Feb. 4, 1936. C. E. FOX 2,029,473

SUPERCHARGING DEVICE FOR OIL PUMPS

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Fig. 1.

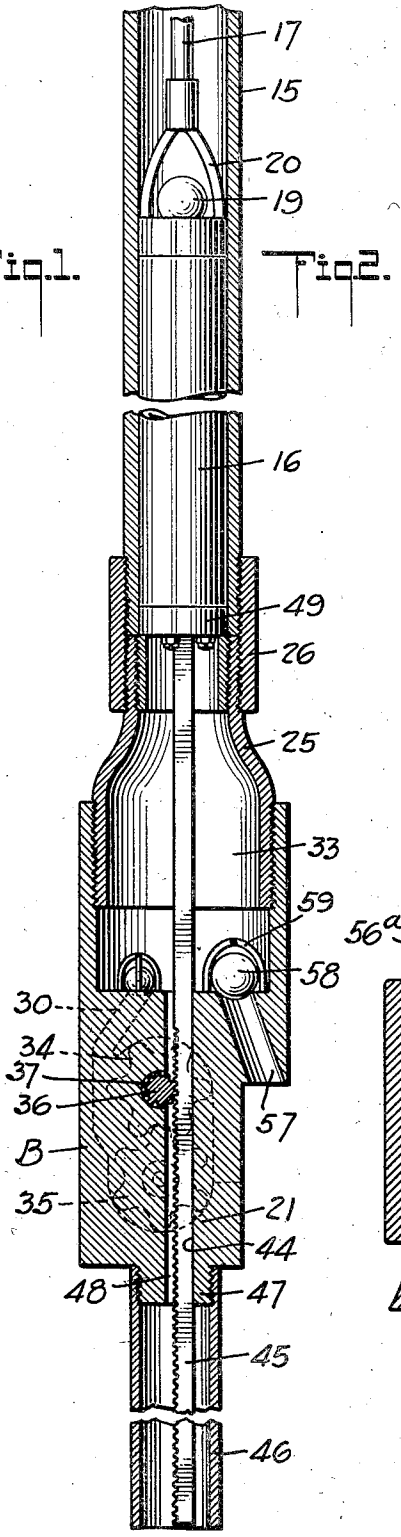


Fig. 2.

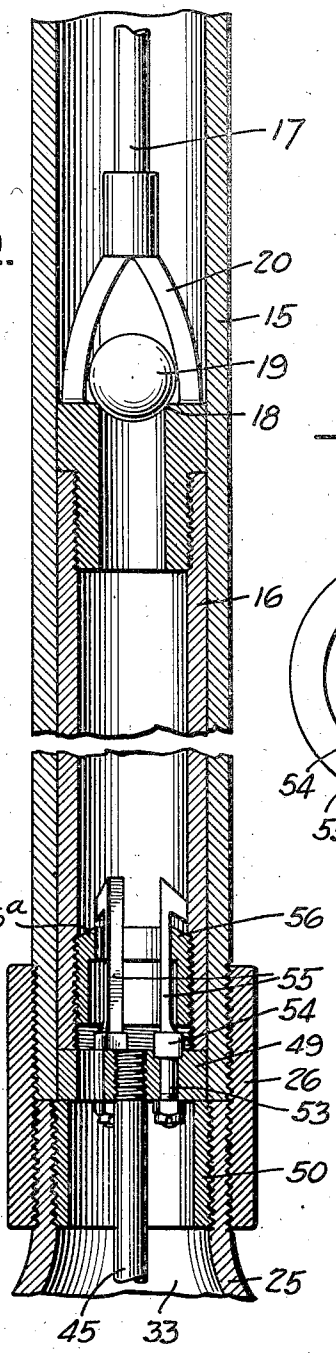
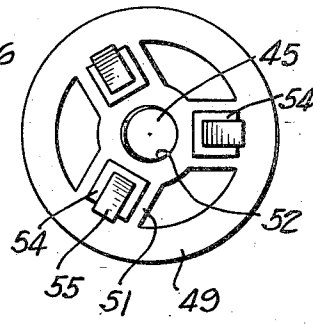


Fig. 3.



