

Jan. 28, 1969

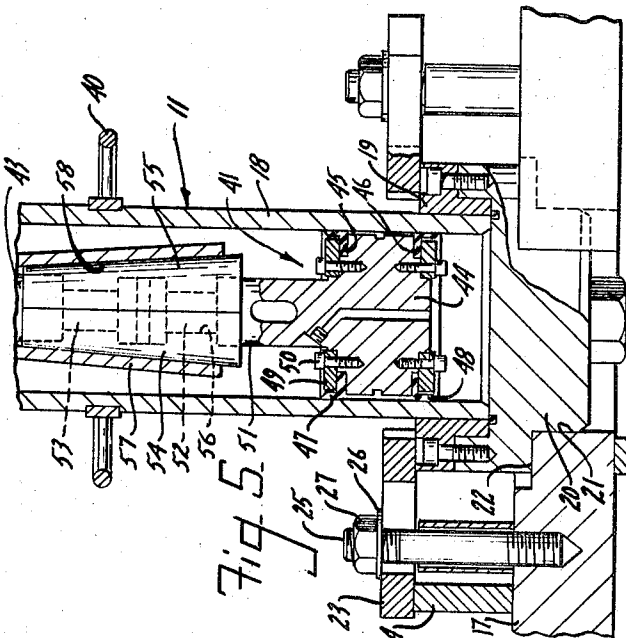
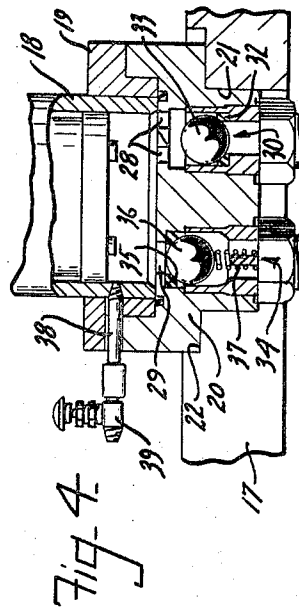
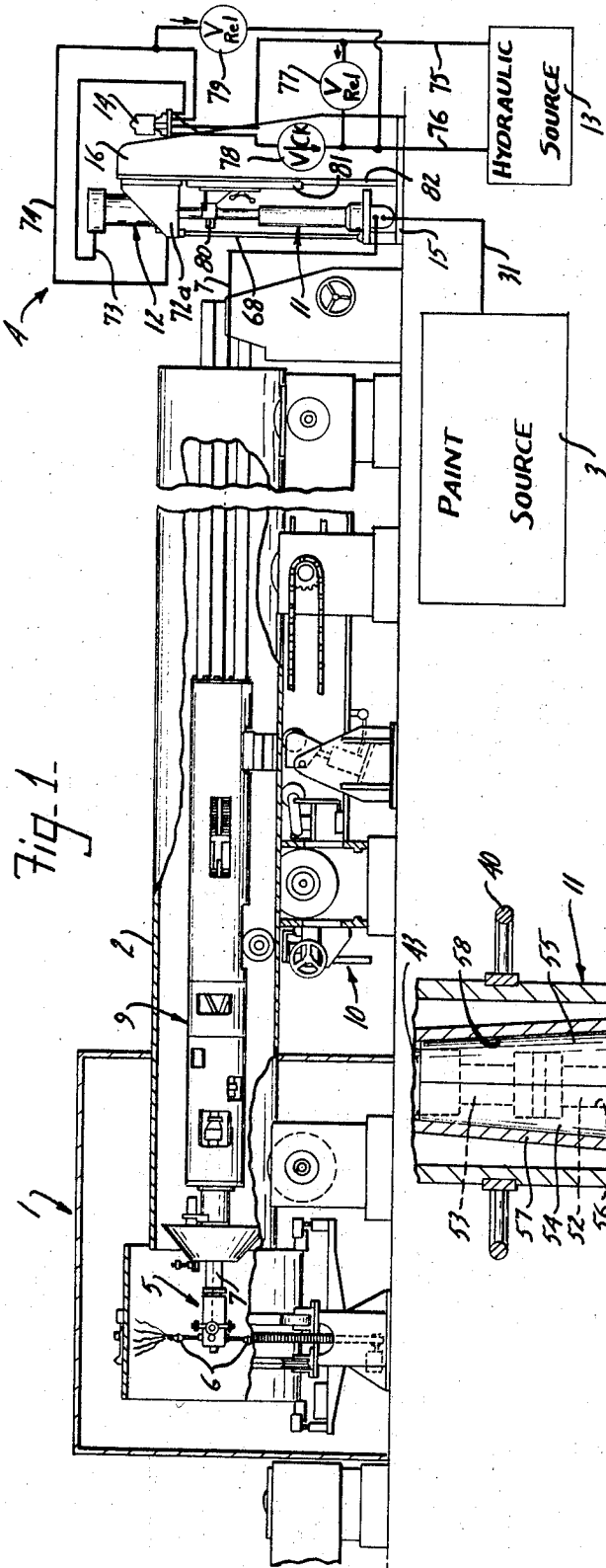
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3,424,092

