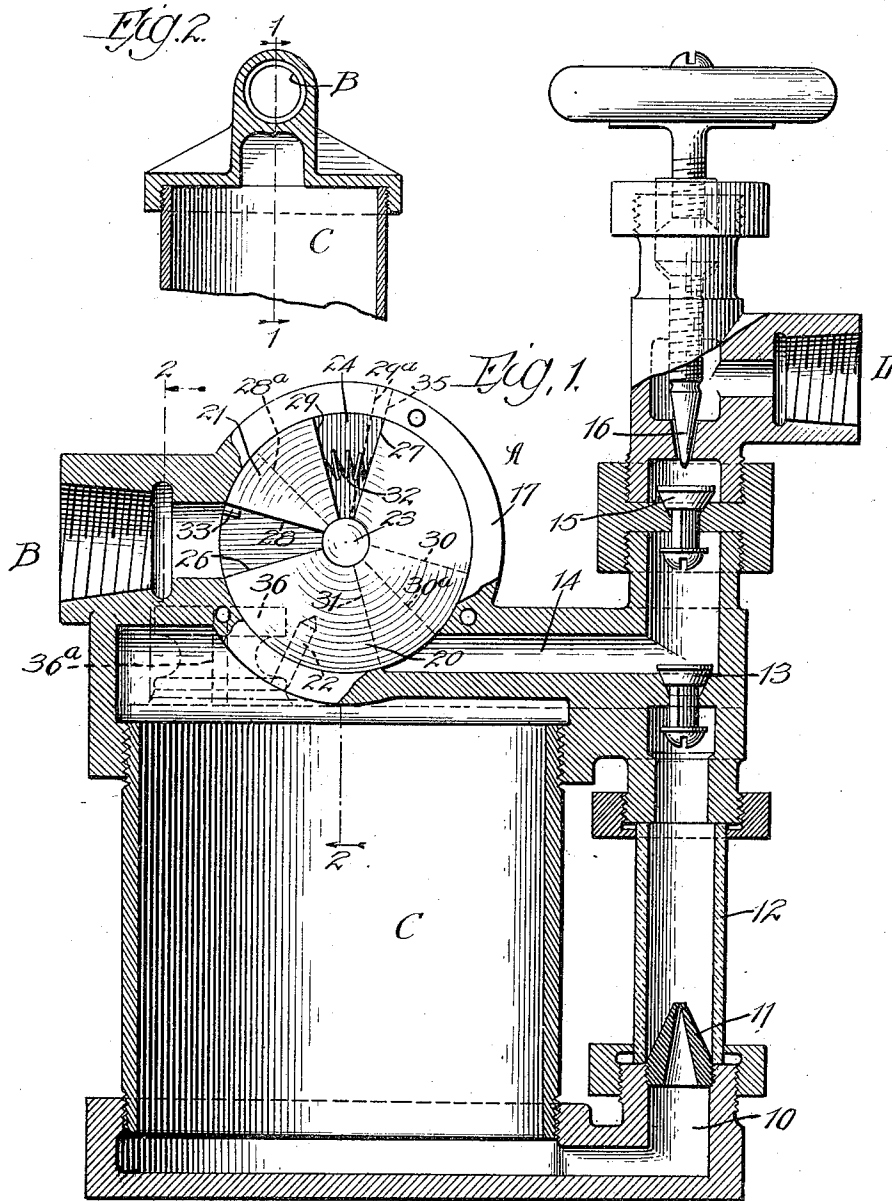


T. F. MULLIGAN.
FORCE PUMP.
APPLICATION FILED JUNE 19, 1913.

1,132,670.

Patented Mar. 23, 1915.

2 SHEETS—SHEET 1.



Witnesses:
R. Burkhardt.
Halo T. Talm.

Inventor
Thomas F. Mulligan,
by Brown & Perkins Patent Attorneys

T. F. MULLIGAN.
FORCE PUMP.
APPLICATION FILED JUNE 19, 1913.

1,132,670.

Patented Mar. 23, 1915.
2 SHEETS—SHEET 2.

Fig. 6.

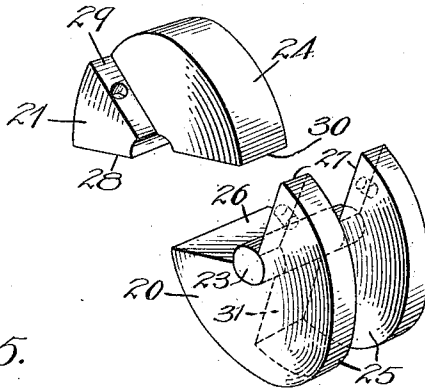


Fig. 5.

