Oct. 27, 1942. C. F. HAMMOND 2,299,979

PUMP

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FIG.1.

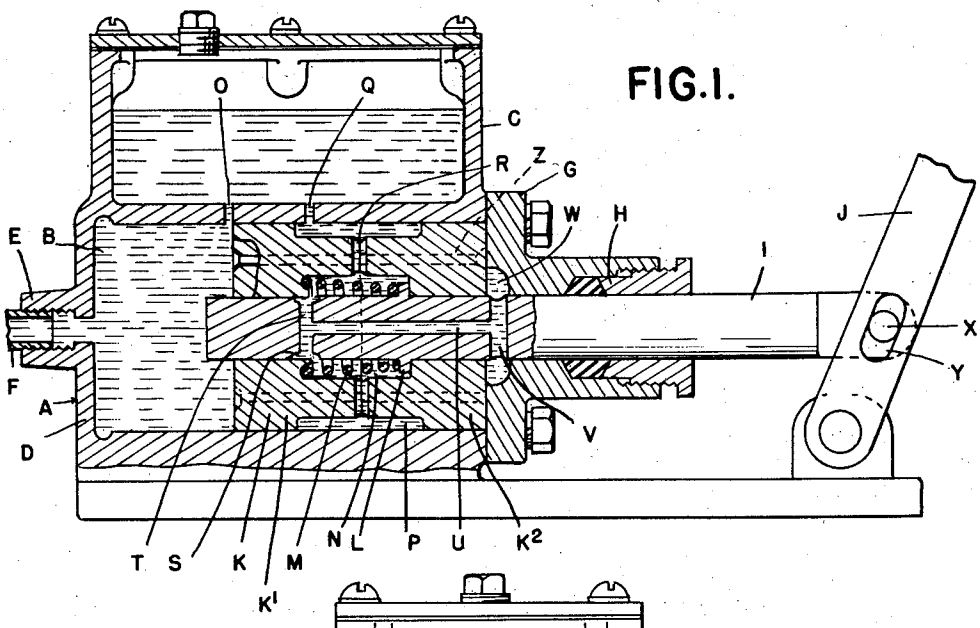
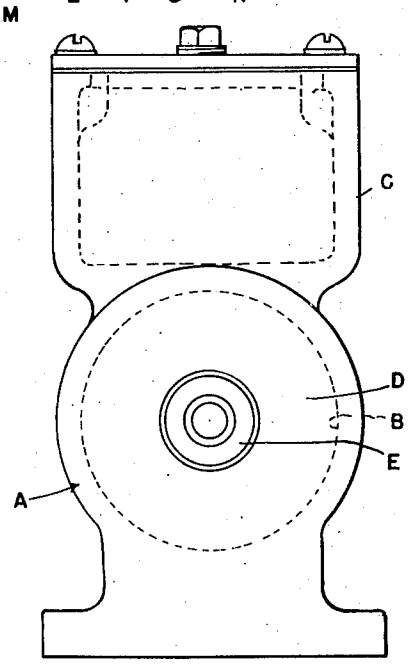


FIG.5.



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FIG.2.

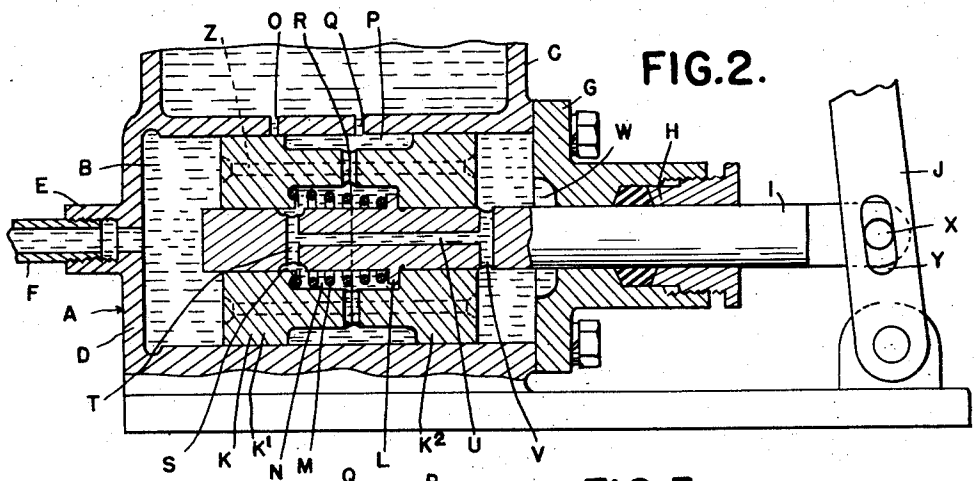


FIG.3.

