Oct. 4, 1927. 1,644,401

E. F. ROSS

PUMP

Filed Oct. 6, 1924

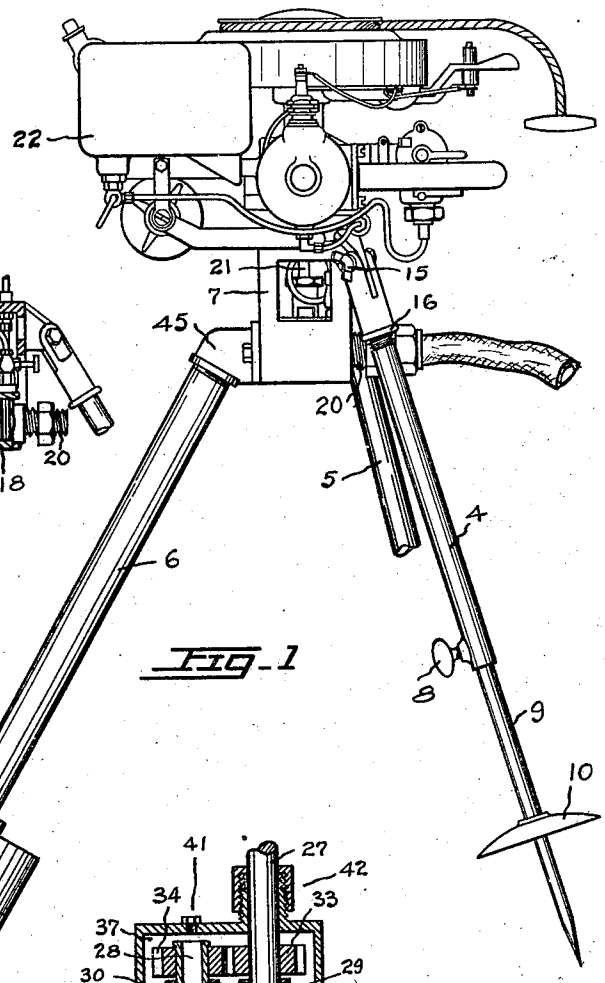


FIG. 1

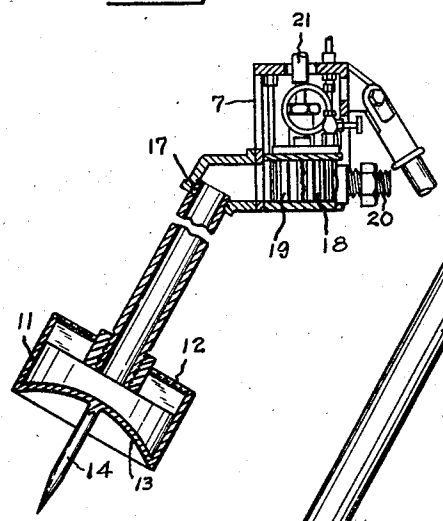


FIG. 2

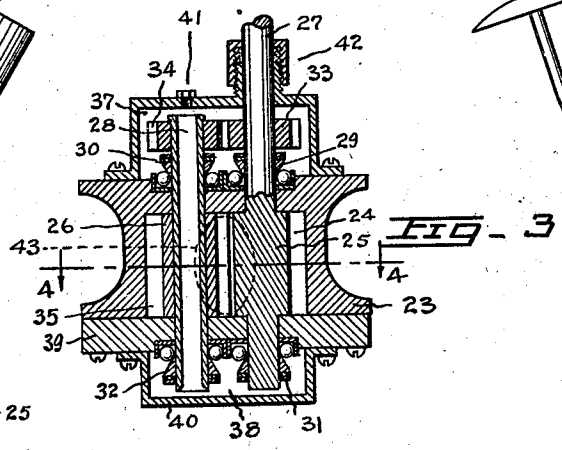


FIG. 3

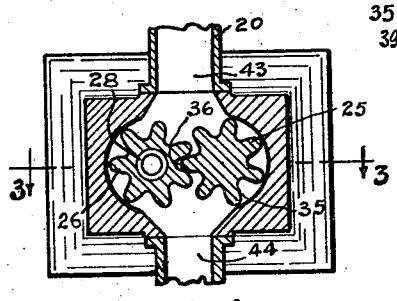


FIG. 4

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# UNITED STATES PATENT OFFICE.

