Dec. 3, 1929. T. C. BANNON 1,738,136

WELL PUMP

Filed March 2, 1927 2 Sheets-Sheet 1

Fig. 1.

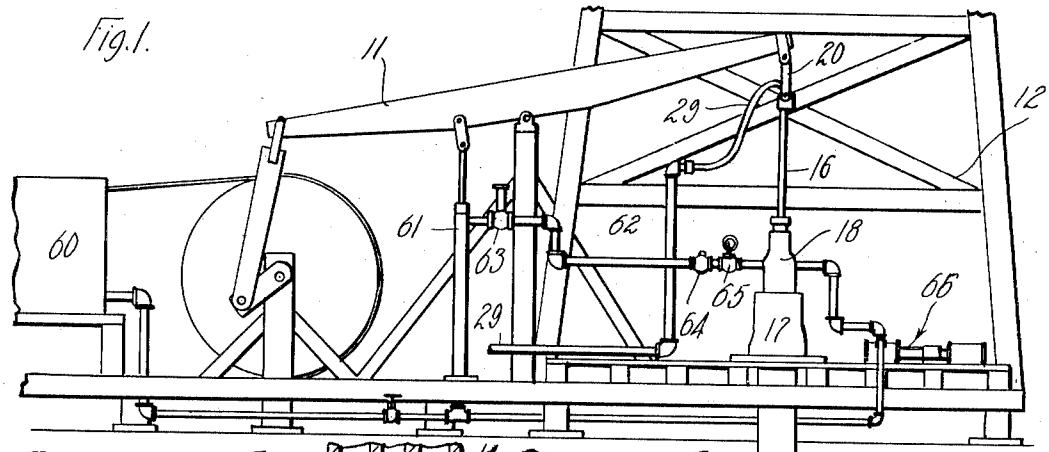



Fig. 2.

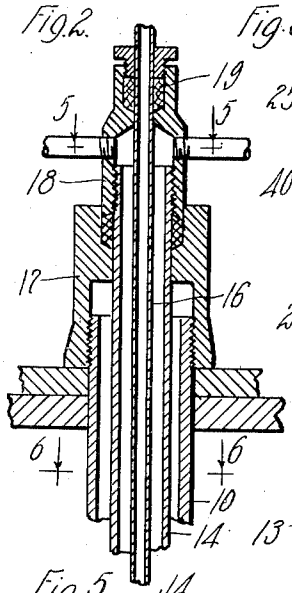



Fig. 3.

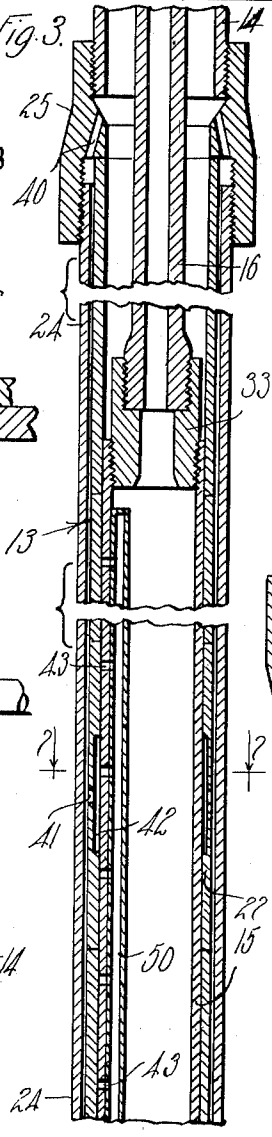



Fig. 4.

