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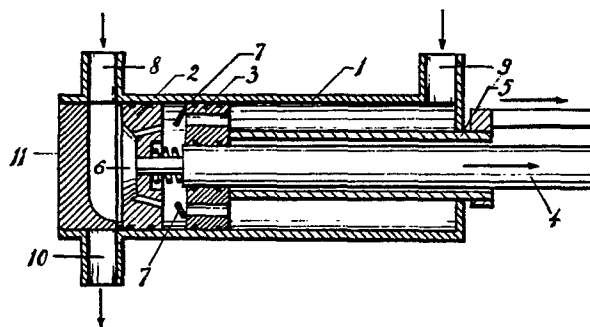
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54 **Pump.**

57 A pump is disclosed which comprises a cylinder (1) having a first (8) and a second inlet (9) and an outlet (10), means (11) for closing communication between the cylinder (1) and the first inlet (8) and between the cylinder (1) and the outlet (10), and, inside the cylinder (1), two movable pistons (2, 3), each having at least one port provided with one or more valves (6, 7). The piston (2) has a central port which is normally held closed by a spring-loaded valve (6). The pump is particularly intended for metering and mixing a relatively thick fluid, or a suspension of solid particles in a liquid, with, for example, another liquid.



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P u m p

The present invention relates to a pump, more particularly to a pump intended for metering and mixing a relatively thick fluid, or a suspension of solid particles in a liquid with, for example, another liquid.

5 The pump according to the present invention comprises a cylinder having a first and a second inlet and an outlet, means for closing communication between the cylinder and the outlet, and, inside the cylinder, two movable pistons each having at least one port provided
10 with one or more valves.

 In one embodiment of the present invention, communication between the cylinder and either the first inlet or the outlet is closed by a distributor valve, and at least one of the pistons is provided with a non-return
15 valve.

 Preferably, one piston has a port which is closable by a spring-loaded valve.

 Preferred embodiments of the present invention are illustrated with reference to the accompanying drawings,
20 in which:

 Figure 1 is a diagrammatic section of an embodiment showing the components in the starting position of the pump cycle;

Figure 2 is the same section as in Figure 1 but showing operation of the components during the cycle;

Figure 3 is a diagrammatic section of a second embodiment showing the components at the beginning of a metering stroke;

Figure 4 is the same section as in Figure 3 but with the components nearing the end of the mixing or dilution stroke.

In the drawings, the pump comprises a cylinder 1 in which two pistons 2 and 3 may reciprocate. Piston 2 is mounted on a piston-rod 4, and piston 3 is mounted on a tube 5 coaxial with the piston rod 4. Piston-rod 4 and tube 5 are actuated independently by means not represented (for example by air cylinders). In another embodiment, they are actuated and synchronised by cams. Adjustable stops limit the piston stroke.

Piston 2 is provided with a central port which is normally held closed by a valve 6 by means of the tension on a spring coaxial with piston-rod 4. In another embodiment, piston 2 is mounted on piston-rod 4 and the valve 6 is actuated by independent means.

Piston 3 comprises several ports having non-return valves which enable a liquid to flow only from right to left in the drawing.

Cylinder 1 comprises two inlets preferably under adequate pressure, a first one 8 for a thick fluid or a suspension and a second one 9 for a liquid. The cylinder also comprises an outlet 10 through which the resulting mixture or diluate flows. In a preferred embodiment, a rotatable distributor valve 11 opens a port at the end of the cylinder (left on the drawing), thus enabling the

cylinder to communicate either with the first inlet 9 (as shown in Figure 1) or with the outlet 10 (as shown in Figure 2). This distributor valve is actuated in synchronism with the movement of the pistons 2 and 3 by means not represented.

In another embodiment, the first inlet 8 is provided with a non-return valve which enables fluid to flow into the cylinder, but prevents it from flowing out through the inlet. Outlet 10 is provided with a non-return valve which enables the resulting mixture or diluate to flow out of the cylinder but stops suction in. The operation of the pump is as follows:

Starting from the position shown in Figure 1, the two pistons 2 and 3 move from the left to the right, piston 3 having a greater speed and a longer stroke than piston 2. During this movement, piston 2 draws in the fluid through the first inlet 8 (valve 6 being closed) whereas the liquid drawn in by the second inlet 9 passes from the right to the left of piston 3 through the non-return valves 7. At the end of the stroke a portion of the liquid brought in through the second inlet 9 is contained between the pistons 2 and 3 and a portion of fluid brought in through the first inlet 8 is contained between distributor valve 11 and piston 2.

