June 11, 1957 S. MOSKOWITZ 2,795,196

HYDRAULIC FLUID DEVICES

Filed March 6, 1956

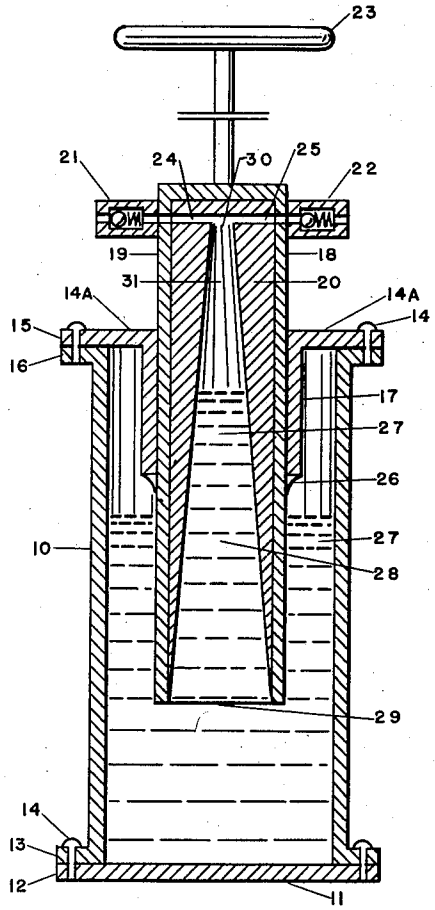


FIG. I

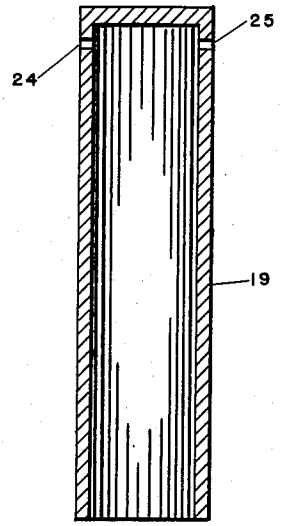


FIG. III

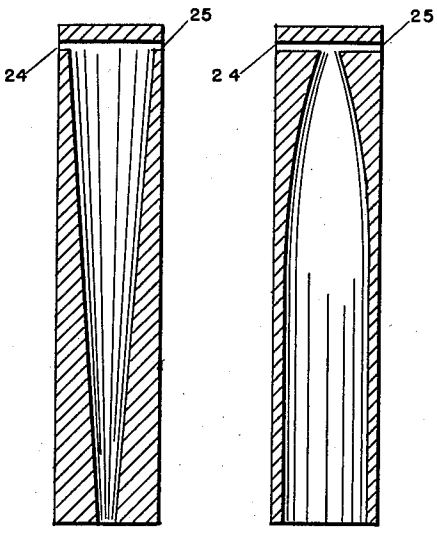


FIG. IV FIG. V

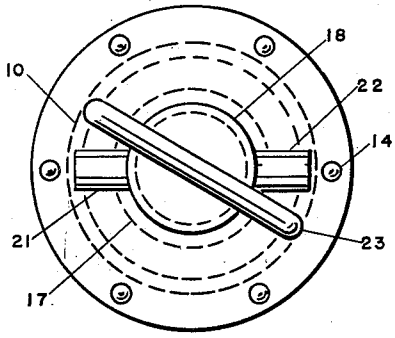


FIG. II

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United States Patent Office 2,795,196 Patented June 11, 1957

2,795,196

HYDRAULIC FLUID DEVICES

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Application March 6, 1956, Serial No. 569,735

4 Claims. (Cl. 103—153)

This invention relates to an improved construction of a pumping unit for circulating either fluids or gases.

One of the objects of this invention is to provide a hydraulic fluid device with a vertical channel of varying cross sectional area which contains a fluid or gas to be pumped by a second fluid which rises and falls in this channel.

Another object of this invention is to provide a pumping device for fluids or gases comprising a sealed container adapted to hold a dense fluid, a vertical plunger entering this container and a vertical channel in this plunger which is open at the bottom and valved at the top.

Another object of this invention is to provide a reciprocating pumping device that allows variable pressure to volume relationships with a given force operating the device during the course of a single pumping stroke.

Additional objects, advantages and features of invention reside in the construction, arrangement and combination of parts involved in the embodiment of the invention and its practice as will be understood from the following description and accompanying drawings wherein

Fig. I is a vertical sectional view through the pumping unit.

Fig. II is a top plan view thereof.

Fig. III is a vertical sectional view of the outer sleeve of the pump plunger.

Fig. IV is a vertical sectional view of a second type of an inner liner which could be placed in the outer sleeve of the pump plunger.

Fig. V is a vertical sectional view of a third type of an inner liner which could be placed in the outer sleeve of the pump plunger.

Referring to the drawings which illustrate three practical embodiments of the invention, **10** designates a container or cylinder which is provided with a bottom wall **11**, detachably secured in place, as by the cooperating flanges **12** and **13**, and the connecting bolts **14**. A top closure **14A** for the container is detachably secured in place as by the cooperating flanges **15** and **16** and the connecting bolts **14**. A fixed cylindrical plunger guide **17** extends into the container from the top closure.

