F. A. LANE.

MILKING MACHINE.

APPLICATION FILED SEPT. 12, 1917.

1,354,666.

Patented Oct. 5, 1920.

4 SHEETS—SHEET 1.

FIG. 1.

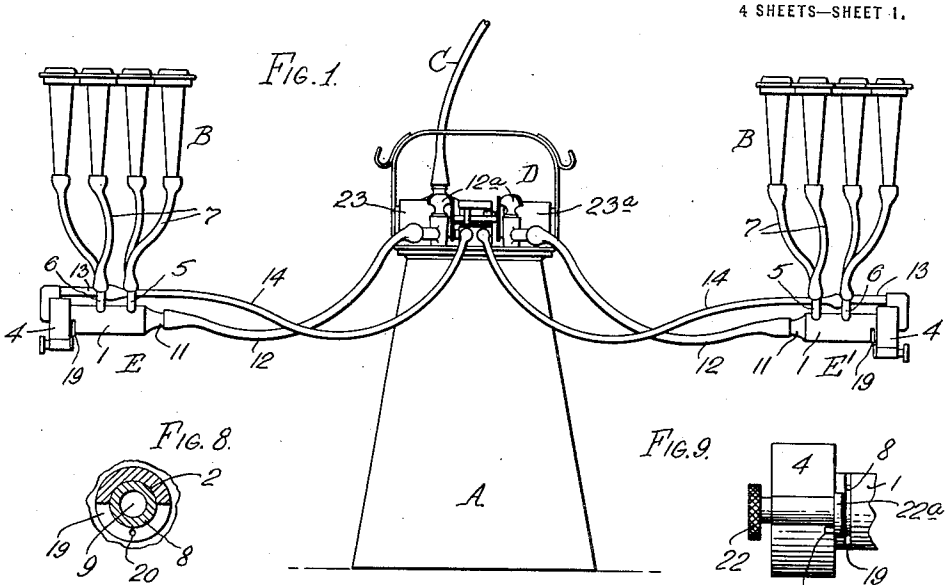


FIG. 8.

FIG. 9.

FIG. 2.

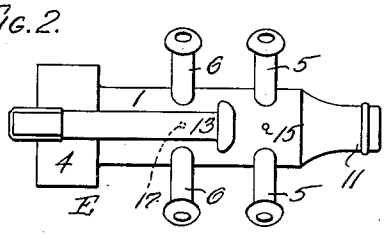


FIG. 3.

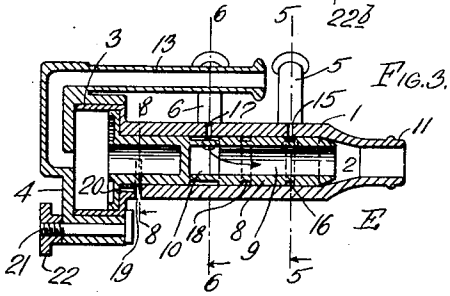
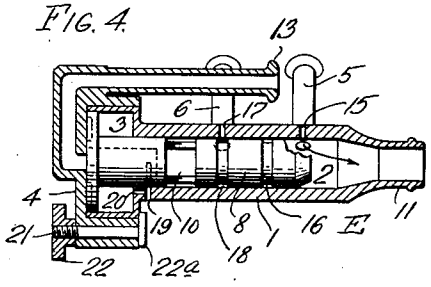
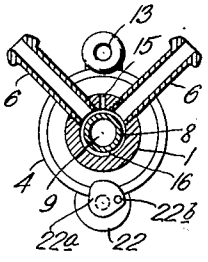


FIG. 4.





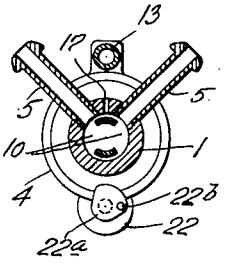


FIG. 5.

FIG. 6.

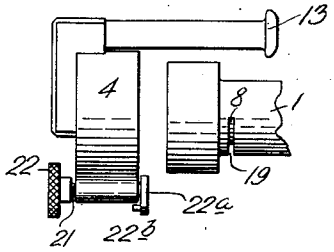


FIG. 7.

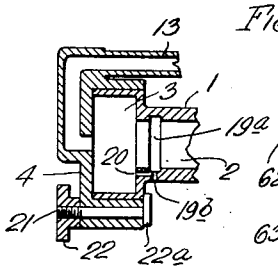


FIG. 9a.

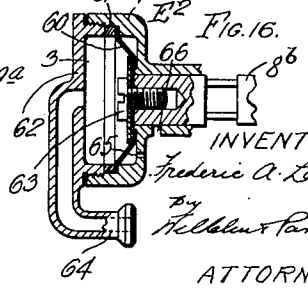


FIG. 16.

INVENTOR.

Frederic A. Lane.

By Hibben & Parker.

ATTORNEYS.

F. A. LANE.

MILKING MACHINE.

APPLICATION FILED SEPT. 12, 1917.

1,354,666.

Patented Oct. 5, 1920.

4 SHEETS—SHEET 2.

FIG. 10.

