

Description

This invention relates generally to fluid dispensing apparatus, and, in particular, to apparatus for mixing and dispensing a plurality of different fluids.

Devices used to pump two or more fluids to a mixing head where the fluids are sprayed onto a surface or injected into a cavity are relatively common.

Some devices utilize independently driven fluid pumps in which the driving means is regulated to obtain a predetermined ratio of fluid volume flow and in which the pressure and temperature of the separate fluids are also monitored to ensure a uniformity of result.

Other devices utilize various differing methods of obtaining a predetermined ratio of fluid volume being pumped. Some devices achieve this result by varying the orifice size of a venturi to vary the suction rate at which the fluids are withdrawn from their reservoirs.

Other devices utilize piston and gear arrangements in the mixing head for metering the flow of fluid. Still other devices use several pumping cylinders of different volumes linked by an actuator arm simultaneously to pump fluids at a predetermined mix ratio.

Other devices use positive displacement pumps having a fixed volume ratio; however, an adjustable length actuating arm is used to vary the ratio of stroke length, and therefore volume, when simultaneously pumping from their respective reservoirs.

EP—A—59 380 discloses a mixing apparatus in accordance with the prior art portion of claim 1. The present invention, as characterised in claim 1, provides for highly efficient pumping and ratio control due to the speeds of the pumps being inversely proportional to the viscosities of the fluids being pumped with the additional precaution of means being provided to stop operation of the pumps when the absence of a fluid is detected in one or other of the reservoirs.

Preferably, a power source is electrically connected to said drive means, means are provided for measuring fluid pressure of said fluid between said first pump and said mixing head, and means are provided for electrically disconnecting said drive means when said fluid pressure exceeds a predetermined pressure and electrically connecting said power source to said drive means when said pressure is less than said predetermined pressure. Preferably, means are provided for overriding said means for electrically disconnecting said drive means when said fluid pressure exceeds a predetermined pressure.

Conveniently, the apparatus can be mounted on a vehicle having a low centre of gravity and provided with a handle rotatable between a normal operative position and another position in which a lifting eye is vertically above the centre of gravity.

The present invention will become further apparent from the following detailed description

given by way of example with reference to accompanying drawings, in which:

Figure 1 is an elevational side view of a multiple fluid mixing and dispensing apparatus embodying the present invention;

Figure 2 is an elevational front view of the multiple fluid mixing and dispensing apparatus of Figure 1;

Figure 3 is an elevational rear view of the multiple fluid mixing and dispensing apparatus of Figure 1;

Figure 4 is a schematic mechanical-electrical diagram of the multiple fluid mixing and dispensing apparatus;

Figure 5 is a partly cut-away view of a detail of the mixing head of the mixing and dispensing apparatus; and

Figures 6A and 6B are detailed drawings illustrating the positioning of the operating handle and lifting eye relative to the centre of gravity of the apparatus.

With reference to Figures 1, 2 and 3, there is illustrated, respectively, side, front and rear elevational views of an assembled multiple fluid mixing and dispensing apparatus 10 comprising a main housing 12 containing the pumps and controls (not shown in Figures 1, 2 or 3) for pumping fluid to the mixing head (not shown in Figures 1, 2 or 3).

A hinged lid 14 is connected proximate the top of housing 12. A support bracket 16, adapted to support a pair of disposable fluid reservoirs 18 and 20, is attached to the top of lid 14.

A pair of wheels 22 are connected to housing 12 proximate the rear thereof so that the apparatus can be conveniently moved about the job site. A pair of level supports 24 are attached to the underside of housing 12 proximate the front thereof to maintain the apparatus level during use and storage.

A steering handle 26 is connected to the rear of housing 12 by handle support brackets 28. A hose or fluid conduit support bracket 30 is attached to steering handle 26 to support fluid supply conduits 60 and 66 when the apparatus is moved about the job site or stored after use.

With particular reference to Figures 1 and 2, it will be noted that steering handle 26 is removable from handle support bracket 28, being retained in position by retaining pin 15. In addition, steering handle 26 can be rotated 180 degrees, as shown in Figures 6A and 6B, to permit lifting eye 17 to project inwardly over center of gravity 188 of housing 12, reservoir support bracket 16 and reservoirs 18 and 20. This permits convenient lifting of the apparatus by a crane or other device at the construction site.

Quick coupling fluid inlet connectors 34 and 36 are also attached to the top of the lid 14 and, respectively, connect fluid reservoirs 18 and 20 into the fluid flow system.

With reference to Figure 4, there is illustrated a schematic mechanical-electrical diagram of the multiple fluid mixing and dispensing apparatus 10 showing the items contained within housing 12 and their operation.

In particular disposable first reservoir 18 is connected in fluid communication with mixing head 50 through first coupling 34, conduit 52, first fluid pump 54, conduit 56, past pressure detector switch 58, conduit 59, first check valve 174, and finally through conduit 60.

Disposable second fluid reservoir 20 is connected in fluid communication with mixing head 50 through second coupling 36, conduit 62, second fluid pump 64, conduit 65, check valve 176 and finally through conduit 66.

First and second fluid pumps 54 and 64, respectively, are driven by a common drive motor 70 mechanically coupled to pumps 54 and 64 through an overload or torque releasable coupling 72 and a gear reduction system 74.

