April 8, 1941. M. ROEDEL 2,237,505

PISTON PUMP

Filed Nov. 15, 1938

Fig.1

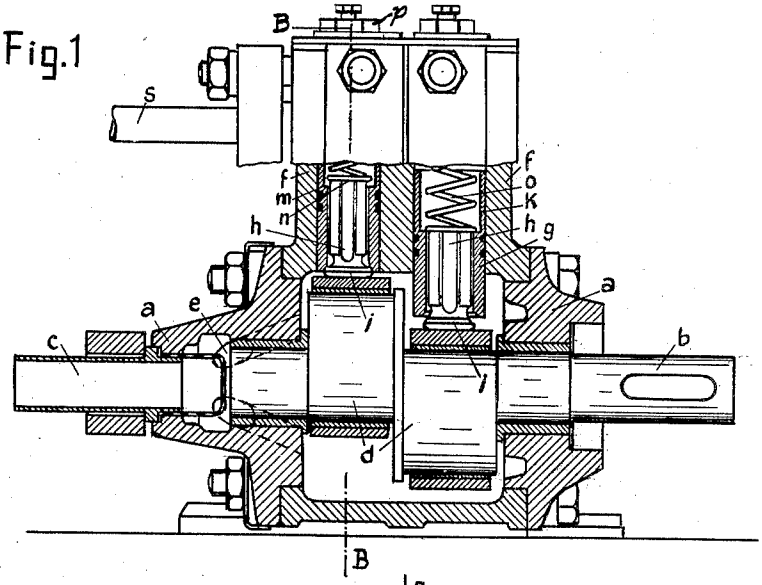


Fig.2

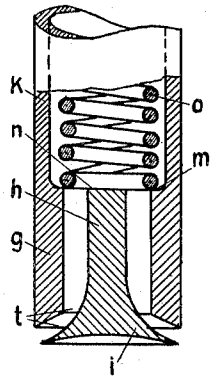


Fig.3

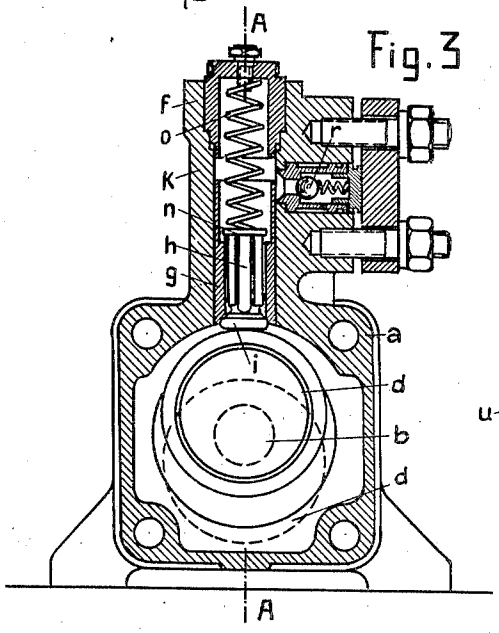
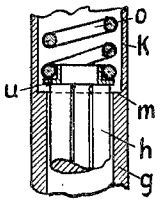


Fig.4



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Patented Apr. 8, 1941 2,237,505

UNITED STATES PATENT OFFICE

2,237,505

PISTON PUMP

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Application November 15, 1938, Serial No. 240,542
In Germany October 12, 1937

5 Claims. (Cl. 103—178)

This invention relates to a piston pump with a piston having an axial bore in its head and of cup-shape, through which the liquid flows, and actuated by a driving cam, and with a pressure spring for the suction stroke bearing against the inner face of the piston.

In this known piston pump the pressure spring only controls the piston but not at the same time the suction valve consisting of a loose ball between the piston heads, so that this valve is left to itself and therefore operates irregularly. During the suction stroke the loose suction valve is subjected to continually increasing retardation forces which cause the premature closing of the suction passage so that the charge is throttled even during the suction stroke. This results in a very imperfect filling of the pump cylinder which considerably reduces the output of the pump. Owing to the uncontrolled suction valve this piston pump fails entirely especially in the case of high speeds of rotation or high speed pumps. The loose suction valve therein commences to vibrate relatively to the piston and opens and closes so irregularly that unavoidable disturbances occur and prevent the perfect running of the high speed pump. All these objections are so serious that high outputs cannot be obtained with piston pumps of this type.

The invention overcomes these objections and is characterized chiefly by a pressure spring continually acting on the suction valve and on the other hand acting on the piston only during the flow.

An embodiment of the invention is illustrated by way of example in the accompanying drawing, in which:

Fig. 1 shows a pump in section on line A—A of Fig. 2,

Fig. 2 is a section on line B—B of Fig. 1,

Figs. 3 and 4 show details on a larger scale.

a is a crank case with cam shaft *b*, suction pipe *c* and driving cams *d*. The lifted liquid, for example oil, flows from the suction pipe *c* through holes *e* into the cam chamber which it fills entirely.

