(No Model.) 3 Sheets—Sheet 1.

M. T. & M. C. CHAPMAN.

PUMP.

No. 572,959. Patented Dec. 15, 1896.

Fig. 1.

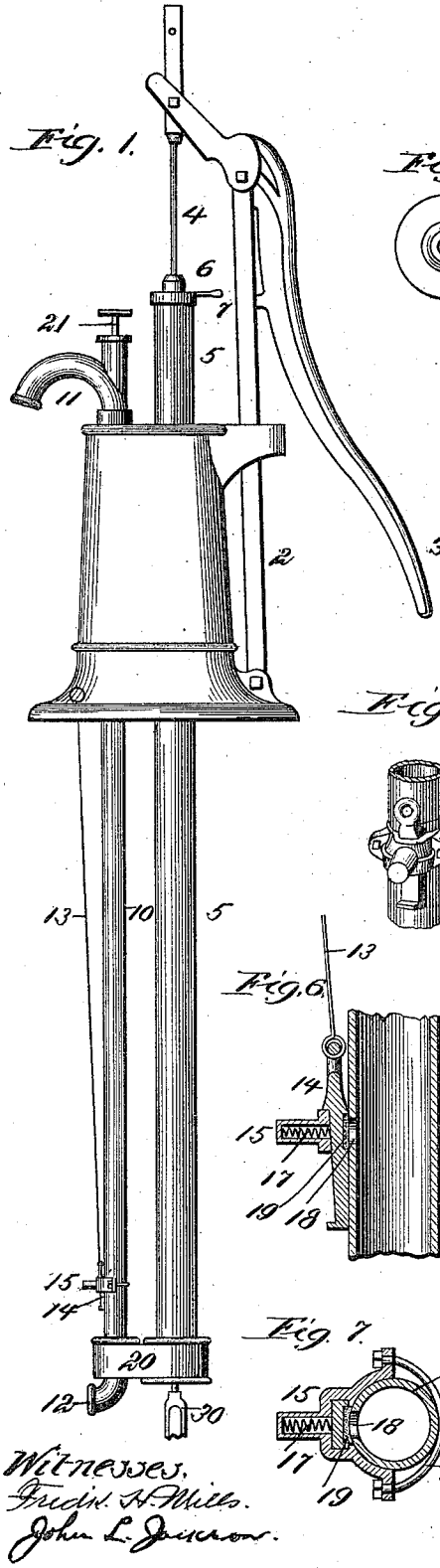


Fig. 4.

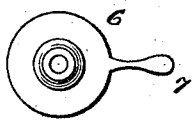


Fig. 5.

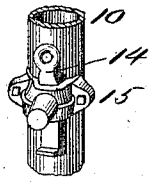


Fig. 6.

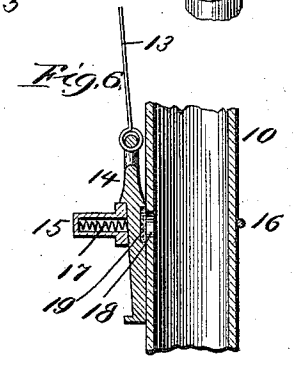


Fig. 7.

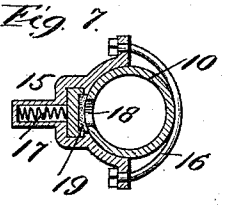


Fig. 2.

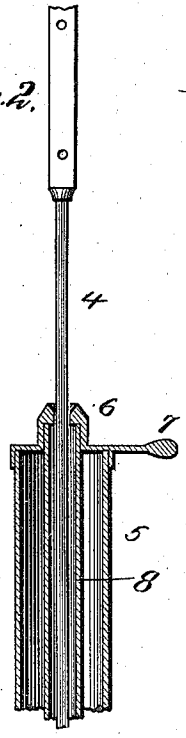


Fig. 3.

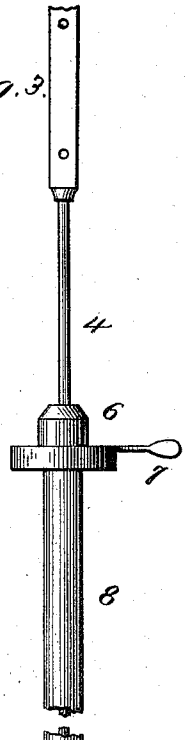
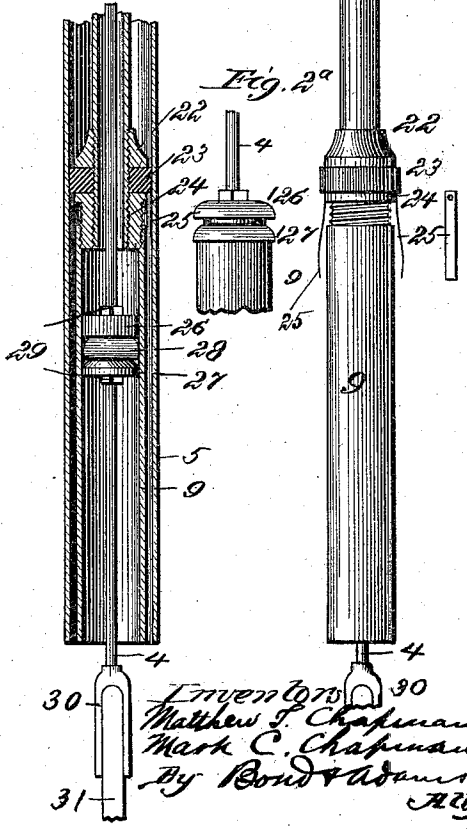