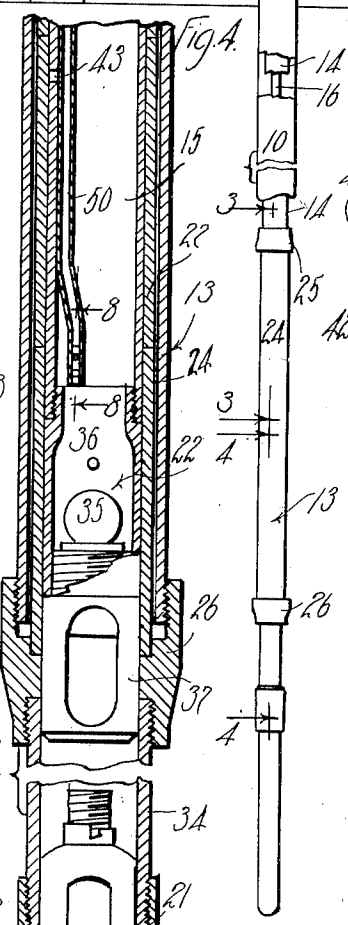



Fig. 7.

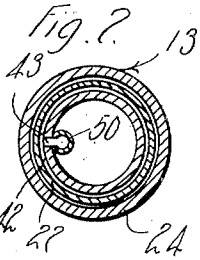



Fig. 8.

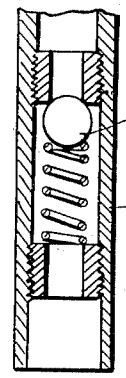



Fig. 5.

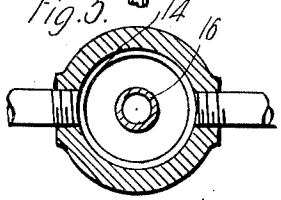
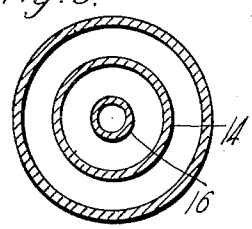



Fig. 6.

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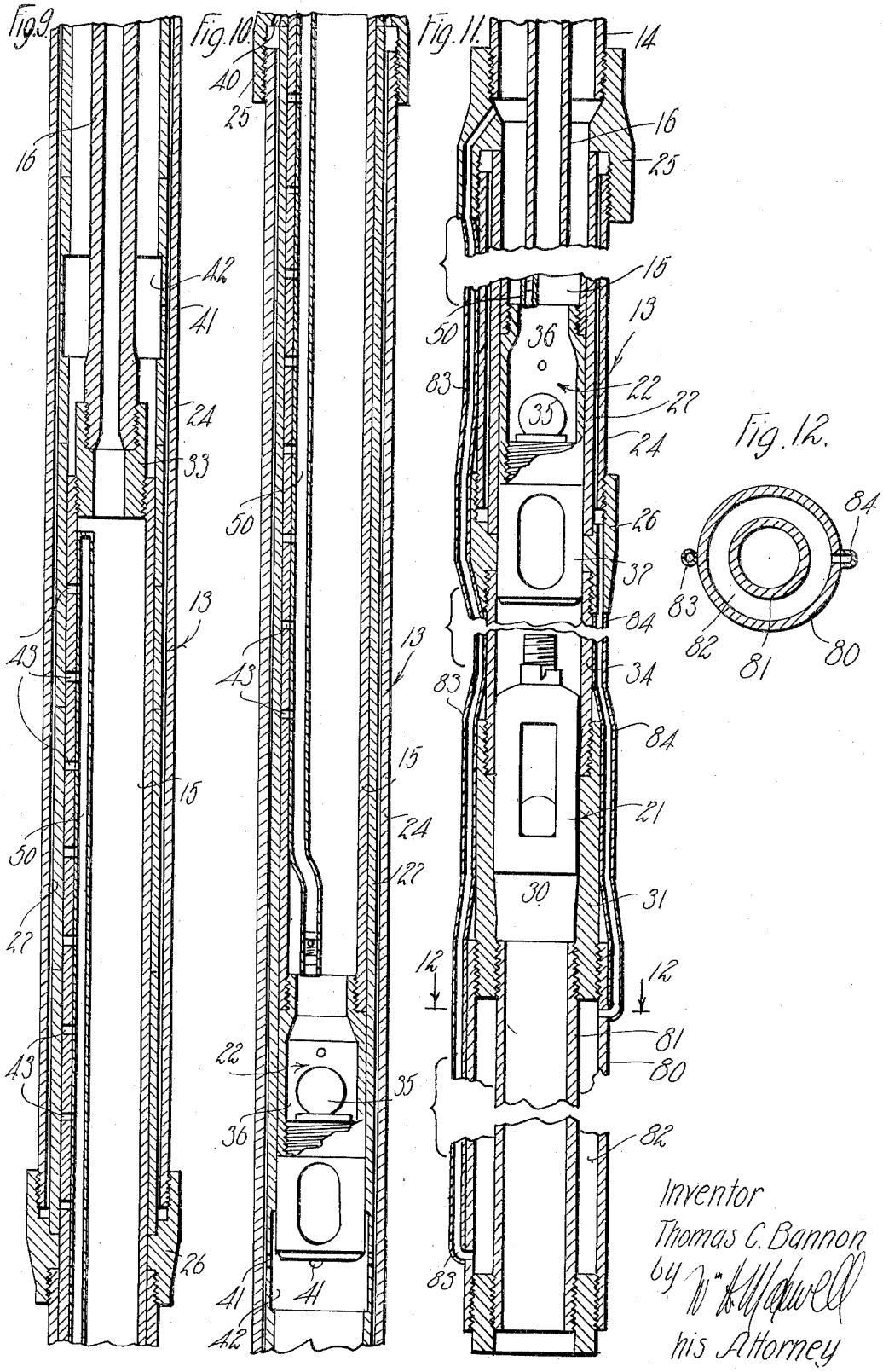
WELL PUMP