PAINT PUMPING SYSTEM

Filed Oct. 28, 1966

Sheet 1 of 2



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Sheet 2 of 2

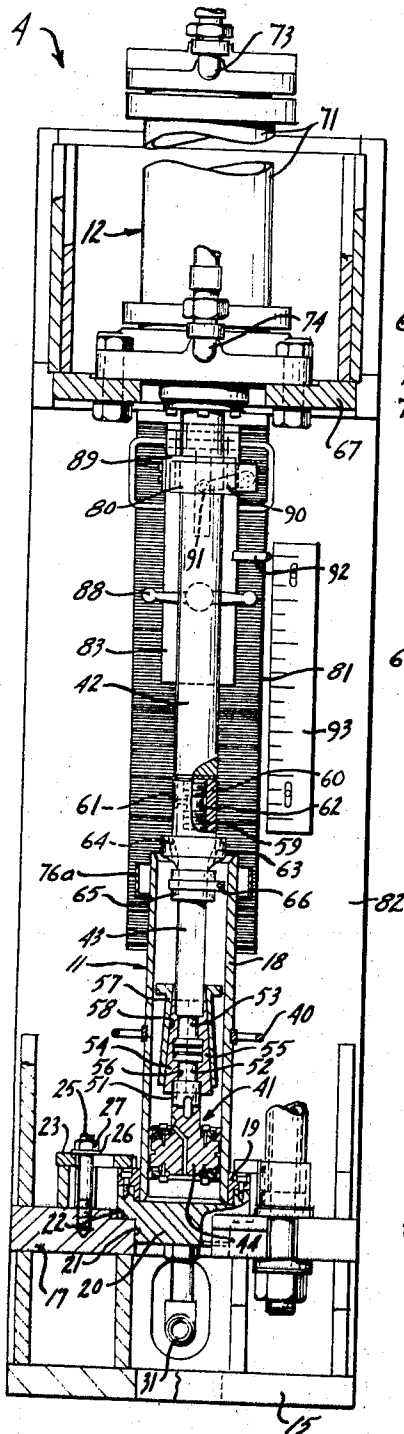


Fig. 3.

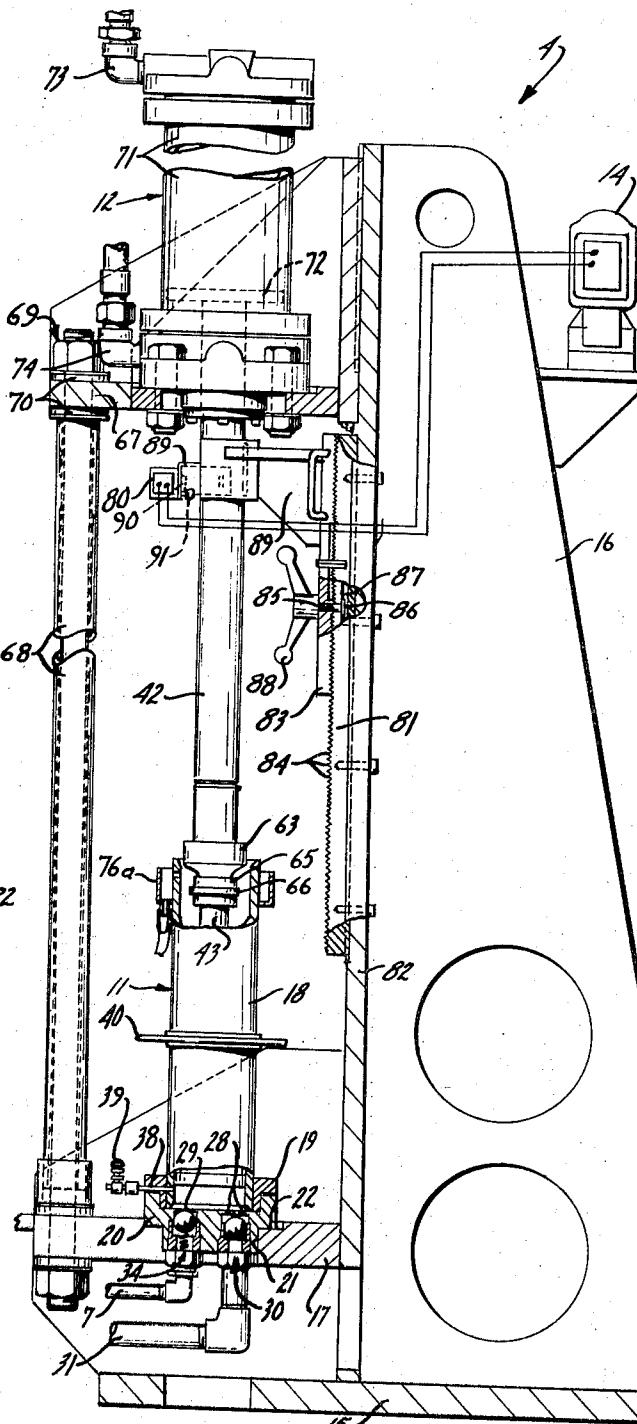


Fig. 2.

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PAINT PUMPING SYSTEM

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13 Claims

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ABSTRACT OF THE DISCLOSURE

The present disclosure relates to a high pressure piston pump delivering paint to a spray nozzle at a uniform and constant pressure. A single stroke hydraulic piston pressure intensifier has its piston connected to the piston of the piston pump. A releasable interconnection permits ready disassembly of the piston and creates a self-centering feature within the cylinder to compensate for any misalignment characteristics and to maintain equalized wearing of the packing. The piston pump cylinder includes an inlet and discharge in the head. A mechanically actuated microswitch is adjustably mounted adjacent the shaft between the pistons and connected to control a four-way valve for actuating intensifiers. A protrusion on the connection shaft actuates the microswitch.