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## PUMP.

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My invention relates to a pump. More particularly, my invention relates to a pump characterized by having a very low weight in comparison to its hydraulic efficiency.

For purposes of illustration and clearness, I will set forth my invention as applied to forest protection against fire, but it is to be expressly understood that the said invention is not to be considered as limited to any such specific use, but the scope of said invention is co-extensive to all uses where like conditions and problems obtain. The said invention is applicable among other uses to the pumping out of ship hulls, flooded basements, also for construction pits, coffer-dams, and for irrigation purposes, the invention having already been applied to some of these specified uses.

A creek or a muddy pool may constitute the source of water supply for combating a forest fire. Every moment during the initial stages of the fire is of the utmost importance. A fundamental purpose of my invention is to provide a pump of the character described, which will prevent a fire from reaching the forest fire stage. Since the one on guard against fires must reach the fire at points often inaccessible by pack animals, it is a fundamental condition that the equipment must be of the lightest possible weight and be capable of being manually carried. Furthermore, since the carrying of the equipment ordinarily involves climbing steep grades, a further reason for the elimination of every possible ounce of weight obtains. In short, the amount of weight eliminated is a direct measure of time saved. A primary object, therefore, of my invention is to provide a portable motor-driven pump, characterized by its lightness of weight, and yet being capable of discharging a large quantity of water,—in short, have an exceedingly low weight in proportion to its hydraulic efficiency. Such a pump must be capable of being quickly set up in the middle of a stream or low marshy place where sand and mud may form the unstable bottom.

A further condition obtains in that a motor operates most successfully when it has a three-point mounting, whether suspension or otherwise; so that the vibration which results from its operation will enable the motor to find its natural base without strain on its operating parts. While a tripod constitutes such a mounting favorable to the motor, nevertheless, the ordinary pump, when mounted on a tripod, creates such a vibration that it is difficult to maintain the same in an upright position in the bed of a stream, where the vibration tends to cause the tripod legs to work deeper and deeper into the bottom. While a pump of the rotary design overcomes the objection of creating great vibratory movement, nevertheless, the rotary pump is designed and constructed to operate with the rotor members horizontally mounted, and, hence, is not adapted to have the motor superimposed as above specified to render it remote from the water level without the employment of gear transmission. To the employment of any gears, very great objection obtains in that there is a great friction and transmission loss of power, and they add considerably to the weight and complications of extra moving parts. The effect is thus not only to add weight, but their operating has a sum total in effect of decreased efficiency that is most objectionable, since they consume power to overcome their friction. When the rotor pumps, as heretofore designed, are employed with the rotors vertically disposed, it has been found that the excessive friction resulting from the weight of the rotors bearing on the low part of the pump housing operates to decrease the life of such rotor members, so that actual experience in field use has shown the same to last only approximately forty-eight hours of continuous service.

A primary object of my invention is to supply a device of the character specified, capable of employing said portable motor unit with the greatest hydraulic efficiency in proportion to the weight.

Another primary object of my invention is to lighten the weight of a pump of the character specified by eliminating the ordinary suction conduit. To this end, I provide a tripod or supporting means with one leg member hollow, which in and of itself may function not only as a supporting leg, but also as a suction conduit, thus eliminating the weight incident to a suction hose member, which is a particularly heavy hose, since it must be non-collapsible and must be capable of sustaining great strains and rough usage.

Moreover, a fundamental condition in providing a pump of the character described is that it be free of the necessity for assembling when arriving at the scene of the fire.

Further, it is necessary that the suction

leg member of the tripod be provided with a strainer to prevent the taking in of objects which may clog or break the mechanism.

Also, it is an object of my invention to provide a rotary pump in which the rotor members may be vartically mounted, and which are characterized by having a low degree of friction, and which re self-lubricating.

Another primary object of my invention is to provide such a rotor pump that the passing of sand through the same will not injure the rotor members.

A further object of my invention in providing a pump to meet the conditions above enumerated is to provide a rotor pump having pilot gears, which pump has but one stuffing box, thereby further providing for the elimination of friction,—all to the end that a rotor pump, having its rotor members vertically disposed and actuated and timed through pilot gears revolving in a bath of oil, may be characterized by reliability and long life.

