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J. SUNNEN

2,493,467

PUMP FOR CUTTING OIL

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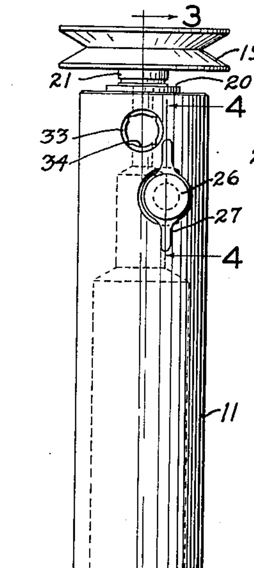

FIG. 1.

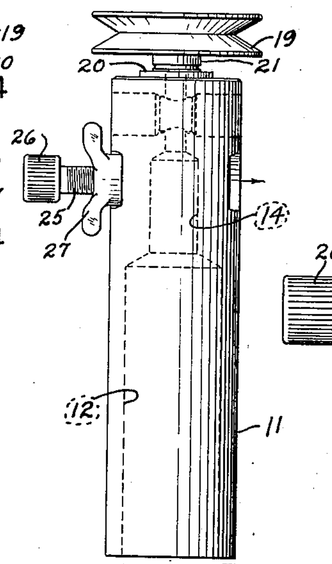

FIG. 2

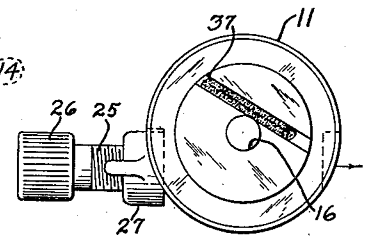

FIG. 5.

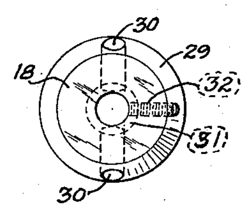

FIG. 6.

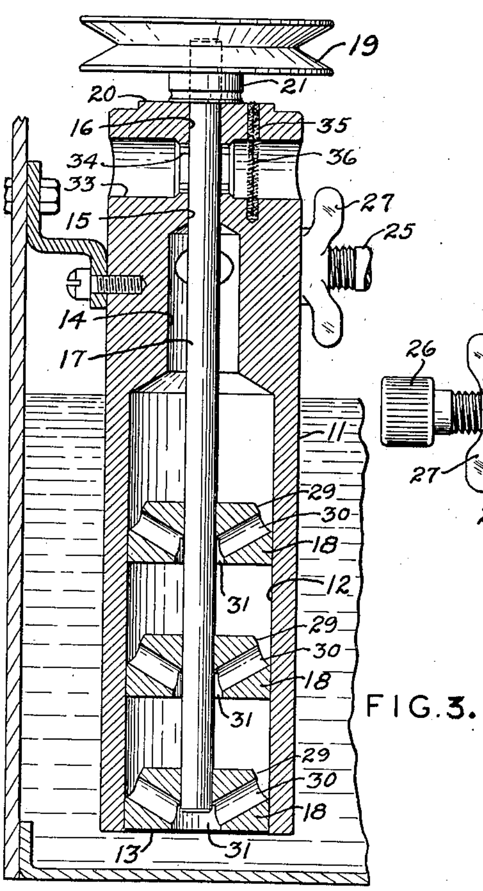

FIG. 3.

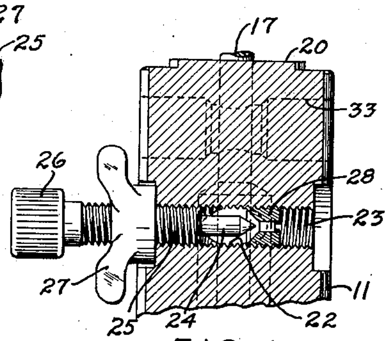

FIG. 4.

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PUMP FOR CUTTING OIL

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4 Claims. (Cl. 103—108)

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This invention relates to oil pumps generally, and more particularly to pumps for pumping used honing or cutting oils.

The designing of such pumps, previously, presented considerable difficulty in that the abrasive particles carried by the oil soon cut out any bearing surfaces, such as between a piston and cylinder, and even caused difficulty with the use of centrifugal pumps.

Such pumps must be extremely durable and rugged in their construction as they are required to operate continuously for long periods of time to pump the cutting or honing oil which may contain large quantities of dirt and grit of varying size and is not usually convenient or desirable to operate the pump at high enough speeds to develop the desired pressure from a single stage centrifugal pump of reasonable size.

