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

(11) EP 0 754 857 A1

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
22.01.1997 Bulletin 1997/04

(51) Int. Cl.[6]: **F04B 45/04**

(21) Application number: **95830308.3**

(22) Date of filing: **17.07.1995**

(84) Designated Contracting States:
AT DE ES FR

(71) Applicants:
- **B.V. di VISINI GIANPIERO & C. S.n.c.**
  I-25016 Ghedi (Brescia) (IT)
- **G.M. S.n.c. dei F.lli VISINI GIANPIERO & MANUELA**
  I-25016 Ghedi (Brescia) (IT)

(72) Inventor: **Visini, Gianpiero**
I-25016 Ghedi (Brescia) (IT)

(74) Representative: **Manzoni, Alessandro**
MANZONI & MANZONI,
UFFICIO INTERNAZIONALE BREVETTI,
P.le Arnaldo 2
25121 Brescia (IT)

(54) Reciprocating diaphragm pump

(57) A reciprocating positive-displacement pump of the type with diaphragm for gaseous fluids, namely air, comprising two parallel pumping units (17) connected physically and rigidly to form an integral whole.

The reciprocating movements of the joined pumping units are controlled by a single transmission organ (30, 36) operated by the output shaft (31) of a motor appliance (32) combined with the pump.

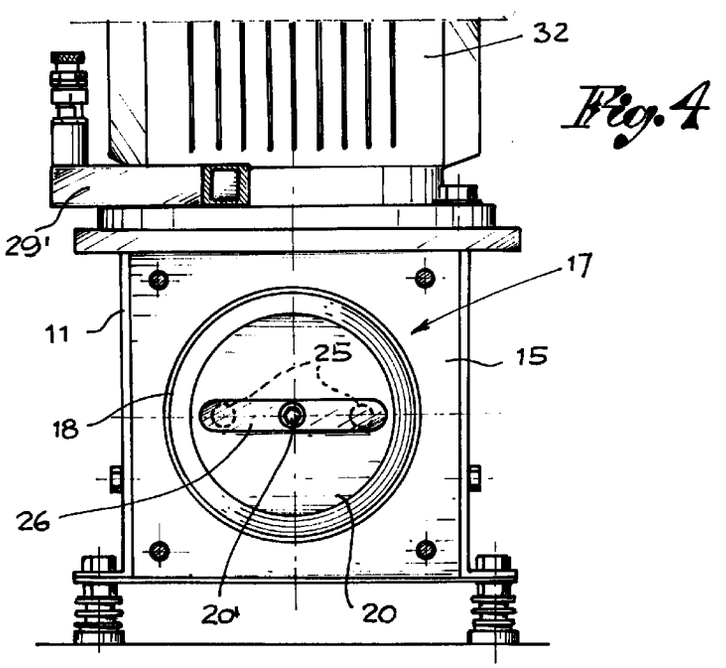

Fig. 4

EP 0 754 857 A1

Description

The present invention pertains to reciprocating positive-displacement pumps of the kind with diaphragm, with conveyance/compression of gaseous fluids, namely air.

Reciprocating diaphragm positive-displacement pumps are already known including the type with two sucking-pressing units, placed in parallel on two opposite sides of a common suction chamber and designed to send the air into two respective compression chambers that may be connected with a manifold to deliver a flow of air to a tank and consequently to the point of use. In reciprocating pumps of this type, the two sucking-pressing units are not physically constrained and are each operated by a crank mechanism even though both crank mechanisms receive motion from the same output shaft of a single motor appliance.

The independence in the control of the two parallel pumping units, besides complicating the structure due to the presence of two crank mechanisms, involves timing problems of the two units and problems of maintaining this condition.

It is an object of the present invention to obviate the said disadvantageous characteristics by providing a new combination and arrangement of elements, namely with a rigid physical connection of the two reciprocating pumping units and with the control of the two units with a single transmission organ for the utmost simplicity in construction.

The reciprocating diaphragm positive-displacement pump proposed herein is basically as claimed in claim 1. Further details of the invention will however become apparent from the description made hereunder with reference to the accompanying drawings, in which:

Figure 1 is an external side view of the pump according to the invention;

Figure 1a is an external view of the head of the pump;

Figure 2 is a cross-sectional view according to arrows II-II in Fig. 1 of a first embodiment of the pump;

Figure 3 is a cross-sectional view according to the arrows III-III in Fig. 2;

Figure 4 is a cross-sectional view according to arrows IV-IV in Fig. 3; and

Figure 5 is a cross-sectional view equivalent to the one in Fig. 3 but relative to another embodiment of the pump.