This invention relates to a paint pumping system and particularly to a system for applying paint from a nozzle under high pressure.

Fluid transmission pipes have been recently constructed with a protective coating normally of an epoxy resin paint applied to the inner surface. The coating protects against corrosion and also increases the flow rate as a result of reducing surface friction. A highly satisfactory internal surface applicator for tubular members such as gas and oil transmission pipes is shown in applicant's copending application, entitled Internal Surface Applicator for Tubular Members, which was filed Apr. 2, 1962 with Ser. No. 184,463. In that application, a cantilevered boom is provided having a special rotating spray gun head mounted on the free or outer end of a cantilevered boom. The pipe is telescoped over the boom and the spray head rotated to apply an epoxy paint or the like. As disclosed therein, the spray or paint guns are preferably of an airless variety, that is, the paint is applied directly to the guns under a high pressure and emitted from the guns directly to the surface.

A coating which is essentially completely free of pinholes is generally desired. Consequently, air operated devices are not generally considered desirable. Further, it is important that a uniform coating be applied and consequently the material should be emitted from the paint nozzles or sprayer at a uniform tip pressure which can be controlled in accordance with the particular coating application or process. The avoidance of surges in the pumping pressure is therefore of substantial significance.

Further, the system for mass production such as required under present day economics must be designed to permit simple, ready and inexpensive cleaning, servicing and other maintenance as well as providing a relatively long and reliable operating life.

The present invention is particularly directed to an improved high pressure pump for delivering paint or the like to a spray nozzle at a uniform constant pressure. The pump system is relatively simple in design and includes improved subassemblies permitting ready assembly and disassembly for service maintenance and the like.

Generally, in accordance with the present invention, the paint is supplied to the nozzle or other applicator by a single stroke reciprocating hydraulic unit having a cylinder within which a piston is slidably mounted. The piston is connected to a hydraulic operating unit adapted to re-

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ciprocate the piston with respect to an inlet-discharge head unit. The hydraulic operating unit and single stroke piston act as a pressure intensifier system, drawing in paint during the retracting stroke of the piston and forcing the paint out of the cylinder during the working stroke under high pressure. In accordance with the present invention, an adjustable switch means is interconnected or mounted as a part of the hydraulic pump unit and actuated by a suitable component which moves with and preferably is connected to the shaft between the hydraulic unit and the pump. A highly satisfactory system employs a small mechanically actuated microswitch which is adjustably mounted adjacent the shaft connecting the hydraulic cylinder unit to the hydraulic pump unit. A protrusion on the connecting shaft actuates the microswitch to control a four-way valve for establishing and limiting the return stroke of the hydraulic unit. During the working stroke, the hydraulic operating unit is controlled by the movement of the pipe.

The system further includes means to control the pressure or speed of movement and thereby controls the tip pressure. A constant weight in gallons per minute of paint applied will also result with this system to insure complete coverage.

The piston pump unit of the present invention in accordance with a particularly unique aspect of the present invention includes an interconnection between the piston and the force transmitting shaft assembly from the hydraulic unit. The interconnection permits ready disassembly of the piston and creates a self-centering feature within the cylinder to compensate for any misalignment characteristics and to maintain equalized wearing of the packing. The cylinder is preferably releasably clamped in position against a valve closure unit or head to permit ready disassembly of the cylinder for clean-up and maintenance purposes.

The present invention thus provides an improved method of applying paint to a pipe or the like and particularly provides a highly improved pump structure particularly adapted for paint application.

The drawings furnished herewith illustrate a preferred mode of carrying out the present invention in which the above advantages and features as well as others will be clear to those skilled in the art from the following description of the drawings.

In the drawings:

FIG. 1 is an elevational view of a paint applicator for tubular pipe or the like incorporating a paint pumping system constructed in accordance with the teachings of this invention;

FIG. 2 is an enlarged side elevational view of a pump unit constructed in accordance with the present invention and with parts in section to show details of construction;

FIG. 3 is a side view of FIG. 2 with parts broken away and sectioned to show other details of construction; and

FIG. 4 is an enlarged fragmentary view more clearly showing the construction of the piston assembly; and

FIG. 5 is an enlarged sectional view of the pump head.

Referring to the drawings and particularly to FIG. 1, the present invention is shown in connection with a rotating paint applicator 1 of the cantilevered type such as shown in applicant's previously referred to application wherein a pipe 2 is adapted to telescope over the cantilevered boom paint applicator 1. A remote paint source 3 is interconnected through a paint pump unit 4 to the applicator 1. The paint employed for coating fluid transmission pipes or lines is generally an epoxy type paint having a base and a catalyst for setting of the epoxy paint after application to the internal side of the pipe. The consistency of the epoxy paint is that of a conventional paint to permit relatively fairly free flow through the system. Generally, the paint applicator includes a

rotating head 5 having a plurality of paint spray nozzles 6 connected thereto and forming a part thereof. A paint line 7 is coupled to the spray nozzle 6 and extended backwardly along the boom and connected to the unit 4. A pipe support 10 is shown mounted adjacent the outward end of the cantilevered beam 9 to support the beam with the pipe removed.

As the paint applicator as such can be of any suitable or desired variety, no further discussion or description thereof is given. As previously noted, for a particularly satisfactory unit, reference may be made to applicant's copending application.

