J. HAHN.

DEEP WELL PUMP.

APPLICATION FILED MAR. 1, 1909.

1,045,282.

Patented Nov. 26, 1912.

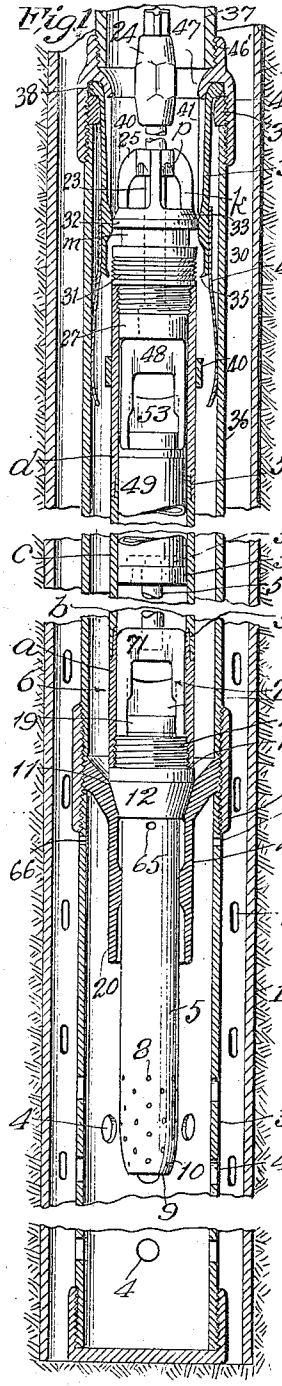

Fig. 1.

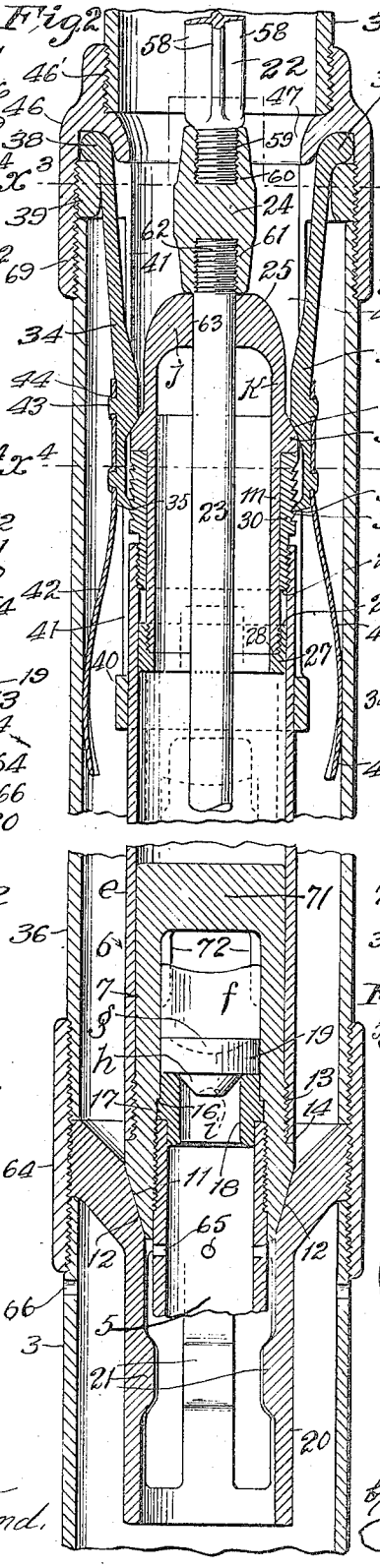

Fig. 2.

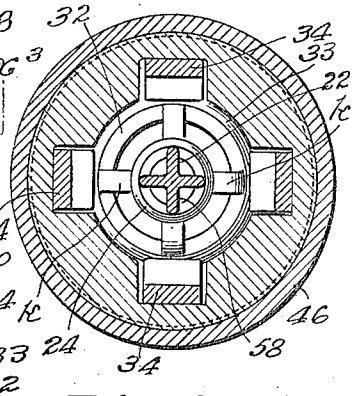

Fig. 3.

