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J. F. BALSLEY & F. C. PRIESTLY.

ROCK DRILL.

No. 572,855. Patented Dec. 8, 1896.

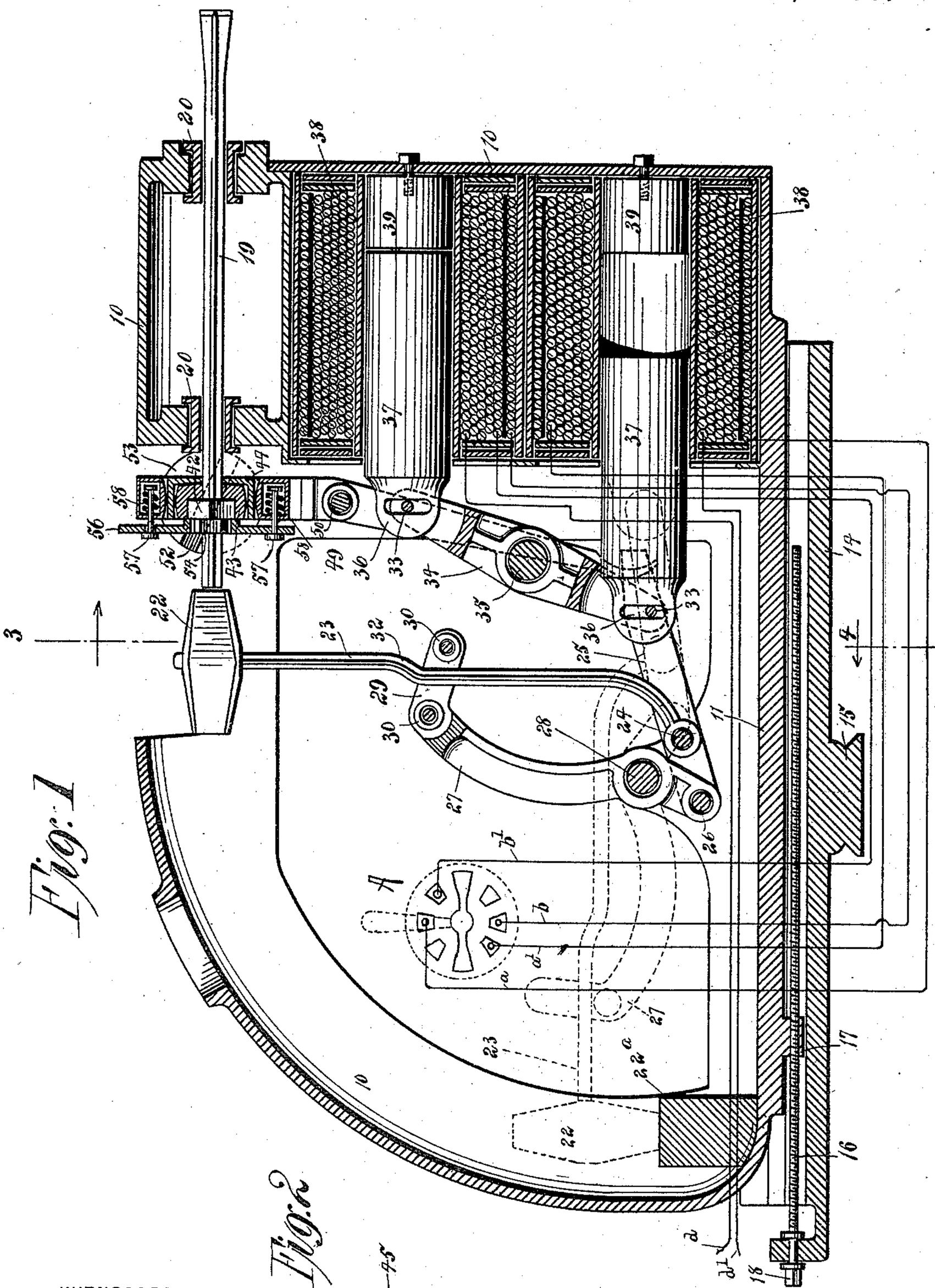

Fig. 1

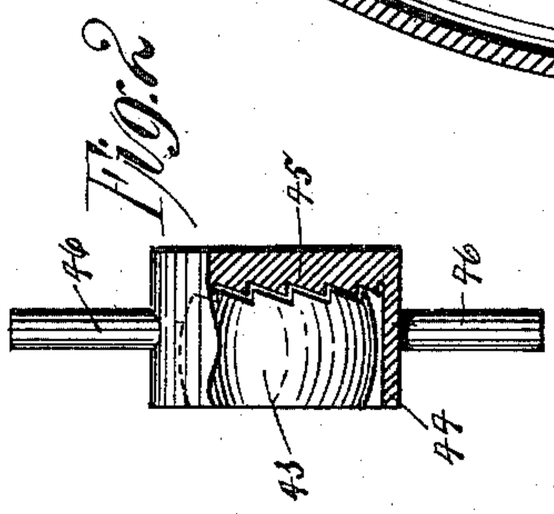

Fig. 2

