(Model.)

2 Sheets—Sheet 1.

T. L. CROWLEY.

GUSHER FOR OIL WELLS.

No. 248,637. Patented Oct. 25, 1881.

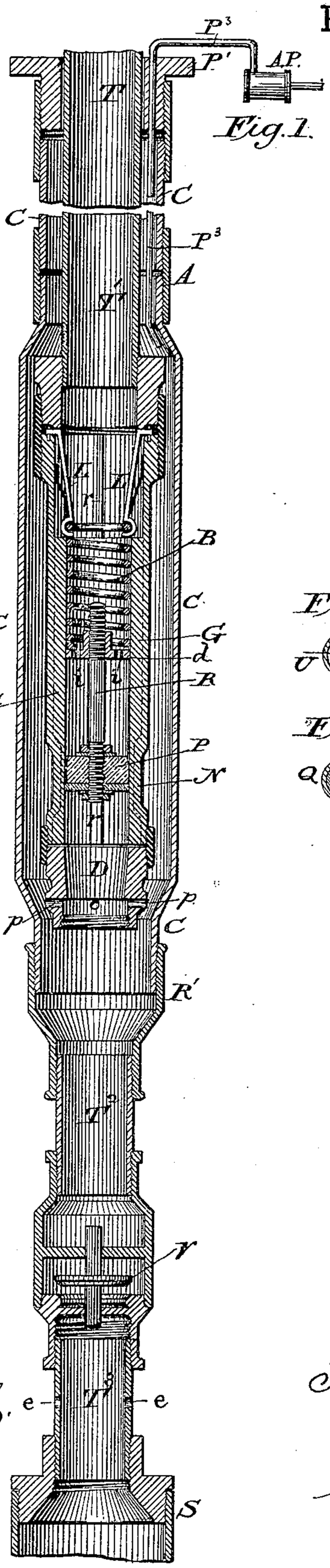

Fig. 1.

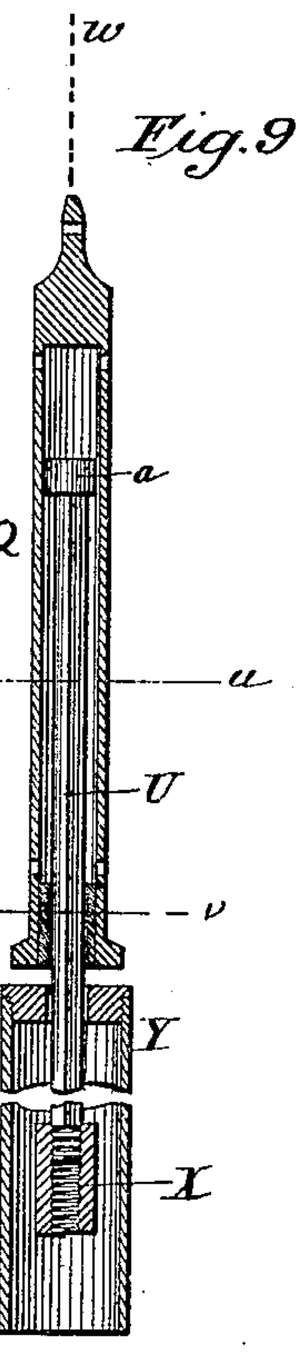

Fig. 9

Fig. 10

Fig. 11

Attest.

Sidney P. Hollingsworth.

W. C. Chaffee

Inventor.

Thomas L. Crowley,

By his Attorneys,

Stansbury & Munn

(Model.)

2 Sheets—Sheet 2.

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Fig. 7.

