

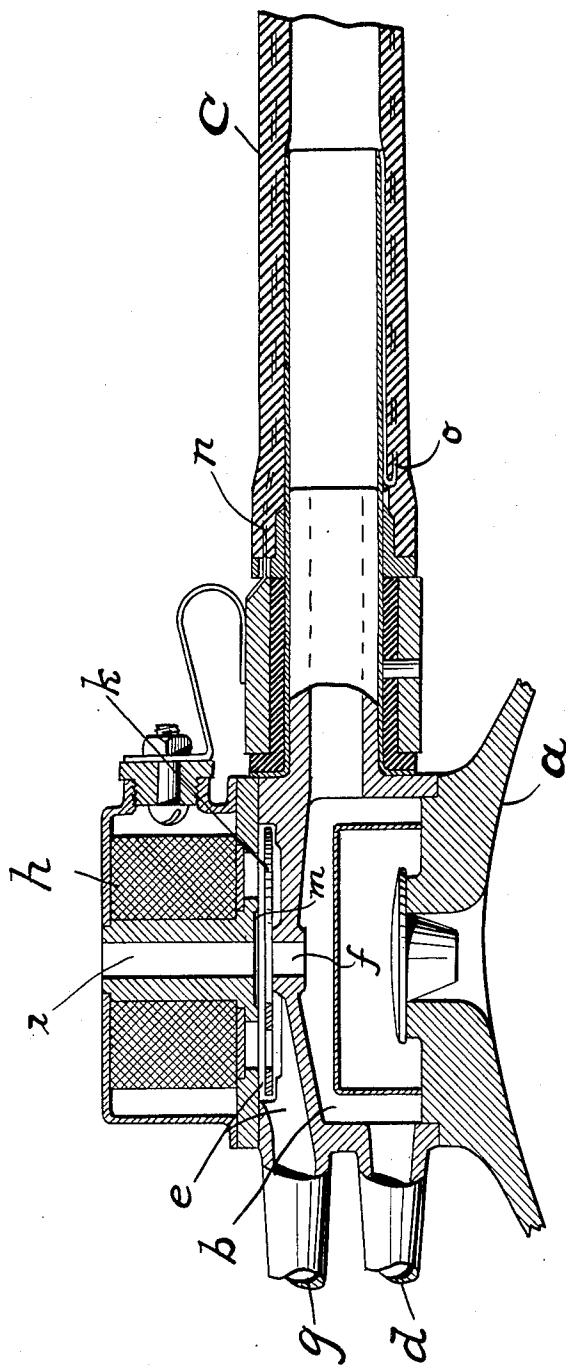
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PULSATOR FOR MILKING MACHINES

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WITNESS:

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PULSATOR FOR MILKING MACHINES

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5 Claims. (Cl. 31—62)

In applications filed by C. H. Hapgood, November 17, 1926, Serial No. 148,787, and December 24, 1927, Serial No. 242,329, there is set forth an electrically operable pneumatic pulsator for milking machines comprising a casing mounted on a milk pail and enclosing a pulsation or valve chamber having a port communicating with a source of vacuum, a port communicating with a tube in which the pneumatic pulsations are to be produced, and a port, opposite the first named port, communicating with a passage formed by the hollow core of an electro-magnet. This passage communicates with a source of high pressure, conveniently the atmosphere. Between the ports is a combination armature and valve in the shape of a magnetizable disc, which, when the magnet is not energized, is forced by atmospheric pressure against the vacuum port and which, when the magnet is energized, is pulled off the vacuum port and drawn against the atmospheric port. Thereby the atmospheric port and vacuum port are alternately brought into communication with the pulsation pipe, producing pneumatic pulsations.

In practice the device is operative, but the armature-valve is not always instantly responsive to the unbalanced air pressure when the magnet is de-energized, the valve sometimes sticking and causing delayed or uncertain action. I have discovered that this action is due to residual magnetism and have also discovered that the difficulty may be overcome by substantially increasing the area that is exposed to atmospheric pressure. In the preferred embodiment of the invention, this increased pressure area is provided by counter-boring the magnet pole face concentrically to the hollow core of the magnet, so that the circular valve seat formed by the magnet pole will be of so great a diameter relative to the diameter of the air passage enclosed by the hollow core of the magnet that the difference between the absolute pressures on opposite sides of the armature will, when the magnet is de-energized, render residual magnetism ineffective to cause sticking of the armature-valve and enable the durations of the periods during which the pulsation pipe is connected with air and vacuum to be more accurately and certainly predetermined.

The figure of the drawing is a vertical sectional view through the pail top, vacuum chamber, vacuum tube, magnet, armature-valve and the tubes intended for direct or indirect connection with the teat cups.

On the pail top *a* is mounted a casing which encloses a vacuum chamber *b* opening to a tube *c* adapted to connect with a source of vacuum and having a nozzle *d* which has a tube connection, either directly or through a claw, with the milk chambers of a set of teat cups. In the casing is also formed a pulsation or valve cham-

ber *e* having a control port *f* opening to the vacuum chamber *b* and a nozzle *g* which has a tube connection either direct with the pulsation chambers of the teat cups, or with an udder pulsator, as shown in said Hapgood applications. On the casing is mounted an electro-magnet *h* having a hollow core forming a passage *i* that communicates with the atmosphere. Air passage *i* preferably aligns with vacuum port *f*, and between this passage and port, that is, between the magnet and the partition separating vacuum chamber *b* from valve chamber *e*, is a disc *k*, which is the armature of the magnet and at the same time serves as a valve which, when lifted by the magnet, opens vacuum port *f* and closes air passage *i* and which, when released by the magnet, is moved by unbalanced pneumatic pressure, assisted by gravity, to open air passage *i* and seat against and close vacuum port *f*.

