

(No Model.)

D. W. BLACK.
PACKER FOR DEEP WELLS.

No. 588,384.

Patented Aug. 17, 1897.

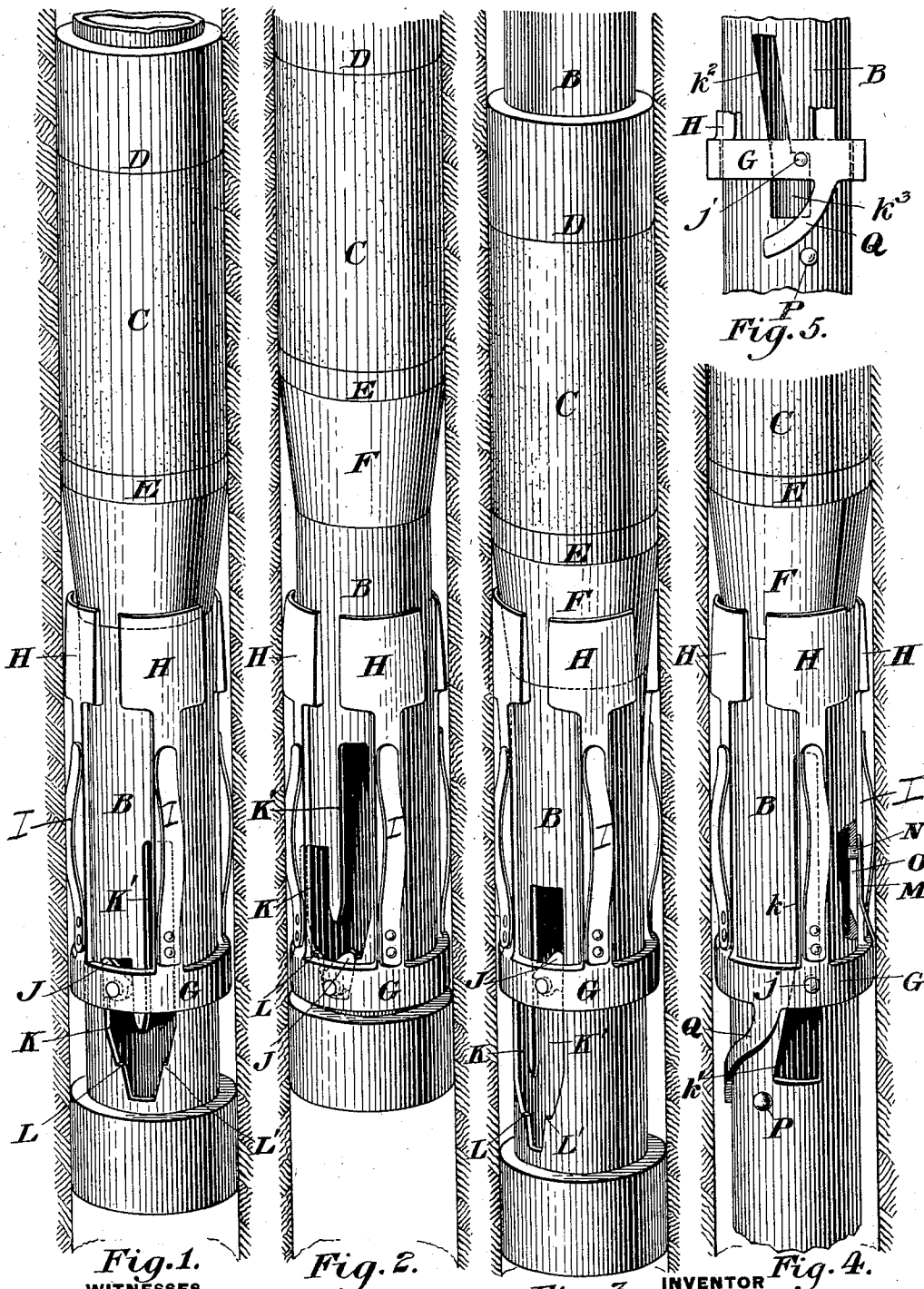


Fig. 1.
WITNESSES

Fig. 2.

Fig. 3.

INVENTOR

Fig. 4.

L. A. Comer
H. M. Corwin

David W. Black
by Bannell & Bannell
his Attorneys.

UNITED STATES PATENT OFFICE.

DAVID W. BLACK, OF BUTLER, PENNSYLVANIA, ASSIGNOR TO BENJAMIN MASSETH, OF SAME PLACE.

