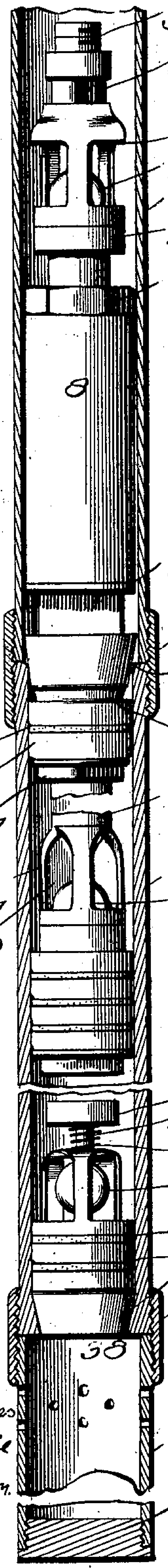
No. 747,728. PATENTED DEC. 22, 1903.

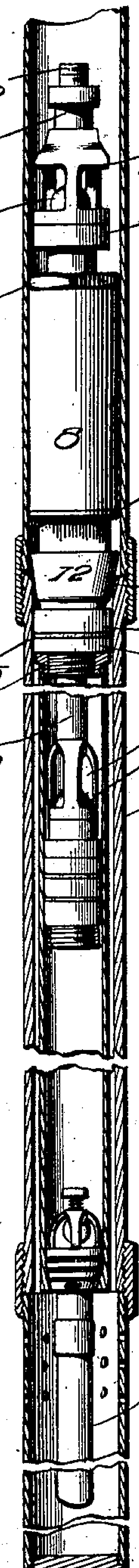
J. E. KIRK.

PUMPING APPARATUS.

APPLICATION FILED OCT. 6, 1902.

NO MODEL. 2 SHEETS—SHEET 1.





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NO MODEL. 2 SHEETS—SHEET 2.

Fig. 3

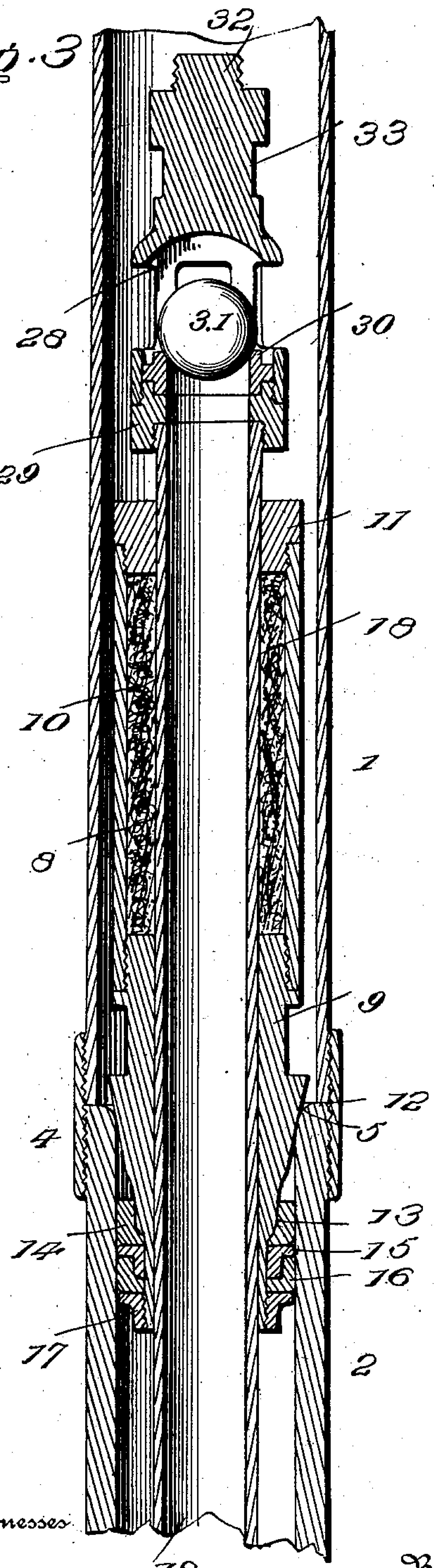
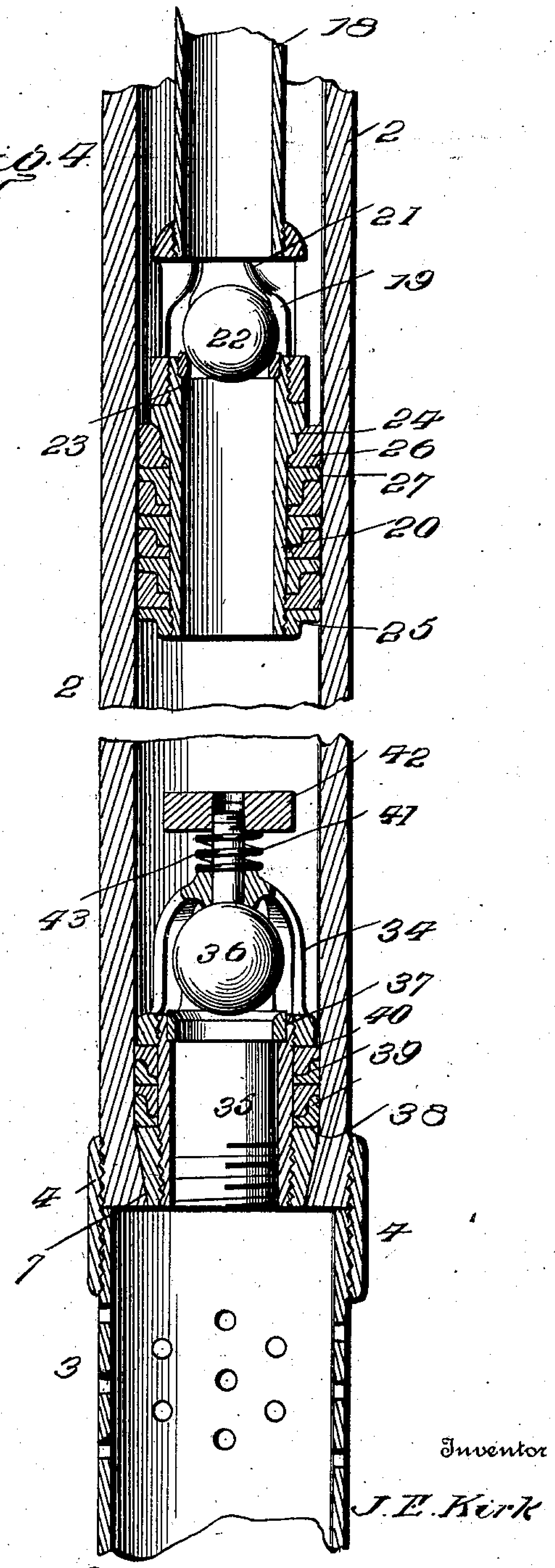