Fig. 2a.



Witnesses.
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THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

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Fig. 8.

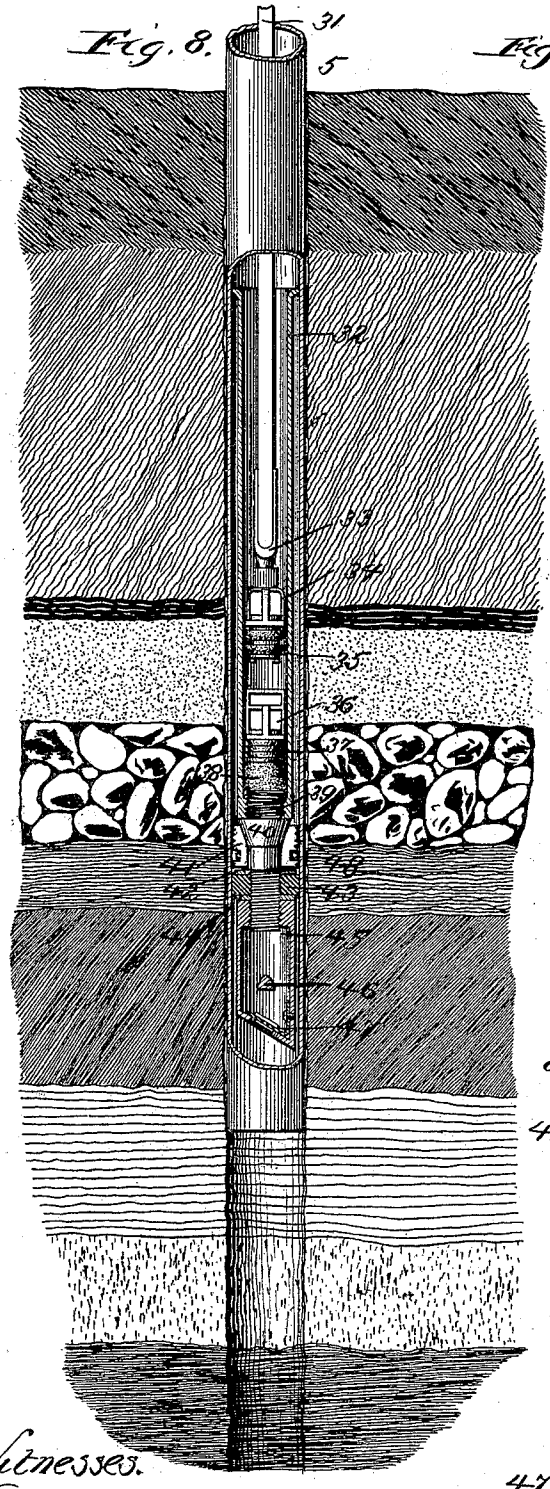

Fig. 9.

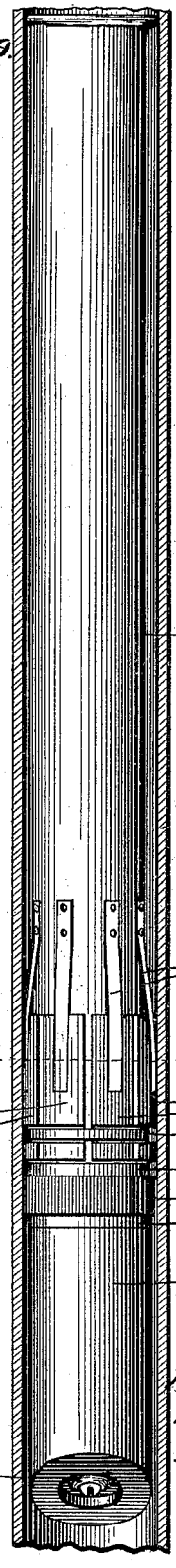

Fig. 26.

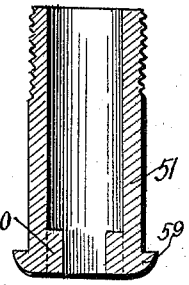

Fig. 27.

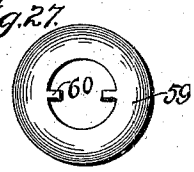

Fig. 10.

