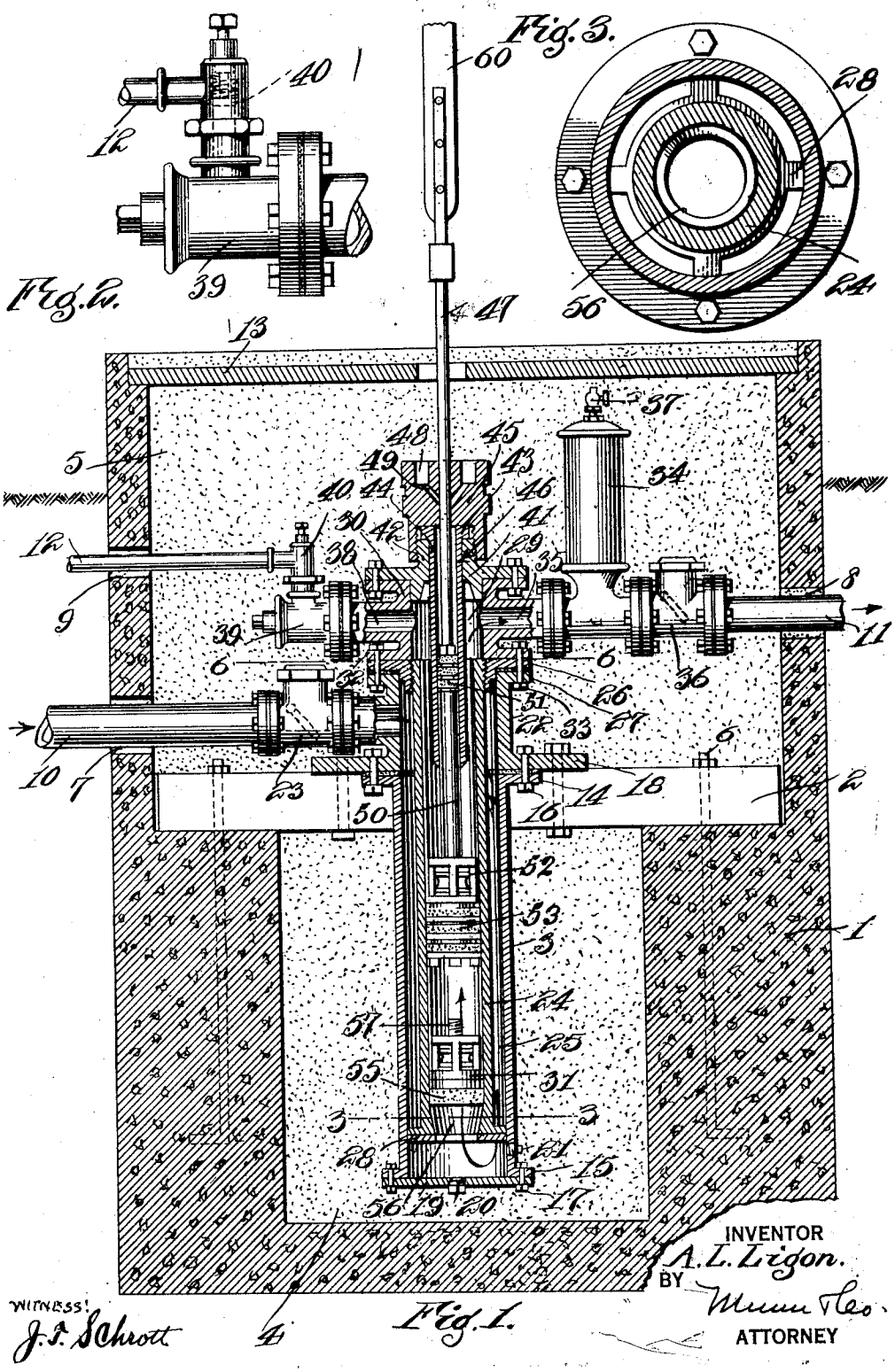
March 29, 1932. A. L. LIGON 1,851,915

BOOSTER PUMP FOR WINDMILLS

Filed May 16, 1929 2 Sheets-Sheet 1



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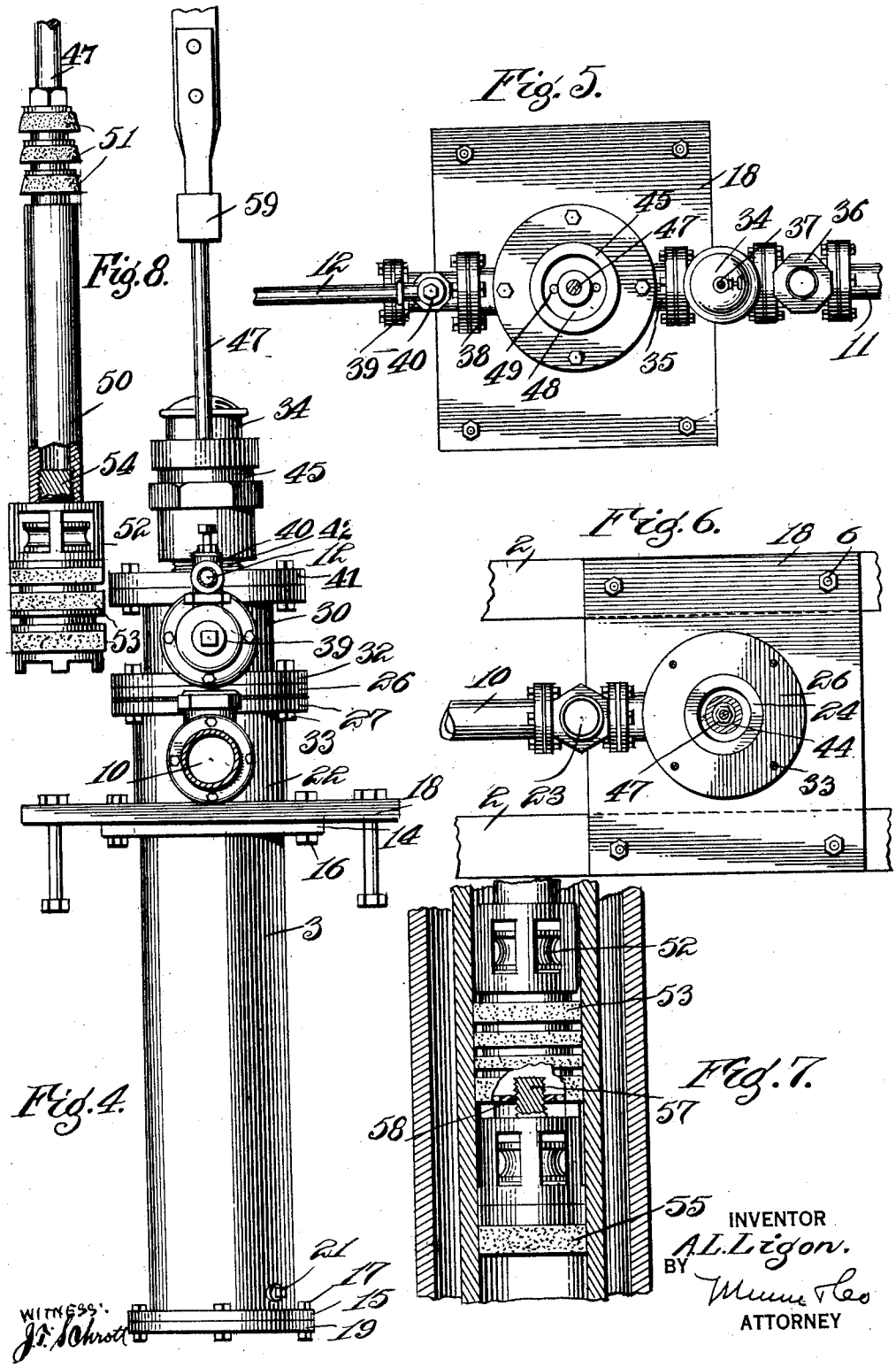

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UNITED STATES PATENT OFFICE

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BOOSTER PUMP FOR WINDMILLS

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This invention relates to improvements in pumping apparatus, and it consists of the constructions, combinations and arrangements herein described and claimed.

