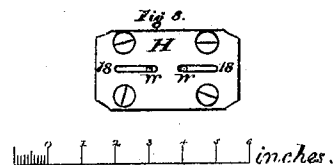
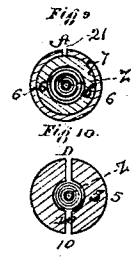
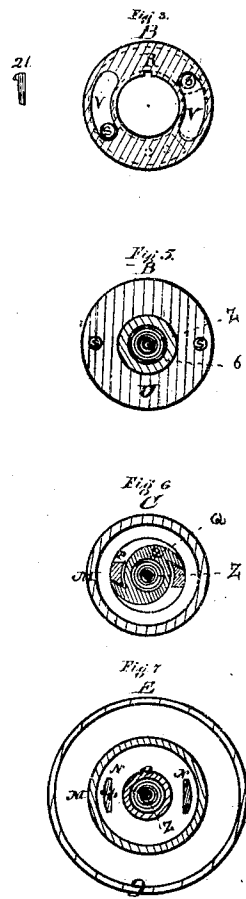
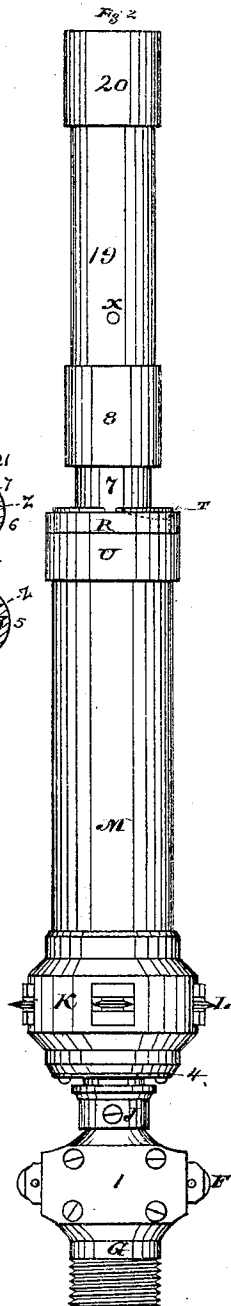
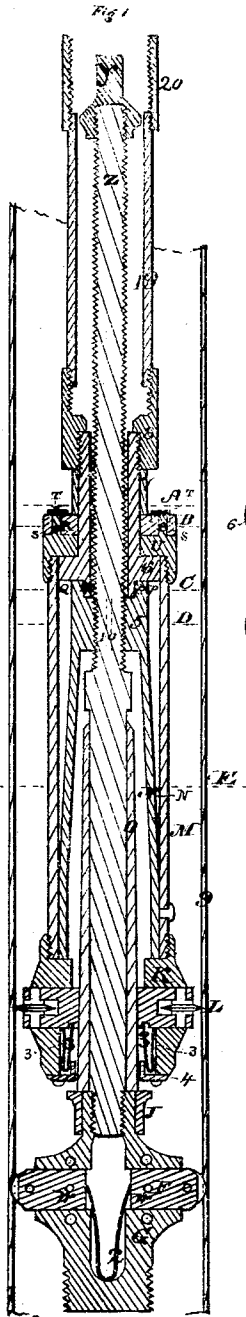


T. M. PATTERSON & R. H. MITCHELL.

Casing Cutters for Oil Wells.

No. 134,162.

Patented Dec. 24, 1872.