With particular regard to Figures 1-3, the pump at issue comprises a body or casing 11, basically prismatic, defining a chamber 12 and having a base wall with an opening 13 for air inlet from the outside through a filter 14 supported by a plate 14'. Also the body 11 has two opposing head walls 15, each provided with an opening 16 and at the level of which two parallel pumping units 17 are located, with reciprocating straight-line movement.

Each pumping unit 17 comprises a diaphragm 18 fixed with a screw 20' between two plates 19, 20 and with a peripheral portion protruding from said plates and tightly locked between the head wall 15 and a flange 21 bolted to the wall itself, between this and a winged counterflange 21' with a seal placed in between. Of the two plates 19, 20 of each pumping unit 17, a first plate 19 is placed on the side of the diaphragm 18 towards the inside of the chamber 12 in the body 11, whereas the other plate 20 is placed on the opposite side of the diaphragm towards the adjacent flange 21. The first plates 19 of the two pumping units are integral or fixed rigidly by means of adjustment screws 22' with a central frame support 22 so that the two pumping units 17 are integral and can move together.

The counterflanges 21' fixed to the head walls 15 of the body 11 can be finned on the outside to dispel the heat generated during operation of the pump into the atmosphere.

Each flange 21 has a central part 23 placed opposite a respective pumping unit 17 at a distance and defining therewith a compression chamber 24 with a variable volume according to the reciprocating movements of the two pumping units.

In the two plates 19, 20 holding the diaphragm 18 at least one transverse hole 25 is provided, preferably two, each with a unidirectional opening and closing valve 26 to connect the suction chamber 12 with the compression chamber 24. In the central portion 23 of the flange 21 there is also at least one transversal hole 27 with a unidirectional valve 28 to connect the compression chamber 24 with a pipe 29 delivering the air to the point of use or towards an accumulation tank through a manifold 29' connected to said pipes with an airtight coupling as shown in Fig. 3.

The valve 26 on the plates 19, 20 of the pumping unit is normally in the closed position of the respective hole 25 and it opens only when the pumping unit 17 moves away from the flange 21, 23 facing it so as to let the air pass from the suction chamber 12 to the compression chamber 24.

The valve 28 on the flange 21, 23 is normally in the closed position of the respective hole 27 and it opens only when the pumping unit 17 moves towards said flange 21, 23 so as to let the air pass from the compression chamber 24 to the delivery pipe 29.

The valves 26, 28 may be of the type with plate as shown in the drawings and adequately calibrated.

In a first embodiment, the reciprocating movements of the two integral pumping units 17 are controlled by an eccentric body 30 - see Figs. 2 and 3 - keyed on and rotating with the output shaft 31 of a motor 32 and interacting with two opposing planes of contact 33 of the frame support 22 connected to the two pumping units.

In this embodiment the free end of the motor shaft 31 may be protruding or more preferably provided with a bearing 34 and supported on a fixed support 35 fixed in the body 11 by means of screws 35'.

In another embodiment - see Fig. 5 - the reciprocating movements of the two integral pumping units 17 are controlled by a connecting rod 36 with a head 37 eccentrically coupled with the output shaft 31 of a motor 32 (as in the first embodiment) and with a foot connected in 38 to the inside plate 19 of one of the two pumping units.

Therefore, in both embodiments the pumping units are controlled by means of a single transmission organ 30 or 36.

Finally, it should be noted that the above described pump lends itself to being placed modularly side by side with other identical pumps so as to form a multistage pump, but with a single motor appliance required to control all the pairs of pumping elements at the same time and with a manifold designed to collect the air-streams coming out in all the stages.

Claims

1. A reciprocating positive-displacement pump of the type with diaphragm for gaseous fluids, namely air, comprising two sucking-pressing pumping units (17), placed in parallel on opposite sides of a common suction chamber (12) defined by a body or casing, reciprocatingly movable in said chamber (12) and destined for the delivery of air in the respective compression chamber (24) connected to a manifold (29, 29') to supply a flow of air to a tank or to the point of use, **characterized in that** the two parallel pumping units (17) are connected physically and rigidly to form a solid whole and in that the reciprocating movements of the joined pumping units are controlled by a single transmission organ (30, 36) operated by the output shaft (31) of a motor appliance (32) combined with the pump.

