement which consists of four piston-cylinder means orientated in a cross and in engagement with a slide in the centre of the cross, the slide being connected to the cord drum for turning the latter).

20

With advantage, the motor is in drivable engagement with the cord drum via a reduction gearing, suitably a planetary gearing. The gear ratio of the reduction gearing should be chosen in the interval of 1:3 to 1:8. The
25 reduction gearing enables use of a cord drum with a relatively large diameter. This leads to that the required turning moment for turning the cord drum will be approximately unchanged during the entire upwinding of the cord, since the diameter of the formed cord coil on
30 the large coil drum only increases insignificantly during the upwinding. Said unchanged turning moment has the consequence that the rotational speed of the rotating sliding vane motor can be kept substantially constant during the upwinding of the cord, which ensures
35 the required output of the relatively small motor.

In this connection it should be noted that for compensating an increased turning moment for turning the cord drum, the power of the rotating sliding vane motor cannot be increased by increasing the pressure difference across the motor. This is so because the existing vacuum conduit, to which the motor is connected, usually distributes a vacuum of at most 50 kPa, which cannot be increased. In addition, it should be unsuitable to choose a stronger motor as an alternative for enabling a higher output, because in such a case the removal device would become heavier and more bulky.

According to a preferred embodiment of the removal device according to the invention the motor has a rotor shaft, which is provided with a number of pairs of vanes. The vanes in each vane pair are slidable along the same radial direction relative to the rotor shaft. A housing forms a cylindrical rotor chamber in which the rotor shaft extends in parallel to the centre axis of the rotor chamber. The rotor chamber is divided by the vanes into separate chambers orientated after one another around the rotor shaft. Preferably, the vanes in each vane pair abut against one another via spacing members, whereby each vane pair together with their associated spacing members forms a unit which is radially slidable relative to the rotor shaft. As a result the frictional resistance between the vanes and the walls of the rotor chamber will be relatively weak during operation of the sliding vane motor, as compared with conventional sliding vane motors, the vanes of which abut against the walls of the rotor chamber under the influence of springs.

Suitably, the extension of the cylindrical rotor chamber transverse to the rotor shaft is substantially constant

along the circumference of the rotor chamber, which gives the rotor chamber a slightly elliptically formed cross-section.

5 The removal device according to the invention is described in more detail in the following with reference to the accompanying drawings, in which figure 1 shows a milking equipment with a removal device according to the invention, figure 2 shows a side view of an operating
10 unit of the removal device according to figure 1, figure 3 shows a view from above of the operating unit according to figure 1, figure 4 shows a view of a longitudinal section through the operating unit according to figure 2, and figure 5 shows a view of a section along
15 the line V-V in figure 4.

The milking equipment shown in figure 1 comprises a frame 1, on which an operating unit 2 and a control means 3 are attached. The frame 1 is by means of a clamp
20 4 suspendable from existing pipe conduits, for instance a vacuum conduit 5. From a milking means 6, comprising four teat cups 7 and a teat cup claw 8, a milk hose 9 and a pulsation hose 10 extend to a milk flow meter 11 and a pulsator 12, respectively, carried by the frame 1.
25 A cord 13 extends from the operating unit 2 to the teat cup claw 8 and is connected to the latter by means of a connection member 14. From the milk flow meter 11 and the pulsator 12 a milk hose 15 and an air hose 16, respectively, extend upwards to a connection member 17,
30 which is arranged on a milk conduit 18. The upper ends of the hoses 15 and 16 are provided with means for quick engagement with the connection member 17. The connection member 17 is adapted to connect the milk hose 15 and the air hose 16 to the milk conduit 18 and the vacuum con-
35 duit 5, respectively.

The operating unit 2 comprises a pneumatically operated, rotating sliding vane motor 19, a cord drum 20, and a planetary gearing 21, which is connected between the motor 19 and the cord drum 20.

