Nov. 3, 1953 J. G. BAKER 2,657,637

PITLESS WELL CONSTRUCTION

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Fig. 1

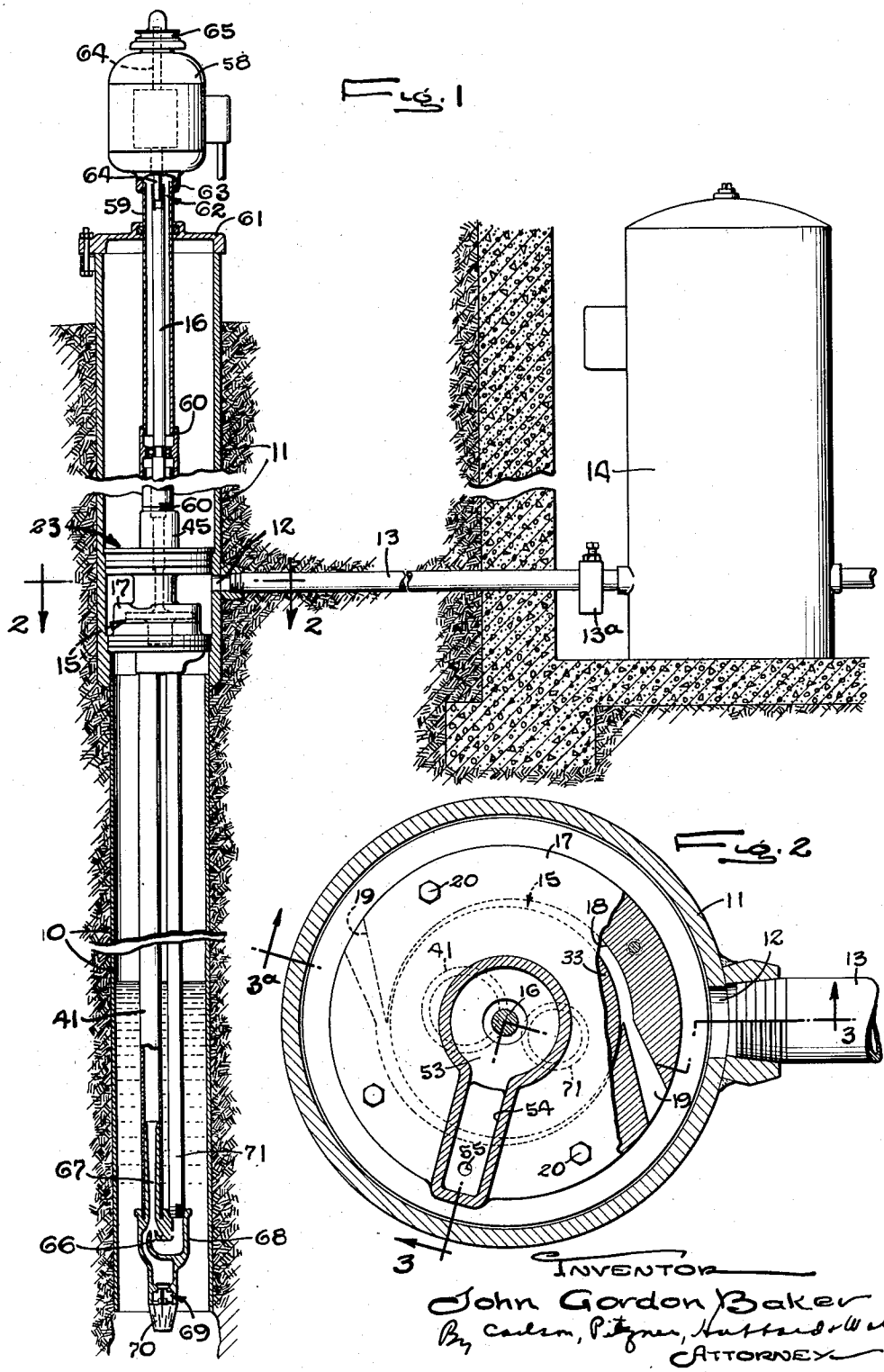


Fig. 2

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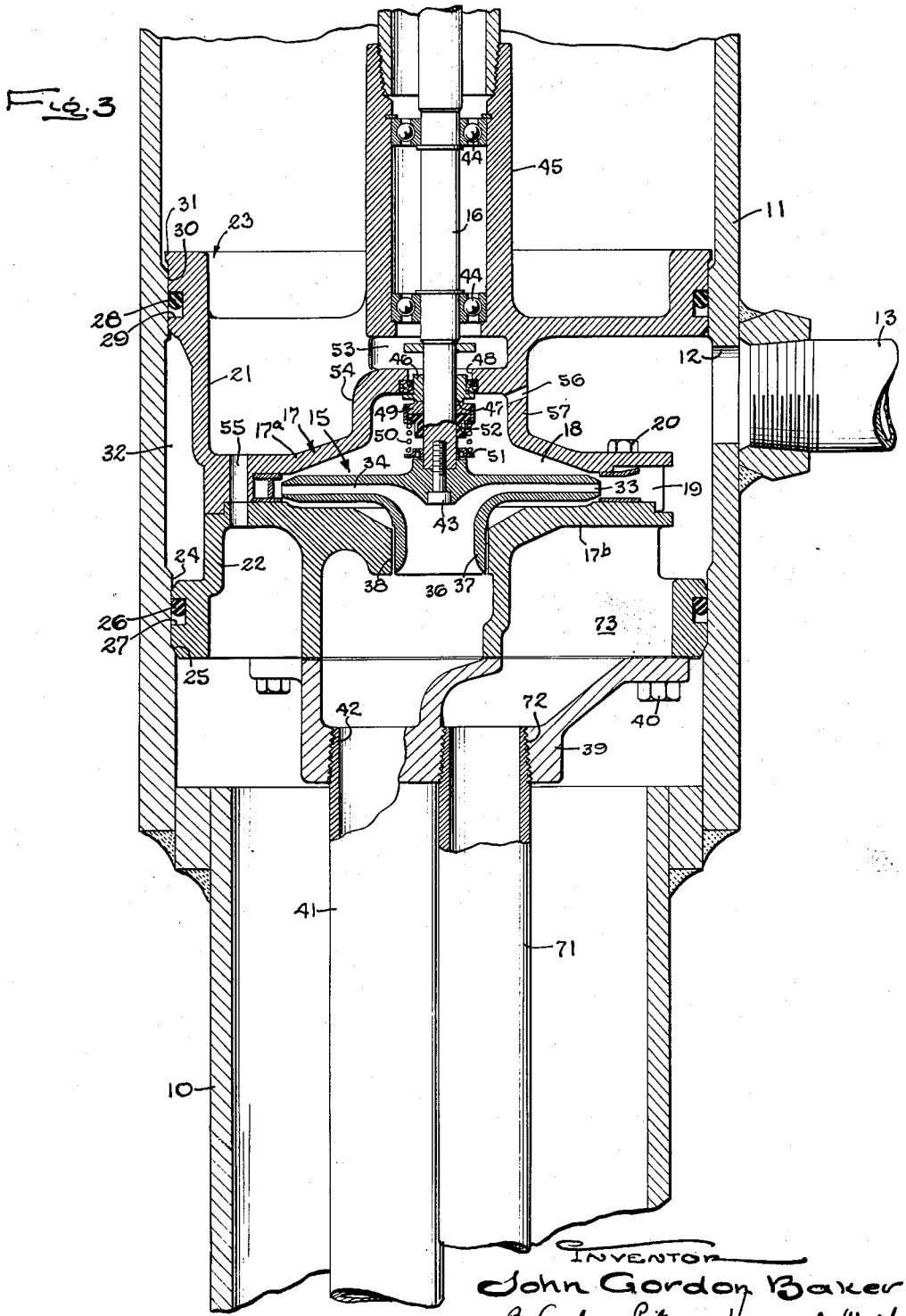
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Fig. 3



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PITLESS WELL CONSTRUCTION

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2 Claims. (Cl. 103—103)

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This invention relates to well constructions of the so-called pitless type in which the pump and the associated parts may be inserted in and withdrawn from the well casing which extends upwardly above the ground surface.

