Dec. 13, 1966 N. CORDIS 3,291,066

PUMP APPARATUS WITH SCAVENGER FOR CHECK VALVE ASSEMBLY

Original Filed Nov. 14, 1961 3 Sheets-Sheet 1

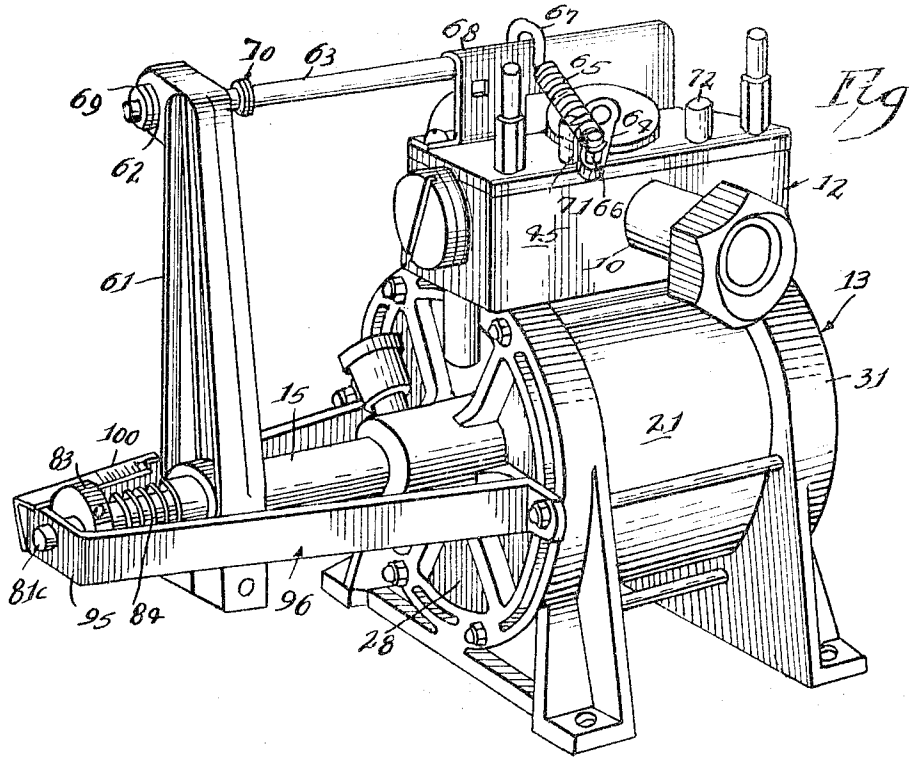



Fig. 1.

Fig. 13.

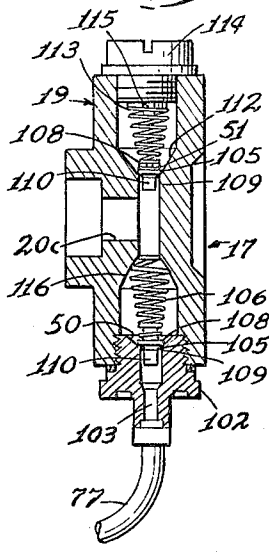
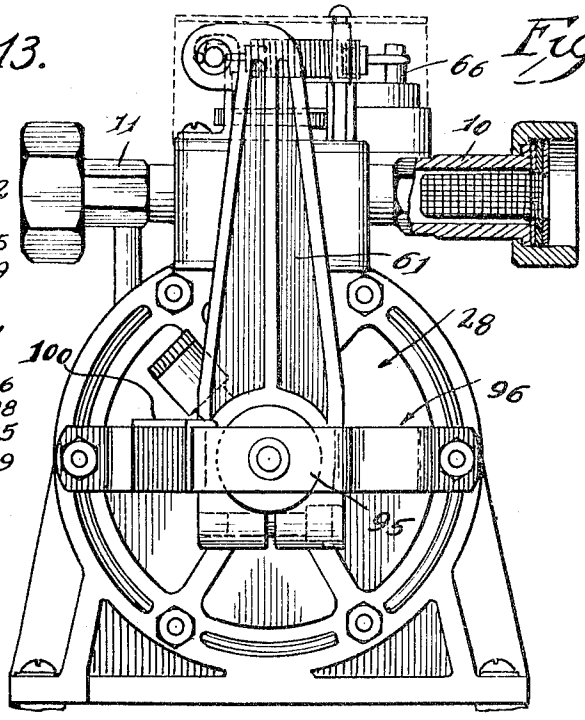



Fig. 2.



