W. M. FRASER.

PUMP.

APPLICATION FILED MAY 4, 1917.

1,263,401.

Patented Apr. 23, 1918.

2 SHEETS—SHEET 1.

Fig. 1.

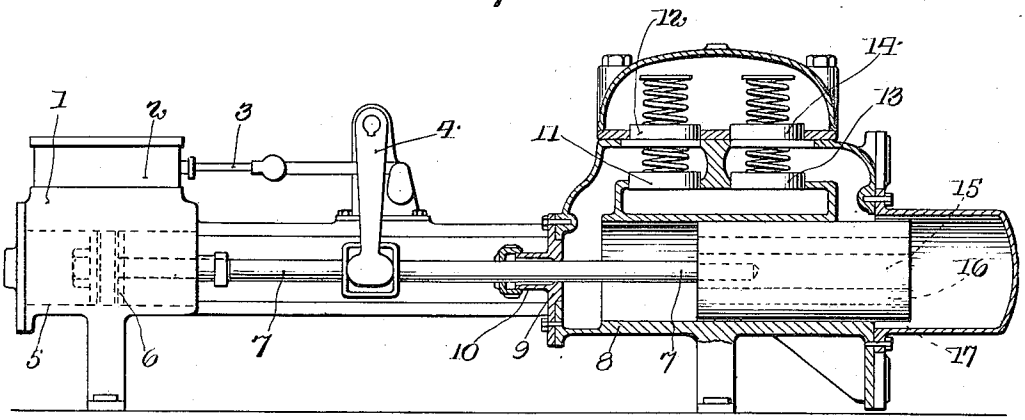
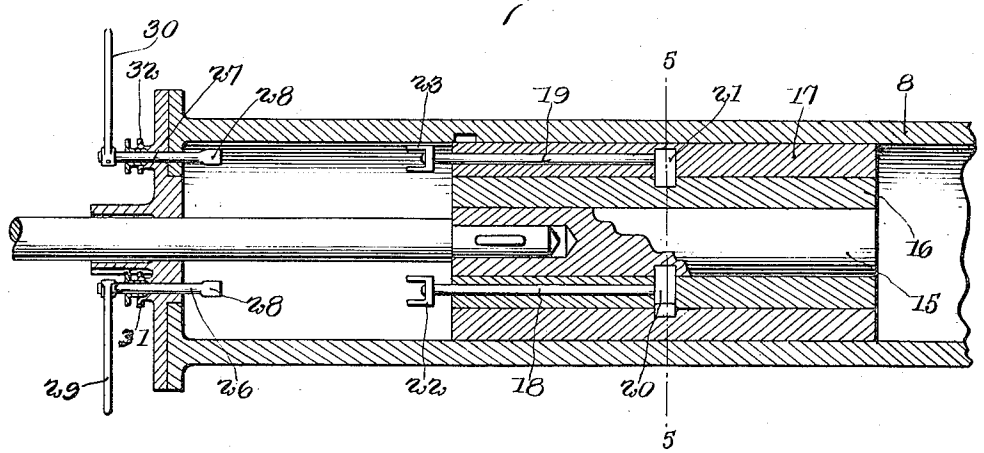



Fig. 2.




Witness

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2 SHEETS—SHEET 2.

Fig. 3.

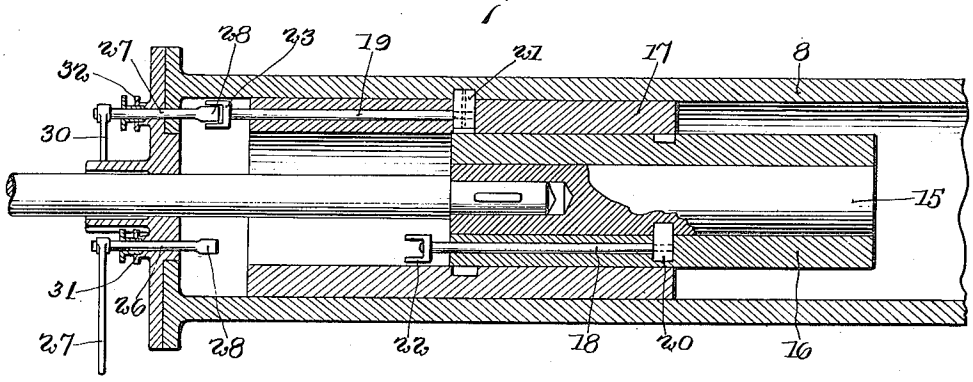



Fig. 4.