2. A pump according to claim 1, wherein every pumping unit (17) comprises a diaphragm (18) fixed between two plates (19, 20) and with a peripheral part protruding from said plates and locked between a wall of said body and a flange (21) bolted with a counterflange (21') onto the wall itself, wherein a first plate (19) is on the side of the diaphragm towards the inside of the suction chamber (12) and the other plate is on the opposite side of the diaphragm, wherein said flange (21) has a portion (23) opposite said pumping unit and defining therewith a compression chamber (24) with a variable volume according to the reciprocating movements of the pumping units, wherein the first discs (19) of the two pumping units are fixed to or integral with a central support (22), and wherein each pumping unit (17) and each flange (12, 23) facing it bear unidirectional valves to connect the suction chamber (12) with the compression chamber (24) and the latter with the pipe or manifold delivering the air to a tank and to the point of use.

3. A pump according to claims 1 and 2, wherein the transmission organ for the reciprocating movements of the two pumping units is an eccentric (30), keyed onto and rotating with the output shaft (31) of the motor appliance (32) and interacting with two opposing planes of contact (33) of said central support (22) of the two pumping units (17).

4. A pump according to claims 1 and 2, wherein the transmission organ for the reciprocating movements of the two pumping units is a connecting rod (36) with a head eccentrically coupled with the output shaft (31) of the motor appliance (32) and with a foot connected with one of the two pumping units.

5. A pump according to claim 1, comprising two or more pairs of pumping units placed in parallel in a body or casing and operated simultaneously by a single motor appliance.