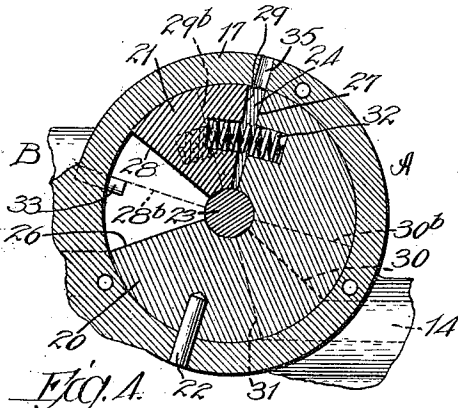
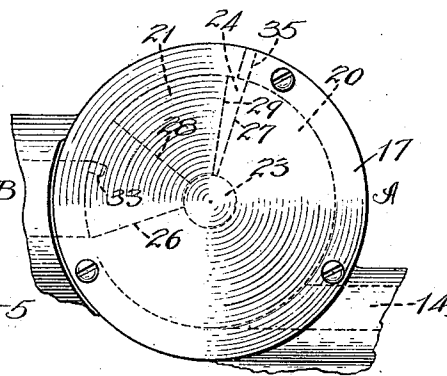
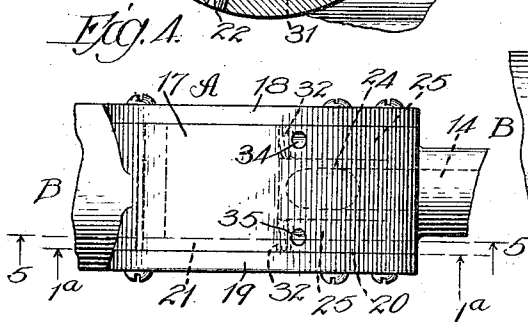


Fig. 3.



Witnesses:
R. Burkhardt.
Robert H. Halm.

Inventor
Thomas F. Mulligan,
By Brown & Hopkins Messrs. Sprinkle
Attorneys

UNITED STATES PATENT OFFICE.

THOMAS F. MULLIGAN, OF FORT WAYNE, INDIANA, ASSIGNOR TO S. F. BOWSER & COMPANY, INCORPORATED, OF FORT WAYNE, INDIANA, A CORPORATION OF INDIANA.

FORCE-PUMP.

1,132,670.

Specification of Letters Patent.

Patented Mar. 23, 1915.

Application filed June 19, 1913. Serial No. 774,504.

To all whom it may concern:

Be it known that I, THOMAS F. MULLIGAN, residing at Fort Wayne, in the county of Allen and State of Indiana, have invented certain new and useful Improvements in Force-Pumps, of which the following is a specification.

My invention relates to force pumps and has for its primary object the provision of an improved force pump which shall have improved means for forcing fluid matter into a pressure chamber.

With the above and other objects in view this invention consists substantially in the combination, arrangement, and construction of parts all as hereinafter described, illustrated in the accompanying drawings, which form a part of this specification and show the preferred embodiment of my invention, and more specifically set forth in the subjoined claims.

In the drawings: Figure 1 is a view of my invention, partly in side elevation, partly in vertical section on the line 1—1 of Fig. 2, looking in the direction indicated by the arrows, and partly on the line 1^a—1^a of Fig. 4, looking in the direction indicated by the arrows. Fig. 2 is a vertical section of a portion of my invention taken approximately on the line 2—2 of Fig. 1 and looking in the direction indicated by the arrows. Fig. 3 is a side elevation of a pump element shown in Fig. 1. Fig. 4 is a top plan view of the pump element shown in Fig. 3. Fig. 5 is a vertical section of the pump element taken on the line 5—5 of Fig. 4, looking in the direction indicated by the arrows. Fig. 6 is a view in perspective of two co-acting parts of the pump element illustrated in detached position.

In my invention a pump element actuated by fluid pressure from a connection B, draws fluid from a supply chamber C and discharges it into a connection D. In one of the uses of my invention the connection B is attached to one end of the piston cylinder of a steam engine in such manner that there is a pressure of live steam through the connection B to the pump element A alternating with a relatively low pressure as an exhaust port of the steam cylinder is opened. In this use of my invention the connection D communicates with a chamber under pres-

sure, and lubricating oil is the fluid drawn from the supply chamber C and discharged into the connection D.

