(No Model.)

2 Sheets—Sheet 1.

J. F. WILLARD.

DRILLING APPARATUS.

No. 541,256. Patented June 18, 1895.

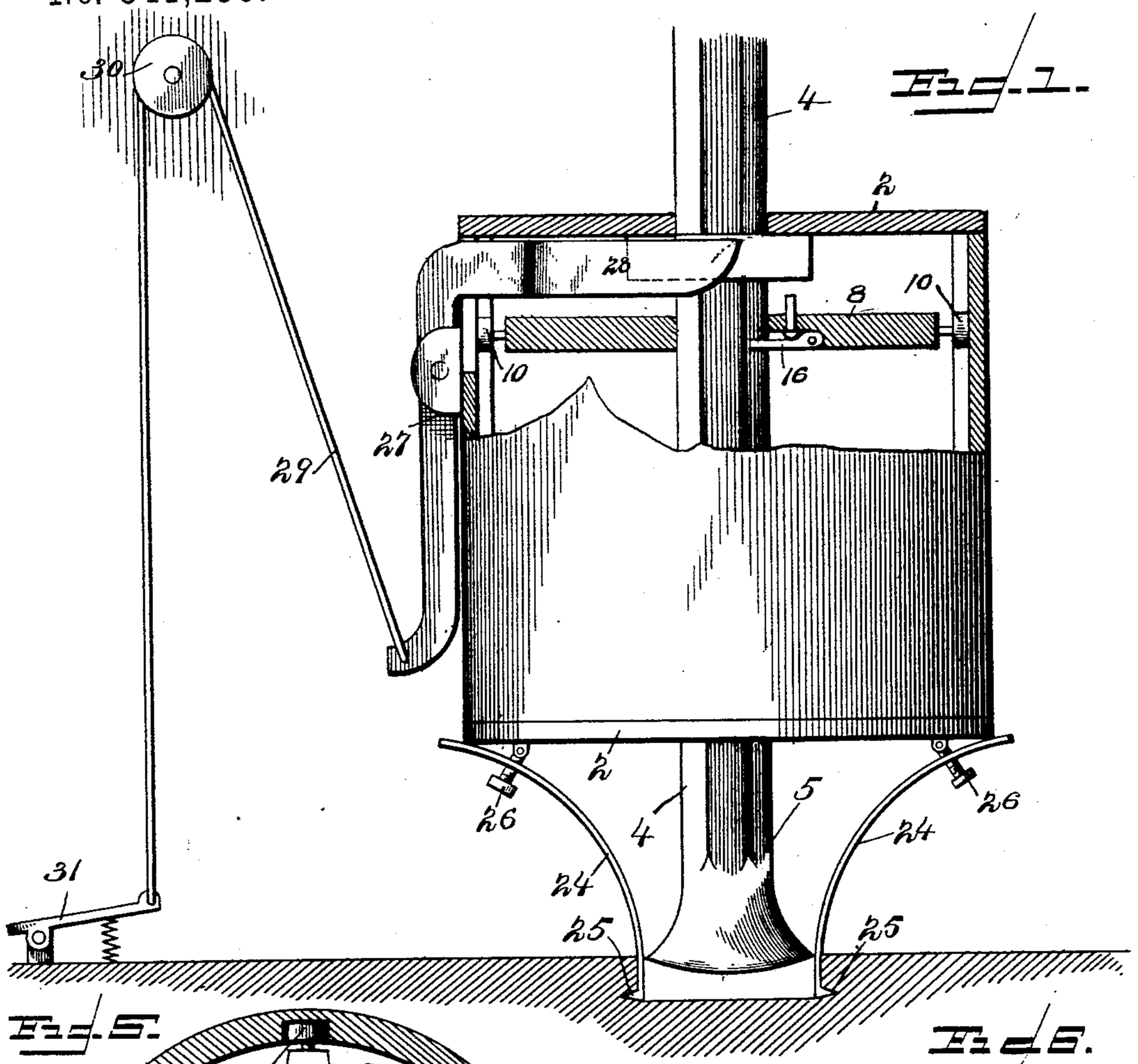


Fig. 1.

