

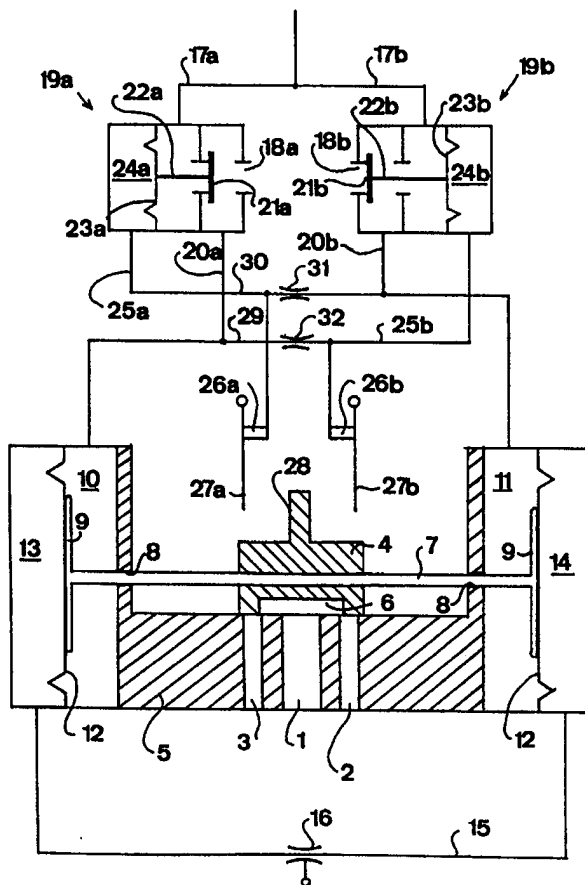


INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification ⁶ : A01J 5/12	A1	(11) International Publication Number: WO 98/53670 (43) International Publication Date: 3 December 1998 (03.12.98)
(21) International Application Number: PCT/SE98/00972 (22) International Filing Date: 22 May 1998 (22.05.98) (30) Priority Data: 9702029-1 29 May 1997 (29.05.97) SE (71) Applicant (for all designated States except US): ALFA LAVAL AGRI AB [SE/SE]; P.O. Box 39, S-147 21 Tumba (SE). (72) Inventor; and (75) Inventor/Applicant (for US only): JOHANNESSON, Leif, Börje [SE/SE]; Ängsvägen 13, S-147 43 Tumba (SE). (74) Agents: BERGLUND, Stefan et al.; Bjerkéns Patentbyrå KB, Östermalmsgatan 58, S-114 50 Stockholm (SE).	(81) Designated States: AL, AM, AT, AT (Utility model), AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CU, CZ, CZ (Utility model), DE, DE (Utility model), DK, DK (Utility model), EE, EE (Utility model), ES, FI, FI (Utility model), GB, GE, GH, GM, GW, HU, ID, IL, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SK (Utility model), SL, TJ, TM, TR, TT, UA, UG, US, UZ, VN, YU, ZW, ARIPO patent (GH, GM, KE, LS, MW, SD, SZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, ML, MR, NE, SN, TD, TG). Published <i>With international search report.</i>	

(54) Title: A PULSATOR**(57) Abstract**

A pulsator comprises a first circuit having a first outlet (2) and a second outlet (3), connected alternately to a first pressure level and a second pressure level, respectively. Furthermore, the pulsator comprises a second circuit, which comprises a first inlet (17a, 17b) connected to the first pressure level, a second inlet (18a, 18b) connected to the second pressure level, and valve members (19a, 19b) for its adjustment by a short connection of a control inlet (26a, 26b) of the valve members to the second pressure level between a first stable position at which the first inlet is connected to a first chamber (10) at the same time as the second inlet is connected to a second chamber (11) or a second stable position at which the first inlet (17b) is connected to the second chamber (11) at the same time as the second inlet (18a) is connected to the first chamber (10).



FOR THE PURPOSES OF INFORMATION ONLY

Codes used to identify States party to the PCT on the front pages of pamphlets publishing international applications under the PCT.