The paint pump unit 4 which particularly forms the subject matter of the present invention is more particularly shown in FIGS. 2 and 3. Generally, the illustrated embodiment of the invention includes a single stroke piston pump 11 coupled to a hydraulic operating unit 12 for operation of the pump 11. Hydraulic unit 12 is connected to a pressurized hydraulic fluid source 13 through a four-way valve 14. The positioning of the valve 14 controls the interconnection to the opposite ends of the hydraulic unit 12 and thereby alternately establishes a working stroke during which period the piston pump 11 is operated to discharge paint and a return or fill stroke during which time the piston pump 11 is operated to fill with paint for the next cycle of discharge.

The illustrated piston pump 11 includes a base structure 15 having a vertical supporting channel 16. A horizontal support plate 17 is secured to the support channel 16 in upwardly spaced relation to the base 15 for supporting of the pump 11 in a vertical position.

The pump 11 includes a cylinder 18 terminating at its lower end in an inverted L-shaped mounting flange member 19 which is welded or otherwise secured to the cylinder with the end face of the cylinder and the mounting flange member 19 in coplanar relation. The member 19 is bolted or otherwise secured to an end closure or head 20 which includes an outer reduced portion which projects through an aperture 21 in the support plate 17 with a forward slot extending from the opening to accommodate the pipe connections to head 20. The reduced portion defines a flange portion 22 which rests on the support plate 17. A pair of L-shaped clamping brackets 23 are disposed to the opposite sides of the head 20 and include vertical legs 24 adapted to rest on the plate 17 with the brackets 23 extending laterally over the flange member 19. Studs 25 extend outwardly from the plate through suitable slots in the brackets 23 and a washer 26 and nut 27 are connected to the stud to securely clamp the pump cylinder 18 in place. This provides a very simple and convenient means of mounting the cylinder 18 in rigid and firm relation to the support plate 17 while permitting rapid disassembly of the cylinder when desired for cleaning and the like.

As most clearly shown in FIGS. 2 and 4, the head 20 includes an inlet opening 28 and a discharge opening 29 in laterally spaced relation. The inlet opening 28 includes a check valve unit 30 connected to a source line 31 for withdrawing of the paint from the paint source 3.

The valve unit 30 may be of any well known construction and is shown including a valve seat 32 secured within the opening with a check ball 33 mounted therein for vertical movement. When the ball 33 is moved upwardly, as viewed in FIG. 2, the line connection is opened. When the ball 33 is forced downwardly, it closes the opening to the line 31.

The discharge opening 29 is provided with a similar check valve unit 34 interconnected to the paint line or transfer line 7 which is connected to the rotating head 5 and particularly nozzles 6. The valve unit 34 includes a valve seat 35 in the upper end of the opening with a check ball 36 disposed therebelow. A preload spring 37 is disposed between the check ball 36 and the entrance side of the valve unit 34. The check ball 36 is thereby held in engagement against the forces of gravity and the

weight of the paint within the cylinder 18 as hereinafter described.

A bleeder pipe 38 is connected to the lower end of cylinder 18 immediately adjacent the base thereof and is provided with a manually operated bleeder valve 39 for bleeding of the cylinder to remove air and the like.

Additionally, a manually manipulating encircling handle 40 is secured about the central portion of the cylinder to permit handling of the cylinder for removal from the support plate 17 for cleaning and the like.

A piston assembly 41 is slidably mounted within the cylinder 18 and is connected to the output shaft 42 of the hydraulic operating unit 12 in series with an extension rod 43.

The piston assembly, as shown in FIGS. 3 and 5 includes a piston body member 44 having the outer edges stepped to define recesses 45 and 46. Cup-shaped seals 47 and 48 are similarly secured within the recesses 45 and 46. Thus, each of the seals 47 and 48 includes a base portion disposed within the corresponding recesses 45 and 46 and rigidly clamped in place by an annular clamp ring 49 which is secured to the corresponding face of the piston body 44 by suitable socket bolts 50. The other lip of the inner seal 47 projects inwardly toward the head 20 whereas the corresponding lip of the outer seal 48 extends outwardly of the cylinder 18. Thus, when the subassembly 41 is moved inwardly, the pressure built up within the unit acts on the sealing lip of the cup seal 48 to force it into firm sealing engagement with the wall of the cylinder.

Similarly, during rearward or retracting movement of the piston subassembly 41, any suction created within the cylinder acts on the sealing lip of the cup seal 47 to draw it into firm sealing engagement with the cylinder wall.

The piston includes an outwardly extending shaft 51, the outer end of which is provided with a stepped or annularly recessed portion defining a coupling recess 52.

The extension rod 43 is provided with a similar recess 53. A split connector including split halves 54 and 55 defines a clamping collar having base protrusions 56 adapted to mate with the recesses 52 and 53. The split connectors 54 and 55 thus form a coupling collar with a sleeve 57 telescoped over the collar to clamp the connectors to the shaft 51 and the rod 43 to provide an interconnection therebetween. The outer surfaces of the split connectors 54 and 55 and the inner surface of the sleeve 57 are provided with corresponding tapers as at 58 such that the sleeve can be wedged down over the connectors to force them into firm engagement with the shaft and the rod and thereby provide an interconnection. The connectors 54 and 55 are formed to establish a slightly loose fit with the shaft 51 and rod 43 to provide for any misalignment in the hydraulic operating unit and the piston pump.

The extension rod 43 extends outwardly of the cylinder and its outer end has a central end tapped opening 59. An attachment stud 60 is integrally formed with a shaft 42 of the hydraulic unit 12. The extension rod 43 is threaded onto the stud 60 and locked in place by a laterally extending lock screw 61 which threads through the outermost portion of the extension rod into bearing engagement with an annular recess portion 62 formed on the attachment stud 60.