5

The motor 19 has a rotor shaft 22 with a circular cylindrical mantle 23. In the mantle 23 there are four radial pockets 24 arranged in two pairs of opposite pockets extending transversely to one another. Four
10 vanes 25-28 are slidable in the pockets 24. Each pair of opposite vanes 25,27 and 26,28 abut against one another via spacing members in the form of two cylindrical pins 29,30 and 31,32. As a result each pair of vanes 25,27 and 26,28 together with their respective associated pins
15 29,30 and 31,32 forms a unit which is radially slidable relative to the rotor shaft 22.

Further, the motor 19 has a housing 33, which forms a cylindrical rotor chamber 34 in which the rotor shaft 22
20 extends in parallel with the centre axis of the rotor chamber 34. The extension of the cylindrical rotor chamber 34 transverse to the rotor shaft 22 is substantially constant along the circumference of the rotor chamber 34, which gives the rotor chamber 34 a slightly
25 elliptical cross-section. The rotor chamber 34 is divided by the vanes 25-28 into four separate chambers 35-38 disposed in series around the rotor shaft 22. The vanes 25-28 seal against the cylindrical wall of the rotor chamber 34 by means of resilient sealing strips 39
30 arranged on the radially outer ends of the vanes 25-28.

Each pocket 24 is axially defined by two opposite walls 40,41 with radially outer ends, which constitute parts of two circular surface portions 42,43 of the mantle 23.
35 The housing 33 is formed with two inner circular shoul-

ders 44,45, which are situated concentrically with the rotor shaft 22 and axially in front of the respective circular surface portions 42,43 of the mantle 23. The shoulders 44,45 of the housing 33 extend close to the surface portions 42,43 of the mantle 23 to seal between the separate chambers 35-38.

The housing 33 has an inlet member 46 for atmosphere. The inlet member 46 is connected to the rotor chamber 34 via an inlet passage 47. Further, the housing 33 has an outlet member 48 for connection to a source of vacuum. The outlet member 48 is connected to the rotor chamber 34 via an outlet passage 49.

One end of the rotor shaft 22 is formed with a gear ring 50, which constitutes a sun wheel in the planetary gearing 21. The planetary gearing 21 has a stationary gear ring 51 formed in the housing 33. Three planet wheels 52 are journaled on the cord drum 20 at the same radial distance from the rotational axis of the cord drum 20 and are in engagement with the gear rings 50 and 51. The gear ratio of the planetary gearing 21 is 1:5, which consequently means that the cord drum 20 is rotated one revolution for every five revolutions the rotor shaft 22 is rotated by the motor 19.

The cord drum 20 is provided with a mounting hole 53, through which one end of the cord 13 can be inserted to enable the cord 13 to be wound on the cord drum 20. The housing 33 is provided with an opening 54, through which the cord 13 passes during unwinding and upwinding the cord 13.

The new removal device is operated in the following way:

First the milker suspends the milking equipment from the vacuum conduit 5 by means of a clamp 4 close to the cow to be milked. Then the milker disengages the milking means 6 from the frame 1 and brings it to the teats of the cow, the cord 13 being unwinded from the cord drum 20. Since the motor 19 at this stage is not activated it only exerts a minor braking resistance on the cord drum 20 during the unwinding of the cord 13. When the milker has applied the teat cups 7 on the teats of the cow the milking starts, extracted milk being passed through the teat cup claw 8, the milk hose 9, the milk flow meter 11, the milk hose 15 and into the milk conduit 18 via the connection member 17.

At the end of the milk extraction the milk flow meter 11 senses the ceasing milk flow and gives a signal to the control means 3, which activates the motor 19 by connecting the outlet member 48 to the vacuum conduit 5 via the air hose 16. As a result an underpressure arises in the outlet passage 49 and in the separate chambers 35-38 which at the time communicate with the outlet passage 49. Thus, in the rotational position shown in figure 5 an underpressure arises in the chambers 35 and 38, which results in that the rotor shaft 22 is rotated in counter-clockwise direction. The cord drum 20 is turned by the rotor shaft 22 via the planetary gearing 21, so that the cord 13 is winded on the cord drum 20 and pulls the teat cup means 6 off the teats of the cow.