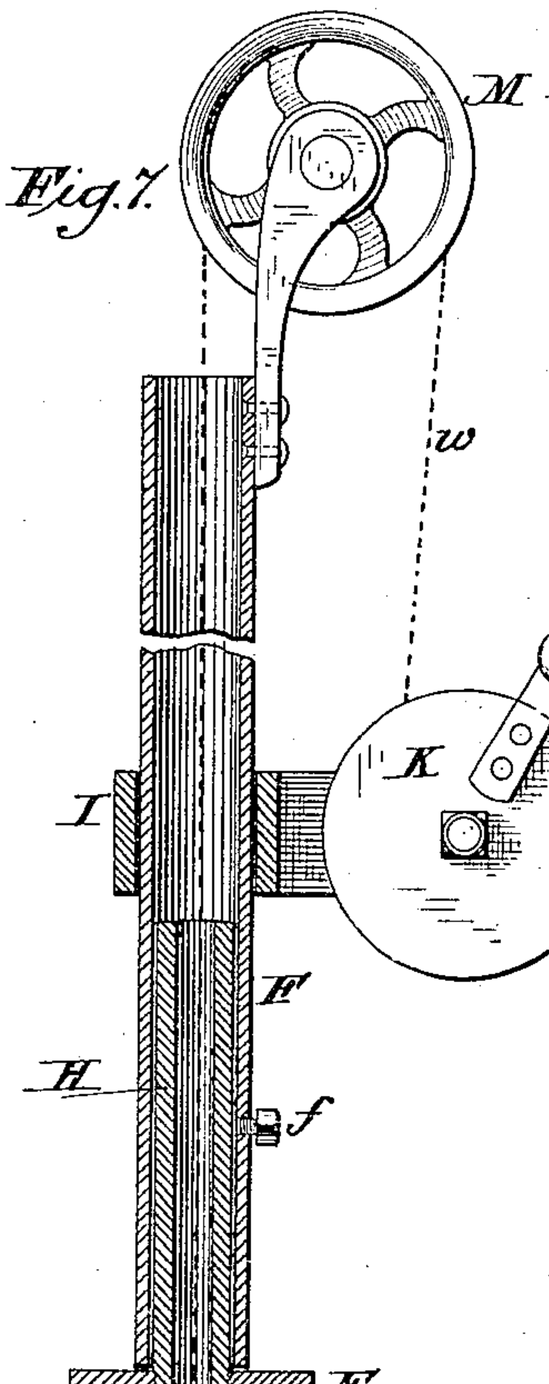


Fig. 8.

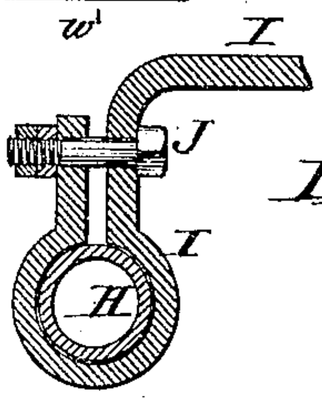


Fig. 6

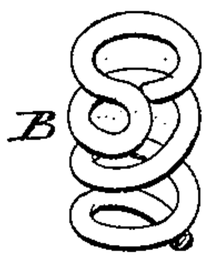


Fig. 2.

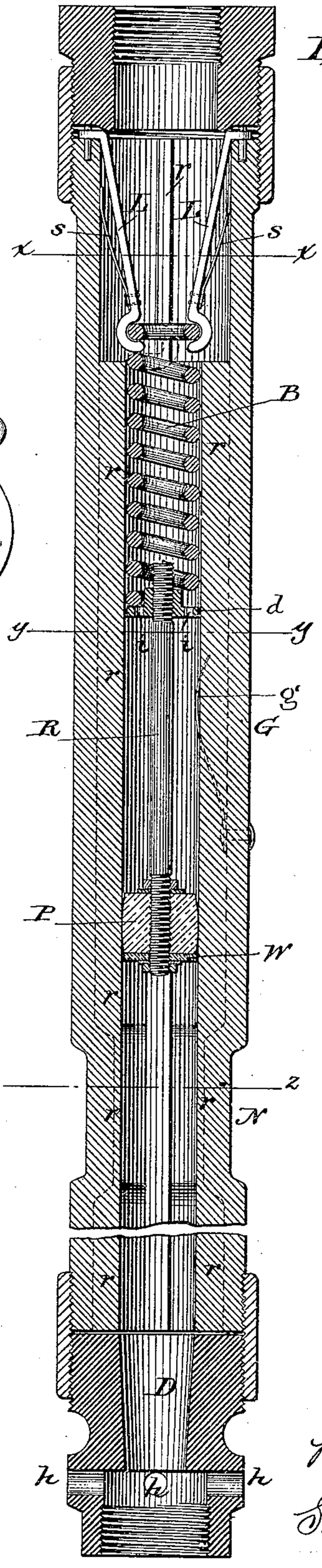


Fig. 3.

