

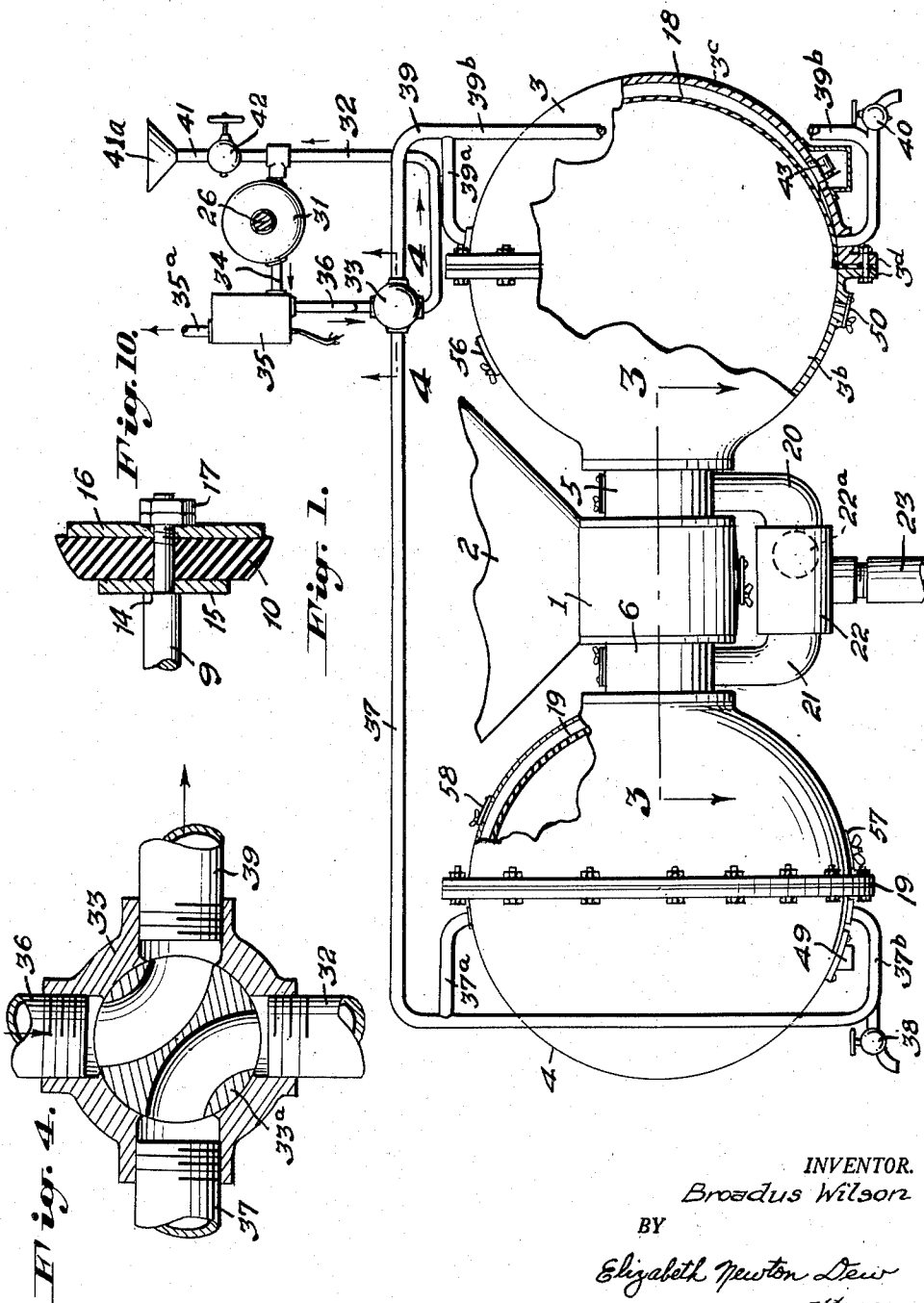
Jan. 14, 1958

B. WILSON
PLASTERING MACHINES

2,819,679

Filed March 2, 1953

5 Sheets-Sheet 1



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5 Sheets-Sheet 2

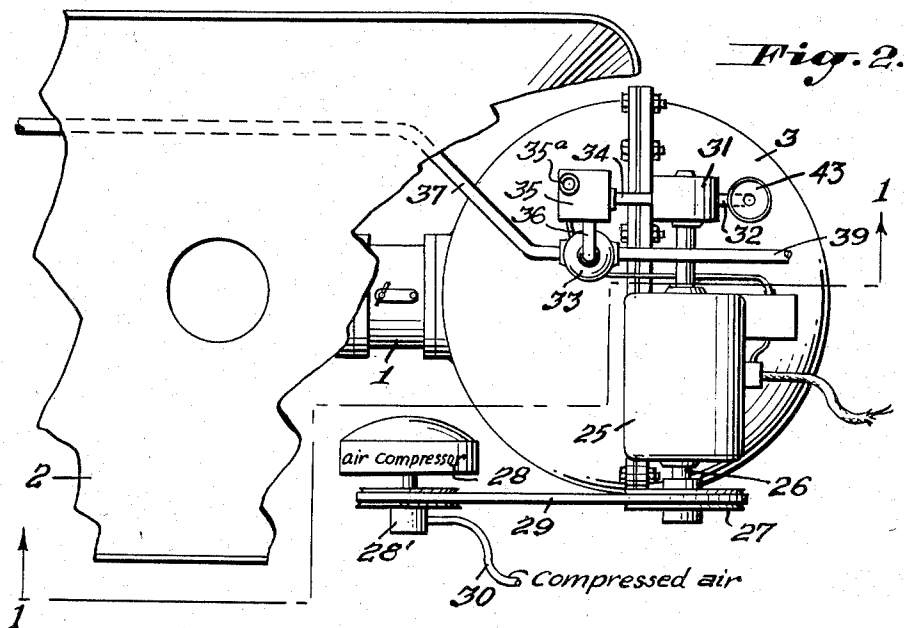
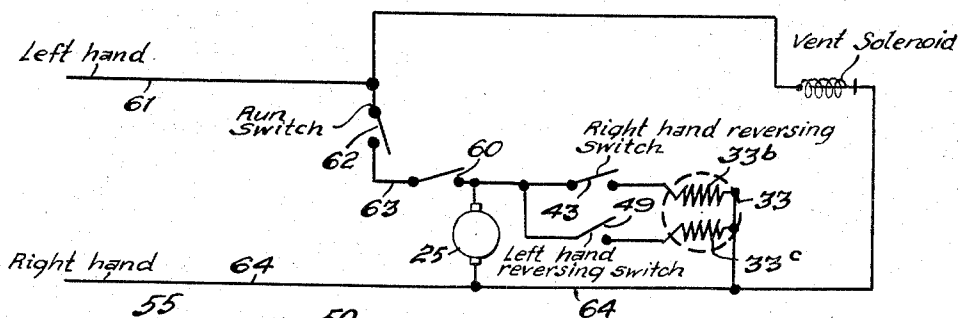
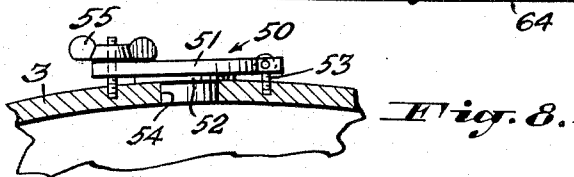
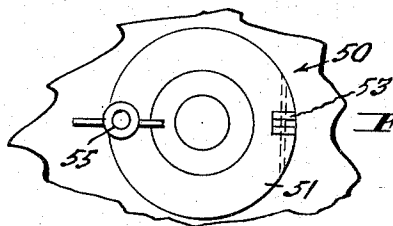


Fig. 5.



