June 4, 1963 N. J. BULLOCK ETAL 3,091,954

FREE-PISTON PUMP FOR WASHING APPARATUS

Filed Dec. 26, 1961

2 Sheets-Sheet 1

Fig. 3

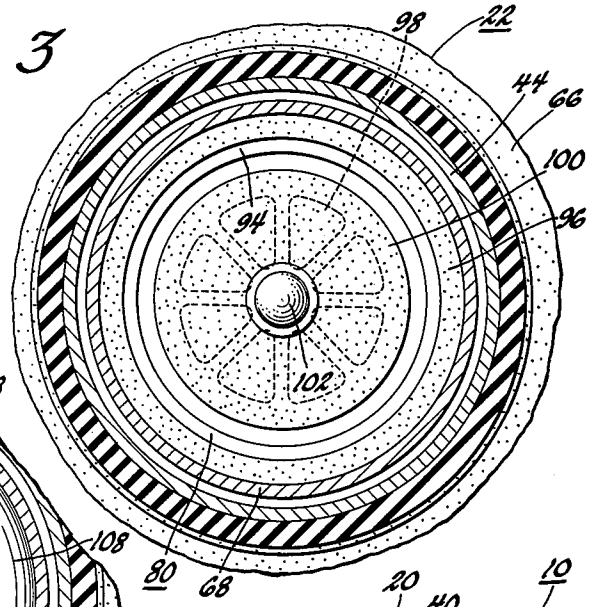
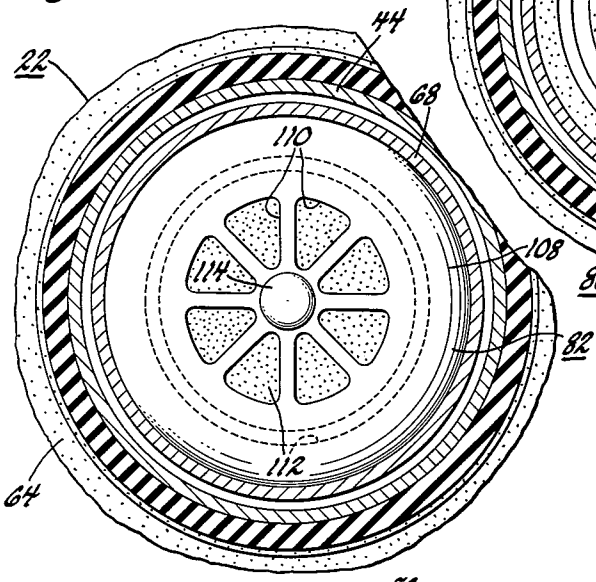