Gear reduction system 74 is adapted to drive pump 64 at a predetermined reduced volume rate relative to pump 54. The gear ratio is adjusted to provide a pumping rate ratio that will give the correct aliquot proportioning of the two liquids necessary to achieve a complete chemical reaction after the mixed fluids leave the mixing head.

In typical gear pump design, two equal displacement pumps are driven at different speeds to secure the pumping ratio. However, it is well known that adhesive components, resin and hardener or curing agent, are typically of different viscosities. Since pumping efficiency goes down with viscosity, equal displacement pumps will not pump two components of different viscosities with equal efficiency. This leads to poor ratioing performance, particularly under low speed and high pressure conditions encountered when using the apparatus of the present invention. These speeds and pressures can range from 0-100 RPM and 0-200 psi (0-13.78 bar), respectively.

To ensure proper pump ratioing under all operating conditions, which may vary from 40 degrees F. to 110 degrees F. (4.4 to 43.3°C), pump size and speed must be properly selected. Because the curing agent, the material contained in disposable reservoir 20, has a low viscosity, and because the volume of the curing agent delivered is low, about one-half the volume of the resin material in reservoir 18, pump 64 is selected to have a low displacement and is adapted to be operated at a high speed. To provide good control the two pumps are driven at speeds inversely proportional to the respective viscosities of the fluids being pumped and at a predetermined ratio of fluid flow. Under these conditions, it has been found that pumping efficiency is greatly improved and ratioing of the fluid flow can be tightly controlled.

Further, accurately to meter the volume of the fluid being pumped, a digital counter 71 is provided. Digital counter 71 is electrically connected to microswitch 73 which counts the number of revolutions of motor 70. Counter 71 is adapted to measure the total fluid flow in increments of 3.8 ccs. The operator can then record the amount of material delivered to each crack, keyway or port or he can tally the entire days volume of material used.

In the event either pump becomes overloaded, torque release coupling 72 allows motor 70 to become disengaged from the pumps until the overload condition is corrected.

Motor 70 is energized using power source 80 which is connected to the electrical system through disconnectable electrical connector 82 mounted on housing 12.

One side of disconnectable electrical connector 82 is electrically connected to ground or common 84, while the other side is first connected to "on-off" switch 86 and then in series to level detector control unit 88, pressure switch 58, motor speed control 90 and finally to pump drive motor 70. Electrically connected across "on-off" switch 86 is spring loaded, normally open, hand held switch 87. Switch 87 allows the operator to jog the injection pressure up slowly for sensitive pumping conditions requiring accurate control of injection pressure. The other side of motor 70 is, of course, electrically connected to ground or common 84.

Located adjacent hand held switch 87 is manually operated, normally open, pushbutton switch 61 which is electrically connected across pressure switch 58. Pushbutton switch 61 permits the operator to increase the injection pressure of the resin material above the setting of pressure switch 58 when the need arises.

Level detector 88 further comprises a first fluid level sensor 96 disposed proximate coupling 34 and adapted to measure the fluid level immediately below that coupling. A second fluid level sensor 98 is disposed proximate coupling 36 and is adapted to measure fluid level immediately below that coupling. One side each of the first fluid level sensor 96 and of the second fluid level sensor 98 are connected together, in common, to conductor 97, which is, in turn, connected to level detector control 88. The other side of first fluid level sensor 96 is connected through conductor 99 back to level sensor control 88 as is the other side of second fluid level sensor 98 through conductor 101.

The disposable fluid reservoirs 18 and 20, typically, are used both for shipping the two-component resin materials to the point of use and also as dispensing reservoirs.

Reservoir 18 comprises a generally transparent or translucent housing 19 having a bottom end 21 and a top end 29. Proximate the bottom end 21 of reservoir 18 is a vent assembly 23 comprising a vent seal teat 25 and a cap receptacle 27. When vent seal teat 25 is cut off to allow displacement air to enter housing 19, the shipping cap (not shown) that sealed top cap end 29 when the container was originally filled and shipped, is adapted to also fit on and be received by cap receptacle 27. Thus seal vent assembly 23 can be sealed closed when reservoir 18 is removed from quick coupling 34 for storage as a partly filled container.

When the shipping cap (not shown) is removed from the top cap end 29, a reservoir coupling member 25' is attached to cap end 29 to replace

the shipping cap. Reservoir coupling member 25' is adapted to engage quick coupling 34 and is also provided with a shut-off valve 27'. When a partially emptied reservoir is to be removed from quick coupling 34, valve 27' is closed and reservoir 18 is removed without spilling any of its contents. Reservoir 18 is then inverted to rest with bottom end 21 down. The original shipping cap (not shown) is attached to cap receptacle 27 prior to inverting the container to prevent loss of fluid from vent assembly 23.

In a like manner, reservoir 20 also comprises a housing 31 having a bottom end 33 and a top cap end 35. Proximate bottom end 33 of housing 31 is a vent assembly 37 comprising a vent seal teat 39 and a cap receptacle 41.

When vent seal teat 39 is cut off, it will allow displacement air to enter housing 31. The shipping cap (not shown) that seals top end 35 during shipping, is adapted also to engage and be received by cap receptacle 39 and thus seal vent assembly 37 when reservoir 20 is removed from quick coupling 36 for storage as a partially filled container.