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Fig. 4.

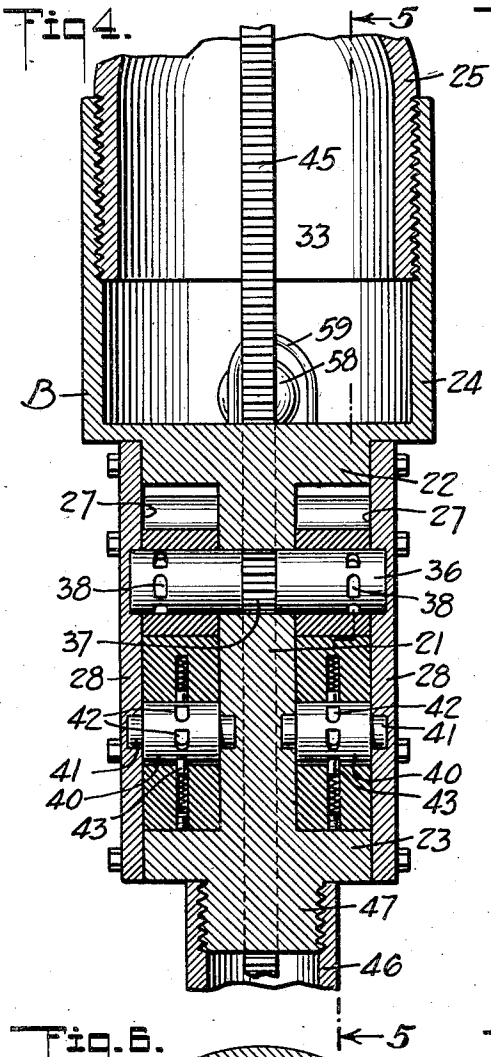


Fig. 5.

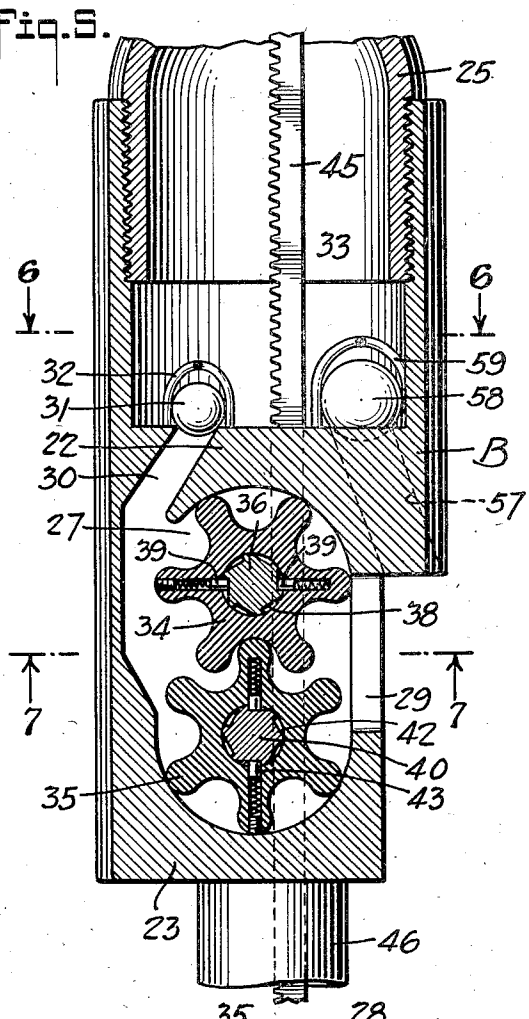


Fig. 6.