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5 Sheets-Sheet 3

Fig. 5.

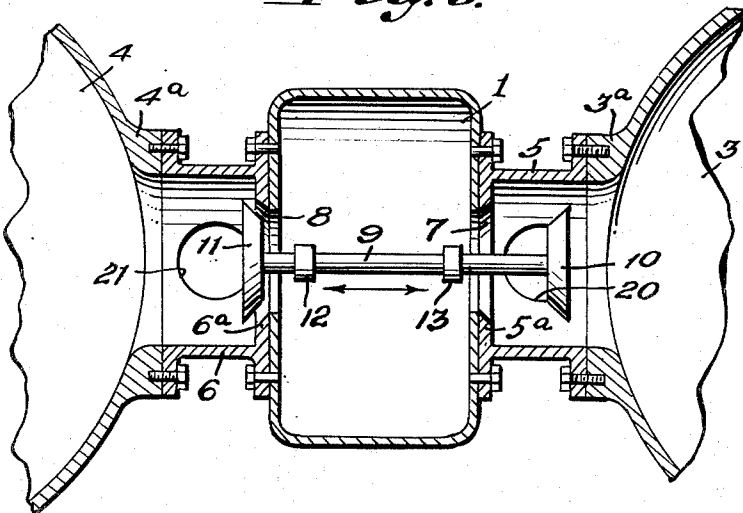


Fig. 6.

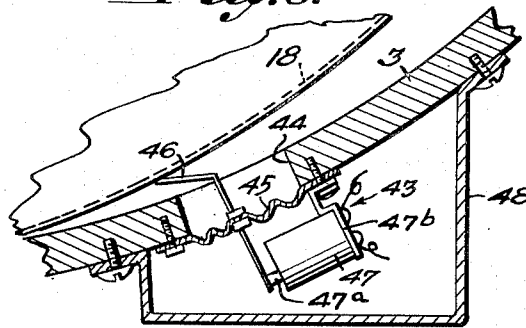
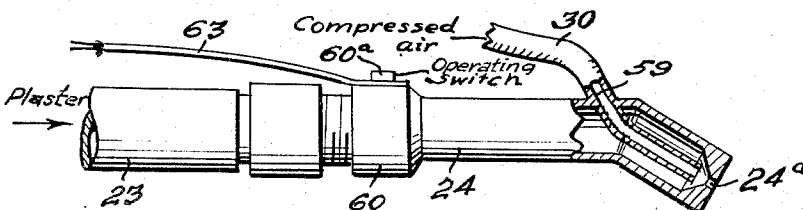


Fig. 7.



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5 Sheets-Sheet 4

Fig. 11.

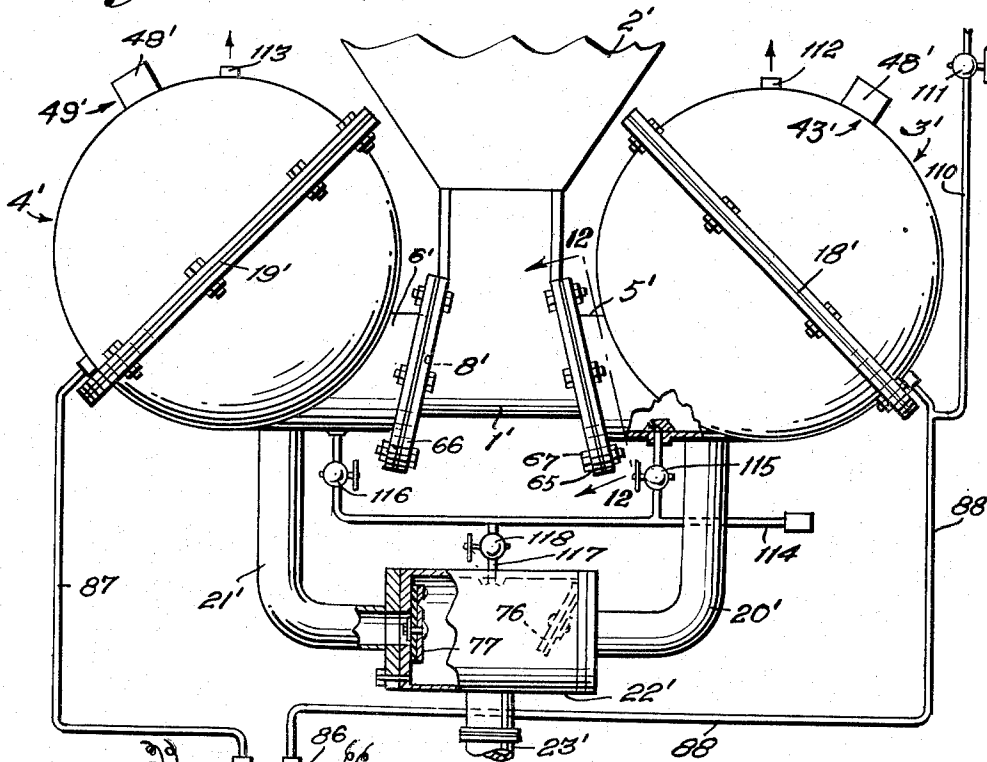
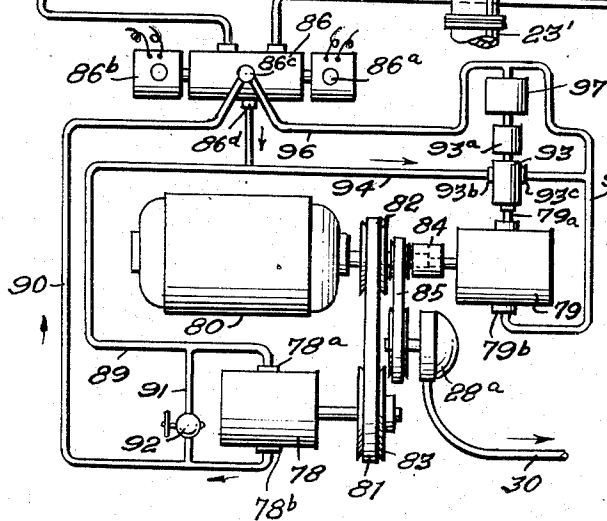


Fig. 16.

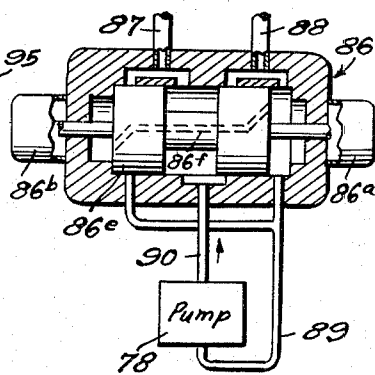
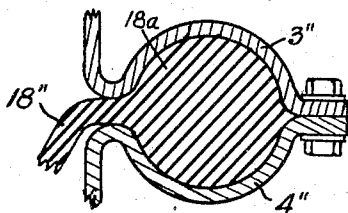


Fig. 17.

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2,819,679

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5 Sheets-Sheet 5

Fig. 12.