AL	Albania	ES	Spain	LS	Lesotho	SI	Slovenia
AM	Armenia	FI	Finland	LT	Lithuania	SK	Slovakia
AT	Austria	FR	France	LU	Luxembourg	SN	Senegal
AU	Australia	GA	Gabon	LV	Latvia	SZ	Swaziland
AZ	Azerbaijan	GB	United Kingdom	MC	Monaco	TD	Chad
BA	Bosnia and Herzegovina	GE	Georgia	MD	Republic of Moldova	TG	Togo
BB	Barbados	GH	Ghana	MG	Madagascar	TJ	Tajikistan
BE	Belgium	GN	Guinea	MK	The former Yugoslav Republic of Macedonia	TM	Turkmenistan
BF	Burkina Faso	GR	Greece			TR	Turkey
BG	Bulgaria	HU	Hungary	ML	Mali	TT	Trinidad and Tobago
BJ	Benin	IE	Ireland	MN	Mongolia	UA	Ukraine
BR	Brazil	IL	Israel	MR	Mauritania	UG	Uganda
BY	Belarus	IS	Iceland	MW	Malawi	US	United States of America
CA	Canada	IT	Italy	MX	Mexico	UZ	Uzbekistan
CF	Central African Republic	JP	Japan	NE	Niger	VN	Viet Nam
CG	Congo	KE	Kenya	NL	Netherlands	YU	Yugoslavia
CH	Switzerland	KG	Kyrgyzstan	NO	Norway	ZW	Zimbabwe
CI	Côte d'Ivoire	KP	Democratic People's Republic of Korea	NZ	New Zealand		
CM	Cameroon			PL	Poland		
CN	China	KR	Republic of Korea	PT	Portugal		
CU	Cuba	KZ	Kazakstan	RO	Romania		
CZ	Czech Republic	LC	Saint Lucia	RU	Russian Federation		
DE	Germany	LI	Liechtenstein	SD	Sudan		
DK	Denmark	LK	Sri Lanka	SE	Sweden		
EE	Estonia	LR	Liberia	SG	Singapore		

5

A pulsator**THE BACKGROUND OF THE INVENTION AND PRIOR ART**

10 The present invention refers to a pulsator according to the preamble of claim 1.

Today, such pulsators are used in milking machines for alternate pulsation of two pairs of teatcups between a suction phase, i.e. usually a sub-atmospheric pressure, and a pressure phase, i.e. usually atmospheric pressure. During alternate pulsation, the pulsation cycle, i.e. the sum of the suction time and the pressure time, for one of the pairs of teatcups is displaced in relation to the pulsation cycle for the other pair. This means that one of the teatcup pairs is essentially in the suction phase and the other of the pairs essentially in the pressure phase. It is important that the suction phases of both the teatcup pairs have the same duration in order to avoid an uneven milking of the teats. This difference between the duration of the suction phases which is provided by a pulsator is called limping.

SE-B-344 531 discloses a pulsator of the type initially defined and intended for a milking machine. The adjustment of the second circuit is performed by this known pulsator by means of a change-over mechanism, comprising a change-over arm provided on the valve element, a change-over spring and a valve slide. The change-over arm is pivotably attached to a housing of the pulsator and is forcibly pivoted back and forth about a pivot point by means of the movements back and forth of the valve element. The valve slide has two curved surfaces which are intended to slide in turn against a corresponding curved surface of the change-over arm. These surfaces co-operate for controlling the time moments for the

change-over of the valve slide from one end position to another. One problem with this known pulsator is that the change-over mechanism comprises many moveable, mechanical construction parts which have to be manufactured with high precision, which makes the production of the pulsator expensive. Due to the many parts and the friction which arises between these parts, there is also a slowness of the change-over mechanism, which results in a mechanical work to be overcome. In addition, the level of the slowness is difficult to determine and is changed with the wear of the parts of the change-over mechanism. Moreover, due to the wear, regular service of the pulsator is required in order to enable the maintenance of a desired pulsation accuracy. Furthermore, the limping of this known pulsator is at least not easily adjustable.

15 SUMMARY OF THE INVENTION

The object of the present invention is to provide a self-controlled pulsator by which the problems mentioned above may be remedied. In particular, it is aimed at a pulsator of a simple and reliable construction having few moveable parts.