PACKER FOR DEEP WELLS.

SPECIFICATION forming part of Letters Patent No. 588,384, dated August 17, 1897.

Application filed March 2, 1897. Serial No. 625,702. (No model.)

To all whom it may concern:

Be it known that I, DAVID W. BLACK, of Butler, in the county of Butler and State of Pennsylvania, have invented a new and useful Improvement in Packers for Deep Wells, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings, forming part of this specification, in which—

Figure 1 is a perspective view of my improved packer in the position it assumes while being lowered in the well. Fig. 2 is a similar view showing the collar in the position it assumes when the tubing is raised to shift the collar. Fig. 3 is a similar view showing the collar in the position assumed when the well is packed. Figs. 4 and 5 illustrate modified forms.

In Figs. 1, 2, and 3 the point of view is changed in each figure, so as to avoid confusion in the illustration of the arms of the collar and the slot in the casing.

My invention relates to an improvement upon the packer described and claimed in the patent of Benjamin Masseth, No. 439,166, dated October 28, 1890. The packer described in that patent was peculiar in that the anchoring device, which when jammed in the well, affords the necessary resistance for setting the packer, is held by a locking mechanism, which, when the packer has been lowered to the desired position in the well at which it is to be packed, can be disengaged by motion of the casing, the anchor being adapted thereafter to be released again by motion of the casing and the locking device set so as to hold the same in order to permit the packer to be lowered to a deeper or raised to a higher position. This facility for packing and unpacking the packer, readjusting it either at a higher or lower position, and repacking it without need of withdrawing it from the well is of great practical advantage. In the device shown in the drawings of said patent the locking device for the arms or slips, constituting the anchor by which the packing is set, was released by causing a relative lateral motion of the said arms on the casing or tubing which carries the packer, and the mode specifically described in that

patent for accomplishing such relative motion was the turning of the casing or tubing at the top of the well. There are, however, occasions in the operation of packers in which it is not convenient and sometimes it is not practically possible to turn the casing or tubing for the purpose of setting the packer, and it is to meet such occasions that I have devised the improvement upon Masseth's said apparatus, which I have described and claimed herein. My present apparatus also has other specific advantages, which will be appreciated by those skilled in the art. Thus, for example, I am enabled by its use to set the packer in the well by suspending it at the end of a cable and lowering it thereby, but without having a continuous string of tubing extending from the position of the packer to the surface of the well.

My invention consists principally in a deep-well packer having, in combination with the expansible packer and the pipe section or casing on which it is set and the anchor adapted to engage the sides of the hole and to hold the casing to afford resistance to the packer, a lock for holding the anchor, which lock is adapted to be disengaged by moving the casing vertically as distinguished from rotating the same.

It also consists more specifically in such packer wherein the disengagement of the lock is effected by means of a laterally or obliquely acting guide, by which on vertical motion of the casing a lateral motion, which may be of very small extent, is imparted to the anchor or to part thereof, which part may consist of a loose ring mounted on the anchor and carrying the guide-stud described below, so that it may be moved from locked to unlocked position or from unlocked to locked position. In the form of my invention shown in Fig. 1 such guide is constituted by a double slot or guideway and a switch or guide-stud, and in the other forms of the invention shown in the drawings it is otherwise constituted, but the guide is present in all the forms which I have illustrated.

Referring now to the drawings, B represents a portion of the stem or pipe-section on which the packer is mounted. C is an ex-

pansible packer-tube set thereon and preferably made of rubber in the usual manner. One end of this packer-tube C bears against a shoulder D on the pipe, and the other end bears against a shoulder E, formed, preferably, by the end of a tubular section F, which fits loosely around the stem or pipe B, so as to be capable of longitudinal motion in setting the packer. This tubular section F is externally tapering or of wedge shape. A collar G is fitted loosely around the pipe and carries arms or slips H, which, together with the collar, constitute the anchor. The arms or slips have leaf-springs I or otherwise project laterally, so as to bear with slight rubbing friction against the side of the hole. The collar G has pivoted to it a projecting guide-stud J, constituting a switch or guide moving within a guideway formed in or on the pipe B. This guideway is preferably formed by slotting the pipe in two connected longitudinally-extending branches K and K', connected at the end, and at the end portions of said slots are shoulders L L', which are adapted to engage with and turn the guide-stud J.