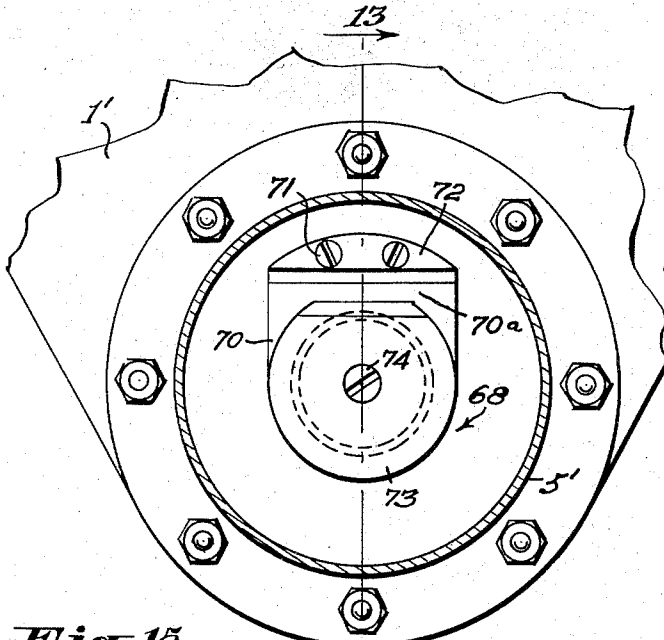


Fig. 13.

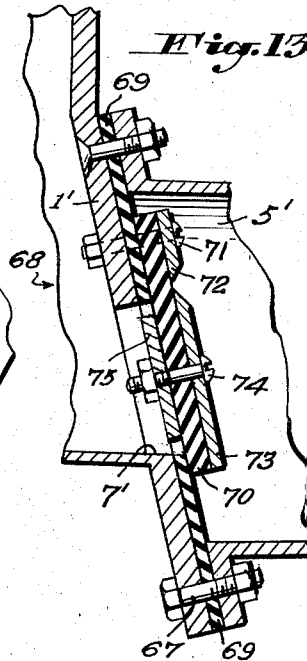


Fig. 15.

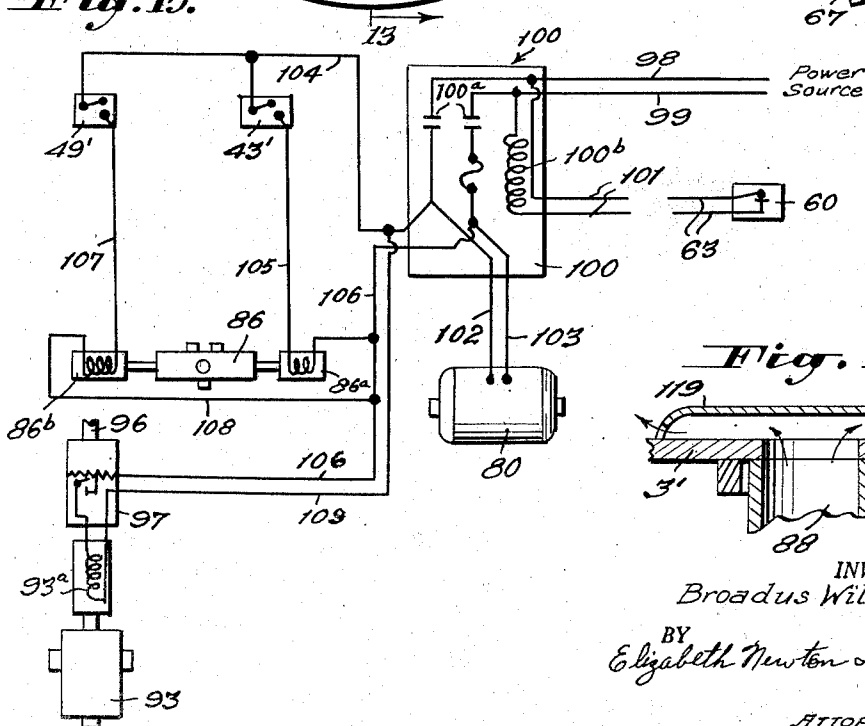
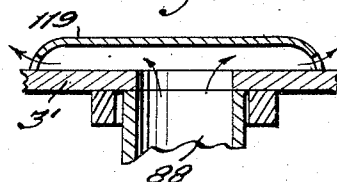


Fig. 14.



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1

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PLASTERING MACHINES

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Application March 2, 1953, Serial No. 339,538

10 Claims. (Cl. 103—152)

This invention relates to machines intended more particularly for applying plaster to walls and other surfaces.

It is the main purpose of the invention to provide a machine capable of supplying a continuous flow of abrasive material such as plaster, under pressure, to a nozzle or gun, from a single source of supply of mixed plaster, such as a hopper, with a minimum of wear on the working parts and surfaces of the machine.

A further object is to provide a machine wherein plaster is fed from alternate drums wherein one drum is filled with plaster from a source, while the plaster in the other is being applied to a surface.

A still further object is the provision of a machine as aforesaid, wherein the plaster is positively forced to the nozzle or spray gun by which it is applied, while maintained completely out of contact with the fluid medium used to impel it.

A further object is the provision of a plaster applying machine embodying two drums, so interconnected and equipped, that exhaustion of plaster from one effects a filling of the other with plaster.

Another object is to provide a machine capable of high-grade plastering at a cost per unit area less than that involved in application by trowel.

A still further object is to provide a machine wherein the exhaustion of plaster from one drum automatically operates to shift to the other drum as a source of supply to the nozzle or gun.

Another object is the provision of a machine as in the preceding paragraph in which the change-over time between drums is extremely short so that the flow of plaster is substantially uninterrupted.

In the drawings:

Figure 1 is an elevation, partly in section, showing the arrangement of plaster drums, piping and interposed hopper, the latter being partly broken away, and taken substantially as indicated by line 1—1 of Figure 2.

Figure 2 is a top plan view of the right hand drum and motor, fluid pump and air compressor carried thereby.

Figure 3 is a section taken on a plane identified by the line 3—3 of Figure 1 and showing the valve for controlling the flow of mixed plaster from the hopper to either of the variable volume drums.

Figure 4 is a section on an enlarged scale and taken in a plane identified by the line 4—4 of Figure 1 and showing the four-way fluid control valve forming a part of the machine.

Figure 5 is a wiring diagram of the motor and valve controls.

Fig. 6 is a section to an enlarged scale through one of the detector switches for automatically reversing the flow of pressure fluid between drums when one drum has been substantially exhausted of plaster and is full of fluid, such as water, while the other drum is substantially full of plaster drawn from the hopper.

Figure 7 is an elevation, partly broken away, of the plastering nozzle and control switch carried thereby.

2

Figure 8 is a sectional view of the clean out valve for one drum.

Figure 9 is a plan view of the same valve.

Fig. 10 is a detail view, partly in section, of one end of the double-ended mushroom valve controlling the flow of plaster from the hopper to the drums alternately.

Figure 11 is a schematic lay-out of a second and preferred form of the invention.

Figure 12 is a detail view to an enlarged scale, of one of the four flap valves used in this species.

Figure 13 is a section in a plane identified by line 13—13, Figure 12.

Figure 14 is a detail sectional view showing one of the baffle plates over each fluid supply opening to the drums.

Figure 15 is a wiring diagram of the preferred form.