PUMP APPARATUS WITH SCAVENGER FOR CHECK VALVE ASSEMBLY

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Fig. 3

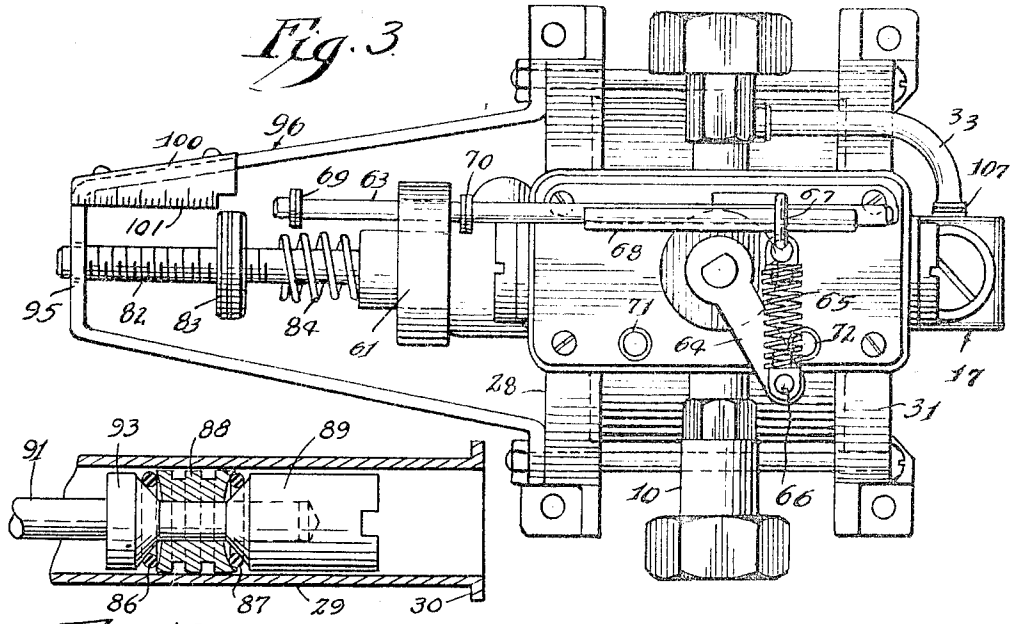



Fig. 12.

