Feb. 14, 1950 J. F. ELLIOTT 2,497,300

FLOATING PISTON PUMP

Filed Jan. 29, 1947

Fig. 1.

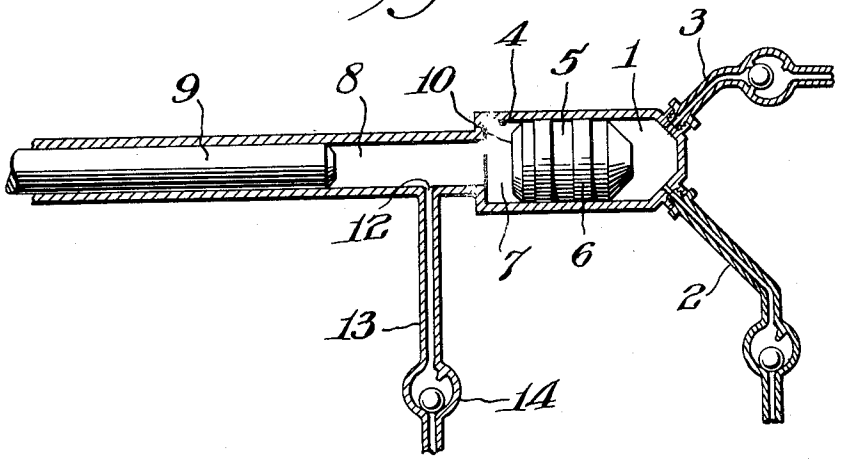
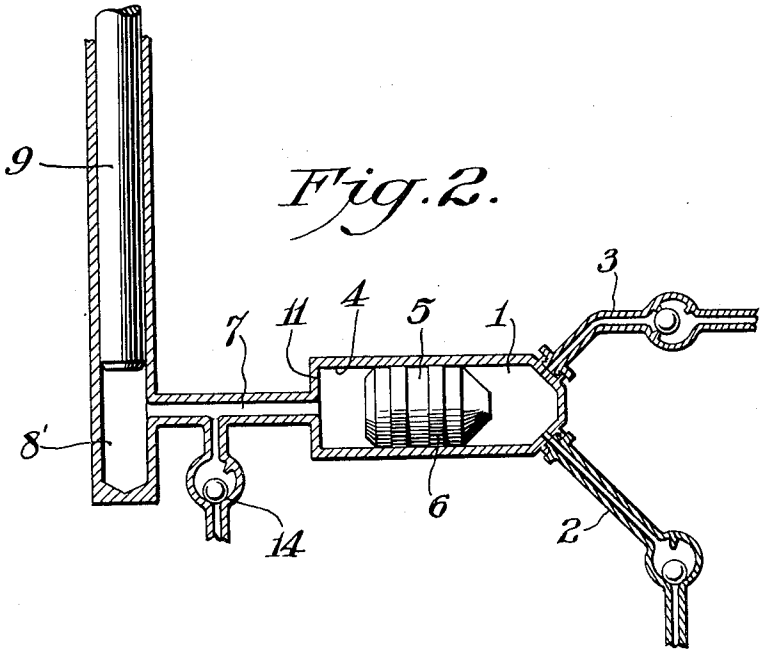


Fig. 2.



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FLOATING PISTON PUMP

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2 Claims. (Cl. 103—52)

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This invention relates to improvements in the art of pumping fluids at high pressures and more particularly to an improved pumping device of the type in which the pumping effect is transmitted through a confined liquid mass interposed between a solid piston and a floating piston which subjects the fluid to the pumping action.

In the pumping of corrosive fluids at high pressures considerable difficulty has been encountered due to failure of the packing which is subjected to abrasion by the plunger and to the corrosive action of the fluid while simultaneously being subjected to a very high pressure differential. An object of this invention is to provide a device which will reduce to a minimum the wear to which the packing element in a high-pressure pump is subjected, thereby prolonging the life of the said packing. Other objects of the invention will appear hereinafter.

In accordance with the present invention a corrosive fluid may be pumped at high pressure without coming in contact with any packing element surrounding the actuating plunger. The present invention makes use of the floating piston (or "stemless piston") principle. In the practice of the present invention the stemless piston is actuated by the pumping action of the plunger which is transmitted thereto by means of an interposed fluid, and means are provided for maintaining the volume of the said fluid substantially constant over a long period of operation.

The improvements which are embodied in the present invention will be apparent from the accompanying drawings.