An outstanding object of the invention is to provide a booster for particular use in connection with windmills, the structure being such that heavy pressure can be imposed upon the water on the up-strokes of the mill thereby to force the water through a pipe line of comparatively great length.

A further object of the invention is to provide a booster pump which has the valuable attribute of separability, it being possible to disassemble the pump in sections or by stages, so to speak, in order that certain successive parts can be gotten at for replacement or repair without necessarily removing the entire apparatus from its foundations or without necessarily taking the whole apparatus apart.

A still further object of the invention is to incorporate in the pumping apparatus a novel form of stuffing box which not only partakes of the foregoing attribute but it possesses the more important feature of preventing the by-passing or pumping of water.

A still further object of the invention is to employ a relief valve in connection with the pumping apparatus for the purpose of preventing damage to the latter should the pipe line for any reason become stopped up.

Other objects and advantages will appear in the following specification, reference being had to the accompanying drawings in which:

Figure 1 is a vertical section of the improved pumping apparatus, parts being shown in elevation,

Figure 2 is a detail view of the relief valve,

Figure 3 is a horizontal section taken on the line 3—3 of Figure 1, particularly illustrating the spider hereinafter referred to,

Figure 4 is a front elevation of the pumping apparatus, parts being shown in section,

Figure 5 is a plan view of the apparatus, the solid plunger rod being shown in section,

Figure 6 is a horizontal section taken on the line 6—6 of Figure 1,

Figure 7 is a detail sectional view illustrating the manner of picking up the standing valve upon desiring to renew the cup leathers,

Figure 8 is a detail side elevation, partially in section, of the so-called packer plunger.

It is common knowledge that there are many persons, especially in the outlying regions of this land, who rely largely if not entirely, for their water supply upon the operation of windmills. In many instances the windmill has imposed upon it the duty of forcing water from a given source through a long pipe line sometimes several miles in length. In the majority of instances, the water thus supplied is taken from a storage tank located either on or above the surface of the ground. In addition to overcoming the friction of the pipe line it is often necessary for the windmill to deliver the water at an elevation considerably greater than its origin.

The common practice is to make the downstroke of the mill the working stroke of the pump. It has been demonstrated that this mode of operation is particularly hard on the windmill mechanism, so much so that when an especially heavy load is imposed upon the windmill it is not unusual that the apparatus will become disabled. It is one of the purposes of the invention to reverse this mode of operation, namely to employ the upstroke of the windmill as the working stroke of the pumping apparatus. This is by far easier on the windmill.

In addition to this, it is a further purpose of the invention to permit the ready disassemblage of the pumping apparatus. The latter will often be used in remote places where the making of repairs and replacements will ordinarily be made with great difficulty. It is not necessary to dismount the entire apparatus from its foundations for the purpose of making many internal repairs, it being possible to abstract all of the inside parts from the suspended stationary casing, and this in successive stages as will presently appear. The removal of cup leathers will probably call for a disassemblage of the parts most frequently, and this also is easily accomplished either by the removal of the guide cap or such succeeding parts as lie in advance thereof.

Reference is made to the drawings. A foundation 1 supports the sills 2 from which a casing 3 is stationarily suspended in the

lower one of a pair of chambers 4 and 5 incorporated in the foundation. Anchor bolts 6 hold the sills 2 down, a particular purpose of locating the pumping apparatus within the chambers 4 and 5, which in effect constitute a pit, being to well avoid the frost line. Openings 7, 8 and 9 in the sides of the chamber 5 admit the intake and discharge pipes 10 and 11 and the relief pipe 12 in the numerical order of the openings. A board or other cover 13 provides a closure for the pit.

Flanges 14 and 15 at the upper and lower ends of the casing 3 have holes to receive bolts 16 and 17 that secure the casing to a bed plate 18 and a bottom cover 19 to the flange 15. The bottom cover has a sediment plug 20, while a drain hole in the adjacent side of the casing 3 may or may not be kept closed by a plug 21. A suitable packing is interposed between the flange 14 and bed plate 18 to make an absolutely water-tight joint. The bed plate comprises part of an intake collar 22 with which the intake check valve 23 is coupled as shown in Figure 1. This valve is located between the pipe 10 and the collar 22.

