# United States Patent

**Kraus**

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[54] **THROUGH RUNNING AND PRESSURE PUMP**


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[58] **Field of Search**.....417/545, 546, 547, 552, 437, 417/511, 512, 513



[56] **References Cited**

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[57] **ABSTRACT**

The specification describes a reciprocating piston pump for manual or power driven operation. It comprises a piston, a cylinder for the piston, a piston tube carrying the piston and valves adjacent to an outer end of the piston tube ad to the other end of the pump for regulating flow through the pump. The valves are provided with means for operating them by mechanical friction on relative movement taking place between the piston tube and the cylinder.


**3 Claims, 2 Drawing Figures**

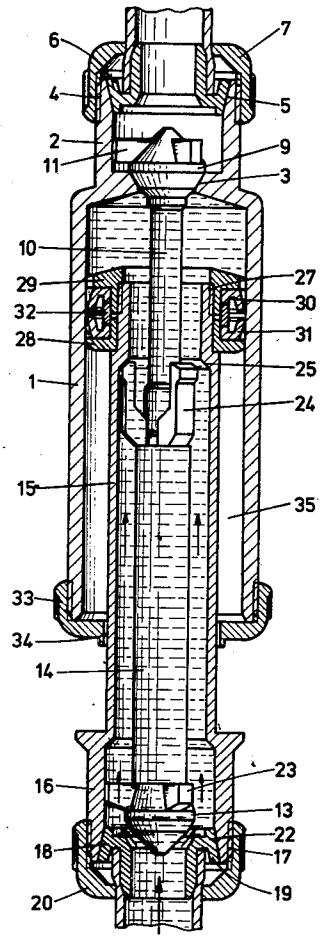


Fig. 1

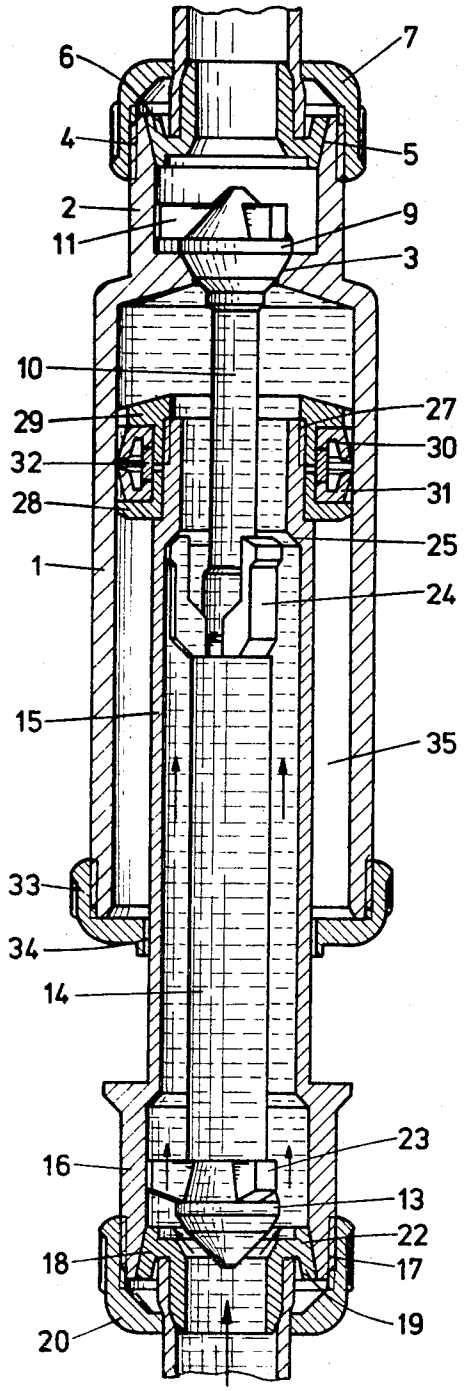
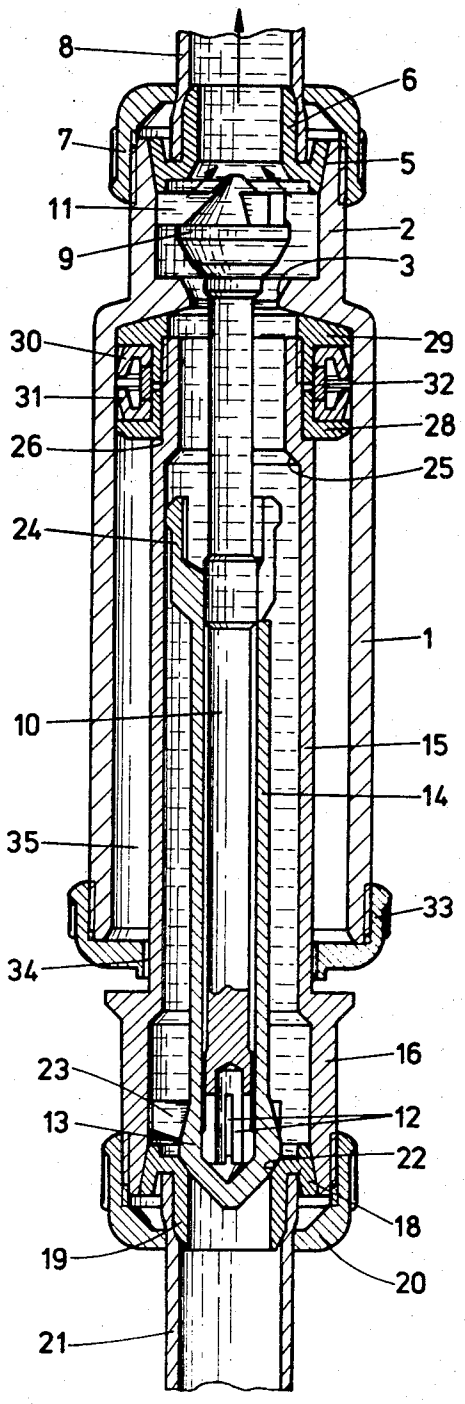