When the cord 13 has been completely winded on the cord drum 20 the motor 19 is nevertheless kept activated until the milker has suspended the milking means 6 from the frame 1. (As an alternative the cord 13 may be provided with a retaining member, which retains the cord 13 from unwinding, as the motor is inactivated. In this

case the milker releases such a retaining member in connection with the next milking occasion). Then the milker can release the clamp 4 and the hoses 15 and 16 from the vacuum conduit 5 and the connection member 17
5 and carry the milking equipment to the next cow to be milked.

Claims

1. A device for automatic removal of a milking means (6) from the teats of an animal after finished milking, comprising a frame (1), and an operating unit (2) carried by the frame and having a rotatable cord drum (20), a cord (13), which is windable on the cord drum and provided with a connection member (14) at its free end for connection to the milking means to be removed, and a driving means (19,21), arranged to turn the cord drum for winding up the cord, whereby the cord pulls the milking means off the teats of the animal, as the cord drum is turned by the driving means, characterized in that the driving means comprises a pneumatically operated motor (19).
2. A device according to claim 1, characterized in that the pneumatically operated motor is a rotating sliding vane motor (19).
3. A device according to claim 1 or 2, characterized in that the motor (19) is in drivable engagement with the cord drum (20) via a reduction gearing (21).
4. A device according to claim 3, characterized in that the reduction gearing is a planetary gearing (21).
5. A device according to claim 4, characterized in that the gear ratio of the planetary gearing is chosen in the interval of 1:3 to 1:8.
6. A device according to any of claims 2-5, in which the motor (19) has a rotor shaft (22), which is provided

with a number of pairs of vanes (25-28), the vanes of each pair (25,27; 26,28) of vanes being slidable along the same radial direction relative to the rotor shaft, and a housing (33), which forms a cylindrical rotor chamber (34) in which the rotor shaft extends in parallel with the centre axis of the rotor chamber, the rotor chamber being divided by the vanes into separate chambers (35-38) disposed in series around the rotor shaft, characterized in that the vanes of each pair (25,27; 26,28) of vanes abut against one another via spacing members (29,30; 31,32), whereby each pair of vanes together with their associated spacing members forms a unit (25,27,29,30; 26,28,31,32), which is radially slidable relative to the rotor shaft.