Fig. 5.

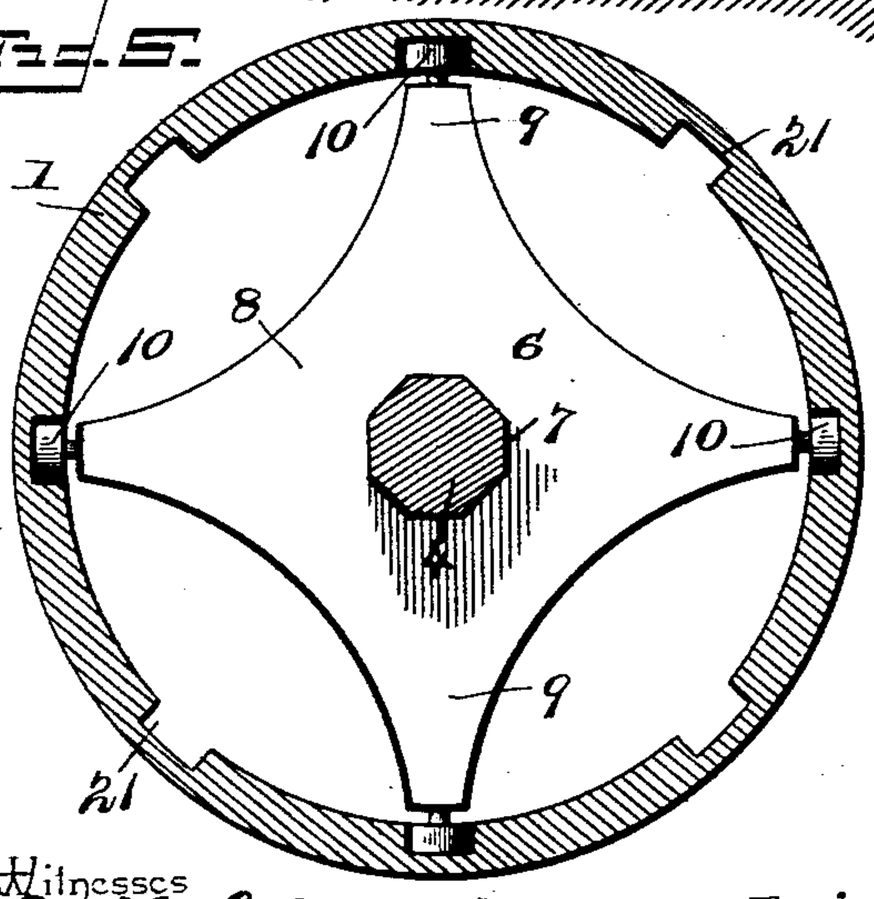
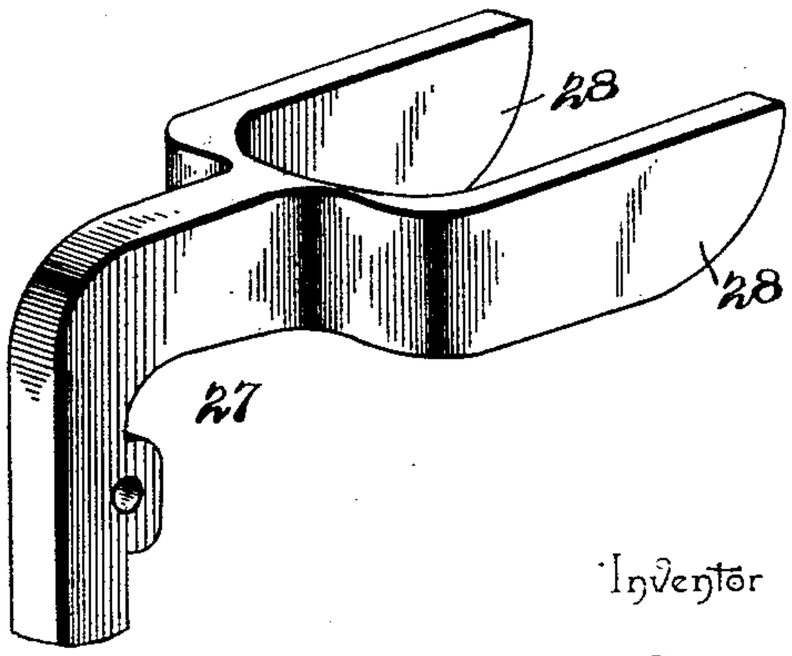


