

R. A. FOWDEN.

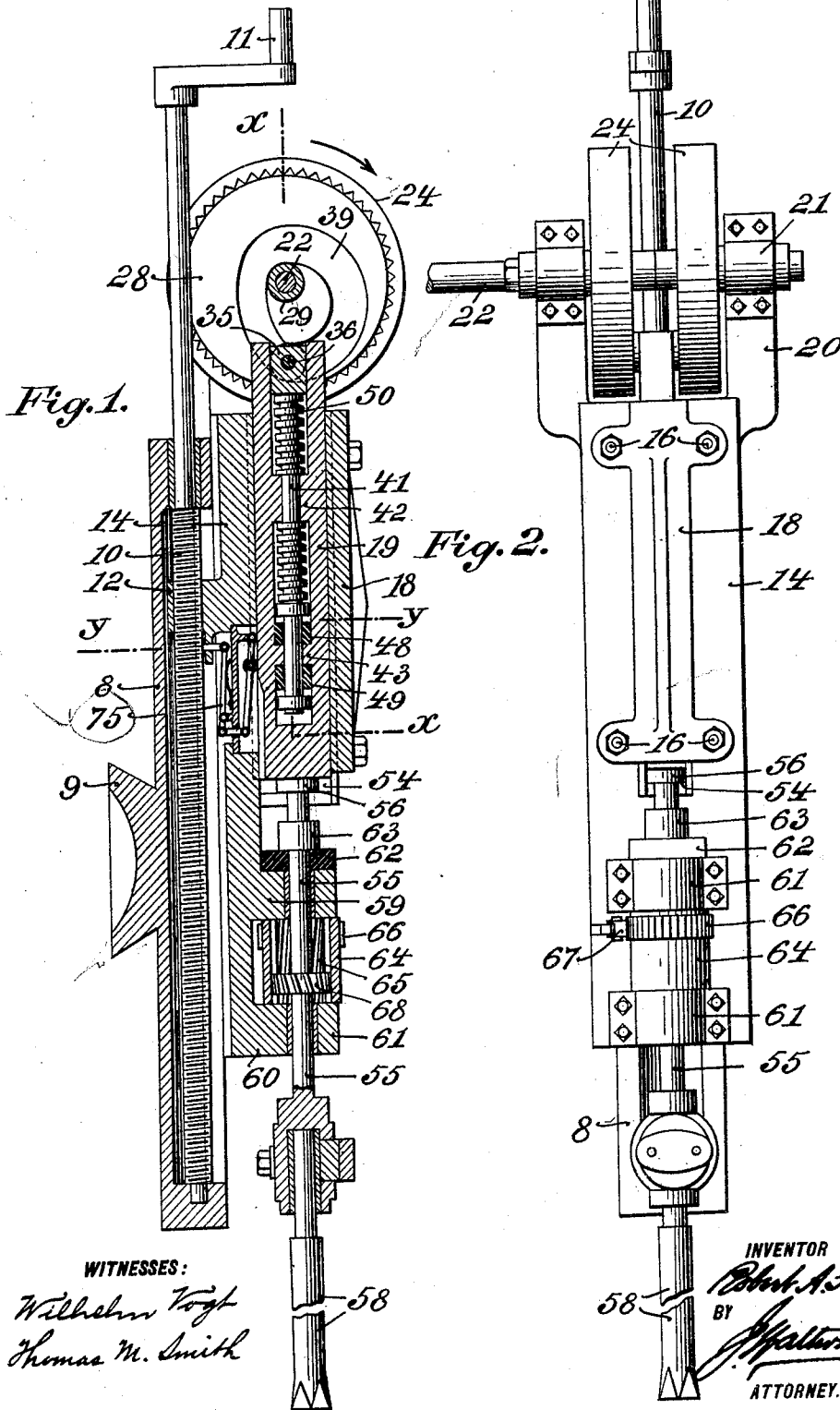
ROCK DRILL.

APPLICATION FILED APR. 1, 1908. RENEWED FEB. 3, 1909.

Patented Sept. 7, 1909.

2 SHEETS—SHEET 1.

933,702.



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2 SHEETS—SHEET 2.

Fig. 3.