Fig. 2




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# THROUGH RUNNING AND PRESSRUE PUMP

## BACKGROUND OF INVENTION

1 Field to Which Invention Relates

The present invention relates to pumps of the suction and force type, and more particularly to such pumps in which the liquid to be pumped is caused to flow through a hollow piston rod or piston tube into the cylinder and then out at the other end of the pump.

2 The Prior Art

Suction and force piston pumps have already been proposed in which at both ends, in extensions of the piston tube, valves are provided in the inlet and outlet connections. On displacement of the piston in the cylinder, one of the tow valves is displaced in the direction of travel of the piston while the other, moving along the same direction, is closed. In this previously proposed form of construction the inlet valve was to be a gravity actuated valve which would come into engagement with the valve seat when the corresponding position of the pump was reached and later came clear of the valve seat during the operation of the pump. This offered the disadvantage in that the liquid present in the hoses connected with the pump and in the pump itself could not be passed back into the vessel from which the liquid was removed. Furthermore it was necessary to move the piston backwards and forwards a number of times, when the pump was held with its outlet connection downwards, in order to bring the inlet valve into the closed position. The tubular piston first had to be completely filled with liquid, this being brought about by pumping the piston up and down, until the liquid brought the inlet valve into the closed position on further pumping. Furthermore the flow of liquid through the pump was turbulent so that eddies were the result.

## SUMMARY OF THE INVENTION

The present invention consists in a suction and force pump comprising a cylinder, a piston in the cylinder, a piston tube on which the piston is mounted, inlet and outlet connections provided in the ends of the piston tube, inlet and outlet valves arranged adjacent to the connections, the valves being arranged to be oppositely opened and closed when the piston is moved in the cylinder, means for displacing the valves by mechanical friction, the valves being capable of being moved in relation to each other on movement of the piston tube in the cylinder, elongated guide parts attached to the two valves respectively, the guide part of the outlet valve fitting inside the guide part of the inlet valve and engaging it frictionally, resiliently acting shoe means on the guide part of the inlet valve for engaging the inside of the piston tube, the shoe means being arranged to engage an abutment face in the piston tube.