This object is obtained by the pulsator initially defined and characterized in that the second circuit comprises valve members which are arranged to enable change-over of the second circuit from one of said stable positions to the other of these positions by means of a connection of short duration of a control inlet of said valve members to the second pressure source. By such valve members controlled by a short connection, or a pulse-shaped connection, the bistable second circuit may be operated by a minimum of moveable parts. In this manner, it is possible to reduce the slowness which did arise during the change-over between the two stable positions according to the technique previously known.

According to an embodiment of the invention, said control inlet comprises a closing member, which at a rest position closes the control inlet, and the valve element comprises a portion arranged to influence the closing member in such a manner that the control inlet

is opened at said change-over. In such a manner, the movement of the valve element of the first circuit may be utilized to provide a short connection or a pulse-shaped connection. The closing member may be designed in a plurality of different manners, for instance as
5 a membrane biased against a seat and openable by means of an extremely small force from the portion of the valve element. The limping of such a pulsator may easily be adjusted by a displacement of the portion of the valve element in relation to the first and second chambers.

10 According to a further embodiment of the invention, said valve members of the second circuit comprise a first and a second relay valve, the first relay valve being connected to the first chamber via a first outlet conduit and the second relay valve being connected to
15 the second chamber via a second outlet conduit. Thereby, each relay valve may comprise a two-way valve which at a first position closes a passage between the first inlet and the respective outlet conduit at the same time as a passage between the second inlet and the respective outlet conduit is opened, and at a second
20 position opens a passage between the first inlet and the respective outlet conduit at the same time as a passage between the second inlet and the respective outlet conduit is opened. Each relay valve may comprise a control chamber which is arranged in such a manner that the pressure level therein determines which of said first
25 and second positions said two-way valve is to take.

According to a further embodiment of the invention, a first control conduit connects a first of said control inlets to the control chamber of the first relay valve and a second control conduit connects a
30 second of said control inlets to the control chamber of the second relay valve. Each control chamber may comprise a membrane to which said two-way valve is connected. In such a manner, it is ensured that the relay valve associated with the actual control inlet is adjusted from the first to the second position. Furthermore, the
35 first outlet conduit may be connected to the second control conduit via a first passage and the second outlet conduit may be connected to the first control conduit via a second passage. In such a manner,

it is ensured that also the second relay valve is adjusted from the second to the first position. Advantageously, each of said passages comprises a throttling, which delays the pulse to the second relay valve and thereby ensures the change-over of the first relay valve.

5

According to a further embodiment of the invention, the valve element is provided on a displaceable element which at its ends is arranged to be influenced by a first and a second membrane forming a limiting wall of the first and second chambers, respectively.

10

Thereby, the first and the second membrane may also adjoin a third chamber and a fourth chamber, respectively, which are arranged to dampen the movements of the displaceable valve element. Advantageously, the third and the fourth chambers are arranged to enclose a damping medium and are connected to each other via a connection conduit which may comprise a controllable throttling for controlling the dampening of the pulsator.

15

BRIEF DESCRIPTION OF THE DRAWINGS

20

The present invention is now to be explained by means of an embodiment, disclosed by way of example, and with reference to the drawing attached, Fig 1 of which discloses a schematical view of a pulsator according to the present invention.

25

DETAILED DESCRIPTION OF DIFFERENT EMBODIMENTS

Fig 1 discloses a pulsator for a milking machine and in particular for alternate pulsating of a pulsation chamber of two pairs of teatcups (not disclosed). The pulsator comprises a first circuit having an inlet 1, which is intended to be connected to a vacuum pump (not disclosed) of the milking machine, and two outlets 2, 3 which each is intended to be connected to one of said pair of teatcups. The outlets 2 and 3 are arranged to be connected alternately to the inlet 1 by means of a valve element 4 which is displaceable by a movement back and forth over the orifices of the inlet 1 and the outlets 2, 3 in a housing 5 of the pulsator. The valve element 4 comprises a recess 6 facing said orifices and forming, depending on the position of the