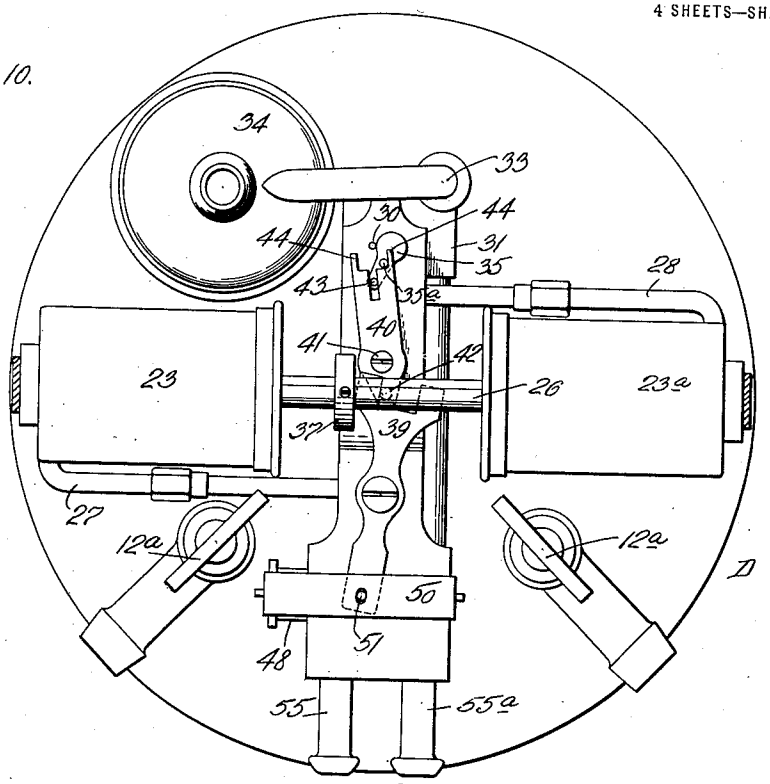
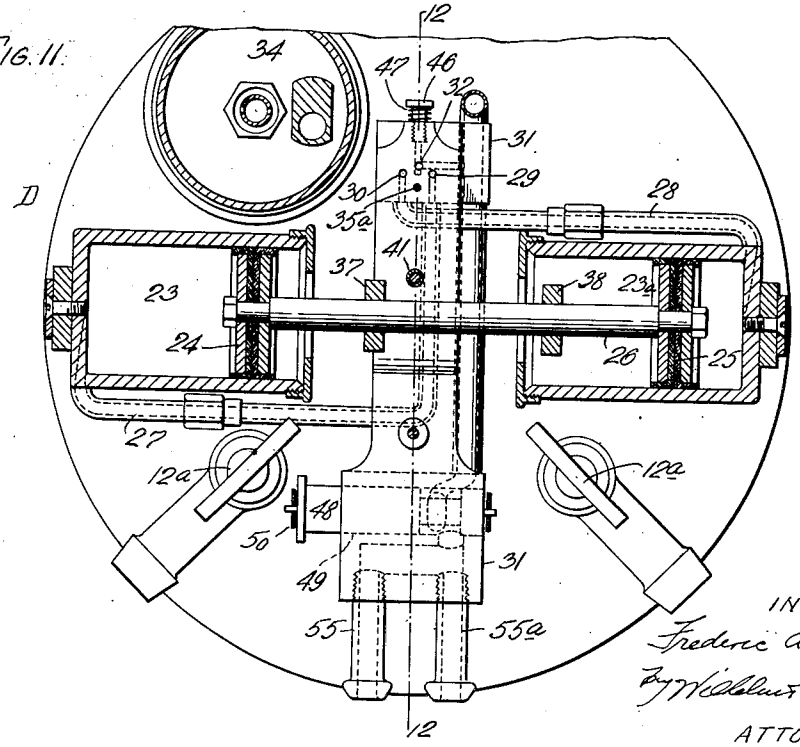


FIG. 11.



INVENTOR.

Frederic A. Lane.

By Williamson & Parker.

ATTORNEYS.

F. A. LANE.

MILKING MACHINE.

APPLICATION FILED SEPT. 12, 1917.

1,354,666.

Patented Oct. 5, 1920.

4 SHEETS—SHEET 3.

FIG. 12.

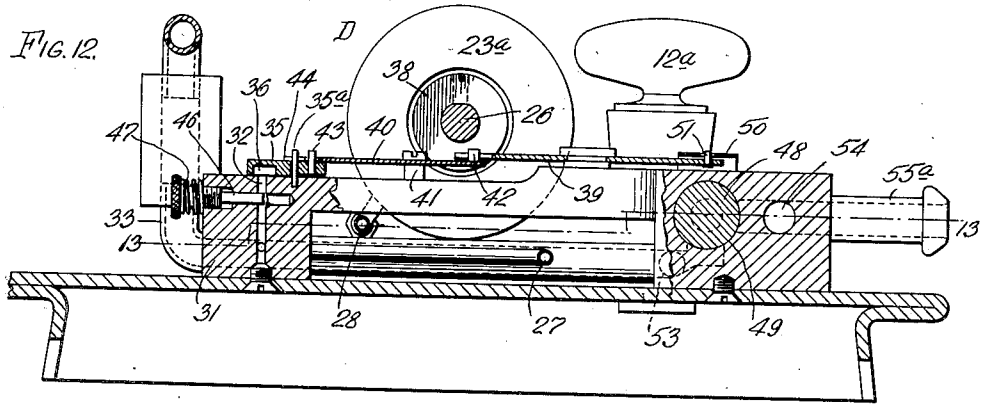


FIG. 13.

