Aug. 23, 1949. F. P. BUCKLEIN 2,479,724

PUMP

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Fig. 1

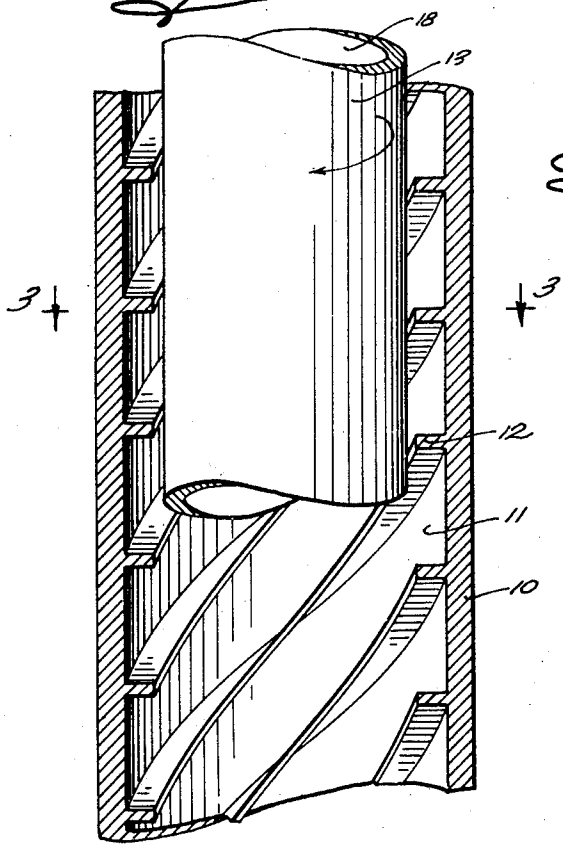


Fig. 2

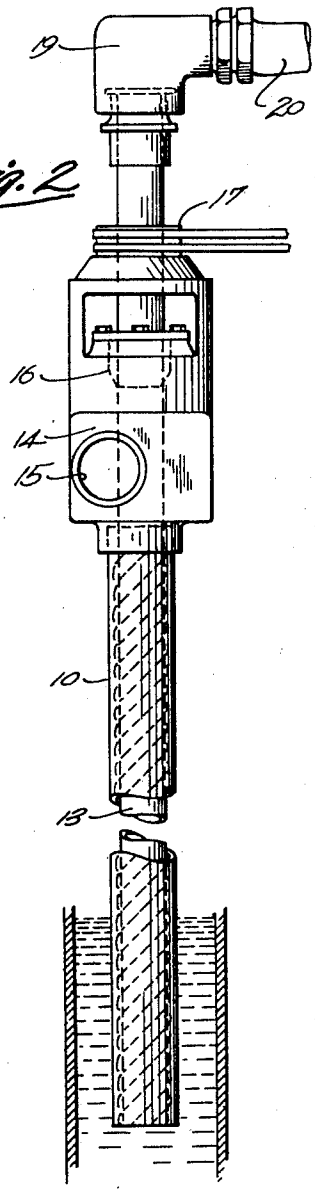
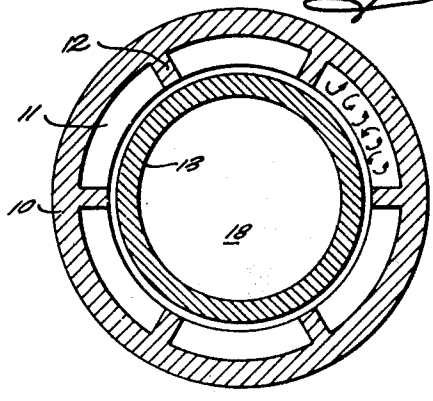


Fig. 3



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2 Claims. (Cl. 103—83)

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This invention relates to improvements in pumps.

An object of the invention is to provide an improved pump which is of relatively simple and durable construction and which is highly efficient in its operation.

Another object of the invention is to provide a pump in which there is an outer casing having on its interior one or more helically arranged passages in close proximity with which a cylindrical rotor or runner is rotatable that defines the inner walls of the passages and which during its rotation causes liquid being pumped to progress lengthwise of the casing through the passages in a highly efficient manner.

Another object of the invention is to provide a pump suitable for pumping wells such as oil wells having the above described characteristics and which is characterized by the rotor being hollow with provision being made for introducing a fluid through the rotor that may be advantageously used in the well in the course of pumping.

With the foregoing and other objects in view, which will be made manifest in the following detailed description and specifically pointed out in the appended claims, reference is had to the accompanying drawings for an illustrative embodiment of the invention, wherein:

Figure 1 is a sectional view through a typical portion of the improved pump;

Fig. 2 is a view in side elevation of the pump illustrating it as being used in pumping a well; and

Fig. 3 is a horizontal section taken substantially upon the line 3—3 upon Fig. 1.

Referring to the accompanying drawing wherein similar reference characters designate similar parts throughout, the improved pump consists of an outer case or housing 10 of generally cylindrical form and having on its interior one or more helically arranged passages 11. These passages may be defined in any suitable manner such as by helical vanes 12 that may be formed integral with the body of the case or which may be separately formed and introduced into the case. The number of the passages 11 may vary and in some instances there may be but a single helical passage. I have built a pump embodying the present invention wherein the vanes 12 are provided merely by the convolutions of a helical spring dropped into an outer cylinder. Such spring defines but a single helical passage 11 within the case. In the preferred form of construction, however, the number of helical

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passages 11 exceeds a single passage and as illustrated there are six of such passages defined by the vanes 12. The inclination of these passages may likewise vary although I prefer that the pitch of the passages be approximately 45° with most liquids.