The above mentioned general objects of my invention, together with others inherent in the same, are attained by the device illustrated in the following drawings, the same being merely preferred exemplary forms of embodiment of my invention, throughout which drawings like reference numerals indicate like parts:

Figure 1 is a view in side elevation of a pump device embodying my invention;

Fig. 2 is a view in cross-section through the tripod head, pump and associated parts, and also a fragmentary view of the tripod hollow suction leg;

Fig. 3 is a view in section of a modified form of a pump unit embodying my invention; and

Fig. 4 is a view in cross section through the pump unit on dotted line 4, 4 of Fig. 3.

A mounting means for the device is provided by a tripod having legs 4 and 5, adjustable for angle and length, and a hollow suction leg 6 secured to tripod head 7. The legs 4 and 5 are preferably provided with a thumb nut means 8 to hold the telescoping leg member 9 in desired position, and said leg member may be pivoted with mud plates 10. The hollow suction leg 6 is provided with strainer cup 11,—the upper portion of said cup is provided with a strainer screen 12, while the under portion 13 of said cup is preferably formed concave, to better enable the same to operate as a mud plate. The said strainer cup may be further provided with a spike 14 to aid in anchoring said leg. The legs 4 and 5 may be adjustably mounted upon the tripod head 7 by a hinged connection through a wing connection through a wing connection formed by wing nut 15. The said legs are preferably provided demountable through screw joints 16. The hollow suction leg 6 may be secured to said tripod head 7 through the threaded connection 17.

In the tripod head 7, there is disposed the rotor pump unit having rotor pump members 18 and 19, with discharge outlet nipple 20. This pump unit may be any standard rotor pump, as shown in Figs. 1 and 2, but preferably the same is the perpendicular type of rotor pump which is hereinafter set forth as a part of my invention, and is illustrated in Fig. 3. The pump rotor members are actuated by the pump shaft 21, which is integrally formed with rotor member 18, by which rotor member 19 is actuated. Also mounted upon the tripod head 7 and operatively connected to shaft 21 is disposed a motor or prime mover 22 of any standard type. The motor 22 is directly connected to the shaft 21 without the interposition of any gears, thus lightening the weight of the device and eliminating loss of power in overcoming gear friction. The modified form of rotor pump unit shown in Fig. 3 is specially developed for use in connection with said pump constituting my invention. A rotor pump housing 23 is provided with a pump chamber 24. In this chamber 24, rotor pump members 25 and 26 are fixedly mounted upon shafts 27 and 28,—28 being preferably a hollow shaft through which oil may pass as hereinafter described. Adjustable cone ball bearings 29, 30, 31 and 32 are operatively disposed upon said shafts 27 and 28 for the purpose of maintaining the rotor members in adjusted position within the chamber 24, so that said rotor members 25 and 26 are suspended therein, and are in no wise supported by the walls of said chamber. This provides for the minimizing of mechanical friction within the chamber 24.

Shafts 27 and 28 are preferably provided with pilot gears 33 and 34 fixedly mounted thereon. Thereon, since shaft 27 is operatively connected with the motor or prime mover, shaft 28 is actuated through gear 34 which intermeshes with gear 33. These gears function to synchronize the pump rotor lobes 35. This arrangement, which provides for the actuating of the pump rotors apart from the lobes themselves, i. e., one rotor is not actuated by the other, further obviates mechanical friction. These lobes 35 are formed to provide a recess 36, so that fine sand, gravel or foreign substance may pass through the pump without injury to the same.

Pilot gears 33 and 34, together with cone ball bearing members 29 and 30, are disposed in an oil chamber 37, while cone ball bearings 31 and 32 are disposed in oil chamber 38, which chamber is formed by a plate 39 bolted to housing 23 and cap 40 bolted to said plate 39. Shaft 28 is preferably hollow, so that oil may pass from chamber 37 to

chamber 38; thereby the parts are automatically lubricated through one oil supply port 41. This arrangement also eliminates all stuffing boxes except the one box 42, located on the drive shaft 27. The shafts 27 and 28 operate under heavy pressure within the chamber 24, and thus the elimination of stuffing boxes is important in removing friction and operating difficulties. The stuffing box 42 is disposed on a part of the shaft 27, where it encounters little or no pressure. Stuffing boxes, positioned where they must sustain high pressure, must be mounted very tight, and this means that they must develop considerable friction and operating difficulties, in that they must be constantly attended to, and also lubricating difficulties. All these objections are overcome by the structure above described constituting my invention.