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Fig. 5

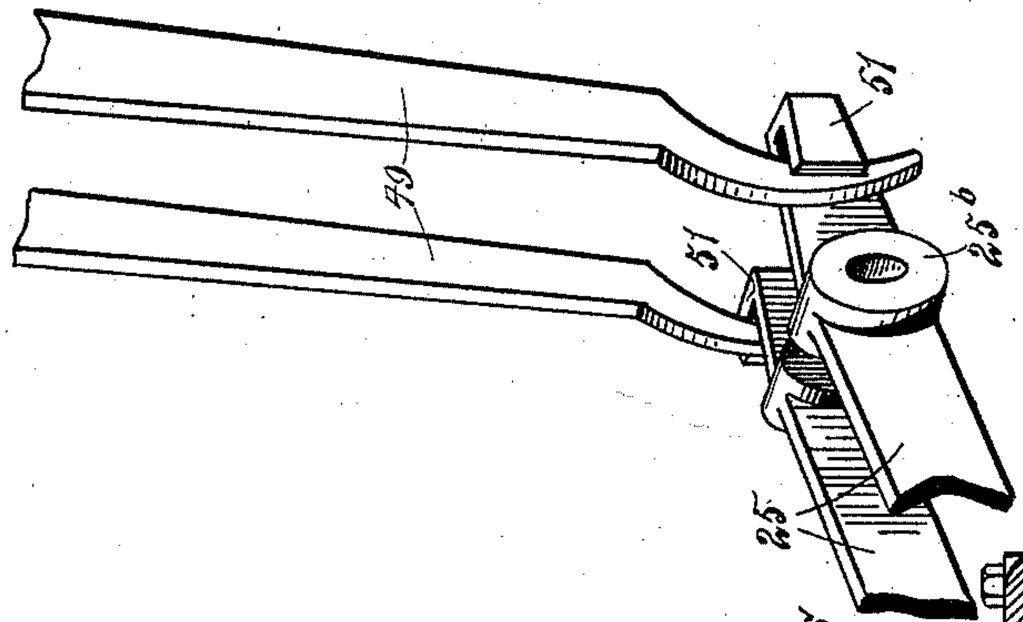

Fig. 4

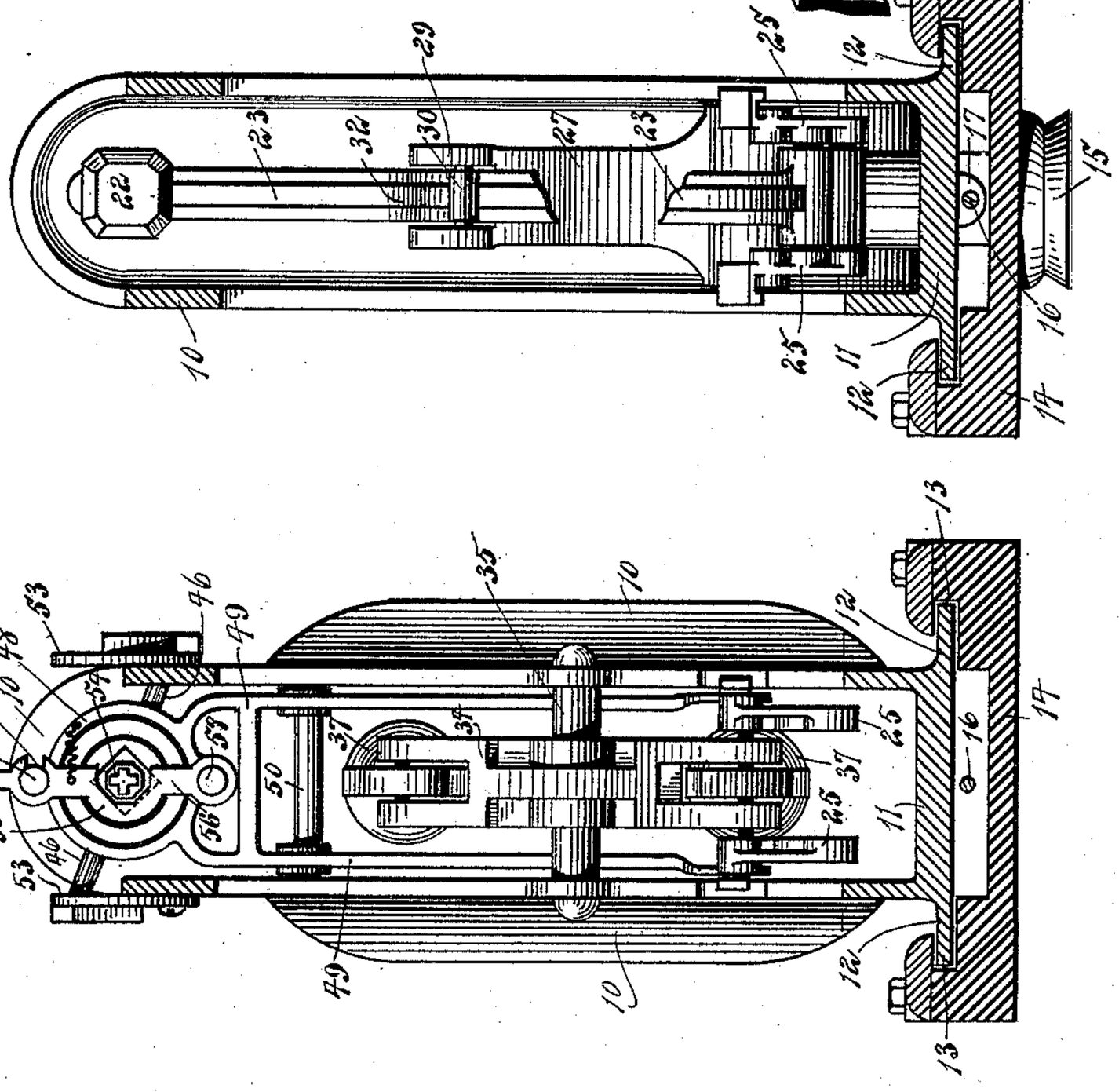

Fig. 3

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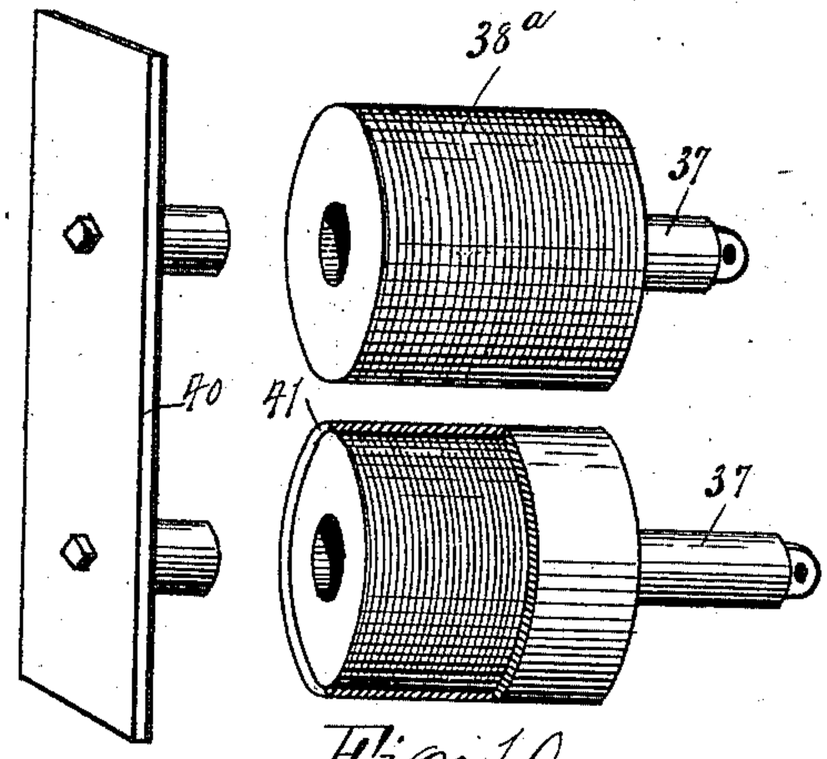