Figure 16 is a schematic sectional view of one form which the fluid flow reversing valve may take, and

Figure 17 is a sectional view to an enlarged scale, showing a modified form of drum wherein the flanges form an annular channel to receive and compress a bead or rim formed integrally with and about the periphery of the diaphragm.

Referring in detail to the drawing, the numeral 1 identifies a casing or receptacle in communication with, and supporting, a hopper 2 for mixed plaster and which is gravity-fed into the casing and thence to either of a pair of drums or variable-volume containers, generally identified at 3 and 4. As best shown upon Figure 3, the drum 3 is secured to and in communication with one end of casing 1 by a coupling 5 whose end flanges are bolted respectively to the casing and a flat machine boss 3a on the drum. In an identical manner, drum 4 is fixed to casing 1 by a coupling 6 bolted at one end to the casing and at the other end to boss 4a. Coupling 5 at its end connected with the casing, has an internal flange 5a defining a circular valve seat 7. Likewise, coupling 6 has an internal flange 6a defining a valve seat 8.

A double-ended mushroom valve comprises a stem 9 and heads 10 and 11. The stem 9 is mounted for axial reciprocation by lugs 12 and 13 fixed with casing 1 and having aligned bores defining an axis which is also the axis of valve seats 7 and 8. Thus, in a manner obvious from inspection of Figure 3, when the valve is shifted to its limiting position to the right communication between casing 1 and drum 4 is cut off while casing 1 and drum 3 are connected. Conversely, when the valve is shifted to its limiting position to the left, casing 1 and drum 4 are in communication while passage from casing 1 to drum 3 is cut off.

Figure 10 illustrates a suitable construction for both of the valves of stem 9. As shown, the end of the valve stem 9 is reduced to form a shoulder on which is seated a relatively small backing washer 15. The valve head 10 is preferably formed of resilient material such as pure gum rubber and has a central hole to receive the reduced end of stem 9. Next is a second larger backing washer 16, and lock nuts 17 which secure the valve head sandwiched between and reinforced by the washers. By this construction, the rubber valve part 10 is reinforced by the washers 15 and 16 and, when seated upon its respective seat 7 or 8, effectively seal the passage of plaster therepast.

As shown, the two drums are of equal volume and conveniently identical. For example, drum 3 consists of two generally hemispherical halves 3b and 3c secured together by means of mating flanges 3d, bolted together to form a generally spherical chamber. A flexible, resilient diaphragm 18 of material such as pure gum rubber, is clamped between the flanges 3d, to divide the drum into two compartments of reciprocally varying volume. The diaphragm will be reinforced around its periphery, as with fabric, to secure it firmly in place and prevent the

3

possibility of the edge or periphery from pulling out from its position clamped between the drum flanges. The reinforced periphery of the diaphragm 18 is made the same diameter and width as the matching surfaces of the flange 3d, Figure 1, whereas the central part or portion of the diaphragm is loose or dished in its undistended position and may, for example, then have the approximate shape or form indicated upon Figure 1. By this construction, and the mechanism subsequently described, a sufficient differential pressure on either side of the diaphragm will distend the latter until it substantially conforms to one of the drum halves, as indicated, for example, in solid lines at 18', Figure 1. Drum 4 is similarly constructed and has a like diaphragm 19 clamped between the flanges of its two hemi-spherical halves.

From Figures 1 and 3, it is noted that couplings 5 and 6, have elbow fittings 20 and 21, leading from the lower wall portions thereof to a ball valve 22 to the outlet of which is connected one end of a flexible hose 23. This hose is of any length convenient for the purpose and, as seen in Figure 7, its other end carries a nozzle or spray gun 24, whose construction will be subsequently described in detail.

In order to distinguish between the two variable-volume chambers into which each drum is divided by its flexible diaphragm 18 or 19, the chambers in communication with couplings 5 and 6, respectively will be termed "inner" chambers while those not in communication with such couplings, will be termed "outer" chambers. Means are provided, then, to pump a body of fluid such as water, with or without anti-freeze, between outer chambers, whereby the diaphragms are flexed between their extreme positions and the volumes of the two chambers in each drum are inversely varied. For example, starting with diaphragm 18 of drum 3 in the position shown in solid lines, Figure 1, and with this drum substantially filled with mixed plaster, diaphragm 19 of drum 4, will be about in the position shown, and this drum will therefore be substantially full of water, oil or whatever other pressure fluid is selected. As fluid is pumped from the outer chamber of drum 4 and forced into the corresponding chamber of drum 3, the plaster in the inner chamber of drum 3 is placed under pressure, while, in drum 4, the withdrawal of fluid, creates a partial vacuum in the inner chamber of drum 4. This pressure differential acts upon valve 9 and moves the same to the left as viewed in Figure 3, until valve head 10 seats at 7 so that plaster can escape only through fitting 20, valve 22 and hose 23. At the same time, the aforesaid suction created in chamber 4, draws plaster from hopper 2, coupling 1, presently open valve head 11 and coupling 6, into the expanding inner chamber of drum 4. Finally, when substantially all of the plaster has been forced out of drum 3 and the same is full of pressure fluid, the inner chamber of drum 4 will be at maximum volume and full of plaster. The flow of pressure fluid is then reversed. Valve 22 may be a simple check valve with ball 22a therein movable under differential pressures from a position on a seat at the right, closing fitting 20, to a position on a second seat at the left, closing fitting 21, all in a manner obvious from inspection of the drawing. That is, when pressure fluid is being forced into the outer chamber of drum 3, the plaster in the inner chamber of this drum is placed under pressure which then acts, in an obvious manner, to move check ball 22a onto its seat at the left so that all plaster being drawn from the hopper, must pass into the inner chamber of drum 4. This action is, of course, aided by the presently existing vacuum in the inner chamber of drum 4.

Referring more particularly to Figure 2, it will be noted that a motor 25 is mounted over drum 3 by any suitable bracket device, not shown, but which may be a flat plate to which the motor base is bolted and having a rigid arcuate flange to be secured to the drum by a number of the same bolts as are employed to secure the flanges of

4

the two drum halves together. At one end, the motor shaft 26 has a pulley 27 keyed thereto by which an air compressor 28 is driven by a V-belt 29 and spring-loaded pulley 28' to supply air under pressure, by way of hose 30, to gun 24. See also Figure 7.

The other end of motor shaft 26 is shown as direct-coupled to a pump 31, which may be of a conventional gear type. This pump (Figures 1 and 2) has a suction or intake line 32 extending from its inlet connection, to a four-way solenoid-operated valve 33, shown in detail cross section upon Figure 4. The outlet or delivery line of the pump includes a pipe 34 extending from its inlet connection to a reservoir 35, and a pipe 36 affording a passage between the bottom of the reservoir and one connection of valve 33. The reservoir 35 may have an automatic vent 35a to let entrapped air out of the hydraulic system and suitable baffles, not shown, therewithin.

A pipe 37 extends from the third connection of valve 33 to the drum 4 where as will be seen upon Figure 1, it is connected by branches 37a and 37b with the upper and lower portions respectively of the outer chamber of that drum. A hand valve 38 in branch 37b affords means for draining the system when desired. Another pipe 39 extends by branches 39a and 39b from the remaining, or fourth connection of valve 33, to the upper and lower portions respectively of the outer chamber of drum 3. A valve 40 in communication with pipe 39b provides drainage for the pipe and drum.