Filed March 2, 1927 2 Sheets-Sheet 2



Patented Dec. 3, 1929 1,738,136

# UNITED STATES PATENT OFFICE

THOMAS C. BANNON, OF LOS ANGELES, CALIFORNIA

## WELL PUMP

Application filed March 2, 1927. Serial No. 171,965.

This invention relates to a well pump and an object of the invention is to provide a simple, practical and effective pump suitable for oil wells.

It is an object of this invention to provide a pump which operates to keep the pumped fluid in flowing condition even though it may include matter that tends to congeal, sand, or other matter such as ordinarily makes well pumping difficult and, in some cases, impossible.

Another object of this invention is to provide a pump which minimizes the danger of the parts becoming clogged or sanded up and makes possible the flushing of the parts.

A further object of my invention is to provide a pump with perfect lubrication between the plunger and barrel.

Another object of the invention is to provide a well pump in which the pressures on the pump parts, for instance, on the barrel and plunger, are equalized in a manner which allows the parts to be fitted to operate at maximum efficiency.

It is a particular object of my invention to provide a pump in which the plunger can be accurately spaced in the proper operating position in the barrel.

Further, an object of this invention is to provide a pump of the general type mentioned which is simple and inexpensive of manufacture and effective and reliable in operation.

The various objects and features of my invention, including those above mentioned and many others, which will be obvious from my disclosure, will be best and more fully understood from the following detailed description of a typical form and application of the invention, throughout which description I refer to the accompanying drawings, in which:

Fig. 1 is a view illustrating the manner in which my present invention may be related to a standard form of well derrick and pumping equipment;

Fig. 2 is an enlarged sectional view, taken at the upper end of the well casing;

Fig. 3 is an enlarged sectional view of the upper portion of the pump, being an enlarged view taken on line 3—3 on Fig. 1;

Fig. 4 is a view similar to Fig. 3 showing the lower portion of the pump, being a view taken on line 4—4 on Fig. 1;

Fig. 5 is a sectional view, taken on line 5—5 on Fig. 2;

Fig. 6 is a sectional view, taken on line 6—6 on Fig. 2;