The pole face of the magnet is counterbored at *m*, thereby greatly enlarging the area subject to constant atmospheric pressure. Practically, the area of the counterbore is such that, if multiplied by the unit difference in pressure between the two sides of the disc when in contact with the pole face, the force produced will be greater than that required to overcome the pull on the disc by residual magnetism in the magnet.

To illustrate the application of this formula, let it be assumed that—

A=area of valve face exposed to higher pressure=.196 sq. inches.

R=pull of residual magnetism=13.1 ounces max.

P=high pressure=14.7 lbs.=235 oz. per sq. in.

p=low pressure=7.3 lbs.=117 oz. per sq. in.

M=total magnetic pull when valve is on air port=96 oz.

Then $A(P-p) > R$; or

$.196(235-117) = 23.128 > 13.1$

Another way of expressing the formula is that the area of the valve face exposed to the higher pressure is greater than the pull of the residual magnetism divided by the difference in unit pressure operative on opposite sides of the armature valve.

Then $A > \frac{R}{P-p}$; or

$.196 > \frac{13.1}{235-117}$; or $.196 > .111$

The above addition is merely a concrete application or illustration of the formula specified in the description and claims and is not new matter.

Imbedded in the walls of the vacuum tube *c* are wires *n*, *o*, which serve to carry electric impulses to the magnet *h*.

In operation, atmospheric pressure entering through passage *i* forces the armature-valve *k*

against the valve seat surrounding vacuum port *f*, and air at atmospheric pressure flows into pipe *g*. When an electric impulse energizes magnet *h*, it draws armature-valve *k* off the seat around vacuum port *f* and against the seat around the enlarged end of passage *i*, shutting off the inlet from the atmosphere, causing air to be drawn through pipe *g*, valve chamber *e* and port *f* into vacuum chamber *b*. When the electric current is broken, residual magnetism in the core of the magnet tends to retain the armature-valve *k* on its upper seat, but atmospheric pressure acting on the surface exposed to the large area port formed by the counterbore *m* immediately overcomes this force and drives the armature-valve *k* down against the seat around vacuum port *f*, thus opening the air inlet, and closing the vacuum connection, to pipe *g*.

Having now fully described my invention, what I claim and desire to protect by Letters Patent is:

1. In a milking machine, the combination with a milk pail and a pulsation pipe in which it is desired to produce pneumatic pulsations of definite duration, of means on the pail forming a vacuum chamber adapted to communicate with a source of suction and with the interior of the pail and having a port adapted to communicate with the pulsation pipe, an intermittently operable electro-magnet and means providing a passage adapted to communicate with a source of higher pressure and adapted to communicate with said pulsation pipe, an armature valve positioned between said port and passage and adapted to be moved, by the greater pressure through said passage, to close said port and to be moved against said greater pressure by the magnet, when energized, to make direct contact with the magnet pole and close said passage, the area of the armature valve face exposed to said higher pressure being greater than the pull of the residual magnetism divided by the difference in unit pressures operative on opposite sides of the armature valve, so that, when the magnet is de-energized, the residual magnetism will be ineffective to resist the actuation of said valve by said higher pressure.

2. In a milking machine, the combination with a pulsation pipe and a milk pail, of means on the pail forming a vacuum chamber adapted to communicate with a source of suction and with the interior of the pail and having a port adapted to communicate with the pulsation pipe, an intermittently operable electro-magnet provided with a passage communicating with a source of higher pressure and adapted to communicate with said pulsation pipe, and an armature valve positioned between said passage and port and adapted to be moved, by the greater pressure through said passage, to close said port and to be moved against said greater pressure by the magnet, when energized, to make direct contact with the magnet pole and said passage, the magnet pole

face being counterbored to provide an area on the face of the armature valve exposed to said higher pressure multiple times as great as the area of a cross-section of said passage and greater than the pull of the residual magnetism divided by the difference in unit pressure operative on opposite sides of the armature valve, so that, when the magnet is de-energized, the residual magnetism will be ineffective to prevent the prompt movement of the armature valve to open said passage and close said port.

3. In a milking machine, the combination of a casing forming a pulsation chamber and provided with a low pressure port, a magnet having one pole against which the hereinafter mentioned armature is adapted to directly seat, said magnet being hollow to afford a high pressure passage, and an armature-valve positioned in said chamber between said ports, the magnet pole face having a counterbore providing an air exit port from said passage whose area is greater than the pull of the residual magnetism divided by the difference in unit pressures operative on opposite sides of the armature-valve.

4. In a milking machine, the combination with an electro-magnet and means forming a pulsation chamber provided with a suction port and a port communicating with a source of higher pressure, of an armature valve positioned in the chamber between said ports and adapted to normally seat on the suction port and to be withdrawn therefrom and seat direct on the magnet pole and close the pressure port by excitation of the magnet; the area of the armature-valve face exposed to said higher pressure being greater than the pull of the residual magnetism divided by the difference in unit pressures operative on opposite sides of the armature-valve.

5. In a milking machine, the combination with a pipe in which pneumatic pulsations are to be produced, of an electro-magnet having one pole adapted to serve as a valve seat and which encloses a passage adapted to convey a pressure fluid therethrough to said pulsation pipe, a disc adapted to make direct contact with the magnet pole and to function as a magnet armature and also as a valve and which is exposed on one face to the pressure of said fluid, means to expose the opposite face of the valve to a substantially lower pressure whereby the higher pressure tends to force said valve off said seat, the strength of said magnet being such that, when energized, it will pull said valve onto its seat against said pressure, the area of the surface exposed to said higher pressure being greater than the pull of the residual magnetism divided by the difference in unit pressures operative on opposite sides of the armature-valve so that, said pressure fluid will immediately overcome the residual magnetism of the magnet when the latter is de-energized.

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