In each of two cylinders *f* a cup-shaped piston *g*, *k* is axially shiftable and accommodates in its lower part *g* a suction valve *h*, *i* whose disc *i* forms the piston head adjacent the drive. The upper part *k* of the cup-shaped piston has an internal diameter larger than the diameter of the spindle *h* of the suction valve and forms a shoulder *m* acting as inner surface of the piston head and which, when the suction valve *h*, *i* is closed, lies below the end face *n* of the valve spindle *h*. The suction valve *h*, *i* is controlled by a pressure spring *o*. The lower end of the spring bears against the end face *n* of the valve spindle *h* acting as spring abutment plate and its upper end bears against an abutment *p* on the upper end of the cylinder. The pressure spring *o* is so constructed and its windings are so dimensioned that its lower end bears continually against the plate *n* of the valve spindle *h* but can bear against the inner shoulder *m* of the piston when the valve has been pushed down.

The pressure conduit *s* is connected to the chamber of the pressure valve *r*; *t* is the inflow passage in the lower part *g* of the piston.

Fig. 4 shows a construction with a separate interposed spring abutment plate *u* which is so large that it also can engage on the shoulder *m* of the piston.

The operation is as follows:

In the position shown in Fig. 2 and in the left piston of Fig. 1 the suction valve *h*, *i* is closed and the pressure spring *o* acts only on the suction valve. When the pump is started, the driving cam *d* gradually liberates the valve disc *i* as the eccentric stroke becomes less, with the result that the spring-controlled suction valve *h*, *i* opens up to the valve stroke (Fig. 3). In this position the pressure spring *o* begins to act upon the inner shoulder *m* of the piston, so that then the opened valve *h*, *i* and the piston *g*, *h* are controlled by this spring. Owing to friction the piston remains at rest during the opening movement of the suction valve and is moved along only when the pressure spring *o* begins to act on the inner shoulder *m* of the piston so that from this moment both the suction valve and the piston are jointly controlled and shifted by the pressure spring *o*. The ring-shaped part of the inflow passage *t* consequently remains constantly open, so that the pump cylinder is uniformly filled and without loss during the entire suction stroke. Shortly before the end of the suction stroke (Fig. 1 right hand piston) the piston automatically closes the inflow passage *t* in that the piston—owing to its inertia and the retardation occurring in the last portion of the cam movement—moves away from the pressure spring *o* and moves into contact with the valve plate *i*. During the closing of the suction valve the driving cam has reached its lower dead centre position and the pressure stroke of the pump commences during which the pressure spring *o* bears only on the spring supporting plate *n*, that is only acts on the suction valve *h*, *i*, and gradu-

ally extends until the initial position is reached.

As the suction valve and piston are controlled continually by the pressure spring during the suction stroke a perfect filling is attained, so that the suction stroke is utilized for the filling completely free from loss, or practically nothing of the filling is lost and the pump operates at full capacity. The speed of rotation of the pump is immaterial; even in the case of high-speed pumps the suction valve and piston operate free from disturbances.

The counter-flowing liquid exerts a cushioning effect during the closing of the suction valve, with the result that hard knocks are avoided and a smooth running of the pump is ensured and the valve and piston are saved. Owing to the favourable degree of efficiency the very simple pump can be of small light construction even for high outputs, so that it can be accommodated anywhere even in restricted spaces.

The example illustrated shows a pump with two pistons, however, pumps with more than two or only one piston may be equipped in a similar manner.

I claim:

1. A piston pump, comprising in combination a cylinder, a cup-shaped piston adapted to move to and fro in said cylinder and having an axial bore forming a passage for the pumped liquid, an inner shoulder in said cup-shaped piston at the upper end of said axial bore, a suction valve in said bore, an eccentric cooperating with said suction valve to reciprocate said piston in said cylinder, and a helical spring in said cylinder constantly acting with its lower end on said suction valve and on said inner shoulder in said piston only when said suction valve has been opened.

2. A piston pump as specified in claim 1, in which the suction valve has a valve disc forming a head of the piston and in permanent contact with the cam.

3. A piston pump as specified in claim 1, in which the shoulder forms an abutment for the spring during the suction stroke of the piston.

4. A piston pump as specified in claim 1, in which the inner shoulder and the pressure spring are of such a diameter that the spring bears permanently on the suction valve and comes into contact with said shoulder during the suction stroke.

5. A piston pump as specified in claim 1, in which a plate is introduced between the end of the spring and the suction valve, said plate being of such diameter that it bears against said shoulder under the action of said spring during the suction stroke of the pump.

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