Situated within the casing 3 is a working barrel 24. This, like the casing, occupies a stationary position. It is spaced from the casing 3 to define an intake chamber 25. It is in this chamber that the water is received from the intake pipe 10 prior to its passage up the stationary working barrel 24 on its way to the discharge pipe 11. A ring 26, applied to the top flange 27 of the intake collar 22 has threads into which corresponding threads of the working barrel 24 are screwed thus to suspend the barrel in its working position. A spider 28 (Figs. 1 and 3), fitted upon the lower end of the barrel 24 keeps the latter in a true central position.

It is observed that the ring 26 makes a tight seal between the intake chamber 25 and the outlet chamber 29 of a coupling 30. The two chambers may communicate with each other only through the standing valve 31 and in order to prevent such communication around the ring 26 the latter is adequately packed in any customary manner. It is further observed that the working barrel 24 and casing 3 are concentric, although it is conceivable that they may not necessarily be so, one being suspended within the other, the working barrel relying upon the sills 2 for its support in common with the rest of the pumping apparatus.

The coupling 30 has a flange 32 which is superimposed upon the ring 26. Bolts 33 secure the ring between the flanges 32 and 27, the packings formerly alluded to being indicated. An air chamber 34 is connected with the outlet port 35 of the coupling 30, this chamber being interposed between the coupling and the outlet check valve 36. The latter communicates with the outlet pipe 11 and prevents the return of water after it has once been forced from the apparatus. The chamber 34 has an air cock 37 at the upper end. A relief port 38 branching from the chamber 29 has a connected fixture 39 to which a relief valve 40 is joined.

This valve is intended for the relief of water from the apparatus when under excessive pressure. Circumstances may arise when the pipe line becomes obstructed. In such case a continued operation of the pumping apparatus might impose such a pressure upon the water as may seriously damage the mechanism. Instead of the water being driven in the direction of the outlet pipe 11 it would escape through the relief valve 40 into the relief pipe 12 and into such reservoir as may be provided. The relief valve is regarded as an important provision in the pumping apparatus.

A cap 41 provides a top closure for the chamber 29. It is bolted down as shown. It has an upstanding hub 42 which not only supports the head 43 of a packing tube 44 but also serves as the mounting for the guide cap 45 which, in being screwed upon the hub 42, bears down upon the head 43 and maintains the packing tube in an immovable position. The guide cap is necessarily chambered to receive both the hub 42 and the head 43 of the packing tube 44. The hub has a bore 46 into which the packing tube is inserted so that it may assume its suspended position within the working barrel 24.

Thus far it will be clear that the structure of the pumping apparatus comprises a succession of supports from which elements 3, 24 and 44 are successively suspended in concentric relationship. By removing the guide cap 45 one will have immediate access to the packing tube 44. Should it be necessary to gain access to the working barrel 24 one has only to remove the coupling 30. Sometimes the working barrel will show wear on the inside, and in such case a new one can be screwed into the ring 26. The last one of the succession of concentric elements comprises the solid plunger rod 47. This is in the nature of a polish rod.

This rod has guidance in the cap 45 whence the latter obtains its name. An annular well 48 has one or more ducts 49 through which oil will be fed from a supply in the well to the bore of the guide cap and to the inside wall of the packing tube 44. The lower end of the rod 47 is connected with a packer plunger 50 which is in tubular form. It carries a plurality of cup leathers 51 at the upper end. The packer plunger is nearly the same in external diameter as the tube 44 is in internal diameter. There is a very particular purpose in this arrangement.

By having the packer plunger 50 full size throughout its entire length from the point where the cup leathers 51 begin to the point where it connects with the valve cage 52 there

will be practically no displacement of water on the down-stroke of the plunger valve 53. The cup leathers 51 constitute a packer, the purpose of which is to prevent the by-passage of water into the upper end of the tube 44 on the downstroke of the plunger valve. If the plunger 50 were of a reduced diameter, the packer would act more or less in the capacity of a piston, not only displacing water from the end of the tube 44 on the down-stroke and thus adding a material resistance to the down-stroke of the windmill which should be as free as possible, but also exposing the upper end of the tube 44 to the likelihood of receiving a quantity of water.