Fig. 4



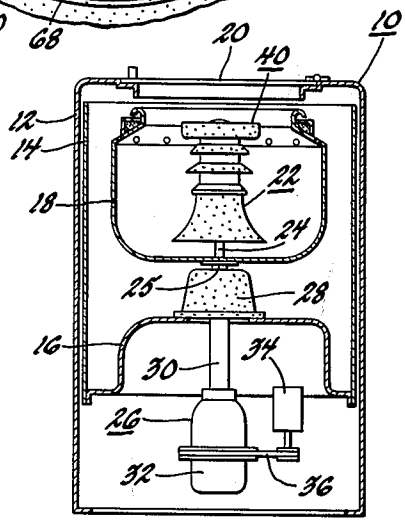


Fig. 1

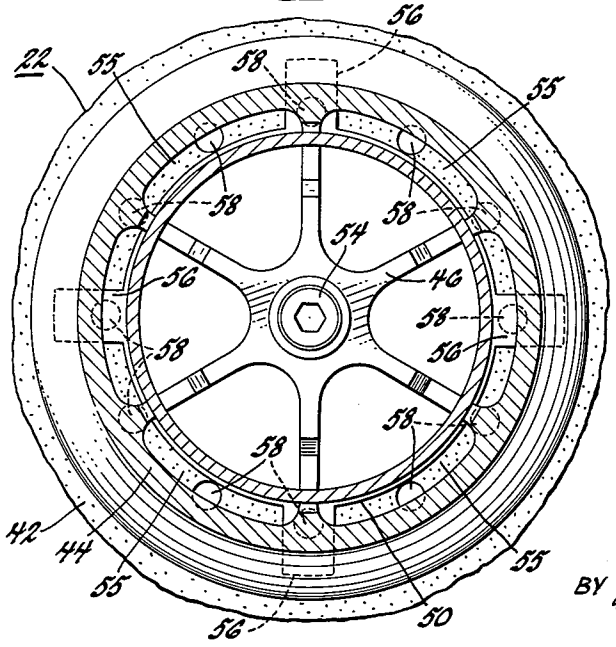


Fig. 5

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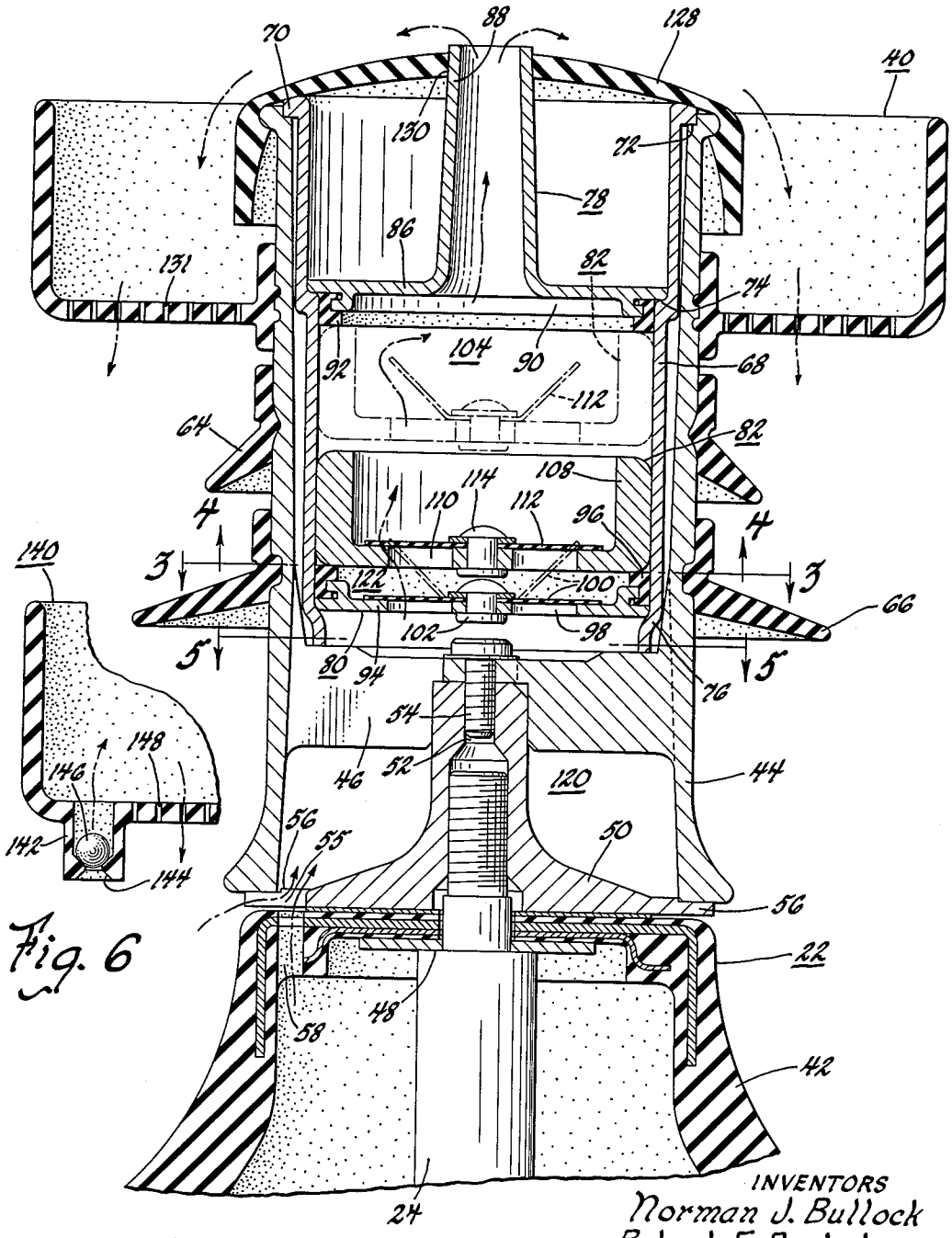


