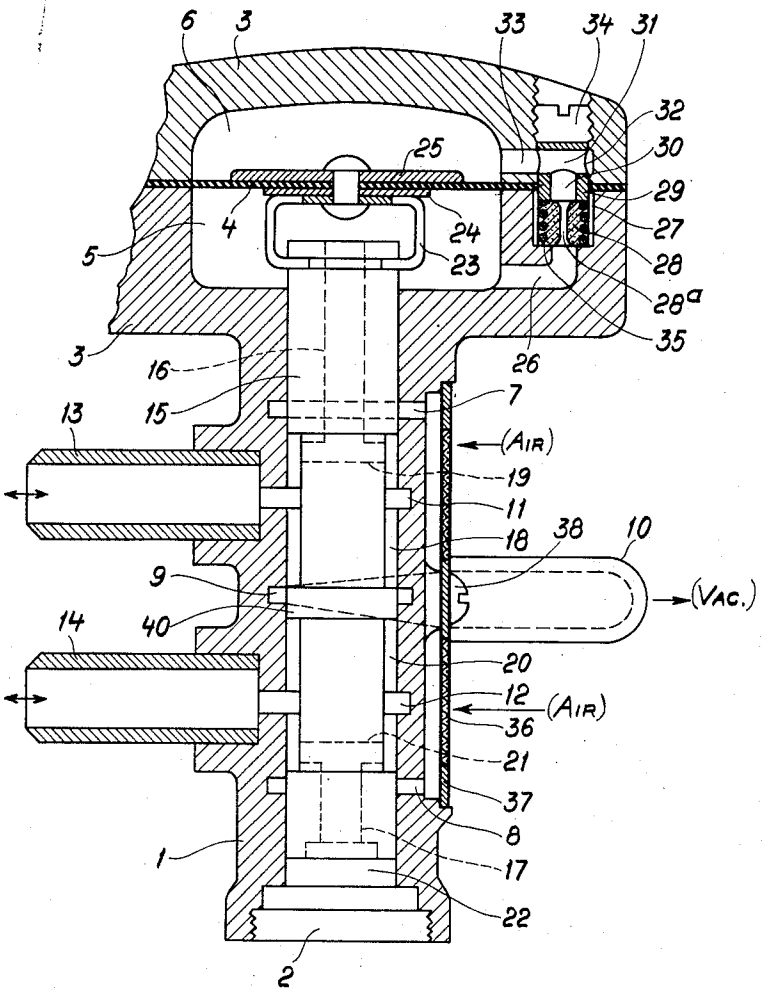
Dec. 29, 1953 K. G. MAGNI 2,664,095

PNEUMATIC PULSATOR

Filed Jan. 19, 1950



INVENTOR.

Karl Gunnar Magni

BY

Davis, Hoxie + Faithfull

Patented Dec. 29, 1953 2,664,095

UNITED STATES PATENT OFFICE

2,664,095

PNEUMATIC PULSATOR

Karl G. Magni, Ronninge, Sweden, assignor to Aktiebolaget Separator, Stockholm, Sweden, a corporation of Sweden

Application January 19, 1950, Serial No. 139,514
In Denmark July 11, 1942

Section 1, Public Law 690, August 8, 1946
Patent expires July 11, 1962

3 Claims. (Cl. 137—103)

1

The present invention relates to a pulsator adapted to be used with that type of milking machines in which a high and a low pressure are alternately established in the outer chambers of double-chamber teat cups. The outer chambers in two of the teat cups are exposed to the high pressure at the same time as the corresponding chambers in the two other teat cups are exposed to the low pressure and vice versa. The high pressure is in practice the prevailing atmospheric pressure, while the low pressure is a partial vacuum of about half atmospheric pressure.

The pressure reversals are obtained by means of a pulsator, which connects the teat cups alternately with the atmosphere and with a source of vacuum. The pulsator contains a working chamber, in which the high or low pressure influences a piston or a membrane (possibly several membranes) connected with a valve system, to reciprocate it between two end positions. In certain pulsators there is a working chamber on each side of the piston or membrane. Between the pulsating chamber and the working chamber there are generally provided throttling elements, by means of which the working speed of the pulsator is regulated. It is sufficient to connect only one of the pulsation chambers with the corresponding working chamber by a narrow opening acting to throttle, and such a connection is often used.