Fig. 6.



Witnesses
E. K. Stewart.
C. E. Hoyle

Inventor
Jacob F. Willard,
By his Attorneys.
C. A. Snow & Co.

(No Model.) 2 Sheets—Sheet 2.

J. F. WILLARD.

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Fig. 3.

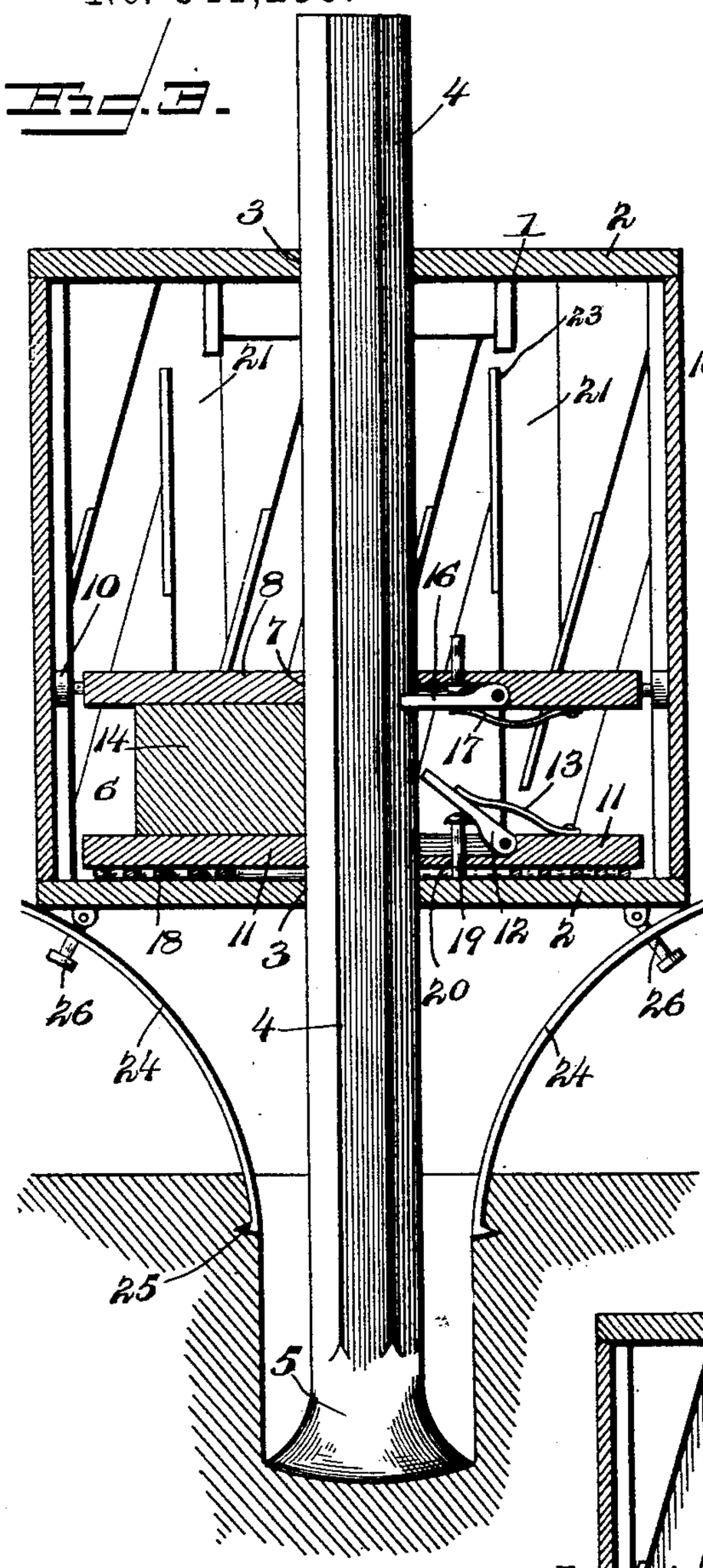


Fig. 2.