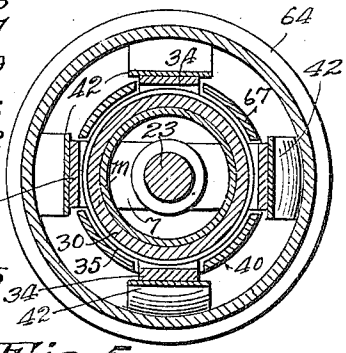

Fig. 4.

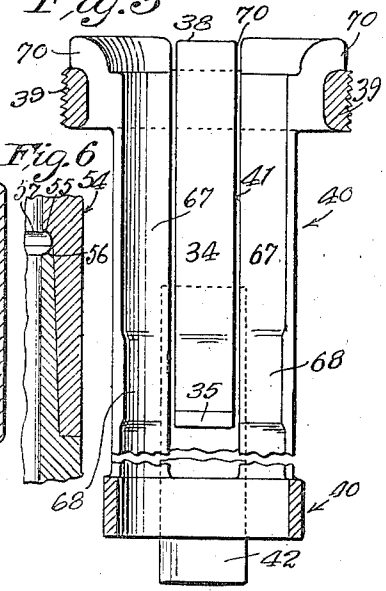

Fig. 5.

Fig. 6.

Witnesses

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UNITED STATES PATENT OFFICE.

JOHN HAHN, OF LOS ANGELES, CALIFORNIA.

DEEP-WELL PUMP.

1,045,282. Specification of Letters Patent. Patented Nov. 26, 1912.

Application filed March 1, 1909. Serial No. 480,787.

To all whom it may concern:

Be it known that I, JOHN HAHN, a citizen of the United States, residing at Los Angeles, in the county of Los Angeles and State of California, have invented new and useful Improvements in Deep-Well Pumps, of which the following is a specification.

This invention relates to pumps for use in oil wells and water wells from which wells the standing-valve, the working-barrel and other parts connected with the suction-rod may be required to be withdrawn through the pump-tubing from time to time for repairs on account of wear or on account of clogging with sand or for any other reason.

Objects of the invention are cheapness of construction, convenience of putting together and taking apart, and security against scratching the plunger-barrel and the standing-valve in the operation of pulling or replacing the same; also the avoidance of clogging with sand, and avoidance of leakage; the provision of larger fluid way than is possible with former constructions of oil well pumps, and to provide a sectional working-barrel that may be straight and true and will keep in line for the plunger-barrel when put together, and that will be held together friction tight; thereby making the sectional working barrel practical for oil well pumps and thus greatly reducing the cost of repairs to said pump. The new construction and arrangement also avoids any danger of injury to the cups of the plunger-barrel while pulling the plunger in cases where such cups are used.

A further object is to make provision for effective high speed action of the plunger and valves.

The invention is applicable with both solid working-barrels and sectional working barrels, and in case of the latter a connecting-rod may be employed between the plunger-barrel and the standing-valve to draw the sections of the working-barrel out of the nipple and pump-tubing.

A further and very important object of the invention is to make provision whereby a standing valve of very substantial proportions may be used and the cage therefor may be of unusual strength and at the same time to make provision for a comparatively large passage through the standing valve, thus to increase the output of the well, to increase the life of the standing valve, and to insure against breakage of the standing valve cage when the same is used for the purpose of pulling the working barrel.