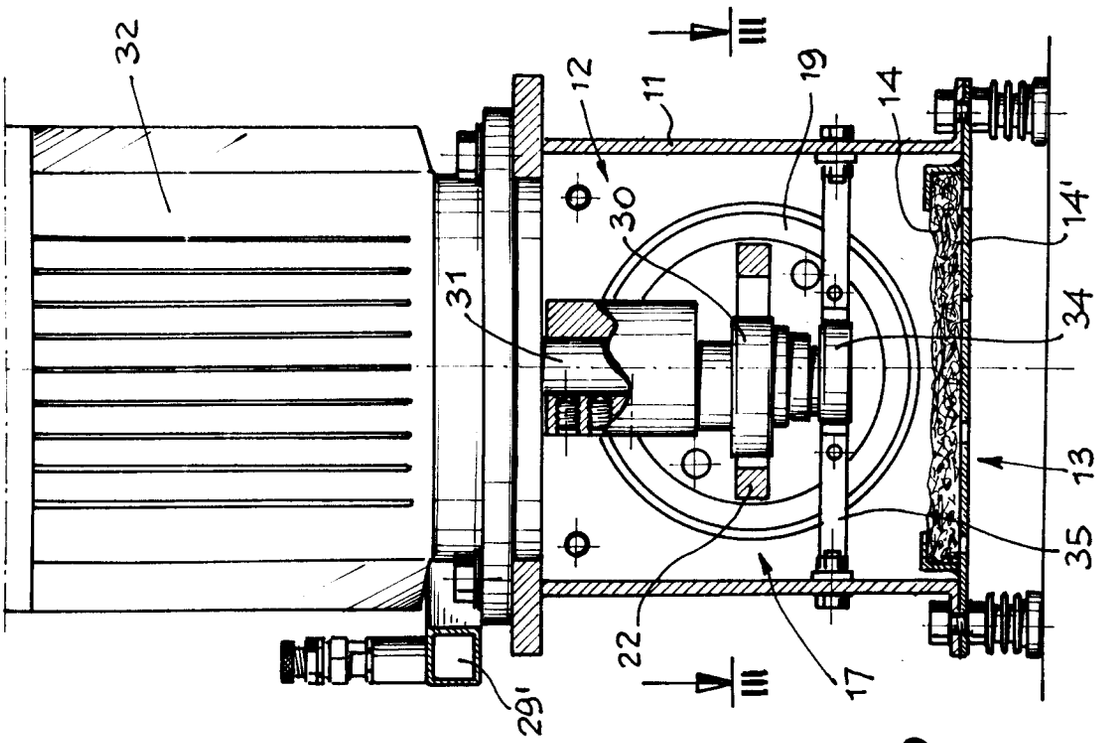

Fig. 2

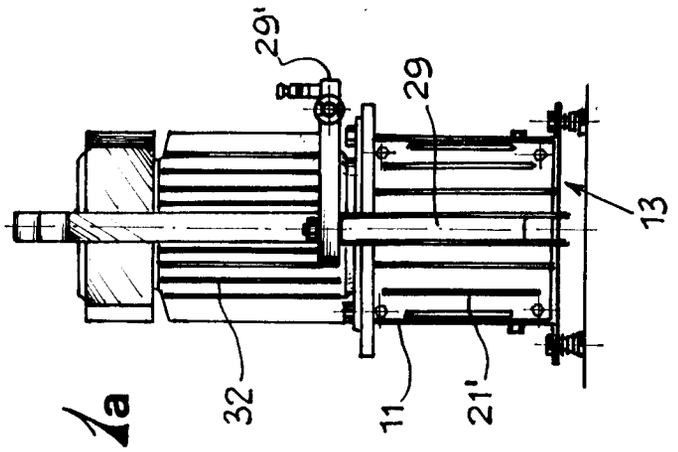

Fig. 1a

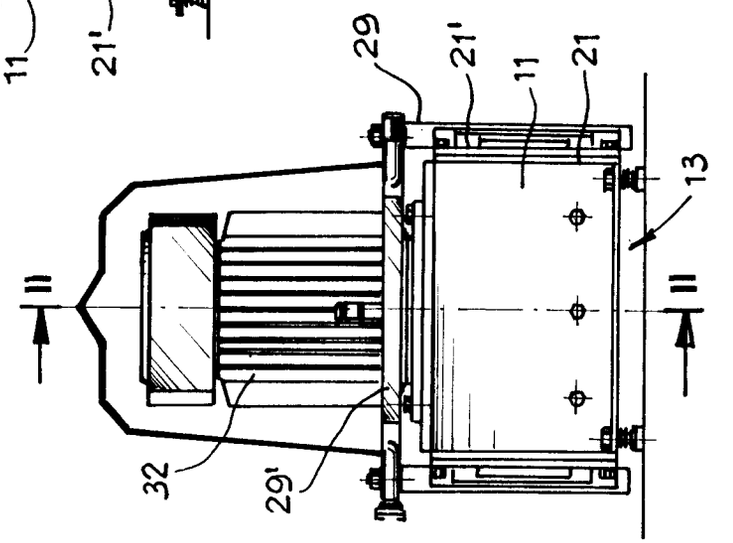