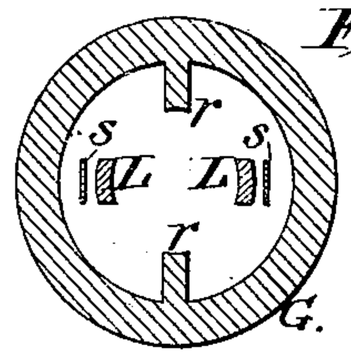


Fig. 4.

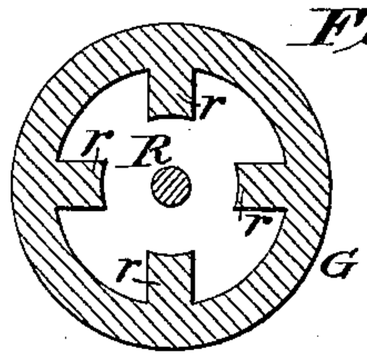
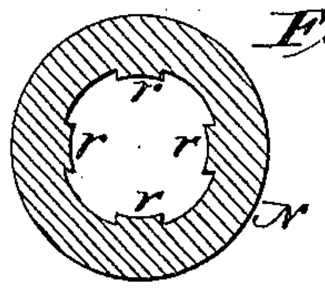


Fig. 5



Attest.

Sidney P. Hollingsworth.

W. E. Chaffee

Inventor.

Thomas L. Crowley

By his Attorneys,

Stansbury & Munn.

UNITED STATES PATENT OFFICE.

THOMAS L. CROWLEY, OF KENDALL CREEK, PENNSYLVANIA.

GUSHER FOR OIL-WELLS.

SPECIFICATION forming part of Letters Patent No. 248,637, dated October 25, 1881.

Application filed February 19, 1881. (Model.)

To all whom it may concern:

Be it known that I, THOMAS L. CROWLEY, of Kendall Creek, in the county of McKean and State of Pennsylvania, have invented certain new and useful Improvements in Gushers for Oil-Wells; and I do hereby declare that the following is a full, clear, and exact description of the invention, which will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, and to letters of reference marked thereon, which form a part of this specification.

Figure 1 is a vertical section of my gusher applied as I propose to use it in wells having a limited gas-pressure. Fig. 2 is a vertical section, on an enlarged scale, of the gusher separately. Fig. 3 is a transverse section on line *x x* of Fig. 2. Fig. 4 is a transverse section on line *y y* of Fig. 2. Fig. 5 is a transverse section on line *z z* of Fig. 2. Fig. 6 is a separate view of the spring B. Fig. 7 is a side view, partly in vertical section, of the reel with its pulley and rotary stand. Fig. 8 is a top view of the clamp. Fig. 9 is a vertical section of the jars and unlatching-tube. Fig. 10 is a transverse section on line *u u* of Fig. 9. Fig. 11 is a transverse section on line *v v* of Fig. 9.

The same part is indicated by the same letter wherever it occurs in the drawings.

The object of my invention is to increase the productiveness and improve the method of working oil-wells by the employment of a new device for the economical application of the expansive force of confined and compressed gas or air to the complete and rapid emptying of the well down to any desired point at stated intervals, thus intermittently and entirely relieving the surface of the oil-bearing rock from the pressure of superincumbent fluids, keeping its pores and crevices open and free from paraffine and in the best condition for yielding oil to its full capacity.

The nature of my invention consists in connecting with a reservoir of gas in the lower part of an oil-well an automatic shut-off apparatus, which I call a "gusher," which at a predetermined pressure opens and closes the tubing, storing and holding in the gas until it acquires by compression the needed elastic force, and then applying that force to the ejection of the entire fluid contents of the well down to a determined point.

It consists, further, in a device for supplementing the natural gas-pressure in wells where such pressure is weak or insufficient by the injection into a suitable reservoir in the well of compressed air, and its application, in conjunction with the gas-pressure, and in the same manner, to the ejection of the fluid contents of the well, all as hereinafter more specifically set forth.

The specified mode of applying and using the devices herein described constitutes a new system or process of working flowing oil-wells which largely enhances and prolongs their productiveness.

My process is founded on the fact, which I have discovered, that one of the principal causes of falling off in the productiveness of oil-wells is the clogging of the pores of the oil-bearing rock by accumulations of paraffine, and that this clogging is mainly owing to the fact that a heavy column of oil is usually standing in contact with the face of the oil-rock and prevents that free discharge of oil from its pores which would keep them open and clear of paraffine. I have found that paraffine is most readily deposited where the movement of the oil is sluggish, and that a sudden relief of the oil-rock from exterior pressure induces a strong and rapid discharge of oil from its pores, which washes them clear of paraffine and leaves them open for the free flow of gas and oil into the well under the influence of the reserve-pressure of gas in the rock.

