No. 864,838. PATENTED SEPT. 3, 1907.

R. A. FOWDEN.

ROCK DRILL.

APPLICATION FILED SEPT. 14, 1906.

3 SHEETS—SHEET 1.

Fig. 1.

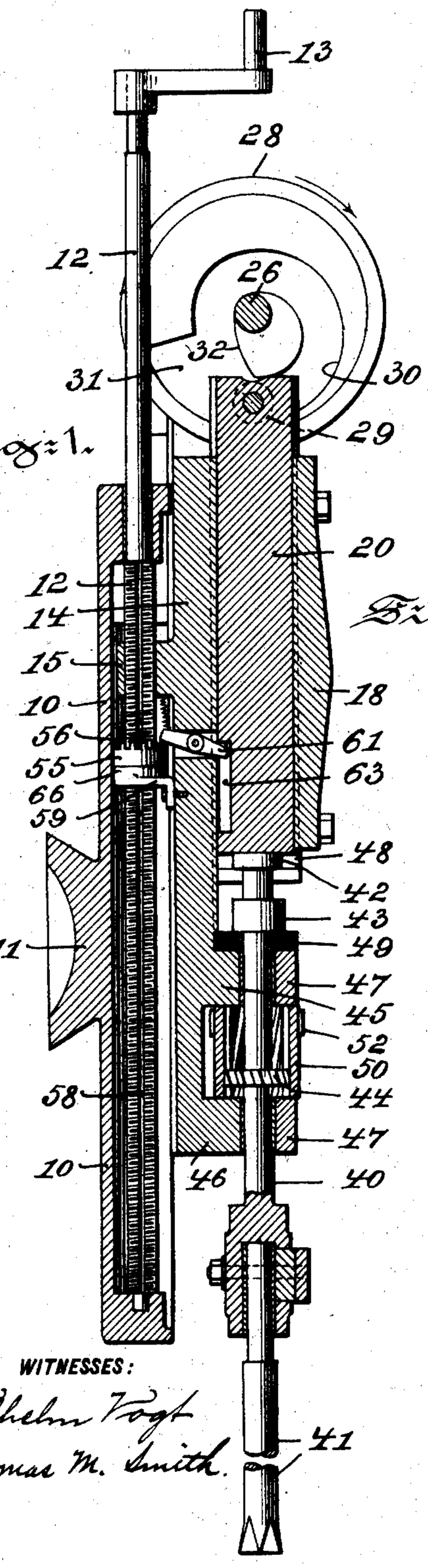
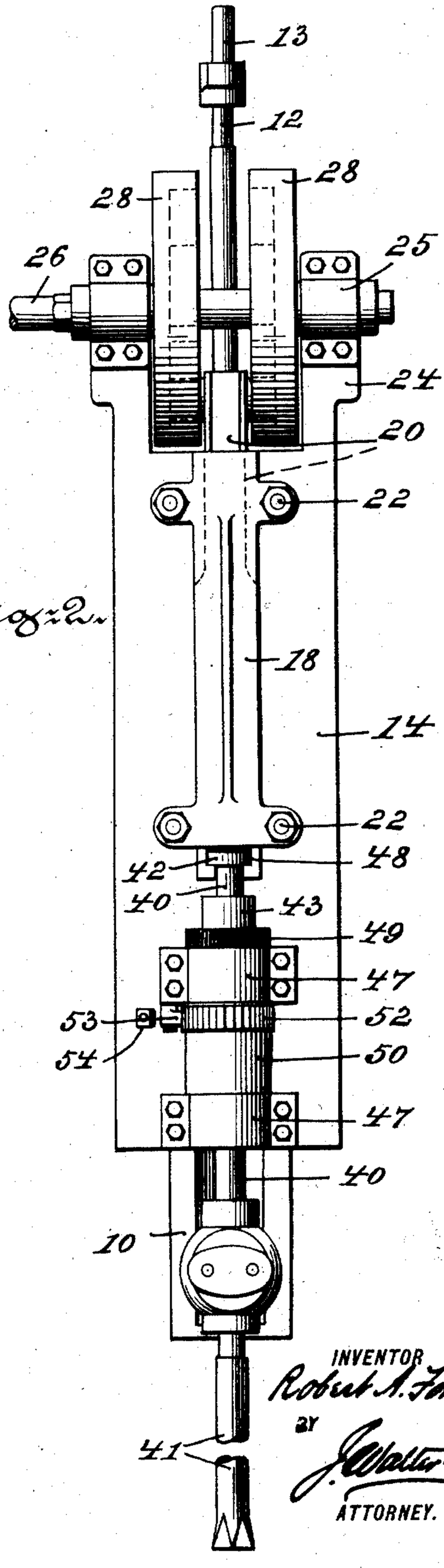


Fig. 2.



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3 SHEETS—SHEET 2.

Fig. 3.