Fig. I represents a cross-section of one form of the pump contemplated by the present invention. In this embodiment of the invention, a pump chamber 1 having a valve-equipped inlet 2 and a valve-equipped outlet 3 is contiguous with a cylinder 4 within which a solid stemless piston 5 is operable. Between the piston and the said cylinder, packing 6 is provided which need only be sufficiently tight to prevent influx of the fluid 7 into the chamber 1 or leakage of the fluid which is being pumped. Since the pressure differential across this packing amounts only to the frictional drag, it is obvious that the wear on the packing 6 is not serious even during long periods of operation. The cylinder 4 is in communication with a second cylinder 8 which has a smaller internal diameter than the cylinder 4. Within the cylinder 8 a solid piston 9 is reciprocably mounted. Means are provided for reciprocating the said plunger 9, but these means are not illustrated in the drawing. The smaller cylinder 4 and the

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larger cylinder 8 are so positioned and adapted that the smaller cylinder can be sealed from the larger cylinder by the stemless piston at the end of a suction stroke of the plunger 9. When this occurs the face 10 of the stemless piston fits tightly against the cylinder wall 11 which forms a seat for the face of the piston, thus sealing off one cylinder from the other. The fluid mass which is interposed between the plunger and the stemless piston may be composed of any convenient fluid, lubricating hydrocarbon oils being preferred. An inlet 12 is provided for introducing the fluid into the smaller cylinder 8. This inlet is so positioned that it is closed by the plunger during a discharge stroke and opened by the plunger during a suction stroke, and it is adapted to permit inflow of fluid when the stemless piston seals the larger cylinder from the smaller cylinder at the end of a suction stroke. Means are provided for supplying fluid to the said inlet. These means may include a conduit 13 and inlet valve 14 and a constant head pump which is not shown in the drawing. The fluid in the cylinders is adapted to actuate the stemless piston, thereby transmitting the pumping effect from the plunger to the fluid in the pump chamber 1.

Fig. II represents another embodiment of the invention. In Fig. II the pump chamber 1 having valve-equipped inlet 2 and outlet 3 conduits, is contiguous with a cylinder 4 within which a stemless or floating piston 5 is operable and the said piston is equipped with packing 6, as in Fig. I. The distinguishing characteristic of the embodiment represented by Fig. II is the conduit 7 which permits communication between the cylinder 4 and the cylinder 8'. During a down stroke of the plunger 9, the ball valve 14 is closed; during an up stroke of the plunger 9 the ball valve opens only when the stemless piston 5 reaches the seat 11. In this way, any of the transmitting fluid which is lost by leakage is made up by inflow through the valve 14 and the quantity of transmitting fluid remains substantially constant throughout prolonged periods of operation. As in the embodiment illustrated in Fig. I, the fluid in the cylinders is adapted to actuate the stemless piston thereby transmitting the pumping effect from the plunger to the fluid in the pump chamber 1.

The pumping device disclosed herein is especially well adapted for the pumping of corrosive fluids at very high pressures. For example, when the suction feed of the corrosive fluid to be pumped is maintained at about 100 pounds per square inch and the required discharge pressure

is 10,000 pounds per square inch, the pump can be made to operate satisfactorily by maintaining a head of about 75 pounds per square inch upon the transmitting fluid during the suction stroke by means of a constant head pump. It is of course to be understood that the aforesaid pressures may be varied very widely. In general, however, the pump can be made to operate for prolonged periods of time during which it delivers fluid at a pressure of about 10,000 pounds per square inch, or higher.

Obviously the construction shown in the illustrative drawings is capable of considerable modification, which modification will be obvious to those who are skilled in the art. The invention therefore is not limited except as set forth in the following claims.

I claim:

1. A device for pumping fluids which comprises in combination a pump chamber with valve-equipped inlet and valve-equipped outlet conduits, a cylinder contiguous with the said chamber, a solid stemless piston operable in the said cylinder, a second cylinder of smaller diameter in communication with the first cylinder, a solid plunger reciprocably mounted in the said smaller cylinder, means for reciprocating the plunger, said smaller cylinder being adapted to being sealed from the larger cylinder by the stemless piston at the end of a suction stroke of the said

plunger, a fluid mass interposed between the said plunger and the said stemless piston, an inlet for introducing fluid into the smaller cylinder, said inlet being so positioned that it is closed by the plunger during a discharge stroke and opened by the plunger during a suction stroke and adapted to permit inflow of fluid when the stemless piston seals the larger cylinder from the smaller cylinder at the end of a suction stroke, and means, including a constant pressure pump and a conduit, for supplying fluid to the said inlet, the fluid in the cylinders being adapted to actuate the stemless piston, thereby transmitting the pumping effect from the plunger to the pump chamber.

2. The device set forth in claim 1 in which the transmitting fluid interposed between the plunger and the stemless piston is a hydrocarbon oil.

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