Devices of the kind mentioned have the inconvenience that the valve system, i. e., the piston or the valves, could easily remain standing in a mid-position, where the pressures in the pulsating chambers and thus in the working chamber or chambers are such that the required motion impulse does not arise. This tendency of the pulsator is, in pulsators provided with disc valves, more or less successfully counteracted by suitably locating the valves in relation to the vacuum chambers and the atmospheric pressure chambers. But with regard to the piston pulsators, which have no disc valves, there is no such possibility.

A distinct reversal of the valve system is achieved because the system is connected to a delaying membrane or a delaying piston which is at the shifting exposed to a pressure difference between the two sides of the membrane or the piston, which pressure difference acts in the opposite direction to that directly influencing the valve system but is later equalized through a throttled channel between both sides of the membrane. Thus, the piston or the valve system is forced to complete the movement begun without stopping in a mid-position. It is advantageous for ensuring a positive functioning to give to the delaying membrane a larger effective area than to the piston, or the membrane arranged for the shifting of the valve system. If this is the case, then the difference between the pressures on both sides of this membrane or piston caused at the shifting makes the valve system complete its movement with a greater force to the outer position. The larger pressure surfaces of the larger membrane thus determine the direction of motion against the action of the pressures on the piston or the smaller membrane. The prevailing pressures also tend to maintain the valve system in the end position attained. To effect a new shifting movement it is required that the pressures on both sides of the larger membrane should be equalized to a certain degree, so as to cause the difference between the pressures acting on the piston or the smaller membrane to become greater than the difference between the pressures influencing the delaying membrane. After such an equalizing has been effected, the valve system is shifted to the opposite end position, and this movement is hastened and ensured because the delaying membrane is at the shifting exposed to the other of the two pressures.

2

For effecting the equalizing between the pressures on both sides of the larger membrane or the piston, respectively, there is provided a throttled channel between chambers on both sides of the membrane. The regulation of the frequency of the pulsator is preferably made by regulating this throttling. In this case, the pulsating chambers and the working chambers in the pulsator should communicate without throttlings.

As the pressure prevailing in one of the pulsation chambers should also act on the membrane or the piston delaying the shifting movement, the air in one of the two chambers limited by the membrane will be subject to constant renewal. Since this chamber communicates with the other chamber by means of a throttled channel, dust particles entering with the air will ultimately deposit in the narrow channel, causing a reduction of the pulsating frequency. On account of the continual exchange of air, new quantities of dust from the surrounding atmospheric air will deposit in the throttling device.

The present invention has for its principal object the provision of a pneumatic pulsator having an improved pulsation frequency determiner in which the tendency for dust deposits in the throttled channel to lower the pulsating fre-

quency is greatly reduced and can be easily counteracted when necessary.

A pulsator made according to the invention comprises a reciprocating valve system adapted to distribute high and low pneumatic pressures to a pipe or pipes through working chambers of the pulsator. The reciprocating movements of the valve system are controlled by a pulsation frequency determiner comprising a housing forming an air chamber adjacent the valve system and in which the air pressure is alternately increased and decreased by the valve system in its reciprocation. The housing has in one of its walls a channel communicating with the housing chamber and through which atmospheric air passes first in one direction and then in the other direction, to and from the housing chamber, as the valve system reciprocates. A tube of rubber or other yielding material is arranged in the channel and has a flow passage forming a throttle for the reversing air current, the throughflow area of this flow passage determining the frequency of the pulsations. The elastic tube is seated at one end, and an adjustment device accessible from outside the housing is operable on the other end of the tube to compress it longitudinally, thus reducing the throughflow area of the throttling passage and therefore the pulsation frequency.

With this construction, for a given throughflow area the surface area of the throttling passage in the elastic tube is much smaller than that of the usual narrow annular passage of a throttle of the needle valve type commonly used in pneumatic pulsators, and therefore dust deposits on this surface area have a relatively small effect upon the throughflow area as compared with the needle type valve. Accordingly, the frequency determiner of the present invention can be operated many times longer, without requiring adjustment, than the frequency determiners commonly used. Moreover, since an initial compression can be imposed in the elastic tube by means of the adjustment device, any reduction in the pulsation frequency due to dust deposits in the tube passage can be readily counteracted by simply operating the adjustment device to release some of the compression and thereby increase the throughflow area.