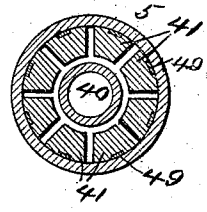

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Fig. 11.

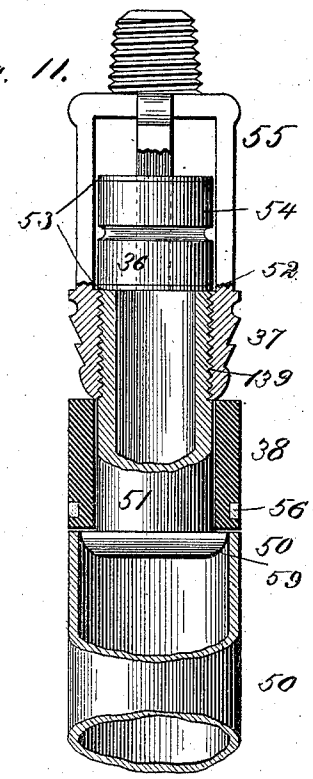


Fig. 12.

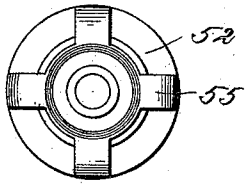


Fig. 14.

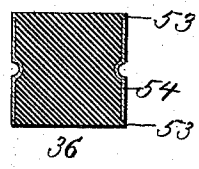


Fig. 13.

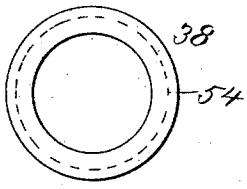


Fig. 15.

Fig. 22.

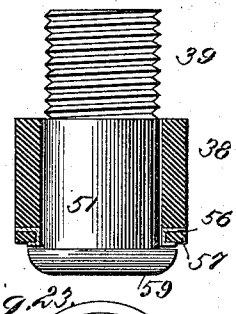


Fig. 16

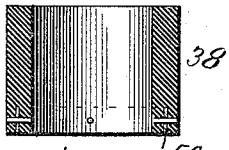


Fig. 18.

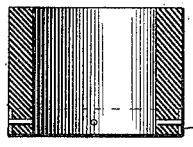


Fig. 20.

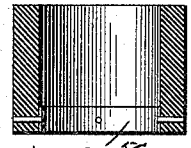


Fig. 17.

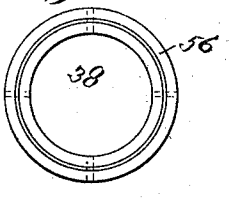


Fig. 19.

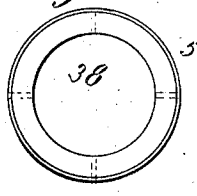


Fig. 21.

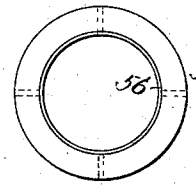


Fig. 23.

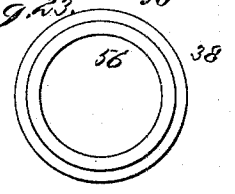


Fig. 24.

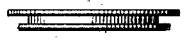
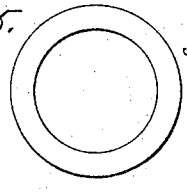


Fig. 25.



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THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

UNITED STATES PATENT OFFICE.

MATTHEW T. CHAPMAN AND MARK C. CHAPMAN, OF AURORA, ILLINOIS.

PUMP.

SPECIFICATION forming part of Letters Patent No. 572,959, dated December 15, 1896.

Application filed August 8, 1891. Serial No. 402,164. (No model.)

To all whom it may concern:

Be it known that we, MATTHEW T. CHAPMAN and MARK C. CHAPMAN, citizens of the United States, residing at Aurora, in the county of Kane and State of Illinois, have invented certain new and useful Improvements in Pumps, of which the following is a specification, reference being had to the accompanying drawings, in which—

Figure 1 is a side elevation of the pump-casing and the upper portion of the tubing. Fig. 2 is a vertical section of Fig. 1 on the line of the pump-rod 4. Fig. 2ª is a modification of the cap or nut for connecting the lower interior tube shown in Fig. 2. Fig. 3 is an exterior view of the inner tubes or cylinders of the upper portion of the pump. Fig. 4 is a top plan view of the cap 6. Fig. 5 is a section of the delivery tube or pipe, showing the vent-controlling devices in perspective. Fig. 6 is a vertical section of the delivery-pipe through the vent-hole and wedge-valve. Fig. 7 is a cross-section of the delivery-pipe through the vent-hole. Fig. 8 is an elevation of the lower end of the pump placed in imaginary earth strata and partly in section. Fig. 9 is an elevation of the lower interior tubes with the exterior tube in section. Fig. 10 is a cross-section on line *a b* of Fig. 9, the exterior tube being completed. Fig. 11 is an elevation, mainly in section, showing the means for expanding the packing for connecting the lower stop-valve and holding it in place. Figs. 12 and 13 are top and bottom views of the cage for holding the valve; Figs. 14 and 15, vertical section and bottom view of the valve placed within the cage; Figs. 16 to 23, both inclusive, vertical sections and bottom views of expansible packings, Fig. 22 also showing the lower end of the tube, which is surrounded by the packing; Figs. 24 and 25, edge and top views of the metal ring shown in Fig. 22. Fig. 26 is a central vertical sectional view of the pipe 51 shown in Fig. 11, and Fig. 27 is an end view of the inside of said pipe.