The general object of the present invention is to adapt a centrifugal pump to a pitless well of the above character so as to minimize pipe losses, permit the well casing to be of minimized diameter, enable the pump to be driven conveniently from an auxiliary power source, and eliminate the danger of water contamination by avoiding any piping located externally of the well and subjected to subatmospheric pressure.

A more detailed object is to support a rotary centrifugal pump and its axially extending drive shaft on a head which may be inserted and removed readily from the well casing, which itself forms the pump casing, and which cooperates with the casing to provide the necessary water outlet passage.

Another object is to construct the centrifugal pump and arrange the same on the supporting head in a novel manner so as to avoid trapping air at any point where such air would be detrimental to the operation of the pump.

The invention also resides in the novel arrangement of the parts which permits the centrifugal pump unit to be operated in conjunction with a booster jet without destroying the pitless character of the installation.

Other objects and advantages of the invention will become apparent from the following detailed description taken in connection with the accompanying drawings, in which

Figure 1 is a fragmentary longitudinal vertical cross section of a water pumping system embodying the novel features of the present invention.

Fig. 2 is a cross section taken along the line 2—2 of Fig. 1.

Fig. 3 is a fragmentary vertical cross section taken along the line 3—3 of Fig. 2 with the lower part of the pump casing broken away and shown as a section on the line 3—3a of Fig. 2.

While the invention is shown in the drawings incorporated in a deep well installation, it is also applicable to other types of wells employing centrifugally acting pumps. It is to be understood, therefore, that I do not intend to limit the invention by the present disclosure, but aim to cover all modifications and alternative constructions falling within the spirit and scope of the invention as expressed in the appended claims.

The well construction comprises a tubular casing having a lower section 10 projecting downwardly beyond the water line of the well and a cylindrical upper section 11 of somewhat larger diameter projecting substantially above the ground surface. Below the frost line, the casing section 11 is apertured at 12 and threaded for connection with a delivery pipe 13 which is extended horizontally and outwardly through the building wall to the usual water storage tank 14. For installations of the jet type, the usual valve 13a included in the pipe 13 operates to pass water to the tank when a predetermined pressure has been developed.

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In accordance with the present invention, the centrifugal pump 15 for producing the primary lifting action is removably mounted wholly within the casing section 11 and arranged to be driven by a shaft 16 extending upwardly along the axis of the casing 11 to a point above the top thereof. The pump comprises a housing 17 defining a generally flat and circular recess 18 communicating at angularly spaced points with tangentially extending passages 19 which flare outwardly and are open at their outer ends. Herein, the housing is cast in two parts 17a and 17b clamped together by bolts 20 and having integral therewith flanges 21 and 22 which project in opposite directions from the pump housing concentric with the axis thereof and which cooperate with the pump housing to form a supporting head or spool indicated generally at 23. At its lower end, the flange 22 fits loosely within a cylindrical surface 24 machined in the well casing 11 and terminating at a shoulder 25 on which the flange rests in the final assembly. A ring 26 of suitable yieldable material such as rubber is compressed in a groove 27 around the flange and bears against the surface 24 to form a pressure tight seal.

In a similar way, a ring 28 of yieldable material is seated in a groove 29 around the upper end portion of the flange 21 and bears against a cylindrical surface 30 in the casing 11 to form a pressure tight seal around the top of the supporting spool 23. Preferably, the surface 30 is somewhat larger in diameter than the lower surface 24 so that the lower ring 26 will, as the spool is lowered into the well, pass the surface 30 without substantial rubbing contact with the latter. During such insertion of the spool, both of the rings 26 and 28 are held out of contact with the interior of the casing 11 by a centering flange 31 which is located at the upper end of the flange 21 and is of a diameter somewhat greater than the expanded size of the rings.