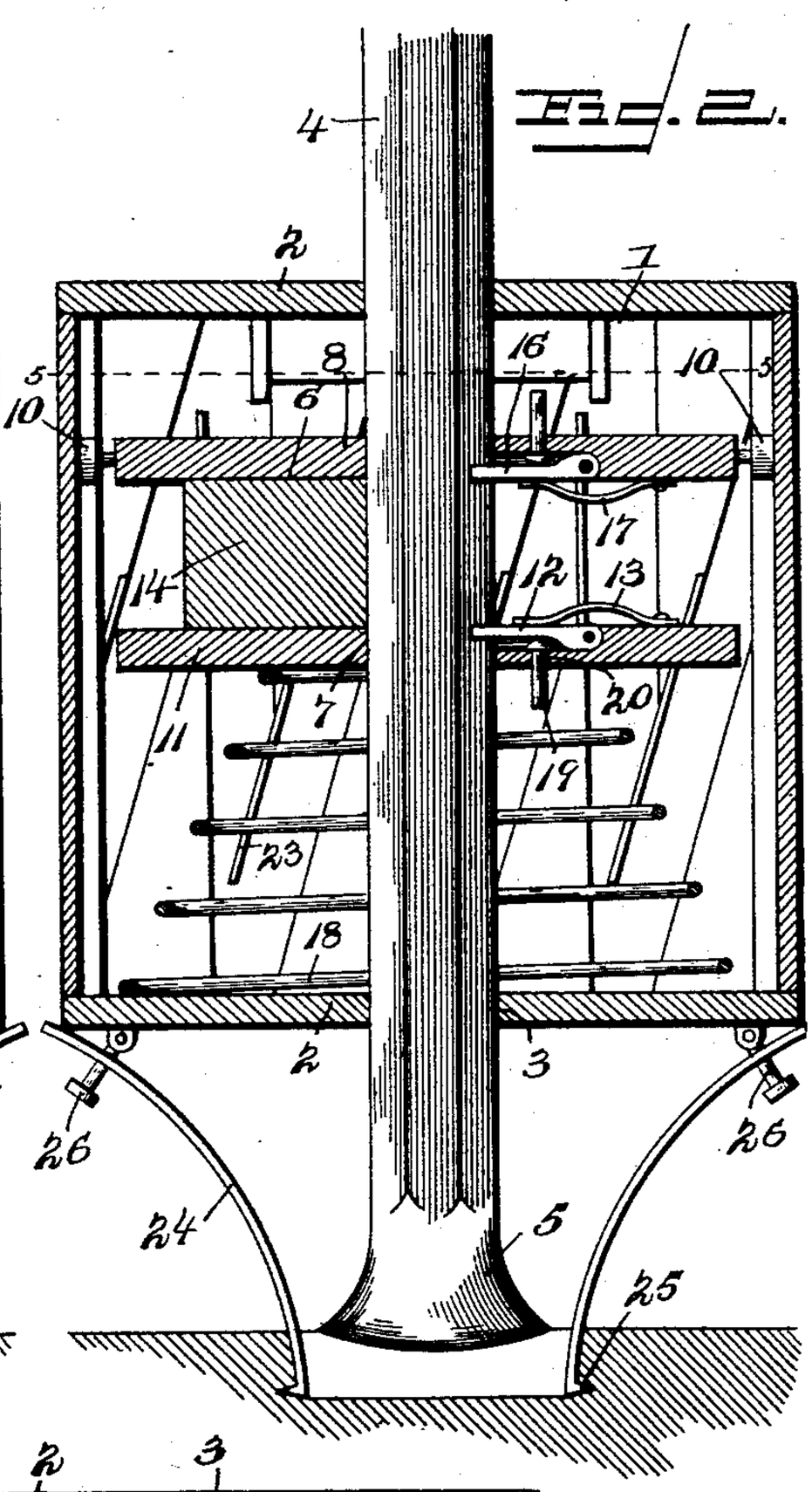


Fig. 7.

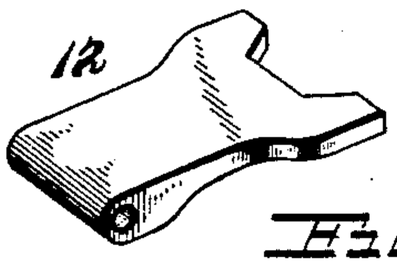