By this construction, when valve rotor 33a is in the position shown upon Figure 4, operation of pump 31 forces fluid into drum 3 and extracts it from drum 4 while, when the rotor is turned 90° in either direction from the position shown, fluid is forced into drum 4 and exhausted from drum 3. A vertical pipe section 41, hand valve 42, and funnel 41a afford means for filling the hydraulic system with fluid or, when necessary, for adding fluid to make up for any lost by leakage or evaporation. Valve 33 has previously been described as of a well-known four-way, two-position, solenoid-operated type. As indicated in the wiring diagram of Figure 5, this valve may have two selectively and alternatively energized coils 33b and 33c so connected and arranged that when one coil is energized, valve rotor 33a is positively moved into the position shown upon Figure 4, while when the other coil is energized, the rotor is positively moved thereby into a position at 90° to the one shown. The complete wiring circuit will be explained in a subsequent paragraph.

Switches are associated with the respective diaphragms 18 and 19 of the drums, to automatically energize the coils 33b and 33c in response to the movement of the respective diaphragms into the position indicated upon Figure 1 for diaphragm 18, that is, into the position in which either drum is substantially exhausted of fluid and, in normal operation, substantially full of plaster.

For this purpose, I provide the wall of each drum with switch mechanism as identified generally at 43, Figure 6. A hole 44 is provided in the lower part of the outer half of the drum wall. This hole is sealed by a flexible pressure-resistant diaphragm 45 having a contact or feeler 46 passing therethrough with a fluid tight connection. The end of this feeler inside the drum is bent about as shown, in position to contact and be slightly angularly moved by the diaphragm 18 as the latter moves into its limiting position wherein the drum is full of plaster and substantially all of the hydraulic fluid in its outer chamber has been transferred to the other drum.

The outer end of feeler 46 is positioned adjacent the plunger 47a of a switch 47 fixed to the drum as by a bracket 47b. The arrangement is such that as the diaphragm moves into the limiting position about as shown in Figure 6, feeler 46 is pivoted slightly counterclockwise to operate plunger 47a, close the switch, and energize a corresponding coil of the valve 33, as subsequently described. A housing 48 removably secured to

the drum wall protects the switch and feeler against damage. A second feeler and switch of the same construction as that just described, is affixed to the lower portion of the outer half of drum 4 and is indicated generally at 49, Figures 1 and 5. This switch, of course, closes in response to substantially maximum outer movement of diaphragm 19, that is, movement to a position wherein this drum is full of plaster and substantially exhausted of hydraulic fluid. If desired, another feeler and switch of the type shown at 43 may be similarly mounted in a corresponding position at the top of drum hemisphere 3c. In such case, the two switches are connected in series so that magnet 33b is energized only when both switches 47 are closed. Likewise, a second feeler mechanism and switch 49 may be provided at the top of the outer half of drum 4 in a position corresponding to 49, Figure 1. As in the case of assembly 43, both switches 49 will be then connected in series so that coil 33c is energized only when both switches are closed. This construction will aid in assuring that the flow of pressure fluid is not reversed until the inner chamber of the corresponding drum is substantially full of plaster.

At 50, Figures 1, 8 and 9 is shown a quick-acting clean out door or cover for the inner or plaster chamber of drum 3. This consists of a plate 51 having a cut-out in its periphery to receive a pivot bolt 53 and a gasket 52, which is compressed between the plate and drum, to seal a hole 54 in the drum, by a bolt and wing nut 55 affording a quick and easy opening for cleaning. At 56, Figure 1, is indicated a second clean-out opening at the top of the inner or plaster chamber of drum 3 so that, when the two openings are uncovered, a hose may be inserted in the upper opening for flushing unused plaster from the chamber. Drum 4 is provided with similarly-located top and bottom clean-outs, as indicated at 57 and 58, Figure 1.

The gun 24 has been previously mentioned and per se, is of conventional construction, with a connection as shown at 59 for compressed air tube 30 for spraying the plaster from opening 24a. This gun is provided at 60, with an operating switch manually closable by the operator, by means of pressure upon button 60a. As this switch is in the circuit of motor 25, the latter is under control of the operator at all times.

The wiring is illustrated at Figure 5 where line 61 extends from one terminal of a voltage source, not shown, through a run switch 62, line 63, and operating switch 60, to motor 25 and thence by line 64 to the other terminal of the voltage source. Branched parallel circuits extend from one terminal of switch 60, through reversing switch 43 and coil 33b to return line 64, and again from one terminal of switch 60 through reversing switch 49 and coil 33c to return line 64.

The operation of the invention will be clear from the preceding description and may be resumed as follows:

Starting with the drums empty and both diaphragms in their central or undistorted positions, valve 42 may be opened and water or other fluid poured into funnel 41a. With motor 25 operating pump 31 and valve 33 adjusted to the position shown upon Figure 4, fluid will be forced into the outer chamber of drum 3 until this drum is substantially full and its diaphragm 18 is distorted leftwardly as viewed in Figure 1, to substantially conform to the surface of drum half 3b. The diaphragm 19 in drum 4 will remain substantially unaffected. Switch 62 is now opened to stop the motor, valve rotor 33a is manually turned 90° from the position shown upon Figure 4, and valve 42 is closed.

Hopper 2 is now filled with mixed plaster, as from an adjacent mixer, and motor switches 60 and 62 are closed to start motor 25. Pump 31 now acts to withdraw fluid from drum 3 and to force it into drum 4 by way of pipe 37. This action creates a suction in the inner or plaster chamber of drum 3 so that plaster is drawn through connections 1 and 5 into the chamber. When

all of the fluid has been drawn from drum 3, and forced into drum 4, the diaphragms are substantially in the positions shown upon Figure 1, and drum 3 is full of plaster. Switch 43 is thus closed, but as switch 60 remains open, valve 33 is not actuated at this time.

The operator now takes nozzle 24 and positions it for applying plaster to the desired surfaces, then closes switch 60. Motor 25 is started and, simultaneously valve coil 33b is energized to shift valve rotor 33a through 90°. Thus, fluid is drawn from drum 4 and forced into drum 3 to exert pressure through diaphragm 18, upon the mass of plaster in this drum. This pressure causes valve 9 to shift to the left, Figure 3, to force head 10 upon its seat 7. Plaster under pressure is now forced out through fitting 20 and forces ball 22a onto its seat at the left, Figure 1, so that plaster can only escape through hose 23 where it passes to nozzle 24 and is sprayed or applied with the aid of compressed air from compressor 28, forced into the nozzle by way of hose line 30. An adequate supply of mixed plaster is maintained in hopper 2 which, simultaneously with evacuation of plaster from drum 3, is drawn into drum 4.

Upon Figures 11 through 16, I have shown a form of the invention now preferred by me which, while operating generally upon the same principles as the form shown upon Figures 1 through 10, embodies certain added modifications and refinements. In these figures, parts which correspond with similar or identical parts shown upon Figures 1 through 10, will be identified by the same reference numerals, primed, as have been used to identify like parts upon those figures. By "like parts" is, of course, meant parts similar in function although not necessarily similar or identical in construction.

Thus, 1' identifies a coupling supporting a hopper 2' and in communication therewith. The coupling has flanged ends 65 and 66 providing valve openings 7' and 3' which are closed by respective flap valves subsequently described.

The two drums are identified generally at 3' and 4'. As these drums are substantially the same in construction as drums 3 and 4, previously described in connection with Figure 1, it will be sufficient to point out that the flanges connecting the two halves of the drums lie in planes which, instead of being vertical as in Figure 1, lie in respective planes which are inclined outwardly and downwardly at equal angles from the central vertical plane of Figure 11 normal to the plane of this figure. These flanges, of course, clamp the peripheries of respective resilient diaphragms 18' and 19' between them.