Distributor valve 11 then leaves a communication between cylinder 1 and outlet 10 (Figure 2) and the pistons move the other way (i.e. from right to left in the drawing). The non-return valves 7 close and piston-rod 4 opens valve 6. In this way, the portion of liquid which was contained between the two pistons passes through piston 2 and mixes with the fluid. At the end of the stroke, the mixture is forced through the outlet 10 in its entirety and the cycle starts again. In the embodiment

shown in Figures 3 and 4, 12a and 12b may be regarded as two parts of one cylinder 12 at right angle to each other. As in the embodiment of Figures 1 and 2, the pump comprises two inlets preferably under adequate pressure, the first, 13, for a thick fluid or a suspension and the second, 14, for a liquid. It also comprises an outlet 16 through which the resulting mixture or diluate flows, a rotatable distributor valve 17 opening a port at the end of the part 12b (left on the drawing), thus providing communication between the cylinder and either the inlet 13 (as shown in Figure 3) or the outlet 16 (as shown in Figure 4). This distributor valve is actuated in synchronism with the movements of piston 18 reciprocating in the part 12a of the cylinder and of piston 19 reciprocating in the part 12b of the cylinder.

The piston 18 is mounted on a piston rod 20 and is actuated by means (not represented) such as for example an air cylinder connected to the piston rod 20. The piston 19 is mounted on a piston rod 21 and is normally held at the right end of the part 12b of the cylinder by means of the tension of a coil spring coaxial with the piston rod 21. Stops limit the travel of the pistons.

The piston 18 has several ports provided with non-return valves which only enable a liquid to flow through the piston when the latter is moving upwards. The piston 19 has a central port provided with a valve 22 which is normally held closed by a coil spring. This valve 22 is connected to a plate 23 located in a chamber inside the piston; the chamber communicates with the part 12b of the cylinder by ports in the right hand wall of the piston.

The operation is as follows:

Beginning with the position shown in Figure 3, the piston 18 moves upwards, its non-return valves open and the liquid which entered through the inlet 14 passes from the upper to the lower face of the piston. Due to the pressure release between the pistons 18 and 19 while the former goes up, the valve 22 closes; assisted by the coil spring, the piston 19 moves from left to right, drawing the thick fluid or suspension through the inlet 13 into the cylinder. When the piston 18 has reached its upper position and the piston 19 its right hand stop, part 12a of the cylinder is full of liquid and part 12b of the cylinder is full of the thick fluid or suspension. This is the end of the metering stroke.

The distributor valve 17 is then turned in the position shown in Figure 4, providing a communication between cylinder 12 and outlet 16. The piston 18 moves downwards, its non-return valves close, liquid is drawn into the cylinder through inlet 14 and piston 19 is moved to the left by the liquid between pistons 18 and 19 until it reaches its left stop. Pressure of the liquid on the plate 23 then opens the valve 22 (Figure 4) and the liquid passes through the central port of the piston 19 towards the outlet 16.

When the piston 18 has reached its lower stop, ending the mixture or dilution stroke, the cycle starts again.

CLAIMS:

1. A pump comprising a cylinder having a first and a second inlet and an outlet, means for closing communication between the cylinder and the first inlet and between the cylinder and the outlet, and, inside the
5 cylinder, two movable pistons each having at least one port provided with one more valves.
2. A pump as claimed in Claim 1 wherein communication between the cylinder and either the first inlet or the outlet is closed by a distributor valve.
- 10 3. A pump as claimed in Claim 1 or Claim 2 wherein at least one inlet and the outlet are each provided with one or more non-return valves.
4. A pump as claimed in any of Claims 1 to 3 wherein one piston has a port which is closable by a spring
15 loaded valve.
5. A pump as claimed in any of Claims 1 to 4 wherein at least one of the pistons is provided with a non-return valve.
6. A pump substantially as described with parti-
20 cular reference to either of the two drawings.