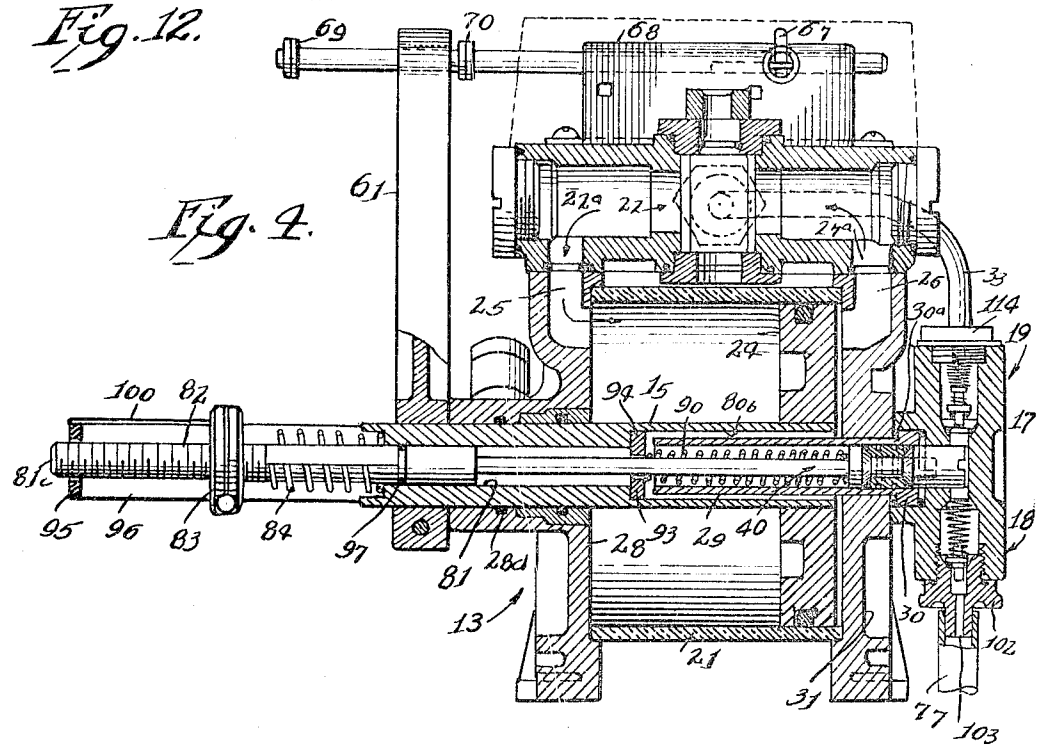



Fig. 4.

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PUMP APPARATUS WITH SCAVENGER FOR CHECK VALVE ASSEMBLY

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Fig. 5.

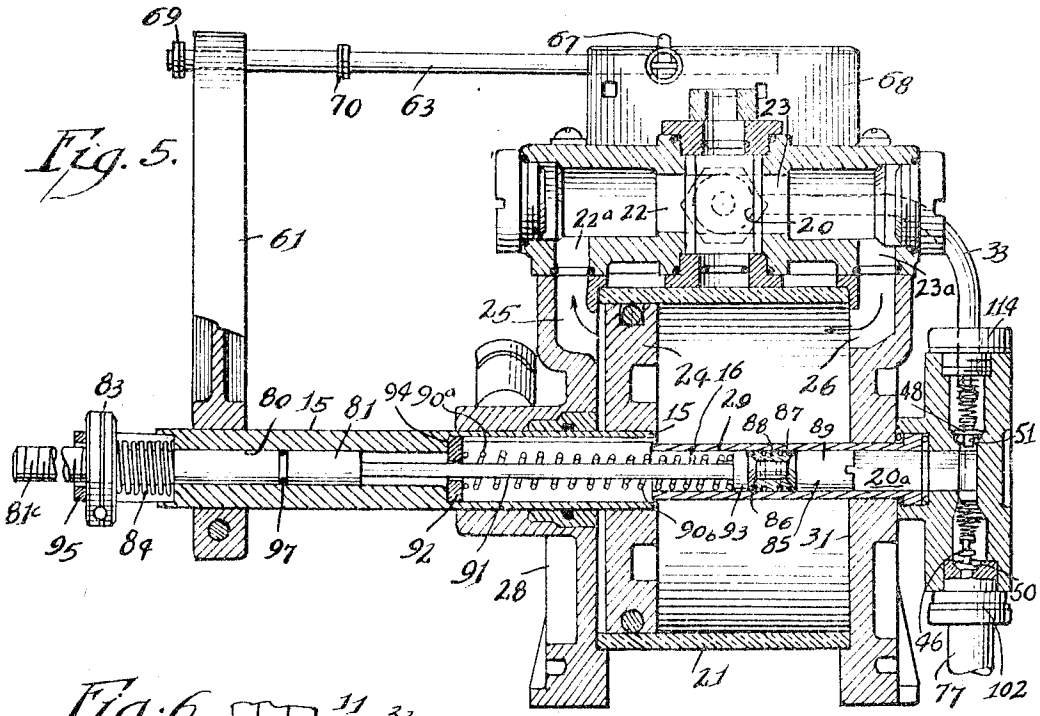



Fig. 6.

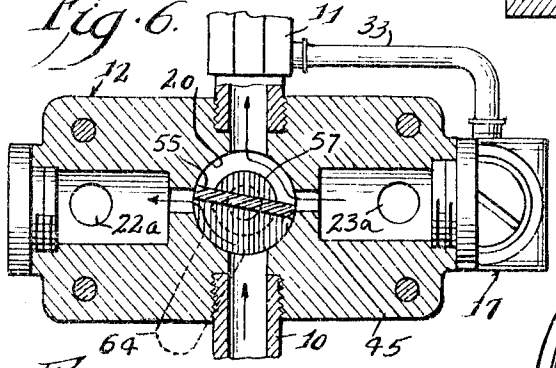



Fig. 11.

