M. HAROLD.

PACKING AND STEAMING OIL WELLS.

No. 180,873. Patented Aug. 8, 1876.

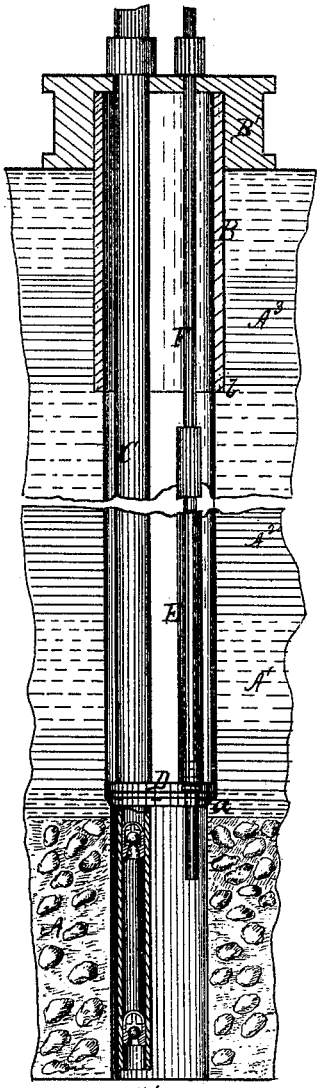

Fig. 1.

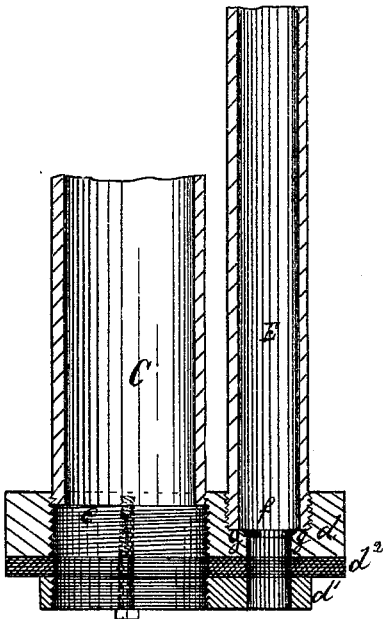

Fig. 2.

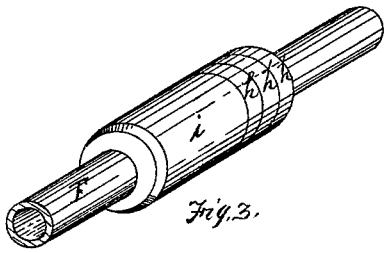

Fig. 3.

Witnesses.

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MICHAEL HAROLD, OF RICHLAND TOWNSHIP, CLARION COUNTY, PA.

IMPROVEMENT IN PACKING AND STEAMING OIL-WELLS.

Specification forming part of Letters Patent No. **180,873**, dated August 8, 1876; application filed April 15, 1876.

To all whom it may concern:

Be it known that I, MICHAEL HAROLD, of Richland township, in the county of Clarion and State of Pennsylvania, have invented a new and useful Improvement in Packing and Steaming Oil-Wells; and I do hereby declare the following to be a full, clear, and exact description thereof, reference being had to the accompanying drawing, forming part of this specification, in which—

Figure 1 is a vertical section of a well having my improvements applied thereto. Fig. 2 is a sectional view of packer, with portions of the pump-tubing, gas-tube, and pipe for steaming the well. Fig. 3 is a detached view of steam-pipe and its packing.

Like letters refer to like parts wherever they occur.

My invention relates to the manner and means for packing, steaming, and flooding petroleum-wells; and consists, first, in packing the tubing of oil-wells by means of a packer which surrounds the tubing and rests upon a shoulder formed in the well for that purpose, thus making a tight joint and shutting off any water which may enter above the packing; second, in a packer provided with devices for securing it to the tubing, and adapted to rest upon and pack with a shoulder or ledge formed in the well for that purpose; third, in so packing the steaming-tube where it passes through the "packer" that said tube may be raised or lowered at pleasure to either confine the steam to the oil-bearing rock or permit it and the gas to escape through the gas-tube, as may be found desirable.

Before proceeding to specifically describe my invention, and in order that it may be clearly indicated, I desire to call attention briefly to what has heretofore been done in operating oil-wells.

It is well known that wells are drilled various depths, from twelve hundred to twenty-five hundred feet, according to the location and dip of the oil-bearing rock; that in the first three hundred feet the fresh water has to be shut out, and between that depth and the oil-bearing rock the salt-water has to be shut out.