Fig. 10

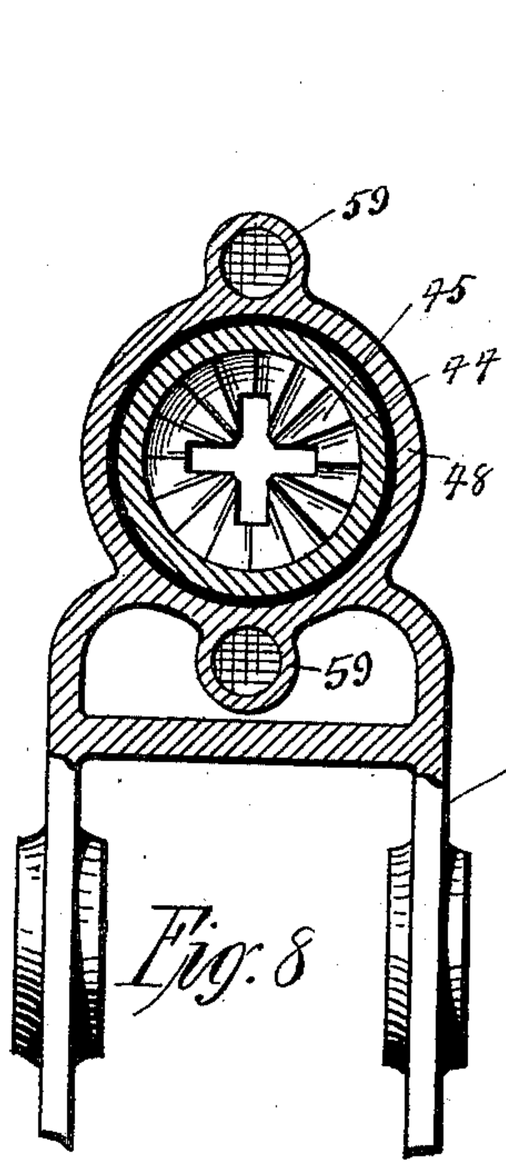

Fig. 8

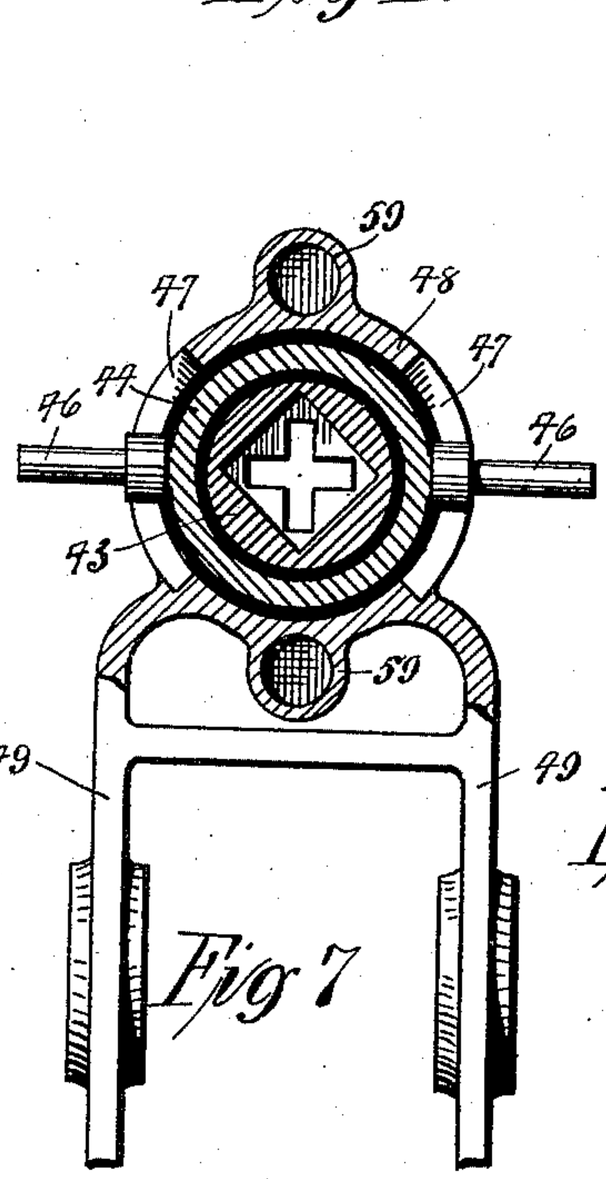

Fig. 7

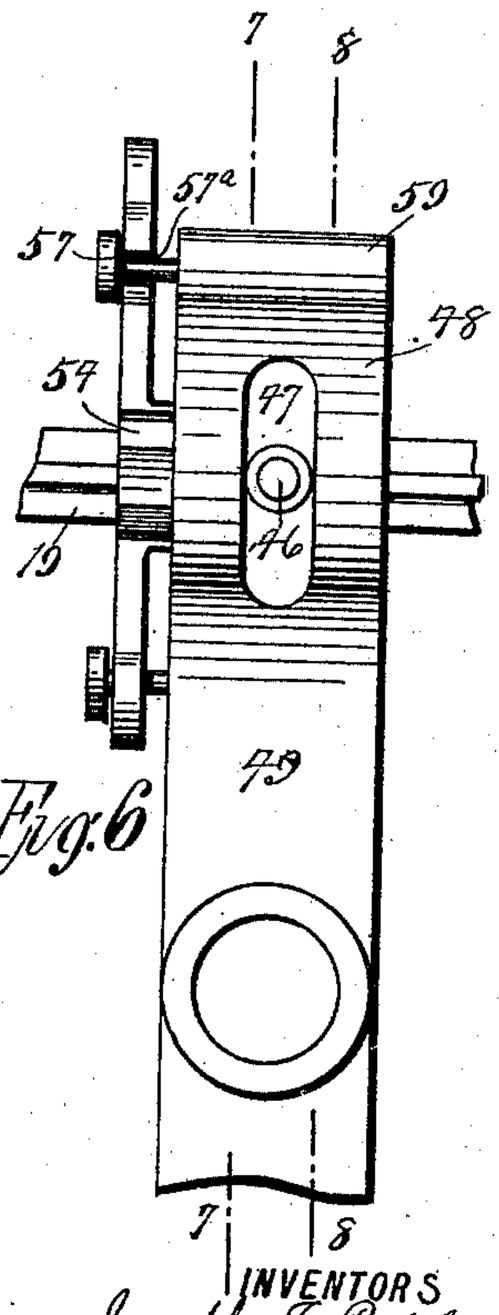