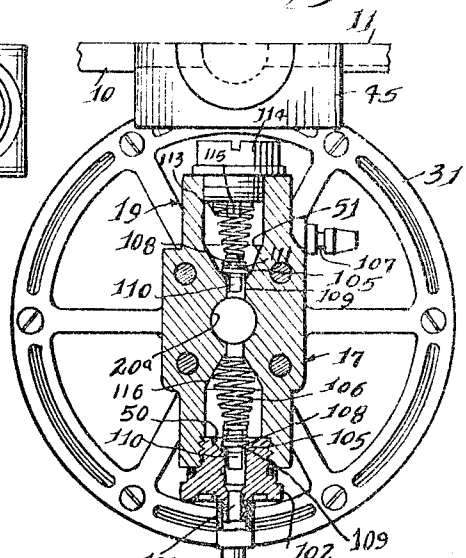



Fig. 7.

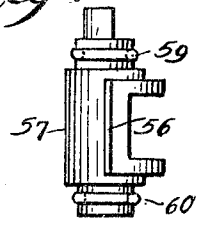



Fig. 9.

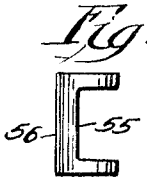



Fig. 8.

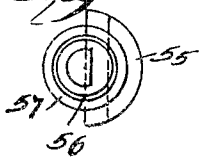
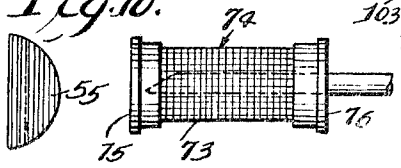



Fig. 10.



United States Patent Office

3,291,066

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3,291,066

# PUMP APPARATUS WITH SCAVENGER FOR CHECK VALVE ASSEMBLY

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Original application Nov. 14, 1961, Ser. No. 152,204. Divided and this application July 6, 1964, Ser. No. 380,695

4 Claims. (Cl. 103—153)

This application is a division of copending application Ser. No. 152,204, filed November 14, 1961, entitled "Variable Proportioner," and issued as U.S. 3,213,796.

This invention relates to a self-powered fluid proportioning apparatus of the variable type adapted for mixing a treating fluid with a raw fluid and discharging the fluids into a distribution means. More particularly, the invention relates to a system wherein a stream of water powers the apparatus as, for example, in medicating drinking water of livestock, including poultry.

Many types of equipment have heretofore been proposed for feeding into a first fluid stream, such as water, a second fluid, including drugs, vaccines, nutrients, sanitizing, deodorizing, and softening materials and the like. Such prior systems, however, have been complicated in construction, unreliable in operation, cumbersome in use, not adapted for both portable and automatic continuous installation, have not been self-powered, nor variable.

A primary object of the invention is to provide a system for feeding a treating fluid into a first fluid in selected and variable proportions over a wide range of pressures and flow rates of the first fluid. Another object of the invention is to provide a system which requires no power for operating the apparatus other than the fluid stream being treated. An additional object of the invention is to provide an efficient and reliable device which is portable and rugged. It is a further object of the present invention to provide new and novel self-powered apparatus for continuously and automatically treating raw water streams with fluid treating agent or adjuvant. It is also an object of the invention to provide an apparatus particularly adapted for use in processing drinking water and for delivering the treated water under pressure into the water distribution system, such as a poultry watering system including drinking troughs having float-controlled inlet valves. A further object is to provide an apparatus for blending detergents with water for washing operations. These and other objects of the invention will become apparent as the description thereof proceeds.

Briefly, according to my present invention, I provide a self-propelled fluid blending or treating apparatus which includes a hydraulic master motor means operated by a primary raw fluid to be treated, a slave pump means for the treating fluid actuated by such motor, and a delivery means through which the fluid used to operate the motor and the treating fluid from the slave pump are commingled and discharged. Such delivery means may include a mixing chamber or manifold.