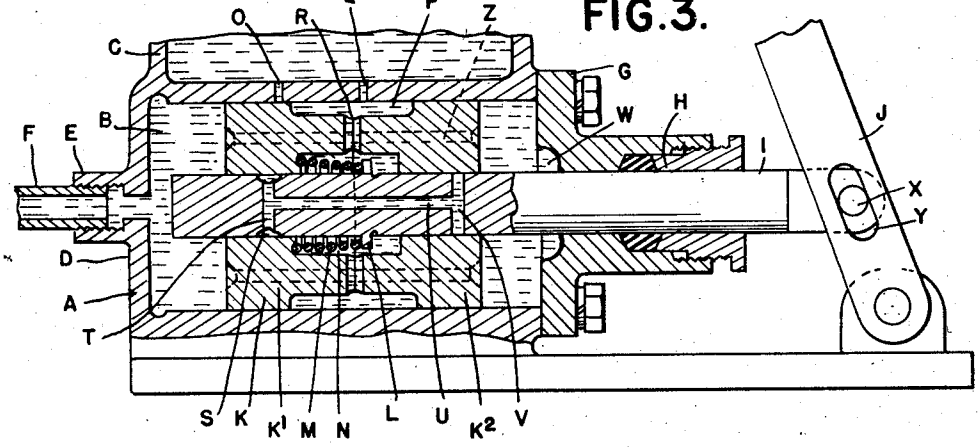
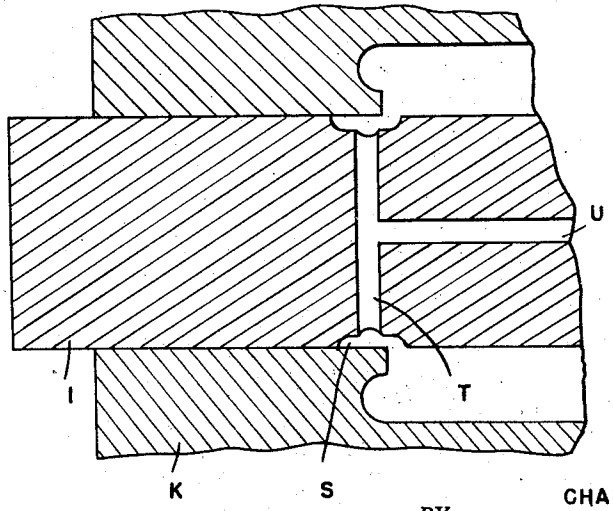


FIG.4.



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UNITED STATES PATENT OFFICE

2,299,979

PUMP

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Application August 27, 1941, Serial No. 408,512

2 Claims. (Cl. 60—54.6)

The invention relates to pumps of that type in which a relatively large volume of liquid is displaced by low pressure and a smaller volume is subsequently displaced at higher pressure. Pumps of this character are adapted for various uses, but are more particularly designed for use in connection with pedal-operated hydraulic brakes.

It is the object of the invention to produce a simple construction of pump in which the operation of the pedal or other actuating means will automatically effect a change from the low pressure large volume displacement to the high pressure small volume displacement.

It is a further object to lock the large volume displacement means against any reverse movement during the operation of the small volume high pressure displacement means.

With these and other objects in view, the invention consists in the construction as hereinafter set forth.

In the drawings:

Fig. 1 is a central longitudinal section through my improved construction of pump, showing the parts in idle position;

Fig. 2 is a similar view, illustrating the position of the parts during the low pressure large volume displacement;

Fig. 3 is a similar view, showing the low pressure displacement means in locked position during the further movement of the high pressure small volume displacement means;

Fig. 4 is an enlarged section, illustrating in greater detail the valve construction; and

Fig. 5 is an end elevation of the pump.

As illustrated, A is a casing which preferably includes a cylinder portion B and a liquid reservoir portion C. The cylinder portion preferably has an integral head D at one end thereof which is connected by a nipple E with the discharge conduit F. The opposite end of the cylinder is closed by a detachable head G provided with a packing gland H for a plunger I, which latter has its outer end operatively connected with a pedal or other actuating device J, while its inner end extends into the cylinder. Slidably sleeved upon the plunger I is a piston K which externally fits the cylinder B. A shoulder L on the plunger limits the movement of the piston thereon in a forward direction, and a coil spring or other resilient means M, preferably located in a recess N in the piston, normally holds the latter against said shoulder. The spring M is pretensioned to a suitable degree so as to resist any relative movement of the piston and plunger until a predetermined fluid pressure is attained within the cylinder B.

In normal idle position, the piston K is in the rear portion of the cylinder B, with its rear end bearing against the head G. In this position, a port O slightly in advance of the forward end of the piston will provide communication between the reservoir C and the cylinder B, so that the latter will be filled with liquid. A slight forward movement of the piston by the actuation of the pedal J will close this port, but, as thus far described, such displacement of the piston would create a vacuum in rear thereof. Such effect is prevented by the provision of a conduit connecting the reservoir with the cylinder in rear of the piston, which conduit is maintained open during the entire displacement movement of the piston.