For a better understanding of the invention, reference may be had to the accompanying drawing in which the single illustration is a longitudinal sectional view of a pulsator embodying a preferred form of the invention.

A cylindrical housing 1 is closed at one end by a threaded plug 2 and opens at the other end into a housing 3, which contains a membrane 4 dividing the interior of the housing into two chambers 5 and 6. The chamber 5 can be regarded as the inner or main membrane chamber and the other chamber 6 as the outer or secondary membrane chamber.

The housing 1 is provided with two openings 7 and 8 for atmospheric air and with an annular groove 9 communicating with a hose-socket 10 or vacuum. The housing 1 also has two annular grooves 11 and 12 formed between the central vacuum groove 9 and the openings 7 and 8. The annular grooves 11 and 12 communicate with hose-sockets 13 and 14 connected with teat cups (not shown).

A reciprocating piston 15 is provided with axial channels 16 and 17 and with annular grooves 18 and 20 separated by a collar 40. Groove 18 communicates by means of holes 19 with the channel 16, and groove 20 communicates by means of holes 21 with the channel 17. The channel 16 is in permanent communication with the chamber 5, and the channel 17 is in permanent communication with a chamber 22 at the opposite end of the piston.

The piston 15 extends into the chamber 5 and is there connected to the membrane 4 by means of a yoke 23, which is connected to the membrane in such a way that the free ends of the yoke engage in an annular groove near the end of the piston. In order to prevent the beat of the pulsator becoming irregular due to the weight of the piston 15 (when the pulsator is operated in an upright position), the membrane 4 is secured between two discs 24 and 25 of different diameters. The larger contacting surface of the disc 25 gives to the membrane 4 a larger effective area when high pressure prevails in the chamber 5 than when high pressure prevails in the chamber 6. Since the magnitude of these high pressures determines the moment of shifting of the valve system, it is possible with this arrangement to compensate for the weight of the valve system.

The housing 3 has a passage 26 leading from chamber 5 to the lower end of an enlarged vertical bore 27 in a wall of the housing. A rubber tube 28 is seated at its lower end on the shoulder formed by the bottom of bore 27, the central passage 28*a* in the tube being aligned with the housing passage 26. A plug 29 is seated on the upper end of tube 28 and has a central vertical passage 30 communicating with a transverse passage 31 in the plug. The ends of the transverse passage 31 open into an enlarged annular space 32 connected by a passage 33 to the outer or secondary membrane chamber 6. Thus, the passages 26, 28*a*, 30, 31 and 33 form a channel connecting the two chambers 5 and 6, so that pressure-equalization between these chambers can be effected. When the membrane 4 bends upward incident to reciprocation of the piston valve 15, air is driven from chamber 6 through the rubber tube 28 to chamber 5, and when the membrane 4 bends downward there is a flow of air in the opposite direction through the rubber tube 28.

The pulsation frequency is determined by the throughflow area of passage 28*a* in the rubber tube, which passage is smaller than the other passages and therefore constitutes a throttle. The throughflow area of throttle passage 28*a* can be varied by means of an adjustment device 34 in the form of a screw threaded in the housing and engaging the top of plug 29, the screw being accessible for adjustment from outside the housing. By tightening the screw 34, the plug 29 is forced downward so as to compress the rubber tube 28 longitudinally, thereby causing a reduction of the diameter of the throttle passage 28*a*. The tube 28 is preferably reinforced by a spiral spring 35, which may be vulcanized to the cylindrical surface of the tube or embedded in the rubber. By utilizing a reinforcing spring of this form, the throttling passage 28*a* will always remain circular in cross section, regardless of the extent to which it is compressed by the screw 34.