Extension rod 43 generally further includes an enlargement defining a horizontal wall 63 immediately inwardly of the connection on which oil and the like running down the shaft unit will accumulate. The enlargement is provided with a plurality of small circumferentially distributed openings 64 which extend downwardly from the upper face of the enlargement and through the enlargement terminating immediately adjacent an oil absorber 65 which is wrapped around the rod extension and held in place by a suitable strap clamp 66.

A hydraulic support plate 67 is secured to the vertical channel 16 and projects outwardly thereover in parallel

spaced relation to plate 17. Pipe spacers 68 extend between the two support plates 17 and 67 and nut and bolt units 69 interconnect the two support plates to provide a rigid support for plate 67. Spherical washers 70 are preferably inserted to the opposite sides of the support plate 67 and the clamping means for interconnecting of the support plate to the supporting structure.

The hydraulic operating unit is any suitable hydraulic drive unit having the cylinder 71 bolted or otherwise firmly attached to the support plate 67. A piston 72 is slidably mounted within the cylinder and connected to shaft 42.

The illustrated support plate 67 is secured to a vertical bracket which in turn is welded to a vertical wall of channel 16.

Lines 73 and 74 are connected to the opposite ends of the cylinder 71 to the four-way solenoid valve 14. A high pressure or inlet line 75 and a return or discharge line 76 connect the valve 14 to the hydraulic source 13. With the high pressure line 75 connected to the top cylinder line 73 and the return line 76 connected to the lower cylinder line 74, the piston will move downwardly driving the piston shaft 42 and the attached piston subassembly 41 of the single stroke piston pump unit 11 downwardly to discharge paint from the cylinder 11 through the check valve unit 34 and the paint line 7 to nozzles 6. When the interconnection of lines 75 and 76 with respect to lines 73 and 74 is reversed, the high pressure is applied to the bottom side of the piston 72 which then moves upwardly, drawing the attached piston subassembly 41 upwardly within the cylinder 11. This will create a suction beneath the piston subassembly 41, tightly closing the discharge check valve unit 34 and opening the inlet valve unit 30 thereby drawing paint into the cylinder 11 with the amount of paint introduced being directly controlled by the rearward travel of the piston subassembly 41. An annular paint trough 76a is secured to a cylinder 18 adjacent the top to receive any paint which may have moved past the piston during the working stroke and is carried upwardly by the subassembly 41 during retraction.

In a practical application, area differential between the cylinders 71 and 11 was 2.5 to 1, such that the system operates as a pressure intensifier in order to produce the desired and necessary paint pressure. In the one system, this pressure would be adjusted between 500 and 3,000 p.s.i. (pounds per square inch). The nozzle pressure is controlled by relief valve connections, as follows.

A relief valve 77 is interconnected between the high pressure line 75 and the return line 76. A check valve 78 is connected between the pressure relief valve connection and the return port connection to the four-way valve 14. A relief valve 79 is also connected between return line 76 and cylinder line 74 from valve 14 to cylinder 71. The relief valves 77 and 79 set the pressure applied to the hydraulic operating unit 12 via the four way solenoid valve 14 and therefore the rate of movement of piston 72.

In the illustrated embodiment of the invention as shown in FIGS. 1 and 2, the four-way valve 14 is mounted on a suitable bracket or stand secured to the back side or bracket of the paint pump stand. The four-way solenoid valve is a well known generally conventional unit and consequently is not shown in detail.

The four-way solenoid valve 14 and consequently the movement established by the hydraulic unit 12 is controlled by a limit microswitch 80 which is adjustably mounted to the support channel 16, as follows. A separate stop slide 81 is bolted or otherwise rigidly fixed to the vertical wall 82 of channel 16. The slide 81 and a piston stop plate 83 are provided with complementary serrated surfaces 84. Plate 83 is adapted to be located in various vertical positions on the stop slide 81, a manual manipulating handle being provided on the opposite sides of the piston stop plate 83 for moving it. The piston stop plate 83 is releasably clamped to the stop slide 81 by a T-bolt 85 having its head 86 slidably disposed within a corre-

sponding T-shaped slot 87 centrally formed in the stop slide 81. The T-bolt extends outwardly through the slot 87 and an opening in the piston stop plate 83. A clamping handle 88 is threaded onto the outer end of the T-bolt 85. In operation, the handle 88 is rotated to move outwardly on the T-bolt 85 to permit movement of the piston stop slide 81. When the piston stop plate 83 is located in the desired position, the handle 88 is rotated to move onto the T-bolt 85 and thereby firmly clamp the piston stop plate 83 to the stop slide.

The limit switch 80 is mounted to the piston stop plate 83 by a suitable bracket 89 welded or otherwise secured to the upper end. The bracket 89 projects laterally outwardly beyond the shaft 42. The limit switch 80 is connected to the outer end of a bracket 89 adjacent shaft 42. Limit switch 80 is shown as a conventional unit having a pivotal switch operating arm 90 terminating in a bearing wheel 91 located immediately adjacent one side of the shaft 42. This locates the bearing wheel 91 in the upward path of the enlargement 63 on the extension rod 43 and thus provides for actuation of the limit switch 80. In operation, the hydraulic unit 12 is actuated to withdraw the piston subassembly 41. During the withdrawal, the extension rod 43 moves upwardly and when it reaches its upper limit as determined by the setting of the limit switch 80 it actuates the limit switch which in turn completes the circuit to energize the solenoid valve 14 to terminate the raising or pump fill cycle and condition the circuit for discharge.