30

35

valve element 4, a passage between essentially the inlet 1 and the outlet 2 or the inlet 1 and the outlet 3. The valve element 4 is provided on an elongated element in the shape of a rod 7 which is displaceably provided in and extends through two passages 8 of the housing 5 of the pulsator. Both the ends of the rod 7 are connected to a respective plate 9, which are located in a respective closed space outside said passages. In particular, the plates 9 are located in a first chamber 10 and a second chamber 11, respectively, of said spaces. The first chamber 10 and the second chamber 11 are limited by a respective membrane 12 outside which a third chamber 13 and a fourth chamber 14, respectively, of said spaces are provided. The third chamber 13 and the fourth chamber 14 are communicating with each other via a connection conduit 15 comprising a controllable throttling valve 16. The third and the fourth chambers 13, 14 form together with the connection conduit 15 a closed circuit enclosing a dampening fluid, for instance a liquid such as oil or water or a gas such as air. In the embodiment disclosed, the connection conduit 15 is external, i.e. it extends outwardly from said spaces and the third and fourth chambers 13, 14. Of course, it is also possible to let the connection conduit 15 extend through the membrane 12 and the rod 7. In the present case, it also ought to be possible to let the dampening fluid, be air and replace the connection conduit 15 by two passages having a preferably controllable throttling, which connect the respective chamber 13, 14 to the atmosphere.

Moreover, the pulsator comprises a second circuit which is separated from the first circuit and which is arranged to provide said movement back and forth of the valve element 4. The second circuit comprises a first inlet 17a, 17b which is connected to said vacuum pump and a second inlet 18a, 18b which is connected to the atmosphere. The second circuit comprises two valve members 19a and 19b which, via a first outlet conduit 20a, are connected to the first chamber 10 and, via a second outlet conduit 20b, are connected to the second chamber 11. The valve members 19a and 19b are designed in such a manner that they may take two stable positions, i.e. they form a bistable element. This means that at a

first stable position, the first chamber 10 will be connected to the vacuum pump at the same time as the second chamber 11 is connected to the atmosphere and at a second stable position, which is disclosed in Fig 1, the first chamber 10 will be connected to the atmosphere at the same time as the second chamber 11 is connected to the vacuum pump.

This function is realized according to the present invention by the provision that the valve members 19a and 19b comprise two relay valves having a respective two-way valve comprising a valve disc 21a, 21b which at a first position closes a passage between the first inlet 17a, 17b and the first and second outlet conduits 20a, 20b, respectively, at the same time as a passage between the second inlet 18a, 18b and the respective outlet conduit 20a, 20b is opened, and at a second position opens a passage between the first inlet 17a, 17b and the respective outlet conduit 20a, 20b at the same time as a passage between the second inlet 18a, 18b and the respective outlet conduit 20a, 20b is closed. The relay valves 19a and 19b are provided in such a manner in relation to each other that when one of the valve discs 21a takes the first position, the other valve disc 21b will forcibly take the second position.

The valve discs 21a, 21b are via a valve rod 22a, 22b connected to a respective membrane 23a, 23b. The membranes 23a, 23b form a limiting wall of a control chamber 24a, 24b of each of the relay valves 19a, 19b. The area of each membrane 23a, 23b is greater than the area of each of the passages covered by the valve discs 21a, 21b at the first and second positions. Each control chamber 24a, 24b is, via a control conduit 25a, 25b connected to a respective control inlet 26a, 26b. Each control inlet 26a, 26b comprises a closing member 27a, 27b which is designed as an one-way valve and comprises a flexible blade biased against a seat of the control inlet 26a, 26b. Consequently, the closing members 27a, 27b are designed in such a manner that they at a rest position close the control inlets 26a, 26b. The valve element 4 comprises a projecting portion 28 which is arranged, during the movement of the valve element 4 and the rod 7, to engage the closing members 27a and

27b in such a manner that when the valve element 4 is displaced to the left in the figure it will in the proximity of its end position open the closing member 27a and when it is moved to the right in the figure it will in the proximity of its end position open the closing member 27b.

Furthermore, the second circuit comprises a first passage 29 which connects the first outlet conduit 20a to the control conduit 25b, and a second passage 30, which connects the second outlet conduit 20b to the control conduit 25a. Each of the passages 29 and 30 comprises a throttling 31 and 32, respectively, which result in a delay of the transfer of the control pulse to the second and first relay valves 19b, 19a, respectively.