The operation is as follows: The packer is lowered into the well at the end of a string of tubing, the parts being then in the position shown in Fig. 1, the guide-stud J on the collar G being at the upper end of the part K of the guideway or slot and the arms or slips H being held thereby from any further upward motion on the pipe, which upward motion, if permitted, would cause them to be expanded by the tapering section F and to jam against the sides of the well. When it is desired to set the packer, the operator lifts it vertically to a slight extent, thus causing the guide-stud J to move down in the slot K, and when it reaches the lower end of said slot, causing it to engage the shoulder L and to be turned thereby into the position shown in Fig. 2, so that if the collar (which is always held by slight friction of the springs I against the side of the well) should be relatively moved up on the stem or pipe B by the lowering of the latter within the collar the end of the guide-stud will act as a switch and will cause the guide-stud to move within the part K' of the guideway or slot. The next operation is as just suggested—the lowering of the packer to a short extent, whereupon, the arms or slips J being held frictionally against the side of the well by the springs I, the stem or pipe B moves down within the collar, the guide-stud travels along the part K' of the guideway, thus turning the collar a little on the pipe, and the part K' being of sufficient height to permit the tapering pipe-section F to descend within the ends of the arms or slips its wedge action spreads said arms and binds them in the hole until their pressure against the sides of the hole opposes enough resistance to cause the expansion of the packer. Thereupon the down pressure of the string of tubing to which the stem or packer-pipe B

is connected will cause the shoulder D to bear down upon the rubber tube and to expand the same outwardly against the sides of the hole.

In the manner above stated I may set the packer at any position, all that is necessary being to give a vertical motion to the pipe in order that the guide-stud and the portion K of the guideway which constitutes the locking device may be put out of alinement and thus operatively disengaged from each other. If it is desired to unpack the packer to move it up or down in the well and to pack it in another position, the operator first elevates the packer slightly in the well, so as to cause the guide-stud J to move down in the guideway K' until it engages the shoulder L' at the base of the latter, and is thereby turned and its end directed toward the part K of the guideway. The effect of this is to release the arms or slips from the side of the hole. The packer is then lowered and the first effect of its downward motion is to cause the guide-stud with the collar G to rise within the guideway K into the position shown in Fig. 1, and thereupon the casing can be lowered as far as desired in the well and can be repacked. If after releasing the arms or slips, as just described, the operator wishes to shift the packer to a higher position, he lifts it to a position slightly above the desired point, then lowers it somewhat, so as to bring the parts into the position shown in Fig. 2, and then he again raises it and proceeds, as first above described, to bring the guide-stud into the part K' of the guideway and thus to release the lock and set the packer.

The part K of the guideway or slot should be made of sufficient length to allow some loose or idle motion of the guide-stud, so that in the ordinary operation of connecting the sections of tubing at the surface of the well the short lifting motion of the tubing which is necessarily incident thereto shall not result in prematurely setting the packer. A length of about six inches for the slot K will be sufficient for such purpose. Where the packer is to be used under circumstances where it can be packed by lifting the casing, the parts may be inverted.

In Fig. 4 I show a modification of my invention in which I make a guide-stud *j* on the collar G fixed and not pivoted, as above explained, and I fit said guide-stud in a vertical slot *k*, one side *k'* of which is oblique. I also attach to the collar a spring M, having a locking-stud N, which, when the arms are in locked position, fits within a slot O. The upper end of the slot O is abrupt, so that it will act as a stop to prevent the collar G with its arms from moving upwardly when the stud N is in the slot, but its other end is tapered, so that on lifting the casing the stud can ride over said tapered portion and thus free itself from the slot. P is a stud on the casing adapted to engage an oblique arm Q, which projects from the collar, so as to act in conjunction with the side *k'* of the slot *k* in

forming means for turning the collar in either direction, as explained below.

If now the stud N is fitted in the slot O, the packer can be lowered to any desired position in the well, for said slot will prevent the arms or slips from moving upwardly on the tapering section F. When it is desired to set the packer, the operator raises it somewhat, the effect of which is, first, to cause the stud N to pass below the slot O, and, next, the engagement of the arm Q with the stud P will turn the collar G, so as to bring the stud N out of line from the slot O. Thereupon the operator again lowers the packer somewhat, and the pipe B, moving down within the arms or slips, causes the latter to engage the tapering section F and to be expanded. This motion is possible, because, as above stated, the stud N is out of line from the slot O and does not enter the same, but toward the end of the upward relative motion of the arms on the pipe the collar will have been turned sufficiently on the pipe by engagement of the stud P with the oblique side k' of the slot to bring the stud N again into line with but above the slot O. If afterward it is desired to unpack the packer and to reset it, say at a lower position, the operator raises it, thereby moving the tapering section F up within the arms or slips until finally the stud N slips into the slot O, with which it is then in a vertical line. The arms or slips then being released from the sides of the well by the lifting of the tapering section F above the same are held from subsequent upward motion by engagement of the stud with the end of the slot, so that the packer can be lowered and again reset at any desired position in the manner explained above.