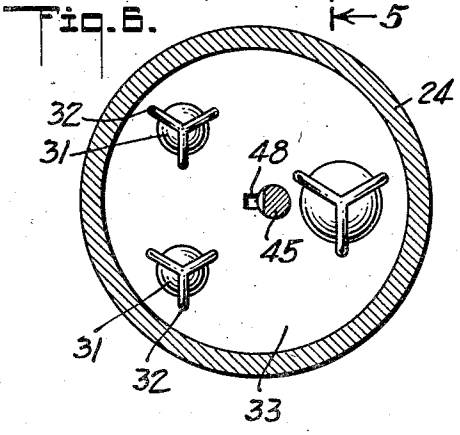
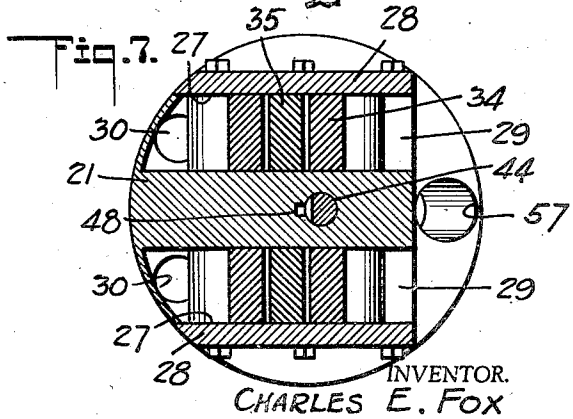


Fig. 7.



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SUPERCHARGING DEVICE FOR OIL PUMPS

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Application January 29, 1934, Serial No. 708,714

10 Claims. (Cl. 103—5)

My invention relates to fluid pumps, and particularly, although not necessarily, to pumps as used in oil wells, of the reciprocating type which embody a working barrel, a hollow plunger reciprocable in the barrel, a traveling valve on the plunger, and a standing valve below on the plunger. Oil pumps of this type fail frequently to pump oil because gas or air accumulates in the working barrel between the traveling and standing valves producing such a degree of elasticity of the fluid as to prevent proper action of the valves and resulting in cessation of oil flow through the pump.

It is a purpose of my invention to provide an auxiliary pump, booster, or what may be more aptly termed, a supercharging device for use with oil pumps of the class above described, and wherein such device functions automatically to maintain that space in the working barrel in the pump between the traveling and standing valves, completely filled with oil so that the possibility of gas or air accumulating in the pump to prevent proper valve action, is entirely eliminated, and the pump, as a consequence, functions at all times to produce a continuous upward flow of oil.

It is also a purpose of my invention to provide a supercharging device for oil pumps which eliminates the necessity for deep submersion of the lower end of the working barrel of the pump in order to attain sufficient hydrostatic pressure exteriorly of the working barrel to properly fill the latter with the oil being pumped.

A further purpose of my invention is a provision of a supercharging device which functions to inject oil into the lower end of the working barrel of the pump without disturbing the sand in the bottom of the well and thereby avoiding pumping of such sand.

I will describe only one form of supercharging device embodying my invention, and one form of reciprocating pump to which my device is attached, and will then point out the novel features of my invention in claims.

In the accompanying drawings:

Fig. 1 is a view showing in vertical longitudinal section an oil pump having associated therewith one form of supercharging device embodying my invention.

Fig. 2 is an enlarged vertical longitudinal sectional view of the oil pump showing more particularly the detachable connection between the pump plunger and the rack bar of the supercharging device.

Fig. 3 is a detailed top plan view showing a part of the detachable connection between the plunger and rack bar.

Fig. 4 is a vertical longitudinal sectional view of the supercharging device.

Fig. 5 is a sectional view taken on the line 5—5 of Fig. 4.

Figs. 6 and 7 are sectional views taken on the lines 6—6 and 7—7 respectively, of Fig. 5.

Referring specifically to Fig. 1, I have here shown a conventional type of reciprocating pump for use in oil wells. This pump includes a working barrel 15 in which works a plunger 16 adapted to be reciprocated by means of a sucker rod 17. As best shown in Fig. 2, the plunger 16 is hollow and its upper end has threaded therein a seat 18 and a traveling valve 19. A valve cage 20 secures the sucker rod 17 to the valve seat 18 and limits the traveling valve 19 in its opening movement, as will be understood.

To complete the structure of this reciprocating pump, a standing valve must be included, but in the present embodiment of my invention the standing valve is incorporated in my supercharging device, but it is to be understood that it is well within the scope of my invention to associate the standing valve with the working barrel of the pump in the usual manner and so modify my supercharging device that it is capable of association with a reciprocating pump as to avoid any structural modification of the pump itself.