The pulsator according to the invention functions in the following way. When the relay valves 19a and 19b of the second circuit takes the position disclosed in Fig 1, the second chamber 11 will, via the second outlet conduit 20b, be connected to the vacuum pump via the inlet 17b. The first chamber 10 will be connected to the atmosphere via the first outlet conduit 20a. It means that the pressure difference between the first and the second chambers 10, 11 will force the valve element 4 to the left in Fig 1. This results in the flowing of the dampening fluid in the third chamber 13 into the fourth chamber 14 via the connection conduit 15. When the valve element 4 approaches its left end position, the portion 28 will engage the closing member 27a, which means that the control inlet 26a is opened. Thereby, the control chamber 24a will be pressurized via the control conduit 25a. This pressurization results in a displacement of the membrane 23a, due to the area relation between the membrane 23a and the passage closed by the valve disc 21a, to the right in Fig 1 and in the movement of the valve disc 21a to its second position. Moreover, this means that the first chamber 10, via the first inlet conduit 20a and the first inlet 17a, is connected to the vacuum pump, which means that the force displacing the valve element 4 to the left in Fig 1 ceases. Via the passage 29, the control chamber 24b will be connected to the vacuum pump, which means that the membrane 23b is displaced to

the right in Fig 1 and that the valve disc 21b changes over to its second position. This means that the second chamber 11 will be connected to the atmosphere via the second inlet 18b and the second outlet conduit 20b. Consequently, the valve element 4 will now move back to the right in Fig 1. It is to be noted that the movement of the valve disc 21b to the right is facilitated by the connection of the relay valve 19b to the atmosphere via the passage 30. In a corresponding manner, the direction of movement of the valve element 4 will again be changed when the portion 28 opens the control inlet 26b via the closing member 27b.

The limping of the pulsator according to the invention may easily be adjusted by displacing the position of the valve element 4 and the portion 28 on the rod 7 somewhat to the right or to the left. In the same way the pulsation rate may be adjusted by changing the dampening via the controllable throttling valve 16.

The present invention is not limited to the embodiment disclosed herein but may be varied and modified within the scope of the following claims.

It is to be noted that even though the pulsator disclosed in the first place is intended for a milking machine, the pulsator according to the invention may also be utilized for other purposes where a pulsating pressure level is desired.

Claims

1. A pulsator comprising a first circuit having a first outlet (2) and a second outlet (3) which, by a displacement of a valve element (4),
5 are arranged to be connected alternately to a first source of a first pressure level and a second source of a second pressure level, respectively, the valve element (4) being displaceable by means of a pressure difference between a first and a second chamber (10, 11), and a second circuit which is arranged to provide said displacement
10 of the valve element (4) and which comprises a first inlet (17a, 17b) connected to the first source and a second inlet (18a, 18b) connected to the second source, the second circuit being designed to take one of a first stable position at which the first inlet is connected to the first chamber (10) at the same time as the second
15 inlet is connected to the second chamber (11) or a second stable position at which the first inlet (17b) is connected to the second chamber (11) at the same time as the second inlet (18a) is connected to the first chamber (10), characterized in that the second circuit comprises valve members (19a, 19b) which are arranged to
20 enable change-over of the second circuit from one of said stable positions to the other of these positions by means of a connection of short duration of a control inlet (26a, 26b) of said valve members (19a, 19b) to the second pressure source.
- 25 2. A pulsator according to claim 1, characterized in that said control inlet comprises a closing member (27a, 27b) which at a rest position closes the control inlet (26a, 26b), and that the valve element (4) comprises a portion (28) arranged to influence the closing member (27a, 27b) in such a manner that the control inlet is
30 opened at said change-over.
3. A pulsator according to any one of claims 1 and 2, characterized in that said valve members (19a, 19b) of the second circuit comprises a first (19a) and a second (19b) relay valve, the
35 first relay valve (19a) being connected to the first chamber (10) via a first outlet conduit (20a) and the second relay valve (19b) being

connected to the second chamber (11) via a second outlet conduit (20b).