Reference numeral 10 indicates a passageway for oil from the supply chamber C, the oil preferably passing through a nozzle 11 and a glass tube 12. From the tube 12 the oil passes through a check valve 13 into an oil chamber 14 which communicates with the pump element A, the check valve 13 preventing the return of the oil. From the chamber 14 the action of the pump element A forces the oil out through a second check valve 15 and a needle valve 16 into the connection D, the check valve 15 preventing the return of the oil into the chamber 14, and the needle valve 16 being adjustable from without the casing of my invention to regulate the amount of oil forced from the chamber 14 into the connection D.

Reference numeral 17 indicates an approximately circular casing for the pump element A, the pump communicating on one side through the casing 17 with the connection B and upon the other side through the casing 17 with the oil chamber 14. The housing for the pump is completed by the attachment of face plates 18 and 19 to the sides of the casing 17, thus forming a cylindrical inclosure for the pump element which very closely fits therewithin. Preferably the connection B, the casing 17, and the chamber 14 are cast integrally as shown in Fig. 1.

The pump A is composed of a fixed element 20 and a movable element 21, the two elements being in cross sectional contour sectors of circles. A pin 22 protruding through the casing 17 into an aperture formed in the fixed sector 20 holds it rigidly in place within the casing. The sectors 20 and 21 have a common center which is bored for engagement with a shaft 23 upon which the movable element oscillates. The fixed sector 20 together with the shaft 23 may be considered as an auxiliary portion of the pump casing. A sector-tongue 24 formed upon the movable element 21 oscillates within a sector-chamber 25 formed in the fixed element 20. Two radial planes 26 and 27 form the sides of the fixed element 20 of the pump, and two radial planes 28 and 29 form the sides of the movable element 21.

The sector-tongue 24 formed upon the movable element 21 terminates in a radial plane 30. The sector-chamber 25 is cut from the radial plane 27 into the fixed element 20 of the pump and is terminated by a radial plane 31. The sides of the sector-tongue 24 are in close engagement with the adjacent ends of the sector-chamber 25. The sector-tongue is of a lesser width than the distance between the face plates 18 and 19, while the movable element 21, of which it forms a part, is of a greater width and area, preferably completely filling the space between the face plates. The fixed element 20 fits closely at each of its ends with the face plates 18 and 19. By this construction fluid is prevented from passing between the face plates and the movable element 21, or between the face plates and the fixed element 20. Likewise the fit between the interior wall of the casing 17 and the cylindrical surfaces of the pump subtended by the radial planes heretofore described is such that fluid cannot leak around the outside of the cylindrical surfaces.

The radial plane surfaces 26 and 28, together with the face plates 18 and 19 and a portion of the surface of the shaft 23, form a steam aperture communicating with the connection B. These radial planes 26 and 28 have as their dimensions the radial distance from the outer surface of the shaft 23 to the inner surface of the casing 17 and the width between the face plates 18 and 19. The sector-tongue 24 and the sector-chamber 25, which it closely fits, are of a width considerably less than the distance between the face plates 18 and 19. The radial planes 30 and 31, together with the ends of the sector-chamber 25 and a portion of the surface of the shaft 23, form, in connection with the interior surface of the casing 17, an oil pumping chamber communicating with the oil chamber 14 and which is, as will be seen from the foregoing description, of lesser width than the steam chamber which communicates with the steam connection B. Consequently greater area is presented on the movable element 21 for contact with steam from the connection B than is presented to oil introduced to the oil pumping chamber through the oil chamber 14.

From the foregoing description it will be seen that on either side of the sector-tongue 24 there is a sector-shaped space bounded by a side of the tongue, one of the face plates, a portion of the surface of the shaft 23, the radial plane 29, and the radial plane 27. Within each of these sector-spaces is disposed a compression spring 32 having its ends bottomed in the opposed radial surfaces 29 and 27 of the movable and fixed members 21 and 20. These spring members 32, or any other means which may be found convenient, act to force the movable mem-

ber 21 about the shaft 23 as an axis or in other words, to force apart the radial surfaces 27 and 29 and to force the radial surface 28 toward the radial surface 26. The oscillation of the movable member 21 is limited in one direction by the engagement of its surface 28 with a stud 33 which protrudes from the inner surface of the casing 17. The location of this stud 33 is preferably such that the outer edge of the surface 28 cannot encroach upon the aperture of the connection B, and the positioning of the fixed member 20 is preferably such that the outer edge of the radial surface 26 lies in a line with the inner surface of the connection B. In this manner the spring members 32 are prevented from forcing the radial surfaces 26 and 28 together and closing the steam receiving aperture of the pump A. To lessen back pressure upon the movable element 21 the casing 17 is apertured as at 34 and 35 for the free passage of air in and out of the sector-shaped spaces in which are disposed the spring members 32.