The piston stop plate 83 is provided with an indicator pointer 92 on its side edge which moves over a scale 93 bolted or otherwise secured to the mounting plate 82 immediately adjacent the stop slide 81. The scale 93 is graduated in any suitable unit such as gallons to indicate the quantity of paint which will be drawn into the pump cylinder 18 of pump unit 11 at the several settings of the switch 80.

The operation of the system may be briefly described with the piston subassembly 41 of the paint pump unit 11 starting from the lowermost position shown in full line drawing in FIGS. 2 and 3. The four-way valve 14 is actuated to interconnect the high pressure line 75 via the valve 14 to the line 74 and thus to the lower side of the hydraulic operating unit 12. Line 73 to the upper side of the unit 12 is connected by the four-way valve 14 to the return line 76. This causes the piston 72 in the upper cylinder 71 to move upwardly, drawing the bottom piston subassembly 41 upwardly with it. During this portion of the cycle, the piston pump 11 acts in the same manner as the hypodermic needle with a suction force opening the inlet valve unit 30 and securely holding the discharge valve unit 34 closed. As a result, paint is drawn from source 3 into the piston pump cylinder 18. The hydraulic operating unit 12 continues to raise the subassembly 41 until such time as the enlargement 63 interengages and actuates the limit switch 80. During this portion of the cycle, pipe 2 is moved onto the cantilevered spray head supporting beam to the full line position shown in FIG. 1.

The actuation of the switch 80 automatically operates the valve 14 to reverse the interconnection of the high pressure line 75 and the return line 76 such that line 75 is connected to the top side of the cylinder 71 and the return line 76 is connected to the bottom side; thereby reversing the movement of the hydraulic piston 72 and the piston subassembly 41 of the paint pump unit 11. The downward movement of the subassembly 41 establishes a positive pressure within the cylinder 18, automatically closing the inlet valve unit 30 and opening the discharge valve unit 34. The paint is then transferred from the paint pump unit 11 through the line 7 to the rotating nozzles 6. The pipe 2 is then moved outwardly over the rotating nozzles 6 to receive a uniform coating of the paint. The rate of travel of the pipe 2 is of course correlated with the nozzle pressure to provide the desired thickness of the coating. The thickness is adjusted by adjustment of the

pressure relief valves or conveyor speed. This cycle continues until the piston subassembly 41 reaches approximately the full line position of FIGS. 2 and 3 at which time the four-way valve 14 is automatically actuated by the movement of the trailing edge of pipe 2 from the head 5 and particularly nozzles 6 to discontinue the operation of the hydraulic operating unit 12. The pipe 2 completes its outward travel and is replaced by another pipe.

The positioning of the limit switch to determine the upward travel of the piston subassembly 41 and thereby the amount of material drawn into the cylinder 11 provides a convenient and reliable means for obtaining the precise amount of paint required for a desired thickness of the coating to be applied to the pipe 2.

The single stroke piston pump unit 11 of the present invention permits delivery of the coating paint at an essentially constant rate in gallons per minute and maintains a highly constant pressure at the discharge nozzles 6. Consequently, a superior application of the coating material is obtained with a uniform coverage of the surface of the pipe. The coated pipe is essentially completely free of pinholes. The hydraulic drive system provides a very stable and reliable system.

Further, the mounting and assembly of the piston pump unit 11 to the plate 17 and of hydraulic operating unit 12 to channel 16 and the interconnection and mounting of the piston subassembly 41 provides a very simple and reliable means for securely mounting thereof for operation while permitting quick removal and disassembly for cleaning, maintenance and the like.

The piston subassembly 41 is mounted within the cylinder 18 with self-aligning and centering construction as a result of the slip connector. This will automatically compensate for any misalignment characteristics and equalize the packing wear on the lip seals.

The pump unit of this invention has been extensively tested and found to provide highly satisfactory and reliable operation on a production basis over long periods and thus has been found to provide an unusually satisfactory method for controlling and applying of an epoxy paint or the like.

Various modes of carrying out the invention are contemplated as being within the scope of the following claims particularly pointing out and distinctly claiming the subject matter which is regarded as the invention.

We claim:

1. An airless paint applicator for supplying paint to a member, comprising:

- a source of paint,
- a pump cylinder member having at least one end closed by a head member,
- a first valve means in said head member permitting material to flow into the cylinder,
- means for connecting the valve means to said source of paint,
- a second valve means in said head member permitting material to flow from the cylinder,
- a rotating paint applying unit including means to rotate the unit relative to said member,
- means for connecting the second valve means to the applying unit,
- a reciprocating piston unit slidably mounted in cylinder member in sealing engagement with the wall of the cylinder to establish actuating pressures between the head member and the piston unit for actuating said valve means, said piston unit having a retracting paint fill stroke and a working paint discharge stroke, and
- a hydraulic operating unit having a hydraulic liquid operated means and an output shaft connected to said piston unit to actuate the piston unit, said hydraulic unit coacting with said piston unit to create a pressure intensifier discharging the paint from the cylinder member at a constant and uniform pressure dur-

ing the working stroke of said piston unit to the paint applying unit.