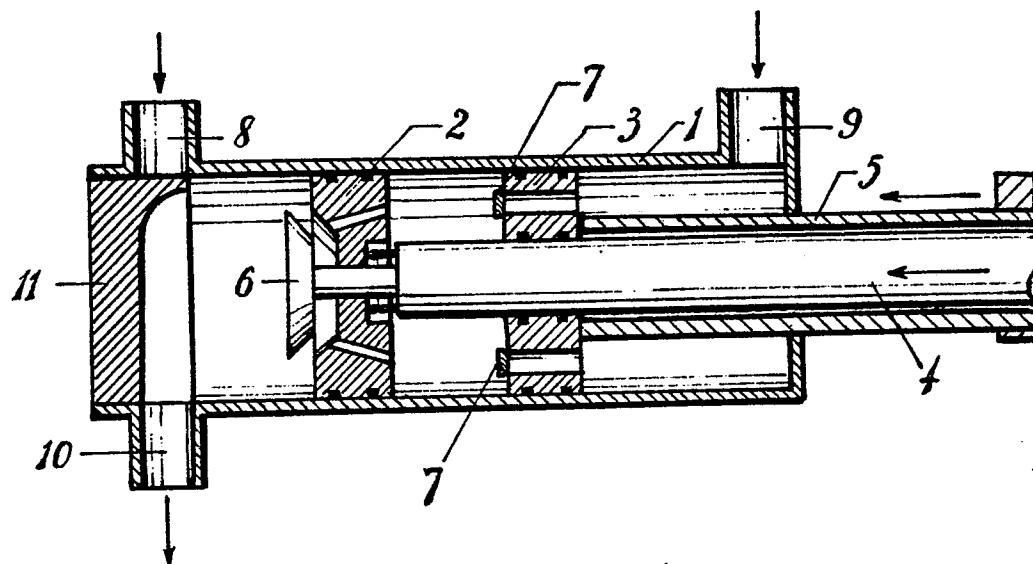
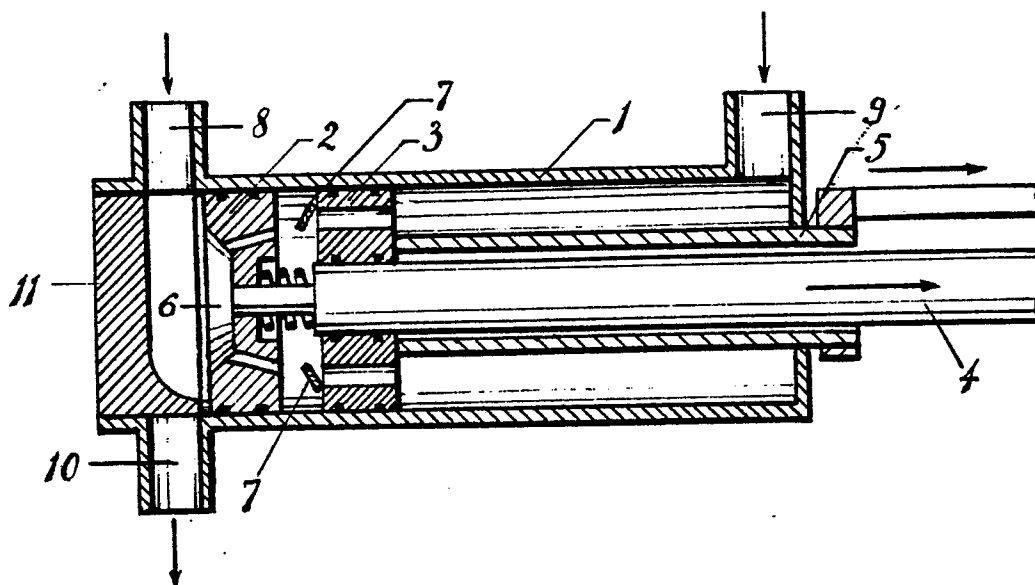
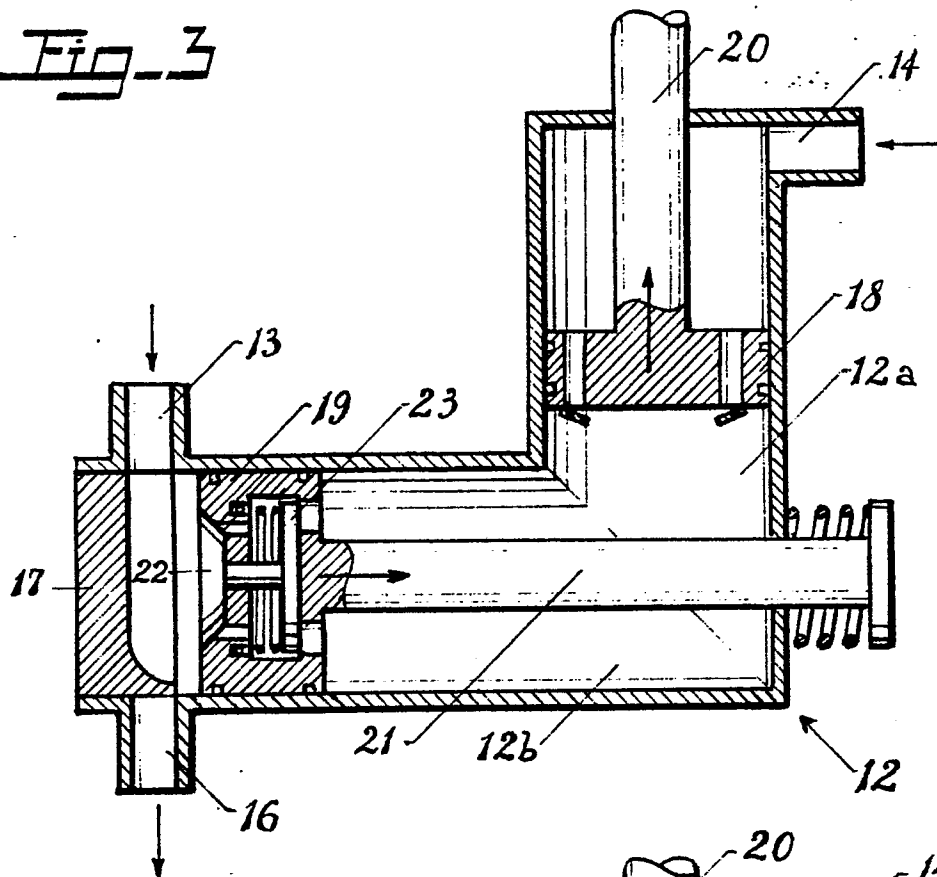
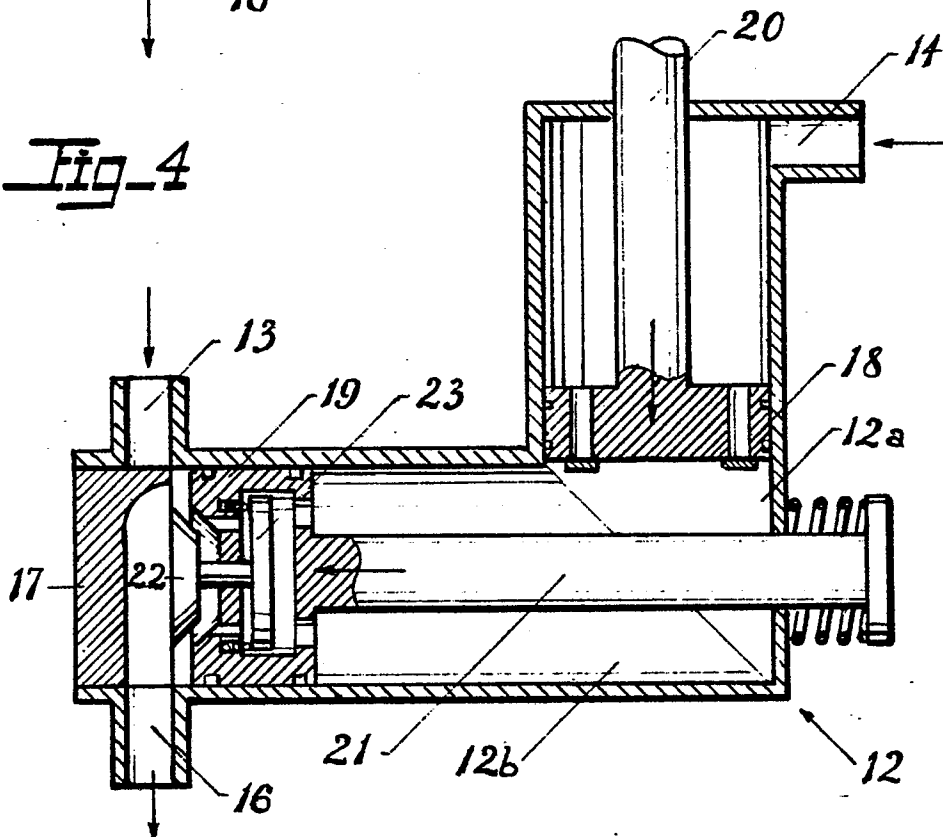
Fig-1Fig-2