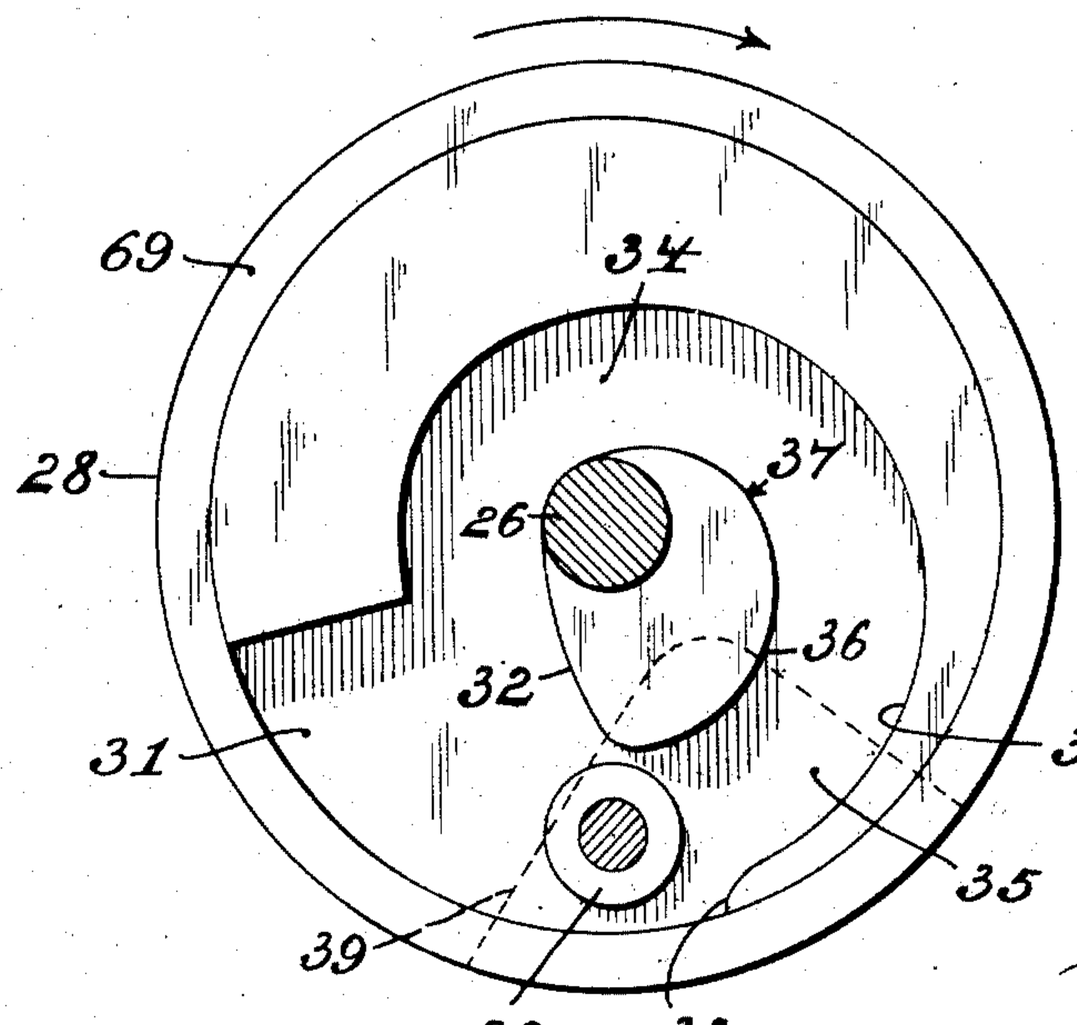


Fig. 5.

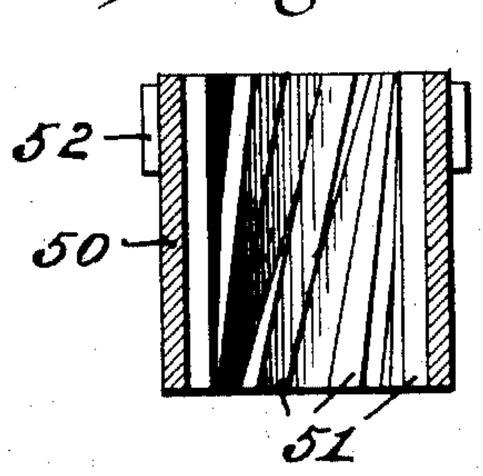
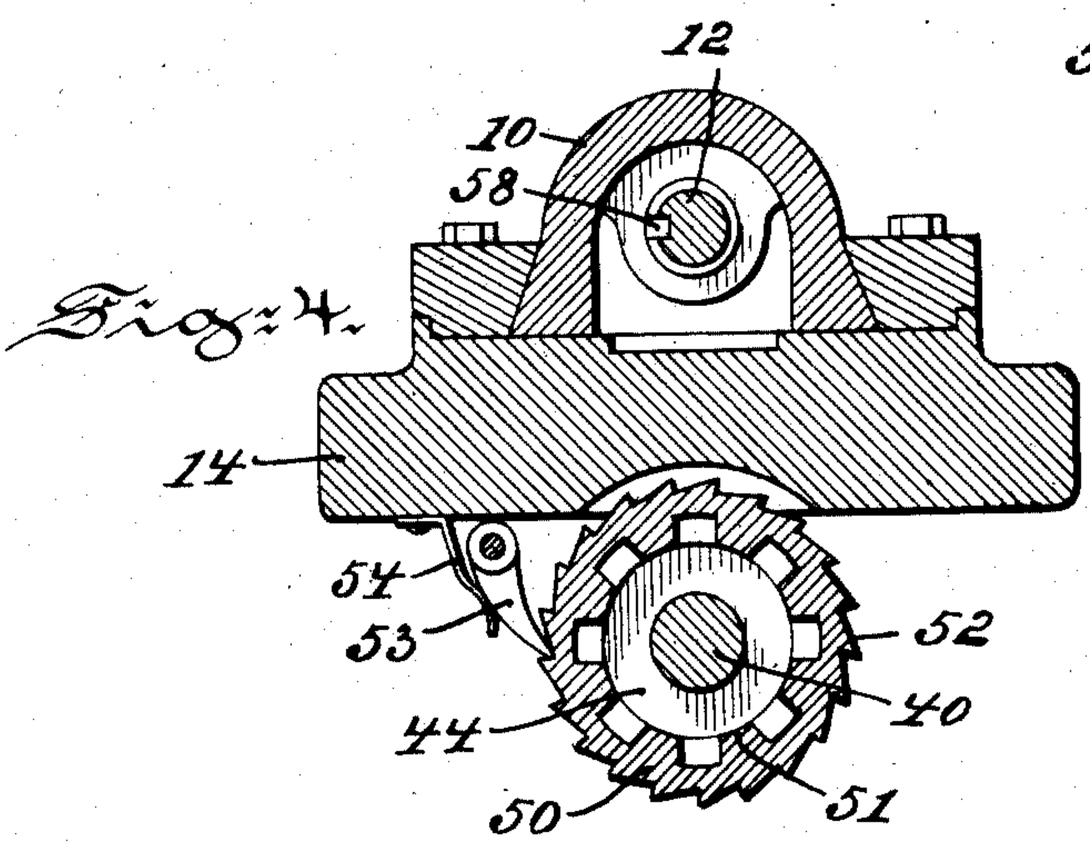