Couplings 5' and 6' each have one end welded or otherwise secured to one of the drum halves or hemispheres, for communication therewith. The other ends of these couplings are flanged and bolted as at 67 to the respective flanges of hopper support 1' to form horizontal passageways from the support to the drums. As generally in the case of Figure 1, a first elbow 20' leads from an opening in the bottom of coupling 5' to one end of valve housing 22', while a second elbow 21' leads from an opening in the bottom of coupling 6' to the other end of housing 22'. A flexible hose 23' has one end connected with the mid-portion of housing 22' to supply plaster under pressure to a nozzle which may be the same as at the one identified at 24, Figure 7.

Four flap valves are used to control the flow of plaster from hopper to drums and from drums to nozzle. As these may all be identical, a description of one will suffice. Referring to Figures 11, 12 and 13, particularly the latter two, the flap valve controlling the passage of plaster from support 1' to drum 3', is generally identified at 67. The wall of hopper support 1' has valve opening 7', previously identified, and to which the contiguous flanged end of coupling 5' is bolted as at 67. The surface of the wall toward coupling 5' is covered

with a layer of rubber 69 which acts both as a gasket and also to prevent the adhesion of plaster thereto.

The valve consists of a rubber pad 70 of a size to extend completely over the opening 7' and secured to the wall by machine screws 71 and a reinforcing plate 72. The pad is reinforced by a plate 73 of metal or other rigid material and held in place to the pad by a screw 74 and a round washer 75 on the other side of the pad and of somewhat less diameter than the opening 7'. As clearly shown at Figure 12, plates 72 and 73 have straight beveled edges in spaced parallel relation to define an area 70a of pad 70 between them which will flex readily. Plate 73 is considerably larger than opening 7' and as seen in Figure 12, is generally circular and cut along a chord to provide the aforesaid beveled edge.

Thus, valve 68 will open promptly in response to a differential pressure on its opposite sides and greater in fitting 1' and close when the pressure in drum 3' exceeds that in the fitting. Due to its rubber construction, the valve remains substantially free of hardened plaster, is rugged, long-lived, easy and inexpensive to replace and positive in action. As the other three flap valves may be identical with the one just described, it will be sufficient to mention that a second, not shown, covers opening 8' and permits the flow of plaster from hopper to drum 4' but prevents flow in the reverse direction. Third and fourth flap valves 76 and 77, Figure 11, are positioned within housing 22' and act, respectively, in a manner obvious from inspection of the figure, to permit the flow of plaster from fittings 20' and 21' to the housing, but to prevent its flow in the reverse direction.

For a purpose to be subsequently described and explained, two fluid pressure pumps 78 and 79, Figure 11, are used to extract fluid from the outer chamber of one drum and to force it into the other. Both may be of any suitable and well known types such as gear pumps. While for clarity of illustration these pumps and their driving motor 80 are shown apart from the drums, it will be understood that in actual practice these parts will usually, but not necessarily, be mounted upon a common platform fixed in any suitable and convenient relation with the drums. Thus all parts may be mounted on or fixed to the platform of a truck or other wheeled vehicle.

Pump 78 is driven from motor 80 by a V-belt 81 and pulleys 82 and 83 keyed on the shafts of the motor and pump, respectively, while pump 79 is directly driven from the shaft of motor 80, through a coupling 84. Air compressor 28a is driven from the motor by a V-belt 85 in the same manner as compressor 28, Figure 2, obvious from inspection of Figure 11.

The reversal of flow of pressure fluid between drums is controlled by a solenoid-operated valve 86 the functional equivalent of valve 33 in the species of Figure 1. This valve is shown as of the sliding or spool type having first and second solenoids 86a and 86b (Figures 11 and 16) which act upon armatures connected with the slide of the valve to operate it in respectively opposite directions. Thus, for example, when solenoid 86a is energized the valve slide is thereby shifted to the right to so adjust the valve, in a manner subsequently described, that fluid is extracted from drum 4' and forced under pressure into drum 3'.

A pipe 87 connects the outer or pressure fluid chamber of drum 4' with valve 86. Likewise a pipe 88 connects the pressure fluid chamber of drum 3' with the same valve. A pipe 89 extends from the intake or suction connection 78a of pump 78, to housing of valve 86 while a pipe 90 connects the valve with the pressure or outlet connection 78b of the same pump. A by-pass connection 91, with valve 92 is provided between pipes 89 and 90 by which the output of pump 78 may be varied

in an obvious way, to correspondingly vary the rate of application of plaster.

Referring to auxiliary pump 79, the intake or suction connection thereof, 79a, is connected into a three-way valve 93 having an operating solenoid 93a. The housing of this valve has a first intake 93b connected by a pipe 94 to the outlet 86d of valve 86, and a second intake 93c connected with a by-pass pipe 95 to outlet 79b and by pipe 96 to the inlet 86c of valve 86. This pipe 96 is also connected with a pressure responsive switch 97 so connected and arranged that the circuit of solenoid 93a is closed only in response to a predetermined low or absolute pressure or, what is the same thing, a high vacuum or suction in pipe 96. Normally, valve 93 is so adjusted that pump 79 merely circulates fluid through its by-pass 95 and thus operates without substantial power consumption. On energization of solenoid 93a, however, when the pressure in pipe 96 drops to a predetermined low value as in change-over or reversal of fluid flow between drums, valve 93 is actuated to close by-pass 95 and to connect outlet 79b to discharge pipe 96 whereby the capacities of the two pumps are added to provide a very rapid pick-up of pressure in the drum from which plaster is to be supplied. By this construction, there is substantially no time delay in shift from one drum to the other and the discharge of plaster from the nozzle is substantially continuous during shiftover.

The wiring circuit is shown at Figure 15, where motor 80, valve 86 and its solenoids 86a and 86b, valve 93, its solenoid 93a and pressure-responsive switch 97 are shown and have been previously described. Leads 98 and 99 extend from a voltage source, not shown, to main switch 100 having breaker contacts 100a closed in response to energization of control solenoid 100b. This solenoid is in a shunt circuit including leads 101 of cable 63 and control switch 60 mounted upon or incorporated into nozzle 24, as previously described in connection with Figure 7, so that the circuit is under control of the operator. Cable 63 may be semi-permanently secured to extend along hose 23.

When main switch 100 is closed, as aforesaid, one circuit extends from lead 98 to lead 102, motor 80 and lead 103 to return 99 whereby the motor is driven. Also branch parallel circuits extend by way of leads 98 and 104 to drum diaphragm switches 43' and 49' which correspond in function and structure with the switches 43 and 49 shown upon Figure 1. See also Figure 11. The return circuit from switch 43' extends by lead 105, solenoid 86a and lead 106 to return lead 99 of the line. Return from switch 49' is by way of lead 107, solenoid 86b, leads 108 and 106 to return lead 99. Another parallel circuit extends from leads 98 and 109 to one contact of pressure responsive switch 97; and from the other contact of this switch by lead 106 to return lead 99.