In Fig. 1 the movable part of the pump is shown in the position it assumes when the pressure present in the connection B and the steam chamber of the pump is least, while by a dotted line 28^a in Fig. 1 is shown the position assumed by the radial surface 28 when the maximum live steam pressure is present in the connection B in the steam chamber of the pump; at 30^a is shown in dotted lines in Fig. 1 the position assumed by the radial surface 30 of the sector-tongue 24 when the maximum live steam pressure is present in the connection B and the steam chamber of the pump and when the radial surface 28 has assumed the position indicated by the dotted lines 28^a.

In Fig. 5 the parts of the pump visible in the section are shown in full lines in the position assumed when the maximum amount of steam pressure is present in the steam chamber of the pump. Consequently the radial surface 28 assumes the position in Fig. 5 which is indicated by the dotted line 28^a of Fig. 1, while at 28^b in Fig. 5 is indicated the position of the radial plane 28 illustrated in full lines in Fig. 1. The heavy dotted line 30 in Fig. 5 shows the position assumed by the radial plane 30 of the sector-tongue 24 when the greatest pressure of steam is present in the steam chamber of the pump, and correspondingly the dotted line indicated in Fig. 5 by reference numeral 30^b shows the position of the radial plane 30 as it is illustrated in Fig. 1, or in other words, when the least pressure is present in the steam chamber of the pump.

At 29^a in Fig. 1 and at 29 in Fig. 5 is indicated the position assumed by the radial plane surface 29 when the maximum amount of pressure is present in the steam chamber of the pump, while reference numeral 29 in

Fig. 1 and reference numeral 29^b in Fig. 5 indicate the position assumed by the radial surface 29 when the pressure in the steam chamber of the pump is least.

5 In that use of my invention heretofore mentioned live steam pressure alternates with exhaust pressure in the connection B and the steam chamber of the pump A. Live steam pressure equal to that in the connection B is present in the connection D, though the pressure in the connection D may be less than that of the live steam pressure, or greater as will appear hereafter.

10 When my invention is adapted to such a use its operation is as follows: Referring to Fig. 1 and the position of parts therein shown, it is assumed that the chamber 14 is filled with oil which has been drawn from the supply chamber C and the position of the parts is shown in full lines at that moment when the lowest or exhaust steam pressure is present in the connection B and the steam chamber of the pump. When in this position the next change in pressure in the steam chamber of the pump is from the lowest to the highest as live steam enters through the connection B. The movable element of the pump then assumes the position shown in dotted lines in Fig. 1 and in full lines in Fig. 5; that is, the steam chamber of the pump is expanded and the oil chamber of the pump, which communicates with the oil chamber 14, is contracted. The surface area of the movable member 21 presented to the incoming steam is relatively large as compared to the area thereof presented to the oil in the oil chamber of the pump, and consequently oil is forced from the chamber 14 through the check valve 15 and the adjustable needle valve 16 into the connection B. When the highest pressure in the steam chamber of the pump ceases and is replaced by the relatively lower pressure, the spring members 32 oscillate the movable member 21 back toward the stud 33, which enlarges the oil chamber of the pump, thereby drawing a fresh supply of oil from the supply chamber 3 through the check valve 13 into the oil chamber 14.

50 It is to be noted that my invention is of great utility in forcing lubricating oil into those parts of an engine requiring lubrication and operating within steam spaces such, for instance, as a piston follower or a slide valve in a steam engine. From this it will be understood also that the pressure conditions in the connection D need not necessarily be constant. In fact, the pressure in the connection D may be variable and may even be greater than that present in the connection B, through the increase of pressure in the connection D over that in the connection B will be limited by the difference in area of the steam and oil contacting surfaces of the movable element 21. That is;

if the steam surface of the movable element 21 were twice the area of the oil surface thereof, oil would be readily forced by the pump into the connection D when that connection was under the same steam pressure as was present in the connection B, but, if the steam area of the movable element 21 were only one and one-half times the area of the oil surface thereof, the pump would obviously force a lesser amount of oil into the connection D under the same conditions by reason of the back pressure exerted upon the movable element 21 by the relative increase in the oil contacting area thereof.

The needle valve 16 is adjusted manually or in any other desired manner from the outside of the liquid conveying system shown in the drawings, and by its adjustment the amount of oil forced from the chamber 14 and through the check valve 15 into the connection D may be regulated. Thus, if it is found that the maximum capacity of the pump under given working conditions delivers an undue amount of oil to the connection D, the exact delivery of oil desired may be obtained by adjustment of the needle valve 16.

At 36 in Fig. 1 is shown in dotted lines a handled cover for a filling aperture provided in the supply chamber C, and through this cover a vent 36^a is provided.