2. The paint applicator of claim 1 wherein said piston unit includes a body portion having flexible sealing members secured to the opposite end faces thereof, said sealing members engaging the wall of the cylinder, a first of the sealing members acted upon by the pressure established during the working stroke to tightly slidably engage the cylinder wall, and the second of the sealing members acted upon by the pressure established during the fill stroke to tightly slidably engage the cylinder wall.

3. The paint applicator of claim 1 wherein said piston unit includes a piston shaft and a releasable coupling interconnects the shaft to the output shaft, said coupling having means permitting slight lateral movement of the piston unit relative to the output shaft to compensate for misalignment.

4. The paint applicator of claim 1, having: operator means connected to move with the piston unit, a switch means mounted in the retracting path of said means, and means connecting the switch means to actuate the hydraulic operating unit.

5. The paint applicator of claim 4 wherein said operator means and said switch means are relatively movable to vary the length of the retracting stroke and thereby the quantity of paint drawn into the pump cylinder member.

6. An airless paint applicator for supplying paint to a member comprising:

- a source of paint,
 - a pump cylinder member having at least one end closed by a head member,
 - a first valve means in said head member permitting material to flow into the cylinder,
 - means for connecting the valve means to said source of paint,
 - a second valve means in said head member permitting material to flow from the cylinder,
 - a discharge means adapted to be moved relative to said member,
 - means for connecting the second valve means to the discharge means,
 - a reciprocating piston unit slidably mounted in the cylinder member in sealing engagement with the wall of the cylinder to establish actuating pressures between the head member and the piston unit for actuating said valve means, said piston unit having a retracting paint fill stroke and a working paint discharge stroke,
 - a hydraulic operating unit having an output shaft connected to said piston unit to actuate the piston unit, said hydraulic unit coacting with said piston unit to create a pressure intensifier discharging the paint from the cylinder member at a constant and uniform pressure during the working stroke of said piston unit,
 - a solenoid valve assembly having input ports connected to a hydraulic liquid source means and output ports connected to the operating unit to control the supply of hydraulic liquid to the operating unit and having a winding having relief valve means in the connections to said ports for establishing the operating pressure levels.
 - switch operator means connected to move with the piston unit,
 - a switch means mounted in the retracting path or said means, and
 - means connecting the switch means to actuate the winding.
7. A paint applicator for supplying paint to a discharge means, comprising:
- a pump cylinder member having at least one end closed by a head member,
 - a first valve means in said head member permitting material to flow into the cylinder,

means for connecting the valve means to a source of paint,
 a second valve means in said head member permitting material to flow from the cylinder,
 means for connecting the second valve means to the discharge means,
 a reciprocating piston unit slidably mounted in the cylinder member in sealing engagement with the wall of the cylinder to establish actuating pressures between the head member and the piston unit for actuating said valve means, said piston unit having a retracting fill stroke and a working discharge stroke,
 a hydraulic operating unit having an output shaft connected to said piston to actuate the piston unit, said hydraulic unit coacting with said piston unit to provide a pressure intensifier for discharging of paint at a constant and uniform pressure during the working stroke,
 said piston unit including a piston shaft and a coupling including a two-piece collar having an outer axially tapered surface,
 the inner surface of the collar having axially spaced clamping protrusions,
 the ends of the piston shaft and output shaft being formed with recesses mating with said protrusions, and
 a tubular clamp having an inner tapered surface releasably telescoped over the collar to securely interlock said shafts, the protrusions and recesses being formed with selected tolerances permitting lateral movement of the piston unit relative to the output shaft to compensate for misalignment.

8. The paint applicator of claim 7 wherein said coupling includes an extension rod coaxially secured to the output shafts and having the outer end formed with an annular recess, said piston shaft having an annular recess, a pair of collar members having projections corresponding to said recesses and having corresponding exterior tapered surfaces, and a clamping member having an inner tapered surface generally corresponding to said tapered surfaces and telescoped over the collar members to securely interlock the piston shaft to the extension rod.

9. A paint applicator for supplying paint to a discharge means, comprising:
 a pump cylinder member having at least one end closed by a head member,
 a first valve means in said head member permitting material to flow into the cylinder,
 means for connecting the valve means to a source of paint,
 a second valve means in said head member permitting material to flow from the cylinder,
 means for connecting the second valve means to the discharge means,
 a reciprocating piston unit slidably mounted in the cylinder member in sealing engagement with the wall of the cylinder to establish actuating pressures between the head member and the piston unit for actuating said valve means, said piston unit having a retracting fill stroke and a working discharge stroke,
 a hydraulic operating unit having an output shaft connected to said piston to actuate the piston unit, said hydraulic unit coacting with said piston unit to provide a pressure intensifier for discharging of paint at a constant and uniform pressure during the working stroke,
 said hydraulic operating unit including an output shaft aligned with and connected to the piston unit, an annular enlargement on the output shaft forming a switch operator means,
 a vertical wall between the hydraulic operating unit and the piston unit,
 a serrated stop slide secured to the support wall,
 a piston stop plate having a corresponding serrated surface mating with the stop slide,

a clamping means releasably clamping the stop plate to the slide,
 a switch bracket secured to the stop plate,
 a switch means mounted to the switch bracket in the retracting path of said annular enlargement, and means to secure the switch to the switch bracket.