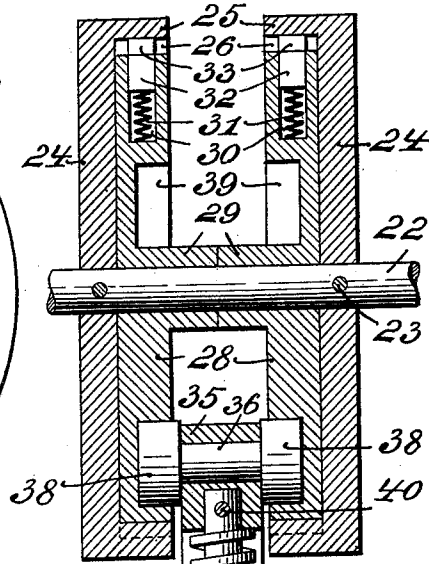
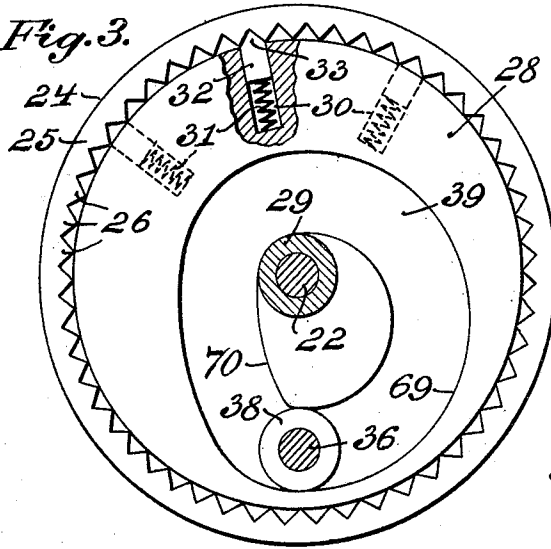


Fig. 4.

Fig. 5.

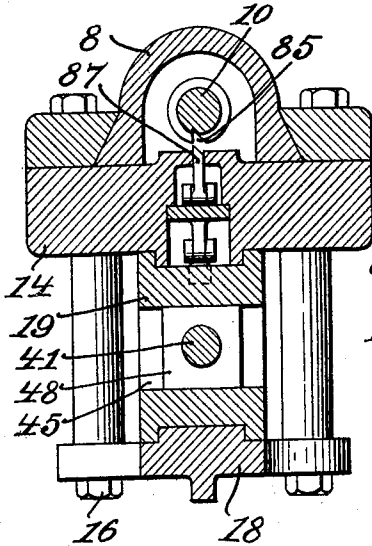
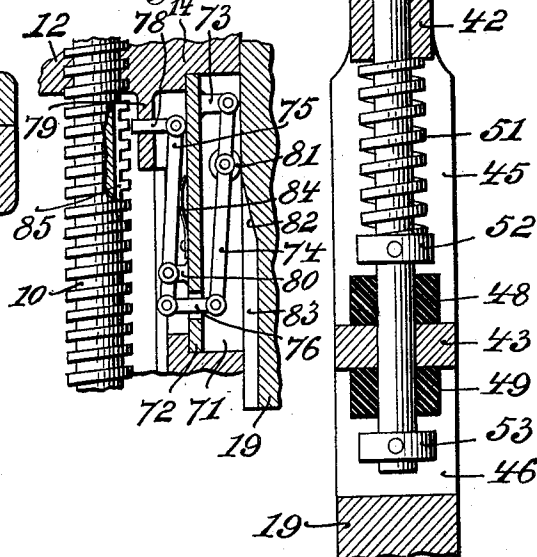


Fig. 6.



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UNITED STATES PATENT OFFICE.

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ROCK-DRILL.

933,702.

Specification of Letters Patent.

Patented Sept. 7, 1909.

Application filed April 1, 1908, Serial No. 424,505. Renewed February 3, 1909. Serial No. 475,925.

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 particularly to a general type of rock-drill such as described and claimed in a Patent No. 864,838, granted to me under date of September 3rd, 1907, and my present invention has for its object to provide connecting means between the hammer and driving mechanism therefor, which up to a certain point flexibly connects and beyond such point substantially rigidly connects the hammer with said driving mechanism; moreover to so arrange the driving mechanism that by an overload is automatically disengaged from the actuating mechanism therefor; and furthermore, to arrange the feed controlling mechanism of the drill so as to quickly respond to a comparatively slight movement imparted to the same by the hammer of the drill.

The nature and scope of my 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 longitudinal central sectional view of the drill, embodying main features of my said invention. Fig. 2 is a front elevational view thereof. Fig. 3 is a detail view, enlarged, of one of the driving-cams and the carrying disk or fly-wheel and spring controlled bolts arranged in the cam forming in conjunction with a toothed portion of the fly-wheel, a coupling. Fig. 4 is a sectional view, enlarged, on the line $x-x$ of Fig. 1. Fig. 5 is a horizontal sectional view, enlarged, on the line $y-y$ of Fig. 1; and Fig. 6 is a detail view, enlarged, illustrating partly in elevation and partly in section, the feed controlling mechanism of the drill.