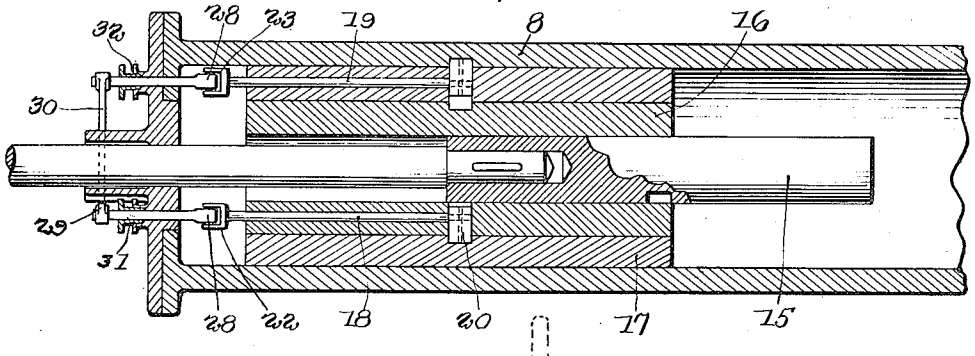
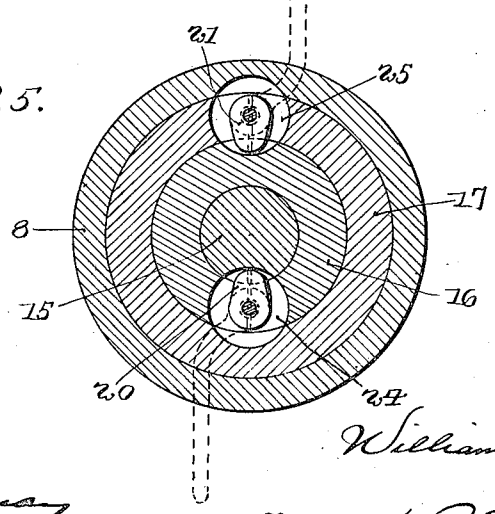



Fig. 5.




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# UNITED STATES PATENT OFFICE.

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## PUMP.

1,263,401. Specification of Letters Patent. Patented Apr. 23, 1918.

Application filed May 4, 1917. Serial No. 166,362.

*To all whom it may concern:*

Be it known that I, WILLIAM M. FRASER, a citizen of the United States, residing at Sewaren, in the county of Middlesex and State of New Jersey, have invented certain new and useful Improvements in Pumps, of which the following is a specification.

This invention relates to pumps; and it comprises a pump having what may be termed a compound or multiplex cylinder and a compound or multiplex piston with means for causing a part of the piston to function as part of the cylinder and a part of the cylinder to function as part of the piston; and it also comprises a pump having a cylinder and a piston, the piston being composed of a plurality of movable parts with means for locking one or more of the parts to the cylinder and thus changing the internal diameter of the cylinder and altering the effective area of the piston; and the invention still further comprises a pump having a cylinder and a piston, the piston being provided with a plurality of plungers one encircling the other, and means advantageously operated from the outside of the cylinder of the pump for locking together two or more of the plungers, whereby all of them may constitute the entire piston, and means for locking the outer encircling plunger to the cylinder of the pump, whereby the other parts of the piston may operate as a piston of smaller diameter, and means for locking another of the cylindrical plungers of the piston to the first cylindrical plunger and thus to the cylinder of the pump, whereby the piston may be made of still smaller diameter and whereby the other plunger may operate inside the said cylinder, thus in effect making a smaller pump; all as more fully hereinafter set forth and as claimed.

The pump may be considered as having a compound cylinder with means for locking different parts thereof together to produce a cylinder of smaller cross sectional area, or the pump may be considered as having a compound piston with means for locking and unlocking the several parts to make the piston larger or smaller; or the pump may be considered as having both a compound or multiplex cylinder with means for locking and releasing the parts and a compound or multiplex piston for locking and releasing the parts.