The supercharging device embodying my invention, comprises a body B in the nature of a box, and this body includes a central and vertically extending partition 21 (Fig. 4) on the upper and lower ends of which are heads 22 and 23, respectively. Formed integral with the upper head 22 is a connecting collar 24 interiorly screw-threaded to have engagement with a reducing nipple 25. This nipple 25 is threadedly connected to the lower end of the working barrel 15 of the reciprocating pump by means of a coupling sleeve 26, as best illustrated in Fig. 2.

From a consideration of Figs. 4, 5, and 7, it will be seen that the body B of my device is constructed to provide chambers 27 on opposite sides of the partition 21, the outer sides of these chambers being closed by plates 28 bolted to the body. As shown in Fig. 5, each chamber 27 has an inlet opening 29 through which oil in the well is admitted to the chamber. Oil is expelled from the chamber through an outlet passage 30 controlled by an upwardly opening ball valve 31 having the usual cage 32 for limiting opening movement of the ball.

The collar 24 and the reducing nipple 25 coact to provide a continuation of the lower end of the working barrel 15, and form a chamber 33 which is at all times in communication with the lower end of the plunger 16. However, the chambers 27 of my device are in communication with the chamber 33 only when the valves are open, and hence, it will be understood that in association with the reciprocating pump, the valves 31 function as standing valves to coact with the traveling valve 19 in controlling the flow of oil to and from the plunger 16 in the usual manner.

As shown in Figs. 4 and 5, each chamber 27 contains an upper gear 34 meshing with a lower gear 35. The two upper gears 34 are mounted on a transverse shaft 36 the ends of which are journaled in the plates 28. This shaft 36 extends through and is rotatable in the partition 21, and at this point it is formed with an annular series of teeth to provide a pinion 37. Adjacent the opposite ends of the shaft 36 ratchet teeth 38 are formed thereon to be engaged by spring pressed pawls 39 which coact with the teeth to lock the gears 34 to the shaft when the latter is rotated in a clockwise direction as when viewed in Fig. 5. It will be of course understood that when the shaft is rotated in the opposite direction the pawl and ratchet mechanism just described is ineffective to secure the gears to the shaft so that the gears remain idle.

The lower gears 35 are rotatable on stub shafts 40 having trunnions 41 journaled in the partition 21 and plates 28, as best shown in Fig. 4. By means of ratchet teeth 42 on the shafts 40 and spring pressed pawls 43 on the gears 35, the gears 35 are secured to the stub shafts for rotation therewith only when the gears are rotated in a counter-clockwise direction, as when viewed in Fig. 5.

As illustrated to advantage in Figs. 6 and 7, the partition 21 is provided with vertical opening or channel 44 in which a rack bar 45 is slidably received. The teeth of the pinion 37 project into this opening 44 to mesh with the teeth of the rack bar 45 so that upon longitudinal movement of the rack bar rotation of the shaft 36 is effected. Thus it will be understood that, according as the rack bar is moved in one direction or the other, the shaft 36 will be rotated in one direction or the other, and by means of the pawl and ratchet mechanisms connecting the shaft with the upper gears 34, such gears will be rotated only when the rack bar is moved upwardly. Under such rotative movement of the upper gears, the lower gears 35 will be rotated in the opposite direction by virtue of being in mesh with the respective upper gears. Conversely, when the rack bar 45 is moved downwardly the upper gears 34 and, hence, the lower gears 35 remain at rest.

As will be seen from an inspection of Fig. 1, the rack bar 45 extends completely through and projects from the lower end of the body B of my device, it being necessary to make the rack bar of great length in order that it will continue to have engagement with the pinion 37 when moved by the plunger 16 which is operatively connected to the bar, as will be described hereinafter.

In order to protect that portion of the rack bar which projects from the lower end of the body B, during introduction of the device into a well, as well as during operation of the device in the well, a protecting sleeve or tube 46 is threaded on a reduced extension 47 of the lower end of the body B. Thus, the rack bar is adequately protected against possible injury even when fully projected from the body.

