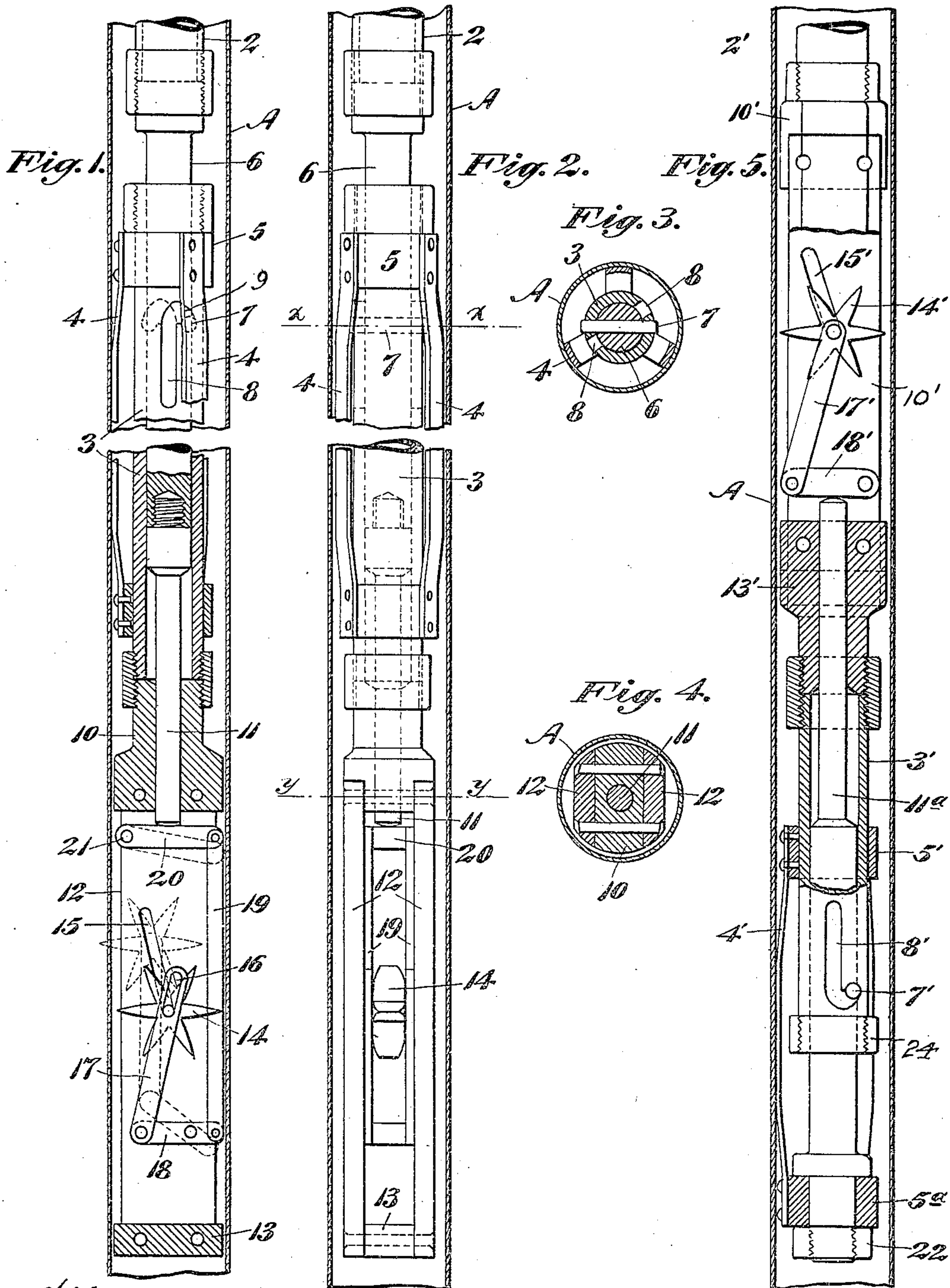


No. 808,235.

PATENTED DEC. 26, 1905.

E. R. GRAHAM.  
PIPE PERFORATOR.

APPLICATION FILED MAY 1, 1905.



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# UNITED STATES PATENT OFFICE.

EDWIN R. GRAHAM, OF COALINGA, CALIFORNIA.

## PIPE-PERFORATOR.

No. 808,235.

Specification of Letters Patent.

Patented Dec. 26, 1905.

Application filed May 1, 1905. Serial No. 258,346.

*To all whom it may concern:*

Be it known that I, EDWIN R. GRAHAM, a citizen of the United States, residing at Coalinga, in the county of Fresno and State of California, have invented new and useful Improvements in Pipe-Perforators, of which the following is a specification.

My invention relates to devices for perforating oil and Artesian well casings for the purpose of admitting the percolating liquids into the casing to be removed therefrom subsequently by the pumps.

The object of the present invention is to provide a simple practical machine for quickly perforating the casing, and comprises an apparatus by which a series of holes may be rolled in a casing instead of having to punch each hole separately and which separate punching necessitates the intermittent moving and stopping of the machine for each hole.