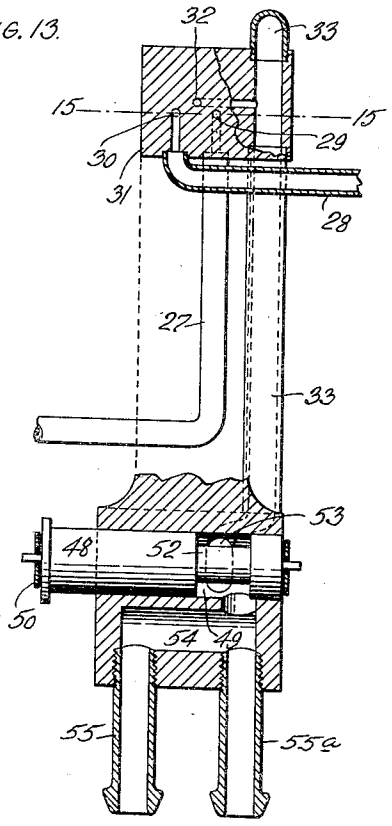


FIG. 14.

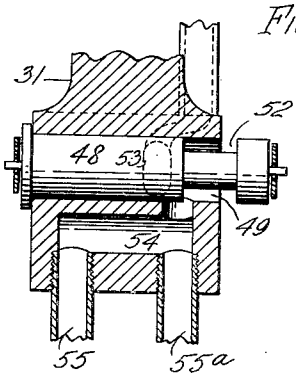
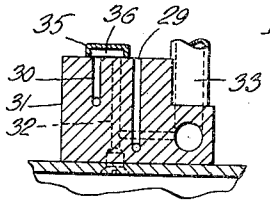


FIG. 15.



INVENTOR.

Frederic A. Lane.

By Wilkelm & Parker.

ATTORNEYS.

F. A. LANE.

MILKING MACHINE.

APPLICATION FILED SEPT. 12, 1917.

1,354,666.

Patented Oct. 5, 1920.

4 SHEETS—SHEET 4.

Fig. 17.

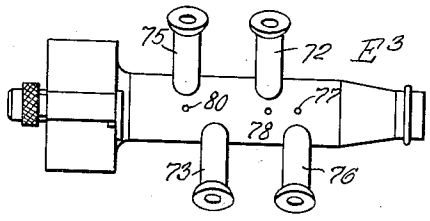
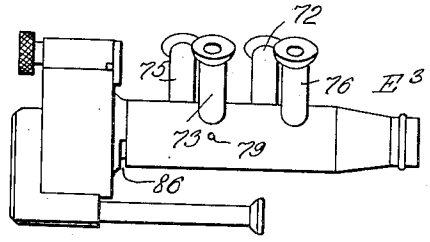


Fig. 18.



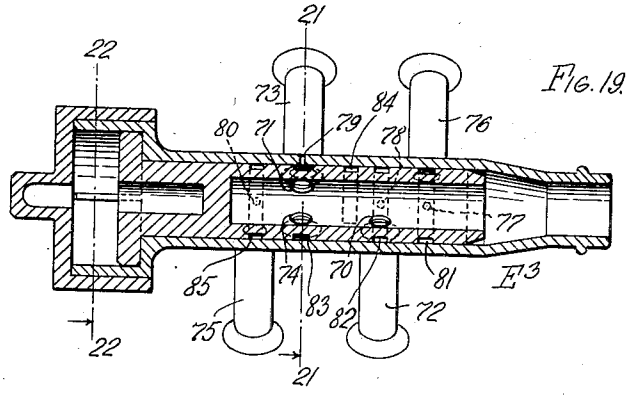
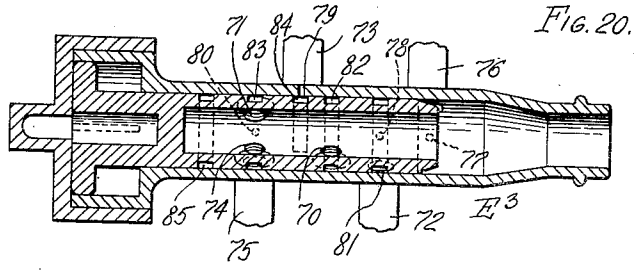


Fig. 19.

Fig. 20.



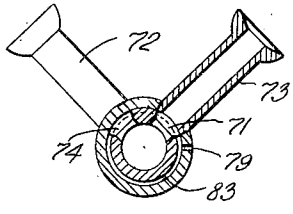


Fig. 21.