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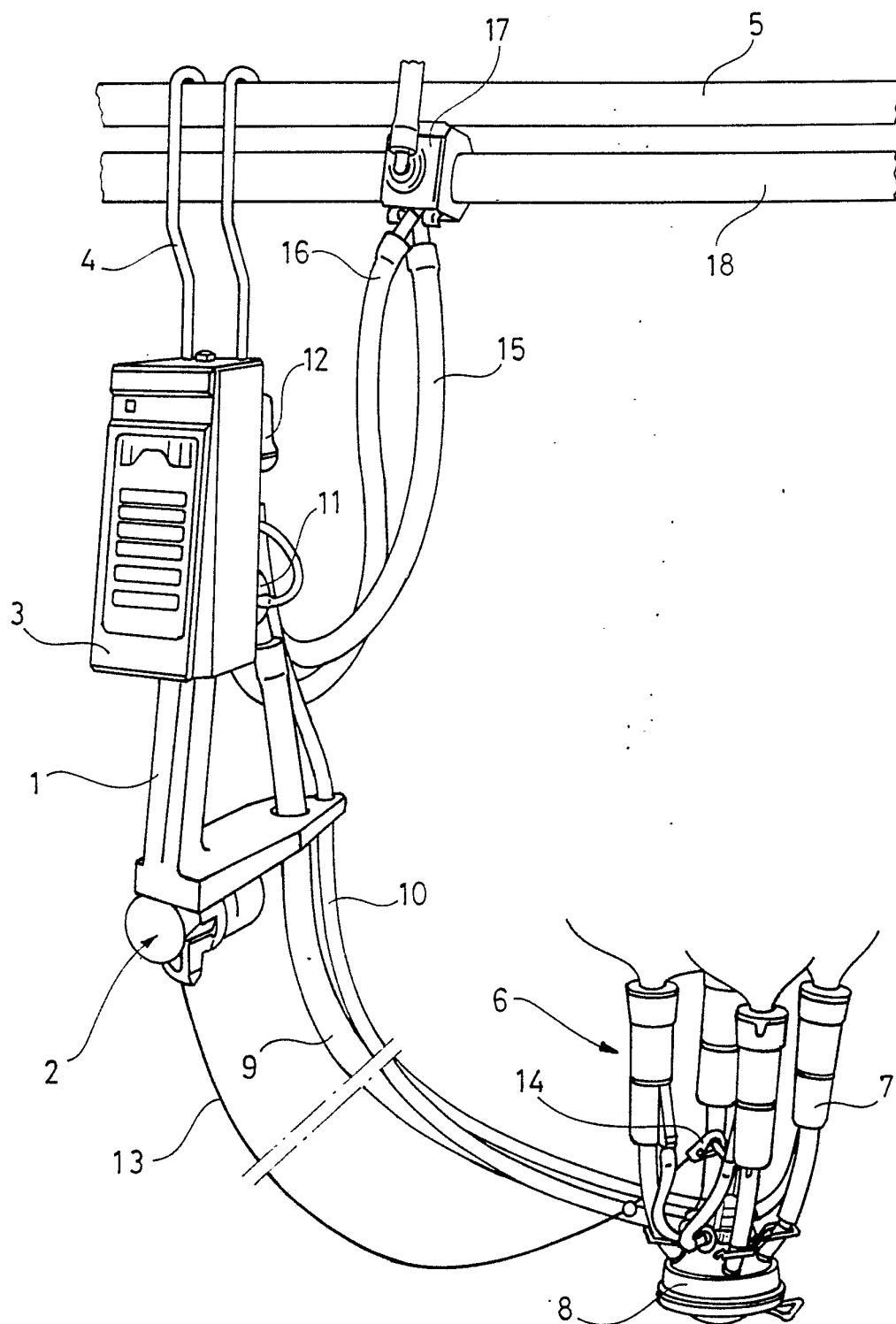
7. A device according to claim 6, characterized in that the extension of the cylindrical rotor chamber (34) transverse to the rotor shaft (22) is substantially constant along the circumference of the rotor chamber.

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8. A device according to claim 6 or 7, characterized in that the rotor shaft (22) has a circular cylindrical mantle (23) with radial pockets (24), in which the vanes (25-28) are arranged, that each pocket is axially defined by two opposite walls (40,41) with radially outer ends constituting parts of two circular surface portions (42,43) of the mantle, and that the housing (33) is formed with two inner circular shoulders (44,45) situated concentrically with the rotor shaft and axially in front of the respective circular surface portions of the mantle, the shoulders of the housing extending close to said surface portions of the mantle to seal between the separate chambers (35-38).