Fig. 6

Fig. 2

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United States Patent Office 3,091,954 Patented June 4, 1963

3,091,954

FREE-PISTON PUMP FOR WASHING APPARATUS

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Filed Dec. 26, 1961, Ser. No. 161,881
11 Claims. (Cl. 68—18)

This invention relates to a domestic appliance and more particularly to clothes washing apparatus having an improved system for pumping clothes washing fluids and for removing lint.

In the development of the clothes washing art, efforts have been made to remove the lint and sediment from the washing fluid throughout the clothes washing process. Many prior art devices have used independently powered recirculating systems for accomplishing the lint removing function with the requirement of additional components to serve these ends.

Accordingly, it is an object of this invention to provide a lint remover for a clothes washer which is actuated by the movement of an agitator in said clothes washer.

A more particular object of this invention is the provision of a lint remover for a vertically reciprocating agitator which incorporates a free piston pump in said agitator for circulating washing fluid through a lint collector.

Generally, an object of this invention is the provision of a free piston fluid pump actuated by the vertical reciprocations of an agitator.

Another general object of this invention is the provision of a free piston pump actuated by the oscillations of an agitator.

Further objects and advantages of the present invention will be apparent from the following description, reference being had to the accompanying drawings wherein preferred embodiments of the present invention are clearly shown.

In the drawings:

FIGURE 1 is a schematic sectional view of a clothes washer suitable for use with this invention;

FIGURE 2 is a fragmentary sectional view of the agitator in the clothes washer of FIGURE 1;

FIGURE 3 is a fragmentary sectional view taken along line 3—3 in FIGURE 2;

FIGURE 4 is a fragmentary sectional view taken along line 4—4 in FIGURE 2;

FIGURE 5 is a fragmentary sectional view taken along line 5—5 in FIGURE 2; and

FIGURE 6 is a fragmentary sectional view of another embodiment of the lint removing system of this invention.

In accordance with this invention and with reference to FIGURE 1, a washing machine 10 is provided with the lint collecting arrangement of this invention. The washing machine 10 includes an outer cabinet 12, an inner casing or water container 14 and a centrally located bulkhead 16. Within the water container 14 is a rotatably mounted washing machine tub 18. An access door 20 overlies the top of tub 18 to provide means for access in placing clothing within the clothes washer. An agitator 22 is disposed at the top of a shaft 24 which extends downwardly from the tub 18 and through the partition 16 into the washing machine agitate and spin mechanism shown generally at 26. A hat-shaped flexible support collar 28 serves indirectly through the agitate and spin mechanism 26 to support the tub 18 a spaced distance above the partition 16. The shaft 24 is rotatably and relatively axially movable within a concentric tubular spin shaft 25 to which the tub 18 is affixed. The support portion 28 flexibly carries a stationary outer tubular support housing 30 which encloses the agitate shaft 24 and

the spin shaft 25 and about which a drive housing 32 for the agitate and spin mechanism is rotatably mounted. The particular washing action produced by the mechanism 26 is such that a rotation of housing 32 in one direction produces a vertical reciprocation of shaft 24 and the agitator 22. On the other hand, a rotation of housing 32 in the opposite direction is adapted to spin the laundry tub 18 in a centrifuging or clothes wringing operation. This agitating and spinning mechanism is more clearly set forth in the patent to Sisson 2,758,685, issued August 14, 1956. As a prime mover for the agitate and spin mechanism 26, a reversible single speed motor 34 is included. The motor 34 is arranged in parallel relationship to the agitate and spin mechanism 26 and is adapted to rotate the drive housing portion 32 thereof by means of a drive belt arrangement shown generally at 36.