Referring to the drawings, 8 is the bed-plate of the rock-drill provided with a trunnion 9, adapted to be engaged by any suitable holder, not shown. The bed-plate 8, is

provided with a threaded spindle 10, actuated by a handle 11, which by engaging the lug or projection 12, of a support 14, slidably held on the bed-plate 8, imparts to the same a movement in a plane parallel to the spindle 10, and also serves to hold the support relative to the bed-plate 8, in any position given. To the support 14, by means of bolts 16, is secured a guide-bar 18, between which and the support is movably arranged a block or hammer 19. The upper end of the support 14, is provided with two extensions 20, supporting in conjunction with bearing-plates 21, a shaft 22, which is driven by any suitable source of power, not shown.

As shown in Fig. 4, within the extensions 20, to the shaft 22, by means of bolts 23, are secured disks or fly-wheels 24, each having a lateral projecting flange 25, provided with teeth 26, at their internal portion. The fly-wheels so formed serve as supports for cams 28, each having a centrally arranged tubular extension 29, forming a bearing for the same and which by abutting against each other hold the cams 28, in position within the flange 25, of the disks or fly-wheels 24. Each of the cams 28, is provided with pockets or chambers 30, adapted to receive springs 31, tending to hold the tapering end 33, of the bolts 32, sliding in the pockets 30, into engagement with certain of the teeth 26, of the flange 25, of the disks 24. Thus the bolts 32, in conjunction with the teeth 26, of the disks 24, form a coupling between the same and cams 28, which normally permit the transmission of movement from the shaft 22, to the cams but on the other hand also permit of a disengagement of the cams 28, from the disks or fly-wheels 24, in instances where the resistance offered by the cams against rotation is sufficient to force the bolts 32, against the tension of the springs 31, out of engagement with the teeth 26, of the disks or wheels 24, as will be hereinafter more fully explained.

Between the cams 28, and disks or fly-wheels 24, is arranged a block 35, provided with a shaft 36, carrying rollers 38, which by engaging the cam-grooves 39, of the cams 28, connect the block 35, with the same. To the block 35, by means of a bolt 40, is removably secured a spin-

dle or rod 41, which loosely passes through partition walls 42 and 43, formed in the weight or hammer 19, by openings or chambers 44, 45 and 46, extending sidewise therethrough and through buffers 48 and 49, preferably consisting of slightly yielding material, such as hard rubber secured to the upper and lower sides of the partition-wall 43, as shown in Figs. 1 and 4. On the upper end of the spindle or rod 41, and within the opening or chamber 44, is arranged a spring 50, bearing with its upper end against the block 35, and with its lower end against the partition-wall 42. On the rod 41, substantially intermediate to its ends and within the chamber or opening 45, of the hammer 19, is similarly arranged a second spring 51, which with its upper end bears against the partition-wall 42, and with its lower end against a collar 52, removably secured to the rod 41, and normally held by the same adjacent to the buffer 48. In addition to the collar 52, the rod 41, at its lower end terminating in the lowermost chamber 46, of the hammer 19, is provided with a second collar 53, normally held by the same adjacent to the lower buffer 49.

As shown in Figs. 1 and 2, the lower end of the hammer 19, is provided with a T-shaped groove 54, adapted to receive the head 56, of a chuck 55, to which is removably secured a bit 58. The chuck 55, is held in proper position with respect to the hammer 19, by the projections 59 and 60, of the support 14, and cap-plate 61, secured thereto. The projection 59, and its cap-plate 61, serves as support for a buffer 62, preferably, consisting of hard rubber against which a projection 63, formed on the chuck 55, abuts, in cases where the same is operated without a bit, or this bit is not contacting with the rock or other material to be pierced. The force of the shock imparted to the hammer 19, and chuck 55, is thus reduced to a minimum. The projections 59 and 60, also serve to loosely support a sleeve 64, which by means of an internal threaded portion 65, engaging the teeth of a spiral-wheel 68, secured to the chuck 55, forms in conjunction with this wheel a rotating mechanism for the chuck 55. The sleeve 64, is provided with a toothed portion 66, forming a ratchet-wheel, which is engaged by a pawl 67, suitably secured to the support 14. The threaded portion 65, of the sleeve 64, is inclined in the same direction as the teeth of the spiral-wheel 68, so that when the chuck 55, is raised by the hammer 19, the spiral-wheel 68, in conjunction with the threaded portion 65, of the sleeve tends to rotate the same. This rotation, however, is prevented by the pawl 67, engaging the ratchet-teeth 66, of the sleeve 64, thus permitting the same to rotate the chuck 53, and drill-bit 58, for a defined distance. During the downward

movement of the chuck 55, the sleeve 64, is again rotated by the spiral-wheel 68, in this instance in an opposite direction, which movement however, is freely permitted by the pawl 67.