In many arts the character of the material pumped varies from time to time. This is particularly true of asphalts, and the like, the consistencies of which vary extremely, depending on the nature of the material being handled and upon the temperature of the atmosphere. In oil plants, crude petroleum oil and asphalts are pumped through pipe lines, sometimes of considerable length (a mile or more) to storage tanks, places of use, etc. In starting up the pumps for pumping such a material, the pipe line being cold, high pressure is often necessary; in fact, frequently a pressure as high as 300 to 400 pounds is necessary in starting for proper delivery of asphalt. The asphalt as it goes to the pump for delivery into the line is often at a temperature of about 460 to 600° F., and when it has filled the line entirely and the line is consequently heated thereby, the necessary pressure for continuous delivery is greatly reduced. After the line has become thoroughly heated, frequently a pressure of 40 pounds is all that is necessary for free transmission of asphalt.

The pumps should be capable of delivering the oil or asphalt at the high pressure above referred to until the line has become heated, or under a high pressure in cold weather, and at the same time the pump should be capable of delivering oil under the low pressure referred to after the line has become heated, or in warmer weather. In practice, pumps are usually installed capable of operating at about the average pressure of the line, say, about 200 pounds. Such pumps labor very slowly in the first part of the delivery, and after the line is heated they work very rapidly, but nevertheless cannot deliver the oil as fast as would be possible with a larger pump. For instance, a pump which is satisfactory for summer use will obviously not be as satisfactory for winter use, since the temperature of the material varies, and the viscosity which is the governing feature in pumping fluctuates with the temperature.

To obviate the difficulties noted and produce a pump which will be adaptable at all seasons of the year and under varying conditions, I provide a pump having a piston of three cylindrical independent sections. One or more of these sections may be locked to the cylinder of the pump. By means of suitable locking devices the three sections may be worked as one unit, as two units or

as three units, at will. Assuming that the diameter of the steam piston is six inches, I provide in the oil pump an inside plunger of three inches diameter and a cylinder surrounding the same to constitute with the inside plunger a piston of six inches in diameter and a further cylinder surrounding the first cylinder to constitute with the inside plunger and first cylinder a piston, when all three are working together, of nine inches in diameter. Assuming that when all three of these piston sections are attached together that the pump is working under 100 pounds steam pressure (ignoring loss in friction) there would be a pressure of 44 pounds. When working the inside plunger alone and locking the two cylindrical sections together and to the cylinder of the pump, and under the same steam pressure, there would be an oil pressure of approximately 400 pounds. When working the inside plunger together with the next section under the same pressure, and with the outer piston-cylinder attached to the pump cylinder there would be a pressure of about 100 pounds. At the same time the amount of material delivered would be increased correspondingly.

The cylinder pistons may be locked to each other and to the casing by any suitable mechanical devices and the piston-cylinder adjacent the inner piston or plunger may be locked thereto through the same type of mechanism. I have shown and described one form of interlocking member comprising a cam or a dog operated through a shaft, having a keyed end adapted to engage the corresponding key on a shaft passing through a stuffing box in the end of the cylinder of the pump. A suitable lever serves to turn the shaft when the keyed portions are in engagement and thus turn the cams or dogs in the cylinder pistons. The keyed portion on the shaft passing through the stuffing box may be permanently located to engage the keyed portion of the shaft carrying the dog in order that the two keys may engage at one end of the stroke of the cylinder piston; or the shaft extending through the stuffing box may be arranged for longitudinal movement therein, whereby it may be moved into position to cause its keyed portion to engage the corresponding keyed portion of the shaft carrying the dog. The piston cylinder adjacent the pump cylinder may be provided with a dog or cam which when turned in one position locks such piston cylinder to the pump cylinder, but which when turned in the other position locks the outer piston cylinder to the adjacent piston cylinder surrounding the solid piston plunger. The second piston cylinder surrounding the solid piston plunger may be provided with corresponding mechanism which when turned in one position serves to lock this particular piston cylinder to the solid central piston plunger and which when turned in the other direction will serve to release the same.

My invention is applicable to air and gas pumps when it is desired to change the pressure or the amount of air or gas being delivered and it is also applicable to many types of liquid pumps.