Fig. 7 is a sectional view, taken on line 7—7 on Fig. 3;

Fig. 8 is an enlarged sectional view of a part of the pump being a view taken on line 8—8 on Fig 4;

Fig. 9 is a sectional view of the lower portion of the pump, showing the plunger down as far as it can be lowered;

Fig. 10 is a sectional view of the upper portion of the pump, showing the plunger in position above its normal working position and in position to cause the pump parts to be flushed;

Fig. 11 is a sectional view illustrating another form of pump embodying my invention; and

Fig. 12 is a sectional view of the pump illustrated in Fig. 11, being a view taken on line 12—12 on Fig. 11.

I have shown the pump arranged in a well casing 10 to be operated from a walking beam 11 of a standard derrick 12. The pump barrel 13 is mounted in the casing 10 on the lower end of a pump tubing 14, while the pump plunger 15 is carried by a sucker rod 16 which operates within the tubing 14. A casing head 17 is applied to the upper end of the well casing 10 and is formed with an opening through which the pump tubing 14 enters the casing. A tubing head 18 is applied to the upper end of the tubing to be supported by the casing head and includes a suitable stuffing box 19 which slidably passes the sucker rod 16. A connection 20 is provided between the upper end of the sucker rod and the walking beam 11 whereby oscillation of the beam causes reciprocation of the rod. The walking beam 11, or other means provided for reciprocating the rod, may be driven in any suitable manner.

The pump provided by my invention in-

cludes, generally, the barrel 13, the plunger 15, a standing valve 21 located at the lower end of the barrel, a working valve 22 carried by the plunger, and means for introducing fluid from the space between the pump tubing 14 and the sucker rod into the plunger to mix with the fluid handled by the pump. The sucker rod 16 is made hollow or in the form of a tube and conducts the pumped fluid to the top of the well where it may be received by a flow connection 29.

The barrel 13 may be of typical construction including a tubular shell 24, a top collar 25, a bottom collar 26, and a liner 27 carried in the shell between the collars. The top collar 25 connects the barrel with the lower end of the tubing 14, while the lower collar 26 connects the shell with an extension nipple 34 which carries the standing valve 21. In the construction shown, the liner 27 is formed in a plurality of tubular sections arranged together end to end and clamped tightly between the collars. A clearance or space of about one-eighth of an inch is left between the shell and liner.

The standing valve 21 may be of any suitable construction; for instance, it may be the usual ball type of valve including a body 30 adapted to fit tightly in a tapered seat formed in a shoe 31 at the lower end of the extension nipple 34. In practice, this valve remains stationary in the shoe 31 and operates as the intake valve of the pump. The fluid to be pumped is admitted into the lower end of the shoe 31.

The plunger 15 is tubular and slidably fits the liner 27. It is connected to the lower end of the sucker rod to operate therewith and so that the interior of the plunger is in communication with the interior of the rod. I have shown the plunger and rod connected by a coupling 33. The working valve 22 is carried by the plunger and, in practice, may be of any suitable construction. I prefer to use the standard form of ball valve and to mount it at the lower end of the plunger. I have shown a ball valve 35 mounted in a blind cage 36 screw-threaded to the plunger. A standing valve puller 37 may be applied to the lower end of the working valve so that the standing valve 21 can be removed with the plunger in the manner commonly followed in well pumps.

My construction provides a communication between the interior of the pump tubing 14 and the interior of the plunger 15 whereby fluid introduced into the tubing around the sucker rod is conducted into the plunger. My preferred construction provides one or more openings 40 in the upper collar 25 to connect the interior of the collar with the space between the shell 24 and liner 27. One or more holes 41 are provided in the liner to connect the space between the shell and liner and a recess 42 formed in the inside of the liner. One or more ports 43 extend through the plunger 15 to co-operate with the recess 42 so that fluid from the recess enters the plunger. It is desirable to have the fluid passage just described open at all times during the pumping operation and, therefore, I locate the recess 42 in the liner to be normally covered by the plunger, and I form the ports 43 in the plunger so that there is always at least one port in register with the recess 42 during normal reciprocation of the plunger. If I use one port 43, it is made comparatively long and extends longitudinally of the plunger. I prefer to provide a plurality of small ports spaced to properly co-operate with the recess. The recess preferably extends entirely around the inside of the liner so that the ports in the plunger co-operate with it regardless of the rotative position of the plunger in the liner.