Fig. 6

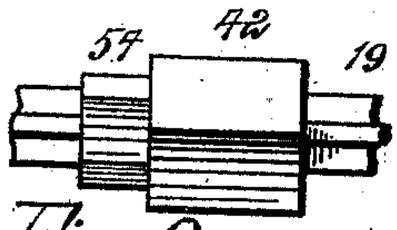

Fig. 9

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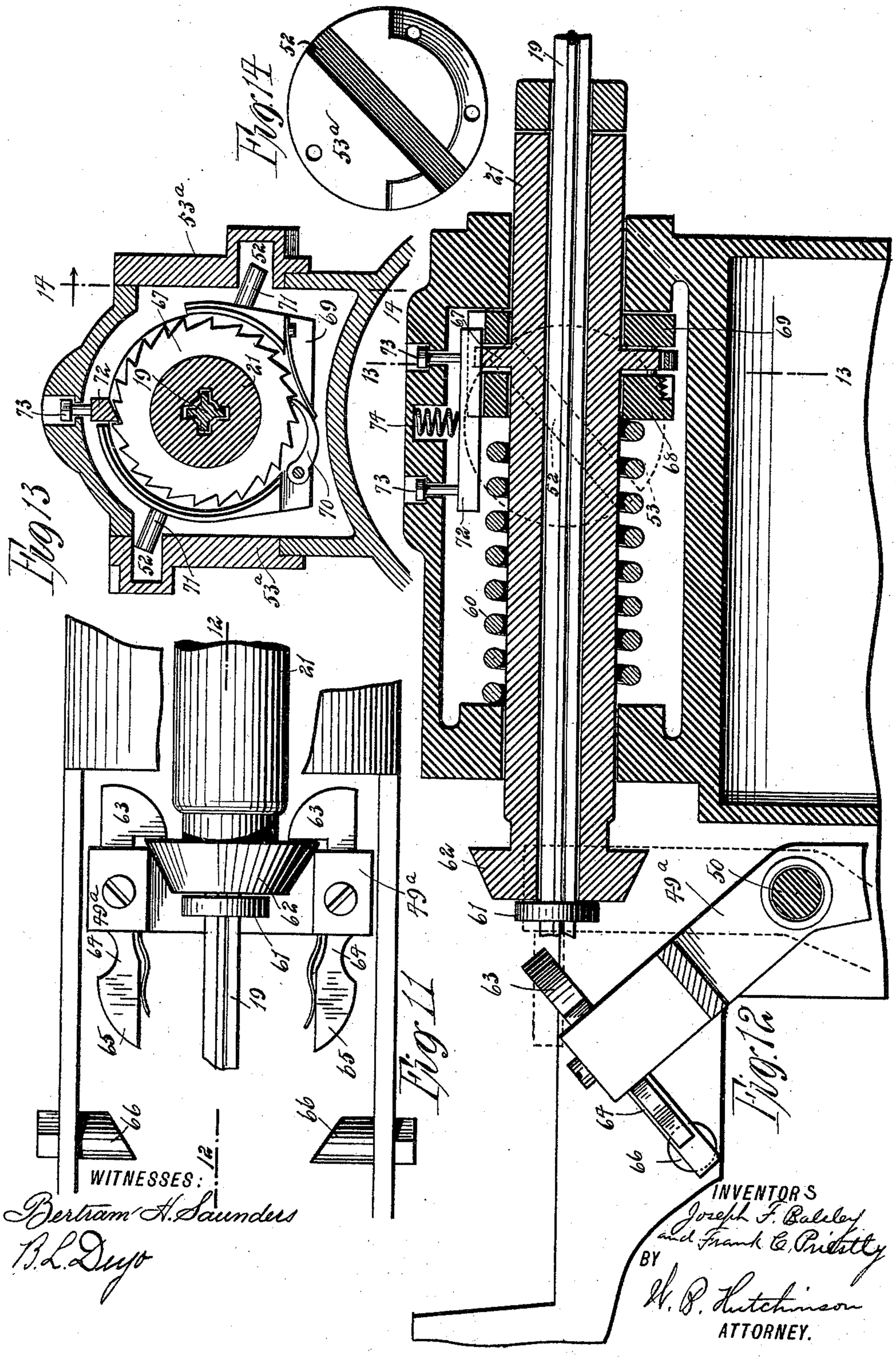

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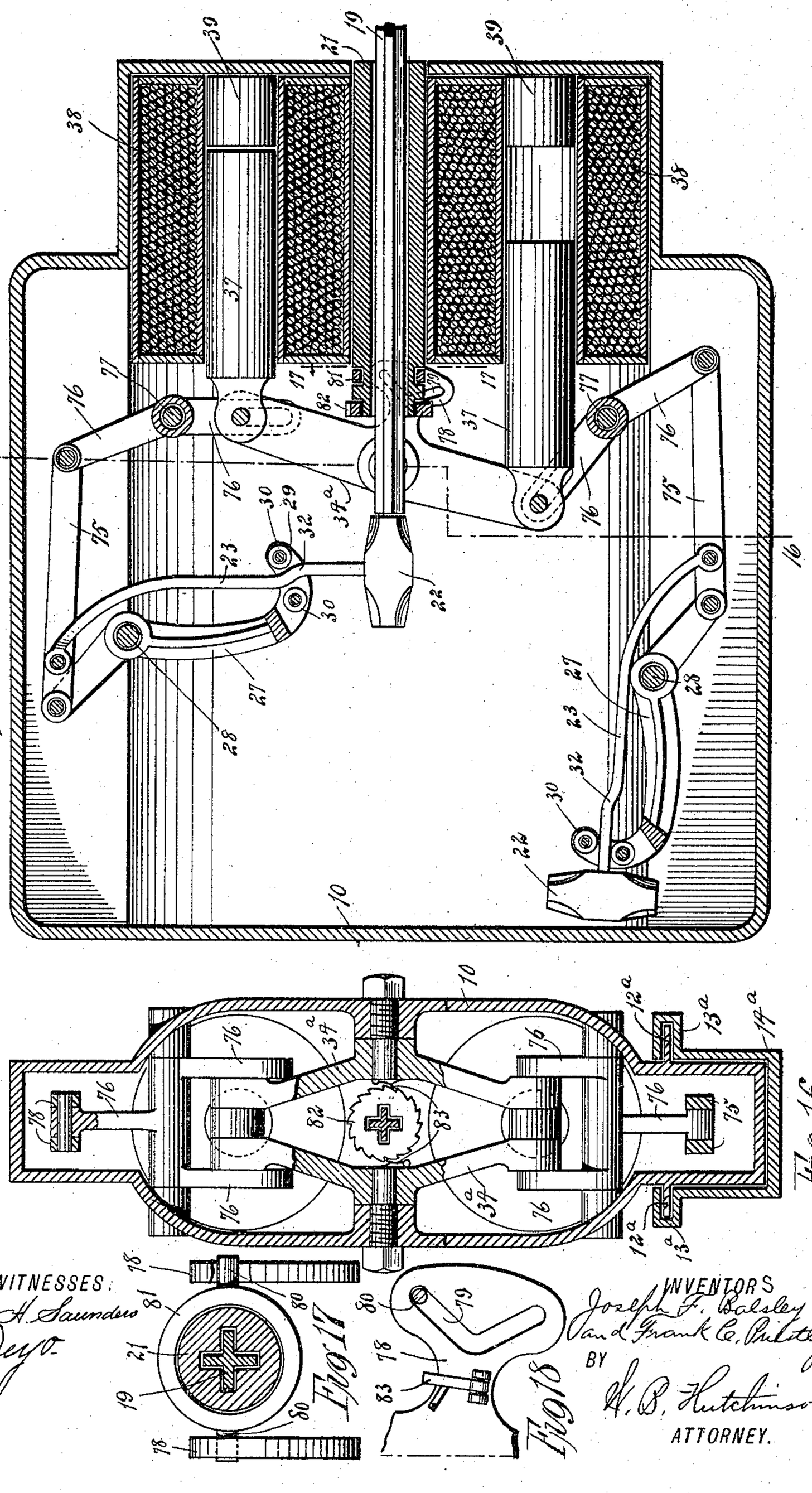