The slave pump and hydraulic motor comprise a unitary system wherein piston means in the hydraulic motor is provided with a cylindrical chamber reciprocatable along or over a fixed slave hollow pump plunger. The



relative travel of the master piston in the fluid motor and the slave pump plunger is controlled by an adjustable linkage between the motor and the pump.

A pumping chamber having check valve means communicates with the fixed follow plunger and the treating agent and the water are discharged into the delivery manifold means wherein the fluids become intimately mixed.

Details and advantages of the apparatus, in accordance with this invention, will be described by reference to the accompanying drawings wherein:

FIGURE 1 is an elevation in perspective;

FIGURE 2 and FIGURE 3 are opposite end elevations;

FIGURE 4 is a top view;

FIGURES 5 and 6 are elevations partly in section;

FIGURES 7 through 10 illustrate details of the gating valve mechanism of FIGURES 5 and 6;

FIGURE 11 is a fragmentary end view showing details of the slave pump valve means; and

FIGURES 12 and 13 are fragmentary views showing details of certain components in FIGURES 4 and 5 in enlarged scale.

Referring to the drawings, the apparatus illustrated includes the water inlet **10**, the water outlet **11**, the water-gating assembly **12**, the water motor **13**, reset tappet means, connecting rod **15**, slave pump **16**, and treating agent valve chamber means **17** having inlet **18** and outlet **19**.

The water enters the valve chamber **20** in the water-gating assembly **12** through line **10** and is gated into the motor body **21** alternately via port **22** or **23** to apply fluid pressure on opposite sides of the motor piston **24** via channel **25** or **26**. The slave pump **16** comprises a connecting rod **15** carried by the piston **24**, rod **15** passing through one end wall **28** of the motor body **21**. The tubular pump cylinder **29** is mounted by an end flange **30** in the opposite wall **31** of the motor body **21** and is provided with the O-ring gaskets **30***a* on both sides of the flange **30**, as shown in FIGURES 4 and 5.

The slave pump valve means **17** fixed to the end wall **31** contains the inlet and outlet check valve assemblies **18** and **19**, the inlet connection and outlet channel **33**. The piston **24** is driven by the water entering the gating system **12**, **22**, **23** and expelled by the piston **24** alternately through channels **42** and **43**, shunt valve **55** and the manifold valve block **45** which discharges through outlet **11**.

When the connecting rod **15** moves the plunger **40** away from the closed end of the pumping tube means **29**, treating fluid is drawn into the treating agent valve assembly **17** through the "open" inlet check valve **18** and at the same time the suction produced by the withdrawal of the plunger **40** within the hollow pumping tube **29** closes the outlet check valve **19**, which when subsequently opened discharges through the tube **33** and line **11**.

When the direction of travel of the pumping plunger **40** is reversed in following the motion of the motor piston **24** through the rigid connecting rod **15**, the inlet check valve **18** closes and the outlet check valve **19** opens so that the treating fluid trapped in the pumping tube **29** is ejected by plunger **40** under pressure into outlet conduit **11** in the manifold **45** via channel **33**. The water and medication are discharged in a proportion based upon the displacement volume of the slave pump **16** and the volume of the motor chamber **21** on either side of the motor piston **24**.

If desired, a multiplicity of check valve-pump assemblies may be provided and actuated by the water motor **13**. In this way several types of treating agents or additives may be blended with the water at the same time.

The pumping valve block **17** houses the inlet check valve **18** and the outlet valve **19**. The inlet check valve **18** and the outlet check valve **19** comprise plugs **46** and **48** held by springs **111** against the valve seats **50** and **51**. A delivery tube **33** communicates with the valve block **17** above the spring-loaded plug **48** and discharges into the line **11**.

The slave pump **16** includes the cylinder shaft **15** comprising the connecting rod for piston **24** with its axial bore and plunger **40**. The treating fluid pumping tube **29** is tubular with an internal pumping channel terminating in chamber **20***a*. On a suction stroke of the pumping plunger **40** the plug **46** of inlet check valve **18** lifts to open the port **50**; and the plug **48** on the outlet check valve **19** closes the outlet port **51**. When the pumping plunger **40** is on the ejection stroke, this situation is reversed so that the plug **48** is lifted and the plug **46** is positioned.