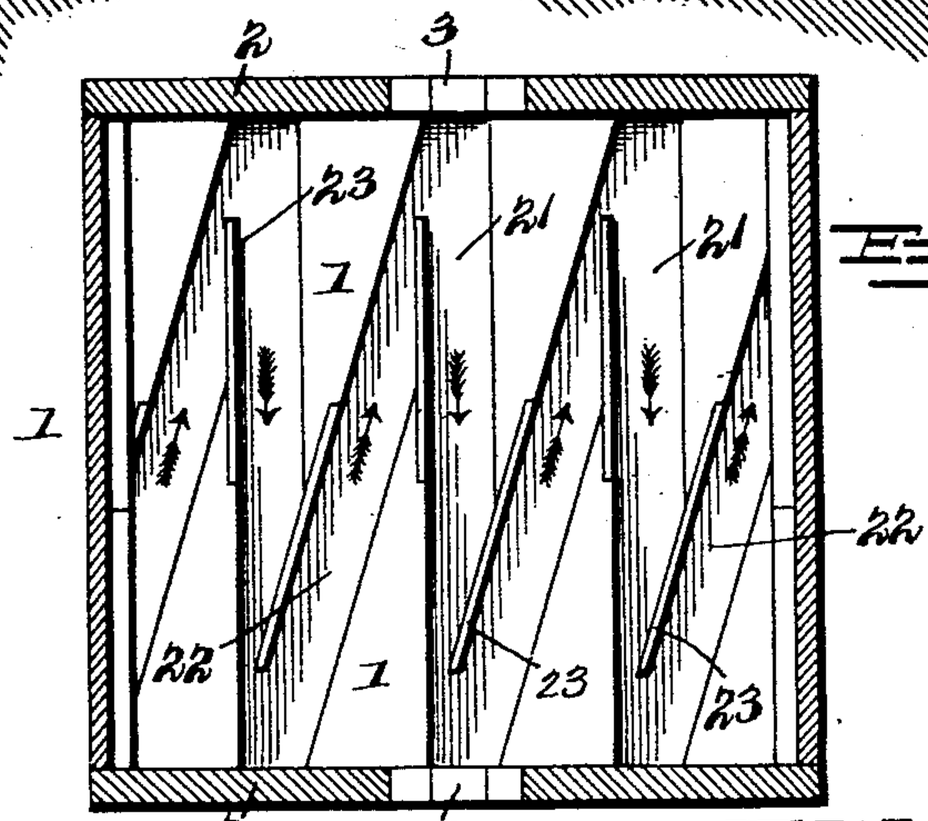


Fig. 4.