The fluid introduced through the ports 43 is preferably received by a manifold 50 mounted on the interior of the plunger, the manifold being designed to discharge the fluid in the desired manner in the plunger. In the construction shown in the drawings, the ports 43 are formed in a row longitudinally of the plunger and, therefore, the manifold 50, which may be a pipe welded to the inside of the plunger, extends longitudinally of the plunger. The fluid may be discharged from either end of the manifold 50. I have shown the manifold provided with a valve controlled discharge opening at its lower end. The check valve 51 in the lower end of the manifold prevents fluid from entering the manifold from the interior of the plunger. The discharge end of the manifold may be directed toward the ball 35 of the working valve so that the fluid discharged from the manifold keeps the working valve clean and in proper operating condition.

I prefer to relate the length of the liner 27, the length of the plunger 25, the position of the recess 42 in the liner, and the ports 43 in the plunger, first, so that the recess 42 is above the plunger when the plunger is lowered to position where the hook-on 37 engages the standing valve 21; second, so that all of the ports 43 are within the liner and closed by the liner when the plunger is in a raised position where the recess 42 is uncovered, allowing fluid from the space between the shell and liner to enter the liner below the working valve; and, third, so that there is always at least one port 43 in communication with the recess 42 during normal reciprocation of the plunger.

In operating the pump, I may introduce circulating fluid, for instance, clean oil, into the space between the sucker rod and pump tubing so that it circulates through the fluid passage above described and into the plunger to mix with the fluid being pumped from the well. The fluid thus introduced may obvi-

ously be heated, if desired, and may be oil or a fluid of a character different from that being pumped, all as circumstances may require. This circulating fluid may be introduced through the tubing head 18 from any suitable source, such as a reservoir 60, and may be introduced by means of a pump 61. I show pump 61 operated from the walking beam 11 so that circulating fluid received from the reservoir 60 is pumped through a pipe 62 into the head 17. I prefer to relate pump 61 to the well pump so that circulating fluid is pumped in by pump 61 during the down stroke of the plunger 15. It is desirable to provide a pressure release valve 63, a check valve 64 and a pressure gauge 65 in the pipe 62. The check valve prevents the circulating fluid from backing up through the pump tubing. An auxiliary pump 66 may be provided for pumping circulating fluid when the beam 11 is out of operation. The circulating fluid, introduced into the tubing, passes through openings 40 in the collar 25, passes through the space between the shell 24 and liner 27, passes through the holes 41 into recess 42, and passes from recess 42 through port 43 into manifold 50. Manifold 50 directs the circulating fluid toward the ball 35 of the working valve, thus keeping it clean and in working condition. The circulating fluid mixes with the fluid from the well and, if the circulating fluid is of the proper character relative to the fluid from the well, it will materially aid the flow of the pumped fluid upwardly through the pump and sucker rod. For instance, if the fluid from the well carries sand, the circulating fluid, if oil, increases the proportion of oil to sand and thus keeps the sand in suspension. The fluid pressures coming on the liner and plunger are equalized to a degree which overcomes difficulties experienced in deep well pumps, due to excessive pressures causing expansion and contraction of the slidably fitted parts. During normal operation, the circulating fluid is introduced into the plunger during each down stroke of the plunger 15.