A suitable balanced piston-type valve 86 is shown upon Figure 16, whose operation will be obvious from inspection of the figure. When piston 86e is moved to the left position shown, as on energization of solenoid 86b, pump 73 forces fluid through pipe 90 to pipe 87 and drum 4' while exhausting fluid from drum 3', pipe 88, valve 86 and pipe 89. When piston 86e is moved to the right, as by energization of solenoid 86a, fluid is forced by pump 78 to pipe 88 and drum 3' and exhausted from drum 4' by pipe 87, valve 86 and pipe 89. The valve is balanced at all times by an equalizing passage 86f connecting the two end chambers of the valve cylinder. Consequently only a small amount of power is required to shift the spool the short distance necessary for reversal of flow of pressure fluid.

Filling of the drums with pressure fluid may be accomplished through a stand-pipe 110 connecting with pipe 88 and having a valve 111 therein. Check valves or vents 112 and 113 at the top of drums 3' and 4', respectively, permit the egress of air during filling. Such valves may also be used upon drums 3 and 4, Figure 1.

A very convenient flush-out system for wet plaster is provided by a pipe 114, Figure 11, adapted for connection with a source of water supply, and having branches leading to the lowermost surfaces of fittings 5' and 6' and to valve housing 22'. The termini of these branches within the fittings 5' and 6' is in the form of a rubber nozzle having apertures forming a number of fine, high-velocity streams or sprays directed onto the adjacent flap valves to clean the same of wet plaster. Likewise the terminus of the branch pipe 114 in housing 22' is a rubber nozzle with apertures forming streams directed at high velocity onto valves 76 and 77 to enable thorough cleaning of the same. Shut-off valves 115, 116 and 118 in the respective branches permit selective flushing of each of the flap valves so that the whole pressure supply is available to be concentrated at any one of the clean-out points. Furthermore, due to the resiliency of the nozzles, any plugs of plaster hardening therein, are blown out by the pressure of the water supply. A branch 117 having valve 118, extends from pipe 114 to housing 22' so that the interior of this valve may be cleaned when desired, as well as hose 23'.

At Figure 14, I have shown a baffle plate 119 which is secured in spaced relation to the inner surface of drum 3', in position over the opening therein, of pipe 88. This plate is a general dished unit having a scalloped edge which is tack welded to the drum surface at several of its points of contact therewith. This plate acts, in an obvious manner, to prevent sealing of the opening to pipe 88 by diaphragm 18', and to prevent direct impingement of the high-velocity streams of fluid coming from the pumps, against the diaphragms.

It is contemplated that the surfaces of the machine which come into contact with plaster, will have a rubber coating sprayed or bonded thereto to reduce the adherence of plaster to these surfaces and also to make it easy to break off any plaster which may adhere to them.

The operation of this form of the invention is basically the same as has been previously described in connection with Figures 1 through 10.

With an adequate supply of water or other pressure fluid in the system, motor 80 is started by closing of switch 60 and, depending upon the position of piston 86e of valve 86, withdraws fluid from one drum and forces it into the other. When the corresponding switch 43' or 49' is thrown as the result of full distentions of the diaphragms, switch 60 is opened. A supply of mixed plaster is deposited in hopper 2' and the motor 80 again energized. As water is exhausted from one drum and forced into the other, the resulting suction draws plaster into the one drum. When this operation has been completed and the valve 86 is automatically reversed, one drum is essentially full of plaster and the other, full of water. The operator then takes the nozzle 24 and, on again closing switch 60, a flow of plaster is forced out by the action of the pump in forcing water into the drum filled with plaster and, simultaneously, drawing fluid from and plaster into, the other drum.

Assuming that work has begun with drum 3' full of plaster, its diaphragm 18' has closed switch 43', energized solenoid 86a and shifted spool 86e to the right as viewed in Figure 16. Fluid is now extracted from drum 4' and forced into drum 3' to thereby force plaster through fitting 20' and valve 22 to hose 23' and nozzle 24. This continues until drum 4' is substantially full of plaster and exhausted of fluid. At this instant diaphragm 19' engages and closes switch 49', thus energizing solenoid 86b and shifting valve 86 to the position shown upon Figure 16. As the flow of fluid is reversed, the pressure in line 37 which has been in connection with the suction or intake side of pump 78 is relatively low. Therefore, when this pipe is connected with discharge pipes 90 and 96 of the pumps, the pressure drop in the latter is effective upon switch 97 to cause the closing of its contacts, in a manner clear from Figure 15, and

causes the energization of solenoid 93a. This operates valve 93 to connect pipe 94 with pump 79 and, simultaneously, to cut off by-pass 95. Pump 79, which is continuously driven whenever motor 80 is operated, then adds its output to that of pump 78, with the result that there is a very rapid build-up of pressure in the fluid in drum 4' and almost no delay in the change-over. As a result, the flow of plaster from nozzle or gun 24 is practically continuous so long as motor 80 continues in operation. The flap valves 76 and 77 are also important in this function because they afford a complete check to prevent compressed plaster in the hose from flowing back to the drum exhausted of plaster, during change-over. The plaster in the end of the hose nearest the drums is under a pressure about twice that of the plaster in the hose near the nozzle. By stopping the backward flow the pressure in the hose tends to equalize rapidly and to keep plaster flowing from the nozzle while pressure is being built up in the drum which is full of plaster.

Figure 17 shows a modified form of drum wherein the drum halves 3'' and 4'' have beaded flanges which, when united by machine bolts as shown, form a toroidal channel receiving a bead 18a formed about the periphery of rubber diaphragm 18'' and compressing the same to form a pressure tight seal between the flanges and, at the same time, to firmly clamp the diaphragm in position.

In a third form, not shown, the rubber diaphragm has a periphery of the same thickness as the body position thereof, which is reinforced with cord or fabric. In this form, the drum itself is of relatively thin metal and its flanges are secured together by relatively heavy clamping rings bolted together through aligned holes in flanges and rings to secure the flanges clamped between the rings.

It should be noted that an essential to proper operation of the invention is that it be filled with a measured volume of fluid but sufficient to fill one drum 3 or 4. In this manner it is impossible to distend either diaphragm into the outlet for plaster, in normal operation. Should a substantial amount of fluid escape by reason of leakage or otherwise, the remaining fluid in the system should be drained and a new measured volume added.

It will thus be seen that I have provided a machine of the type described which is relatively simple to construct and operate, while positive, reliable, and substantially continuous in operation. Due to the few and simple moving parts, which are themselves inexpensive and easily replaced, maintenance costs are reduced to a minimum and long life and low depreciation are assured. It has been found that an operator can apply about one cubic foot of plaster per minute with my machine. The drums are preferably of between two to four cubic feet capacity. However, such capacities can be varied widely depending upon the desired rate of application and the substance applied. In the claims "pump means" is to be interpreted to include both pumps 78 and 79.

While I have shown a preferred form of the invention, numerous modifications, alterations and substitutions will be obvious to those skilled in the art after a study of the foregoing description. Consequently the description is to be taken as an illustrative rather than a limiting sense; and it is my desire and intention to reserve all modifications and substitutions falling within the scope of the subjoined claims.

Having now fully disclosed the invention, what I claim and desire to secure by Letters Patent is:

1. In a plastering machine, first and second closed drums of substantially like volumes, a diaphragm dividing each respective drum into first and second chambers of reciprocally varying volume, a hopper, a first passageway from said hopper to one said first chamber, a second passageway from said hopper to the other said first chamber, a one-way valve in each said passageway permitting flow of plaster from said hopper to respective ones of said first chambers only, a plaster discharge housing,

third and fourth passageways from respective ones of said first chambers to said housing, a one-way valve in each of said third and fourth passageways permitting flow of plaster from chamber to housing only, connections between said second chambers and including a pump and a flow-receiving valve, said second chambers and connections being adapted to contain hydraulic fluid, means responsive to predetermined distention of said diaphragms to actuate said last-mentioned valve and reverse the flow of hydraulic fluid between said second chambers, and means responsive to vacuum in one said second chamber at reversal, to augment the flow delivered by said pump.