Inventor

Witnesses
E. K. Stewart.
C. E. Foyle

By his Attorneys. Jacob F. Willard
C. A. Snow & Co.

UNITED STATES PATENT OFFICE.

JACOB F. WILLARD, OF HOWARD, KANSAS.

DRILLING APPARATUS.

SPECIFICATION forming part of Letters Patent No. 541,256, dated June 18, 1895.

Application filed August 6, 1894. Serial No. 519,582. (No model.)

To all whom it may concern:

Be it known that I, JACOB F. WILLARD, a citizen of the United States, residing at Howard, in the county of Elk and State of Kansas, have invented a new and useful Drilling Apparatus, of which the following is a specification.

My invention relates to a percussion or impact rock drill, and has for its object to provide automatic rotary and longitudinal feed mechanism for the drill; and furthermore to provide means whereby the drill may be operated by hand or foot power, or by any suitable driving or impact mechanism.

Further objects and advantages of this invention will appear in the following description, and the novel features thereof will be particularly pointed out in the appended claims.

In the drawings, Figure 1 is a view of a drilling mechanism embodying my invention arranged in operative position. Fig. 2 is a central sectional view of the same parallel with the drill, showing the latter in its elevated or retracted position. Fig. 3 is a similar view showing the drill in its depressed or operating position. Fig. 4 is a sectional view of the cylinder with the drill and actuating devices removed. Fig. 5 is a horizontal section on the line 5 5 of Fig. 2, showing the tappet-plate in plan. Fig. 6 is a detail view in perspective of the operating-lever. Fig. 7 is a detail view of one of the pawls.

Similar numerals of reference indicate corresponding parts in all the figures of the drawings.

1 designates a cylinder, which is preferably provided with removable heads 2, having central guide-openings 3, to receive the polygonal shank 4 of the rock-drill 5. Within this cylinder, and arranged parallel with its heads, is a reciprocating tappet 6, also provided with a guide-opening 7, to register with the guide-openings in the heads and receive the shank of the drill. This tappet comprises a plate 8, having radial arms 9, which are provided at their terminals with antifriction rollers 10 for a purpose hereinafter explained. Arranged at an interval from and parallel with the plate 8 is a disk 11 forming a part of the tappet and carrying a pivoted pawl 12, which operates in conjunction with a block 14, by which the plates 8 and 11 are connected to form a clutch for the engagement of the shank of the drill to prevent independent upward movement of the tappet and independent downward movement of the drill. The pawl 12 is provided with an actuating spring 13. The main plate 8 of the tappet carries a locking pawl 16, similar to the pawl 12, and provided with an actuating spring 17. The clutch-pawl 12 is arranged upon the upper surface of the disk 11 and engages the shank of the drill to enable the latter to derive vertical upward movement from the tappet when the latter is elevated; and the locking pawl 16 is located at the under side of the main plate 8 to communicate downward motion from the tappet to the drill shank when the tappet is depressed. In other words, the pawl 12 is capable of upward movement and is held from downward movement, while the pawl 16 is capable of downward movement and is held from upward movement, beyond the points at which they are firmly engaged with the surfaces of the polygonal shank of the drill. Thus, with said locking and clutch pawls in their normal or operative positions, as they are held by their actuating springs, the drill shank is locked against motion in either direction independently of the tappet.

18 represents a drill actuating or retracting spring which is preferably spiral in form to enable the coils thereof to fold into a common plane when the spring is compressed by the downward movement of the tappet, as shown clearly in Fig. 3; and carried by the lower plate 11 of the tappet, and depending below the lower surface thereof, is a trip-pin 19, which fits slidably in a perforation 20 in said plate or disk and engages at its upper end to the pawl 12, near the free end of the latter, whereby, when the tappet is depressed, as shown in Fig. 3, the trip-pin comes in contact with the lower head of the cylinder and is elevated, thus disengaging the pawl 12 from the shank of the drill.