The gating system **12** includes a valve plug **55**, the valve leaf spring **56**, and the valve shaft **57** disposed within the valve chamber **20** in the valve block **45**. These components are shown in detail and in subassembly by FIGURES 7 through 10 in the drawings. In FIGURE 6, the valve block **45** is shown in cross-section and illustrates the alternate positions of plug **55** and flows through the channeled block.

Opposite ends of the valve shaft **57** are provided with O-rings **59** and **60** to effect a fluid-tight seal. The valve plug **55** is shifted from two extreme positions, alternately closing and exposing the ports **22** and **23** leading to channels **22***a* and **23***a*, respectively, which direct the flowing fluid to opposite sides of the motor piston **24**.

The connecting rod **15** projects through the end wall **28** and supports the actuating arm **61** which terminates at its upper end in a bore **62** through which the reversing rod **63** passes. A pair of C-rings **69** and **70** on the reversing rod **63** comprise travel stops contacted by the arm **61** for shuttling the reversing rod **63** between its positions.

The upper end of the valve shaft **57** is provided with a toggle lever **64** which is actuated by coil spring **65** anchored at one end to the post **66** carried by the free end of toggle lever **64**, and is anchored at its other end by the inverted post **67** which is fixed to the shiftable reversing rod **63** which is slidably carried within the guide **68** secured to the valve block **12**.

When the actuating arm **61** contacts either of the stops **69** or **70**, the movement of the actuating arm **61** is imparted to the reversing rod **63** which in turn shifts the spring anchor post **67** with the result that the spring **65** swings about the post **66** carried by the toggle lever **64** until there has been sufficient travel thereof to shift the toggle lever **64** by the action of the spring **65**. When this occurs, the valve shaft **57** is rotated and moves the valve plug **55** to a different diverting position. The travel or throw of the free end of the toggle lever **64** is controlled and restricted by posts **71** and **72** fixed to the valve block assembly **12**.

As the piston **24** travels in the motor cylinder **21** the connecting rod **15** carries the actuating arm **61** with it causing the toggle lever **64** to pivot between the two positions determined by the posts **71** and **72**. At the limits of travel of the reversing rod **63**, the shunt valve **55** is placed in the alternate positions as shown in the drawings. This causes the water to course through the channels **22***a* or **23***a* leading to the opposite sides of the piston **24** thereby displacing the piston **24** to opposite ends of the motor cylinder **21** and actuating the slave pump **16** as described.

The illustrated embodiment of the invention includes the screen, the washer, and the pressure-responsive flow restricter in the inlet **10**, but these may be omitted as unnecessary with clean fluid and moderate flow pressure.



Referring to FIGS. 4, 5 and 12, the O-rings **86** and **87**, urged axially by the wedge-like faces of the end plug **89** and the collar **93**, expand the chevron seal **88**, and the tool slot in the end of the plug **89** permits adjustment in place. The motor piston **24** within motor cylinder **21** has tubular connecting rod **15** fixed to it and projecting axially of end wall **28**. The connecting rod **15** contains bore **80** accommodating the adjustable shaft **81**, which includes the threaded portion **82**, the adjustment nut **83**, the balancing spring **84** about the shaft **81**, the slave pump plunger head **85** having O-rings **86** and **87**, the expandable chevron seal **88**, and threaded end plug **89**. The spring **90**, arranged about the constricted portion **91** of the shaft **81**, has one end **90***a* abutting the plunger shoulder **92** and the other end **90***b* acting against collar **93** floating on the shaft **81** to abut shoulder **94** within the bore **80** in propelling slave plunger head **85** after compressing spring **90**. The slave pump plunger **85** operates within the cantilever-mounted slave pumping barrel **29** which is extendable within the chamber **80***b*. The adjustment of these components determines the time lag in the operation of the slave pump in relation to the travel of the piston **24**.

The exposed end **81***c* of the shaft **81** has its threaded portion **82** extending through stop yoke **95**, forming part of the bracket **96** fixed to the end plate **28** of the motor housing **21**. Adjusting proportioning nut **83** in one extreme of its travel abuts the stop yoke **95** which is the minimum or decreased proportion position.