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Fig.1

SUBSTITUTE SHEET

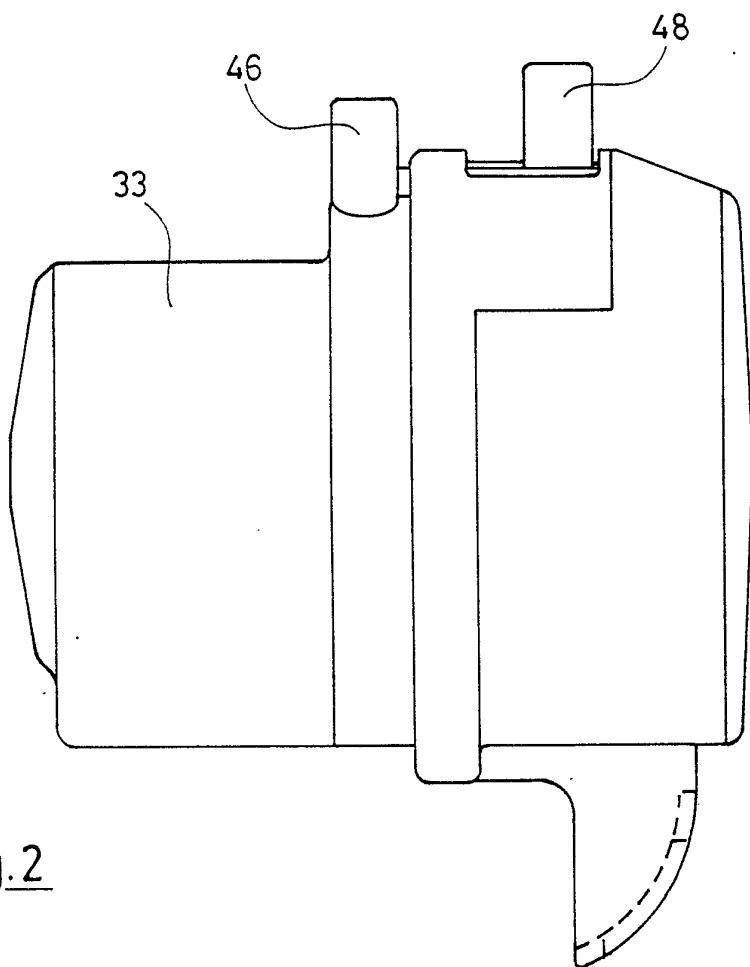


Fig. 2

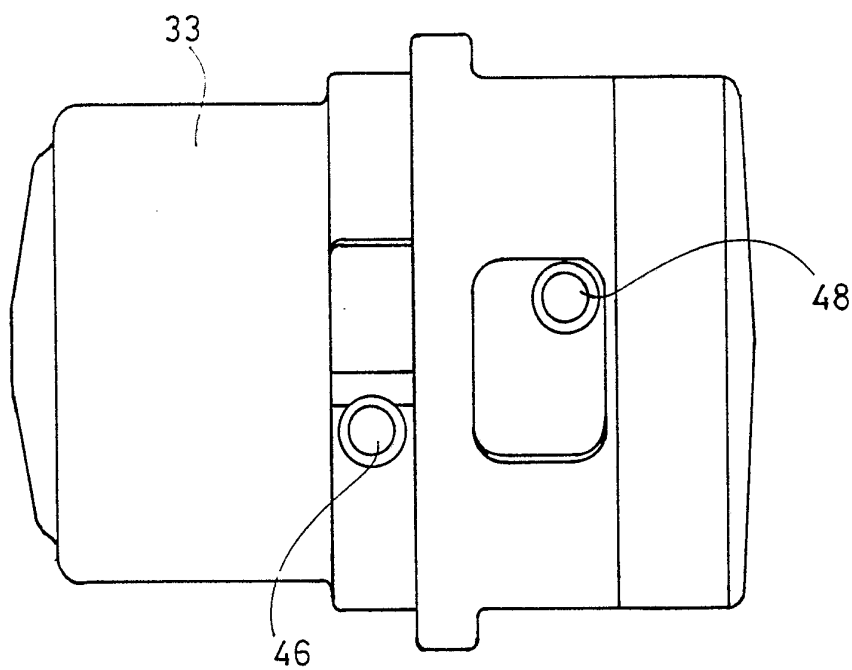


Fig. 3

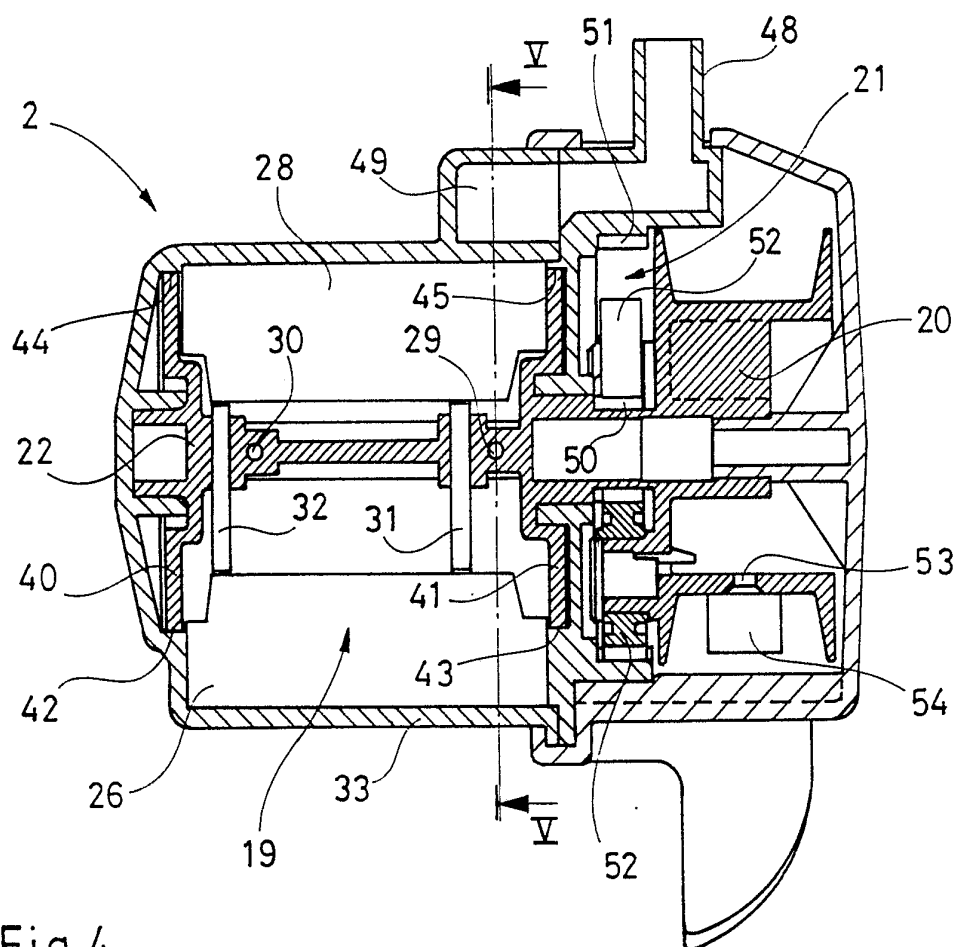


Fig.4

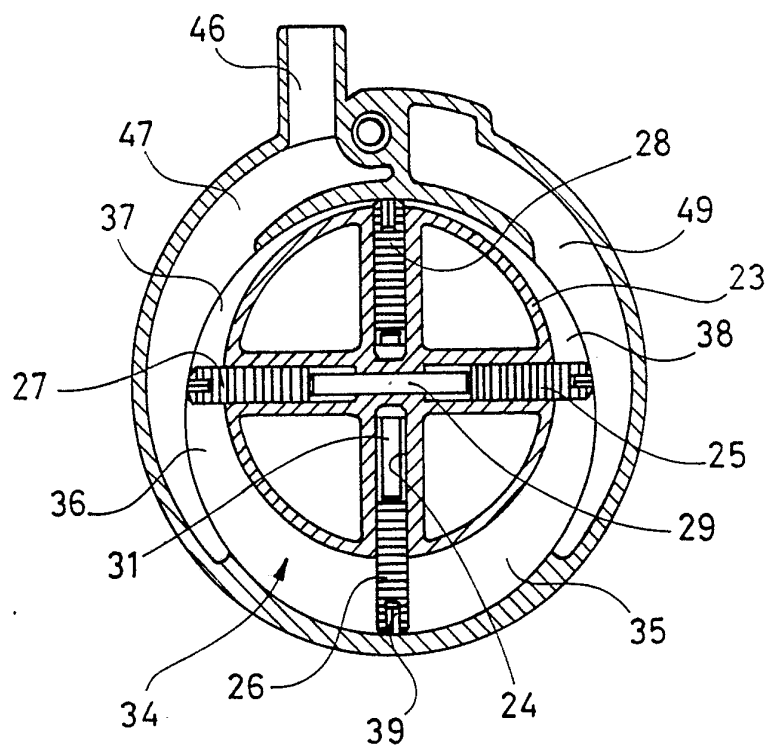


Fig.5

INTERNATIONAL SEARCH REPORT

International Application No PCT/SE 92/00457

I. CLASSIFICATION OF SUBJECT MATTER (If several classification symbols apply, indicate all) ⁶ According to International Patent Classification (IPC) or to both National Classification and IPC IPC5: A 01 J 7/00								
II. FIELDS SEARCHED Minimum Documentation Searched⁷ <table style="width: 100%; border: none;"> <tr> <td style="width: 25%; border: none;">Classification System</td> <td style="border: none;">Classification Symbols</td> </tr> <tr> <td style="border: none; height: 40px; vertical-align: bottom;">IPC5</td> <td style="border: none; vertical-align: bottom;">A 01 J</td> </tr> </table> Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in Fields Searched⁸ SE,DK,FI,NO classes as above			Classification System	Classification Symbols	IPC5	A 01 J		
Classification System	Classification Symbols							
IPC5	A 01 J							