In the clothes washer of FIGURE 1, the vertical reciprocation of the agitator 22 sets up toroidal water currents within the spin tub 18 which tend to wash the clothes. As the clothes are tumbled and flexed, dirt and lint are released therefrom and float free in the washing fluid. For the best washing results, it is desirable to remove this sediment and lint from the circulating fluids so that it will not be redeposited upon the surfaces of the clean clothes. For this reason, the agitator 22 is provided with a lint collector basket or screen, shown generally at 40. The lint collector catches and filters or strains washing fluid which has been pumped upwardly through the center part of the agitator 22 in accordance with the teachings of this invention. After the washing fluid has been filtered or conditioned in the lint collector, the uncontaminated wash fluid returns by gravity to the wash tub 18.

Turning now to FIGURE 2, the novel free-piston pump agitator of this invention will now be described more fully. The agitator or pulsator 22 is comprised of a somewhat flexible flared rubber-like pulsator diaphragm 42 and a rigid generally cylindrical and hollow agitator post 44 which may be formed of metal or plastic. An integral strengthening spider 46 within the interior of the agitator post 44 facilitates fluid passage from the lower end of the post to the upper end thereof in accordance with the vertical reciprocation of the agitator post.

The agitator post or column is assembled to the diaphragm 42 in the following manner. The diaphragm is fitted over the upper end of the agitate shaft 24 where it rests on a shoulder 48 thereof. A spacer nut 50 threadedly engages the threaded upper end of the agitator shaft and includes also a tapped opening 52 for receiving a fastening means 54 which acts through the spider 46 to retain the hollow agitator post 44 in spaced engagement with the pulsator diaphragm 42—passageways 55 being provided by the spaced radially directed foot portions 56 of the spacer nut 50. Additional ports 58 are formed in a circumferential circle about the top of the diaphragm 42 to aid in the admission of washing fluids to the interior of the agitator post. Thus, when the agitator 22 is reciprocated vertically, washing fluid rushes into the interior of the post 44 through the passageways 55 and 58. For additional fluid agitation, flexible rings 64 and 66 may be attached in retaining grooves on the exterior surface of the agitator post.

The lint pump is housed in the hollow of the agitator post and is comprised of a generally cylindrical lint pump housing 68 which has a radially outwardly turned flange 70 for resting on a shoulder 72 at the top of the agitator post. The lint pump housing 68 has reduced diameter portions to form a central shoulder 74 and a bottom shoulder 76 to retain, respectively, the lint pump cap assembly 78 and the inlet valve assembly 80. Between the lint pump cap assembly and the inlet valve assembly,

there is disposed a floating valve assembly **82**—the mass of which cooperates with the reciprocation of the agitator **22** to force fluids upwardly through the hollow of the agitator.

The lint pump cap assembly **78** is comprised of an inverted funnel-like cap **86** having an upwardly directed collar or nozzle **88** through which wash fluids are pumped to the lint collector or strainer **40**. An annular flange on the cap has a depending support shoulder **90** for retaining an annular upper floating valve cushion **92**.

The inlet valve assembly **80** rests on the shoulder **76** of the lint pump housing and is comprised of an inlet valve plate **94** and an annular lower floating valve cushion. **96**. The plate **94** is formed with a plurality of circumferentially arranged inlet ports **98** which are selectively covered and uncovered by the affixed lint pump valve **100**—a rivet **102** retaining the valve on the plate **94**. Note that the lint pump cap **86** forms the upper extremity of a pump chamber **104** which is limited or defined at its lower extremity by the inlet valve assembly **80**.

Within the chamber or cylinder **104**, the floating valve assembly **82** is adapted to reciprocate relative to the agitator **22**. More particularly, the floating valve assembly **82** is comprised of a floating valve weight or piston **108** formed with a plurality of circumferentially arranged ports **110** motion responsively covered and uncovered by a lint pump valve **112**, which is held to the piston by a rivet **114**. The weight of the piston **108** depends upon the resistance or back pressure of the pump supply system against which you want the piston to work. The greater the weight of the piston, the more force or pressure that is exerted on the fluid between the piston and the pump outlet, i.e. (agitator motion in G's) × (piston weight) = force. If the agitator **22** is reciprocating at 330 strokes per minute, a force due to motion is exerted in the amount of 2.7 G's. By subtracting the 1.0 G due to the natural force of gravity, there remains (2.7 − 1.0 = 1.7 G) to do work solely as the result of the reciprocations of the agitator. Therefore, the weight of the piston cooperates with the agitator to ascertain how effectively the work force from the reciprocations of the agitator is utilized in pumping.