4. A pulsator according to claim 3, characterized in that each relay valve (19a, 19b) comprises a two-way valve (21a, 21b) which at a first position closes a passage between the first inlet (17a, 17b) and the respective outlet conduit (20a, 20b) at the same time as a passage between the second inlet (18a, 18b) and the respective outlet conduit (20a, 20b) is opened and at a second position opens a passage between the first inlet (17a, 17b) and the respective outlet conduit (20a, 20b) at the same time as a passage between the second inlet (18a, 18b) and the respective outlet conduit (20a, 20b) is opened.

5. A pulsator according to claim 4, characterized in that each relay valve (19a, 19b) comprises a control chamber (24a, 24b) which is arranged in such a manner that the pressure level therein determines which of said first and second positions said two-way valve (21a, 21b) is to take.

6. A pulsator according to claims 2 and 5, characterized by a first control conduit (25a), connecting a first of said control inlets (26a) to the control chamber (24a) of the first relay valve (19a), and a second control conduit (25b), connecting a second of said control inlets (26b) to the control chamber (24b) of the second relay valve (19b).

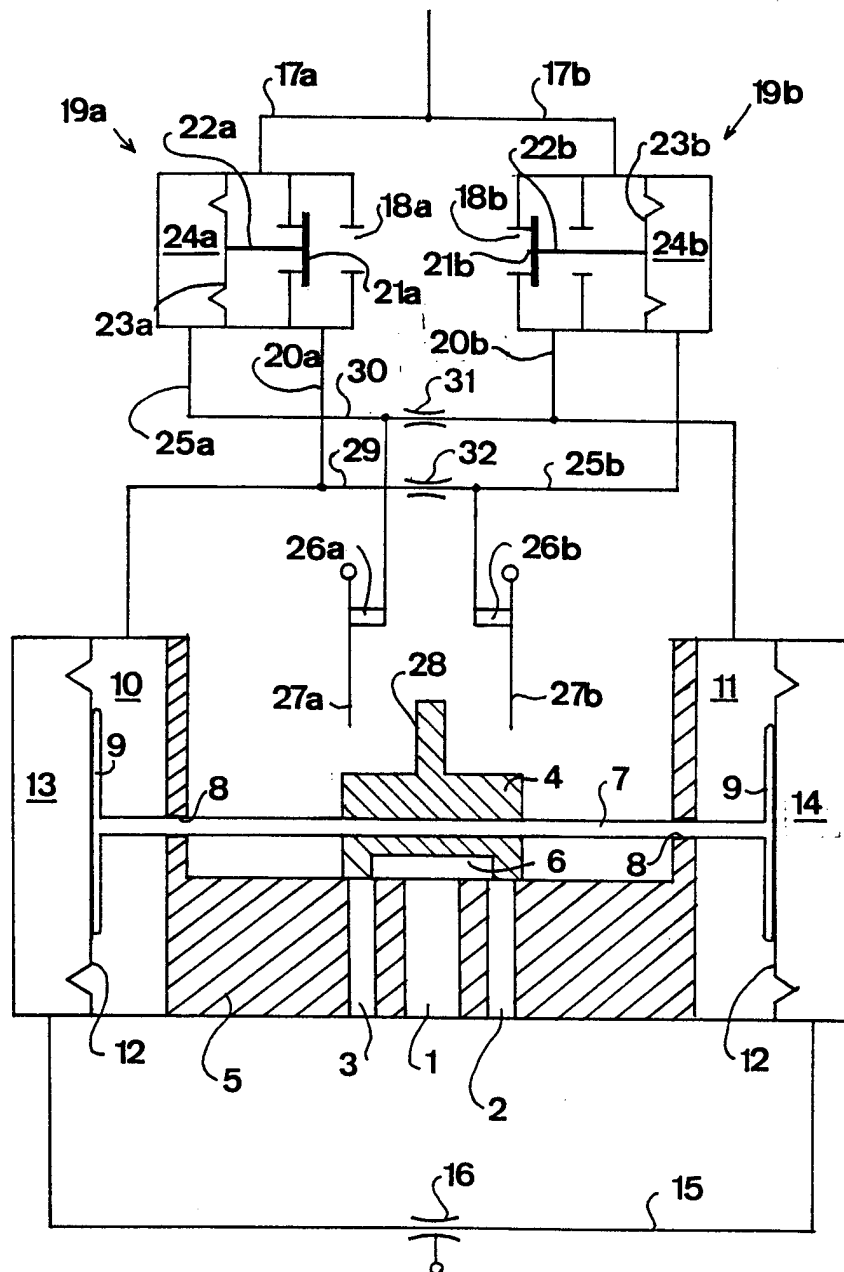
7. A pulsator according to claim 6, characterized in that each control chamber (24a, 24b) comprises a membrane (23a, 23b) to which said two-way valve (21a, 21b) is connected.