III. DOCUMENTS CONSIDERED TO BE RELEVANT⁹ <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 10%;">Category *</th> <th style="width: 60%;">Citation of Document,¹¹ with indication, where appropriate, of the relevant passages¹²</th> <th style="width: 30%;">Relevant to Claim No.¹³</th> </tr> </thead> <tbody> <tr> <td style="vertical-align: top; padding: 5px;">A</td> <td style="vertical-align: top; padding: 5px;"> NO, B, 138428 (DEC INTERNATIONAL, INC.) 29 May 1978, see page 5, last paragraph, fig 5 ----- </td> <td style="vertical-align: top; text-align: center; padding: 5px;">1</td> </tr> </tbody> </table>			Category *	Citation of Document, ¹¹ with indication, where appropriate, of the relevant passages ¹²	Relevant to Claim No. ¹³	A	NO, B, 138428 (DEC INTERNATIONAL, INC.) 29 May 1978, see page 5, last paragraph, fig 5 -----	1
Category *	Citation of Document, ¹¹ with indication, where appropriate, of the relevant passages ¹²	Relevant to Claim No. ¹³						
A	NO, B, 138428 (DEC INTERNATIONAL, INC.) 29 May 1978, see page 5, last paragraph, fig 5 -----	1						
* Special categories of cited documents:¹⁰ "A" document defining the general state of the art which is not considered to be of particular relevance "E" earlier document but published on or after the international filing date "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified) "O" document referring to an oral disclosure, use, exhibition or other means "P" document published prior to the international filing date but later than the priority date claimed "T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention "X" document of particular relevance, the claimed invention cannot be considered novel or cannot be considered to involve an inventive step "Y" document of particular relevance, the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art. "&" document member of the same patent family								
IV. CERTIFICATION <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 50%; padding: 5px;"> Date of the Actual Completion of the International Search 29th September 1992 </td> <td style="width: 50%; padding: 5px;"> Date of Mailing of this International Search Report 02 -10- 1992 </td> </tr> <tr> <td style="width: 50%; padding: 5px;"> International Searching Authority SWEDISH PATENT OFFICE </td> <td style="width: 50%; padding: 5px;"> Signature of Authorized Officer Agneta Änggård </td> </tr> </table>			Date of the Actual Completion of the International Search 29th September 1992	Date of Mailing of this International Search Report 02 -10- 1992	International Searching Authority SWEDISH PATENT OFFICE	Signature of Authorized Officer Agneta Änggård		
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ANNEX TO THE INTERNATIONAL SEARCH REPORT
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Patent document cited in search report	Publication date	Patent family member(s)	Publication date
NO-B- 138428	78-05-29	NONE	