As shown in Figs. 1 and 7, the opening 44 is extended laterally throughout its length to provide a passage 48 provided for the purpose of functioning as a by-pass for oil expelled from between the teeth of the rack bar 45 and the teeth of the pinion 37. Yet at the same time, the passage 48 in receiving the oil so expelled, holds the oil in such relation to the rack bar as to provide a perfect fluid pack for the bar during its reciprocating movements to eliminate the necessity of having stuffing boxes.

Referring now to Figs. 2 and 3, the rack bar 45 is operatively connected to the lower end of the plunger 16 so as to be reciprocated with the plunger in effecting operation of the gears 34 and 35. This connection is a detachable one to facilitate the assembly and disassembly of the plunger and rack bar, and yet permit withdrawal of the rack bar with the plunger should it become necessary to pull the pump plunger from the well. Upon withdrawal of the rack bar from the body of my device, the channel 44 and the passage 48 are opened so that that oil in the working barrel as well as the oil in the chamber 33, can flow back into the well and thereby prevent what is called a "wet job" when pulling the pump.

The connection above referred to is shown in Fig. 2 as comprising a collar 49 arranged at the lower end of the plunger 16 and limited in its downward movement by a sleeve 50 threaded in the upper end of the reducing nipple 25. This collar 49 is provided with a three-armed spider 51, as best shown in Fig. 3, and the center of the spider is formed with an opening 52 in which the upper end of the rack bar 45 is threaded. Each arm of the spider receives a bolt 53 having a squared head 54 on which is formed a spring slip 55. This slip extends upwardly through an abutment sleeve 56 threaded in the plunger 16 and having an enlarged and inclined upper end 56a which the bill of the slip is adapted to engage. Thus the three slips 55 coact with the abutment sleeve in retaining the rack bar connected to the plunger, and yet these two elements can be readily disconnected when desired by unscrewing. It will be understood that when inserting the slips into the sleeve, the inclined bills or heads of the slips all engage the enlarged end 56a and are thus flexed inwardly to return to normal position once the bills pass the upper side of the enlarged end.

As best shown in Fig. 1, the body B of the device is provided with a passage 57 at the upper end of which is a ball valve 58 confined by a cage 59. This passage 57 provides communication between the chamber 33 and the exterior of the supercharging device, and it is designed for the purpose of admitting to such chamber, additional oil in the event the device for any reason fails to supply sufficient oil to the reciprocating pump to completely fill the working barrel below the traveling valve. Oil is caused to flow through the passage 57 by reason of the hydrostatic pressure of the column of oil above such passage and exteriorly of the pump and device.

The operation of my invention is as follows:

Let it be assumed that the plunger 16 is in the lower extreme position of its movement, as illustrated in Fig. 1. With movement of the plunger upwardly from this position, the traveling valve 19 closes so that the oil above the plunger is lifted within the working barrel. Concurrently

with such elevation of the plunger the rack bar **45** is moved upward to rotate the shaft **36** and thus cause rotation of the gears **34** and **35**. Thus, my supercharging device is now actuated to pump oil inwardly of the inlets **29**, through the chambers **27** and upwardly of the outward passages **30** to open the standing valves **31** and cause oil to flow into the chamber **33**.

The pumping force exerted by the gears **34** and **35** is such as to forcibly feed or inject sufficient oil into the chamber **33** as to completely fill the working barrel and particularly that space therein between the standing valves and the traveling valve. As a consequence of such complete filling of the aforesaid space any gas or air within such space or entering the same with the oil so injected, will be forced upwardly with the oil and above the traveling valve. Thus it will be seen that it is impossible for gas or air to accumulate in the working barrel to any appreciable extent, and therefore the traveling and standing valves will operate as intended to lift and produce a continuous flow of oil upwardly through the working barrel.

As the plunger **16** descends within the working barrel the traveling valve opens while the standing valves are maintained closed under the hydrostatic pressure of oil imposed thereon. Thus the oil injected into the working barrel by my device passes upwardly through the plunger and above the traveling valve. With initial upward movement of the plunger the traveling valve closes so that that body of oil above the traveling valve is lifted upwardly within the working barrel.