Letters Patent of the U. S. No. 993,520, granted to me May 30, 1911, have shown a pump provided below its standing valve with a conduit leading vertically to direct liquid to such valve, said conduit being provided with a lateral inlet and having an imperforate portion above such inlet, means, as a pipe forming a chamber outside and around such conduit to intercept air or gas on its way to the conduit, and provided with an inlet to direct liquid approximately horizontally toward the inlet of the conduit, an outlet being provided for air or gas from the upper part of said conduit and said chamber; and have provided pump tubing and a coupling between the pipe and tubing, an outlet being provided through the coupling from the interior of the pipe above said imperforate portion; and have also shown a bushing forming a seat for the standing valve cage, the same frictionally engaging said downward extension, and a suction pipe around said extension provided with an imperforate portion corresponding to that of the downward extension, and also provided below said imperforate portion with an inlet and above such portion with an outlet. In said Letters Patent the standing valve cage is provided with a resilient downward extension and a resilient bushing is provided to seat the cage and to engage the resilient portion of the extension; and furthermore, the standing valve cage body is shown as formed of a single piece having a valve-way and terminating below the valve-way in a downwardly tapering nearly cylindrical spigot, the taper of which is slight and elongate, and there is also provided an elongate taper seat for and corresponding to said spigot. The features of said Letters Patent are claimed therein and for that reason claims therefor are omitted from this application.

The accompanying drawings illustrate the invention.

Figure 1 is a fragmental, vertical, sectional elevation of a pump in place inside a well-casing and constructed in accordance with this invention and provided with a sec-

tional working-barrel and a lost-motion connection between the plunger-barrel and standing-valve to pull the latter and the working-barrel when desired. Fig. 2 is an enlarged, sectional, fragmental view further illustrating the invention and showing the same as it may be applied without the sectional working-barrel. Fig. 3 is a cross-section on line x^3, Fig. 2. Fig. 4 is a cross-section on line x^4, Fig. 2. Fig. 5 is a fragmental detail of the resilient guide for centering the working-barrel. Fig. 6 is an enlarged fragmental detail illustrating the construction of the spigot-joint with packing-groove.

The well-casing 1 is provided as usual with perforations 2 to admit fluid as oil or water and any gas that may be contained therein, to the anchor 3 which is provided with perforations 4 to admit the fluid to the extension 5 of the working-barrel 6 and standing-valve-cage 7, which extension 5 may be provided with perforations 8 and may be open at its bottom 9 to admit the fluid and to allow sand to drop out in case of any accumulations. The lower end of said extension 5 is beveled or rounded, as shown at 10, so as to be readily inserted downwardly through the seat 11 which supports the standing-valve and working-barrel; said seat being funnel-shaped to receive and center said lower end and to seat a tapered shoulder 12 forming the lower end of the valve-cage 7, the butt of the working-barrel 6 and the upper end of said extension 5.

The working-barrel 6 is an inserted working-barrel of less diameter than the tubing that can be pulled out of the tubing, and it may be composed of pipe-sections *a*, *b*, *c*, *d*, as shown in Fig. 1, or of a solid pipe *e*, as shown in Fig. 2; the lower end thereof being screwed onto a threaded neck 13 on the standing-valve-cage 7 above the tapered shoulder 12 which is provided with an offset 14 against which the lower end of the working-barrel 6 seats when screwed home. The upper end of the extension 5 is threaded and is screwed into the tapered lower end of the cage 7 which is provided with an internal shoulder 16 spaced apart from the upper end of the extension 5, between which shoulder and the upper end of the extension 5 is seated a flange 17 of the valve-seat 18 which seats the valve 19 of the cage in the usual manner. Said valve may be of any desired form. The valve shown is constructed after the general form of one previously patented to me in United States Letters-Patent No. 753,828, dated March 1, 1904; the same being provided with a central vertical web *f* with cavities *g* at the sides thereof to catch the superposed liquid so as to seat the valve quickly, and also provided with a downwardly, inwardly sloping lower face *h* having a central cavity *i*, the purpose being to prevent back flow of oil and hammering during rapid operation of the plunger-barrel. The seat 11 has a downward extension 20 formed of resilient bars connected together at their lower ends and each provided with an inward bend 21 thus together forming latches to frictionally engage the standing-valve extension 5 to frictionally hold the same against withdrawal during the usual operation of the pump, but to allow the extension to be withdrawn when force is applied for that purpose.