Discharge and suction ports 43 and 44, preferably of oval form respectively to minimize hydraulic friction, provide connections for the discharge nipple 20 and the suction connection 45, which connects with hollow leg 6.

The mode of operation of a pump embodying my invention is as follows:

In a large measure, the particular function of specific parts has already been set forth in describing the construction of the device. Normally, the pump legs 4, 5 and 6 are removed, and the said parts, together with the rest of the device, are placed in a back-packing means. Manifestly, the elimination of all suction hose, which ordinarily must be very heavily constructed, eliminates many pounds of weight from the device. The hollow leg 6 functions both as a support for the mounting means and also as a suction conduit. Therefore, the fire fighter in carrying this device is free of any suction hose equipment, and the device, being specially adapted to be set up in a stream, makes it possible to employ a suction leg 6. The motor is disposed at the point furthest above the level of the water. A back-pack load of fifty pounds may be readily handled, provided it is compact. The apparatus herein provided for, including motor pump and tripod complete, is manifestly compact and weighs less than forty pounds, and is capable of throwing twenty gallons a minute at seventy pounds pressure. Thus, the second member of the ordinary forest fire crew is free to carry the discharge equipment exclusively, which consists primarily of two hundred feet of one-inch lightweight, cotton-covered hose and a nozzle. Hence, the two rangers can readily carry said equipment expeditiously, together with the necessary provisions to maintain themselves for forty-eight hours in the woods, and together with the necessary motor fuel.

The mounting means formed by the tripod thus enables, through its three-point support, the motor to be in efficient operative position, even though one tripod leg may settle more than another, and also provides for the pump to operate under water so long as the motor itself is above the water level. The importance of this vertical disposition of the motor, as respects the pump, is further emphasized by the fact that it has been found advantageous to tie the said pump and motor to two logs in a swamp without any tripod connection and with the pump unit itself below the water level. Also, it has been found advantageous to omit the tripod legs and lower the pump unit in suspended form by ropes into holes containing water, thereby providing for the operation of the device in shallow water in holes. While this vertical disposition of the motor, as respects the pump, is thus important to meet actual operating conditions, it does develop the difficulty with respect to the vertical disposition of rotor pump members which must operate at high speed, and at the same time must operate efficiently and with the minimum of weight. This vertical disposition of the rotor members is provided for in the pump unit constituting a part of this invention by freely mounting said rotor members in the chamber 24, so that mechanical friction is reduced to a minimum, thus providing for increased rotor speed to build up a greater discharge volume and higher pressure in proportion to the power of the motor. This free mounting is provided for by the adjustable cone bearings and the pilot gears.

The device is made practically operative by providing for its automatic lubrication from one supply chamber. This is important for operation in the woods, where machinery must sustain neglect and abuse. The apparatus herein described, it will be noted, is free of open oil holes or grease cups, which may permit sand or dirt to enter the bearings, or which may become lost.

Obviously, changes may be made in the form, dimensions, and arrangement of the parts of my invention, without departing from the principle thereof, the above setting forth only preferred forms of embodiment.

I claim:

1. In a device of the character described in combination a pump unit, and a supporting suction conduit means for said unit, said means including a hollow leg member whereby said leg member constitutes a part of the supporting means and also the suction conduit.

2. In a device of the character described in combination a pump unit, actuating means for said unit; and a supporting suction conduit means for said unit, said con-

duit means including a hollow leg member whereby said leg member constitutes a part of the supporting means and also the suction conduit.

3. In a device of the character described in combination with a pump unit, a supporting suction conduit means for said unit, said means including a hollow leg member whereby said leg member constitutes a part of the supporting means and also the suction conduit, and a strainer-mud plate operatively disposed upon said leg member.

In witness whereof, I hereunto subscribe my name this 26th day of September, A. D. 1924.

ELTON F. ROSS.