By making the packer plunger 50 nearly as large as the bore of the tube 44, the cup leathers or packer 51 are protected to a material extent. Large volumes of water are kept away from the packer and such small amount as may reach the cup leathers will be turned aside so that the upper end of the tube will never become wet with water. The plunger valve 53 may be of any known construction. It has cup leathers as shown, and a threaded stud 54 located at the top is screwed into the threaded end of the plunger 50 to make the necessary connection between the two.

The standing valve 31 may also be of a substantially conventional structure. A possible exception is the addition of a cup leather or leather facing 55 on the outside as shown in Figures 1 to 7. This facing is compressible to a limited extent and will serve not only to make a tight joint when the plunger valve is pressed into place, but also maintains a good grip with the bevelled entrance 56 to the working barrel 24. The standing valve is simply pushed down into the beveled entrance and under ordinary circumstances will stay in place. A probable exception to the conventional structure of the standing valve is the provision of a threaded stud 57 on the order of the stud 54 previously mentioned. The plunger valve 53 has a threaded bore 58 into which the stud 57 can be screwed by turning the plunger rod 47 for the purpose of abstracting the standing valve after the plunger rod has been disconnected at 59 from the windmill pump pole 60.

The operation is readily understood. The plunger valve 53 opens upwardly, that is to say, when the plunger 47 makes a down-stroke water below the plunger valve will be transferred to the upper part of the working barrel 24. At such a time the standing valve 31 will close. The two valves operate in the the same directions, but when one is open the other is closed as will readily be apparent from a study of the drawings. It is on the down-stroke of the rod 47 that the packer plunger 50 performs its most important function.

Being nearly of uniform diameter with the cup leathers or packer 51, the latter is prevented from functioning as a piston which would displace water on the down-stroke. The extremely thin wall of water that will occupy the space between the plunger 50 and the tube 44 will be prevented from passing the packer 51 by the spreading tendency of the cup leathers. Inasmuch as the packer is not allowed to do any displacing of water it follows that the down-stroke of the windmill will be very easy and practically unimpeded. The up-stroke of the windmill is most effective, and it is on this stroke that the plunger valve 53 forces the column of water out of the working barrel and into the discharge pipe 11.

The course of the water stream is indicated by the arrows in Figure 1. The water enters the casing 3 from the intake pipe 10, from which casing it flows into the working barrel 24 in the manner already stated. Should the pipe line, especially at the discharge side of the pumping apparatus become obstructed from any cause so that the next up-stroke would meet with such resistance as might seriously damage the mechanism, there would be an immediate relief of the pressure through the valve 40 and the pipe 12. The relief valve is an important provision in a pump of this kind, and although obstructions of the pipe line are rare, yet it is imperative that some remedy be provided in case of an obstruction if the disablement of the apparatus is to be avoided.

It is deemed unnecessary to enlarge upon the sectional nature of the apparatus. This is constructed in stages so to speak. Working from the inside to the outside, should it become necessary to remove the tube 44 for inspection the only requirement is to unscrew the guide cap 45. The removal of the cap 41 will permit the abstraction of the entire structure within the working barrel 24, and if it is desired to remove the standing valve 31 with this structure it is only necessary to turn the rod 47 in the right direction after having disconnected it from the pole 60, thereby to screw the plunger valve upon the threaded stud 57.

While the construction and arrangement of the improved pumping apparatus is that of a generally preferred form, obviously modifications and changes may be made without departing from the spirit of the invention or the scope of the claims.

I claim:

1. Pumping apparatus comprising a plurality of concentric tubular elements respectively defining intake, working and packer chambers, a plunger valve operating in the working chamber, a connected packer working in the packer chamber, a plunger rod joined with the packer, a cap in which the rod has guidance, and a plurality of means

with one of which the cap has connection and from which said elements are successively suspended for removability in stages to successively gain access to the interior of the apparatus.

2. In pumping apparatus including a reciprocable plunger valve with a packer, and a packing tube containing said packer: means to shut out virtually all fluid from the packer tube and packer said means comprising a plunger connecting the packer with the plunger valve, said plunger being nearly the same in outside diameter as the inside diameter of said tube.

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