The sucker-rod may be formed of two sections 22 and 23 connected by a coupling 24 which forms a shoulder on said sucker-rod above a loose head 25 of the working-barrel 6 on which it is slidingly mounted. Said head consists of a centrally-apertured crown *j*, arms *k*, that depend therefrom, a sleeve *m* connected with the crown by the arms and provided at the lower end with an external shoulder 26 formed by a collar 27 screwed on the lower end of the sleeve and provided with an internal shoulder 28 to jam against the lower end of the sleeve to secure solidity. The external shoulder 26 at the lower end of the head engages an internal shoulder 29 formed in the working-barrel 6 by a thimble 30 that is provided on its outer face with a vertical series of annular corrugations or teeth 31.

The head 25 is provided with an external annular shoulder 32, the under face of which forms a stop to engage the thimble 30. The upper face 33 of said shoulder slants downwardly and outwardly to engage and distend latches 34 that are arranged symmetrically around the head and are provided with teeth 35 to engage the vertical series of external teeth 31 of the thimble 30. Said latches are pivotally suspended inside the nipple 36 of the pump-tube 37 by means of an outwardly-projecting heel 38 which rests on top of a projecting rim 39 of an upper guide 40 for the working-barrel, which guide is provided with vertical slots 41 in which the latches 34 are mounted to swing; said latches being provided at their lower ends with springs 42 that are wider than the slots 41 and are arranged externally of the guide 40 so that said springs form stops to prevent the latches from swinging in too far. Said springs may be fastened to the latches in any suitable way, as by lugs 43 cast on the latches and passed through holes 44 in the springs and then riveted; the latches being made of malleable iron, brass, steel, or other suitable material for that purpose.

The lower ends of the springs are inwardly bent as shown at 45 in order that they may be easily inserted into the nipple 36. The coupling 46 that connects the nipple 36 with the bottom of tube 37 is

provided with an internal inwardly-slanting apron 47 below its upper internally screw-threaded seat 46′ to house the heels 38 of the latches and to direct the standing-valve extension and the working-barrel centrally as the same are inserted.

The lower section 23 of the sucker-rod is connected with the cage 48 of the plunger-barrel 49 which may be loosely connected with the standing-valve through the medium of the connecting-rod 50 as shown in Fig. 1, where the plunger-barrel is provided at its lower end with a foot-piece 51 surrounding the rod 50 and engaging the head 52 of said rod when the plunger-barrel is drawn sufficiently above the top limit of its working stroke, thus to pull the standing-valve. The valve 53 of the plunger-barrel may be of the same character as the valve 19 of the standing-valve, but it is to be understood that either of said valves may be of any approved construction.

In case the working-barrel is formed of sections said sections may be united by elongate slightly-tapering, nearly-straight spigot-joints 54 in which the engaging surfaces between the sections are of considerable length, say two inches more or less, so that when they are forced together the sections will be held straight, true and friction tight on account of the slight taper of the joint, but will readily come apart after being once started from each other. The latches 34, the seat 11 and nipple 36 constitute means for clamping together the working barrel sections.