In operation a blow upon the end of the drill shank advances the latter and carries the tappet to the lower end of the cylinder, thus causing the trip-pin to disengage the clutch-pawl from the shank, and allowing the contracted spring 18 to repress or elevate the tappet; but, as the disengagement of the pawl 12 from the drill shank is only momen-

tary, owing to the action of the spring 13, and as the said pawl is allowed to resume its normal position in engagement with the drill shank, as soon as the tappet has been moved a sufficient distance to remove the trip-pin from contact with the head of the cylinder, the backward movement of the tappet, independent of the drill-shank, will be checked, and any further movement of the tappet in the same direction will be communicated to the drill. This momentary release of the clutch-pawl from the drill shank at the limit of the forward movement of the drill, thus causes a change in the relative positions of the tappet and the drill, such change of position consisting in a slight advance of the drill. Thus the drilling operation is advanced slightly at the end of each forward movement.

In the drawings I have shown, and in the description I have referred, in matters of position and direction, to the mechanism as arranged to drill vertically downward, or in the floor, but it will be obvious that it is adapted to operate with equal facility in drilling horizontally, as in a breast-wall, or vertically upward, as in the roof of a cut. The step-by-step advancement of the drill being effected by means of spring-actuated mechanism proceeds in any position of the drill.

The side walls of the cylinder are provided with a continuous or endless series of communicating guides, which are preferably constructed as grooves or channels. The advance guides 21 are arranged longitudinally, or parallel with the axis of the cylinder, and are spaced apart at regular intervals, and the connecting or return guides 23 are arranged at an inclination to the axis of the cylinder and connect the lower or inner end of one advance guide to the upper or outer end of the adjacent advance guide. Gates 23 are located respectively at the intersections of the advance and return guides, and preferably consist of plate springs which are disposed to lie across, and hence close the outlet end of each return and advance guide.

The anti-friction rolls carried by the tappet fit and operate in these guides and travel therein in the direction indicated by the arrows in Fig. 5, whereby the gates which close the outer ends of the guides are deflected or opened by contact of the arms of the tappet to allow such parts to pass into the intersecting end of the succeeding guide, but return immediately to their normal or closed positions to bar return through the preceding guide and direct the arm into said succeeding guide. Thus, the drill is reciprocated by successive blows of a sledge, or by other intermittent operating mechanism, and by the return spring, the tappet and drill are rotated regularly and steadily by the arms of said tappet traveling in the guides, said guides preventing backward and compelling forward movement or rotation. The advance guides 21 are arranged parallel with the axis of the cylinder in order that the drill may not be turned while advancing, and thus offer no impediment thereto; and the return guides are arranged spirally or at an inclination to the axis of the cylinder in order that the rotation of the drill may be upon the backward movement of the same when it is actuated only by the return spring.

In addition to the above I have provided means for securing the apparatus to the opening or mouth of the hole in which the drill is operating, the same consisting of pivotal arms 24, provided with spurs 25 to engage the walls of said hole, and adjusting-screws 26, whereby the lower or spurred ends of the holding arms may be spread or contracted, and thus adjusted to suit the size of the opening formed by the drill. It will be understood that when the drill is forwardly actuated by means of a sledge or by any other force acting directly upon the shank of the drill, the locking-pawl 16, carried by the tappet, is unnecessary for the reason that the downward movement of the drill is communicated to the tappet, and the upward movement of the tappet is communicated to the drill by the clutch-pawl 12; but when it is desired to operate the drill by foot-power, or other means acting upon the tappet to advance the drill, said locking-pawl is necessary in order to communicate the advance movement of the tappet to the drill. I have shown a foot-operating device in connection with the apparatus, the same consisting of an angle-lever 27, which is fulcrumed upon the casing or cylinder, operates in a slot in the side thereof, and is provided with a bifurcated and cam-faced head 28, which spans the drill-shank and contacts with the upper surface of the tappet upon opposite sides thereof. To the outer end of said lever is connected a flexible band 29, which travels over a guide-pulley 30 and is connected to a foot-lever or treadle 31.