Concurrently with downward movement of the plunger the rack bar **45** is likewise moved, and although the bar remains in mesh with the pinion **37** to rotate the shaft **36**, because of the pawl and ratchet mechanisms the gears **34** and **35** remain idle and are thus ineffective to pump the oil.

As previously mentioned herein, should the gears **34** and **35** fail to pump oil into the working barrel in quantity sufficient to fill the latter, for any reason such as injecting a large volume of gas or air, the valve **58** will allow oil exteriorly of the device to flow into the chamber **33** and supply what additional oil is necessary to completely fill the barrel.

Although I have herein shown and described only one form of supercharging device embodying my invention, it is to be understood that various changes and modifications may be made herein without departing from the spirit of my invention and the spirit and scope of the appended claims.

I claim:

1. In combination, a reciprocating pump adapted for operation within a well; a rotary pump adapted for operation within a well; and means operatively connecting one pump to the other so that upon operation of the reciprocating pump the rotary pump would be actuated to forcibly inject fluid into the reciprocating pump.

2. In combination, a pump having a reciprocable plunger, and a standing valve below the plunger; a supercharging device below the standing valve; and an operative connection between said plunger and said device for operating the latter only upon upward movement of the plunger.

3. In combination, a pump having a reciprocable plunger, and a standing valve below the plunger; a rotary pump; a rack bar secured to said plunger; and means operatively connecting said rack bar with said rotary pump to forcibly inject fluid into said plunger through said standing valve.

4. In combination, a pump having a reciprocable plunger, and a standing valve below the plunger; a rotary pump; a rack bar for actuating said rotary pump; and a detachable connection between said plunger and said rack bar.

5. In combination, a pump having a reciprocable plunger, and a standing valve below the plunger; a rotary pump; a rack bar for actuating said rotary pump; and a detachable connection between said plunger and said rack bar, comprising a member secured within the plunger, and spring slips secured to said member.

6. In combination, a pump having a working barrel, a reciprocable plunger therein, and a standing valve below the plunger; a supercharging device including a body disposed beneath said standing valve; a rack bar secured to said plunger and extending through said body; means operatively connecting said rack bar with said device to forcibly injet fluid into said barrel through said standing valve; and a protecting sleeve secured to said body to cover that portion of said rack bar projecting from said body.

7. In combination, a reciprocable pump; a second pump; means operatively connecting one pump to the other so that operation of the reciprocating pump will effect operation of said second pump to forcibly inject fluid into the reciprocating pump; and means for admitting fluid to the reciprocating pump under the hydrostatic pressure of fluid exteriorly of the two pumps.

8. In combination, a reciprocating pump having a working barrel, a plunger, and a standing valve below the plunger; a second pump below the standing valve and in communication therewith; means operatively connecting said plunger to said second pump so that upon movement of said plunger operation of said second pump will be effected to forcibly inject fluid into said barrel; and means for admitting fluid to said barrel independently of said standing valve under the hydrostatic pressure of fluid exteriorly of the two pumps.

9. In combination, a reciprocating pump having a working barrel, a plunger, and a standing valve below the plunger; a second pump below the standing valve and in communication therewith; means operatively connecting said plunger to said second pump so that upon movement of said plunger operation of said second pump will be effected to forcibly inject fluid into said barrel; a passage between said pumps for admitting fluid to said barrel under the hydrostatic pressure of fluid exteriorly of the two pumps; and a valve for preventing discharge of fluid outwardly through said passage.

10. In combination, a pump having a working barrel, a reciprocable, valved and hollow plunger, and standing valve below the plunger; a rotary pump below the standing valve and comprising a body provided with an opening therethrough, a gear in the body; and a rack secured to the plunger, slidable in said body opening, and meshing with said gear; said body having a passage therein communicating and coextensive in length with said opening for allowing liquid expelled from between the teeth of the rack bar and gear to pass inwardly or outwardly of the pump body.

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