When the shipping cap (not shown) is removed from cap end 35, a reservoir coupling member 43 is attached to cap end 35 to replace the shipping cap. Reservoir coupling member 43 is adapted to engage quick coupling 36 and is also provided with a valve 45.

When a partially emptied reservoir 20 is to be removed from quick coupling 36, valve 45 is closed, reservoir 20 is removed without spilling any of its contents and is then inverted to rest with bottom end 33 down. The original shipping cap is attached to cap receptacle 39 to prevent loss of fluid from vent assembly 37.

The above described configuration permits disposable shipping reservoirs 18 and 20 to be connected directly to the apparatus without the need for field transfer of the adhesive components. This will prevent the introduction of contaminants into the pumping apparatus which would tend to accelerate wear of the pumping elements leading to severe damage and destruction of the pumps. Also, since the curing component of the epoxy adhesive system is hygroscopic, the use of the above-described configuration prevents water from contaminating the components, which would, in time, degrade the performance of the cured adhesive.

Because both reservoirs 18 and 20 are transparent (or translucent), the operator can readily check the ratioing performance of the apparatus by comparing the levels and volumes of material in the containers. Further, the operator can detect contamination or incorrect material by the colour through the transparent or translucent wall of the container.

Because construction sites and other areas where the apparatus of the present invention is used are generally dirty with various air-borne contaminants such as dust and chemical vapors, the use of the shipping container as the reservoir reduces the possibility of introducing such con-

taminants into the system to cause the pumps to become eroded and corroded, thus reducing their close ratioing performance.

With reference to Figure 5, there is illustrated a partial cut-away view of mixing head 50 showing its internal construction.

Mixing head 50 comprises a body member 100, a first inlet port 102 adapted to receive conduit 60 conducting fluid from first disposable reservoir 18, a second inlet port 104 adapted to receive conduit 66 conducting fluid from second disposable reservoir 20, and outlet port 112 adapted to receive control nozzle 114. A set of mixing channels 106, 108 and 110 provides fluid communication between inlet ports 102-104 and outlet port 112.

Control nozzle 114 comprises an inlet end 116 adapted to engage outlet port 112, a fluid flow control valve 118 and an outlet end 120. Mixing brushes 122, 124 and 126 are disposed in respective mixing channels.

A first interconnecting port 130 is provided in the wall between the first two mixing channels distal inlet ports 102 and 104. A second interconnecting port 132 is located in the wall between the second and third channels distal first interconnecting port 130 and distal outlet port 112.

A first plug 136 is adapted to threadably engage housing 100 at the end of the first channel proximate inlet port 102. Second plug 138 is also adapted threadably to engage housing 100 at the end of the first mixing channel proximate first interconnecting port 130 distal inlet port 102.

Third end plug 140 is adapted threadably to engage housing 100 proximate second interconnecting port 132 while fourth plug 146 is adapted threadably to engage housing 100 at the opposite end of the second channel proximate the first interconnecting port 130.

A fifth end plug 144 is adapted threadably to engage housing 100 at the lower end of the housing proximate the second interconnecting port 132, while sixth end plug 146 is adapted threadably to engage housing 100 proximate exit port 112.

Thus it can be seen that the two fluids flowing from inlet ports 102 and 104 will become mixed and blended by bristles 154 of brush 127 as it passes up the first mixing channel towards first interconnecting port 130. As the fluid continues its flow, as indicated by arrow 156, bristles 158 of brush 124 will continue to cause the fluids to become more intimately mixed as they travel towards second interconnecting port 132.

The same is true as the fluids flow in accordance with arrow 160 up the third mixing channel 110 to be finally mixed by bristles 162 of brush 126 and then flow out of exit port 112 through valve 118 and outlet end 120 of nozzle 114.

To operate the multiple mixing and dispensing apparatus a first disposable reservoir 18 containing, typically, a reactive resin, is connected to quick coupling 34 while a second fluid reservoir 20 containing, typically, an activator for the reactive resin, is connected to second quick connector

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coupling 36. After power source 80 is connected to plug 82, switch 86 is operated to activate motor 70 through speed control 90. When motor 70 is energized, first fluid pump 54 and second fluid pump 64 are actuated through gear reduction unit 74 to obtain a precise ratio of the flow of fluids from disposable container 18 relative to the fluid in disposable container 20. The fluid then simultaneously flows from disposable containers 18 and 20. From container 18 the fluid flows first past level detector 96, then through conduit 52, through pump 54 and conduit 56 past pressure switch 58 into conduit 59, through check valve 174, through conduit 60 and finally to mixing head 50. In mixing head 50 it is intermixed and blended with the second fluid in that it enters inlet port 102 (Figure 5) into mixing channel 106.

In similar manner, fluid flowing from disposable reservoir 20 flows first past level detector 98, then through conduit 62, through pump 64, through conduit 65, through check valve 176, and conduit 66 to outlet port 104 (Figure 5) and into mixing channel 106.

The two mixing fluids then pass in and around bristles 154 of brush member 122 towards interconnecting port 130. They then travel down mixing channel 108, being blended and intermixed by bristles 158 of brush 124, then through second interconnecting port 132, and up through mixing channel 110 to be further intermixed by bristles 162 of brush 126.

The fluid then passes out of mixing head housing 100 through outlet port 112, out through valve 118 and exit end 120 of nozzle 114.