This invention relates to the constructing of force-pumps for tubular wells, and has for one of its objects the construction and arrangement of the tubes and valves so that water may be delivered aboveground or underground below the frost-line to a point or points at a distance from the pump, the withdrawing of the valves for repairs without removing the pump or the exterior tubing, and to overcome the difficulties and disadvantages heretofore experienced with force-pumps when attempting to convey water underground or to any considerable distance from the pump, and at the same time to make an approximately even discharge of water.

Another object is to provide means in a pump for saving the water which would otherwise run away while pumping by improving the vent apparatus; and another object is to provide suitable connections at or near the lower end of the pump for properly supporting the valves in position and the weight of a superposed column of water, and to otherwise generally improve the construction and operation of the parts necessary to adapt the pump to deep wells. We accomplish these objects in the manner shown in the drawings and hereinafter described.

That which we deem to be of our invention will be pointed out in the claims.

In the drawings, 1 indicates the upper pump-case, which is provided with a suitable base for supporting it upon a platform or at the top of the well. A swinging fulcrum-bar 2 is pivoted at its base and passes through a slotted supporting-arm at the top, upon which the handle 3 is mounted, so that the fulcrum-bar can move to make the changes of position necessary to operate the pump-rod 4 in a vertical line with but little friction.

The pump-rod 4 is a round iron rod flattened at its top for proper connection with the handle 3 and extending beyond the handle connection, so as to be connected with a windmill or other driving-machine, so that it may be operated by power when desired instead of being operated by hand. The lower end of this iron rod is provided with a coupling 30, by which it is attached to a wooden rod 31, which is continued down to the upper one of the lower valves of the pump. The iron rod could be continued down; but we prefer to employ the wooden section shown, as it will tend to float in the column of water and thereby render the pumping operations easier, especially when performed by hand. The exterior tube of the pump 5, which may be also the lining or tube

of the well, extends through the pump-casing and is provided at its top with a cap 6, which may be provided with a handle 7 or have some angular or other provision for being operated in connection with a proper wrench.

At any suitable distance below the pump-casing, which for cold countries should be below the frost-line, the pipe 5 is provided with a valve section or box 20, into which said pipe opens or with which it is connected. This box extends to one side of the pipe 5 and connects with the delivery-pipes 10 and 12, and the box is provided with valves which are connected with and operated by a rod 21, which passes down through the pipe 10, by which the valves are shifted so as to cause the water to pass up through the delivery-pipe 10 and 11 or so as to pass out at the pipe 12, a short section of which is shown in Fig. 1, and which is continued out in as nearly a horizontal line as is practicable sidewise to the point distant from the pump where it is desired to deliver water. This pipe is also to be located below the frost-line in cold countries, but in warmer it may be placed at or near the surface of the ground. The valve may be a plug or screw valve which when operated in either direction will open one of the delivery-pipes and close the other; or it may be of any other form which will peform this service, and as valves which will perform this service are common they are not shown or described.

At a suitable point below the frost-line the pipe 10 is provided with a vent-closer or a water-stop for stopping the outflow of water while the pump is running, and thereby save the water which would otherwise run to waste while the pump is working, while it should be operative, at least in cold weather, when the pump is not working.

The pipe is provided with a vent-hole 18, which is usually left open, or provided with a short open-ended tube. We cover this opening by a clip, (shown in cross-section in Fig. 7,) which consists of a closely-fitting plate and a rod or staple 16, by which the plate is firmly clamped to the tube. This plate is provided with a vertical opening for the wedge 14 and a side projection 15, which incloses a spring 17. The wedge 14 is provided with a packing 19, which covers the hole in the tube and fits closely against it when the wedge is lowered, as shown in Fig. 6; but when the wedge is raised by the rod 13 the packing moves from over the vent-hole, and the latter is thereby uncovered, so that the water which would otherwise stand in the pipe may escape into the ground. The wedge is provided with shoulders or flanges at its ends, which prevent its being drawn out and provide limits for its proper movement; and in case the wedge should become worn, or, for ease of working, not tightly fitted, the spring 17 will force the packing of the wedge when at its lowest point against the vent-hole, and thereby close it, even though the wedge did not fit tightly at this point. The packing 19 is best made of leather; but it may be made of rubber or other flexible material which when pressed against the vent-hole will prevent any outflow of water. The wedge is easily operated by the rod 13, which passes up through the base of the pump-casing, so as to be in convenient reach, as shown in Fig. 1, and the position of the handle end of this rod in its relation to the base will show the position of the wedge, as to whether it is up or down. By these devices we produce a vent which may be of the usual size, or larger than the usual size, and quicker in its operation than the ordinary vent-hole, and which may be operated to prevent all leakage when the pump is working and to permit the proper outflow to prevent freezing when the pump is stopped.