In the drawings, T T′ T² T³ mark the ordinary tubing of a well coupled and strung in the usual manner. P′ is an air and fluid tight packing inserted around the tubing at a point in the lower part of the well, any desired distance above the shut-off valve-seat D. I generally place it about a hundred feet above the oil-bearing rock. This packer forms the top of the gas-reservoir, and its location must, in some degree, depend upon the quantity of gas the well supplies relatively to the quantity of oil, the greater the supply of gas the larger the reservoir required to store and condense it. The size of the tubing would also affect the location of the packer, the largest reservoir being required where the largest tubing

is used; but, under all conditions, I place the packing P′, forming the top of the reservoir, near the lower part of the well. The break in the tubing (shown in the drawings at the upper end of Fig. 1) indicates the point at which the necessary additional tubing would be inserted to give the packer its proper location relatively to the shut-off valve-seat D.

Just below packer P′ is coupled the casing C of the air-reservoir used in feeble wells. In wells with a large supply of gas and strong gas-pressure this casing, extending from P′ to T^3 in Fig. 1, is dispensed with, together with valve V, and the tubing T^3 coupled directly to the lower end of the shut-off or gusher, below the holes *p p*.

The gusher-barrel G is coupled at top to the lower end of tubing T′, Fig. 1. This barrel is shown in enlarged view in Fig. 2. At its top are hinged a pair of spring-latches, L L, which are forced inward by the springs *s s*, and embrace the upper end of the spiral spring B. The barrel G is provided with ribs or guides *r r*, projecting radially inward from its inner surface, as clearly shown in Figs. 3, 4, and 5. The bore of the barrel is narrowed to form the neck N, which makes the ribs *r* shallow, as seen in Fig. 5. Below the neck the bore of the barrel enlarges to the same size as above, and its cross-section is the same as at line *y y*. (Shown by Fig. 4.) Near the top of the barrel two of the ribs are cut away to give play to the latches L, as shown in Fig. 3, where the latches and their springs are shown in cross-section. The inner faces of the ribs form together a cylindrical guide for the movements of the plug P, its upper disk, *d*, and the spring B. The plug P is made of wood, preferably of green hard maple thoroughly soaked in melted tallow, and is attached by screw, nuts, and washers, to a rod, R, having a disk, *d*, perforated with holes *i i*, screwed onto its upper end. On the bottom of the plug is a soft washer, W, held by a nut on the end of the screw.

D is a conical valve-seat for the reception of the plug P. In the lower part of this seat are the holes *h h* for the admission of fluids to the gusher. Other holes, *e e*, for the same purpose, are placed at a distance below in the tubing T^3. No opening for the entrance of fluid to the gusher or tubing is made between the holes *h h* and the packer P′, a distance of, say, one hundred feet, and the space in the well around the tubing between those points forms an annular chamber or reservoir, in which gas may collect and become compressed by accumulation, ready for the exertion of its expansive power to expel the fluids from the well.

In the lower end of the well is inserted a sand-cylinder, S, nearly of the full diameter of the well, coupled to or near the lower end of the string of tubing. Between this and the valve-seat D (which is the point where the gas is shut off, as hereinafter explained) is inserted an ordinary check-valve, V, opening upward, to allow of the upward flow of fluids, but not of their descent. The common anchor or tubing is coupled onto the lower end of the sand-cylinder by bushing, and should be perforated sufficiently to allow that portion of the oil which enters the well from the rock during the flow, and which is mingled with sand, to enter, that the sand may be separated from it by the slowness of its ascent through the sand-cylinder, as hereinafter further explained.