Fig. 4.



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3 SHEETS—SHEET 3.

Fig. 6.

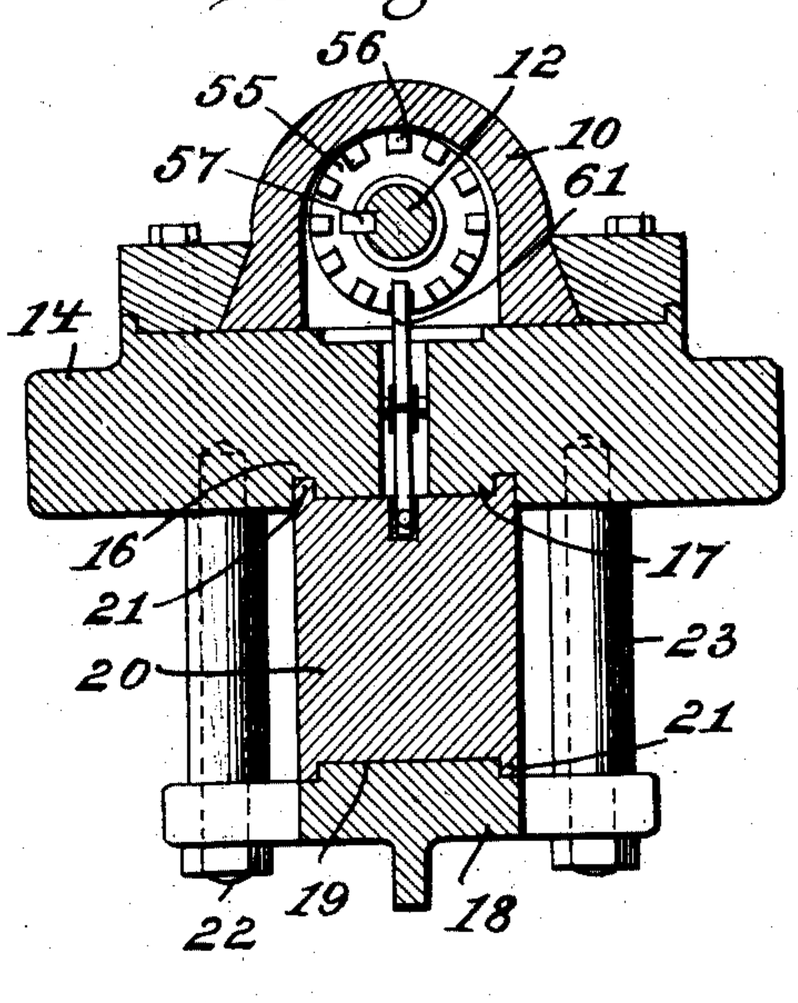


Fig. 7.