The pipe 8 is a small pipe through which the pump-rod 4 works. At its upper end it is screwed into or otherwise firmly attached to the cap 6, so as to turn with it, and its lower end is provided with a screw-thread which passes through the nut or washer 22, through the packing 23, and into or through the nut 24. The nut 24 screws into the top of the tube or cylinder 9 tightly, and its interior is screw-threaded to receive the smaller pipe 8, as shown in Fig. 2. This nut is preferably made of brass; but it may be made of other suitable material. The cap 6, in which the pipe 8 is secured, turns loosely on the top of the tube or cylinder 5, so that the tube 8 can be screwed down into the nut 24, which draws it up and thereby compresses the packing 23 against the nut or washer 22 and expands it out, so as to fit tightly against the exterior tube; and in order to prevent the nut 24 from rotating with the tube 8 we attach to the nut spring-bars 25 by rivets or otherwise, which bars at their lower ends spring out far enough to engage the inside surface of the exterior tube, and thereby prevent the nut 24 from rotating when the pipe 8 is being turned for the purpose of compressing the packing. These springs may be applied to the pipe 9 instead of the coupling-nut 24, if desired. By the use of these spring-bars we can locate the packing at any desired distance below the top of the exterior tube and compress it tightly into place without making any special provision for holding the coupling-nut 24 against such rotation as would prevent the compressing of the packing, which is a very desirable feature of our improvements, as the locking against rotation in this manner does not interfere with drawing out the interior tube or tubes through the top of the tube 5 when desired.

Instead of using a nut 24 with a rubber packing 23 a nut may be used having leather cups 126 and 127, as best shown in Fig. 2ª. These cups expand by the upward pressure of the water and thereby form a tight joint.

At a suitable distance below the nut 24 a working pump-piston is located, which consists of the disks 26 and 27, with a packing 28

between them. This piston is applied to the rod when it is out of the pump and before the parts 22, 23, and 24 are placed in position, so that it can be compressed and adjusted by the nuts 29, which operate upon the screw-threads on the rod or on a screw-threaded collar attached to the rod. The packing 28, as shown, is a common leather packing such as is usually used in pumps, but it may be made in any other known manner.

The lower end of the pump is shown on Sheet 2 of the drawings. The pipe 5 and the rod 31 are continued down of any desired length to any desired depth, and near the lower end of the rod 31 is located a tube 32, which is preferably close-fitting at its upper end, as shown in Fig. 8. This tube 32 extends down below the lifting valved piston 34 and the fixed valve 36, where it is provided with an interior screw-thread 39, by which a smaller pipe-section 40 is attached, which said pipe-section 40 is screwed to a larger pipe section or cage 45, which we call the "grip-cylinder." The lifting-piston 34 is attached to the pump-rod 31 by a coupling 33, as shown in Fig. 8, and the piston is provided with packings 35. This piston, as shown, has a valve-cage at its upper end, which incloses a puppet, ball, or clack valve, as may be desired, and the lower end is provided, preferably, with cup-shaped leather packings, which tend to expand under water-pressure. Below this piston 34 and as near the downward limit of its stroke as is practicable we locate a check-valve 36, the supports for which are firmly attached in position by wedges 41, which on their outsides press against the tube 5 and on their inner sides against the tube 40, as shown in Fig. 8, or against the lower end of the tube 32, as shown in Fig. 9. As shown in Fig. 8, the lower end of the tube 32 is provided with the screw-thread 39, by which the pipe 40 is connected with it.

The wedges 41 have a slight space left between them at their edges, and they are held in place by a rubber or other suitable ring 48, located in transverse grooves formed in the backs of these wedges, as shown enlarged in Fig. 9. The wedges are also held in place at their upper ends by springs 49, which rest in longitudinal grooves at the upper ends of the wedges, as shown in Figs. 9 and 10.