This construction results in the following advantages:

The valves can be moved into their open and closed positions as desired in any position of the pump. Furthermore the liquid can be brought about in any position of the pump. Furthermore the liquid can be completely returned to the source, for instance, a liquid supply vessel, both from the pump and also from the hoses connected with the pump. The passage of the liquid in the pump is substantially non-turbulent. A significant advantage is that the pump can be produced by injection molding, something which was not possible with the pump previously proposed described above. Thus cheap mass production methods can be used in the manufacture of the pump. The pump can be made of a synthetic resin material in accordance with the particular purpose.



## LIST OF SEVERAL VIEWS OF THE DRAWINGS

One embodiment of the invention is shown by way of example in the accompanying drawing.

FIG. 1 shows the pump with the inlet open and the outlet closed.

FIG. 2 shows the pump with the inlet closed and the outlet open.

The pump comprises a cylinder **1**, preferably made of transparent synthetic resin, with a coaxial outlet connection **2** whose diameter is less than that of the cylinder. At the position at which these two parts are connected together there is a conically constructed valve seat **3**. The free end of the outlet connection has a screw thread **4** and an internal conically narrowing part **5** on which there is mounted a suitable abutment part **6**. On the thread **4** a tightening nut **7** is screwed for tightening up and holding a hose **8**. On the valve seat **3** an outlet valve **9** with a corresponding conical mating surface can come to rest so as to block the outlet of the pump. The valve **9** is provided with a cylindrical guide part or stem. The valve **9** also has guiding abutment ribs **11** which extend as far as the inner wall of the outlet connection **2**.

The lower free end (see FIG. 2) of the guide stem **10** is of slightly increased diameter and is provided with several radial slots **12**. An inlet valve **13** is mounted on the guide stem **10** so as to allow relative movement between them. The inlet valve **13** has a cylindrical guide stem **14** which is hollow and receives the slotted end **12** of the guide stem **10** of the outlet valve. The cylindrical guiding stem or part **14** entrains the valve guiding stem **10** when the piston tube **15** is drawn out for sucking up fluid to be pumped. The piston tube **15** extends between the cylinder **1** and the guide part or stem **14**. The piston tube **15** merges with an inlet connection **16** with a greater internal diameter. Its lower end is provided, like the outlet connection, with an external screw thread **17**. It has a conically narrowing part **18** for the abutment part **19** and a tightening nut **20** for holding and tightening up the hose **21**. The abutment part **19** has a conical seat for a conical inlet valve **13** which on its rear side has guide ribs **23** extending as far as the inner wall of the inlet connection **16**. When the conical valve **13** comes to rest against the seat **22** the entry of liquid is shut off.

The cylindrical guide part of stem **14** ends in three resilient shoes **24** which lie against the inner wall of the piston tube **15**. Inside the piston tube **15** there is an abutment **25** for the shoes **24**. The inner end of the piston tube **15** has an external recess **26** and a screw thread **27** for receiving holding rings **28** and **29** of hard plastics material. Between the rings **28** and **29** there are two sealing washers **30** and **31** of elastic plastics material which are separated by a spacing ring **32**. The holding rings **28** and **29** serve simultaneously for guiding the piston tube.

Further guidance is provided by a nut **33** which is screwed on the cylinder and is provided at its inner edge with radially extending projections **34** of the same

height around the piston tube, so that air can pass into and out of the cylinder space **35** as the piston is moved inwards and outwards.

The manner of operation of the pump is as follows.

The cylinder is held in one hand. On pulling on the outer end of the piston tube with the other hand, the inlet valve **13** with the guiding stem **14** and the resilient shoes **24** and the valve guiding stem **10** with the outlet valve **9** are entrained so that the outlet valve comes to rest against the valve seat **3**. On pulling further, a vacuum is created in the cylinder space so that the inlet valve **13** is lifted from the seat **22** and the liquid inlet is opened. Still further drawing out of the piston tube **15** leads to liquid being drawn into the pump and by a number of backward and forward movements of the piston tube the liquid is caused to fill the cylinder. When this has been carried out the inlet valve **9** is raised from its seat **3** so that the liquid can now run out freely. On pushing in the piston tube **15** and its inlet connection **16** until the inlet valve **13** abuts against the seat **22**, the passage of liquid is blocked. On drawing out the piston tube, the procedure is repeated.