Moving the proportioning nut **83** outwardly of the end **81***c* of the shaft **81** decreases the proportion delivered by the slave pump **16**, and positioning the proportioning nut **83** inwardly of the yoke **95**, to contact spring **84**, increases the quantity of the fluid delivered by the slave pump **16**; in these adjustments the lengths of springs **84** and **90** are altered whereby the effect of movement of the piston **24** necessary to actuate the slave plunger **40** in suction and delivery strokes is correspondingly altered.

The shaft **81** within the bore **80** in the connecting rod **15** is fluid-sealed by an "O" ring **97**. The hollow shaft or rod **15** with its cylindrical chambers **80***b* and **80***c* accommodating the spring **90**, the shaft **81** having threaded portion **82** on which the proportioning nut **83** runs and axially adjusts the delayed projection and retraction of the slave plunger, when taken together comprise an adjustable connecting rod means by which the motion of the motor piston **24** is imparted to the slave plunger head **85** relative to the cantilever pump barrel **29** which is axially aligned with the connecting rod means and reciprocates therewithin.

A proportioning scale **100** may be carried by the bracket **96** with indicia **101** thereon correlated with the settings of the proportioning nut **83**, whereby the selected proportions of raw power fluid, such as water, and of the treating fluid delivered by the slave pump **16** are selected and blended.

Thus I have provided a system for treating or blending fluids in selected variable proportions. The apparatus includes a fluid motor comprising a cylinder, a piston, a piston connecting rod means for power take-off, and a fluid gating means in combination with a slave pump means comprising a treating fluid valving means, a slave pump barrel projecting axially inward of the motor cylinder, a variable stroke slave plunger means carried within the hollow connecting rod means and operating within the slave pump barrel which communicates with the treating fluid valving means. Slave plunger adjusting means is provided exterior of the motor housing whereby the proportions of raw fluid and treating fluid blended therewith can be varied even during operation of the device.

A novel check valve assembly **17**, shown in detail by FIGURES 4 and 11, includes a valve block, a lower

inlet poppet valve plug **46**, a lower valve screw cap **102** having an inlet channel **103** and a plug seat **50**. The inlet check valve **18** includes a plug **46** having a body portion **105** and a tapered spring **106** extending between the plug **46** and tapered bore **116**. A transverse flow chamber **20***a* comprises an extension of the pumping channel in the tube means **29** and the plug **89** on the end of the plunger **40** projects into chamber **20***a* on each ejection stroke to displace all fluids from the block D through the outlet check valve **19** and discharge them via nipple **107**, tubing **33** and delivery line **11**.

The upper end of the discharge valve cavity **113** is closed by screw cap **114** having an axial inward projection **115**. Outlet poppet plug **48** comprises a body portion **105** having an upper axial projection **108**, an O-ring seal **109**, and a depending guide stem **110**. A tapered spring **111** engages the axial projections **115** and **108** and urges the O-ring **109** on plug **48** against the tapered seat **51**. The lower inlet poppet valve plug **46** comprises corresponding components; however, the normally closed check valves **18** and **19** are in opposed array so that the inlet valve **18** opens on the suction stroke and the outlet valve **19** opens on the delivery stroke.

In operation, the intake assembly **73** connected to the inlet end of the conduit **77** is placed within a vessel containing the treating agent. The assembly **73** includes a cylindrical strainer screen **74** and two end plates **75** and **76**, one of which is provided with a port to receive the tubing or conduit **77**. The assembly may be weighted with a ball-bearing or the like so as to assure that the inlet end of the conduit **77** remains near the bottom of the vessel.

The invention as described discharges mixed fluids from the conduit **11**. If desired, an auxiliary mixing chamber (not shown) may be provided but ordinarily this is not necessary, the proportioner providing adequate agitation and mixing of fluids.

The drawings accompanying this specification show numerous details of construction which have not been designated by individual reference numerals. However, it will be apparent to one skilled in the art that these details include such items as grease cups, hose connectors, screws, valve block plugs, O-rings and the like. The end plates **28** and **31** are provided with feet, but it is contemplated that screws or bolts may be substituted for securing the apparatus to a base (not shown).

Materials of construction will be selected to be compatible with the fluids. For example, with corrosive treating agents we may use a nylon pumping plunger head **85** in a glass or stainless steel sleeve **40** as the pumping tube, and the check valve assemblies **18** and **19** in block **17** may be of plastic or stainless steel. Other metals provided with ceramic or plastic coatings may also be used.