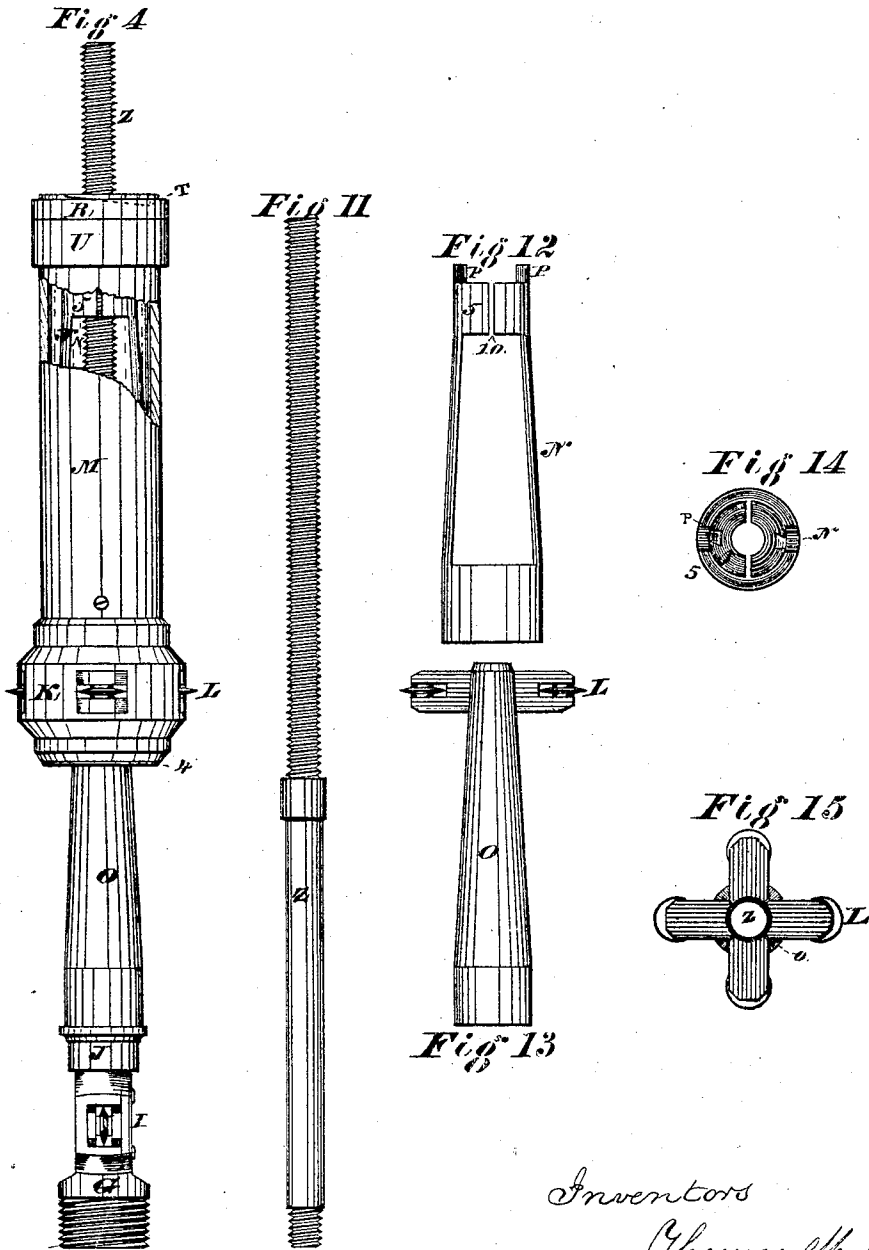
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UNITED STATES PATENT OFFICE.

THOMAS M. PATTERSON, OF TARR FARM, AND RICHARD H. MITCHELL, OF OIL CITY, PENNSYLVANIA.

IMPROVEMENT IN CASING-CUTTERS FOR OIL-WELLS.

Specification forming part of Letters Patent No. 134,162, dated December 24, 1872.

To all whom it may concern:

Be it known that we, THOMAS M. PATTERSON, of Tarr Farm, and RICHARD H. MITCHELL, of Oil City, in the county of Venango and State of Pennsylvania, have invented certain Improvements in Casing-Cutters; and the following is a full and exact description thereof, and of the manner and process of making, constructing, and using the same, reference being had to the accompanying drawing which is a part of this specification.

Our improved machine operates only on the inside of the casing, which must be vertical, as in oil-wells, for use in which our invention is particularly designed. It consists of a knife-carrying cylinder, to be rotated in the casing at the point where the cut is to be made. The rotating of the cylinder, besides carrying the knives around in a circle, also draws up a screw, to which is attached a tapered mandrel, which is therefore drawn between the knife-carriers, forcing them outward and feeding the knives into the casing. For practical use in cutting the casing in oil-wells our machine is also necessarily provided with a means of withdrawing the cutters after they have been forced into the substance of the casing.