With my invention, it is possible to accurately locate the stroke of the plunger in the barrel. The plunger may first be lowered to its lowermost position where the hook-on 37 rests on the working valve. The plunger is then below the recess 42 in the liner so that the circulating fluid cannot enter the plunger to circulate. As the plunger is drawn up, the uppermost port 43 in the plunger registers with the recess 42 and the circulating fluid starts to flow, the flow being indicated by the gauge 65. This flow indicates to the operator that the plunger is now at the lowermost limit of its proper stroke and has the proper clearance above the standing valve. The space then between the reciprocating part and the standing valve will depend upon the proportioning of the parts and will be known by the operator. As the plunger is further drawn up, the ports 43 remain in communication with the recess 42 and the circulating fluid continues in circulation until the lowermost port 43 moves out of register with the recess 42 at which time the fluid circulation is cut off, indicating that the plunger is at the uppermost limit of its proper stroke. By thus finding the proper limits of stroke of the plunger, the operator can accurately space the plunger to operate in the proper manner.

If the working valve becomes clogged or inoperative, the plunger can be raised to an up position, shown in Fig. 10, where all ports 43 are still within the liner and closed or out of register with recess 42. The circulating fluid then enters under the working valve to flow upwardly through the valve and flush it.

In Figs. 11 and 12, I show a heater whereby heated circulating fluid may be used to heat the pumped fluid before entering the pump. The heater may be applied to shoe 31 and may include two cylindrical parts 80 and 81 spaced apart to form a chamber 82. The parts 80 and 81 may be any desired length and the lower end of the inner part 81 may be open to receive fluid from the well. In this case, the circulating fluid, instead of passing directly from the pump tubing 14 to the space between the shell and liner, is bypassed through the chamber 82. To do this, a pipe 83, or other connection, extends between the tubing and the chamber 82. The pipe 83 may be applied to the exterior of the other parts, as shown in the drawings. A second pipe, or connection 84, connects the chamber 82 with the space between the shell and liner. The connection 84 may be applied to the exterior of the pump parts and may connect through the lower collar 26. The pipes 83 and 84 connect into opposite ends of the chamber 82 to assure proper circulation of the fluid through the chamber. With this form of construction, the general mode of operation is the same as above described, except that the circulating fluid circulates through the chamber 82 of the heater in passing from the pump tubing to the space between the shell and liner. It will be obvious that if the circulating fluid is in a neated condition upon reaching the circulating chamber, it will heat the oil before entering the pump parts and thus aid the action of the pump.

Having described only a typical preferred form of my invention, I do not wish to limit myself to the specific details set forth, but wish to reserve to myself any changes or variations that may appear to those skilled in the art or fall within the scope of the following claims.

Having described my invention, I claim:

1. A pump for use with a tubing and a hollow sucker rod, including a barrel carried

by the tubing, and a hollow plunger carried by the rod and slidably fitting the barrel, the plunger and barrel having co-operating openings through which a fluid connection is made between the tubing and the plunger the opening in the barrel being between parts of the barrel which slidably carry the plunger.

2. A pump for use with a pump tubing and a hollow sucker rod, including a barrel carried by the tubing, a plunger carried by the rod and slidably carried in the barrel, and a fluid connection between the tubing and the plunger, said connection including an opening in a part of the barrel slidably carrying the plunger and an opening in the plunger to register with the opening in the barrel.

3. A pump for use with a pump tubing and a hollow sucker rod, including a barrel carried by the lower portion of the tubing, a plunger carried by the rod and slidably carried by the barrel, and a fluid connection between the tubing and the plunger, said connection including an opening extending around the interior of the plunger carrying portion of the barrel and a port in the plunger to register with the opening.

4. A pump for use with a pump tubing and a hollow sucker rod, including a barrel carried by the tubing, a plunger carried by the rod, and a fluid connection between the tubing and the plunger, said connection including an opening in the barrel and a plurality of ports spaced longitudinally in the plunger to co-operate with the opening.