The special advantage secured by constructing the working barrel of sections having elongate friction tight joints is that such construction greatly increases the facility of securing true alinement of sections of the working barrel after they are bored so that said sections may be made interchangeable and can be put together by an ordinary workman and when the barrel is so put together and the sections driven home the barrel is invariably absolutely straight, thus avoiding the injury which occurs through unequal wearing and through excessive friction arising from internal irregularities at the joints which are liable to occur in any former construction. In this novel construction of plunger barrel it is made possible for the workman to take out any worn section and to replace it with a new section without any liability of destroying the alinement of the barrel. In said joint the inside face of the upper section is hollowed above the inserted end, as shown at 55, and the upper end of the spigot is beveled, as shown at 56, so as to make a groove 57 at the end of the joint between the two parts; the walls of said groove being aslant upwardly and downwardly so that the liquid will not be squeezed through the joint by rapid operation of the plunger but will circulate in the groove and thereby form a kind of liquid-packing to prevent leakage of oil or water through the joint under high pressures caused by depth of water above the joint. Said grooves also afford open spaces around the plunger-barrel at intervals therealong to accommodate sand that may accumulate between the upper end of the plunger-barrel when worn, and the working-barrel. Such accumulations will be washed out by the oil upon rapid movement of the plunger-barrel past such grooves which are preferably concave.

The upper section 22 of the sucker-rod has its body formed of a plurality of longitudinal blades 58 united at the axis of the rod so that the rod is cruciform in cross-section, the purpose being to secure great rigidity combined with extreme lightness. A sucker-rod formed of longitudinal blades is also shown in my co-pending application Serial No. 554,063, filed April 7, 1910. Said cruciform body is provided at its lower end with a pin 59 screwed into a socket 60 of the coupling 24, said coupling being also provided with a screw-threaded socket 61 into which the upper end 62 of the rod-section 23 is screwed. Said section 23 is cylindrical and passes through an orifice 63 in the loose head 25 of the working-barrel. The sucker-rod may be made in sections provided at each end with a pin 59. The seat 11 may or may not be externally screw-threaded to screw into a coupling 64 which screws onto and couples the nipple 36 and the anchor 3, the rim of said seat 11 being clamped between said anchor 3 and nipple 36 when the parts are screwed together.

In practical use, the upper well-tubing 37 carrying the coupling 46, nipple 36, anchor 3, seat 11, latches 34, and guide 40, and their attached parts, may be lowered into the well-casing 1 without the sucker-rod and its attachments; it being understood that the pump-tubing 37 is constructed in sections connected by couplings not shown, in the usual manner.

When the anchor has reached the bottom of the hole and the last section of pump-tubing has been screwed in place, then the standing-valve-cage with its extension attached to the working-barrel, and said working-barrel with its cage containing the plunger-barrel will be lowered into the pump-tubing by means of the sucker-rod, sections of which will be screwed in place as the work proceeds until the extension 5 enters the apron 47 through which it passes on downwardly until reaching the position shown in Fig. 1.

During the downward course of the parts carried by the sucker-rod the working-barrel passes between the latches which tempo-

rarily support the parts until the sucker-rod is lowered sufficiently to bring the coupling 24 against the top of the loose head 25, whereupon said loose head may be forced down, thus forcing the parts past the latches 34 until the shoulder 33 comes below the shoulders of the latches and the teeth 35 of said latches engage the teeth 31 of the thimble 30.