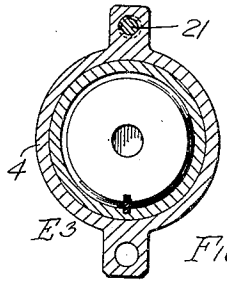


Fig. 22.

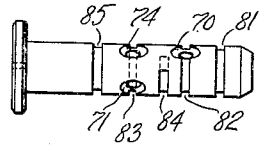


Fig. 23.

INVENTOR.

Frederic A. Lane,

by Wilkelms Parker.

ATTORNEYS.

UNITED STATES PATENT OFFICE.

FREDERIC A. LANE, OF LITTLE FALLS, NEW YORK, ASSIGNOR TO D. H. BURRELL & CO., OF LITTLE FALLS, NEW YORK.

MILKING-MACHINE.

1,354,666. Specification of Letters Patent. Patented Oct. 5, 1920.

Application filed September 12, 1917. Serial No. 190,876.

To all whom it may concern:

Be it known that I, FREDERIC A. LANE, a citizen of the United States, residing at Little Falls, in the county of Herkimer and State of New York, have invented a new and useful Improvement in Milking-Machines, of which the following is a specification.

This invention relates to milking machines of that type in which an intermittent or pulsating suction is applied to the teat cups, and more particularly to machines in which the portable pulsators by which the suction is alternately connected with and disconnected from the teat cups, are located adjacent to the teat cups and are acted upon by fluid pulsations produced by a primary pulsator which can either be carried by the milk pail or otherwise portably arranged, or located in a fixed position in the barn.

One object of the invention is to provide a thoroughly reliable and practical milking machine of this type. Other objects of the invention are to produce pulsating mechanisms of strong and durable construction which will operate properly at slow speeds and in which the reversing valve is operated positively without the use of springs; also to provide a secondary pulsator of simple, practical and desirable construction in which means are provided to prevent the milk from being drawn from one chamber to the other of the pulsator cylinder so as to interfere with the action of the pulsator piston; also to provide a secondary pulsator which operates alternately on different teat cups and is so constructed that the milk from some of the teat cups passes through the interior of the pulsator piston, whereas the milk from the other teat cups passes over the exterior of the piston, thus simplifying the construction of the pulsator.

In the accompanying drawings:—

Figure 1 is an elevation of a milking machine embodying the invention.

Fig. 2 is a plan view of the secondary pulsator.

Fig. 3 is a sectional elevation thereof showing one position of the pulsator piston.

Fig. 4 is a similar view thereof showing the other position of the pulsator piston.

Figs. 5 and 6 are transverse sectional elevations thereof on lines 5—5 and 6—6, respectively, Fig. 3.

Fig. 7 is a fragmentary elevation thereof showing the cap or cover of the casing removed.

Fig. 8 is a transverse sectional elevation thereof on line 8—8, Fig. 3.

Fig. 9 is a fragmentary bottom plan view thereof showing the securing device for the cap or cover.

Fig. 9ª is a fragmentary section showing a slight modification of the pulsator casing.

Fig. 10 is a plan view of the primary pulsating mechanism.

Fig. 11 is a plan view thereof, partly in section.

Fig. 12 is a sectional elevation thereof, on an enlarged scale on line 12—12, Fig. 11.

Fig. 13 is a sectional plan view thereof, on line 13—13, Fig. 12.

Fig. 14 is a fragmentary view similar to Fig. 13, showing a different position of the primary pulsator valve.

Fig. 15 is a sectional elevation thereof on line 15—15, Fig. 13.

Fig. 16 is a sectional elevation of a secondary pulsator of modified construction.

Figs. 17 and 18 are respectively a plan and side elevation of a modified form of secondary pulsator.

Figs. 19 and 20 are enlarged horizontal sections thereof viewed from below and showing respectively different positions of the pulsator piston.

Figs. 21 and 22 are sections thereof on lines 21—21 and 22—22 respectively, Fig. 19.

Fig. 23 is a plan view of the pulsator piston removed from its casing.

A represents the milk pail or vessel and B the teat cups which may be of any usual or suitable construction; C the suction pipe connecting the milk pail with the suction device or source of vacuum for exhausting air from the pail; D the primary pulsating mechanism, and E and E′ the secondary pulsators. The primary pulsating mechanism is interposed between the secondary pulsators and the source of vacuum or suction, and produces fluid pulsations which act upon the secondary pulsators E E′ in such a manner as to produce in the secondary pulsators a reciprocatory movement, whereby the secondary pulsators cause the milking pulsations in the teat cups, as by alternately connecting the teat cups with and disconnecting them from the suction.

The primary pulsating mechanism D is

shown as mounted on the milk pail A, but it can be located in any suitable position, either in a fixed location in the barn or in connection with the milk pail A. Preferably there is a separate secondary pulsator for each set of four teat cups located adjacent to the teat cups between the same and the milk pail.