5. A pump for use with a pump tubing and a hollow sucker rod, including a barrel carried by the tubing, a plunger carried by the rod, and a fluid connection between the tubing and the plunger, said connection including a recess in the barrel and a plurality of ports spaced longitudinally in the plunger to register with the recess so that there is always one port in register with the recess during normal operation of the plunger.

6. A pump for use with a pump tubing and a hollow sucker rod, including a barrel carried by the tubing, a plunger carried by the rod and slidably fitting the barrel, and a fluid connection between the tubing and the plunger, said connection including a recess in the barrel and ports in the plunger to register with the recess, the recess being located in the wall of the plunger carrying portion of the barrel so that the plunger can be lowered to a position in the barrel where the ports are all below the recess.

7. A pump for use with a pump tubing and a hollow sucker rod, including a hollow plunger carried by the rod, and a barrel for the plunger carried by the tubing, the barrel including a shell and a liner spaced within the shell, the space between the shell and liner being in communication with the tubing, the liner and plunger having registering openings connecting said space with the interior of the plunger.

8. A pump for use with a pump tubing and a hollow sucker rod, including a hollow plunger carried by the rod, and a barrel for the plunger carried by the tubing, the barrel including a shell, a collar connecting the shell with the tubing, and a liner spaced within the shell, the collar having an opening connecting the tubing with the space between the liner and shell, the liner and plunger having registering openings connecting said space with the interior of the plunger.

9. A pump for use with a tubing and a hollow sucker rod, a barrel carried by the tubing, a hollow plunger carried by the rod and slidably carried in the barrel, a working valve in the plunger, and means whereby fluid is conducted from the tubing to the interior of the plunger and directed downwardly above the valve, said means including a recess in the plunger carrying wall of the barrel receiving fluid from the tubing, a plurality of ports in the plunger to co-operate with the recess, and a manifold in the plunger receiving fluid from the ports.

10. A pump for use with a pump tubing and a hollow sucker rod, a barrel carried by the tubing, a hollow plunger carried by the rod and slidably carried in the barrel, and means whereby fluid is introduced into the plunger from the tubing, said means including an opening in the barrel receiving fluid from the tubing and ports in the plunger to co-operate with the opening, the plunger being movable to a position in the barrel with its lower end related to the opening so that the plunger is slidably carried in the barrel and fluid from the opening enters the lower end of the plunger.

11. A pump for use with a pump tubing and a hollow sucker rod, a barrel carried by the tubing, a hollow plunger carried by the rod, a working valve in the plunger, and means whereby fluid from the tubing is introduced into the plunger above the valve, said means including an opening in the barrel receiving fluid from the tubing and ports in the plunger to co-operate with the opening, the plunger being movable to a position where it is slidably engaged in the barrel and has its lower end related to the opening so that fluid from the opening enters the lower end of the plunger.

12. A pump for use with a pump tubing and a hollow sucker rod, a barrel carried by the tubing, a hollow plunger carried by the rod, a working valve in the plunger, and means whereby fluid from the tubing is introduced into the plunger above the valve, said means including an opening in the barrel receiving fluid from the tubing and ports in the plunger to co-operate with the opening and a manifold in the plunger to receive fluid from the ports and direct it at the valve,

the plunger being movable to a position where it is slidably engaged in the barrel and has its lower end related to the opening so that fluid from the opening enters the lower end of the plunger.

13. A well pump for use with a pump tubing and a hollow sucker rod including a barrel carried in the well by the tubing, a plunger carried by the rod to operate in the barrel, a heater in the well in connection with the barrel to pass the pumped fluid, and means for circulating fluid from the tubing through the heater and into the plunger.

14. A pump for use with a pump tubing and a hollow sucker rod including a barrel carried by the tubing, a plunger carried by the rod, a standing valve at the lower end of the barrel, a heater mounted below the valve, and means whereby fluid from the tubing is circulated through the heater and discharged into the plunger.

In witness that I claim the foregoing I have hereunto subscribed my name this 21st day of February, 1927.

THOMAS C. BANNON.