Such being the construction of the gusher, its operation is as follows: The pressure necessary to throw a given amount of fluid from the well having been determined in advance by calculation or experiment, the plug P is weighted to the proper amount and inserted in its conical seat D. The spring B is placed above it, resting on the perforated disk *d*. This spring, which is horizontal on top, as shown in Fig. 6, is grasped and held in place by the spring-latches L L. Thus prepared, the gusher-barrel G is attached to the string of tubing in such a position that it will rest, when in place, at or near the upper margin of the oil-bearing rock. The packer P′ is firmly inserted in the well, around the tubing, at a point usually about one hundred feet above the shut-off point D. The well is now prepared for operation. The gas flowing into it, with the oil from the oil-bearing rock, rises to the top of the reservoir formed in the well below the packer P′, and around the tubing, as before described, and becomes compressed, by accumulation, till it exerts upon the fluids below it an elastic force sufficient to overcome the load of the plug P and its friction in the seat D. The fluids entering through holes *h h* and *e e* drive the plug P with great force out of its conical seat and rush up the tubing, propelled by the gas, and discharge themselves at the top of the well. The plug P, when thus driven up, cushions, by its disk *d*, upon the bottom of spring B, and is supported by the upward rush of the fluids and gas in the uppermost position, till the elastic force of the gas has fully expended itself, and a portion of the gas has followed the fluids up the tubing and escaped. While the plug is in the upper part of the barrel G, above the neck N, there is ample space around it between the guides *r* for the free upward passage of the fluids and gas, as seen in Fig. 4. When the expansive force is relieved the plug P descends, passes slowly through the neck N, and then suddenly falls and fixes itself in the conical seat D with a force due to the load it carries and to the momentum acquired by the height of fall. The well is thus again sealed, ready for a repetition of the operation, which will recur as often as the accumulated gas attains a tension equal to the expulsion of the plug P from its seat.

It will be apparent that after the gush has taken place and the pressure been relieved, as soon as the tension of the gas falls below what is necessary to support the plug the plug will immediately resume its seat and prevent the

escape of any more gas than is necessary to relieve the highest required tension. The gas thus shut in at its initial tension will remain in the reservoir, ready to act again when a sufficient quantity of new gas has been added to it to raise it to the tension necessary to eject the plug.

It will be observed that at the neck N the bore of barrel G is considerably diminished, (see Fig. 5,) so as to allow but a small space for the upward passage of gas when the plug P is passing through this part of the barrel; hence, from the contraction of the current, its strength will be sufficient to cause the plug to descend quite slowly through the neck while the last expansive force of the gas is expending itself. When the plug has passed the neck it will fall freely, as the gas will have ample passage-way around it, and the disk *d*, being perforated, will offer little or no obstruction to its descent. The upward rush of the oil through the gusher will induce a current of water and oil to rise in the sand-cylinder S and pass the check-valve V, and be carried out in front of the gas during the gush. The sand that may be in the water or oil will settle to the bottom of the sand cylinder, owing to the smallness of the tubing as compared with the cylinder, causing a retardation of the flow of water or oil sufficient to allow of the subsidence of the sand, the tendency of the current to hold it in suspension not being equal to the force of gravity, which causes it to settle in the bottom of the cylinder and fall back into the well after the flow or gush has ceased.

As before intimated, when the pressure and flow of gas are insufficient to operate the well in the manner hereinbefore set forth, I surround the gusher with a casing, C C, extending from the packer P′ to and below the seat D, as shown in Fig. 1. Into this chamber air or gas is pumped, by any ordinary and suitable condensing air-pump, A P, from the top of the well through a pipe, P^3, leading to the top of the chamber until the tension is reached which is necessary to expel the plug and clear the well in the same manner as before described. The casing, however, is not indispensable, as the air or gas may be pumped in the same manner directly into the reservoir formed by the walls of the well, through a pipe inserted in the packer.

To aid in holding up the plug, should the weakness of the flow of gas render it necessary, I sometimes use a weak flat spring, *g*, attached on the inside of the gusher-barrel, as shown in Fig. 2. The force of this spring is to be so adjusted that it will release the plug when the tension of the gas in the gusher has reached the lowest point desired.

It may become necessary to withdraw the plug P for repairs or to alter its load to meet the changing condition of the gas-pressure in the well, or to increase occasionally the violence of the gush, in order to more thoroughly cleanse the pores of the oil-rock of paraffine by the inrush of new gas through its pores and crevices. To accomplish this I use the apparatus represented in Figs. 7, 8, 9, 10, and 11 of the drawings.

The bushing E (see Fig. 7) rests on and is attached to the T of the well at the top of the tubing. From it projects upward the pipe H, which is surrounded by the sleeve F, which turns upon it, but can be fixed at any desired point by the set-screw *f*.

To the sleeve F is clamped, by screw-bolt and nut J, the arm I, to which is attached a reel, K, turned by a winch or crank.