Fig. 15

Fig. 16

Fig. 17

Fig. 18

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UNITED STATES PATENT OFFICE.

JOSEPH F. BALSLEY AND FRANK C. PRIESTLY, OF DENVER, COLORADO.

ROCK-DRILL.

SPECIFICATION forming part of Letters Patent No. 572,855, dated December 8, 1896.

Application filed March 19, 1896. Serial No. 583,865. (No model.)

To all whom it may concern:

Be it known that we, JOSEPH F. BALSLEY and FRANK C. PRIESTLY, of Denver, in the county of Arapahoe and State of Colorado, have invented certain new and useful Improvements in Rock-Drills, of which the following is a full, clear, and exact description.

Our invention relates to improvements in that class of rock-drills which employ a swinging hammer or hammers adapted to deliver free swinging blows on the drill after the manner of a hand-swung sledge; and the object of our invention is to produce a comparatively simple and very efficient machine of this kind which has its parts arranged in such a way as to work practically without getting out of repair, which has means for accelerating the movement of the hammer as it strikes the drill, so as to deliver a free blow, and which has a particularly effective means of operating the mechanism for turning the drill and swinging the hammer electrically, enabling solenoids to be used with particularly good effect and rapid action.

A further object of our invention is to arrange the working parts of the drill in a housing or case which is of such a structure that the drill can be easily transported and readily set up ready for use.

To these ends our invention consists of certain features of construction and combinations of parts which will be hereinafter described and claimed.

Reference is to be had to the accompanying drawings, forming a part of this specification, in which similar figures and letters of reference indicate corresponding parts in all the views.

Figure 1 is a central longitudinal section of the drill embodying our invention. Fig. 2 is a broken detail view, partly in section, of one form of device used in turning the drill. Fig. 3 is a cross-section on the line 3 4 of Fig. 1, looking in the direction of the upper arrow. Fig. 4 is a cross-section on the line 3 4 of Fig. 1, looking in the direction of the lower arrow. Fig. 5 is a detail perspective view showing the connection of the drill-turning lever with the links which operate it. Fig. 6 is a broken enlarged side elevation of the drill-turning lever and the mechanism which it carries. Fig. 7 is a vertical section on the line 7 7 of Fig. 6. Fig. 8 is a vertical section on the line 8 8 of Fig. 6. Fig. 9 is a broken detail side elevation of a part of the drill with the turning and locking collars thereon. Fig. 10 is a broken perspective view illustrating modified forms of magnets. Fig. 11 is a broken plan view of a modified means of operating the drill to pull it back and turn it. Fig. 12 is a longitudinal section on the line 12 12 of Fig. 11. Fig. 13 is a cross-section on the line 13 13 of Fig. 12. Fig. 14 is a sectional elevation on the line 14 14 of Fig. 13. Fig. 15 is a central longitudinal section of a modified form of the drill, showing a duplex arrangement of the hammers. Fig. 16 is a cross-section on the line 16 16 of Fig. 15. Fig. 17 is a detail cross-section on the line 17 17 of Fig. 15 and shows the mechanism for pulling back the drill preparatory to turning it, and Fig. 18 is a detail elevation of one of the arms of the walking-beam which actuates the drill-pulling mechanism

The drill is provided with a compact housing or case 10, which has a thickened bottom 11, with side flanges 12, (see Fig. 3,) which run in ways 13 of the base 14, which base is preferably provided with a depending anchor or boss 15, (see Fig. 1,) which can be let into a tripod or bar and thus made to hold the drill-frame steady. Beneath the housing 10 is a longitudinal screw 16, which turns in a nut 17 on the bottom of the housing and is journaled in an upturned end of the base 14, the said screw having a squared end 18, by which it may be turned so as to advance the housing as fast as the drill cuts its way into the rock. We have shown no mechanism for turning this screw, but if automatic mechanism is applied to it it will not interfere with the principle of this present invention.

The machine is provided with a drill 19, which can be of any approved kind, but which is longitudinally ribbed to enable it to be conveniently turned, and, as shown in Fig. 1, this drill turns in short holders 20, which fit it and which are journaled in the upper part and front end of the housing 10, but, if desired, a long drill-holder 21, as shown in Figs. 11, 12, and 15 and hereinafter more specifically described, can be used.