Each of the secondary pulsators is preferably constructed as follows:

1 represents the pulsator casing or cylinder which is provided with a bore forming two chambers 2 and 3 of different diameters, the larger of which, 3, is provided with a cap or cover 4 which is removably secured on the casing by suitable means permitting the cap to be readily secured and removed. 5 and 6 represent two pairs of nipples to which the teat cups are connected by short tubes 7. The passages of these nipples connect with the small chamber 2 of the pulsator cylinder, the passages of one pair of nipples 5 being located in a different transverse plane from the passages of the other pair of nipples 6. 8 represents a pulsator piston which is provided with portions of different diameters fitting and adapted to reciprocate in the two chambers 2 and 3 of the cylinder. The small portion of the piston is hollow or provided with a chamber 9 which is open at the small end of the piston and connects with one or more openings 10 through the side walls of this portion of the piston. The pulsator cylinder is provided at its small end with a nipple 11 which is connected by a milk tube 12 and cock 12^a with the milk pail for conveying the milk to the latter. There is always a constant suction in this tube since a partial vacuum is maintained in the milk pail. The cap or cover of the pulsator cylinder is provided with a nipple 13 to which is attached a pulsation tube 14 leading to the primary pulsator D by which fluid pressure pulsations are produced in the large chamber 3 of the cylinder as hereinafter explained. The small end of the pulsator piston 8 is always subject to the constant suction in the milk tube 12. When no suction is acting in the chamber 3 on the large end of the piston, the piston is held in the position shown in Fig. 3 because the suction acting on the small end of the piston and the atmospheric pressure acting on the large end of the piston force the piston to the right in Fig. 3. In this position the suction acts on the rear pair of nipples 6 through the chamber 9 and the openings 10 in the piston, and the milk passes through the nipples 6, the openings 10 and the chamber 9 of the piston, and flows through the milk tube 12 into the pail. At the same time air enters through a small hole 15 in the wall of the pulsator cylinder and passes through a circumferential external groove 16 in the piston into the other pair of nipples 5 relieving the suction on the teat cups connected thereto. When suction acts through the pulsation pipe 14 connecting with the large chamber 3 of the pulsator cylinder, the piston is pulled to the left to the position shown in Fig. 4, because the area of the piston in the chamber 3 is larger than the area on which the suction in the milk tube 12 acts. In this position of the piston the milk is drawn from the forward pair of teat cups through the pair of nipples 5 past the small end of the piston 8 and through the nipple 11 and milk tube 12 into the pail. At the same time the suction is cut off from the other pair of nipples 6 and air enters these nipples and the teat cups connected thereto through a small hole 17 in the wall of the cylinder and an external circumferential groove 18 in the piston. A small amount of air is admitted through the holes 15 and 17 when the milk is passing down through the nipples 5 and 6 respectively, which aids in clearing the milk passage and moving the milk to the pail.

In order to prevent the milk from being drawn from the small chamber 2 of the pulsator cylinder into the large chamber 3 thereof, a transverse slot 19 is provided in the lower part of the wall at the small portion of the cylinder. This slot is located at a point between the chamber 3 and the point at which the openings 10 in the piston are located when the piston is in its extreme left-hand position, shown in Fig. 4, and prevents a film of milk from forming in the cylinder around the piston and finding its way into the large chamber 3. Without this slot or its equivalent the milk is apt to be carried back and gradually get into the large chamber 3 of the pulsator cylinder so as to gum up the piston and interfere with its action. This slot 19 performs two functions; first it serves to separate the two cylinders and allows a small amount of air to leak in between the piston and the cylinder in both directions and prevents a film of milk from forming. The milk that gets in between the piston and the cylinder in the forward part of the pulsator, in place of creeping back toward the larger cylinder will be swept forward by the air which leaks in at the slot. Secondly when the pulsator is not in operation, the film of milk can escape at the slot.

Instead of a slot cut through the wall of the cylinder, as shown, a similar result could be secured by providing the cylinder with an internal annular groove or recess 19^a and a hole 19^b leading from this groove to the exterior of the cylinder, as shown in Fig. 9^a. The slotted construction, however, is preferred, as it can be more readily kept clean.

20 represents a small hole, commonly

called a "breathing hole" which connects the large chamber 3 of the cylinder with the slot 19 and permits air to enter and discharge from the chamber 3 in front of the piston head to prevent compression or suction in the chamber 3 in front of the piston head.

A screw 21 and thumb nut 22, see Figs. 4–7, are shown for securing the cap 4 on the pulsator casing. The screw extends through a hole in one side of the cap and has an irregular shaped head 22^a adapted to project over the inner end of the large part of the casing, and a pin 22^b adapted to strike the side of the cap to limit the turning of the screw in its hole. When the thumb nut is loosened the screw will turn with it until its head 22^a is swung clear of the casing, permitting the removal of the cap. When the thumb nut is turned in the opposite direction, the screw will turn with it until arrested by the pin 22^b striking the side of the cap, after which the further turning of the nut will draw the cap tightly onto the casing. This is a convenient device for quickly releasing and securing the cap 4. Any other suitable securing device can, however, be used.