Within the lint housing cylinder or chamber **104**, the floating valve assembly **82** is shown in a solid line position at the bottom of the chamber and in a phanhom line position at the top of the chamber. These represent the operating relationships of the floating valve assembly when the agitator **22** is in its uppermost position (floating valve assembly in solid line) and when the agitator is in its lowermost position (floating valve assembly in its phantom line position). In both of these positions, the floating valve cushions **92** and **96** serve to minimize the slapping noise of the piston against the top and bottom of the pump chamber.

In operation, the motor **34** is energized to rotate the agitate and spin mechanism **26** in a direction to vertically reciprocate the agitator **22** at approximately 330 strokes per minute. Since the floating valve weight **108** is of substantial mass, it will tend to stand relatively still as the agitator **22** and the lint pump housing **68** reciprocate vertically past it. As aforesaid, washing fluid within the spin tub **18** rushes into the inlet chamber **120** at the bottom of the agitator post. When the agitator **22** moves downwardly, the inlet valve **100** moves to the phantom line position to admit water to the chamber **122** between the inlet valve assembly and the floating valve assembly **82**. Then, when the agitator **22** moves upwardly, the inlet valve **100** is closed by the force of the water in the chamber **122** and the weight **108** tends to compress the fluid trapped in the chamber **122** in a manner to raise the pump valve **112**, as shown in phantom line. This permits the trapped fluid to pass through the openings **110** in the floating or free piston pump unit and into the supply nozzle or passage **88**. It should be realized that the repeated reciprocations of the agitator **22** will produce a rather continuous fluid pumping action from the inlet passages **55** and **58** to the outlet passage **88**.

The top of the lint pump housing and the agitator column is closed by a soap dispenser cap **128** which has a central opening **130** for receiving the nozzle end **88** of the lint pump cap **86**. Thus, water pumped through the center of the agitator post flows over the outer surface of the soap dispenser cap, as shown by the flow arrows, and drops by gravity into the lint collecting basket **40**. From this point, it is strained through the openings **131** in the bottom of the lint collector and returns to the spin tub in an uncontaminated lint-free condition. The collector **40** may be removed from the agitator post **44** for cleaning or the lint may simply be scraped from the collector while in place on the agitator.

Another embodiment of this invention is seen in FIGURE 6 and is comprised of a modified lint collecting basket **140** adapted for attachment to the agitator post in the same manner as in FIGURE 2. Depending from the bottom wall of the lint collector are a plurality of integral cylinders, such as **142**, each of which has an annular shoulder **144** at the bottom thereof to form a valve with a free floating ball check **146**. The bottom of the lint collector **140** is perforated as at **148** so that when the lint basket **140** is reciprocated by the agitator **22**, the ball **146** stands still and alternately either permits wash fluid to enter the lint basket or closes to force the wash fluid to return to the wash basket through the perforations **148**. This strains the lint from the wash fluid. It is within the purview of this invention to form a second annular shoulder like **144** above the ball **146** to prevent the ball from leaving the cylinder **142**.

It should now be seen that an improved lint collecting system has been devised for a clothes washer which uses the motion of the agitator to actuate a pump for forcing wash water to a lint collector. The free piston pump arrangement of this invention may also be used to pump all sorts of fluid laundry agents, and is easily adaptable for many applications where liquid transfer is involved with an oscillating device.

While the embodiments of the present invention as herein disclosed constitute preferred forms, it is to be understood that other forms might be adopted.