When the parts are first put together, the wedges are in their lowest position, so that this part may be easily lowered to place, which is done by a separate rod having a grip adapted to take hold of the cross-bar 46 in the grip-cylinder 45 in such manner that this grip-cylinder can be turned upon the exterior screw-thread of the short pipe 40 and compress the packing 43, which is held between the disks 42 and 44, the disk 42 being in contact with the lower end of the wedges, so that in screwing up the grip-cylinder 45 the packing 43 is expanded, and as the lower ends of the wedges 41 form the principal abutment for this packing the compressing of the packing forces the wedges upward and outward, so as to cause the pipes 32 and 40 to be firmly locked in place and held with sufficient firmness to support the column of water upon the check-valve without being displaced or moved out of position by the weight of the superposed column of water standing upon it. By this construction and arrangement we form a strong lock for supporting the check-valve in a smooth pipe, which is of great value, especially for deep wells, as it does away with the necessity for inserting in the exterior tube any shoulders or secondary tubes for the valves and cylinder to rest upon, which would be in the way when inserting or withdrawing the lowermost parts.

The check-valve and its packing are shown enlarged on Sheet 3, and it consists of a cage 55 at the upper end, which cage may be provided with a screw-top, as shown in Fig. 11, for inserting or withdrawing it by a rod having a properly-fitting interior screw at its lower end. The cage 55 and the annularly-serrated conical part 37 are made in one piece, and, as here shown, a pipe 51 is screwed into the part 37 by the screw 139. Within the cage is located a solid valve 36, which moves upward when water is being lifted and drops to its seat when the lift-piston is being lowered. This valve is made of a cylinder of solid rubber or other suitable material, as shown in Fig. 14, having a case 54, which extends nearly its length, but which leaves unincased portions 53 at each end, so as to insure the proper seating of the valve. The casing 54 may be of metal or of canvas, wound cord, or other fibrous material, or the casing may be united with the rubber, as is practiced in making rubber hose. The serrated portion of the valve-support 37 is also slightly conical or wedge-shaped, being largest at its upper end. The packing 38, which is shown in position in Fig. 11 for being expanded, passes over or partly over the serrated portion and is expanded thereby and held or partly held by the roughened exterior of the part 37.

The packing 38 is made of rubber, and its lower end, in order to adapt it to and hold it over against the pressure necessary to force it upon the part 37, is provided with a ring 56, which may be on the exterior set in the groove, as shown in Fig. 11; or it may extend entirely to the bottom and be held by rivets, as shown in Figs. 18 and 19; or it may be secured to the rubber, as shown in Figs. 16 and 17, or embedded in the interior, as shown in Figs. 20 and 21; or the packing may be in two parts and applied as shown in Figs. 22 and 23, the metal rings of which are shown again at Figs. 24 and 25, the object and purpose of this provision being, as before stated, to prevent the lower end of the packing from expanding and giving way or getting out of line and slipping off when drawing the valve up, and thereby to prevent the lower end of the pipe 51 from drawing up through the rub-

ber when it is drawn forcibly out of the tube. In practice it is found that the rubber will become cemented to the tube, and if the lower end of the rubber were not confined approximately tightly to the tube 51 the pipe would draw through it. The rubber is expanded by forcing the part 37 downward into the top of the packing, the wedges 41 holding the parts below it in place, so that this operation can be performed.

The grip-cylinder 45 is provided with a clack or other suitable valve 47 at its lower end, as shown in Figs. 8 and 9. The valves may be of the form shown in the patent to M. T. Chapman, No. 349,339, dated September 21, 1886. The manner of putting the grip 45 and the tube or working barrel 32 into the well is by placing the parts 32, 40, 41, 42, 43, 44, 45, and 46 together, but not tightly enough to expand the packing or force up the wedges, so that it can easily be lowered down the proper distance into the tube 5 by a separate rod which is connected with the cross-bar 46 in the grip 45, and when in position the parts are turned by the lowering-rod, and the springs 49 prevent the cylinder 32 from being turned by the turning of the rod which turns the grip-cylinder 45, presses up the packing 43 and the wedges 41, thereby screwing the grip onto the tube 40 and compressing the wedges, so as to firmly lock these parts in place and at the same time compress the packing 43 until a tight joint is formed with the pipe 40 and the inside of the pipe 5, at which time the wedges 41 will have been forced in so firmly between the incline and the pipes 5 and 40 that the part becomes immovably fixed so far as the weight of the water resting upon it is concerned. The rod composed of the parts 4 and 31 is then put together with its pistons and lowered into position, when the pipe 8 is applied and the cap 6 is turned to lock the tubes 8 and 9 together and compress the packing 23, so as to prevent egress of water above the point of this packing 23. For the purpose of putting the parts together the flattened portion of the rod 4 may be made detachable, or the rod may be run through the cap before the coupling 30 is applied and have its disk 26 put in place. By this arrangement, as before stated, with the tube 5 extending up through the pump-case 1, all of the working parts may be applied after the pump-case is set and may be withdrawn for repairs or for renewing parts without again disturbing the tube 5 or pump and without necessitating the withdrawal of this exterior tube from the well, as the parts may all be withdrawn by reversing the method used in inserting and locking them and be again replaced in the same manner in which they were originally located and attached.

In operation the upstroke of the pump lifts the water into the space between the working pistons and into the space above the fixed valves 36 and 47. The downstroke forces out a portion of this column of water, so as to make the delivery of the water at the tubes 11 or 12 substantially uniform and continuous.