In the accompanying illustration I have shown the invention as applied to an inside packed plunger type pump and I have shown the piston provided with three sections. Any number of these sections may be used. In the drawings

Figure 1 is a view partly in longitudinal section and partly in side elevation (and is more or less diagrammatic) of a steam pump showing my invention.

Fig. 2 is a longitudinal section of the cylinder and piston on a somewhat larger scale than that of Fig. 1 and illustrates the operation of the piston when the three sections are interlocked.

Fig. 3 is a view similar to Fig. 2 and illustrates the operation of the piston when the cylinder piston adjacent the pump cylinder is locked to the pump cylinder and when the central plunger and its adjacent cylinder piston are locked together.

Fig. 4 is a view similar to Figs. 2 and 3 illustrating the operation of the piston when the cylinder piston adjacent the cylinder of the pump and the cylinder piston adjacent the central piston plunger are locked together leaving the central plunger to operate alone.

Fig. 5 is a section along line 5—5 of Fig. 2.

Referring to the drawings, 1 is the steam end of the pump having valve chest 2, valve rod 3, rocker arm 4, cylinder 5, piston 6 and piston rod 7 of the ordinary type. This portion of the pump is shown diagrammatically and forms no part of the invention, except as used in combination with the particular piston of my pump.

The fluid pump comprises a main cylinder 8 having the head 9, and stuffing box 10, through which the piston rod (7) passes. The cylinder 8 is provided with the inlet 11 which opens upon the suction stroke of the piston to admit oil in the main cylinder and outlet valve 12 which opens upon the pressure stroke of the piston to permit delivery of the fluid being pumped. For convenience of illustration I have shown a double acting pump, valves 13 and 14 operating on the other end of the cylinder and corresponding to valves 11 and 12 respectively. The cylinder is of the same bore throughout, but its internal diameter may be changed when the piston cylinders (hereinafter more fully described) are locked thereto. The pump may be considered as having a piston comprising a plurality of sub-pistons or the pump may be considered

from the standpoint of a pump having a cylinder with a plurality of sub-cylinders.

The piston rod (7) is attached to the cylinder piston or piston plunger 15 and serves to operate this piston plunger or the auxiliary pistons when suitably interlocked. Surrounding piston plunger 15 is what I term a cylinder piston 16, and surrounding this in turn is another cylinder piston 17 adjacent the cylinder of the pump. I may provide as many of these cylinder pistons as the exigencies of the case may warrant.

The piston plunger 15 may operate alone, in which event the piston cylinder 16 serves as the cylinder or part of the cylinder of the pump; or the piston plunger 15 may operate together with the piston cylinder 16, in which event piston cylinder 17 serves as the cylinder or part of the cylinder of the pump. In order that the cylinder piston-plunger 15 alone, or the piston-cylinder 16 together with the piston plunger, or all three sub-pistons together, may operate, it is necessary to provide certain interlocking and releasing mechanism. Any suitable form of such device may be employed. I have shown rods or shafts 18 and 19 located respectively in piston cylinders 16 and 17. Each of these shafts carries a cam 20 and 21, respectively, at one end and keyed portions or sockets 22 and 23 at the other end. The piston cylinders 16 and 17 are properly cut away as is clearly shown at 24 and 25 in Fig. 5, to permit rotation of these cams or dogs 20 and 21. If desired, the shafts may be rotated from the inside of the pump cylinder, but this would necessitate removing the piston head and I therefore, for convenience in operation, provide special means for operating these shafts 18 and 19 and the dogs 20 and 21. These operating means comprise shafts 26 and 27, having keyed portions 28 and 29, adapted to engage keys 22 and 23, respectively, when the piston cylinders are retracted to their rearward position. Shafts 26 and 27 may be operated through hand levers 29 and 30 and such shafts are suitably journaled in stuffing boxes 31 and 32 in the piston head.

In operation if it is desired to pump heavy oil of high viscosity or if it is desired to pump lighter oil of lower viscosity in cold weather when there would be a tendency of the oil to thicken, I pump the oil from the cylinder of the pump by means of the central piston plunger 15, utilizing the full steam pressure of the pump. This operation is shown diagrammatically in Fig. 4, piston cylinder 17 being locked to piston cylinder 16 through the cam 20, and piston cylinder 17 being locked to the cylinder 8 of the pump through the cam 21. The result of this interlocking of the piston cylinders is that piston cylinder 16 constitutes the cylinder in which the piston plunger 15 travels. This piston 15 forces the oil in less quantity than if all three piston sections were used, through the valves 11 and 12, but at a greater pressure.