In the machine shown in the drawings, the primary pulsating mechanism D is mounted on the cover of the milk pail and is actuated pneumatically by connection with the source of vacuum or suction which exhausts the air from the milk pail, the mechanism being constructed as follows:

23 and 23^a represent two oppositely disposed cylinders in which are arranged to reciprocate pistons 24 and 25 which are connected by a single piston rod 26. 27 and 28 indicate tubes or passages connecting with the outer ends of the cylinders 23 and 23^a respectively. These tubes connect with passages 29 and 30 respectively in a base block or casting 31 mounted on the pail cover. The passages 29 and 30 extend to the upper surface of said base block. 32 is a suction passage extending through the block 31 from its upper surface between the two passages 29 and 30 and connecting with a suction tube or passage 33, which can be connected with the suction device or source of vacuum in any suitable way. As shown, it is connected with the usual suction trap 34 on the pail cover with which the suction pipe C connects for exhausting air from the milk pail.

35 represents a reversing valve consisting of a plate suitably pivoted at 35^a on the block 31 to swing on the upper surface thereof over the passages 29, 30 and 32. This valve is provided in its underside with a recess or cavity 36 see Fig. 15 which, in the position of the valve shown in Fig. 10, connects the exhaust passage 32 with the passage 29 and leaves the passage 30 open to the atmosphere. In another position the reversing valve is adapted to uncover the passage 29 and connect the exhaust passage 32 with the other passage 30. For shifting the reversing valve to thus uncover the passages 29 and 30 and alternately connect them with the exhaust passage 32, the piston rod 26 is provided with two collars or projections 37 and 38 adapted to strike a pulsator lever 39 suitably pivoted on the base block 31 and provided between the collars 37 and 38 with a bifurcated end. A reversing lever 40 suitably pivoted at 41 on the base block 31 has a pin or projection 42 at one end extending between and adapted to be struck by the forks of the bifurcated end of the pulsator lever 39. The reversing lever 40 is provided at its other end with a slot into which extends a pin or projection 43 on one end of the reversing valve 35. This end of the reversing lever is also preferably provided with two stop projections 44 adapted to strike the pivot 35^a of the reversing valve to limit the throw of the reversing lever.

In the position of the parts shown in Figs. 10 and 11, the reversing valve 35 connects the passage 29 with the exhaust passage 32 and the passage 30 is uncovered. The cylinder 23 is thus connected with the vacuum and the cylinder 23^a with the atmosphere. The pistons 24 and 25 will therefore be moved in the cylinders to the left in Fig. 11, and as the pistons approach the end of their movement to the left, the collar 38 will strike the bifurcated end of the pulsator lever 39 and shift this lever until one of its forks strikes the pin 42 and swings the reversing lever 40, thereby shifting the reversing valve from the position shown in Fig. 10 to a position in which it uncovers the passage 29 and connects the passage 30 with the exhaust passage 32. This will connect the cylinder 23^a with the vacuum and the cylinder 23 with the atmosphere and thus cause the reverse movement of the pistons. In a similar manner as the pistons approach the end of their movement to the right in Fig. 11, the collar 37 will strike and swing the pulsator lever 39 and the other fork of this lever will strike the pin 42, thereby swinging the reversing lever 40 and the reversing valve back to the position shown in Fig. 10.

46 represents a regulating valve or screw which works in a screw-threaded hole in the end of the base block 31 and has its inner end arranged to enter and more or less obstruct the suction passage 32. By adjusting this screw or valve the suction can be regulated to govern the operation of the pulsator motor or operating mechanism. A spring 47 surrounding this screw between

the head thereof and the base block holds the regulating screw in the position to which it is adjusted.

48 represents a pulsator valve or piston arranged to reciprocate in a hole or cylinder 49 extending through the base block 31. A yoke 50 straddling the base block 31 and connected at its ends to the ends of the pulsator valve or piston 48 is suitably connected to the pulsator lever 39, as by a pin 51 on the lever entering a slot in the yoke. Thus when the pulsator lever 39 is swung by the engagement of the collars on the piston rod 26 therewith, as before explained, the pulsator valve is shifted alternately in opposite directions. The pulsator valve is provided with a reduced portion or annular groove 52 which, in the position of the valve shown in Fig. 13, connects two passages 53 and 54 in the base block 31. The passage 53 connects with the suction tube or passage 33 and the passage 54 connects with two nipples 55 and 55^a which are connected respectively with the pulsation tubes 14 leading to the two secondary pulsators E E', so that in this position of the valve the secondary pulsators are connected to the suction means. In the position of the pulsator valve 48 shown in Fig. 14, the body of the valve closes the passage 53 and cuts off connection with the suction tube 33, and the groove 52 of the valve connects the passage 54 with the atmosphere through the open end of the valve hole 49, thereby connecting the secondary pulsators with the atmosphere. Thus by the reciprocation of the primary pulsator valve 48, the large chambers 3 of the secondary pulsators are alternately placed in connection with the atmosphere and with the source of vacuum to cause the reciprocation of the secondary pulsator pistons as before explained.