Normally, this particular apparatus is used to inject a polymerizable resin mixture into cracks in a concrete wall 170 for their repair.

To repair a crack in concrete wall 170, a self-adhesive tape, having a width slightly larger than the diameter of nozzle outlet end 120, is placed to span across the crack at intervals along the crack approximately equal to the wall thickness.

Between successive tapes, the crack is sealed with either a hot-melt adhesive or a two component fast curing, epoxy adhesive 172. The material is puttied over the crack and allowed to harden.

The strips of self-adhesive tape are removed prior to the hardening or setting up of adhesive 172. This leaves a series of small access ports along the crack length. The adhesive mixture from reservoirs 18 and 20 is then pumped into the crack by pressing nozzle end 120 against wall 170 at one of the openings created by the removed self-adhesive tape. "On-off" switch 86 is then actuated on the "On" position. The mixed adhesive material is then pumped into the crack until the resin mixture begins to appear at the next adjacent opening created when the self-adhesive tape was removed.

Nozzle end 120 is then pressed against the crack at the next adjacent opening and the process repeated.

In order to achieve a controlled rate of increase in pressure of the fluid being injected into the

crack, a normally open, spring loaded, hand held switch 87, which is electrically connected across "on-off" switch 86, may be used by the operator to "jog" pump motor 70. By turning "on-off" switch 86 to the "off" or open position, hand held switch 87 can then be actuated to activate pump motor 70 to gradually raise the fluid pressure in steps. Pressure switch 58 will protect the system from fluid over-pressure during normal operation.

The pressure at mixing head 50, in particular outlet end 120, must not be so high as to cause the fluid being injected into the crack to break the seal of the hot-melt or epoxy adhesive 172, placed over the crack on the surface of concrete wall 170. The pressure must also not be so low as to prevent, or appreciably decrease, the flow rate of fluids leaving exit end 120 of nozzle 114.

To prevent such an occurrence, a pressure switch 58 is located on the high pressure side of first pump 54 between conduits 56 and 59. A pressure switch could also be included in conduit 66 on the high pressure side of pump 64; however, the hydraulic pressure in each conduit would be approximately the same as the pressure at exit end 120 of nozzle 114 (not taking into account fluid friction). Thus only one pressure switch is really needed.

Pressure switch 58 is, therefore, adjusted for the optimum pressure needed to meet the requirements stated above.

Under certain circumstances, it may be necessary to inject the fluid mixture out of mixing head 50 at a higher pressure than the pressure setting of pressure switch 58. This would occur, typically, for very fine cracks or where debris in the crack prevents the rapid flow of fluid into the full volume and depth of the crack.

Under these circumstances, the operator can depress normally open, pushbutton switch 61 which is electrically connected across pressure switch 58. This action will temporarily short out pressure switch 58 and allow pump motor 70 to continue pumping should the fluid pressure exceed the pressure setting of pressure switch 58.

When pushbutton switch 61 is released, then pressure switch 58 will resume its function of de-energizing pump motor 70 until fluid pressure is reduced to below the pressure setting of pressure switch 58.

Where a polymerizing resin is being injected into a crack in concrete, it is important that there be a correct mixture of the two resins, otherwise the material will fail to harden and there will be no binding of the two sides of the crack to each other to create a monolithic whole. This usually occurs where there is single component pumping.

To prevent this deficiency, a first level detector 96 is located proximate quick coupling 34 to detect an empty reservoir 18. A second level detector 98 is disposed proximate second quick coupling 36 to detect an empty disposable reservoir 20. If either reservoir 18 or 20 becomes empty, either detector 96 or 98, respectively, will be activated to actuate a disconnect relay (not

shown) in level detector control 88. Since level detector control 88 is connected in series with speed control 90 and motor 70, motor 70 will become deactivated and pumping will stop.

After the multiple fluid mixing and dispensing apparatus 10 has been used, it can be cleaned by pumping solvent through the conduit and pumping system with mixing head 50 being cleaned by removing plugs 138, 142 and 146 and then removing brushes 122, 124 and 126. Housing 100 can then be easily cleaned with a minimum of solvent. The brushes can be thrown away without cleaning.

In order to prevent inadvertent switching of the two reservoirs with the resultant wrong mixing of the two fluids, top end 29 of reservoir 18 is made to have a cap diameter different from that of the top end 35 of reservoir 20.

Also, in order to permit an operator to monitor the proper proportioning of the fluids being pumped, a scale 51 is provided along the side of reservoir 18 whose graduations can be coordinated with the graduations of a similar scale 53 along the side of second reservoir 20. The scales can be either molded into the reservoir material itself or applied to the surface of the reservoir.

With respect to Figures 6A and 6B, there is illustrated a more detailed drawing of the positioning of the operating handle 26 relative to main housing 12.

The operating handle of Figures 6A and 6B comprises, basically, a shaft portion 180, a curved portion 182 and a T-shaped handlebar 184.

In addition, a lifting eye 17 is provided at the top of handle 26 to permit the apparatus to be lifted to the job site.

A retaining pin 15 is also provided in bracket 28 to hold handle 26 in place while lifting and steering the apparatus.

In Figure 6A, operating handle 26 is shown in its normal position when rolling the apparatus of the present invention about the job site.

In Figure 6B, operating handle 26 has been rotated 180 degrees by removing retaining pin 15, rotating shaft 180 180 degrees in bracket 28 and then re-inserting pin 15 back through bracket 28 and shaft portion 180.