Fig. 4



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No. 747,728. Patented December 22, 1903.

UNITED STATES PATENT OFFICE.

JOSEPH E. KIRK, OF SISTERSVILLE, WEST VIRGINIA.

PUMPING APPARATUS.

SPECIFICATION forming part of Letters Patent No. 747,728, dated December 22, 1903.

Application filed October 6, 1902. Serial No. 126,176. (No model.)

To all whom it may concern:

Be it known that I, JOSEPH E. KIRK, a citizen of the United States, residing at Sistersville, in the county of Tyler and State of West Virginia, have invented certain new and useful Improvements in Pumping Apparatus, of which the following is a specification.

This invention provides a novel form of apparatus for deep-well pumping to meet varying conditions, the purpose being to expend a minimum amount of energy in the performance of the work.

The invention relates more particularly to the class of pumping apparatus in which the piston embodies upper and lower valves and an intermediate packing, the purpose being to relieve the fluid-pressure in the barrel and off the working valve under downward stroke and utilize that same pressure in forcing valves downward, while keeping a steady tension on line or rods all the time.

The invention provides a pump for operating satisfactorily and effectively in wells where the sand is soft and it is not desirable to allow the fluid to rush back into the well when the valves are pulled or in wells of heavy gas-pressure and containing little oil or fluid and it is desired to pump the gas and whatever little oil or fluid the well makes.

The invention consists, essentially, of the novel details of construction and combinations of parts, which hereinafter will be more fully described and claimed.

In the accompanying drawings, forming a part of the specification, Figure 1 is a vertical central section of a well-casing, showing the pump mechanism embodying the invention in operative relation. Fig. 2 is a view similar to Fig. 1, showing a liner in place and a piece of pipe attached to the lower end of the automatic stand-valve and extending into the perforated pipe. Fig. 3 is a vertical central section of the upper portion of the pump-barrel, a portion of the well-tube coupled thereto, the packer and the upper portion of the piston-stem and the check-valve applied to the upper end thereof. Fig. 4 is a section similar to Fig. 3, showing the stand-valve and the piston.

Corresponding and like parts are referred to in the following description and indicated in all the views of the drawings by the same reference characters.