The drill is struck by a swinging hammer

22, which is carried at the free end of a shank 23 and which on its back stroke drops upon a cushion 22ª. The hammer-shank is at one end pivoted, as shown at 24, between links 25, although a single link may be used, if desired, and as these links are moved, as presently described, a movable pivot or center is furnished for the hammer-shank, which is an important feature, as the center advances at the same time the hammer is swung, and so a tremendous blow is delivered by the hammer. The links 25 are at one end pivoted, as shown at 26, to the rocking arm 27, which is pivoted as shown at 28, and which has a bent upper end 29, carrying rollers 30, which clasp the hammer-shank 23, and so when the arm is swung back and forth the shank is swung likewise. The hammer-shank is provided with an offset or cam 32, which is engaged by one of the rollers just before the hammer strikes the drill, and so an accelerated movement is given to the hammer, causing it to deliver a free swinging blow on the drill. The front ends of the links 25 are pivoted, as shown at 23, to the lower end of the walking-beam 34, which is pivoted at its center, as shown at 35, and the pivots 33 extend into slots 36 of the armatures or plungers 37, which are alternately actuated by the solenoids 38, these solenoids having the usual stops 39 to limit the inward movement of the plungers.

In Fig. 10 is shown an arrangement for giving a horseshoe magnetic effect to the solenoids. 38ª represents a solenoid without an iron jacket, which arrangement is used when it is desired to connect the two cores in a horseshoe magnetic circuit by means of an iron plate 40, but when the cores are isolated an iron jacket 41 is employed, and then a brass plate is used instead of the iron plate 40.

It will be observed that the alternate energizing of the solenoids causes the plungers to be reciprocated and the walking-beam to be tilted, which imparts a movement to the hammer-shank, which will be more particularly described hereinafter.

The solenoids are alternately energized by means of any suitable switch, but we have shown a switch A (see Fig. 1) in a general way to illustrate how the apparatus is worked. The switch A connects by wires a a' b b' with the two solenoids, which also have connections d d', and by the operation of the switch the circuit is rapidly shifted from one solenoid to the other.

In order that the drill 19 may be pulled back slightly after each blow and easily turned, it is provided with a squared collar 42, (see Figs. 1 and 6 to 9,) which fits in a washer 43, which is held in a sleeve 44, and the washer 43 has at one end ratchet-teeth connecting with similar teeth on the sleeve, as shown at 45 in Fig. 2. The sleeve 44 has opposite and outwardly-projecting pins 46, which extend through slots 47 in the cylindrical upper end 48 of the lever 49, which lever is fulcrumed as shown at 50, and has its lower end connected with hooks 51 of the links 25, as best shown in Fig. 5. The pins 46 enter the diagonal grooves 52 in the stationary plates 53, which are rigidly secured to the main frame or housing 10, and thus as the lever 49 tilts it carries back the sleeve 44, washer 43, and drill 19, while at the same time the pins strike the walls of the grooves 52, turning the sleeve 44, which also turns the washer 43 and drill 19, so that the drill when next struck strikes in a different position in the drill-hole precisely as if turned by hand.

To hold the drill from turning while a blow is to be delivered, it has a squared collar 54, which is preferably hexagonal or octagonal, so that it will not be too securely held, and this collar engages a socket 55 (see Fig. 3) of the latch 56, which is held at its ends on headed pins 57, the latch at one end being slotted laterally, as shown at 57ª, so that it can be disengaged from the drill when desired. The pins 57 are pushed forward by springs 58, which are held in sockets 59, (see Figs. 7 and 8,) and thus the tension of the spring throws the drill forward to a bearing before it is struck by the hammer.

Instead of holding and turning the drill precisely as above described the drill-holder 21 can be arranged as shown in Figs. 11 to 13. Here it is substituted for the short drill-holders 20 and is pressed forward by a spring 60, which carries the drill against the rock, but in order that the drill may be pulled backward it has a collar 61, (see Fig. 12,) which engages the rear end of the drill-holder 21, on which there is an inclined collar 62, which is adapted to be engaged on opposite sides by the hooks 63 of the latches 64, which are pivoted at the upper end to a forked lever 49ª, which operates like the lever 49 already described. When the lever is tilted so that its upper end swings back, the latches 64 pull back the drill-holder 21 against the tension of the spring 60, so that the drill can be turned, and when the latches are released the drill is thrown forward again, as presently described. The rear ends of the latches 64 are inclined or curved, as shown at 65, and in the paths of these inclined ends are stops 66, against which the latches strike, thus releasing the hooks 63 and freeing the drill-holder.

Near the front end of the drill-holder is a ratchet-wheel 67, which is rigid on the drill-holder and which is clasped by the connected collars 68 and 69, which carry a spring-pressed pawl 70, (see Fig. 13,) which engages the ratchet-wheel. These collars are also pressed by the spring 60, so as to throw the drill-holder and drill forward when the drill-holder is released, as above described. The collars 68 and 69 also carry pins 71, which engage grooves 52 in the plates 53ª, these grooves being like those already described for turning the drill-holder. When the drill-holder is pulled back, the pins 71 enter the grooves 52 and the collars are turned, while the pawl 70

imparts a similar movement to the ratchet-wheel 67 and drill-holder 21; but when the drill-holder is moved forward the collars are moved back and the pawl travels back over the ratchet-teeth without turning the drill-holder, which is held in place temporarily by a pawl or detent 72, which is provided with guide-pins 73, moving in holes in the case-top, and is pressed downward by a spring 74. (See Fig. 12.)