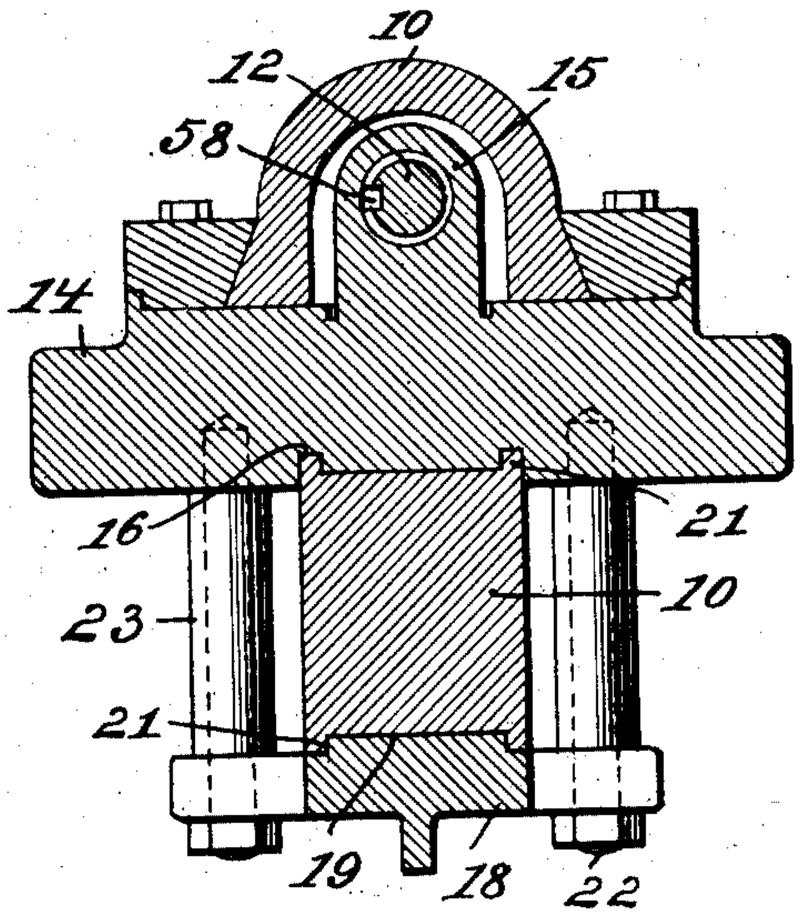


Fig. 8.

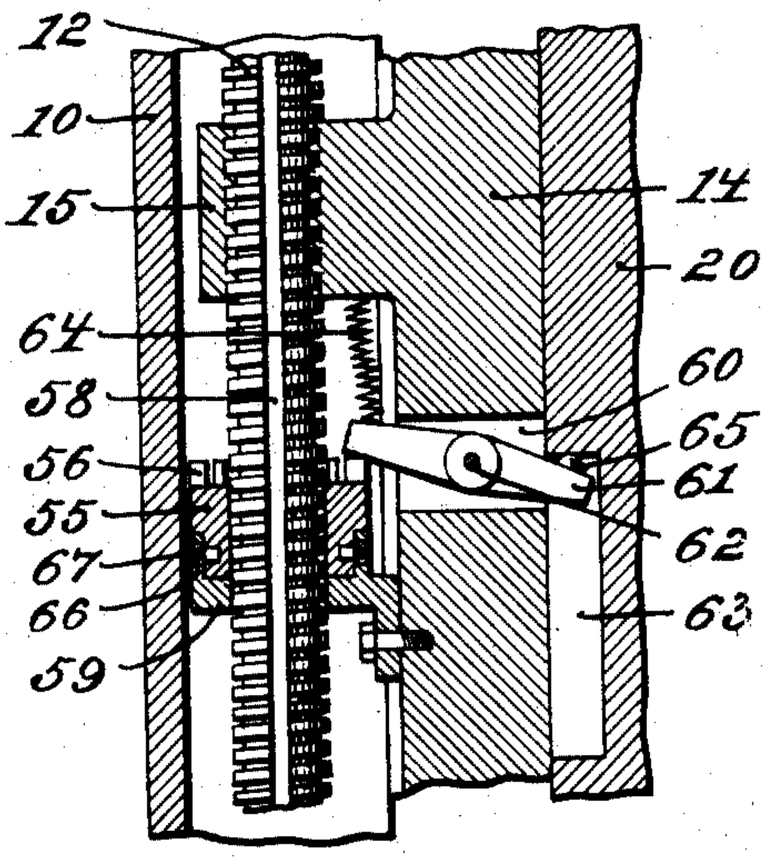
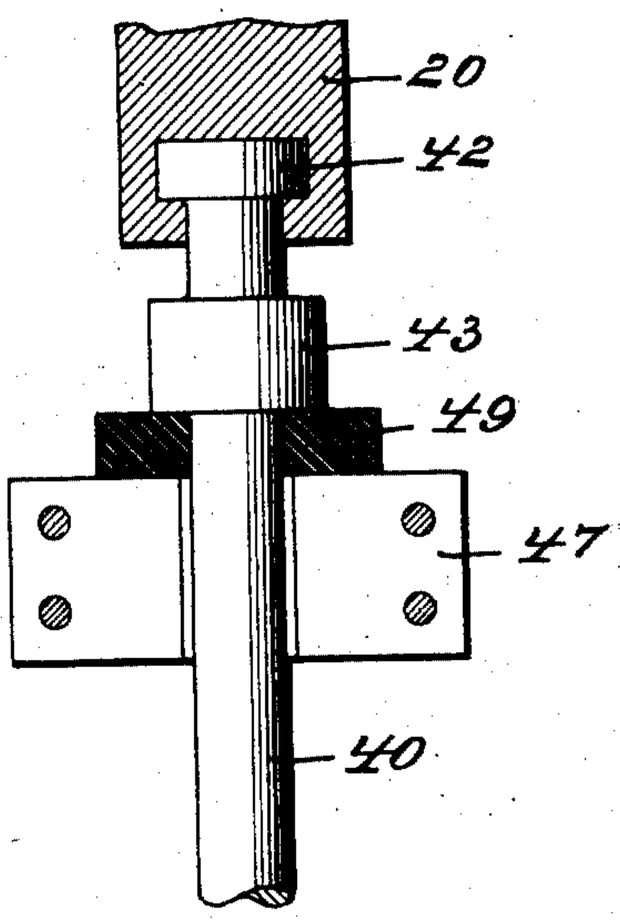


Fig. 9.