10. A paint applicator for supplying paint to a discharge means, comprising:
 a pump cylinder member having at least one end closed by a head member,
 a first valve means in said head member permitting material to flow into the cylinder,
 means for connecting the valve means to a source of paint,
 a second valve means in said head member permitting material to flow from the cylinder,
 means for connecting the second valve means to the discharge means,
 a reciprocating piston unit slidably mounted in the cylinder member in sealing engagement with the wall of the cylinder to establish actuating pressures between the head member and the piston unit for actuating said valve means, said piston unit having a retracting fill stroke and a working discharge stroke,
 a hydraulic operating unit having an output shaft connected to said piston to actuate the piston unit, said hydraulic unit coacting with said piston unit to provide a pressure intensifier for discharging of paint at a constant and uniform pressure during the working stroke,
 a horizontal supporting plate having an opening, means to clamp the cylinder member on the plate with the head disposed within the opening,
 said first valve member being a ball check valve unit having a check ball resting on a lower valve seat,
 said second valve means is a ball check valve unit having a check ball resiliently held in engagement with an upper valve seat by a spring means,
 said hydraulic operating unit including an operating cylinder member aligned with the pump cylinder member and piston slidably mounted therein, the cross section area of the operating cylinder member being substantially greater than the cross sectional area of the first named cylinder member,
 a mounting plate having an opening and mounted in spaced relation to the supporting plate with the openings aligned,
 means to secure the operating cylinder member to the mounting plate with the output shaft extending toward the piston unit,
 control valve means to selectively supply high pressure liquid to opposite ends of the operating cylinder to reciprocate the output shaft at a selected constant rate of travel,
 said output shaft having the outer end formed with an annular recess and said piston unit having a shaft with an annular recess,
 a pair of collar members assembled in encircling relation about the recessed portions of the shaft and rod having projections generally corresponding to said recesses and having corresponding exterior tapered surfaces, said projections and recesses being formed permitting lateral movement of the piston unit to compensate for misalignment of the hydraulic operating unit and the pump cylinder member,
 a clamping member having an inner tapered surface generally corresponding to said tapered surfaces and telescoped over the collar members to securely interlock the piston shaft to the output shaft,
 said output having an enlarged portion adjacent the output shaft, axial apertures in the enlargement, and
 a switch means connected to actuate the control valve means and mounted in the path of said enlargement.

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11. A paint applicator for supplying paint to a discharge means, comprising:

a pump cylinder member having at least one end closed by a head member,

a first valve means in said head member permitting material to flow into the cylinder,

means for connecting the valve means to a source of paint,

a second valve means in said head member permitting material to flow from the cylinder,

means for connecting the second valve means to the discharge means,

a reciprocating piston unit slidably mounted in the cylinder member in sealing engagement with the wall of the cylinder to establish actuating pressures between the head member and the piston unit for actuating said valve means, said piston unit having a retracting fill stroke and a working discharge stroke,

a hydraulic operating unit having an output shaft connected to said piston to actuate the piston unit, said hydraulic unit coacting with said piston unit to provide a pressure intensifier for discharging of paint at a constant and uniform pressure during the working stroke,

said cylinder member is provided with a flange on the head member,

a horizontal supporting plate having an opening, means to locate the cylinder member on the plate with the head disposed within the opening.

clamp means releasably secured to the plate and engaging the flange for firmly releasably clamping the cylinder member to the plate,

said first valve member being a ball check valve unit having a check ball resting on a lower valve seat,

said second valve means is a ball check valve unit having a check ball resiliently held in engagement with an upper valve seat by a spring means,

said piston unit includes a body portion having cup-shaped flexible sealing members secured to the opposite end faces thereof, said sealing members having one leg clamped to the end face of the body portion and the second leg engaging the wall of the cylinder, the sealing member secured to the innermost face extending axially toward the head and acted upon by the pressure established during the working stroke to tightly slidably engage the cylinder wall, the sealing member secured to the outermost face extending axially outwardly from the head and acted upon by the pressure established during the fill stroke to tightly slidably engage the cylinder wall,

said hydraulic operating unit including an operating cylinder member and piston slidably mounted therein, the cross section area of the operating cylinder member being substantially greater than the cross sectional area of the first named cylinder member,

a mounting plate having an opening,

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means to mount the mounting plate in spaced relation to the supporting plate with the openings aligned, means to secure the operating cylinder member to the mounting plate with the output shaft extending through the opening therein toward the piston unit, control valve means to selectively supply high pressure liquid to opposite ends of the operating cylinder to reciprocate the output shaft at a selected constant rate of travel,

a coupling means interconnecting the output shaft to the piston unit, said coupling including an extension rod coaxially secured to the output shaft and having the outer end formed with an annular recess, said piston unit having a shaft with an annular recess,

a pair of collar members assembled in encircling relation about the recessed portions of the shaft and rod having projections corresponding to said recesses and having corresponding exterior tapered surfaces,

a clamping member having an inner tapered surface generally corresponding to said tapered surfaces and telescoped over the collar members to securely interlock the piston shaft to the extension rod,

said extension rod having an enlarged portion adjacent the output shaft, axial apertures in the enlargement, an oil absorber secured to the rod immediately below the enlargement,

a switch means mounted in the path of said enlargement, and

means connecting the switch means to actuate the control valve means.

12. The applicator of claim 11 wherein said switch means is adjustably mounted for vertical positioning to adjust the piston stroke effective to operate the switch means.

13. The applicator of claim 11 having a vertical support wall extending between the supporting plate and the mounting plate, a serrated stop slide secured to the support wall, a piston stop plate having a corresponding serrated surface mating with the stop slide, a clamping means releasably clamping the stop plate to the slide, a switch bracket secured to the stop plate, and means to secure the switch to the switch bracket.

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