As shown in Figure 6B, lifting eye 17 is located directly over center of gravity 188 of the apparatus. Thus, the apparatus of the present invention can be lifted in an up-right position by a crane or other device and moved about the job site without causing spillage or leakage of fluids from the apparatus during such movement.

Further, where a restricted entrance limits movement of the apparatus to its place of use, reservoir support bracket 16 is adapted to be easily removable through the use of bolts or the like whereby housing 12, minus steering handle 26, reservoir 18 and 20, and reservoir support bracket 16, can pass through a small opening followed by the removed parts for simple assembly at the place of use.

Claims

1. Apparatus for mixing and dispensing a fluid comprising a first fluid reservoir (18), a second fluid reservoir (20), a first fluid pump (54) having an inlet port in communication with the first reservoir, a second fluid pump (64) having an inlet port in communication with the second reservoir, the reservoirs being such that the pressure of fluid in use of the apparatus is substantially the same at both inlet ports, drive means (70) for driving the pumps, means (74) connecting the pumps to each other for proportionately pumping fluid from the reservoirs at a predetermined volume ratio, and a mixing head (50) having first and second inlet ports in fluid communication with outlet ports of the respective pumps, characterised in that the pumps are arranged to be driven by drive means (70) at respective speeds inversely proportional to the respective viscosities of the fluid being pumped and in that means (96,98,88) are provided in communication with the inlet side of the pumps for detecting the absence of fluid and stopping the drive to said pumps when an absence of fluid is detected.

2. Apparatus as claimed in claim 1, characterised in that a power source (80) is electrically connected to said drive means (70), means (58) are provided for measuring fluid pressure of said fluid between said first pump (54) and said mixing head, and means (90) are provided for electrically disconnecting said drive means (70) when said fluid pressure exceeds a predetermined pressure and electrically connecting said power source (80) to said drive means (70) when said pressure is less than said predetermined pressure.

3. Apparatus as claimed in claim 2, characterised in that the means (96, 98, 88) in fluid communication with said inlet ports of said pumps for detecting the absence of fluid are adapted electrically to disconnect said power source (80) from said drive means (70) when an absence of fluid is detected.

4. Apparatus as claimed in claim 2 or 3, characterised in that means (61) are provided for overriding said means (90) for electrically disconnecting said drive means (70) when said fluid pressure exceeds a predetermined pressure.

5. Apparatus as claimed in any preceding claim, characterised by means (174, 176) for preventing the flow of fluid back into said first and second pumps (54, 64) from said mixing head (50) when said pumps are not in operation.

6. Apparatus as claimed in any preceding claim, characterised in that means (87) are provided for controlling the rate of increase in pumping pressure of said first and second pumps.

7. Apparatus as claimed in any preceding claim, characterised in that said mixing head (50) comprises a mixing channel having an inlet end (102, 104) and an outlet end (120), said means (60) for fluidly communicating said mixing head (50) with said outlet port of said first pump (54) being connected to said inlet end (102) of said mixing head (50), said means (66) for fluidly communicating



shown) in level detector control 88. Since level detector control 88 is connected in series with speed control 90 and motor 70, motor 70 will become deactivated and pumping will stop.

After the multiple fluid mixing and dispensing apparatus 10 has been used, it can be cleaned by pumping solvent through the conduit and pumping system with mixing head 50 being cleaned by removing plugs 138, 142 and 146 and then removing brushes 122, 124 and 126. Housing 100 can then be easily cleaned with a minimum of solvent. The brushes can be thrown away without cleaning.

In order to prevent inadvertent switching of the two reservoirs with the resultant wrong mixing of the two fluids, top end 29 of reservoir 18 is made to have a cap diameter different from that of the top end 35 of reservoir 20.

Also, in order to permit an operator to monitor the proper proportioning of the fluids being pumped, a scale 51 is provided along the side of reservoir 18 whose graduations can be coordinated with the graduations of a similar scale 53 along the side of second reservoir 20. The scales can be either molded into the reservoir material itself or applied to the surface of the reservoir.

With respect to Figures 6A and 6B, there is illustrated a more detailed drawing of the positioning of the operating handle 26 relative to main housing 12.

The operating handle of Figures 6A and 6B comprises, basically, a shaft portion 180, a curved portion 182 and a T-shaped handlebar 184.

In addition, a lifting eye 17 is provided at the top of handle 26 to permit the apparatus to be lifted to the job site.

A retaining pin 15 is also provided in bracket 28 to hold handle 26 in place while lifting and steering the apparatus.

In Figure 6A, operating handle 26 is shown in its normal position when rolling the apparatus of the present invention about the job site.

In Figure 6B, operating handle 26 has been rotated 180 degrees by removing retaining pin 15, rotating shaft 180 180 degrees in bracket 28 and then re-inserting pin 15 back through bracket 28 and shaft portion 180.

As shown in Figure 6B, lifting eye 17 is located directly over center of gravity 188 of the apparatus. Thus, the apparatus of the present invention can be lifted in an up-right position by a crane or other device and moved about the job site without causing spillage or leakage of fluids from the apparatus during such movement.