For the valve 36 it is not essential that the casing 54 be as wide or come as near the ends of the valve as shown in Fig. 14, and other means than the groove there shown may be used for holding the casing in position. By extending the flexible material beyond the casing at both ends when the lower end is worn the valve may be turned over or reversed for further use. By placing the packing 38 above the wedges 41 we avoid the difficulty of the locking parts becoming set by the infiltration of fine sand between the tubes 5 and 32, which has heretofore made it difficult to unlock the connecting devices, especially after the pump has been used for some considerable time, so that by this arrangement the devices can be withdrawn at any time after the pump has been in use. For shallow wells, where the weight of the column of water to be supported from the bottom is inconsiderable, the packing 38 and the wedges 41 may be directly attached to the grip-cylinder 45, and the check-valve 47 may be used alone for operating the pump, and in this event the packing 43 will not be required.

By placing the packing below the parts to be held the packing can be loosened, and then it will contract, leaving a space for the sand or sediment to fall down and let the parts become loose. The old method was to turn the cylinder or check-valve, and in that case when the sediment packed it was impossible to move it to remove the cylinder or check-valve from the well.

As best shown in Figs. 26 and 27, the pipe 51 is provided at its lower end with internal lugs or projections 60, which extend into the pipe from the sides, as shown. By this construction when it is desired to unscrew the pipe 51 a suitable key, adapted to engage the lugs 60, may be inserted into the pipe 51 until it engages the lug 60, when the pipe 51 may be readily unscrewed.

That which we claim as new, and desire to secure by Letters Patent, is—

1. In a pump, the combination with a well-tube, of a pump-cylinder within said tube, pumping mechanism in said cylinder, a tube 8, flexible packing 23, and nuts 22 and 24 at opposite sides of said packing, said nuts being screwed upon said tube 8, and said nut 24 being screwed into the upper end of the pump-cylinder, substantially as described.

2. In a pump, the combination with a well-tube, of a pump-cylinder within said tube, pumping mechanism in said cylinder, a tube 8, packing in said well-tube above said pump-cylinder, a rotatable cap upon the upper end of the well-tube and secured to said tube for rotating the latter, and means for compressing the packing by rotating the tube 8, substantially as described.

3. In a pump, the combination with a well-tube, of a pump-cylinder within said tube,

pumping mechanism in said cylinder, a tube 8, flexible packing 23, nuts 22 and 24 at opposite sides of said packing, said nuts being screwed upon said tube 8, and said nut 24 being screwed into the upper end of the pump-cylinder, and springs or stops 25, substantially as described.

4. In a pump, the combination with a pump-case, and a well-tube 5 extending above the pump-case and having a rotatable cap 6, of a pump-cylinder within said tube, pumping mechanism in said cylinder, a tube 8 connected to said cap 6 whereby said tube may be rotated, removable packing in said well-tube above said pump-cylinder, and means for compressing the packing by rotating the tube 8, substantially as described.

5. In a pump, the combination with a well-tube, a pump-tube therein, and pumping mechanism, of a support for said pump-tube, a grip-cylinder below said support, packing between said support and grip-cylinder, and means for expanding said packing, substantially as described.

6. In a pump, the combination with a well-tube, a pump-tube therein, and pumping mechanism, of a support for said pump-tube, a grip-cylinder below said support, packing between said support and grip-cylinder, and means for expanding said packing from below, substantially as and for the purpose specified.

7. In a pump, the combination with a well-tube, a pump-tube therein, and pumping mechanism, of a support for said pump-tube, a grip-cylinder below said support, packing between said support and grip-cylinder, means for expanding said packing, and a valve in said grip-cylinder, substantially as described.

8. In a pump, the combination with a well-tube, a pump-tube therein, and pumping mechanism, of a support for said pump-tube, a grip-cylinder below said support, packing between said support and grip-cylinder, said grip-cylinder being adapted to be screwed upon said support to expand the packing, substantially as described.

9. The combination with a well-tube, of a pump-cylinder therein, a wedge-shaped tube below and supporting said pump-cylinder, and wedges between said wedge-shaped tube and the well-tube, substantially as described.

10. The combination with a well-tube, of a pump-cylinder therein, a wedge-shaped tube below and supporting said pump-cylinder, wedges between said wedge-shaped tube and the well-tube, and means for exerting pressure upon said wedges in an upward direction for expanding them against the well-tube, substantially as described.

11. The combination with a well-tube, of a pump-cylinder therein, a wedge-shaped tube below and supporting said pump-cylinder, wedges between said wedge-shaped tube and the well-tube, and a grip-cylinder below said wedges, said grip-cylinder and wedge-shaped tube being adjustably connected, whereby upward pressure may be exerted upon said wedges, substantially as described.