Figure 1 is a vertical cross-section of our improved cutter and of the casing which it has cut. Fig. 2 is a perspective view of our cutter with the mandrel drawn up and the knives out. Fig. 4 is a perspective view taken with the mandrel turned at right angles to its position in Figs. 1 and 2, with the mandrel down and the knives in. This figure has a portion of the outer covering broken away so as to show a portion of the internal arrangement. Fig. 9 is a horizontal section of Fig. 1 at the dotted line A. Fig. 10 is a section of the internal part of the machine at the dotted line D. Fig. 6 is a section of the whole machine at the dotted line C. Fig. 7 is a horizontal section of the machine and casing at the dotted line E. Figs. 3 and 5 are a horizontal section of the machine at B, Fig. 3 being the portion above the line of section and Fig. 5 below it.

The other figures are separate parts of the machine, and will be sufficiently designated hereafter.

9 represents the casing which is to be sev-

ered by the action of the Stanwood cutters L which move in and out in the slots cut in the cylinder K. Z is a straight steel rod, of suitable length, (say two and a half feet,) one inch in diameter, with a screw (say ten threads to the inch) cut on its upper part for the distance of about nine and one-half inches, and its lower portion polished to receive the hollow mandrel O, Fig. 13. Where the thread terminates there is a shoulder to prevent the mandrel O from being pushed onto the thread. The lower end of Z is threaded so as to be received by the female thread of G. This rod Z is separately shown on Plate 2 by the Fig. 11. The mandrel O is shown on Plate 2 by the Fig. 13. It is hollow, and fitted to the polished part of Z below the shoulder, upon which it turns freely. It is larger in diameter at its bottom than at its top, (say three-eighths of an inch,) and is about eleven inches long. The knives L, which show clearly at Fig. 13, are the ordinary Stanwood cutters. They may, however, be made of any material or shape adapted for cutting iron. To the bottom of the rod Z is screwed the knife-carrier G, which contains the two Stanwood cutters F, which are placed vertically, and are forced against the casing 9 or the sides of the well by the powerful spring 2. The plate H, Fig. 8, covers these lower knife-holders and the spring 2. The pins W W play in the slots 18 in H, Fig. 8, and prevent the knife-carriers F from being thrown out of G by the action of the spring 2. G terminates in a screw-thread, as shown, to which weights may be attached, if needed. I is merely a thin metal plate, which covers H to prevent dirt from clogging the slots 18. The portion G and the vertical knives F keep the rod Z stationary while the cylinder K is rotating. The knives F run up and down freely, but "bite" into the casing or rock sufficiently to prevent any lateral motion. K is the knife-carrying cylinder. It is slotted for the reception of the needed number of knife-carriers—preferably four. The knife-carriers are shown in Figs. 13 and 15, from which a clear idea of their shape may be derived. Their inner ends fit closely to the mandrel O, being finished with the same conical taper. Their sides are beveled at the inner ends, as shown at Fig. 15, for the obvious purpose of