8. A pulsator according to claim 7, characterized in that the first outlet conduit (20a) is connected to the second control conduit (25b) via a first passage (29) and that the second outlet conduit (20b) is connected to the first control conduit (25a) via a second passage (30).

9. A pulsator according to claim 8, characterized in that each of said passages (29, 20) comprises a throttling (31, 32).
- 5 10. A pulsator according to any one of the preceding claims, characterized in that the valve element (4) is provided on a displaceable element (7) which at its ends is arranged to be influenced by a first and a second membrane (12) forming a limiting wall of the first (10) and second (11) chamber, respectively.
- 10 11. A pulsator according to claim 10, characterized in that the first and second membranes (12) also adjoin a third chamber (13) and a fourth chamber (14), respectively, which are arranged to dampen the movements of the displaceable valve element (4).
- 15 12. A pulsator according to claim 11, characterized in that the third and fourth chambers (13, 14) are arranged to enclose a damping medium and are connected to each other via a connection conduit (15).
- 20 13. A pulsator according to claim 12, characterized in that said connection conduit (15) comprises a controllable throttling (16) for the control of the dampening.

1/1

Fig 1



INTERNATIONAL SEARCH REPORT

International application No.

PCT/SE 98/00972

A. CLASSIFICATION OF SUBJECT MATTER

IPC6: ~~A01J~~ 5/12

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC6: A01J

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	EP 0009282 A1 (INTERPULS S.N.C. DI LIGABUE & C), 2 April 1980 (02.04.80) --	1,10-13
A	FR 2201828 A (LIGABUE LUGI), 3 May 1974 (03.05.74) --	
A	SE 344531 B (ALFA-LAVAL AB), 24 April 1972 (24.04.72) --	
A	SE 467183 B (ALFA-LAVAL AGRICULTURE INTERNATIONAL AB), 15 June 1992 (15.06.92) --	

☒ Further documents are listed in the continuation of Box C.☒ See patent family annex.

* Special categories of cited documents:

"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 when the document is taken alone

"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

Date of the actual completion of the international search

21 August 1998

Date of mailing of the international search report

26.08.98

Name and mailing address of the ISA/

Swedish Patent Office

Box 5055, S-102 42 STOCKHOLM

Facsimile No. +46 8 666 02 86

Authorized officer

Magnus Thorén

Telephone No. +46 8 782 25 00

INTERNATIONAL SEARCH REPORT

International application No.

PCT/SE 98/00972

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 5167200 A (ICKING ET AL), 1 December 1992 (01.12.92) -- -----	

INTERNATIONAL SEARCH REPORT

Information on patent family members

27/07/98

International application No.

PCT/SE 98/00972

Patent document cited in search report			Publication date	Patent family member(s)	Publication date
EP	0009282	A1	02/04/80	AT 339 T	15/11/81
FR	2201828	A	03/05/74	NONE	
SE	344531	B	24/04/72	BE 660936 A DE 1507025 A FI 49102 B,C NL 6503043 A US 3448756 A	01/07/65 04/12/69 31/12/74 13/09/65 10/06/69
SE	467183	B	15/06/92	DK 64890 A EP 0380514 A SE 8703538 A WO 8902216 A	13/03/90 08/08/90 15/03/89 23/03/89
US	5167200	A	01/12/92	AU 645636 B AU 8962391 A DE 4102369 C DE 59100365 D DK 496971 T EP 0496971 A,B SE 0496971 T3 JP 4293438 A JP 7077535 B NZ 241270 A	20/01/94 30/07/92 30/01/92 00/00/00 03/01/94 05/08/92 19/10/92 23/08/95 23/12/93