Between the seal rings, the flanges 21 and 22 are spaced inwardly from the casing wall and

cooperate with the latter to define an annular recess 32 which communicates with the pump outlet passages 19 and with the casing outlet 12. As shown in Fig. 3, the latter is disposed near the top of the annular recess 32 so as to permit air accumulating in the recess to escape through the outlet and the delivery pipe 13.

The impeller 33 of the pump 15 is of well known construction and journaled in the casing 17 to rotate in a horizontal plane, the outer ends of its centrifugal passages 34 being movable across the inner ends of the outlet passages 19. At their inner ends, the impeller passages communicate with the suction inlet 36 of the pump through a hollow hub 37 which is integral with the impeller and fits with a close clearance in a cylindrical part 38 in the lower part 17b of the pump casing. The inlet 36 is cored in the casting 17b and a casting 39 clamped against the bottom of the latter by screws 40. Water from the well is delivered to the pump inlet 36 through a vertical suction pipe 41 disclosed within the casing section 10 and threaded at its upper end 42 into the casting 39.

Within the pump casing 17, the impeller 33 is clamped by a screw 43 to the lower end of a drive shaft 16 which extends upwardly along the axis of the well casing 11 and is journaled in spaced anti-friction bearings 44 mounted in a tubular extension 45 which is cast integral with the upper part 17a of the pump housing. Beyond the lower bearing 44, the lower end portion of the shaft 16 projects loosely through a ring 46 pressed into a hole 48 in the housing wall and having a flat inner end surface 47. The latter bears against a similar surface on a ring 49 urged against the ring 46 by a spring 50 which acts between the ring 49 and a shoulder 51 on the upper hub of the impeller 33.

The ring 49 is sealed around the shaft 16 by a sleeve 52 of yieldable material. The pump casing is thus effectually sealed around the shaft 16. Any water escaping between the engaging surfaces of the rings 46 and 49 is received into a recess 53 cast in the pump housing and opening laterally at the top of a well 54 in the top of the spool 23. Such leakage water flows down through a hole 55 and is returned to the well.

To maintain efficient operation of the pump and effectiveness of the seal around the drive shaft, provision is made for effective disposal of the air which is drawn into the pump casing along with the water being pumped. For this purpose, the uppermost part of the pump recess 18 is disposed below the upper part of the outlet 12 from the well casing and also communicates with the annular recess 32 around the supporting head 23. Herein, such communication is achieved through a hole 56 formed at the top of the cylindrical part 57 of the pump casing. With the pump chamber thus constructed and arranged, any air entering the pump will rise in the chamber 18 and escape out through the hole 56, the recess 32, and the delivery pipe 13. The pumping system is thus freed of air automatically and the engaging surfaces of the shaft seal are at all times kept submerged in water by which they are lubricated effectually. Wear at the rubbing surfaces of the rings 46 and 49 is thus minimized so that the shaft seal will remain effectual through long service use.

The shaft 16 is driven by a rotary power actuator, an electric motor 58 in this instance whose frame is held against turning with respect to the supporting spool 23 so that the driving torque applied to the shaft does not tend to turn the spool and the seal rings 26 and 28 within the well casing. To this end, the motor housing is fast on the upper end of a tube 59 whose lower end is coupled as by threads 60 to the tubular extension 45 of the pump casing. The tube 59 projects through and is centered relative to the well casing 11 by a cap 61 bolted to the top of the casing.

One end bell of the motor housing is threaded at 63 onto the upper end of the tube 59 through which the shaft 16 extends for connection by a coupling 62 with the lower end of the vertical motor shaft 64. Since the motor housing is thus connected rigidly to the pump casing 17, the motor torque is applied directly to the pump impeller and there is no tendency for the spool 23 to turn within the well casing during operation of the motor.