By reason of the described construction of the primary pulsating mechanism an extremely short motion of the piston rod 26 shifts the reversing valve completely from one to the other of its positions. The device will operate at a very slow speed, say of about forty strokes per minute, and shift the reversing valve properly at this speed, and it is not necessary to have a spring-actuated reversing valve. This is an advantage, as springs are always troublesome. Heretofore pulsating mechanisms have been made which operate fairly well at high speeds but it has been found very difficult to produce a mechanism without a spring actuated reversing valve which operates satisfactorily at the slow speeds at which the present construction is capable of operating, owing to the described operating connections between the pistons and the reversing valve which afford a greatly multiplied movement of the reversing valve. The parts of the primary pulsating mechanism constructed as described are sufficiently strong and rigid not to give trouble from breakage.

If the primary pulsating mechanism is located in a fixed position in the barn, or is not mounted on the pail as shown in the drawings, the milk pail will, as before, be connected with the constant suction from the main vacuum line in the barn, and can have a simple cover with cocks or nipples for the connection of the main milk tubes 12 leading from the secondary pulsators. The primary pulsator can be of other construction, whether operated pneumatically or mechanically. The primary pulsator described is also desirable for use with lining teat cups. In such case the primary pulsator is used without the secondary pulsators, the main milk tube 12 connecting with the milk pail as shown, and the pulsation tubes 14 which operate the linings, connecting with nipples 55 and 55^a of the primary pulsator.

The movable parts of the primary pulsator mechanism are preferably covered and protected by a removable cover, which, however, is omitted from the drawings in order to better disclose the mechanism.

In the modified construction of the secondary pulsator E^2 shown in Fig. 16, the larger end of the pulsator piston 8^b consists of a diaphragm 60 of suitable material held tightly in place in the larger chamber 3 of the pulsator casing 1^b by a ring 61 and the cap 62 of the casing. This cap is shown as being screwed into the enlarged end of the body of the casing but it could be held in any other suitable way. The diaphragm is fastened centrally to the end of the piston by a screw 63 and washer or other fastening. The cap 62 is provided with a nipple 64 which communicates with the larger chamber 3 of the casing. In other respects this pulsator is constructed and operates substantially the same as that shown in Figs. 1–9. The pulsation tube 14 from the primary pulsator is connected to the nipple 64 and the milk tube 12 is connected to a nipple at the smaller end of the pulsator casing, so that the pulsations from the primary pulsator will reciprocate the piston 8 in the manner before described. The larger chamber 3 is provided with a breathing hole 65, and the casing 1 with a slot 66, as in the first construction described.

The secondary pulsator E^3 shown in Figs. 17 to 23 is constructed so as to suck on the cow's teats in a different order from the pulsators hereinbefore described. Instead of applying the suction, as before, alternately to the two rear teats and then to the two forward teats, this pulsator E^3 applies the suction first on one rear teat and the opposite forward teat, and then on the other rear teat and the remaining forward teat.

Sucking in this way has a tendency to keep the device in better position on cows whose rear teats hang much lower than their forward teats, which frequently happens. The piston in this construction is substantially built and is not likely to be bent. In the position of the piston shown in Fig. 19, the holes 70 and 71 therein register with one forward nipple 72 and the opposite rear nipple 73 and apply the suction to the teat cups connected with these nipples. In the position of the piston shown in Fig. 20, the suction is applied to the other rear teat cup and remaining forward teat cup through a hole 74 in the piston and nipple 75 and through the nipple 76 which latter is opened by the reduced extremity of the piston. Holes 77, 78, 79 and 80 in the pulsator casing and coöperating grooves 81, 84 and 85 in the piston are provided for admitting air to either pair of teat cups while the suction is being applied to the other pair, as will be apparent from Figs. 19 and 20. The piston also has grooves 82 and 83 for admitting air to the pulsator casing to assist the flow of milk and the casing is provided with a slot 86 to prevent the milk from working into the larger piston chamber, as before explained.

I claim as my invention:—

1. The combination of a set of teat cups, a secondary pulsator comprising a casing having piston chambers of different diameters, a reciprocating piston having portions of correspondingly different diameters arranged in said chambers, said pulsator being constructed and connected to produce pulsations alternately in different teat cups of said set, suction means applying constant suction to the small end of said piston, a primary pulsator mechanism which produces fluid pulsations, and means for applying said fluid pulsations to the large end of said piston.

2. The combination of teat cups, a pulsator for producing pulsations in said teat cups comprising a casing having piston chambers of different diameters, and means connecting the teat cups with the chamber of smaller diameter, a reciprocating piston having portions of correspondingly different diameters arranged in said chambers, means for reciprocating said piston, said piston having a chamber in the small portion thereof which communicates with the small chamber of the casing and in one position of the piston connects with a portion of said teat cups to permit the passage of milk through said piston chamber, the remaining teat cups being placed in communication with the small chamber of said casing exteriorly of the piston in another position of said piston.