A pump plunger assembly **18**, comprising an outer sleeve **19**, a sleeve liner **20**, an intake valve **21**, an exhaust valve **22**, and a handle **23** which is one possible means to reciprocate the entire pump plunger assembly, fits slidably into the fixed cylindrical plunger, and is sealed gas tight by the high pressure seal **26**. The closed upper end of the outer sleeve and the sleeve liner is connected to the intake and exhaust valves by the channels **24** and **25**.

The container **10** is filled with a working fluid **27** to such a level that, at the top of the stroke of the plunger assembly, the bottom of the vertical channel **28** is immersed in the working fluid. The vertical channel **28** may vary in cross sectional area from the open lower end **29** to the closed and valved upper end **30**. Above the working fluid **27** is the fluid or gas **31** which is being pumped.

As the plunger assembly shown in Fig. I is moved downward, the pumped fluid or gas is displaced from the channel as the working fluid rises in the channel because pressure is being exerted upon both the pumped and working fluids and this pressure can only be relieved as the pumped fluid escapes through the exhaust valve.

As the plunger assembly shown in Fig. I is moved upward, the pumped fluid or gas is drawn into the channel because pressure is reduced in both the pumped and working fluids until the partial vacuum thus formed is relieved as the pumped fluid flows in through the intake valve.

As the working fluid rises and falls in the channel, drawing in and then exhausting the pumped fluid or gas through the intake and exhaust valves, the cross sectional area of the channel may vary. Therefore, if the surface of the working fluid is considered as a piston face doing work on the pumped fluid in the channel, a given amount of force on this piston face may either pump a smaller amount of the pumped fluid at a higher pressure or a larger amount of the pumped fluid at a lower pressure depending on the cross sectional area of the channel which determines the area of the hypothetical piston face. Therefore, as the configuration of the channel varies, this pump may have different pressure to volume ratios in the different parts of a single stroke while a constant force or thrust moves the piston which is the surface of the working fluid in the channel.

There are two necessary characteristics of the working fluid. The first is that it be of greater density than the pumped fluid or gas, and the second is that it not mix or react in a harmful manner with the pumped fluid or gas. An example of a contemplated working fluid would be mercury pumping oil, water or air. Water could be used as a working fluid to pump light oils, or it could be used to pump air. It is to be understood that there are any number of possible combinations of working fluids and pumped fluids or gases that may be used to practice this invention.

Fig. I shows one contemplated embodiment of my invention. Fig. III shows the pump plunger outer sleeve. This pump plunger outer sleeve may be fabricated from metal or other suitable material by any standard precision means. The sleeve liner **20** in Fig. I and the two alternate types shown in Fig. IV and Fig. V may be made from plastic, rubber or any easily fabricated material.

Fig. I shows the sleeve liner **20** with a conical vertical channel. With this sleeve liner the pump will put out a smaller amount of the pumped fluid at a higher pressure as the pump plunger is moved with a constant force into the working fluid.

If the sleeve liner shown in Fig. IV is used, the pump will put out a greater amount of the pumped fluid at a lower pressure as the pump plunger assembly is moved downward. Fig. V shows still another possible configuration for the channel in the sleeve liner. In the practice of my invention the channel may assume any form necessary to give desired pumping characteristics.

Having illustrated and described three preferred embodiments of my invention, it is to be understood that it is not limited to the precise construction herein disclosed and the right is reserved to all changes and modifications coming within the scope of the invention as defined in the appended claims.

I claim:

1. A hydraulic fluid device comprising a sealed container, a vertical plunger which is slidably mounted and which enters said sealed container, a vertical channel in said vertical plunger, an intake valve connected to the upper end of said vertical channel, an exhaust valve connected to the upper end of said vertical channel, a working fluid in said container, and means attached to said

vertical plunger to move it upward and downward within said container and within said working fluid so that as the vertical plunger moves upward and downward within the sealed container and within the working fluid the surface of the working fluid will rise and fall in the vertical channel and thereby cause the intake and exhaust valves to operate.

2. A hydraulic fluid device comprising a sealed container, a vertical plunger which is slidably mounted and which enters said sealed container, a vertical conical channel in said vertical plunger with the large part of the conical channel extending downwards, an intake valve connected to the upper part of said vertical conical channel, an exhaust valve connected to the upper part of said vertical conical channel, a working fluid in said container, and means attached to said vertical plunger to move it upward and downward within said sealed container and within said working fluid so that as the vertical plunger moves upward and downward within the sealed container and within the working fluid the surface of the working fluid will rise and fall in the vertical conical channel and thereby cause the intake and exhaust valves to operate.

3. A hydraulic fluid device comprising a sealed container, a vertical plunger which is slidably mounted and which enters said sealed container, a vertical channel which varies in cross sectional area from one end to the other in said vertical plunger, an intake valve connected

to the upper end of said vertical channel, an exhaust valve connected to the upper end of said vertical channel, a working fluid in said sealed container, and means attached to said vertical plunger to move it upward and downward within said sealed container and within said working fluid so that as the vertical plunger moves upward and downward within the sealed container, and within the working fluid, the surface of the working fluid will rise and fall in the vertical channel of variable cross sectional area and thereby cause the intake and exhaust valve to operate.

4. A hydraulic fluid device comprising a sealed container, a movable element entering said container, a vertical channel in said element, an intake valve connected to the upper end of said vertical channel, an exhaust valve connected to the upper end of said vertical channel, a working fluid within said container, and means to move said element and said vertical channel upwards and downwards within the working fluid within said container so that the working fluid will rise and fall within the vertical channel and thereby cause the exhaust and intake valves to operate.

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