allowing them to occupy a less horizontal diameter. K must be a ring, of metal, of sufficient thickness to be a support to the carriers of L. Its exterior diameter is slightly less than the internal diameter of the casing 9. Its inner diameter is but a trifle larger than the lower and larger end of the mandrel O. M is gas-pipe, of suitable length, (say twelve inches,) which screws to the cylinder K and to the collar U. To the lower part of M is riveted the collar of P 5 N, Fig. 12. The head of one of the rivets is shown in Fig. 1. This part is shown separately at Figs. 12 and 14, Fig. 12 being a side and Fig. 14 an end view. Its lower portion is a collar or ring fitted closely to the inside of M, resting on K, and riveted as aforesaid. From opposite sides of the ring rise the steel springs N N, which terminate each in one-half of a divided nut or female screw, 5. A horizontal section of this nut is shown at Fig. 10. The springs N N keep this nut firmly closed, except when opened as hereafter described. Upon the upper portions of the nut or female screw are the projections P P. U is a collar or cap, which screws firmly to M. It is pierced with a round hole for the admission of the stem of 6. 6 is a disk, which fills the upper part of the gas-pipe M. From its center rises a hollow stem, which is threaded with a male thread on its upper end to attach to the thimble 8. This stem admits the screw Z, and passes through the aperture of U. Around the stem the sleeve 7 fits closely. R is a ring, made of the shape shown in Fig. 3. 6, 7, and R are keyed firmly by the key 21 so that they all move together. On the bottom of 6 is cut the double or scroll cam Q, shown separately at Fig. 6. These cams engage the ends P of the divided female screw 5, so that when 6 is turned to the left the parts of 5 are separated, and the screw Z will move freely through them. The termination of each cam is recessed so as to prevent the nut 5 from opening, except when desired, and one side of the projections P is made to fit in the recess. The lower surface of R and the upper surface of U are smoothly finished so as to allow a movement on each other. This movement is limited by the pins S S, fixed in U and playing in the slots V V of R, Fig. 3. T is a spring, shown in Figs. 2, 3, 4 by a dotted line, riveted to R between the slots V V, and terminated in a wedge-shaped end, partly shown by the dotted lines in Figs. 2 and 4, which fits into one of the slots V, and, by engaging with the pin S, prevents R from turning upon U as freely as it otherwise would. 19 is a piece of tubing to cover the end of the screw Z. It screws into the thimbles 8 and 20 at its respective ends, and to the thimble 20 may be screwed the poles, tubing, or rods, which reach as far above the casing to be cut as may be necessary. The carriers of the knives L have a small recess cut in their lower sides, at their inner ends, to hold one end of the springs 3. These springs force the carriers inward when the mandrel is down. They are kept in their

places by the cap 4. The nut Y at the end of the screw Z is square-headed, so that it can be screwed on, and by it the rod Z is held firmly while G is screwed to it. The nut Y is made large so that it cannot pass the shoulder of 8. As it drops quickly and with considerable force upon 8, we sometimes put a rubber ring immediately below Y to obviate the sudden jar. J is a ring or washer, which limits the height to which the mandrel can be drawn. It may be fastened by a screw, as shown in Fig. 2.

The machine is made of different sizes so as to cut different sizes of casing. The thread of Z can be coarser or finer, and the taper of the mandrel can be greater or less, according to the "feed" desired to be given to the knives. The mandrel and screw can both be made shorter, and the machine be more compact; but this makes a loss of power.

The practical operation of our cutter at an oil-well is as follows: The depth at which the casing is to be cut being determined, a quantity of tubing sufficient to reach to the desired point is taken. The mandrel is dropped, as in Fig. 4. The knives L are drawn in by the springs 3. A piece of tubing, weighing between five and ten pounds, is screwed to G. The machine is then placed in the casing, some little force being required to compress the knives F toward each other as the spring 2 sets their edges out beyond the diameter of the casing. Once in, however, they roll down easily. The machine is lowered by hand until the upper thimble 20 is at the top of the hole. It is held there by a tubing-clamp placed under the thimble. A piece of tubing is screwed to the thimble 20. The thimble on the upper end of this piece of tubing is attached to a swivel which is suspended from a tackle. The rope of the tackle is carried over the pulley on the top of the derrick, and fastened to the bull-wheel. The bull-wheel is allowed to revolve, the tubing-clamps are loosened below the thimble 20, and the machine and tubing sink by their own weight. Their motion is stopped when the upper thimble touches the clamp, which is placed on the tubing again as soon as the first thimble has sunk. Length after length of tubing is added until the knives L are at the place where the cut is to be made. The string of tubing then hangs suspended from the swivel. For convenience it should project from the well not less than four nor more than twenty feet. The operator then grasps the tubing at a convenient height with ordinary tubing-tongs, and walks around "with the sun," rotating the tubing, and, consequently, the cylinder below. The knives F prevent the rod Z from turning with the cylinder. If the nut 5 is open the plate R slides the length of the slots V V, the projections P P slide along the slope of the cams Q, the nut 5 closes on the screw Z, and, as the cylinder rotates, the nut 5 draws up the screw Z and the mandrel O, gradually pushing out the knives L. The knives L