3. The combination of teat cups, a pulsator for producing pulsations in the teat cups comprising a casing having a piston chamber connected with said teat cups, a piston arranged to reciprocate in said chamber and itself having a chamber which communicates with said chamber of the casing and in one position of the piston communicates with a portion of said teat cups to permit the passage of milk through said piston chamber, said casing chamber communicating directly with the remaining teat cup exteriorly of the piston in another position of the piston and means for reciprocating said piston.

4. The combination of teat cups, a pulsator for producing pulsations in the teat cups comprising a casing having passages connecting with said teat cups, a piston arranged to reciprocate in said casing to control said passages and having a hollow portion through which passes the milk from certain of said teat cups, the interior of said casing being placed in communication with a portion of said teat cups exteriorly of said piston in one position of the piston and with the remaining teat cups through the interior of said piston in another position of the piston, and means for reciprocating said piston.

5. The combination of teat cups, a pulsator for producing pulsations in the teat cups comprising a casing having milk passages connecting with said teat cups, and air inlet ports, a piston arranged to reciprocate in said casing and having a hollow portion, said piston in one position thereof connecting the interior of said casing with a portion of said milk passages and with one of said air inlet ports, through the interior of said piston, and said piston in another position thereof connecting the interior of said casing with the remaining milk passages and with one of said air inlet ports exteriorly of said piston, and means for reciprocating said piston.

6. The combination of teat cups, a pulsator for producing pulsations in the teat cups comprising a casing having milk passages connecting with said teat cups, and air inlet ports, a piston arranged to reciprocate in said casing and having a hollow portion, said piston in one position thereof connecting the interior of said casing with a portion of said milk passages through the interior of said piston and connecting the remaining milk passages with one of said air inlet ports, and said piston in another position thereof connecting the interior of the casing with said remaining milk passages exteriorly of the piston and connecting the other milk passages with one of said air inlet ports, and means for reciprocating said piston.

7. The combination of teat cups, a pulsator for producing pulsations in the teat cups comprising a casing provided with two

chambers and with passages connecting one of said chambers with the teat cups, a piston arranged to reciprocate in said last mentioned chamber and controlling said teat cup passages, a part connected to said piston and arranged in said other chamber, and fluid pressure connections with said chambers of the casing for reciprocating said piston, said casing having an opening located between said teat cup passages of one chamber and the other chamber of the casing for preventing the milk from passing from one to the other of said chambers.

8. The combination of teat cups, a pulsator for producing pulsations in the teat cups comprising a casing having two piston chambers, a milk discharge passage from one of said chambers, a piston having portions arranged to reciprocate in said chambers, one portion of said piston controlling communication between the teat cups and the interior of said chamber which connects with the milk discharge passage, means for operating said piston, and an opening to the atmosphere between said chambers.

9. The combination of teat cups, a pulsator for producing pulsations in the teat cups comprising a casing having chambers of different diameters, a piston having portions of correspondingly different diameters arranged to reciprocate in said chambers, communication between said teat cups and the interior of the casing controlled by the smaller portion of said piston, and fluid pressure connections with the chambers of said casing for operating said piston, said casing having an opening to the atmosphere between the large chamber thereof and the passages connecting with the teat cups.

10. The combination of teat cups, a pulsator for producing pulsations in the teat cups comprising a casing having chambers of different diameters and passages connecting the smaller chamber with the teat cups, a piston having portions of correspondingly different diameters arranged to reciprocate in said chambers of the casing and adapted to control said teat cup passages, and fluid pressure connections with the chambers of said casing for reciprocating said piston, said casing having an opening located between the teat cup passages and the large chamber of the casing to prevent the milk passing into the large chamber of said casing.

11. In a milking machine, the combination of a pulsator mechanism comprising a pulsator valve which causes fluid pressure pulsations, a fluid-pressure-actuated motor for operating said pulsator valve, a reversing valve which controls the passage of actuating fluid to said motor for reversing the motion of the movable member thereof, a lever which is actuated by the movable member of said motor and has a lost motion connection therewith permitting a movement of the motor member independently of said lever, and a connection between said lever and said reversing valve for shifting the latter.

12. The combination of a pulsator mechanism comprising a fluid-pressure-actuated motor, means operated thereby for producing fluid pulsations, a reversing valve controlling the reversing of said motor, an operating lever for said valve and spaced devices which are reciprocated by said motor and strike a part of said lever located between said devices for shifting said lever and reversing valve, said devices being arranged to allow lost motion between the movable member of the motor and said valve.

13. The combination of a pulsator valve, cylinders, pistons arranged to move in said cylinders, a piston rod connecting said pistons, projections on said piston rod, a reversing valve controlling the flow of fluid pressure to said cylinders for reciprocating said pistons, a lever connected to said pulsator valve and actuated by projections on said piston rod, said lever having a bifurcated portion, a second lever provided with a portion extending between the forks of the bifurcated portion of said first lever for actuating said second lever, said first lever having a movement independent of said second lever, and a connection between said second lever and said reversing valve for shifting the latter.

Witness my hand, this 8th day of Sept., 1917.

FREDERIC A. LANE.

Witnesses:
C. G. STINGER,
LYDIA L. WHITE.