It will be understood that in the operation of the pulsator the air passing back and forth through the throttling passage 28*a* will contain some dust, since the chamber 5 communicates through channel 16, holes 19, groove 18 and openings 7 and 8 with atmospheric air. Even when these openings are covered by a strainer or filter cloth 36, fixed by a perforated cover plate 37 and a screw 38, it is inevitable that some dust will be carried by the air into chamber 5 and thus

pass back and forth through the throttling passage **35**. However, by virtue of the rubber tube **28** forming the throttling passage, the tendency for dust deposits on the wall of this passage to decrease the pulsation frequency is much less than in the case of the usual needle valve throttle, in which the annular passage must be of much greater diameter and much smaller width than the passage **28***a* in order to provide the same throughflow area. It will be apparent that dust deposits on the surfaces of the narrow annular passage of a needle valve will cause a much greater reduction in the throughflow area than in the case of the central opening **28***a*, and will therefore require much more frequent adjustment of the pulsator to maintain the desired pulsation frequency.

In addition to this advantage of the new pulsator, the rubber throttling tube **28***a* can be readily adjusted by means of the screw **34** to compensate for dust deposits when they become sufficient to lower the pulsation frequency beyond the desired minimum. In practice, the tube **28** is normally compressed a substantial amount by the screw **34**, and as the dust deposits build up in the throttling passage **28***a*, the screw **34** is simply retracted from time to time as may be necessary, thereby enlarging the diameter of the passage **28***a*.

It will be understood that when the pressures in all chambers of the pulsator are equalized, gravity, acting on the piston **15**, will slightly flex the diaphragm or membrane **4** and allow the piston to move downward until there is a slight opening between the annular vacuum groove **9** and groove **18** in the piston. This will permit exhaustion of chamber **5** so that expansion of air in chamber **6** can move the diaphragm **4** and the piston **15** downward to increase the opening from groove **9** to groove **18**. Further movement will open port **8** to annular groove **20** and permit air to flow through holes **21** and **17** into chamber **22** to start the piston upward.

This application is a continuation-in-part of my copending application Serial No. 629,160, filed November 16, 1945, now abandoned.

I claim:

1. In a milking machine pulsator of the pneumatically operated type, control apparatus for regulating the operation of said pulsator, comprising a housing having a channel formed therein, a compressible tube of yielding material disposed in the channel and having a longitudinal throughflow passage limiting the throughflow area of the channel, an adjustment device operatively associated with the compressible tube for compressing said tube longitudinally to throttle said passage, and a spiral spring coiled around and reinforcing the compressible tube whereby the material of the tube is displaced inwardly toward said passage upon longitudinal compression of the tube.

2. In a pneumatic pulsator having a reciprocating valve system for distributing high and low pneumatic pressures alternately to a pipe through working chambers of the pulsator, the combination of a housing having an air chamber formed therein adjacent the valve system and in which the air pressure is alternately increased and decreased by the valve system in its reciprocation, the housing having a throttled channel communicating with the air chamber for passage of air to and from the chamber incident to the pulsations, a compressible tube of yielding material disposed in the channel and having a longitudinal throughflow passage limiting the throughflow area of the channel, an adjustment device operatively associated with the compressible tube for compressing said tube longitudinally to throttle said passage and thereby adjust the pulsation frequency, and a spiral spring coiled around and reinforcing the compressible tube, whereby the material of the compressible tube is displaced inwardly toward said passage upon longitudinal compression of the tube.

3. In a pneumatic pulsator having a reciprocating valve system for distributing high and low pneumatic pressures alternately to a pipe through working chambers of the pulsator and having a housing in which an air chamber is formed adjacent the valve system and in which the air pressure is alternately increased and decreased by the valve system in its reciprocation, the housing having an enlarged air space and a throttled channel leading to the enlarged air space from the air chamber for passage of air to and from the chamber incident to the pulsations, mechanism for regulating the operation of the pulsator comprising a compressible tube of yielding material disposed in the channel and having a longitudinal throughflow passage limiting the throughflow area of the channel, an adjustment device operatively associated with the compressible tube for compressing said tube longitudinally to throttle said passage and thereby adjust the pulsation frequency, and a spiral spring coiled around and reinforcing the compressible tube whereby the material of the compressible tube is displaced inwardly toward said passage upon longitudinal compression of the tube.

KARL G. MAGNI.

References Cited in the file of this patent

UNITED STATES PATENTS

Number	Name	Date
261,640	Straight	July 25, 1882
1,657,663	Devereux	Jan. 31, 1928
1,977,504	Brown	Oct. 16, 1934
2,313,822	Hapgood	Mar. 16, 1943
2,379,483	Hapgood	July 3, 1945
2,464,917	Babson	Mar. 22, 1949