If the oil is of a slightly less viscosity, I may operate as is shown in Fig. 3, wherein the cylinder piston 17 is locked by means of cam 21 to the cylinder 8 of the pump but wherein the piston cylinder 16 is interlocked with the piston plunger 15 by means of the cam 20. The pressure of the oil delivered will be slightly less than the pressure of the oil delivered when the pump is operated as shown in Fig. 4, but the quantity in a given time will, of course, be somewhat greater. When the oil is of still less viscosity I may operate with a pump as adjusted in Fig. 2, in which the entire piston is used and in which the pump operates as an ordinary pump. In this view the piston cylinder 17 is locked to the cylinder 16 of the pump by means of a dog 21 and the cylinder 16 is locked to the piston 15 by means of dog or cam 20. When the pump is operating with the piston parts as shown in Fig. 2 the oil is delivered at less pressure than when the pump is operating as is shown in Figs. 3 and 4 but a greater quantity of oil is delivered in a given time.

The pump, as described, is adapted to deliver oil under varying pressure without the necessity of changing the pressure in the steam operating end and this is a decided advantage since an average steam pressure desired may be ascertained and the pump having a certain capacity installed and this pump may be used to deliver oil at different pressures.

What I claim is:

1. A double acting pump comprising a cylinder, a piston within the cylinder, inlet and outlet valves at each end of the cylinder, and means for moving the piston within the cylinder, the piston being provided with means for altering its effective area.

2. A construction as described in claim 1 having a piston cylinder arranged between the piston and the cylinder, said piston cylinder having means to secure it to said cylinder, or to secure it to said piston and cause it to travel therewith.

3. A construction as described in claim 1 in which the means for altering the effective area of the piston and the cylinder comprises a piston-cylinder arranged between the piston and the cylinder and adapted to be secured to either the piston or the cylinder.

4. A construction as described in claim 1 wherein the cylinder is provided with cylinder heads, and means projecting through one of said cylinder heads for effecting the change in the effective area of the piston.

5. In a pump, a cylinder, a piston com-

prising a central plunger, a surrounding piston cylinder and a second piston cylinder surrounding the first said piston cylinder, means for locking the first said piston cylinder to the plunger and means for locking the second piston cylinder to the pump cylinder, or to the first said piston cylinder, whereby either the said second piston cylinder may be held stationary with respect to the pump cylinder while the central plunger and the first said cylinder piston travel together, or whereby the first said cylinder piston and the second said piston cylinder may be interlocked and locked to the pump cylinder and the central plunger may travel with respect to the two said piston cylinders and the pump cylinder.

6. In a pump comprising a central plunger, and an encircling cylinder plunger comprising two relatively movable parts, means for locking the two relatively movable parts of the encircling plunger together and to the cylinder of the pump, whereby the central plunger may travel with respect thereto, means for locking the adjacent part of the compound cylinder plunger to the central plunger and for locking the other part of the cylinder plunger to the cylinder of the pump, whereby the central plunger together with a part of the encircling cylinder may travel with respect to the other part of the encircling cylinder and the cylinder of the pump to which it is locked.

7. In a pump, a cylinder and a piston, said piston comprising a central plunger and a surrounding piston plunger, means for locking the piston plunger to the cylinder comprising a cam in the cylinder plunger, a shaft extending longitudinally thereof, operating means for said shaft, and means in the cylinder for engagement with said cam.

8. In a pump, a cylinder and a compound piston, said compound piston comprising a central plunger, and two encircling cylinder pistons, one encircling the other, means for locking one of the encircling cylinder pistons to the cylinder of the pump and means for locking the other encircling piston to the central plunger, said last named means comprising a cam in the encircling piston plunger, a longitudinal shaft connected to said cam, means for operating said shaft and means in the cylinder plunger coöperating with the cam.

In testimony whereof, I affix my signature.

WILLIAM M. FRASER.

Witnesses:

FRANK NEER,

MARGARET HARNED.