Within the case there is disposed a cylindrical rotor or runner 13. This rotor or runner presents cylindrical external walls which define the inner walls or sides of the passages 11. They are arranged in close proximity with the inner edges of the vanes and although there may be some substantial clearance between the rotor or runner and the vanes as indicated in Fig. 3 when relatively heavy or viscous liquids are being pumped the clearance should not be very great. Where thin highly fluid liquids are being pumped the clearance should be correspondingly reduced and in some instances the exterior of the rotor or runner 13 may actually engage the inner edges of the vanes and bear against them in which case the vanes serve to provide a bearing or stabilizer for the rotating runner.

In Fig. 2 the pump is illustrated as being installed in a well such as an oil well in which case the case 10 may be formed of the conventional tubing and the vanes 12 either formed therein or supplied by additional parts that are introduced into the tubing. These vanes may extend continuously throughout substantially the complete length of the tubing or the vanes may be located only at spaced intervals throughout the length of the tubing. 14 indicates a tubing head in which there is an outlet 15 for the pumped liquid. The tubing head is equipped with a packing gland 16 around the rotary rotor or runner. The rotary runner may be driven in any suitable manner such as that indicated by the belt drive at 17, for example. The rotor or runner is preferably hollow from end to end or has a passage 18 therethrough. The upper end of this passage communicates with the interior of a swivel case 19. By having the rotor or runner hollow the weight of the runner is materially reduced and if desired a fluid may be introduced through the swivel case and forced downwardly through the rotor. To this end a hose connection 20 leads to the swivel case and may supply it with gas, solvents, or high temperature liquids that can be discharged from the runner in the well during the course of pumping. Thus in an oil field where repressuring conditions may be required gas under pressure may be discharged downwardly through the runner. In other situations solvents or high temperature liquids may be dis-

charged to dissolve or melt heavy liquids that it is desired to pump.

In operation the rotor or runner is driven continuously relatively to the case 10 which remains stationary or substantially so. The optimum speed of rotation will vary depending upon the diameter, the depth of the helical passage, and the viscosity of the liquid being pumped.

While the exact nature of the performance of the liquid within the passage is difficult to ascertain from the observation I have made apparently what transpires is as follows: The liquid in the passages is, of course, in contact with the exterior surfaces of the rotor and as the rotor rotates this liquid that is immediately adjacent the rotor is frictionally carried with it. If increment of liquid however sets up within the passage a type of rolling action such as is indicated by arrows on Fig. 3 so that in effect the liquid rolls up the helical passages rolling on the stationary outer walls of the passages and being impelled by the movable inner walls afforded by the exterior surface of the rotor, this rolling action causes the liquid to be driven up the helical passages with a minimum resistance. While probably that film of liquid that is in contact with the outer walls of the passages and with the sides of the vanes 12 remains stationary so the ball of the liquid rolls thereon. The rolling action is probably set up by the combination of the frictional engagement between the liquid and the exterior of the rotor and the centrifugal force imparted to the liquid as soon as it is picked up and is carried by the rotor.

As it is possible to have a substantial clearance between the rotor and the internal edges of the vanes the pump may be advantageously employed in pumping liquids containing finely divided solids such as for example pumping wells wherein the oil contains substantial amounts of sand. The sand particles can readily pass up through the clearance space without wearing the rotor or the vanes. The clearance space when employed should not be excessive for I have observed that if the clearance is too great that the liquid instead of rolling up the inclined passages will merely spill through the clearance space from passage to passage and will not be elevated by the rotor.

While the pump is merely shown as having its lower end submerged in the liquid that is to be pumped, it will be appreciated that any conventional or preferred type of standing valve or foot valve may be used in conjunction with the pump if desired.

From the above described construction it will be appreciated that the improved pump is of very simple construction and the parts are so arranged that they will not be easily worn. Even the presence of grit in the liquid being pumped will not severely wear the working parts of the pump and will not interfere with its normal operation. The construction of the pump also lends itself to the forcing through the rotor of a fluid that it may be desired to introduce into the well while it is being pumped.

Various changes may be made in the details of construction without departing from the spirit and scope of the invention as defined by the appended claims.

I claim:

1. A pump comprising an outer generally cylindrical case on the interior of which there extends from substantially end to end thereof one or more continuous helical grooves, and a rotor within the case presenting a smooth cylindrical surface in close proximity to the inner ends of the walls of the grooves whereby upon rotation of the rotor relative to the case fluid will be induced by the rotor to proceed with rolling action through the grooves from one end of the case to the other, said rotor being hollow and open from end to end thereof.

2. A pump comprising an outer generally cylindrical case on the interior of which there extends from substantially one end to the other one or more continuous helical vanes defining therebetween helical grooves, and a rotor within the case presenting a smooth cylindrical surface in close proximity to the inner edges of the vanes whereby upon rotation of the rotor relative to the case fluid will be induced by the rotor to proceed with rolling action through the grooves from one end of the case to the other, said rotor being hollow and open from end to end thereof, and a swivel case secured to the top of the rotor enabling fluids to be conducted through the rotor.

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