If desired, the hammers may be duplicated, so as to strike very rapid blows on the drill, this arrangement being shown in Figs. 15 to 18, and where this duplicate arrangement is used the drill-holder 21 or equivalent holder is preferably arranged between the solenoids 38, the hammers 22, shanks 23, and rocking arms 27, as already described, except that one hammer and its actuating mechanism are located directly opposite the other and the short end of each rocking arm 27 connects by links 75, to which the hammer-shank is pivoted, with a rocking lever 76, which is pivoted as shown as 77, and connects also with one end of the walking-beam 34^a, which is substantially like the walking-beam 34 already described and is actuated in like manner by the solenoid-plungers 37. It will be observed that when this arrangement is used one hammer 32 swings forward to strike the drill while the other swings backward. When this arrangement just described is used, the drill-holder and drill can be conveniently turned by means of forwardly-extending arms 78 on the central part of the walking-beam 34^a, each of which arms is provided with a cam-slot 79 to receive a pin 80 on the loose collar 81, which is carried by the drill-holder 21, and it will be noticed that the rocking of the arm 78 will cause the pin 80 to travel in the groove or slot 79 so as to move the collar 81 and drill-holder 21 backward and forward.

The drill-holder 21, when arranged as in Fig. 15, has a ratchet-wheel 82 at its rear end, which is engaged on opposite sides by the oppositely-pitched pawls 83, which are carried by the arms 78, and so when the arms 78 rock and pull the drill-holder and drill back the pawls engage the ratchet-wheel and turn the drill-holder and drill to bring the latter into the right position to receive a new blow.

The operation of the single drill shown in Fig. 1 is as follows: When the upper plunger 37 is pulled forward, as in Fig. 1, the walking-beam 34 is tilted and the lower end of the walking-beam is turned backward, thus moving back the links 25 and tilting the arm 27, so as to swing the upper end of the arm forward. This carries with it the hammer-shank 23, and just before the hammer reaches the drill the rear roller 30 strikes the cam 32 and gives an accelerated movement to the hammer. When the lower plunger 37 is pulled forward, the opposite effect ensues, the lower end of the arm 27 being pulled forward and the upper end thrown back, carrying with it the hammer-shank 23, and the hammer swings down upon the cushion 22^a. At the same time the rear end of the lever 49 is struck by the enlarged journal 25^b of the links 25, (see Fig. 5,) and the lever 49 is tilted so as to throw its lower end forward and its upper end backward, this latter movement carrying back the drill by means of the sleeve 44 and washer 43, while the washer and drill are turned by means of the pins 46 and grooves 52, together with the ratchet connection between the washer 43 and sleeve 44. In this connection it will be understood that the grooves 52 on the opposite sides of the lever are of opposite pitch, so that when the hooks 51 engage the lever 49 and pull it forward the pins and sleeve are turned back by the action of the walls of the groove on the pins, but in the latter case the teeth of the sleeve 44 ride over the teeth of the washer 43 without turning the latter.

If the holder 21 (shown in Figs. 12 and 13) is used, the connection is similar, but the drill-holder is turned by the modified form of mechanism, the action of which has already been described.

When the duplex arrangement is used, the operation is substantially like that already described, except that the two hammers are alternately swung forward and the turning is effected by the rocking of the arms 78 in the manner previously explained.

Having thus described our invention, we claim as new and desire to secure by Letters Patent—

1. A rock-drill, comprising a drill-holder and a swinging hammer having its shank pivoted to a rigid support which slides back and forth with the swinging of the hammer, substantially as described.

2. In a rock-drill, the combination of the tilting walking-beam, the tilting rocking arm, the link connecting one end of the rocking arm with the walking-beam, the swinging hammer having its shank pivoted on the aforesaid link, and a sliding connection between one end of the rocking arm and the hammer-shank, substantially as described.

3. A rock-drill, comprising a drill-holder, a swinging hammer, a tilting walking-beam, a pair of reciprocating armatures pivotally connected with opposite ends of the walking-beam, an operative connection between one end of the walking-beam and the hammer-shank, a tilting lever worked from the opposite end of the walking-beam, and mechanism operated by the lever to turn the drill-holder, substantially as described.

4. A rock-drill, comprising a drill-holder, a swinging hammer, a tilting walking-beam, a rocking arm connected with the shank of the hammer, a link connection between the rocking arm and one end of the walking-beam, the said link carrying the hammer-shank, a tilting lever connected with the opposite end of the walking-beam, and means for turning the drill-holder by the tilting of the lever, substantially as described.

5. The combination with the drill-holder, the drill having a collar thereon, the hammer, the hammer-swinging mechanism, and the tilting lever worked by the hammer-swinging mechanism, of the washer engaging the collar on the drill, the sleeve carried by the lever, held on the washer and connected therewith by ratchet-teeth, the outwardly-projecting pins on the sleeve, and the guide-plates having slots to receive the pins, substantially as described.

6. The combination with the tilting lever, the drill holding and turning mechanism carried thereby, and the squared collar on the drill, of the spring-pressed latch carried by the lever and provided with a socket to engage the squared collar, substantially as described.

7. A rock-drill, comprising a pair of reciprocating armatures, magnets to operate the armatures, a walking-beam tilted by the reciprocation of the armatures, a swinging hammer, and an operative connection between the hammer and the walking-beam, substantially as described.

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