Additional features of the described invention include providing a pulsating meter and pump device, including a flow control member comprising a dual-valve block **17**, said block having inlet and outlet ports **50** and **51** with a pumping chamber **20***a* intermediate the ports. A first flow control plug is disposed between the inlet port **50** and the pumping chamber **20***a* whereas a second control plugs **48** is disposed downstream of the pumping chamber **20***a* in the block **17**. Each of said first and second flow control plugs **46** and **48** is provided with an O-ring **109** forming a seal with its associated port **50** or **51**. Tapered first and second coil springs **106** and **111** urge each of said plugs **46** and **48** into sealing relation to the respective ports **50** and **51**. Each coil spring **106** or **111** has end apertures receiving a stem **108** on the plug it positions. The opposite end of each such tapered spring **106** or **111** comprises a tapered shoulder which is nestled into a correspondingly shaped recess **116** in the block **17** and/or a stem **115** on threaded cap **114**.

Although the invention has been described with particular reference to a preferred embodiment thereof, it should be understood that this is by way of illustration only and that modifications therein may be made in view of the teachings, without departing from the spirit and scope of the invention.

What is claimed is:

**1.** A pumping device comprising opposed check valve means including a dual-valve block, said block having an inlet and an outlet spaced therefrom, a transverse pumping chamber in said block communicating with said inlet and outlet, a pumping plunger operating in said pumping chamber, said plunger including a reciprocating shaft, an adjustable end plug threaded on said shaft, a shoulder on said shaft spaced from said end plug, and an expandable seal on said shaft between said shoulder and end plug, a first poppet valve interposed said chamber and said inlet and a second poppet valve controlling said outlet, said first poppet valve comprising a plug member having a first axial projection which extends into said inlet, an O-ring about said first projection, a second axial projection extending upwardly from said plug, and a compression coil spring having an end thereof about said second projection and normally urging said first projection and said O-ring into the inlet, and said second poppet valve comprising a second plug member, projection, and O-ring, and a second coil spring, both of said springs urging the associated poppet valves into normally closed positions.

**2.** In a pulsating metering apparatus comprising a valve chamber having an inlet, a removable combination end closure for said chamber and inlet metering check valve extending within said chamber, said metering check valve controlling said inlet, a bridging wall across said chamber, a flow port through said wall, flow duct means intermediate said check valve and said flow port communicating with a pumping cylinder, and a plunger operating in said chamber, the improved plunger including a reciprocating shaft, an expandable seal on said shaft, a pair of O-rings embracing said seal, a shoulder on said shaft, said seal and O-rings being disposed between said shoulder and said end plug, a removable outlet check valve means seated in said flow port in said bridging wall and controlling flow through said flow port, and a delivery port from said valve chamber downstream of said outlet check valve.

**3.** In a device comprising opposed check valves in axial array, a flow chamber between said valves, a transverse chamber terminating in said flow chamber, and a plunger operating in said flow and transverse chambers, the improved plunger comprising a reciprocating shaft, a cylindrical deformable seal on said shaft, a shoulder on said shaft, an adjustable end plug on said shaft and of lesser outer diameter than said seal, said plug extendible into said flow chamber to scavenge pumped fluid therefrom, and a pair of O-rings, one each being disposed between said shoulder and seal and between said seal and plug, respectively whereby said seal and O-rings are placed in compression between said shoulder and plug and said seal is expanded by said O-rings to seal the transverse pumping chamber.

**4.** In a pumping means including a cylindrical pumping chamber, a transverse unidirectional flow chamber across an end of said pumping chamber, check valve means controlling flow into and from said flow chamber, and a pumping plunger operating cyclically in said pumping and flow chambers, the improved plunger comprising a shaft, an end plug on said shaft operating in said flow chamber, a cylindrical plastic seal on said shaft extending axially of said plug, said end plug being of lesser diameter and of greater length than said plastic seal, and thrust means on said shaft, said end plug and said thrust means placing said plastic seal in compression and radially expanding the end portions thereof to be in fluid sealing contact with the inner wall of said pumping chamber.

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