When the parts are all firmly seated in place as shown in Fig. 2, then power may be connected with the sucker-rod and the operation of pumping proceeded with. The smooth and cylindrical section 23 of the pumping-rod moves freely through the orifice 63 of the loose head 25, allowing the plunger barrel to move up and down. The head 25 thus serves as a guide for the sucker-rod and prevents lateral movement of the same, thereby avoiding uneven bearing of the plunger-barrel on the working-barrel. The downward extension 5 is provided at its top with gas and air outlets 65, and the anchor at its top with gas and air outlets 66 below the seat 11, so that gas and air may flow out into the well-casing 1 and thence to the top of the well. The crown *j* of the loose head 25 is beveled to form concavities *p* between the arms so that on the upward strokes the liquid forced up by the piston will pass the crown with slight friction and the liability of clogging will be minimized. The coupling 46 is of larger diameter below than above the apron 47, and the nipple 36 is screwed thereinto and forms an enlarged chamber to accommodate the springs 42 and the latches 34 outside the guide 40 which has resilient, inbent bars 67, the inward projections 68 of which hold the working-barrel truly centered and also serve as a packing to intercept sand that otherwise might pass downward to wedge between the nipple and the working-barrel. By means of these projections clogging of the working-barrel by sand is avoided. The rim 39 of the guide 40 is externally threaded to screw into the internally-threaded lower sleeve 69 of the coupling 46, and is provided with slots 70 to accommodate the heels of the latches 34. The annular shoulder 32 on the head of the working-barrel serves to afford a spring-seat for the arms *k* and allows the arms to be widely spaced apart from each other and from the sucker-rod 23 so as to allow the liquid to flow with minimum friction from the top of the working-barrel, and said shoulder further affords a packing means to engage the projections 68 on the guide 40 and latches 34 and prevent sand from working down between the working-barrel and the nipple. The anchor 3, coupling 64, nipple 36, coupling 38, and upper pump-tubing 37 constitute parts of the tubing of the pump inside which the standing-valve-seat is suspended. By making the standing-valve-cage of a single piece to serve as the foot of the plunger-barrel it is possible to mount inside said cage a valve-seat 18 having an oil or water way therethrough of larger diameter relative to the diameter of the plunger than is possible with other constructions, and the cost is minimized.

Especial attention is directed to the construction of the standing valve cage 7 which is made of a single piece of metal including the spigot shoulder 12 at the lower end which terminates at its upper end with an offset 14 above which is a screw-threaded neck 13 and above that the valve-retaining bail 71 provided internally with ribs 72 and forming a slide-way for the valve 19, said bail fitting the plain interior of the working barrel 6 and the screw-threaded neck 13 being tightly screwed into the lower end of the working barrel and the shoulder 12 forming a downward extending spigot internally screw-threaded to receive the downward extension 5 the upper end of which holds the valve seat 18 in place to support the valve 19. By thus making the standing valve cage of a single piece from the bottom of its spigot to the top of its bail a great advantage is secured over former constructions, there being possible a much greater thickness of solid material in the bail for the purpose of pulling the working barrel by the bail 71; and yet at the same time a larger diameter of bore for the passage of oil through the valve seat is provided. By this means a great improvement in combined strength of cage and capacity of flow is made. It is understood that an increase of diameter of the bore through the valve seat 18 greatly increases the output of oil through the valve and since the valve seat is especially subject to wear from the passage therethrough of sand-containing oil it is important that the valve seat be made as substantial as possible and by making the valve cage of a single piece the valve seat may be made unusually thick and yet the strength of the cage be unusually great.

Pressure may be applied through the plunger-rod and the coupling thereon through the head of the working-barrel, thus to force the working-barrel down and solidly seat the tapering shoulder at the foot thereof in the standing-valve seat, and the latches hold the same solidly in position and prevent jarring loose. When it is desired to pull the working-barrel, the sucker-rod is first drawn up until the plunger-barrel-cage 48 engages the shoulder 27, thus lifting the loose head 25 and causing its shoulder 33 to force the latches 34 outward against the pressure of the springs 42 until the latch-teeth 35 are disengaged from the teeth 31 of the thimble 30; whereupon the working-bar-

rel and its attached parts may all be withdrawn.

It is to be understood that the invention is not limited to the specific shape and form shown, but that it may be embodied in various mechanical constructions.

I claim:—

1. In a pump provided with pump-tubing and a working-barrel, a funnel-shaped seat connected with the pump-tubing and provided with a downward hollow extension that has resilient portions and a standing-valve connected with the working-barrel of the pump and provided with a taper shoulder to fit said seat and also provided with a hollow downward extension to frictionally engage said resilient portions.

2. In a pump, the combination of a coupling, a nipple, an anchor and a funnel-shaped seat between said nipple and anchor, said nipple and anchor being screwed into the coupling and against said seat, a standing-valve having a taper shoulder seated in said seat and a downward extension, and means below said seat to frictionally engage said downward extension.