Further, where a restricted entrance limits movement of the apparatus to its place of use, reservoir support bracket 16 is adapted to be easily removable through the use of bolts or the like whereby housing 12, minus steering handle 26, reservoir 18 and 20, and reservoir support bracket 16, can pass through a small opening followed by the removed parts for simple assembly at the place of use.

Claims

1. Apparatus for mixing and dispensing a fluid comprising a first fluid reservoir (18), a second fluid reservoir (20), a first fluid pump (54) having an inlet port in communication with the first reservoir, a second fluid pump (64) having an inlet port in communication with the second reservoir, the reservoirs being such that the pressure of fluid in use of the apparatus is substantially the same at both inlet ports, drive means (70) for driving the pumps, means (74) connecting the pumps to each other for proportionately pumping fluid from the reservoirs at a predetermined volume ratio, and a mixing head (50) having first and second inlet ports in fluid communication with outlet ports of the respective pumps, characterised in that the pumps are arranged to be driven by drive means (70) at respective speeds inversely proportional to the respective viscosities of the fluid being pumped and in that means (96,98,88) are provided in communication with the inlet side of the pumps for detecting the absence of fluid and stopping the drive to said pumps when an absence of fluid is detected.

2. Apparatus as claimed in claim 1, characterised in that a power source (80) is electrically connected to said drive means (70), means (58) are provided for measuring fluid pressure of said fluid between said first pump (54) and said mixing head, and means (90) are provided for electrically disconnecting said drive means (70) when said fluid pressure exceeds a predetermined pressure and electrically connecting said power source (80) to said drive means (70) when said pressure is less than said predetermined pressure.

3. Apparatus as claimed in claim 2, characterised in that the means (96, 98, 88) in fluid communication with said inlet ports of said pumps for detecting the absence of fluid are adapted electrically to disconnect said power source (80) from said drive means (70) when an absence of fluid is detected.

4. Apparatus as claimed in claim 2 or 3, characterised in that means (61) are provided for overriding said means (90) for electrically disconnecting said drive means (70) when said fluid pressure exceeds a predetermined pressure.

5. Apparatus as claimed in any preceding claim, characterised by means (174, 176) for preventing the flow of fluid back into said first and second pumps (54, 64) from said mixing head (50) when said pumps are not in operation.

6. Apparatus as claimed in any preceding claim, characterised in that means (87) are provided for controlling the rate of increase in pumping pressure of said first and second pumps.

7. Apparatus as claimed in any preceding claim, characterised in that said mixing head (50) comprises a mixing channel having an inlet end (102, 104) and an outlet end (120), said means (60) for fluidly communicating said mixing head (50) with said outlet port of said first pump (54) being connected to said inlet end (102) of said mixing head (50), said means (66) for fluidly communicating



ing said mixing head (50) with said outlet port of said second pump (64) being connected to said inlet end (104) of said mixing head, an injection nozzle (114) connected in fluid communication with the outlet port (112) of said mixing head (50), a valve (118) connected to said nozzle (114) and adapted to control the flow of fluid to said nozzle, and a brush (122) disposed in said mixing channel having a plurality of bristles (154) adapted to project into the cavity of said mixing channel.

8. Apparatus as claimed in any preceding claim, characterised by a housing (12) with the first and second fluid reservoirs being adapted to be mounted proximate the top of the housing, the first and second pumps being mounted within said housing with their inlet ports being in fluid communication with said reservoirs.

9. Apparatus as claimed in claim 8, characterised in that the housing comprises part of an equipment vehicle which comprises a pair of wheels (22) connected to said housing; an operating handle (26) comprising a shaft portion (180), a curved portion (182) and a handle portion (184), a lifting eye (17) connected to said handle portion proximate the top thereof; means (28) for connecting said shaft portion (180) of said operating handle (26) to said housing (12); and means (15) for permitting said shaft portion to be rotated relative to said housing from a position in which said handle portion is projecting away from said housing to a position in which said handle portion is projecting over said housing; said curved portion (182) and said handle (184) being of a sufficient length for said lifting eye (17) to be vertically disposed over the centre of gravity of said housing and operating handle combination.

Patentansprüche

1. Gerät zum Mischen und Abgeben eines Fluides, enthaltend einen ersten Fluidvorratsbehälter (18), einen zweiten Fluidvorratsbehälter (20), eine erste Fluidpumpe (54) mit einem Einlaßkanal, der mit dem ersten Fluidvorratsbehälter in Verbindung ist, eine zweite Fluidpumpe (64) mit einem Einlaßkanal, der mit dem zweiten Vorratsbehälter in Verbindung ist, wobei die Vorratsbehälter derart sind, daß der Fluiddruck beim Einsatz des Gerätes an beiden Einlaßkanälen im wesentlichen gleich ist, eine Antriebseinrichtung (70) zum Antreiben der Pumpen, eine Einrichtung (74), die die Pumpen miteinander verbindet, um Fluid aus den Vorratsbehältern in proportionierter Weise mit einem vorbestimmten Volumenverhältnis zu pumpen, und einen Mischkopf (50) mit ersten und zweiten Einlaßkanälen, die in Fluidverbindung mit Auslaßkanälen der jeweiligen Pumpen sind, dadurch gekennzeichnet, daß die Pumpen dazu eingerichtet sind, von der Antriebseinrichtung (70) mit entsprechenden Geschwindigkeiten angetrieben zu werden, die umgekehrt proportional zu den jeweiligen Viskositäten des gepumpten Fluides sind, und daß Einrichtungen (96, 98, 88) in Verbindung mit der Einlaßseite der Pumpen vorgesehen sind, um die Abwesenheit

von Fluid festzustellen und den Antrieb der Pumpen anzuhalten, wenn eine Abwesenheit von Fluid ermittelt wird.