In Fig. 5 I show another modification of my invention, which resembles the modification shown in Fig. 4 except that it dispenses with the slot O and stud N. In this case the guide-slot k^2 is oblique and has at its lower end an enlarged portion k^3 . The arm Q and the stud P are used as in Fig. 4. When the arms are in locked position, so that the packer may be lowered into the well, the stud j on the collar G bears against the upper end of the enlarged lower portion k^3 of the slot, which upper end acts as a stop. When it is desired to set the packer in the well, the operator raises it slightly, thus causing the stud P to engage the arm Q and to turn the collar G a little to the right, so as to disengage the guide-stud j from the part k^3 of the slot and to bring it opposite to the part k^2 . Thereupon the packer is again lowered, when the stud j will move within the slot k^2 and the pipe B will have unrestrained motion within the arms. The conical section F will thus be moved within the arms and expand the same. When the packer is to be unpacked and moved, say, to a lower position in the well, the operator raises the packer, thereby shifting the guide-stud j to the lower end of the slot k^2 , which, or the lower end of which, being oblique, causes the

stud when it passes beyond the end of the slot to be opposite to a shoulder k^4 at the corner of the part k^3 , so that when the packer is then lowered the engagement of the stud with the shoulder k^4 will prevent the arms or slips from moving up on the pipe B. The parts are then locked, and the packer may be lowered and reset at any desired place.

With this modification of my invention, in releasing the packer and locking it, so that it may be set at a lower position, care should be exercised to raise the packer only enough to bring the guide-stud j out of the oblique slot k^2 without lifting the same far enough to cause the stud P to engage the arms Q and to turn the collar, since otherwise it would bring the parts into unlocked position prematurely, and would thus defeat the object sought for. Like precaution should be taken in using the modification shown in Fig. 4, above described.

Within the scope of my invention as defined in the claims the parts of the device may be modified in various ways, the only essential, broadly considered, being that the anchor shall be held by a locking device which is disconnected or brought into operative position by vertical motion of the casing. The construction of the anchor and of the expansible packer-tube may of course be modified.

In the pending application, Serial No. 627,953, filed March 17, 1897, I have shown and claimed, specifically, the forms of the apparatus shown in Figs. 4 and 5 of the drawings of the present specification.

The device may be used for packing tubing as well as casing.

I claim—

1. In deep-well packers, the combination with the pipe, carrying an expansible packer, of an anchor adapted to engage the sides of the hole and to hold the pipe to afford resistance to the packer, a locking device for holding said anchor, and a guide arranged to be operated by vertical motion of the pipe and to move the locking device into disengaged position.

2. In deep-well packers, the combination with the pipe carrying an expansible packer, of an anchor adapted to engage the sides of the hole and to hold the pipe to afford resistance to the packer, a locking device for holding said anchor, and means whereby by vertical motion of the pipe the locking device is disengaged and the anchor permitted to operate, said means consisting of a laterally-acting guide, whereby when the pipe is moved vertically the anchor is shifted laterally into locked or unlocked condition.

3. The combination with a stem adapted to be let into a well, of an anchor mounted on the stem, a guideway and a pivoted guide-stud on the anchor and stem respectively, and means for turning the stud at the end of the guideway in order to switch the guide-stud into or out of said way.

4. The combination with a stem adapted

to be let into a well, of an anchor mounted on the stem, a guideway consisting of two branches K, K' formed on said stem, shoulders at the base thereof, and a pivoted guide-stud adapted to be moved by said shoulders and to operate as a switch.

5. The combination with a stem adapted to be let into a well, of an anchor mounted thereon, a locking device for holding the an-

chor, and a guide arranged to be operated by vertical motion of the stem and to move the locking device into disengaged position.

In testimony whereof I have hereunto set my hand.

DAVID W. BLACK.

Witnesses:

THOMAS W. BAKEWELL,
H. M. CORWIN.