travel in a circle around the inside of the casing 9, and at each turn of the cylinder are forced a minute distance—about the three-hundredth ($\frac{1}{300}$) part of an inch—but with tremendous power, into the casing 9. With the thread and taper mentioned about sixty revolutions are necessary to completely sever the casing, or about twenty-five before the knives commence to cut and thirty-five more to cut through the ordinary thickness (one-eighth inch) of casing. As the cut may be at the inside of a thimble of the casing, where the material is consequently of nearly double the usual thickness, ninety turns will sometimes be made and the screw completely wound up. The mandrel will then be in the position of Fig. 2 and the knives out their full extension.

The power with which the knives are forced into the casing can be roughly estimated, as follows: The ordinary tubing-tongs are two feet (twenty-four inches) long. The operator therefore walks in a circle whose diameter is forty-eight inches and whose circumference is one hundred and fifty inches, and by thus traveling he advances each knife the one-three-hundredth part of an inch. One pound pressure on the tongs is therefore forty-five thousand pounds upon the cutters, or over five tons on each one. If the operator exerts but fifty pounds of pressure the knives have a pressure of two hundred and fifty tons each, or, allowing one-half for friction, of one hundred and twenty-five tons each. To such a force, applied on a Stanwood cutter, the toughest iron offers no appreciable resistance. In fact, the resistance offered by the substance of the casing is so very little additional to the friction on the swivel above and the screw below that only an experienced operator can tell when the machine commences to "cut." But, if this power should not be enough, the lever of the tongs can be lengthened readily at any well by slipping a piece of tubing on them. A piece eight feet long (and the ordinary derricks will allow free use of that length) would increase the power at least sixteen times. We mention this to show that by such simple means as lengthening a horizontal lever our machine can be increased to any power.

The cut having been effected, as described, a "lift" is taken on the tubing by means of the bull-wheel and tackle, or on the casing 9, or perhaps on both. If the casing is severed and loose, so it can be drawn, the tubing is "twitched" quickly a half turn, as if to unscrew it; the plate R moves back the length of the slots V on the collar U; the cams Q open the nut 5, releasing the screw Z; the rod

and mandrel drop by their own weight (aided by the weight of the tubing first attached to the male thread of G) until the nut Y engages with the shoulder of 8; the springs 3 draw in the knives L, and the cutter can be withdrawn. The severed casing can then be taken out by the ordinary means.

There are several casing-cutters in use, some of which have been patented. The difference between ours and them consists mainly in the following points of superiority: First, in our cutter the use of sucker-rods is dispensed with, thus saving half the time and greatly diminishing the trouble of cutting casing. Second, we need no dogs nor other extra appliances to hold up the tubing. All we require is the common swivel. Third, we need but one operator to rotate the tubing in cutting. Fourth, in our machine the feed of the knives is definite, fixed, and certain, and given, as needed, with scientific mechanical exactness. In all others the feed is empirical, uncertain in amount, and given by guess. Fifth, our cutting-knives are forced with tremendous pressure into the casing. Where others can give but pounds, we apply tons. Sixth, as a cutter our machine is automatic. The operator rotates it, and the rest it does itself. Seventh, it is easier to disengage—that is, to withdraw the knives; a slight twitch of the tubing and the machine is free. Eighth, although our improved cutter will ordinarily be used on tubing, because tubing has great strength for its weight, and because every fully-equipped well always has tubing, yet it is not confined to tubing, for it can be used on poles or solid connections; and, so far as we are aware, the other cutters must have a tubular connection.

What we claim, and desire to secure by Letters Patent, is—

1. The combination of the screw Z, the nut 5 with its springs N, the mandrel O, and the carriers of the knives L, united, as shown, with the vertical knives F in the carrier G, so that the rotation of the cylinder K screws up the mandrel O and pushes out the knives L, as herein described.

2. The cams Q on the disk 6, in combination with the projections P on the divided nut 5, arranged to open the nut 5, as herein described.

3. The hollow revolving mandrel O, as described.

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