Fig. 1

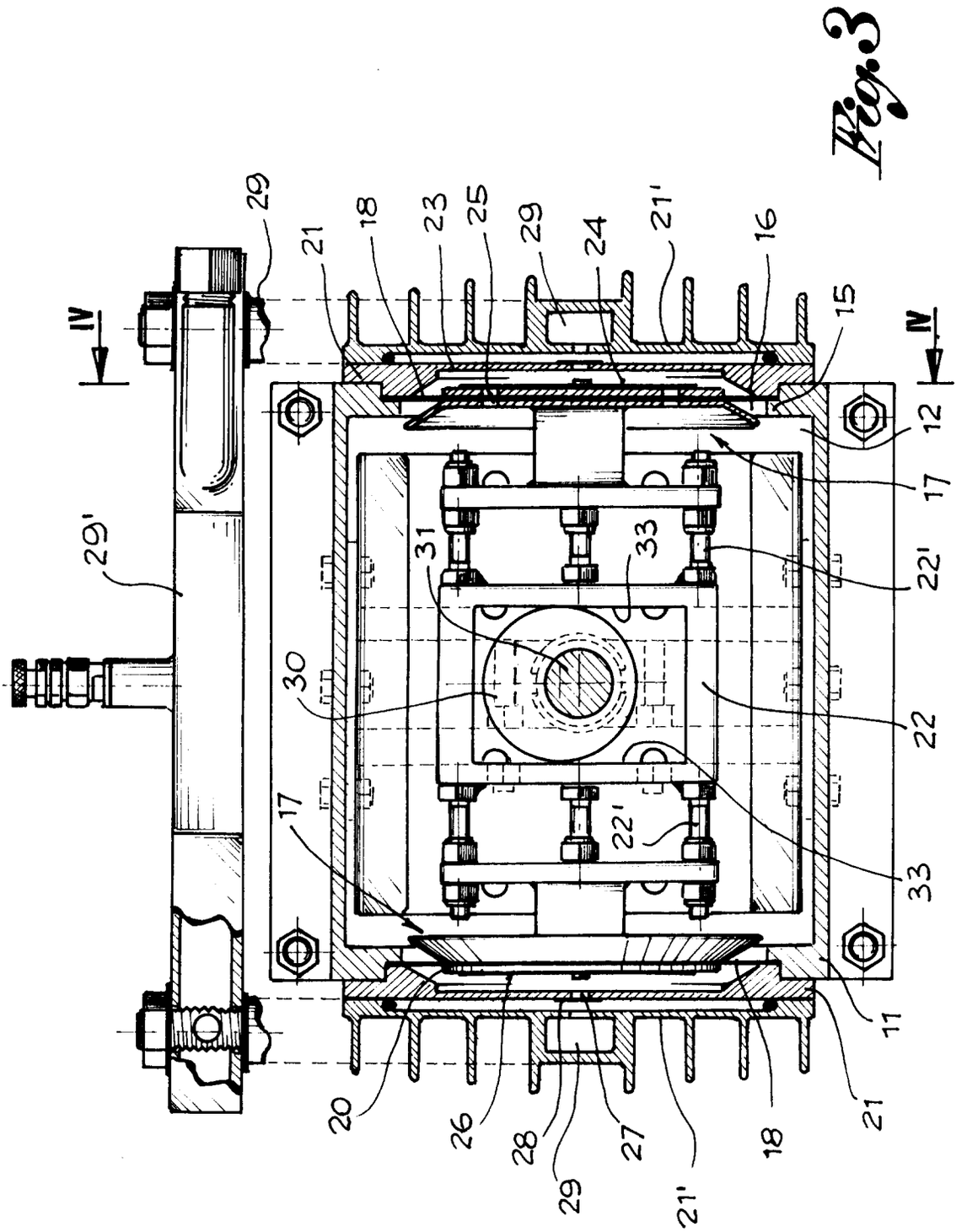
IV
IV
29
21
18
23
25
29
24
21'
16
15
12
17
22'
33
31
30
22
29'
17
22'
33
11
20
26
28
29
27
21'
18
21