From the above description it will be understood that whether the drill is actuated by impact, as by the use of a sledge or hammer, or by other means, such as the foot-lever above described, it will be advanced or fed longitudinally step by step, and at the same time will receive a rotary motion which distributes the action of the head of the drill and avoids the necessity of turning the same by hand as in the ordinary practice. It will be understood, furthermore, that various changes in the form, proportion, and the minor details of construction may be resorted to without departing from the principle or sacrificing any of the advantages of this invention. For instance, the disposition of the parts forming the foot-operating mechanism requires change to suit the position of the drill, for the reason that the operation of the cam lever will be affected differently by gravity—that is, when drilling in a roof the spring for elevating the foot lever would not be required; or if used, it would be arranged in the reverse position to that shown in Fig. 1; while in drilling a breast-

hole springs would be arranged on both sides, or both above and below the foot lever.

Having described the invention, what is claimed is—

1. In a drill-operating mechanism, the combination of a spring-retracted tappet, a clutch carried by said tappet, and a trip device to disengage the clutch from the drill at the end of the advance stroke, substantially as specified.

2. The combination with a drill, of a spring-retracted tappet, a clutch-pawl carried by the tappet to engage and prevent independent advance movement of the drill, a locking pawl carried by the tappet to engage and prevent independent return movement of the drill, means for imparting an advance movement to the tappet, and a trip device to disengage the clutch-pawl at the end of the advance stroke, substantially as specified.

3. The combination with a drill, of a tappet carrying a clutch-pawl to engage and prevent independent advance movement of the drill, a spiral retracting spring arranged to return the tappet after each advance stroke, and a trip-pin arranged to trip the clutch-pawl at the end of an advance stroke, substantially as specified.

4. The combination with a drill, of a tappet carrying a clutch-pawl to engage the drill, a retracting spring for the tappet, and a trip-pin carried by the tappet, connected to the free end of said clutch-pawl and depending in position to contact with a stationary object at the end of each stroke, substantially as specified.

5. The combination with a drill, of a tappet having parallel plates provided with radial arms terminating in anti-friction rolls, means carried by the tappet for imparting a forward or advance movement to the drill, a cylinder inclosing said tappet and provided in its walls with a continuous series of communicating advance and return guides the advance guides being parallel with the path of the drill and the return guides being at an inclination to the advance guides and connecting opposite ends of said guides, the anti-friction rolls at the terminals of the arms of the tappet being arranged to travel in the guides, and spring gates attached to the side walls of said guides adjacent to their points of communication with the preceding guides, respectively, and having their free ends arranged to close said preceding guides and in alignment with the guides to the walls of which they are secured, whereby the rolls during their advance movement travel toward the free ends of the gates to facilitate passage from one guide to the next, substantially as specified.

6. The combination with a drill, a tappet provided with an actuating retraction spring, locking and clutch pawls carried by the tappet to engage the drill, and trip devices to disengage the clutch-pawl from the drill, of an operating lever provided with a bifurcated cam-faced head to engage the upper surface of the tappet, and means to operate said lever, substantially as specified.

7. The combination with a cylinder or casing, a drill and operating mechanism therefor, of a holding device comprising curved spring metal arms 24 adjustably connected to the cylinder or casing and provided at their lower ends with terminal spurs 25 to engage the walls of the hole in which the drill is operating, and adjusting devices for said arms consisting of set-screws 26, substantially as specified.

In testimony that I claim the foregoing as my own I have hereto affixed my signature in the presence of two witnesses.

JACOB F. WILLARD.

Witnesses:
C. L. McKESSON,
C. W. BOGUE.