As specifically illustrated, this conduit is formed by an annular recess P in the periphery of the piston, which is in communication with the reservoir through a port Q during the entire piston movement. The annular recess P communicates through one or more radial passages R with the annular recess N in which the spring M is located. The plunger I is provided with an annular recess S extending slightly in rear of the forward end of the recess N, and the recess S communicates through radial passages T with a longitudinal extending passage U within the plunger. The rear end of the passage U communicates through radial passages V with an annular recess W in the head G in rear of the piston.

With the construction as described, it will be obvious that a movement of the pedal J will be communicated to the plunger I through suitable means such as the cross pin X engaging the slot Y. The movement of the plunger will be imparted to the piston through the medium of the spring M, while the forward displacement of the piston will draw liquid from the reservoir to fill the cylinder in rear of the piston. Thus, the volume of liquid displaced from the forward end of the cylinder through the conduit F is equal to the full area of the piston times the distance of forward travel.

When the pump is used for operating hydraulic brakes or any other device where resistance to fluid displacement is built up, the pressure of the fluid in the forward portion of the cylinder will be increased until its reaction on the piston will equal the opposing pressure of the spring M. When this occurs, further forward movement of the piston is arrested, but

the movement of the plunger can continue until the annular recess S is moved out of registration with the annular recess N. This will cut off liquid communication between the reservoir and the portion of the cylinder in rear of the piston, thereby producing a substantially rigid liquid abutment for preventing any rearward displacement of the piston. Continued forward movement of the plunger will increase the pressure of the fluid in the forward portion of the cylinder and will displace a small volume thereof corresponding to the area of the forward end of the plunger times the distance of its forward travel. This, in the case of a hydraulic brake, will produce the actual braking pressure, while the initial movement of the piston will take up the lost motion of the parts and bring the friction surfaces into contact.

When pedal pressure is released, the spring M will first return the plunger I to its original position, where communication between the reservoir and the cylinder in rear of the piston is reestablished. Thus, as the plunger and piston move rearward, the fluid in the rear end of the cylinder will be displaced into the reservoir C.

To simplify the manufacture and assembly of the parts, the piston K is preferably formed of sections K', K^2. This will permit of first placing the spring M around the plunger with its rear end abutting against the collar or shoulder L. The section K' is then sleeved upon the plunger to abut against the forward end of the spring, and the section K^2 is sleeved upon the plunger in rear of the collar L. The two sections are then secured to each other by rivets Z. The plunger I may be properly termed a high pressure piston, and the element K a low pressure piston.

What I claim as my invention is:

1. A hydraulic pump comprising a casing including a cylinder portion and an adjacent fluid reservoir portion, a discharge conduit leading from one end of said cylinder, a detachable head closing the opposite end of said cylinder, a plunger of smaller diameter than said cylinder extending thereinto through said head, a shoulder on said plunger extending radially outward therefrom, a piston formed in two sections sleeved upon said plunger on opposite sides of said shoulder and recessed to receive the same, a coil spring sleeved on said plunger in said recess, one end abutting against said shoulder and the opposite end against the end of the recess, means for securing said piston sections to each other and placing said spring under a predetermined tension, ports connecting said reservoir with said cylinder, one slightly in advance of the piston in its rear position and the other registering with a peripheral recess in the piston, said peripheral recess being radially connected with the recess surrounding said plunger, said plunger being provided with a longitudinal passage therein connecting at its forward end with an annular port normally registering with the forward end of the recess containing the spring, and the rear end of said passage communicating with the cylinder in rear of the piston, whereby forward movement of said plunger will advance with it said piston to displace fluid from the forward portion of the cylinder and fill the portion of the cylinder in rear of the piston with fluid withdrawn from said reservoir, said movement continuing until the fluid pressure reaction against the forward end of the piston equals the pressure of said spring, whereupon further advancement of the plunger will trap fluid in the cylinder in rear of the piston and hold the latter against rearward displacement.

2. In a hydraulic pump, the combination with a cylinder and a fluid reservoir, of a piston assembly comprising a cylindrical plunger of smaller diameter than said cylinder extending thereinto and having solid inner and outer end portions, and a longitudinally extending fluid passage in an intermediate portion thereof terminating in peripheral ports at its opposite ends, said plunger also having an outwardly extending annular shoulder between said peripheral ports, a piston formed in two sections sleeved on said plunger on opposite sides of said annular shoulder, said sections being formed with an inner annular recess into which said shoulder projects and a peripheral annular recess communicating with said inner recess between said sections, a spring within said inner annular recess sleeved about said plunger and abutting with its rear end against said annular shoulder, with its forward end pressing against said piston with a predetermined resilient pressure, said recesses, peripheral ports and longitudinal passage normally constituting a fluid connection between said reservoir and the cylinder in rear of said piston, and said plunger constituting a valve for closing said passage when said plunger moves forward independently of said piston.

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