Fig.3

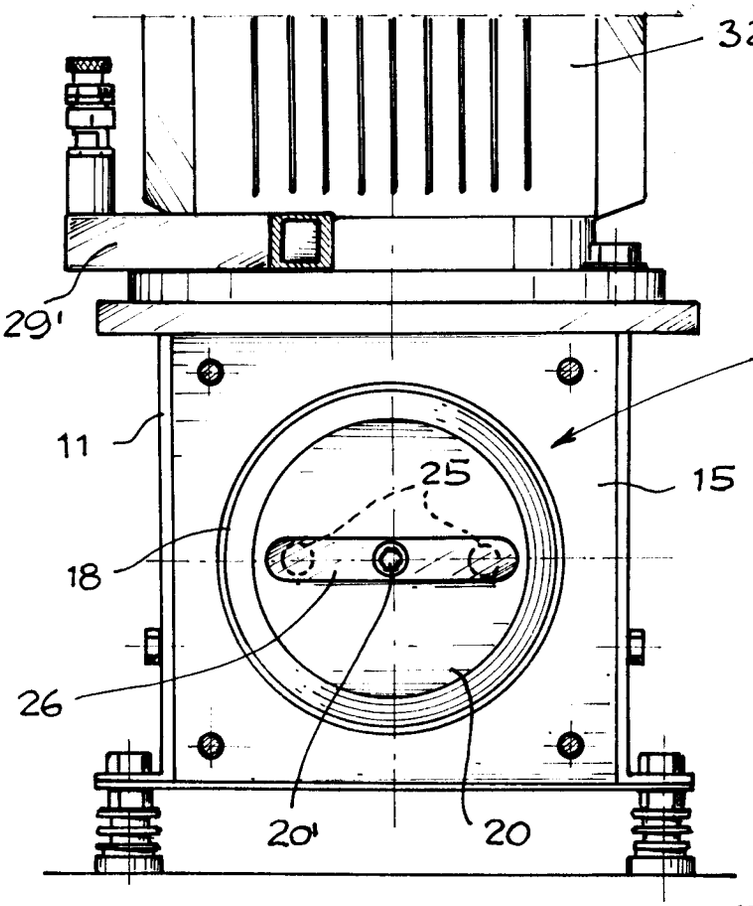
32
29'
17
11
25
15
18
26
20'
20

Fig. 4

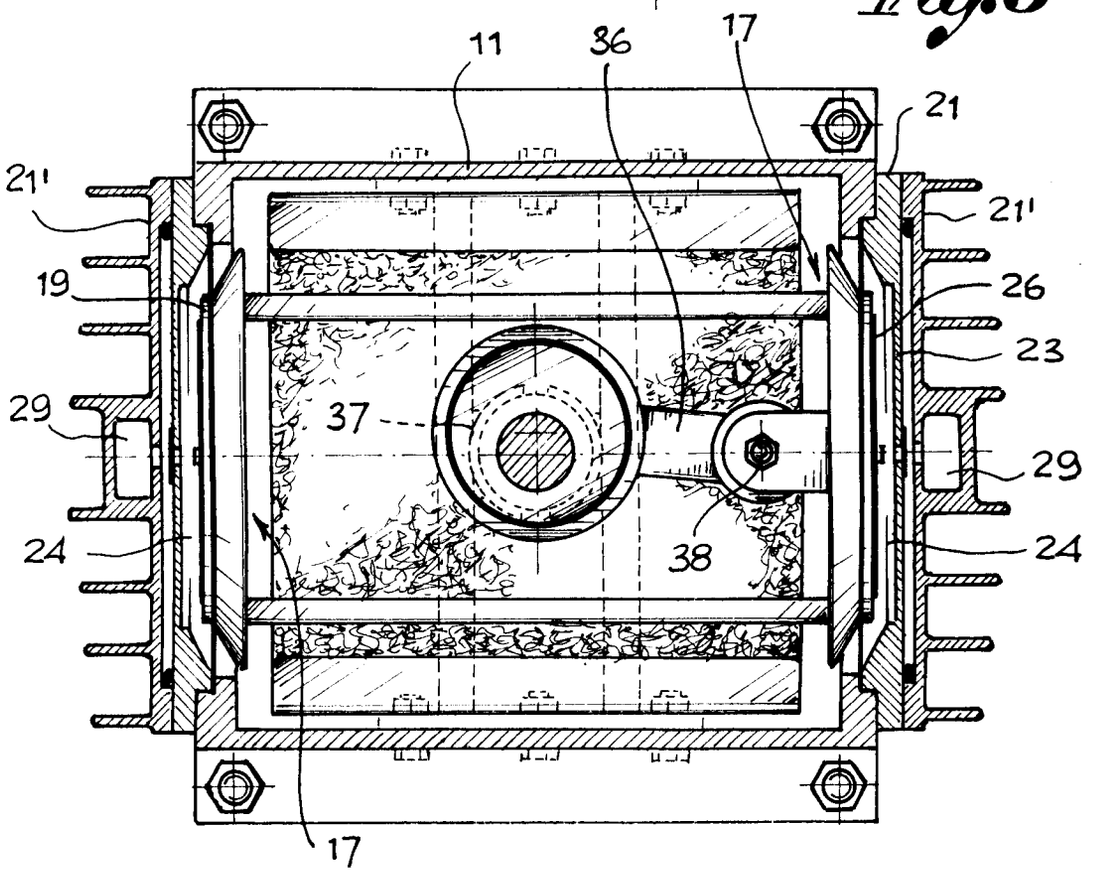
11
36
17
21
21'
21'
19
26
23
29
37
29
24
38
24
17

Fig. 5

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 95 83 0308

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)
X Y	DE-A-20 00 375 (HYRO-VAKUUM) 22 July 1971 * page 6, line 10 - page 10, line 4; figures 1-3 *	1,5 2-4	F04B45/04
X	GB-A-616 173 (SELF-PRIMING PUMP) 17 February 1949 see figures of provisional spec. 2067446 * page 4, line 75 - page 5, line 6; figures 1,2 *	1,2,4	
Y A	FR-A-2 200 908 (PERRINET) 19 April 1974 * page 2, line 25 - page 4, line 14; figures 1,2 *	2-4 1	
A	FR-A-925 748 (HANVAG) 11 September 1947 * figures 3,6 *	1-4	
A	FR-A-2 266 012 (MORENO GARCIA JESUS) 24 October 1975 * figures 1,2 *	1-3	
A	FR-A-2 416 360 (FRENOS AUTOPLAS SA) 31 August 1979 * figures 1,2 *	1,2,4	TECHNICAL FIELDS SEARCHED (Int.Cl.6) F04B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	14 December 1995	Bertrand, G

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)