The invention consists of the parts and the construction and combination of parts, as hereinafter more fully described and claimed, having reference to the accompanying drawings, in which—

Figure 1 is an elevation in section of my perforator. Fig. 2 is a corresponding view of same at right angles to the view of Fig. 1. Fig. 3 is a section on line X X of Fig. 2. Fig. 4 is a section on line Y Y of Fig. 2. Fig. 5 is a modified form of my invention shown in partial section.

A represents a casing of an oil, Artesian, or other well, which casing it is desired to perforate at some one or more points in its length for the purpose of allowing the liquid percolating in the surrounding soil to enter the casing.

2 is a tube reaching to any suitable depth in the casing and carrying at its lower end a section 3, to which is secured a spring device, such as shown in my prior patent, No. 708,763, dated September 9, 1902, for holding the perforating-tool which is carried by section 3 at any desired point in the casing. This holding device comprises a series of convex springs 4, secured at each end to collars 5, one of which collars is locked to section 3, while the other is loosely slidable thereon to permit of the expansion or contraction of the springs 4. Reciprocal within the tube 2 and projecting therebelow is a rod 6, which carries a pin or pins 7, adapted to slide in vertical slots 8 in the section 3 or to be turned side-

wise into lateral prolongations 9 of the vertical slots 8 when it is desired to hang up the rod 6. Detachably connected with the lower end of the section or sleeve 3 is a head carrying the perforating mechanism, which is actuated on occasion by means of the prolongation 11 of rod 6. This head is here shown as comprising a centrally-perforated block 10, having secured to the opposite sides two parallel bars or plates 12, with their lower ends suitably spaced and maintained rigid by means of a brace-block 13.

The perforating star-wheel 14 operates in the space or slot formed between the plates 12. Normally this star-wheel is confined entirely within the space between the plates, but is adapted to be projected outwardly beyond the limit of the plates 12 when it is desired to puncture the casing. This wheel or perforating-tool is formed with puncturing-points of any desired shape and is mounted on an axle whose ends are movable in incline slots 15 in the plates. Attached to the wheel-shaft on each side of the wheel and having by reason of the slots 16 a limited movement independent of the wheel are the links 17, which connect to respective levers 18, fulcrumed intermediate of their ends on the plates 12. Other links 19 connect the opposite ends of the levers 18 with the end of the lever 20, fulcrumed at 21 above the wheel. The lever 20 is disposed in the path of the mandrel portion 11 of the operating-rod 6, so that when the mandrel is dropped the several connections 20, 19, 18, and 17 operate together in toggle fashion to carry the axle of the wheel 14 upward and outward in the slots 15, and so project the wheel into operative position relative to the casing.

Obviously the parts 10, 12, and 13 could be made in one piece and channeled or slotted to receive the perforating-tool; but I prefer to make the head in the form herein shown and described.

In practice the operating-rod is lifted to carry the pins 7 into the rests formed in the sleeve 3 by the offset slots 9, thereby lifting the mandrel 11 out of operative engagement with the link 20 to allow the tool to be raised or lowered in the casing without the perforator doing any damage. With the operating-rod in this position the apparatus is moved to any desired point in the casing, and, if desired, the entire weight of the apparatus may be sustained by the frictional contact of the springs 3 with the casing. The operating-rod is then lifted to carry the pins 7 into a line-



ment with the vertical slots 8, and on releasing the rod the mandrel 11 is dropped onto the lever 20, pushing the perforating-wheel upward and outward to cause its points to  
 5 pierce the casing. Suitable power is then applied on the tube 2 to reciprocate the device in the casing, and as long as the weight of the mandrel and operating-rod are supported on the link 20 the wheel continues to  
 10 roll holes up and down in the casing.

A rolling perforator of this sort is preferable in some respects to a knife which will slit the casing, since perforating has a less tendency to weaken the casing than where a long  
 15 slit is made.