With the rotary pump thus mounted in the well exteriorly of the building to be supplied with water and with the drive shaft disposed vertically, the pump may be operated readily from an auxiliary source of power in the event of failure of the electric power supply. This is accomplished simply by attaching a drive pulley 65 to the upper exposed end of the motor shaft 64. A suitable belt may be extended around the pulley when it is desired to operate the pump by a tractor or other stand-by power source.

The pump 15 mounted within the well casing in the manner described above, is especially adapted for use in deep well pumping systems of the so-called jet type in which water at the pump outlet pressure is forced through the nozzle 66 and into a Venturi tube 67 whose inlet end communicates with the body of water in the well. Herein, the Venturi tube is mounted in the lower end of the tube 41 which leads to the pump inlet 36. The lower end of the tube 41 threads into a casting 68 in which the jet nozzle 66 is formed above a foot-valve 69. The lower end of the casting is open and covered by a screen 70.

The nozzle is supplied with water under pressure through a pipe 71 disposed alongside the suction pipe 41 and threaded at its lower end into the jet casting 68. At its upper end, the pipe threads at 72 into a hole formed in the bottom cap 39 of the spool 23 and communicating through a passage 73 in the spool with the annular passage 32 into which water is discharged under pressure by the pump. In operation, part of the water delivered by the pump is forced back through the pipe 71 to the nozzle 66 and the resulting Venturi action draws water from the well upwardly through the screen 70 and forces the same upwardly into the pipe 41 from which it is drawn into the pump proper.

With the deep well installation thus provided, it will be observed that the Venturi unit 74 and all parts of the passages for supplied water under pressure to the nozzle 66 are disposed wholly within the well casing leaving the single delivery pipe 13 as the only connection between the well casing and the tank 14. The latter pipe is always under pressure and, as a result, there is no possibility of the water being contaminated by seepage into the system through leaks which may inadvertently exist or develop in service.

To install the pump above described, the pump, the pipes 41 and 71, the Venturi unit 74, and the tube 59 are joined together as a rigid assembly and lowered endwise into the upper part of the well casing 11. When the lower end of the spool seats on the bevel 25, the rings 26 and 28

will be compressed within the casing forming pressure tight seals at opposite ends of the spool. The cap 61 is secured in place and the motor attached thus completing the installation. If it becomes necessary in service to remove the pump for repair or otherwise, the whole assembly may be withdrawn from the well after removing the bolts for the cap 61.

I claim as my invention:

1. In a pitless well construction, the combination of, an elongated casing adapted to be opened at the top, a hollow head insertable into and withdrawable endwise from said casing from the top thereof and cooperating with the interior thereof to define an outlet recess, a pump chamber within said head, a centrifugal pump having an impeller disposed within said chamber and journaled in said head, a shaft carrying said impeller and extending upwardly along said well casing for actuation from a point above the top of the latter, said recess extending upwardly at least as high as said chamber, means on said head defining a passage connecting the upper portion of said pump chamber with said recess and permitting the natural flow of air from the pump chamber into the recess, and means defining a water delivery outlet extending laterally through said casing near the upper part of said recess.

2. In a pitless well construction, the combination of, an elongated casing adapted to be opened at the top, a hollow head insertable into and withdrawable endwise from said casing from the top thereof and cooperating with the interior thereof to define an outlet recess, a pump chamber within said head, a centrifugal pump having an impeller disposed within said chamber and journaled in said head, a shaft carrying said impeller and extending upwardly along said well casing for actuation from a point above the top of the latter, means on said head defining a passage connecting the upper part of said pump chamber and said recess and permitting the natural flow of air out of the chamber and into the recess whereby to maintain the chamber substantially filled with water at all times, and a water delivery outlet extending through said casing and communicating with said recess to permit air flowing through said passage to escape through said outlet.

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