2. Gerät nach Anspruch 1, dadurch gekennzeichnet, daß eine Stromquelle (80) elektrisch mit der Antriebseinrichtung (70) verbunden ist, daß Einrichtungen (58) vorgesehen sind, um den Fluiddruck des Fluides zwischen der ersten Pumpe (54) und dem Mischkopf zu messen, und Einrichtungen (90) vorgesehen sind, um elektrisch die Antriebseinrichtung (70) abzuschalten, wenn der Fluiddruck einen vorbestimmten Druck übersteigt, und elektrisch die Stromquelle (80) mit der Antriebseinrichtung (70) zu verbinden, wenn der genannte Druck geringer als der vorbestimmte Druck ist.

3. Gerät nach Anspruch 2, dadurch gekennzeichnet, daß die Einrichtungen (96, 98, 88), die in Fluidverbindung mit den Einlaßkanälen der Pumpen sind, um die Abwesenheit von Fluid zu ermitteln, elektrisch so eingerichtet sind, daß sie die Stromquelle (80) von der Antriebseinrichtung (70) trennen, wenn eine Abwesenheit von Fluid ermittelt wird.

4. Gerät nach Anspruch 2 oder 3, dadurch gekennzeichnet, daß Einrichtungen (61) vorgesehen sind, die die Einrichtung (90) außer Kraft setzen, welche elektrisch die Antriebseinrichtung (70) abschaltet, wenn der Fluiddruck einen vorbestimmten Druck überschreitet.

5. Gerät nach einem der vorhergehenden Ansprüche, gekennzeichnet durch Einrichtungen (174, 176) zum Verhindern der Fluidströmung zurück in die ersten und zweiten Pumpen (54, 64) aus dem Mischkopf (50), wenn die genannten Pumpen nicht in Betrieb sind.

6. Gerät nach einem der vorhergehenden Ansprüche, dadurch gekennzeichnet, daß Einrichtungen (87) vorgesehen sind, um die Steigerungsrate des Fluiddrucks der ersten und zweiten Pumpen zu beeinflussen.

7. Gerät nach einem der vorhergehenden Ansprüche, dadurch gekennzeichnet, daß der Mischkopf (50) einen Mischkanal enthält, der ein Einlaßende (102, 104) und ein Auslaßende (180) hat, daß die Einrichtungen (60) zum fluidischen Verbinden des Mischkopfes (50) mit dem Auslaßkanal der ersten Pumpe (54) mit dem Einlaßende (102) des Mischkopfes (50) verbunden sind, daß die Einrichtungen (66) zum fluidischen Verbinden des Mischkopfes (50) mit dem Auslaßkanal der zweiten Pumpe (64) mit dem Einlaßende (104) des Mischkopfes verbunden sind, daß eine Einspritzdüse (114) in Fluidverbindung mit dem Auslaßkanal (112) des Mischkopfes (50) verbunden ist, ein Ventil (118) mit der Düse (114) verbunden und dazu eingerichtet ist, die Fluidströmung zu der Düse zu steuern, und daß eine Bürste (122) in dem Mischkanal angeordnet ist, die eine Vielzahl von Borsten (154) hat, die dazu eingerichtet sind, in dem Hohlraum des Mischkanals vorzustehen.

8. Gerät nach einem der vorhergehenden Ansprüche, gekennzeichnet durch ein Gehäuse (12), wobei die ersten und zweiten Fluidvorratsbehälter dazu eingerichtet sind, nahe der Oberseite des



Gehäuses montiert zu werden, die ersten und zweiten Pumpen in dem Gehäuse befestigt sind, wobei ihre Einlaßkanäle in Fluidverbindung mit den genannten Vorratsbehältern sind.

9. Gerät nach Anspruch 8, dadurch gekennzeichnet, daß das Gehäuse Teil eines Gerätefahrzeugs ist, das ein Paar Räder (22) enthält, die mit dem Gehäuse verbunden sind; daß ein Steuergriff (26) mit einem Schaftabschnitt (180), einem gebogenen Abschnitt (182) und einem Griffabschnitt (184) vorgesehen ist, eine Huböse (17) an dem Griffabschnitt nahe dem oberen Ende desselben befestigt ist; daß eine Einrichtung (28) zum Verbinden des Schaftabschnitts (180) des Steuergriffs (26) an dem Gehäuse (12) vorgesehen ist; und daß eine Einrichtung (15) vorhanden ist, die es erlaubt, den Schaftabschnitt relativ zu dem Gehäuse aus einer Position, in der sich der Griffabschnitt von dem Gehäuse wegerstreckt, in eine Position zu drehen, in der der Griffabschnitt sich über das Gehäuse erstreckt; wobei der gebogene Abschnitt (182) und der Griff (184) ausreichend lang sind, daß die Huböse (17) vertikal über dem Schwerpunkt der Kombination aus Gehäuse und Steuergriff liegt.