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ROCK-DRILL.

No. 864,838. Specification of Letters Patent. Patented Sept. 3, 1907.

Application filed September 14, 1906. Serial No. 334,580.

To all whom it may concern:

Be it known that I, ROBERT A. FOWDEN, a citizen of the United States, residing at Germantown, in the county of Philadelphia and State of Pennsylvania, have invented certain new and useful Improvements in Rock-Drills, of which the following is a specification.

My invention has relation to rock-drills; and in such connection it relates more particularly to the construction and arrangement of such a drill.

The principal objects of my invention are first, to provide a drill with a driving cam for the blow striking means thereof, which acts as a fly-wheel in storing up and giving off energy and which can be driven by any suitable motive power, such as steam, compressed air, water, electricity or explosive mixtures; second, to provide the driving cam with lifting and releasing portions and a driving or hammer portion to positively raise and lower an anvil and to release the same at the proper time so as to strike the blow free from the said portions of the cam; third, to so arrange the lifting portion with respect to the driving or hammer portion of the cam, as that the anvil will be slowly raised, but quickly driven downwards to increase the force of the blow delivered by the same and to a drill-bit connected therewith; fourth, to so shape the back of the hammer or driving portion and a certain part of the lifting portion of the cam as to provide a gradually contracted path for a roller connecting the anvil with the cam so as to permit of a certain free movement of the roller and thus of the anvil at the beginning of the lifting movement and to prevent the pounding of the roller between the said portions of the cam at the lowering of the lifting speed imparted to the anvil by the cam; fifth, to provide the drill with a chuck having formed integral therewith a head, projection and spiral wheel, respectively, adapted to removably connect the chuck with the anvil so as to limit the downward movement thereof, under certain conditions and also to turn the same; sixth, to provide the support for the anvil with a buffer, which is adapted to limit the downward movement of the same, in case the anvil is actuated, without a drill bit contacting with material to be pierced; seventh, to so connect the chuck with the anvil and the support for the same as to permit of sidewise introduction and removal of the chuck and a turning device therefor; eighth, to provide the chuck with a turning device to rotate the same in one direction in the anvil and in the support for the same with a step by step movement; ninth, to provide the drill in with a locking mechanism, which automatically locks or releases the feed mechanism for the drill so as to permit of the feeding to the same extent as material is pierced by the drill; and tenth, to so arrange the anvil that the force of the blow of the drill-bit connected therewith may be increased by the increasing of the speed of rotation of the actuating cam, or by the ready removal of the anvil and the substituting for the same of an anvil having a greater weight.

The nature and scope of my present invention will be more fully understood from the following description taken in connection with the accompanying drawings forming part hereof, in which

Figure 1, is a view illustrating partly in section and partly in side elevation a rock drill, consisting of an anvil and chuck removably connected therewith and a drill-bit carried by the same, a cam for reciprocating the anvil, chuck and drill-bit, a feed mechanism and an automatic controlling mechanism for the same, and means for rotating the chuck, all embodying main features of my said invention. Fig: 2, is a front elevational view of the rock drill. Fig: 3, is a detail view, enlarged, illustrating partly in side elevation and partly in section, the cam and roller occupying a certain position with respect to the driving or hammer and releasing portions of the same. Fig: 4, is an enlarged cross-sectional view of the lower portion of the drill. Fig: 5, is a detail view, enlarged, illustrating in section a portion of the turning mechanism for the chuck. Figs: 6 and 7, are respectively, enlarged cross-sectional views of the upper portion of the drill. Fig: 8, is an enlarged vertical sectional view of the central portion of the drill; and Fig: 9, is a similar view of the lower portion of the drill.

Referring to the drawings 10, is the bed-plate of the rock drill provided with a trunnion 11, adapted to be engaged by any suitable holder, not shown, by means of which the drill may be held in such a position as to work in any direction desired. The bed-plate 10, is provided with a threaded spindle 12, operated by a handle 13, which by engaging a lug or projection 15, of a support 14, imparts to the same a movement in a plane parallel to the spindle 12, and also serves to hold the support on the bed-plate 10, in any position given.