What is claimed is as follows:

1. In combination with a container adapted to contain wash fluid and having an agitator and means for vertically reciprocating said agitator,

said agitator comprising cylindrical means forming a hollow agitator post having a top opening above said fluid and a bottom opening below said fluid,

a lint pump in the hollow of said agitator, said lint pump comprising a lint pump housing having an upper shoulder and a lower shoulder forming respectively the upper and lower limits of a pump chamber, said pump chamber having a lower pump chamber inlet in communication with said bottom opening of said agitator post and an upper pump chamber outlet, a pump chamber cap supported on said upper shoulder and having a supply outlet from said chamber in communication with said upper pump outlet, an inlet valve assembly for said pump chamber supported on said lower shoulder and having a pump chamber inlet valve in intercepting flow relationship with said lower pump chamber inlet and said bottom opening in said agitator, and a free floating piston between said pump chamber cap and said inlet valve assembly adapted to slide relatively to said lint pump housing when said agitator is reciprocated,

and means on the top of said agitator post means for retaining said lint pump housing in said agitator post for movement therewith and having an opening for receiving said supply outlet from said pump chamber,

said free floating piston having a fluid flow responsive flap valve openable for passing a first quantity of fluid toward the upper pump outlet when said agitator is moving in one direction and said pump chamber inlet valve is closed and closable for forcing said passed fluid from said supply outlet when said agitator is moving in another direction and said pump chamber inlet valve is open to pass a second quantity of fluid toward said flap valve,

and means for straining the lint from said fluid forced from said supply outlet.

2. In combination with a container adapted to contain fluid and having an agitator and means for vertically reciprocating said agitator,

said agitator comprising means forming a hollow agitator post having a top opening above said fluid and a bottom opening in communication with said fluid,

and a lint pump in the hollow of said agitator, said lint pump comprising a lint pump housing forming a pump chamber, said pump chamber having a lower pump chamber inlet in communication with said bottom opening of said agitator post and an upper pump chamber outlet, a pump chamber cover supported in an upper portion of said chamber and having a supply outlet from said chamber in communication with said upper pump outlet, an inlet valve for said pump chamber supported in a lower portion of said chamber in intercepting flow relationship with said lower pump chamber inlet and said bottom opening in said agitator, and a free floating piston between said pump chamber cap and said inlet valve adapted to slide relatively to said lint pump housing when said agitator is reciprocated,

said free floating piston having a fluid flow responsive piston valve openable for passing a first quantity of fluid toward the upper pump outlet when said agitator is moving in one direction and said pump chamber inlet valve is closed and closable for forcing said passed fluid from said supply outlet when said agitator is moving in another direction and said pump chamber inlet valve is open to pass a second quantity of fluid toward said piston valve,

and means for straining the lint from said fluid forced from said supply outlet.

3. In combination with a container adapted to contain fluid and having an agitator and means for oscillating said agitator,

said agitator comprising means forming a hollow agitator post having a first opening above said fluid and a second opening in communication with said fluid,

and a pump in the hollow of said agitator, said pump comprising a pump housing forming a pump chamber, said pump chamber having a pump chamber inlet in communication with said second opening of said agitator post and a pump chamber outlet, a pump chamber cover supported in one portion of said chamber and having a supply outlet from said chamber in communication with said pump outlet, an inlet valve for said pump chamber supported in another portion of said chamber in intercepting flow relationship with said pump chamber inlet and said second opening in said agitator, and a free floating pistons means between said pump chamber cover and said inlet valve adapted to slide relatively to said pump housing when said agitator is oscillated,

said free floating piston means having a fluid flow responsive piston valve openable for passing a first quantity of fluid toward the pump outlet when said agitator is moving in one direction and said pump chamber inlet valve is closed and closable for forcing said passed fluid from said supply outlet when said agitator is moving in another direction and said pump chamber inlet valve is open to pass a second quantity of fluid toward said piston valve, thereby to recirculate fluid between said container and said agitator.

4. The combination of claim 3 including a strainer means between said outlet and said container for receiving said fluid recirculated for removing contaminants from said fluid.

5. In combination with a container adapted to contain fluid and an oscillating agitator in said fluid, means forming a chamber having an inlet for receiving fluid from said container and an outlet for supplying fluid to said container, said chamber being connected for movement in response to the oscillation of said agitator, first valve means in said inlet having an open position for passing a quantity of fluid received by said inlet when said agitator is moving in a first direction and having a closed position for retaining said quantity of fluid when said agitator is moving in a second direction, piston means freely relatively slidably positioned in said chamber in fluid flow intercepting relationship between said inlet and said outlet, said piston means having a second valve means, said second valve means having an open position for passing said quantity of fluid from one side of said piston means to the other side of said piston means when said agitator is moving in said second direction and having a closed position for pumping said quantity of fluid from said chamber through said outlet to said container when said agitator is moving in the next succeeding first direction.