2. In a machine for dispensing a fluent material, first and second drums, a resilient distortable diaphragm dividing each said drum into first and second pressure-tight chambers of reciprocally variable volume, a supply hopper for material in communication with both said second chambers, a source of fluid under pressure, pump means including a reversing valve to supply pressure fluid to either one of said first chambers and, simultaneously, to exhaust pressure fluid under suction from the other said first chamber to reciprocally vary the volumes of said chambers, a conduit for supplying material valve means responsive to increasing volume of either one of said second chambers to withdraw material from said hopper to said one second chamber only, and responsive to decreasing volume of either one of said second chambers to effect flow of material therefrom to said supply conduit only, means responsive to a predetermined maximum volume of said second chambers to operate said reversing valve and the flow of pressure fluid to and from said first chambers respectively, and means responsive to suction in one said second chamber at flow reversal to temporarily increase the rate of flow effected by said pump means to said one second chamber.

3. In a machine for continuously dispensing fluent material at substantially constant flow rate, first and second drums, partition means dividing each said drum into first and second chambers of reciprocally variable volumes, a power-driven pump, connections including a reversing valve to withdraw pressure fluid from one said first chamber and to force it into the other said first chamber in response to operation of said pump, to thereby reciprocally vary the volumes of said second chambers, means responsive to attainment of substantially maximum volume of one of said second chambers to automatically operate said valve and reverse the flow of pressure fluid between said first chambers, an auxiliary pump and means responsive to suction in said one second chamber at flow reversal to connect said auxiliary pump in series with said power driven pump whereby the rate of flow to said one second chamber is momentarily increased.

4. In a machine for continuously dispensing fluent material at substantially constant flow rate, first and second drums of fixed volume, flexible diaphragm means dividing each said drum into first and second closed chambers of reciprocally variable volume, a pump, a motor connected to drive said pump, pressure connections from said pump to said first chambers, including a reversing valve, whereby operation of said pump exhausts pressure fluid under suction from one said first chamber and forces it into the other said first chamber, the direction of flow depending upon the adjustment of said reversing valve, means supplying fluent material to said second chamber of increasing volume only, a dispensing conduit, means effecting flow of fluent material from said second chamber of decreasing volume to said dispensing conduit only, means responsive to attainment of maximum volume of one said second chamber to automatically operate said valve and thereby reverse the flow of pressure fluid between said first chambers, and means responsive to suction in the second said chamber exhausted of fluid, to momentarily augment the flow of fluid to said chamber in addition to that effected by said pump.

5. In a machine for continuously dispensing fluent material at substantially constant flow rate, first and second drums, flexible diaphragms dividing each said drum into first and second chambers, a supply hopper, connections from said hopper to each of said second chambers including check valves permitting hopper-to-chamber flow only, a dispensing conduit, connections from each said second chamber to said conduit including check valves permitting chamber-to-conduit flow only, a main pump, pressure connections between said pump and said first chambers including a solenoid-operated reversing valve adjustable to determine the direction of flow of pressure fluid between said first chambers, a pair of switches each fixed with a respective one of said drums to be actuated by the diaphragm thereof only in response to substantially maximum volume of the corresponding one of said second chambers, and circuit connections including the said switches and the solenoid of said reversing valve whereby the latter is actuated to reverse the flow of fluid between said second chambers in response to maximum volume of each said second chamber.

6. In a machine as recited in claim 5, a second continuously driven pump, and means responsive to a predetermined vacuum in one of said first chambers on reversal of flow, to connect said second pump in parallel with said main pump.

7. In a machine for dispensing fluent materials at substantially constant flow rate, first and second drums each comprising first and second complementary halves having mating separable connectors, an elastic diaphragm clamped at its periphery between the halves of each said first and second drums to divide the drums into first and second discrete pressure-tight chambers, a supply hopper, means forming a passageway from said hopper to each of said second chambers, check valves in said passageways permitting flow of material in the hopper-to-chambers direction only, a supply housing, a conduit from each of said second chambers to said housing, check valves permitting flow of material through said conduits in the chambers-to-housing direction only, a power driven pump, fluid pressure connections from said pump to each of said first chambers and including an electromagnetic reversing valve, whereby said pump extracts fluid from one first chamber and forces it into the other in dependence upon adjustment of said valve, first and second switches associated with the respective drums, each said switch having an actuating member positioned to be engaged and operated by a respective diaphragm in response to maximum volume of the corresponding first chamber, and a control circuit including said electromagnetic reversing valve and switches.

8. In a machine of the type described, first and second drums, partition means dividing each drum into first and second discrete chambers and movable to reciprocally vary the volumes thereof, a first power fluid pump, pressure connections from each of said first chambers to said pump and including a main valve adjustable to reverse the direction of fluid flow between said first chambers, means operable to discharge fluent material alternately from said second chambers in response to decreasing volume of one said chamber, and to simultaneously supply fluent material to the other said second chamber of increasing volume, main valve actuating means responsive to a predetermined position of said partition means to automatically adjust said valve and thereby reverse the flow of fluid between said first chambers, a second normally ineffective power driven fluid pump, and valve means responsive to a predetermined low pressure in the one said second chamber of lesser volume to connect said second pump into said pressure connections to augment the discharge of said first pump.

9. In a plaster-applying machine, first and second drums, a flexible diaphragm dividing each drum into first and second discrete chambers of volume reciprocally variable in response to distention of said diaphragm, a

13

power-driven fluid pump, pressure connections from each of said first chambers to said pump and including a valve adjustable to reverse the direction of fluid flow between said first chambers, hopper means to supply fluent material to each said second chamber in response to expanding volume thereof, conduit means connected to discharge fluent material from said second chamber of contracting volume, means operated by each said diaphragms in response to distention thereof corresponding to maximum volume of the second chamber defined thereby, to adjust said valve and reverse the flow of fluid between said first chambers, and means responsive to predetermined low pressure in said first chamber of minimum volume to temporarily augment the fluid flow thereto induced by said pump on reversal of fluid flow.

10. In a machine for the deposition by flexible conduit, of an aqueous cementitious mix, first and second drums, a flexible diaphragm dividing each said drum into first and second discrete chambers of reciprocally variable volume, in response to distention of said diaphragms, a first power-driven fluid pump, pressure connections from each of said first chambers to said pump and including an electromagnetic valve operable to reverse the flow of fluid from said pump to said first chambers, means connected with said second chambers to supply cementitious mix to the chamber of increasing volume only, conduit means connected with said second chambers to conduct cementitious mix under pressure from the second chamber of decreasing volume only, first and second switches associated with the re-

14

spective diaphragms in response to maximum distention thereof, a control circuit including said electromagnetic valve and said switches, whereby to reverse the flow of fluid between first chambers in response to a minimum volume of a corresponding one of said first chambers, a second pump, pressure connections between said second pump and both said first chambers, and valve means responsive to a predetermined low pressure in said first chamber of minimum volume on reversal of flow, to connect said second pump to augment the rate of fluid flow to said first chamber of minimum volume.

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