In the accompanying drawings and in the foregoing description is set forth the preferred embodiment of my invention, but it is obvious that one skilled in the art may make modifications thereof without departing from the spirit of the invention.

I claim:

1. In a force pump, a casing reduced in width at one portion, ports communicating with the casing at the wide and narrow portions, and a pivoted oscillatable element having a tight-fitting part in each portion of the casing.

2. In a force pump, a casing having segmental portions one of which is reduced in axial width, ports communicating with the casing at said portions, and a pivoted oscillatable element having a fluid-tight part movable in each portion of the casing.

3. In a force pump, a casing having segmental portions, one of which is reduced in axial width, a pivoted oscillatable element having parts which fit the portions of the casing fluid-tight, ports in communication with the said portions of the casing, and a spring tending to press the element to close the portion of reduced width.

4. In an automatic force pump, a casing having segmental portions, one of which is less in width than the other, ports communicating with the said portions of the casing, a pivoted reciprocable element having parts to fit the said portions fluid tight and rotatable about the pivot through a limited arc,

a stop for limiting the movement in one direction, and a spring tending to press the element against the stop.

5 5. The combination of a pump casing provided with a sector-shaped inclosure, and a sector-shaped pumping element mounted for oscillation in the inclosure and dividing it into a power chamber and a relatively small pumping chamber, said element being reduced at its pumping chamber end.

10 6. The combination of a casing provided with a sector-shaped inclosure, and a sector-shaped element mounted for oscillation in the inclosure and constituting a movable fluid-tight partition dividing the inclosure into a large chamber and a small chamber.

15 7. The combination of a casing provided with a sector-shaped inclosure reduced in axial dimension at one end, a sector-shaped element mounted for oscillation in the inclosure and having an axially reduced end engaging the reduced end of the inclosure, the sector-shaped element constituting a movable fluid-tight partition dividing the inclosure into a wide chamber and a narrow chamber, a source of intermittent pressure communicating with the wide chamber, and an inlet and outlet passage communicating with the narrow chamber.

20 8. A casing provided with a sector-shaped inclosure reduced in axial dimension at one end, a sector-shaped element mounted for oscillation in the inclosure and having an axially reduced end engaging the reduced end of the inclosure, the sector-shaped element constituting a movable fluid-tight partition dividing the inclosure into a steam chamber and a liquid chamber, a source of intermittent supply of steam pressure communicating with the steam chamber to actuate the sector-shaped element in one direction, elastic means for actuating the sector-shaped element in the opposite direction, and an inlet and outlet passage communicating with the liquid chamber.

25 9. The combination of a pump casing provided with a sector-shaped inclosure reduced in axial dimension at one end, a sector-shaped pumping element mounted for oscillation in the inclosure and having an axially reduced end engaging the reduced end of the inclosure, the sector-shaped element constituting a movable fluid-tight partition dividing the inclosure into a steam chamber

and a liquid chamber, a source of intermittent supply of steam pressure communicating with the steam chamber to actuate the sector-shaped element in one direction, elastic means for actuating the sector-shaped element in the opposite direction, a source of liquid supply communicating with the liquid chamber, a check valve permitting the passage of liquid from the source of supply to the liquid chamber and preventing its return, a pressure chamber communicating with the liquid chamber for receiving pumped liquid, a check valve permitting the passage of fluid from the liquid chamber toward the pressure chamber and preventing its passage in the other direction, and an adjustable valve operable from without the pressure chamber for regulating the amount of liquid pumped into the pressure chamber.

10. A casing provided with a sector-shaped inclosure reduced in axial dimension at one end, a sector-shaped element mounted for oscillation in the inclosure and having an axially reduced end engaging the reduced end of the inclosure whereby in one position of the sector-shaped element sector-shaped spaces are formed on opposite sides of the axially reduced end of the sector-shaped element between the sector-shaped element and a radial plane of the casing, the casing being provided with air-vents communicating with said spaces, spring members disposed in the spaces to oscillate the sector-shaped element in one direction, a stop within the sector-shaped inclosure limiting the oscillation of the sector-shaped element in that direction, the sector-shaped element constituting a movable fluid-tight partition separating the ends of the sector-shaped inclosure into a large and a small chamber, a source of intermittent supply of steam pressure communicating with the large chamber to actuate the sector-shaped element in the opposite direction, and an inlet and outlet passage communicating with the small chamber.

In testimony whereof I have signed my name to this specification, in the presence of two subscribing witnesses, on this 14th day of June A. D. 1913.

THOMAS F. MULLIGAN.

Witnesses:

J. R. MATLACK,

L. W. THOMAS.