Fig-3Fig-4



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EUROPEAN SEARCH REPORT

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Application Number
EP 79 20 0708

DOCUMENTS CONSIDERED TO BE RELEVANT			CLASSIFICATION OF THE APPLICATION (Int. Cl. 3)
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	
	<u>DE - B - 1 173 805 (BRAN)</u> * Column 3, lines 34-66; figure 1 *	1,3	F 04 B 3/00 F 04 B 13/02
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	<u>US - A - 2 365 234 (WINEMAN)</u> * Page 2, left-hand column, lines 2-20; figure 2 *	1,3	
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	<u>DE - C - 575 142 (DEAN)</u> * Page 2, lines 30-78; figure 2 *	1,5	TECHNICAL FIELDS SEARCHED (Int.Cl. 3)
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	<u>DE - A - 2 455 430 (MIELITZ)</u> * Page 3, paragraphs 5,6; page 4, paragraph 1; page 5, paragraphs 3,4; page 6, paragraphs 1-3; figure *	1,3,4,5	
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	<u>US - A - 2 497 300 (ELLIOTT)</u> * Column 1, lines 37-55; column 2, lines 1-40; figures 1,2 *	1,3	CATEGORY OF CITED DOCUMENTS
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	<u>US - A - 4 093 108 (HEIN)</u> * Column 3, lines 4-13; figure 1 *	1,4,5	
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	The present search report has been drawn up for all claims		&: member of the same patent family, corresponding document
Place of search	Date of completion of the search	Examiner	
The Hague	07-03-1980	HEINLEIN	