As shown in Figs: 1, 6 and 7, the support 14, is provided with grooves 16, forming a guide rib 17, which in conjunction with a rib 19, of a guide bar 18, forms the guides for an anvil, weight or block 20, which by means of ribs 21, respectively, engaging the grooves 16, and rib 17, of the support 14, and the rib 19, of the guide bar 18, prevents side movements of the anvil or block 20, between the same. In order to render the anvil 20, readily removable from the support 14, the guide-bar 18, is connected with the same, by bolts 22, preferably passing through distance pieces 23, interposed between the guide-bar 18, and the support 14. The upper end of the support 14, is provided with two extensions 24, supporting in conjunction with bearing-plates 25, a shaft 26, which is driven from any suitable source of power, not shown. Within the extensions 24, and on the shaft 26, are arranged two cams 28, between which terminate the upper end of the anvil 20, which by means of rollers 29, is connected with the cams, as

shown in Figs: 1 and 2. Each of the cams 28, is provided with a lifting portion 30, which by engaging the roller 29, slowly raises the anvil 20, during three fourths of a revolution of the cam 28, at which time the roller 29, having reached the releasing portion 31, at the end of the lifting portion 30, and by being engaged by the driving or hammer portion 32, thereof, is as well as the anvil 20, quickly forced downwards during the last fourth of the revolution of the cam 28. For this purpose the driving or hammer portion 32, of the cam 28, extends from the shaft 26, slightly in advance of the releasing portion 31, thereof, and terminates substantially opposite the starting point 33, of the lifting portion 30, of the cam 28.

As shown in Fig: 3, the driving or hammer portion 32, of the cam 28, is so arranged as to permit the anvil 20, to complete the downward movement thereof, free from this portion, at which time the roller 29, occupies the position shown in this figure. A chuck 40, secured to the anvil 20, and a drill-bit 41, secured to the chuck 40, will thus permit the anvil 20, and its roller 29, to move upward independent of the driving or hammer portion 32, of the cam 28, in case the drill-bit 41, owing to the hardness of the material to be pierced by the same, rebounds therefrom. This free movement of the roller 29, is also permitted when the same in the rotation of the cam 29, has passed beyond the starting point 33, of the lifting portion 30, and has reached the portion 35, of the passageway 34, for the roller 29, formed by the driving or hammer portion 32, and lifting portion 30, of the cam. For this purpose the back 36, of the driving or hammer portion 32, of the cam 28, is so shaped as to enlarge the portion 35, of the passageway 34, up to the point 37, of the driving or hammer portion 32, of the cam 28, at which point the passageway 35, merges into the passageway 34, slightly larger in width than the diameter of the roller 29. The roller 29, owing to the rebound of the anvil 20, contacts with the lifting portion 30, beyond the point 33, thereof, and is now raised with a gradually increasing speed by the same until the maximum speed is attained at which time the roller 29, has entered the passageway 34, about opposite the point 37, of the back 36, of the driving or hammer portion 32, of the cam 28. By the checking of the upward movement of the roller 29, and anvil 20, at the point of greatest velocity by the lifting portion 30, of the cam 28, the roller 29, is forced against the driving or hammer portion 37, of the cam 28, from which the same rebounds. Owing to the contacting of the passageway 34, at this point, however, such a forcing of the roller 29, against the driving or hammer portion and the rebounding of the same therefrom is eliminated.

By the above described arrangement of the passageways 34 and 35, for the roller 29, the anvil 20, is permitted to freely rebound from the material to be pierced by the drill-bit 41, and the anvil is then slowly raised with a gradually increasing speed and is then quickly forced downwards. The lifting portion 30, and driving or hammer portion 32, as well as the releasing portion 31, of the cam 28, is preferably surrounded by an annular flange 69, which prevents the disengagement of the roller 29, of the anvil 20, when the said roller 29, occupies the position shown in Fig. 3. The cam 28, is provided with a counterweight 39, arranged in the back portion thereof which in balancing the cam permits the same to act as a fly-wheel in storing up energy during the time the roller 29, does not contact with the lifting portion 30, and driving or hammer portion 32, of the cam and giving off the stored energy during the raising and forcing downwards of the anvil 20. By this arrangement of the cam 28, the same is also permitted to absorb shock, due to the lifting and freeing of the anvil 20, from the acting portions of the cam, which shock would otherwise be transmitted to all portions of the drill, as well as to the motor, not shown, employed to actuate the camshaft 26.

As shown in Fig: 2, preferably two cams 28, are employed to evenly lift and force downwards the anvil 20, chuck 40, and drill-bit 41. In order to resist all strain to which the chuck 40, may be subjected, this chuck as well as the head 42, at the upper end, a projection 43, and a spiral wheel 44, are formed integral therewith. The chuck is held in proper position with respect to the anvil 20, by projections 45 and 46, of the support 14, and is connected therewith by cap-plates 47. The head 42, of the chuck 40, by engaging a T-shaped groove 48, arranged in the lower end of the anvil 20, is connected therewith and readily withdrawn sidewise from the same, as well as from the support 14, by the removal of the cap-plates 47, from the projections 45 and 46. The upper projections 45, in conjunction with the cap 47, serves as a support for a buffer 49, preferably consisting of rubber, against which the projection 43, of the chuck 40, abuts, in case the same is operated without a bit or the bit is not contacting with the rock or other material to be pierced. In such manner the force of the shock imparted by the anvil 20, and chuck 40, upon the projection 45, and by the same to the support 14, is reduced to a minimum. The projections 45 and 46, also serve to loosely support a sleeve 50, surrounding the chuck 40, which by the internal threaded portion 51, engaging the teeth of the spiral-wheel 44, of the chuck, forms in conjunction with the wheel a rotating mechanism for the same, as shown in Figs: 1 and 4. At the outer side the sleeve 50, is provided with a toothed portion 52, forming a ratchet-wheel, which is engaged by a pawl 53, pivotally connected with the projection 45, of the support 14. As shown in Fig: 5, the internal threaded portion 51, of the sleeve 50, is inclined in a direction opposite to that of the teeth of the spiral wheel 44, so that when the chuck 40, is raised by the anvil 20, the spiral wheel 44, in conjunction with the threaded portion 51, of the sleeve tends to rotate the same. This rotation, however, is prevented by the pawl 53, engaging the ratchet teeth 52, of the sleeve 50, which is now permitted to rotate the chuck 40, and drill-bit 41, for a defined distance. During the downward movement of the chuck 40, the sleeve 50, is again rotated by the spiral wheel 44. In this instance, however, in an opposite direction, which movement is freely permitted by the pawl 53, held in engagement with the ratchet teeth 52, by a spring 54. By this arrangement the drill-bit 41, is rotated with a step by step movement in one direction, during each upward movement of the chuck and anvil.