12. The combination with a well-tube, of a pump-cylinder therein, a wedge-shaped tube below and supporting said pump-cylinder, wedges between said wedge-shaped tube and the well-tube, a grip-cylinder below said wedges, said grip-cylinder and wedge-shaped tube being adjustably connected, whereby upward pressure may be exerted upon said wedges, and packing between said grip-cylinder and the wedge-shaped tube, substantially as described.

13. The combination with a well-tube, of a pump-cylinder therein, a wedge-shaped tube below and supporting said pump-cylinder, wedges between said wedge-shaped tube and the well-tube, means for exerting pressure upon said wedges in an upward direction for expanding them against the well-tube, washers 42 and 44, and packing 43 between said washers, substantially as described.

14. The combination with a well-tube, of a pump-cylinder therein, a wedge-shaped tube below and supporting said pump-cylinder, wedges between said wedge-shaped tube and the well-tube, and springs 49 connected to said pump-cylinder and projecting between said wedges and the well-tube, substantially as described.

15. The combination with a well-tube, of a pump-cylinder therein, a wedge-shaped tube below and supporting said pump-cylinder, wedges between said wedge-shaped tube and the well-tube, and a grip-cylinder below said wedges, said grip-cylinder and wedge-shaped tube being adjustably connected, whereby upward pressure may be exerted upon said wedges, and springs 49 connected to said pump-cylinder and projecting between said wedges and the well-tube, substantially as described.

16. The combination of the grip-cylinder provided with the transverse bar 46, the valve 47 arranged in the bottom of the grip-cylinder, a threaded tube connected to the upper end of the grip-cylinder and provided with a wedge-shaped upper end, a packing 43 arranged upon said tube, collars 42 44, above and below said packing, wedges 41 disposed between the wedge-shaped end of said tube and an exterior tube 5, and a tube 32 arranged within the tube 5 and attached to the tube 40, whereby the parts are firmly supported in the exterior tube and the column of lifted water given a double support by the check-valves 36 and 47, substantially as specified.

17. In a force-pump, the combination of the tube 5, having the upper non-leaking packing 23, and tubes 8 and 9, pump-rod 4, 31, with the upper working piston 28 and lower working piston 34, having the packing 35 and check-valve 36, tube or working barrel 32, supported upon or by the wedges 41, and the grip-cylinder 45, whereby the working parts,

the packings, and check-valve supports may all be placed within the tube or well through the top of the pump without disturbing the exterior tube, substantially as set forth.

18. The combination with a well-tube, of a pump-cylinder therein, a wedge-shaped tube below and supporting said pump-cylinder, wedges between said wedge-shaped tube and the well-tube, a grip-cylinder below said wedges, said grip-cylinder being screwed upon the lower end of said wedge-shaped tube, whereby upward pressure may be exerted upon said wedges, substantially as described.

19. The combination with a well-tube 5, of a vertically-adjustable cylinder 9 arranged therein, a nut 24 screwed into the upper end of the cylinder 9, a tube 8 screwed into said nut, a packing 23 arranged over said nut, a nut 22 screwed on the tube 8 over said packing, a pump-rod passing through the tube 8, and means for rotating said tube 8, whereby the packing may be compressed to hold the cylinder in place and prevent the passage of water therepast or be released to permit the removal of the parts, substantially as described.

20. The combination with a well-tube 5, of a cylinder 9 arranged in the upper portion and a tube 32 arranged in the lower portion thereof, a pump-rod 4 31, a piston 28 arranged in the cylinder 9 and carried by the pump-rod 4, a valved piston 34 arranged in the tube 32 and fixed on the pump-rod 31, packing attached to the upper end of the cylinder 9, and means for expanding said packing and for removing the same from above to permit of the removal of the working pistons, substantially as described.

21. In a pump, the combination with a tube 5 forming the wall of the well, an adjustable check-valve in said tube, a lower piston, a cylinder 32 in which said lower piston moves, a wedge-shaped tube supporting said cylinder 32, wedges supporting said wedge-shaped tube, a grip-cylinder screwed to said wedge-shaped tube, and packing between said grip-cylinder and the said wedges, of a cylinder 9, a piston in said cylinder 9, said cylinder and piston being adjustable in the well-tube 5, and removable packing at the upper end of said tube 9, whereby all the pumping mechanism may be inserted or removed from the well without removing the parts of the pump, substantially as described.

22. The combination with a well-tube, of a wedge-shaped supporting device, wedges between said supporting device and the well-tube, and a device adapted to be screwed upon the lower end of said supporting device to expand the wedges, the whole forming a removable foundation to support the parts of the well-tube above it substantially as described.

23. The combination with a well-tube, of a foundation, a pump-cylinder carried thereby, packing 38 at the lower end of said pump-cylinder, said packing having a band 56, a tube 51 having shoulders 60, a cone 37 adapted to enter and expand said packing 38, a cage 55, and a valve 36 in said cage, substantially as described.

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