The well-casing comprises, essentially, the tube 1, pump-barrel 2, and perforated pipe 3, the pump-barrel being thicker than the tubing 1 and 3 in order to withstand the wear and strain of the working parts. The several sections are coupled in any substantial way, preferably by means of thimbles 4, having the ends of adjacent sections threaded therein. The upper end of the pump-barrel forms an inner shoulder 5, which is beveled or made rounding and is adapted to support the well-packer 6. The lower end of the pump-barrel is thickened to provide an inner shoulder or stop 7 to support either the stand-valve or a lower packer.

The upper packer comprises a stuffing-box 8 and a packer-head 9, connected by a screw-thread, the packing 10 within the stuffing-box being of rubber, leather, soft metal, flax, hemp, or any variety and confined therein by means of the packer-head and the gland 11, the latter being screw-threaded to the upper end of the stuffing-box in the well-known way. The packer-head 9 is provided intermediate of its ends with a cone 12, which closes the upper end of the working barrel and fits snug against the beveled or rounded shoulder 5, so as to support the packer and preserve a tight joint. An annular shoulder 13 is provided below the cone 12 and forms a stop for the cup or packing-ring 14. The lower end of the packer-head receives a spacing-ring 15 and a cup or packing-ring 16 and is threaded to receive a nut 17, by means of which the parts 14, 15, and 16 are confined or clamped between the shoulder 13 and nut 17. The lower end portion of the packer-head is securely fitted within the upper portion of the working barrel, and a tight joint is provided by reason of the cups or packing-rings 14 and 16. This packer 9 when lowered into the well-casing is held in place upon the shoulder 5 by the friction of the packing applied to its lower end against the inner walls of the pump-barrel and by the weight of the column of liquid in the pump-tube above said packer.

The piston comprises upper and lower valves, connected by means of a stem 18, which is preferably tubular to admit of the

passage of the fluid therethrough. The piston-head comprises a cage 19 and a tubular body 20, preferably separably formed and connected by a screw-thread. The cage 19 is tapered to allow of easy return of fluid and is internally threaded at its opposite ends to receive the stem 18 and tubular body 20, and its bars or straps have inner extensions 21 to form stops to limit the insertion of the stem 18 into the cage and to arrest the upward movement of the ball-valve 22. The upper end of the tubular body is enlarged to receive an annulus 23, which constitutes a seat for the ball-valve 22, which may be of brass or steel; but other forms of valve may be used and may be of rubber, leather, or comparatively soft metal. An annular shoulder 24 of approximately conical form surrounds the upper portion of the tubular body, and the lower end of said body is externally threaded to receive a nut 25, between which and the shoulder 24 a series of cups or packing-rings 26 and spacing-rings 27 are confined. It is to be understood that the nature of the packing applied to the tubular body 20 is unimportant within the purview of the invention, so long as a tight joint is maintained between the piston-head and the inner walls of the pump-barrel 2.

The check-valve applied to the upper end of the piston-stem 18 comprises a cage 28 and coupling 29, the latter being threaded upon the upper end of the stem 18 and having its upper end reduced and externally threaded to receive the lower end of the cage 28. An annulus 30 is fitted to the upper end of the coupling 29 and constitutes a valve-seat and may be of any material suitable for the purpose, similar to the valve-seat 23. The ball-valve 31, located within the cage 28, is normally seated upon the annulus 30, so as to support the weight of the fluid above said valve. The cage is provided with a coupling end 32, to which the operating line or rod may be attached, and below said coupling end a square portion 33 is provided for the reception of a wrench or an elevator to admit of turning the cage when screwing or unscrewing from part 29 or hold the same while the line or rod is being attached thereto. Just below the square 33 and just above the opening in the cage is a flange or rim projecting a little beyond the line of the body of the cage. As the valve is lifted quickly on upstroke of piston the action of the fluid passing over this rim creates a partial vacuum underneath the rim and acts as a relief to the ball-valve 31 in the discharge of the fluid through said valve on upstroke of piston.