In order to prevent breaking of the cams 28, by a too rapid feeding of the anvil 20, chuck 40, and bit 41, to-

wards the material to be pierced, the following automatic locking and releasing mechanism for the feed mechanism of the drill is employed. As shown in Figs: 1, 6 and 8, on the threaded spindle 12, is slidably arranged a collar 55, provided with teeth 56, and a key 57, engaging a groove 58, of the spindle 12. The collar 55, is normally supported by a bracket 59, secured to the support 14, which is also provided with an opening 60, in which is arranged a lever 61, pivotally secured in the point 62, to the support 14. The lever at one end terminates above the teeth 56, of the collar 55, and at the other end projects into a groove 63, arranged in the anvil 20. The groove 63, is so arranged in respect to the lever 61, that when the anvil 20, has descended and reached the end of its downward movement it will contact with the lever 61, and bring the same out of engagement with the teeth 56, of the collar 55, thereby releasing the same. The spindle 12, may now be freely turned in the support 14, and by the same the anvil 20, chuck 40, and bit 41, fed downwards in the bed-plate 10. As soon as the anvil 20, is lifted a spring 64, will bring the lever 61, into reëngagement with the teeth 56, of the collar 55, thereby automatically locking the same and preventing the turning of the spindle and feeding of the bit 41, until the anvil 20, in its downward movement due to the progress made by the penetration of the matter by the bit 41, is again brought into engagement with the lever 61. Thus the operator is only allowed to feed the anvil 20, as fast as the bit 41 is penetrating the matter to be pierced and therefore the danger of breaking the cams 28, rollers 29, or other parts of the drill, which otherwise would occur when the anvil 20, is being driven downward by the cams 28, owing to the position of the matter to be pierced with respect to the bit 41, is thereby effectually prevented. In order to reduce the force of contact of the anvil 20, with the lever 61, the same is provided with a buffer 65, consisting of rubber or other suitable material. Instead of moving the anvil 20, downwards when feeding the same forwards, the anvil may also be fed sidewise or in an upward direction depending upon the position of the hole to be drilled in the rock or other matter by the bit 41. In order to permit the support 59, to also hold the collar 55, in position thereon when the anvil 20, is moved in an upward direction to actuate the bit 41, the same is provided with an annular extension 66, partially surrounding the collar 55. The extension 66, is provided with bolts 67, engaging an annular groove arranged in the collar 55, thereby connecting the same with the support 59, and permitting of a free rotation of the collar therein. The force of the blow delivered by the anvil 20, and the drill bit 41, connected therewith, may be increased by increasing the speed of rotation of the actuating cams 28, or by the substituting of an anvil 20, of a greater weight, than that employed.

Having thus described the nature and objects of my invention, what I claim as new and desire to secure by Letters Patent is:—

1. In a rock-drill, a cam having lifting, releasing and driving portions, the latter forming a hammer, and an anvil having a tool connected with said cam, said cam and anvil arranged to form a cam driven drill.

2. In a rock drill, an anvil having a tool, and a cam having lifting, releasing and driving portions, the latter forming a hammer and said cam adapted to impart to said anvil a reciprocatory movement.

3. In a rock-drill, an anvil having a tool, and a cam connected with said anvil and having lifting, releasing and driving portions, the latter forming a hammer, the lifting and hammer portions of the cam adapted to impart to the anvil a reciprocatory movement and the releasing portion arranged to permit said anvil to strike a blow independently of the lifting and hammer portions of said cam.

4. In a rock-drill, an anvil having a tool, and a cam connected with the anvil having lifting, releasing and hammer portions, the lifting and hammer portions of the cam arranged respectively to impart to the anvil a slow upward movement and a quick downward movement, and the releasing portion of the cam arranged to permit the anvil to strike a blow independently of the lifting and hammer portions and to permit of a certain reciprocatory movement of the anvil free of such portions.

5. In a rock-drill, an anvil having a tool, and a cam connected with the anvil having lifting, hammer and releasing portions, the lifting and hammer portions of the cam arranged to respectively impart to the anvil a reciprocatory movement and the releasing and hammer portions of the cam arranged respectively to permit the anvil to strike a blow and to permit a certain free movement up to the checking of the upward movement imparted to the anvil by the lifting portion of the cam.