The form of device above described is particularly suitable for perforating pipes of medium size or those ranging from four or five to ten or twelve inches. Where it is desired  
 20 to perforate pipe of a diameter less than the minimum above mentioned, or of a diameter greater than the maximum stated, I prefer to use a modified design of the invention such as is shown in Fig. 5. In this case I attach  
 25 the head 10' direct to the rod 2', and in a slot in this head I insert a perforating-wheel 14', having its axle operating as before in the incline slots 15'. Instead, however, of operating the wheel from above, as in the first-described instance, I now work it from below  
 30 through the medium of the following - described mechanism: Links 17' connect the axle with the cross-lever 18', disposed in the path of the vertical reciprocating rod 11<sup>a</sup>,  
 35 slidable in the portion 13', which is a continuation of the head 10'. Detachably connected with the part 13' is a tubular section 3', on which is slidable a collar 5', carrying the convexed supporting-springs 4'. These springs  
 40 connect at their lower end to a collar 5<sup>a</sup>, which is loose on the lower end of the rod 11<sup>a</sup>, but which collar 5<sup>a</sup> is movably held thereon by the nut 22. The tubular part 3' has an annular flange or external collar portion 24, limiting the downward movement of the collar  
 45 5'. It will thus be observed that the rod 11<sup>a</sup> and the springs 4' have a limited movement relative to the rest of the apparatus, or, conversely, the rest of the apparatus has a limited movement relative to the operating-rod  
 50 11<sup>a</sup> and its spring-hold means 4'. The tubular portion 3' is slotted at 8', similarly as in Fig. 5, and the rod 11<sup>a</sup> carries the pin or pins 7', engageable in suitable offsets in the slots 8' to permit of the movement of the entire apparatus up or down in the well without working the perforator. In practice with this form of device the rod 11<sup>a</sup> is suitably turned and locked in slots 8' to maintain the perforator in inoperative position, and the device  
 60 is lowered by the rod 2' to a suitable point in the well. By lifting up slightly on the rod 2' and turning it the pins 7' are carried into the vertical portion of the slot 8', so that the rod  
 65 11<sup>a</sup> is supported entirely independent of the

head and rod 2', the frictional contact of the springs 4' with the casing being sufficient to hold the rod 11<sup>a</sup> in position. By pushing down on the rod 2' the lever 18' is carried  
 70 down onto the end of the rod 11<sup>a</sup>, which in turn pushes the perforating-wheel upward and outward into the casing. Lifting up on the rod 2' releases the wheel and allows the apparatus to be withdrawn from the well or to be turned or moved to any other desired  
 75 position in the well. This latter form of device is preferred on large machines, where the weight of the entire apparatus is too great to be carried by the springs. It is also preferred in the machines for perforating small  
 80 pipe, since the space occupied by the springs when they are arranged below the head is considerably less than where they are made to surround the sleeve 3, as in Fig. 1. In the last-described construction the mandrel also  
 85 protects the springs, and there is no danger of shearing the springs off in case the tool is dropped to the bottom of the well.

The advantage possessed by both forms of construction is that I am enabled to roll a  
 90 row of holes of any desired length in practically the same length of time that it formally took to make a single hole where radial punches were used.

It is possible that various changes and  
 95 modifications may be made without departing from the principle of my invention, and I do not wish to be understood as limiting myself to the specific structure here shown and described.  
 100

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

1. In apparatus of the character described, the combination of a perforating-tool mounted to rotate and having a plurality of radial perforating-points, means for suspending the tool in the well-casing, means for holding it normally out of operative relation with the casing and means including toggle-levers for  
 105 moving it into operative relation therewith.

2. In apparatus of the character described, the combination of a head, a perforating star-wheel carried by said head and normally out of operative relation with the casing and  
 110 means including toggle-levers and a reciprocal rod for actuating the same to project the star-wheel into operative relation with the casing.

3. In apparatus of the character described, the combination with a suitable support within the well-casing, of a perforating-tool carried by said support, said perforating-tool mounted to rotate and having a plurality of radially-disposed puncturing-points, means  
 115 including a toggle-lever mechanism and a reciprocal rod adapted to engage the same, for moving said wheel radially of the casing, and means to reciprocate said wheel-support.

4. In apparatus of the character described, 130



the combination of a slotted head, a rotary puncturing-tool carried by said head and normally retracted out of operative relation with the casing, means including a toggle-lever connection and a member contacting therewith for moving said tool radially of the head and means to reciprocate the latter.

5 5. In apparatus of the character described, the combination of a slotted head, star-wheel carried thereby, said wheel having a limited movement radially of the head, means including toggle-levers for moving the wheel radially of the head and means for reciprocating the latter.

15 6. In apparatus of the character described, the combination of a head or other suitable support, a puncturing-tool comprising a star-wheel carried by said head and having its axle supported in inclined slots in the head, 20 means including a contact member and a toggle-lever mechanism disposed in the range of action thereof for reciprocating the wheel in said slots and means for reciprocating the head.

25 7. In apparatus of the character described, the combination of a head, a star-wheel having its axle supported in inclined slots in said head, toggle-levers connected with said wheel, a rod operable on said levers to actu-

ate the wheel and means to reciprocate the head. 30

8. In apparatus of the character described, the combination of a head, a puncturing star-wheel carried thereby, said star-wheel having a limited movement radially of the head and 35 normally out of engagement with the casing, toggle-levers connected with said wheel, an operating-rod for said levers and means to reciprocate the head.

9. In apparatus of the character described, 40 the combination of a head, a puncturing star-wheel and a toggle-lever mechanism connected therewith said wheel having a limited movement radially of said head, an operating-rod below said wheel and adapted to op- 45 erate said mechanism having means of support within the well-casing independent of the wheel-support, and means for reciprocating the head to cause the rod to operate the star-wheel. 50

In testimony whereof I have hereunto set my hand in presence of two subscribing witnesses.

EDWIN R. GRAHAM.

Witnesses:

A. B. HILL,  
BEN W. KILBY.