Accordingly, the main object of the invention is to provide an oil pump of extremely simple and rugged design capable of pumping used cutting oils containing grit and metallic particles.

Another object of the invention is to provide a multi-stage pump of the general character indicated without any close fits or wearing surfaces in the balance of the oil which is being pumped.

Another object of the invention is to provide a pump of the above described character with means to rub its bearing surfaces with oil from which all abrasive particles have been removed and to prevent the danger of unpurified oil reaching the bearing.

Another object of the invention is to provide a multi-stage centrifugal pump comprising only a substantially cylindrical casing and a single moving part or rotor of the simplest possible construction.

Another object of the invention is to provide a centrifugal pump having adequate bearing for stable rotation of a rotor, yet in which wear due to abrasive particles in the pumped oil will be reduced to a minimum.

Still another object of the invention is to provide a pump which is durable in operation, cheap and simple to manufacture, and economical in operation.

While the scope of the invention is defined in the appended claims, the following detailed description, when taken in connection with the accompanying drawing, will explain the invention, its construction, and use.

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Fig. 1 is a side elevational view of a pump which embodies the invention.

Fig. 2 is a side elevational view of the same at right angles to Fig. 1.

Fig. 3 is an enlarged longitudinal section taken along line 3—3 of Fig. 1.

Fig. 4 is a partial longitudinal section taken along line 4—4 of Fig. 1 and showing in detail the needle valve assembly and discharge outlet.

Fig. 5 is a top view of the pump with the sheave wheel removed and showing a portion of the oil feed system, and

Fig. 6 is a top view of one of the impellers.

As shown in the drawings, the preferred embodiment of the invention has a body **11** with a longitudinal bore including a main cylinder **12**, which is open at the bottom, as at **13**, and which includes reduced portions **14**, **15**, and **16**, the latter forming a journal bearing for a pump shaft **17**. The reduced portion **15** may or may not be originally formed of the same diameter as the reduced portion **16** but in any case, it should not be considered as a bearing because its utility as such is soon destroyed by the abrasive action of the grit in the cutting oil which is being pumped. The passage between the reduced portion **15** and the shaft **17** is that of a flow restricting device which permits only a small amount of oil to escape from the upper end of the chamber **14** to insure the supply of a restricted quantity of oil to the lower end of wick **36**. Centrifugal impellers **18** are carried by shaft **17** within the cylinder **12**. Affixed to the other end of the shaft **17** is a sheave **19** for receiving a belt (not shown) to rotate the shaft **17** and its impellers **18**. Shaft **17** is carried by an end bearing **20** on body **11** against which rests a shoulder forming boss **21** on sheave **19**.

A threaded cross passage **22** intersects the reduced portion **14** of the longitudinal bore and forms an oil discharge opening **23** at its right end (Fig. 4) for attachment of an oil feed line which is not shown. Contained within the threaded cross passage is a control needle valve **24** having a threaded enlargement **25** and knurled head **26**. The control needle valve **24** is locked into an adjusted position by a wing nut **27**. A valve seat **28** also is threadedly seated in passage **22** into which the control needle valve acts to control the rate of oil delivery.

Impellers 18, of which there are three in number shown in the preferred embodiment, are disk shaped, each having a bevel 29 and a pair of aligned diagonal passages 30. A counterbore 31, in the under surface of each impeller, intersects each passage and forms an inlet opening around shaft 17. Each impeller 18 is secured to the shaft 17 by set screws 32. It will be noted that these impellers are substantially operated from each other in the main cylinder 12 so that the walls of the cylinder between the rotors acting with the viscosity of the oil which is being pumped provide sufficient friction to substantially slow down the rotation of the oil after it leaves the outlet passage of the rotor and before it enters the inlet passage of the next rotor or the outlet passage of the pump. It will be understood by those skilled in the art that the pressure developed by a centrifugal pump cannot be delivered at the center of rotation until the rotative speed of the fluid is reduced. I accomplish this by the friction of the cylindrical bore 12 without the insertion of any baffles, volutes, or any members in addition to the rotor and the cylinder.

A cross duct 33 extends between the shaft journal bearings 15 and 16 above the oil discharge opening 23. The restricted intermediate portion 34 of this duct is broached approximately square to prevent oil from being carried upward by capillary attraction between the shaft 17 and the wall of the cross duct.