3. In a pump, a coupling, a funnel-shaped seat in said coupling, two sections of pump-tubing screwed into the coupling on opposite sides of said seat, a downward resilient extension of said seat, a working-barrel, a downward extension below the working-barrel to engage said resilient extension, and a taper shoulder at the lower end of the working-barrel to rest in said seat.

4. In a pump having a piston, a working barrel comprising a series of tubular sections surrounding the piston, and means inside of said working-barrel and in slidable relation to the piston for raising said sections together.

5. In a pump, a working barrel comprising a series of tubular sections having their adjacent ends correspondingly beveled and forming spigot joints, the inside face of one section being hollowed above the inserted end of another section to form a groove, the walls of said groove being aslant upwardly and downwardly, and means for clamping said sections together.

6. In a pump, the combination with the pump tubing, a working-barrel composed of sections that are united by friction tight elongate spigot-joints, grooves being formed at the upper ends of the spigots of said joints, the walls of said grooves being aslant upwardly and downwardly for the purpose set forth.

7. In a pump, the combination with tubing, of an inserted sectional working-barrel, and guiding springs carried by the tubing for frictionally holding the working-barrel tight in the tubing.

8. In a pump, a working-barrel having a loose head and a latch to retain the barrel, said head being provided with a shoulder to engage said latch to disengage the same from the barrel, and means connected with the sucker-rod of the pump to operate said loose head.

9. In a pump provided with a pump-plunger and with pump-tubing, a working-barrel, a head therefor having a limited movement relative thereto, a latch for the working-barrel, means on the head to release the latch, and a sucker-rod having a limited movement relative to the head and connected with the pump-plunger to operate the same and constructed and connected to engage the head to move it downward and upward relative to the working-barrel and the pump-tubing.

10. In a pump provided with a sucker-rod, a working-barrel provided with a vertical series of teeth, pump-tubing, latches pivotally connected with the tubing, springs fastened to the latches and slidably engaging the pump-tubing to hold said latches in engagement with said teeth, and means operatable by the sucker-rod to release the latches.

11. In a pump, a working-barrel provided with a vertical series of teeth, pump-tubing, latches pivotally connected with the tubing, and springs slidable inside the pump-tubing to hold said latches in engagement with said teeth.

12. In a pump, a working-barrel, a plunger-barrel therein, a thimble connected with the working-barrel and provided with external teeth, a head extending down through the thimble, and a collar on the lower end of said head to engage the lower end of the thimble, said head being provided with shoulders, and latches to engage the thimble to hold the same down, the shoulders of said head being adapted to release said latches when the head is moved up.

13. In a pump provided with upper tubing and a nipple, a coupling between the nipple and the upper tubing, the same being provided with a funnel-shaped apron.

14. The combination with the nipple, of a coupling screwed onto the nipple and provided with an inwardly-projecting apron, a guide for the working-barrel inside the coupling and resting on the nipple and chambered beneath the apron.

15. The combination with a working barrel and a nipple, of a coupling screwed onto the nipple and provided with an inwardly-projecting apron, a guide for the working-barrel inside the coupling and resting on the nipple and chambered beneath the apron, the rim of said guide being slotted, and latches provided with heels in said slots.

16. In a pump, pump tubing, a working barrel inside of and free from the pump-

tubing and composed of separable sections and having friction-tight joints, a standing valve fastened to the working barrel, a plunger barrel inside of the working barrel, and internal means loosely connecting the standing valve to the plunger barrel to raise and lower the sections together through the pump tubing.

17. In a pump, a working-barrel comprising a series of tubular sections having their adjacent ends correspondingly beveled and forming spigot joints, there being grooves at said joints.

In testimony whereof, I have hereunto set my hand at Los Angeles, California, this 19th day of February, 1909.

JOHN HAHN.

In presence of—

JAMES R. TOWNSEND,

M. BEULAH TOWNSEND.