6. In a rock-drill, an anvil, a chuck carrying a tool connected with said anvil, a cam having lifting, releasing and hammer portions adapted to impart to the anvil a reciprocatory movement, and means engaging the chuck and adapted to rotate the same in one direction in said anvil.

7. In a rock-drill, an anvil, a chuck carrying a tool connected with said anvil, a cam having lifting, releasing and hammer portions adapted to impart to said anvil a reciprocatory movement, means surrounding the chuck and adapted to be rotated thereby in opposite directions, and means engaging the rotating means and adapted to arrest the movement of the same in one direction to permit said rotating means to actuate said chuck.

8. In a rock-drill, an anvil, a cam adapted to reciprocate said anvil, a support carrying said anvil and cam, a bed plate carrying said support, a feeding mechanism for shifting said support on said bed plate and means connected with said feeding mechanism and anvil and adapted to automatically prevent actuation of said feeding mechanism until released by said anvil.

9. In a rock-drill, an anvil carrying a tool, a cam adapted to reciprocate said anvil and tool thereof, a support carrying said anvil and cam, a bed plate carrying said support, a threaded spindle arranged in said bed plate and adapted when rotated to shift said support on the bed plate in a plane parallel to said spindle, means slidably arranged on said spindle, and means carried by said support and adapted to normally engage the sliding means of said spindle to prevent rotation thereof, and said anvil when moved into a certain position with respect to said support adapted to release the engaging means from said sliding means.

10. In a rock-drill, a bed plate, a support carried by the same, feeding means carried by said plate and adapted to shift the support thereon, an anvil, a chuck carrying a tool connected with said anvil, a cam adapted to reciprocate said anvil, chuck and the tool thereof on said support, means carried by said support surrounding said chuck and adapted to rotate the same in one direction with a step by step movement, and locking means for the feeding means, said locking means arranged to prevent feeding of said support and by the same the feeding of said anvil, chuck and the tool thereof until released by said anvil.

11. In a rock-drill, a support having projections, an anvil carried by said support and having a groove, a chuck guided in the projections of said support and having a head engaging the groove of said anvil and means for locking said chuck to said projections and adapted when removed therefrom to permit of the sidewise removal of the chuck from the projections of said support and groove of said anvil.

12. In a rock-drill, a support having projections, an anvil carried by said support and having a groove, means for reciprocating said anvil on said support, a buffer car-

ried by one of the projections of said support, a chuck guided in the projections of said support and having a head engaging the groove of said anvil and a projection, the projection of said chuck adapted when contacting with the buffer to limit by said chuck the downward movement of said anvil, and means for locking the chuck to said projections and adapted when removed therefrom to permit of the sidewise removal of the chuck from the same and said support and the head thereof from the groove of said anvil.

13. In a rock-drill, a plate, a threaded spindle rotatably arranged in the plate, an anvil, a support connected with said spindle and adapted when actuated by the same to shift said support and anvil on said plate, means for reciprocating said anvil on said support, a collar having teeth slidably arranged on said spindle, a lever carried by said support and engaging said anvil and adapted when engaging the teeth of said collar to automatically prevent rotation of said spindle, and said anvil adapted when moved into a certain position by said reciprocating means to automatically disengage the lever from the teeth of said collar so as to permit of the free rotation of said spindle.

14. In a rock-drill, a plate, a threaded spindle rotatably arranged in the plate, an anvil, a support connected with said spindle, said spindle adapted when actuated to shift said support and anvil on said plate, means for reciprocating said anvil on said support, a toothed collar slidably arranged on said spindle, a lever carried by said support and engaging said anvil and adapted when engaging the teeth of said collar to automatically prevent rotation of said spindle, said anvil adapted when moved into a certain position by said reciprocating means to automatically disengage the lever from the teeth of said collar so as to permit of the free rotation of said spindle, means connected with said support and holding said collar in a certain position with respect to said lever and means engaging said lever and adapted to normally hold the same in engagement with the teeth of said collar.

15. In a rock-drill, an anvil, a chuck carrying a tool connected with said anvil, a counterbalanced cam having lifting, releasing and hammer portions adapted to reciprocate said anvil, chuck and tool thereof and to permit said anvil to strike a blow free from said portions of the cam, means for rotating said cam, said counterbalanced cam, when rotated adapted to store up energy, while the anvil is free from the hammer and lifting portions of said cam to absorb the shock caused by the striking of said anvil and to transmit the stored up energy to said anvil at the beginning of the downward movement thereof.

16. In a rock-drill, an anvil, a chuck carrying a tool connected with said anvil, a counterbalanced cam having lifting, releasing and hammer portions adapted to reciprocate said anvil, chuck and the tool thereof, at variable speeds, and permit said anvil to strike a blow free from said portions of said cam, means for rotating said cam, said counterbalanced cam, when rotated, adapted to store up energy while said anvil is free from the hammer and lifting portions of said cam to absorb the shock caused by the striking of said anvil and to transmit the stored up energy to said anvil at the beginning of the downward movement thereof.

In witness whereof, I have hereunto set my signature in the presence of two subscribing witnesses.

ROBERT A. FOWDEN.

Witnesses:
GEO. W. REED,
THOMAS M. SMITH.