The method first adopted to shut off the fresh water was by means of "seed-bags" and various "packers" invented and applied for that purpose, and this was subsequently abandoned for the casing, which was extended down for three hundred feet, or so much thereof as was necessary, and was supported upon a ledge or shoulder, formed by narrowing the well; but, owing to the expense attendant upon casing the well to the great depth required to shut off the salt-water, the old seed-bag or packer system has been, and, as far as I am aware, is, the only plan adopted for the latter purpose. The seed-bag system of packing, of course, closed the well in such a manner that the gases could only escape through the pumping-tube, giving rise to much trouble in operating the pumps, to avoid which a gas-tube, parallel to the pump-tubing, and extending through the seed-bag or packer, has been for a long time commonly employed; also, in operating oil-wells it is a common practice, when the yield decreases, to "flood" the wells—that is, to let oil or benzine into the oil-yielding portion—and when the veins become clogged with paraffine, to "steam" the well, both of which operations have been practiced through the pumping and gas tubes. In flooding, which is generally done through the pumping-tube, much trouble and delay arise, from the necessity of removing the sucker-rods and valves; and steaming, which is generally done through the gas-tube, but has been done through the pumping-tube, and through a separate tube, specially introduced for that purpose, is inefficient, owing to the condensation which results from the said tubes being surrounded by liquid; and if the packer is above the oil-bearing rock, (in the slate-rock,) the steam is liable to soften the slate-rock and induce caving, with its attendant troubles.

My object is, therefore, to simplify and render more efficient the packers and packing of oil-wells, and to adapt them to the flooding and steaming of wells, so as to obviate the difficulties recited.

I will now proceed to describe my invention so that others skilled in the art to which it appertains may apply the same.

A A^1 A^2 A^3 represent strata of rock and soil, of which A is the oil-bearing rock, or sand. B is the usual casing, with casing-cap B′. C indicates the pumping-tube, provided with the usual valves and sucker-rods, or any approved pumping devices. D is my improved packer, hereinafter more specifically described. E is the ordinary gas-tube, and F is a tube for steaming the well.

In boring a well I proceed as follows: For the first three hundred feet, more or less, according as is rendered necessary by the fresh water, I bore the well the usual diameter, say, eight inches, and then contract or reduce the diameter, say, to five and one-half inches, forming the ledge or shoulder *b* for the casing B, which is applied in the ordinary way. The well, thus reduced in diameter to five and one-half inches, is continued down to a point below where the salt-water enters, and, preferably, for reasons hereinafter stated, down to a point adjacent to the oil-bearing rock, where it is again contracted, say, to four and one-half inches diameter, so as to form a second shoulder, *a*, either square or sloping, with which the packer D may engage. From this point the well may be continued down to the desired depth without further narrowing.

I will next proceed to describe my improved packer D. It consists of two disks, *d* d^1, which clamp a packing-ring or disk, d^2. The upper disk, *d*, approximates the size of the well just below the casing. The lower disk, d^1, is less in size, and, its function being simply to clamp the packing to the main disk, it is immaterial what its dimensions and shape are, provided it will enter the bore of that portion of the well below the second shoulder, so as to allow the packing d^2 to engage with shoulder *a*. This packer D has two openings, *e* and *f*, one for the passage of the pump-tubing, and the other for the steaming-pipe and for the connection of the gas-tube. The hole *e* is preferably threaded in both disks, so as to act as a thimble or socket, which I find to be the best way of making a connection between the pump-tubing and packer, though other and well-known means may be adopted. The hole *f* is of greater diameter above than below, forming a shoulder, *g*, for the thimble of the steam-pipe to rest upon, and the end of the gas-tube to abut against, the larger or upper portion of *f* being likewise threaded to form the connection between the packer and gas-tube. F is a tube for introducing steam into the lower part of the well. It is passed, centrally of the usual gas-tube E, through the opening *f* of the packer, and is provided with leather or other washers *h*, which rest against the socket *i*, and pack the joint between the packer D and tube F, so as to close the gas-tube, and confine any steam which may be introduced through said pipe to the lower part of the well.

Instead of the leather washers, or washers of that nature, the thimble *i* and shoulder *g* may be ground to make a close joint; but I prefer the washers, as the ground joint may be rendered inoperative by sand or other matter falling or resting on the shoulder *g*.

In putting down the tubing, I first connect to the under side of the packing-disk a number of sections of pump-tubing, with pumping-barrel, &c., to reach the required distance below the lower shoulder or ledge *a*, and into the oil-bearing rock. I then connect to the upper side of the packing-disk both pump and gas tubing, and lower the disk into the well, adding sections of tubing until there have been sufficient sections of gas-tubing added to reach from shoulder *a*, where the packer will rest, to a point above the level which the salt-water is likely to reach in the well. This will vary from two hundred and fifty to four hundred feet, in different wells, and of course require a varying length of gas-tubing. When the requisite length of gas-tubing has been determined and added, thenceforth the pump-tubing only is added, and the disk lowered thereby until it rests upon the shoulder *a*, where it is held firmly and caused to pack closely by the weight of the tubing above it. The salt-water will thus be shut off from the oil-bearing portion of the well, and the column accumulating above the packer will aid in forcing it close upon its seat.