Revendications

1. Appareil pour mélanger et disperser un fluide comprenant un premier réservoir de fluide (18), un second réservoir de fluide (20), une première pompe à fluide (54) comprenant un orifice d'entrée en communication avec le premier réservoir, une seconde pompe à fluide (64) comprenant un orifice d'entrée en communication avec le second réservoir, les réservoirs étant tels que la pression du fluide utilisé dans l'appareil soit sensiblement la même aux deux orifices d'entrée, des moyens d'entraînement (70) pour entraîner les pompes, des moyens (74) pour raccorder les pompes mutuellement afin de pomper proportionnellement le fluide des réservoirs sous un rapport volumique prédéterminé, et une tête de mélange (50) comprenant un premier et un second orifice d'entrée en communication fluide avec les orifices de sortie des pompes respectives, caractérisé en ce que les pompes sont agencées pour être entraînées par les moyens d'entraînement (70) à des vitesses respectives inversement proportionnelles aux viscosités respectives des fluides pompés et en ce que des moyens (96, 98, 88) sont prévus en communication avec le côté entrée des pompes pour détecter l'absence de fluide et arrêter l'entraînement desdites pompes lorsqu'une absence de fluide est détectée.

2. Appareil selon la revendication 1, caractérisé en ce qu'une source d'énergie (80) est reliée électriquement auxdits moyens d'entraînement (70), que des moyens (58) sont prévus pour mesurer la pression fluide dudit fluide entre ladite première pompe (54) et ladite tête de mélange, et que des moyens (90) sont prévus pour déconnecter électriquement lesdits moyens d'entraînement (70) lorsque la pression fluide dépasse une pression prédéterminée et pour

connecter électriquement ladite source d'énergie (80) auxdits moyens d'entraînement (70) lorsque ladite pression est inférieure à ladite pression prédéterminée.

3. Appareil selon la revendication 2, caractérisé en ce que des moyens (96, 98, 88) en communication fluide avec lesdits orifices d'entrée desdites pompes pour détecter l'absence de fluide, sont adaptés électriquement pour couper ladite source d'énergie (80) desdits moyens d'entraînement (70) lorsqu'une absence de fluide est détectée.

4. Appareil selon la revendication 2 ou 3, caractérisé en ce qu'il est prévu des moyens (61) l'emportant sur lesdits moyens (90) servant à déconnecter électriquement lesdits moyens d'entraînement (70), lorsque ladite pression fluide dépasse une pression prédéterminée.

5. Appareil selon l'une quelconque des revendications précédentes, caractérisé par des moyens (174, 176) pour empêcher l'écoulement du fluide en retour dans lesdites première et seconde pompes (54, 64) à partir de ladite tête de mélange (50), lorsque lesdites pompes ne sont pas en service.

6. Appareil selon l'une quelconque des revendications précédentes, caractérisé en ce qu'il est prévu des moyens (87) pour régler la vitesse d'élévation de la pression de pompage desdites première et seconde pompes.

7. Appareil selon l'une quelconque des revendications précédentes, caractérisé en ce que la tête de mélange (50) comprend un canal de mélange muni d'une extrémité d'entrée (102, 104) et d'une extrémité de sortie (180), lesdits moyens (60) de mise en communication fluide de ladite tête de mélange (50) avec ledit orifice de sortie de ladite première pompe (54) étant reliés à ladite extrémité d'entrée (102) de ladite tête de mélange (50), lesdits moyens (66) de mise en communication fluide de ladite tête de mélange (50) avec ledit orifice de sortie de ladite seconde pompe (64) étant reliés à ladite extrémité d'entrée (104) de ladite tête de mélange, une buse d'injection (114) reliée en communication fluide à l'orifice de sortie (112) de ladite tête de mélange (50), une vanne (118) reliée à ladite buse (114) et agencée pour régler le débit de fluide vers ladite buse et une brosse (122) disposée dans ledit canal de mélange comportant une pluralité de poils (154) agencés pour faire saillie dans la cavité dudit canal de mélange.

8. Appareil selon l'une quelconque des revendications précédentes, caractérisé par un carter (12) dans lequel le premier et le second réservoir de fluide sont agencés de façon à être montés à proximité du haut du carter, la première et la seconde pompe étant montées à l'intérieur dudit carter, avec leurs orifices d'entrée en communication fluide avec lesdits réservoirs.

9. Appareil selon la revendication 8, caractérisé en ce que le carter fait partie d'un véhicule de service comportant une paire de roues (22) reliées audit carter; un levier de manoeuvre (26) comprenant une partie en forme de barre (180), une



partie incurvée (182) et une partie en forme de poignée (184), un oeillet de suspension (17) étant fixé à ladite partie en forme de poignée près du sommet de celle-ci; des moyens (28) pour relier ladite partie en forme de barre (180) dudit levier de manoeuvre (26) audit carter (12); et des moyens (15) pour permettre à ladite partie en forme de barre d'effectuer une rotation par rapport audit carter, à partir d'une position dans

laquelle ladite partie en forme de poignée fait saillie en direction opposée audit carter jusqu'à une position dans laquelle ladite partie en forme de poignée fait saillie au dessus dudit carter; ladite partie incurvée (182) et ladite poignée (184) étant d'une longueur suffisante pour que ledit oeillet de suspension (17) soit disposé verticalement au dessus du centre de gravité de ladite combinaison de carter et de levier de manoeuvre.

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