Any lubrication which may be required between the shaft 17 and the lower restricted portion 15 is accomplished by the pumped oil which contains grit and metallic particles. The oil flowing under pressure from passage 14 flows through the lower journal 15 and then out through the duct 33. An oil bore 35 is fashioned longitudinally into the body 11 from its upper end and intersects with duct 33. This oil bore 35 holds a wick 36 which may be in the form of the ordinary wire held cotton pipe cleaner. The upper portion of this wick 36 lies in a slot 37 which extends across the face of the bearing 20 on the body 11. Thus, clean oil is fed to the bearing 20 and journal 16 by capillary attraction. Abrasive action of the grit and metallic parts in the pumped oil will wear out any journal action at 15 but upper journal 16 and bearing 20 will remain true because the lubrication which is fed to them by the wick 36 is clean and therefore there will be no appreciable wear at these points.

The shaft 17 is stabilized against the belt forces by bearing 20 and journal 16 which, accordingly, should fit closely. However, the restricted portion 15 and the impellers 18 need not fit close and their clearances may be increased up to a certain point during operation of the pump by the abrasive action of the particles in the oil. Ultimately, little or no further wear will occur at these points because of the clearances.

The peripheries of the impellers 18 need not be in close bearing contact with the wall of the cylinder and even if originally made close fits at these points, they would not remain so on account of the wear.

However, there is little or no tendency to flow across the periphery of the impeller from the outlet side to the inlet side because the speed of rotation of the oil is substantially the same at each point so that there is likely to be a constant flow of grit through the space between the cylinder and the periphery of the impeller. The oil under pressure above each impeller 18 leaking back to its inlet side stabilizes the shaft 17 as well as does the journal 16 and bearing 20.

After the oil is pumped through each of the impellers 18, it is rotating at the same speed as the impeller 18. This rotation of the oil is slowed by the frictional forces of the wall between each impeller 18 acting upon the rotating oil, whereby the oil is applied to the inlet of the next impeller 18 which has been slowed and hence under increased pressure. The space between each impeller is not critical but only must be of sufficient distance to allow the oil which has been pumped by lower impeller 18 to be slowed down so that the pressure near the inlet of the next impeller will be approximately that of pressure adjacent the walls of the body.

Various changes may be made in the details of construction, within the scope of the appended claims, without departing from the spirit of the invention. Parts of the invention may be used without the whole and improvements may be added while retaining some or all of the advantages of the invention.

I claim:

1. In an oil pump, a body member having a vertical bore therein, a shaft mounted in said bore, an impeller carried by said shaft, said impeller having an inlet near the center at its lower end and an outlet near the periphery at its upper end, a discharge outlet in said body member above said impeller, a bearing for said shaft in the upper part of said body member, a second bearing for said shaft above said first bearing and an oil return outlet to permit the escape of oil under pressure escaping from the upper end of said first bearing.

2. In an oil pump, a body member having a vertical bore therein, a shaft mounted in said bore, an impeller carried by said shaft, said impeller having an inlet near the center at its lower end, and an outlet near the periphery at its upper end, a discharge outlet in said body member above said impeller, a bearing for said shaft in the upper part of said body member, a second bearing for said shaft above said first bearing, an oil return outlet to permit the escape of oil under pressure escaping from the upper end of said first bearing, and a wick having an end positioned to receive oil escaping from said first bearing and having its upper end positioned to supply oil to the upper bearing by capillary feed only.

3. In an oil pump, a body member having a bore therein, a shaft mounted in said bore, a driven member mounted on said shaft above said body member, an impeller carried by said shaft, said impeller having an inlet opening near the center at its lower end and an outlet near the periphery at its upper end, a discharge opening in said body member above said impeller, a first bearing for said shaft in the upper part of said body member, a second bearing for said shaft above said first bearing, an oil return outlet above said first bearing to permit the escape of oil under pressure escaping from the upper end of said first bearing, a thrust bearing above said second bearing formed by said driven member and the upper end of said body member, and a wick having an end positioned to receive oil escaping from said first bearing and having its upper end positioned to supply oil to the second bearing and said thrust bearing by capillary feed only.

4. A pump for cutting oils comprising a body having a longitudinal bore, an oil intake port and an oil discharge port therein, said bore hav-

ing an enlarged portion at its lower end, and a shaft rotatably supported in the upper end of said bore by spaced upper and lower bearings, drive means affixed to said shaft and having a thrust bearing against the upper end of said body, a plurality of impellers affixed to said shaft and rotatable in said enlarged bore, and a bearing lubricating system having an oil discharge opening communicating with said bore above said lower bearing, a second bore connecting said thrust bearing with said oil discharge opening, and a wick in said second bore to apply oil to said upper bearing and said thrust bearing by capillary feed only.

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