The pumping devices may then be applied and the well pumped in the usual manner. When it is desirable to flood the well with water, the valves, rods, &c., need not be disturbed, as all that is necessary is to raise the whole line of tubing slightly, so as to lift the disk-packer off its seat upon shoulder *a*, when the column of salt-water above the disk will descend into the oil-bearing sand, effectually flooding the well with water, and the shock of the descending column will open all the fissures which have been stopped by the accumulation of paraffine, sand, &c. After the desired effect has been produced, the tubing is again lowered to carry the packer back upon its seat, and the well is ready to pump at once, for the removal of the salt-water, and the obtaining of oil. By my method and devices the flooding operation can be quickly effected and rapidly repeated.

In flooding with oil or benzine, I make use of the steam-pipe, introducing the oil by this means into the closed chamber, and bringing it in direct contact with the walls of the oil-bearing portion of the well. The well, being effectually closed by the packer and packing of the steam-tube, confines the oil, so that it can be (like the steam) introduced under pressure, and, the space in which it can rise being limited, less quantities of oil are required to effectually flood the well. The pumping-tube and its valves being intact, the well can be pumped at the time of flooding, thus removing paraffine or like matter freed by the flooding process.

Another mode of treating unproductive wells to remove obstructions from the veins, has been to close the well and use an exhaust-

pump; but, owing to the depth of the wells, it has been found difficult to produce an effective vacuum. With my packer, forming a closed chamber of the oil-bearing portion of the well, the pump may be attached to the steam-tubing, and an effective vacuum produced where required, viz., in the oil-bearing rock.

In steaming a well, the pipe is introduced through the packer, centrally of the gas-tube, and the socket *i* may be held slightly off shoulder *g*, until all gas has been expelled or escaped from the lower chamber of the well, after which (or before, if preferred) the pipe F is lowered, and hangs suspended on shoulder *g*, with which it forms a tight joint, confining all the steam to the oil-bearing rock, where the heat is needed, enabling the pressure of the steam to be utilized as well as its heat. Any condensation that takes place in the chamber below the packer will only result in increasing the heat.

In the preceding portion of the specification it was specified that though not intending to limit or define the position of the shoulder *a* in any respect, except in so far as it must be low enough down to shut off salt-water, yet the narrowing was preferably adjacent to the oil-bearing rock. The reason for this is as follows: Above the oil-bearing rock are strata of slate-rock, which are affected by steam to such an extent that often, in steaming wells, this rock becomes softened by the steam and caves in, necessitating the drawing of the tubing and clearing of the well at great expense and loss of time, and often resulting in irreparable injury to the productiveness of the well. If the packer is adjacent to the oil-bearing rock, and the steam is confined, as specified, the slate-rock cannot become affected.

When not steaming the well, the tube F may be withdrawn from the gas-tube, or simply lifted off its seat on shoulder *g*, as preferred. When steaming the well, little or no condensation can take place in tube F, as it is out of contact with the column of water which stands in the well; consequently the full effect of the steam is obtained.

In some wells no salt-water is met with, and of course a packer is not absolutely necessary; but in such wells the packer herein described (without the gas-tube) is valuable for the purpose of flooding and steaming, as by it the steam or oil is effectually confined to the oil-bearing rock, and renders the several processes specified effective, and prevents injury to the well, as before stated. In fact, though thoroughly effective as a packer for wells having salt water veins, it has been almost especially devised to facilitate the steaming and flooding processes in all oil-wells, whether wet or dry, and its great advantages of cheapness, simplicity, and easy application recommend it in both cases.

Having thus described my invention, what I claim, and desire to secure by Letters Patent, is—

1. A packer for oil-wells resting upon a seat or shoulder formed in the well, substantially as and for the purpose specified.

2. The packer herein described, composed of the disk perforated for the passage of the pumping-tube, and the packing disk or ring, adapted for use in connection with a shoulder in the well, substantially as and for the purpose specified.

3. The combination of the packer D, the pumping-tube, the shoulder *g*, and the detachable tube F, adapted to form a joint with the shoulder *g*, substantially as and for the purpose specified.

In testimony whereof I, the said MICHAEL HAROLD, have hereunto set my hand.

MICHAEL HAROLD.

Witnesses:

F. W. RITTER, Jr.,

JAMES I. KAY.