6. The combination of claim 5 including a strainer means between said outlet and said inlet for receiving said quantity of fluid pumped from said chamber and removing contaminants from said fluid.

7. In combination with a container adapted to contain fluid and an oscillating agitator in said fluid, means forming a chamber having an inlet in communication with said fluid for receiving fluid from said container and an outlet above said fluid for returning fluid to said container, said chamber being connected for movement in response ot the oscillation of said agitator, free-floating valve means in communication with said inlet and substantially stationary relative to the movement of said chamber, said valve means having an open position for passing a quantity of fluid received by said inlet when said agitator is moving in a first direction and a closed position for trapping said quantity of fluid on the side of said valve means toward said outlet when said agitator is moving in a second direction, and means in gravity fluid flow relationship between said outlet and said container for filtering said trapped fluid as said fluid returns to said container after said agitator has moved in said second direction.

8. In combination with a container adapted to contain fluid and an oscillating agitator in said fluid, means forming a chamber having an inlet in communication with said fluid for receving fluid from said container and an outlet for returning fluid to said container, said chamber being connected for movement in response to the oscillation of said agitator, free-floating valve means in communication with said inlet and substantially stationary relative to the movement of said chamber, said valve means having an open position for passing a quantity of fluid received by said inlet when said agitator is moving in a first direction and a closed position for trapping and forcing said quantity of fluid on the side of said valve means toward said outlet when said agitator is moving in a second direction, and means in fluid flow relationship between said outlet and said container for filtering said trapped fluid as said fluid returns to said container.

9. In combination with a container adapted to contain fluid and a vertically reciprocating agitator in said fluid, means forming a chamber having an inlet for receiving fluid from said container and an outlet for supplying fluid to said container, said chamber being connected for movement in response to the reciprocation of said reciprocating agitator, first valve means in said inlet having an open position for passing a quantity of fluid received by said inlet when said reciprocating agitator is moving in a first direction and having a closed position for retaining said

quantity of fluid when said reciprocating agitator is moving in a second direction, piston means freely relatively slidably positioned in said chamber in fluid flow intercepting relationship between said inlet and said outlet, said piston means having a second valve means, said second valve means having an open position for passing said quantity of fluid from one side of said piston means to the other side of said piston means when said reciprocating agitator is moving in said second direction and having a closed position for pumping said quantity of fluid from said chamber through said outlet to said container when said reciprocating agitator is moving in the next succeeding first direction.

10. In combination with a container adapted to contain fluid and an oscillating agitator in said fluid, means forming a chamber having an inlet in communication with said fluid for receiving fluid from said container and an outlet for supplying fluid for said container, said chamber being connected for movement in response to the oscillation of said agitator, free-floating valve means in communication with said inlet and substantially stationary relative to the movement of said chamber, said valve means having an open position for passing a quantity of fluid received by said inlet when said agitator is moving in a first direction and a closed position for trapping said quantity of fluid on the side of said valve means towards said outlet when said agitator is moving in a second

direction, and means in fluid flow relationship with said outlet for conditioning said trapped fluid before said fluid is supplied to said container.

11. In combination with a container adapted to contain fluid and an oscillating agitator in said fluid, means forming a chamber having an inlet in communication with said fluid for receiving fluid from said container and an outlet for supplying said fluid, said chamber being connected for movement in response to the oscillation of said agitator, and free-floating valve means in communication with said inlet and substantially stationary relative to the movement of said chamber, said valve means having an open position for passing a quantity of fluid received by said inlet when said agitator is moving in a first direction and a closed position for trapping said quantity of fluid on the side of said valve means towards said outlet when said agitator is moving in a second direction, thereby to force said fluid through said outlet.

References Cited in the file of this patent

UNITED STATES PATENTS

1,703,984	Braselton	Mar. 5, 1929
1,737,380	McLaren	Nov. 26, 1929
2,909,051	Altorfer	Oct. 20, 1959

FOREIGN PATENTS

519,599	France	Jan. 27, 1921