To the upper end of sleeve F is attached a bracket, which supports the journals of a grooved pulley, M, over which passes wire *w* from reel K. This wire is attached (see Fig. 9) to the top of the upper one, Q, of a pair of jars. The upper jar is a long cylinder, perforated at top and bottom to facilitate its movement in the fluids of the well. The lower and inner jar, U, is a square bar provided at top with a circular head, *a*, and carrying at bottom a tapped box, X, and the latch-opening tube or cylinder Y. The section Fig. 11 on line *v v* shows how the square bar U is held in the mouth of the jar Q so as not to turn.

When it is desired to withdraw the plug from the well, the jars, Fig. 9, are let down into the well by the reel. The unlatching-tube passes between the latches L L and forces them apart, releasing them from the spring B. The box X comes down upon the top of the screw on the upper end of rod R, and is screwed upon it by rotating the sleeve F around pipe H. The wire *w* is then wound up on the reel, and the plug and spring are drawn out at the top of the well. To replace the plug and spring in the well, remove cylinder Y, attach box X to top of rod R, and lower into the well until the plug reaches its original position. The box is then detached by unscrewing by means of the rotating sleeve of the reel and the wire drawn up.

To prevent the box X from binding on the screw or rod R, I provide both screw and tap with an offset or stop, and these, when a sufficient union is made, abut together and prevent further rotation.

To clearly distinguish my invention from what has been done before, I wish to have it understood that I do not claim the shutting in or liberating of the gas-pressure at the top or outside of the well; nor do I claim the shutting in of the gas-pressure at or near the bottom of the well by means of a high column of liquid; nor do I claim the permanent shutting in of the gas-pressure outside of the tubing, as is now done by the common packers; nor, finally, do I claim the ejection of liquids from the well by the natural pulsation of the gas.

Having now fully described my invention and the principles of its operation, what I claim as new, and desire to secure by Letters Patent, is—

1. A gusher or shut-off device for an oil-well, consisting of the barrel G, provided with ribs

r and neck N, conical seat D, plug P, rod R, spring B, and spring-latches L L, all constructed, arranged, and operating as specified.

2. The combination, with the tubing in an oil-well, of the common packer P′, shutting off the passage between the wall of the well and the tubing, and a gusher, all constructed, arranged, and operating as set forth.

3. The revolving reeling device, consisting of the bushing E, tube H, sleeve F, clamp-arm I, reel K, and pulley M, all constructed, arranged, and operating as specified.

4. The double jar Q U, constructed as described, provided with the threaded box X and unlatching-tube Y, all as and for the purpose stated.

5. The combination of the plug P, rod R, disk *d*, spring B, and latches L L, in the manner and for the purpose described.

6. The described apparatus for working a sluggish well having a scanty flow of gas, in which compressed air or gas is used to supplement the natural gas-pressure of the well, the same consisting of the casing or reservoir C C, attached below the packer P′ and surrounding the gusher, and provided with a check-valve, V, in combination with a suitable air-pump and pipe for the supply of air or gas from without the well, as set forth.

7. The sand-cylinder S, constructed as described, and located near the bottom of the well-tubing and connected to it, as shown, and operating in the manner and for the purpose specified.

8. The combination of the barrel G, plug P, flat spring *g*, and spiral spring B, substantially in the manner and for the purpose set forth.

9. The described method of increasing and maintaining the productiveness of sluggish wells having a scanty flow of gas, the same consisting, first, in shutting in and storing the products between gushes near the bottom of the well, and, second, in forcing air and gas taken from outside the well upon the liquids in the well, so that the pressure will open the confining device and eject the accumulated head of oil in a sudden and powerful gush, all in manner and by the means substantially as set forth.

10. An automatic gusher located in and near the bottom of an oil-well to shut in and store the products between gushes outside the tubing, in combination with tubing provided with induction-openings below the gusher, a packer located above the gusher, shutting the passage outside the tubing, and tubing connecting the packer with the gusher, all as and for the purpose described.

11. A gusher or shut-off device located in the lower part of the well to shut in the products between gushes, a packer between the tubing and the wall of the well, tubing provided with one fluid-entrance at bottom of the gusher and one several feet below, and means, substantially as described, for artificially forcing air and gas into the well, all combined and arranged as and for the purpose set forth.

In testimony that I claim the foregoing as my own invention I affix my signature in presence of two witnesses.

THOS. L. CROWLEY.

Witnesses:
H. B. MUNN,
CHAS. F. STANSBURY.