The stand-valve located at the lower end of the pump-barrel 2 comprises a cage 34 and a tubular body 35, preferably connected by means of a screw-joint to admit of ready separation of the parts when required for any purpose, such as to admit of placing the ball-valve 36 or the valve-seat 37 in position or removing them when required. The upper portion of the tubular portion 35 is provided externally with packing, which is confined between an annular enlargement 38 at the lower end of the tubular body and the lower end of the cage 34, said packing being of any nature and, as shown, comprising cups 39 and spacing-rings 40. A stem 41 is movably mounted in the upper end of the cage 34, and the ball-valve 36 is applied to the lower end, the upper end of the stem being threaded to receive a nut 42, to which a tap is adapted to be fitted when it is desired for any reason to pull the valve out of the well. An expansion-spring 43 is mounted upon the stem and confined between the nut 42 and cage 34 and normally exerts an upward pressure upon the nut 42, so as to hold the valve 36 unseated. When the valves are withdrawn from the well, the fluid contained therein, exerting a downward pressure upon the valve 36, overcomes the tension of the spring 43 and closes said valve, thereby preventing the fluid passing back into the well, this being of special advantage in wells where the sand is soft. The lower enlargement 38 of the stand-valve is of conical form and corresponds to the inwardly-flared shoulder 7 at the lower end of the pump-barrel.

When it is desired to use a liner, as in small wells, the liner 52 is coupled at its upper end to the lower end of the packer 9 by means of a coupling 53, which replaces the nut 17, said coupling 53 having an extension externally threaded to receive the upper end of the liner 52. The piston and adjunctive parts operating in the liner must of necessity be of a size to fit the same in substantially the same manner as if constructed to fit the pump-barrel in the manner herein stated, said liner being constructed in all essentials to coöperate with the working parts in substantially the same manner as described in connection with the pump-barrel.

The perforated pipe 3 has the perforations just below the working barrel, and in some instances it may be desirable to make use of a pipe 54, which is connected with the tubular body of the stand-valve and located inside of said perforated pipe and extended to a point three feet or more below the perforations, thereby preventing any gas contained in the well from interfering with the pumping operation. In use of pump, as shown in Fig. 1, it is desirable to have the perforations in the pipe 3 at a point below the gas, since if placed where the gas comes into the well or above that point the gas is sucked into the barrel with the fluid and interferes with the action of the valves; but where it is not practicable to tube the well below where the gas comes in or if the gas is strong enough to interfere with the valves the pipe 54 is employed and extends sufficiently below the perforations of the pipe 3 so that the stroke of the piston will not exhaust the fluid, the pipe

54 serving as a seal to hold back the gas-pressure. It is preferred to have the lower end of the perforated pipe 3 plugged, as shown at 55.

In the operation of the apparatus, as shown in Fig. 1, the upstroke of the piston by its tendency to create a vacuum in the lower portion of the working barrel causes the liquid to be drawn above the stand-valve 36, which is normally open. The weight of the liquid which has thus been drawn above the valve 36 causes said valve to become seated, overcoming the tension of the spring 43. The valve 22 opens as the piston descends upon the downstroke, and the liquid passes upward to a point in the working barrel above the said valve. The weight of the liquid being now removed from off the stand-valve 36 the same again becomes unseated under the influence of the spring 43. The next upstroke causes the liquid which is above the check-valve 22 to be forced upward and discharged into the pump-barrel above the upper check-valve 31, the latter becoming unseated to permit this action. The last upstroke above described of course repeats the former action of filling the pump-barrel above the stand-valve.

Having thus described the invention, what is claimed as new is—

1. In pumping apparatus, the combination with a well-casing comprising tubing and a working barrel, the latter having an inner beveled shoulder at its upper end, a packer located at the juncture of the tubing and the working barrel and comprising a stuffing-box and a packer-head, the latter having a conical enlargement for coöperation with the beveled shoulder at the upper end of the working barrel and having the portion below said enlargement externally packed to make a tight joint with the upper portion of the working barrel, the packed portion of the enlargement being disposed below the aforesaid beveled shoulder, a valved piston arranged to operate in the working barrel, a tubular stem extended from the piston and arranged to operate in said packer, and an upwardly-opening check-valve at the upper end of the piston-stem adapted to be held seated by the weight of the fluid in the tubing above the packer upon the downstroke of the piston, substantially as set forth.

2. In a pumping apparatus, the well-casing comprising tubing and a working barrel, a packer at the upper end of the working barrel, a piston arranged to operate in the working barrel below the packer and having its stem arranged to operate in said packer, an upwardly-opening valve at the upper end of the piston-stem, and a stand-valve located at the lower end of the working barrel and comprising a cage, a valve located within the cage and having a stem mounted for free movement therein, and a spring applied to the extended end of the valve-stem and normally exerting an outward pressure thereon to hold the valve unseated, substantially as set forth.

In testimony whereof I affix my signature in presence of two witnesses.

JOSEPH E. KIRK. [L. S.]

Witnesses:
ORION KIRK,
JONATHAN E. LADD.