It is to be noted that the movement of the piston tube **15** both backwards and forwards serves to drive air out of the inlet hose **21** and the cylinder for priming the pump. For siphoning the liquid from a vessel lying at a higher level than the vessel to receive the liquid, the liquid can now flow freely through the pump. If it is desired to shut off the liquid flow, the piston tube **15** with the inlet connection **16** is moved into the cylinder until the inlet valve **13** comes to rest on the seat **22**. If it is desired to fill another vessel, for example, the seat **22** must be moved away from the inlet valve **13**, this being carried out by pulling the piston tube **15** outwards together with the inlet connection **16**.

On the other hand, when the container to be filled with liquid is on the same level as the vessel supplying the liquid or is at a higher level, it is necessary to pump continuously, using the piston tube.

Emptying of the pump itself can be carried out as follows; firstly the inlet valve **13** is brought into contact with the seat **22** by pressing in the piston tube **15** together with its inlet connection **16**, so that the liquid inlet is blocked. The remaining liquid which then practically only remains in the piston tube can emerge through the opened inlet valve so that all liquid is removed from the pump. Following this, the pump with the outlet part directed upwards is lifted above the level of the vessel which is to be emptied and the inlet connection **16** with the piston tube **15** is drawn out so that the inlet valve **13** is removed from the seat **22** and the outlet valve closes. In order to bring the two valves **9** and **15** into the open position, it is necessary to move in the piston tube **15** a little, together with the inlet connection **16**. The air can now pass through the outlet connection **2** into the cylinder space and into the piston tube **15** with its inlet connection **16** so that also the liquid in the hose can flow back into the vessel as well.

When the pump handle **16** is pulled out as shown in the position in FIG. **1**, the inlet valve **13**, opens in the piston rod and the outlet valve **9** closes on the outlet side. When the piston rod is pushed in (FIG. **2**), the inlet valve **13** arranged in the piston rod closes in the pump handle and the outlet valve **9** is opened by the friction of the drag part **24** inside the working barrel **15**, as well as by the friction of the elastic end **12** of the drag bar **10** of the outlet valve **9** inside the drag tube **14** of the inlet valve **13**.

When filling liquids from higher vessels, the piston handle must be pulled out slightly. The inlet valve thus opens, and the outlet valve is opened, by the pressure of the liquid so that the liquid can continue to flow until the piston handle is again in its end position and the inlet valve **13** stops again the flow.

The pump in accordance with the invention can also be used in the form of a multiple unit with several such pumps as described, the drive of the piston tubes being carried out simultaneously by means of levers, cranks or the like by hand or with a motor drive.

I claim:

**1**. A suction and force pump comprising a cylinder, a piston displaceable in said cylinder, a piston tube having interior walls and an abutment face, said piston being mounted on said piston tube, said cylinder being provided with inlet and outlet means, inlet and outlet valves adjacent said inlet and outlet means respectively, means for opening and closing said inlet and outlet valves when said piston is displaced in said cylinder including elongated guide elements secured to said inlet and outlet valves, the guide element secured to said outlet valve being mounted interiorly of the guide element of said inlet valve and in frictional engagement therewith, resilient shoe means on said guide element secured to said inlet valve for engaging said interior walls of said piston tube, said shoe means being adapted to engage said abutment face of said piston tube.

**2**. A suction and force pump as claimed in claim **1**, wherein said outlet valve is formed with guide and abutment ribs, and said inlet valve is formed with guide ribs.

**3**. A suction and force pump, as claimed in claim **1**, wherein said guide element secured to said outlet valve has an outside diameter slightly larger than the inside diameter of the guide element secured to the inlet valve and is provided with a plurality of radial slots so that said guide element secured to said outlet valve frictionally engages the interior of the guide element secured to the inlet valve.

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