The upward and downward movement of the hammer 19, is imparted to the same by the cams 28, through the intervention of the rollers 38, the block 35, spindle or rod 41, springs 50 and 51, and the partition-wall 42, against which the springs abut. The springs thus forming the flexible connection between the cams 28, through the intervention of the strength and under normal conditions are sufficient to actuate the hammer by the rollers 38, to which in the rotation of the cams by the lifting portion 69, thereof is imparted during three-fourths of the revolution of the same a slow upward movement and by the driving portion 70, thereof a quick downward movement during the last fourth of the revolution of the cams. During the engagement of the rollers 38, with the lower part of the lifting portion 69, of the cams, the same and the disks or fly-wheels 24, will store up energy and will give off the stored energy during the latter portion of the raising and forcing downward movement of the hammer 19. When the hammer is driven downward by the driving portion 70, of the cams 28, the spring 50, will not be compressed until the bit 58, of the chuck 55, strikes the rock to be pierced, at which time the rollers 38, in their travel in the cam-groove 39, will have nearly reached the end of the driving portion 70, of the cams 28. At the latter portion in this travel of the rollers 38, at the point where the bit 58, comes in contact with the material to be pierced, the spring 50, due to the resistance offered to further downward movement of the hammer 19, by the material will be compressed sufficiently to permit of clearance of the driving portion 70, by the rollers 38, as shown in Fig. 1. Thus the blow imparted to the bit 58, by the hammer 19, and chuck 55, will be increased at the end in force, and thus force can be added or taken away from the blow delivered by the hammer 19, by the interposition of springs 50, of varying tensions. The spring 50, also acts on the upward stroke when the bit, chuck and hammer are rebounding from the material to be pierced, while the lower spring 51, serves to take up the shock which otherwise would be imparted by the hammer to the rollers 38, and by the same to the cams 28, through the rollers striking the portions of the cams contiguous to the lifting portion 69, thereof and also to assist in the lifting of the hammer 19, when the force of the rebound is exhausted. The collars 52 and 53, are so arranged on the actuating-rod 41, that the same under normal working conditions, in which the springs 50 and 51, are sufficient

to actuate the hammer 19, as to be held out of engagement with the buffers 48 and 49, traveling with the hammer 19. In cases, however, where the friction between the drill bit and the material to be pierced becomes so great as to overcome the ordinary tension of the springs 50 and 51, the collars 52 and 53, of the actuating rod 41, will come in contact with the buffers 48 and 49, carried by the hammer 19, thus forming a rigid connection between the same and the cams 28, which condition will continue unless the bit becomes positively jammed into the hole drilled. In this instance, the resistance offered by the rollers 38, against movement by the cams 28, is sufficient to overcome the tension of the springs 31, of the coupling bolts 32. The cams will thus become automatically released from the disks or fly-wheels 24, permitting the same to be freely rotated by the shaft 22, without injury to the drill and the means for actuating the shaft 22, not shown. As well known at excessive speed a hammer actuated by springs will not be sufficiently reciprocated by the same as at such a speed the springs counterbalance each other, resulting in the shortening of the travel of the hammer to such an extent as to render the drill inoperative. In the present construction, however, of the drill, this disadvantage is fully overcome in that the springs after having been compressed to a predetermined limit permit the collars 48 and 49, of the actuating rod 41, to contact with the buffers 48 and 49, thus again forming a substantially rigid connection between the hammer and the cams which insures a positive reciprocation of the hammer and a sufficient stroke of the same to also render the hammer effective under conditions of excessive speed. By the above described arrangement of the springs 50 and 51, the actuating-rod 41, and the collars 52 and 53, and the traveling buffers 48 and 49, it will be understood that the buffers will limit the movement of the springs and will positively actuate the hammer in all instances where more power is required to reciprocate the hammer than the springs are able to furnish. Moreover, by the above described connection between the cams and disks of fly-wheels, the cam 28, will become automatically disengaged from the fly-wheels 24, at any time the drill becomes fast so as to overload the driving-mechanism, not shown, actuating the shaft 22.

In a rock-drill of the defined construction, it is necessary to have a positive feed limit so as to prevent the shortening of the stroke of the hammer 19, to an extent which would not permit of proper clearance of the driving portion 70, of the cams 28, by the rollers 38. Moreover, it is absolutely necessary to prevent the feeding of the hammer at a faster rate than the bit 58, is cutting the ma-

terial to be pierced, otherwise the stroke of the hammer will be shortened to such an extent as to prevent the clearance of the rollers 38, by the driving portion 70, of the cams.

The feed of the frame 14 carrying the hammer 19, chuck 55, and bit 58, and by means of the shaft 22, the disks or fly-wheels 24, and cams 28, is controlled by the following automatic locking and releasing mechanism:—As shown in Figs. 1, 5 and 6, the frame 14, is provided with a chamber 71, in which is located a plate 72, suitably secured to the frame 14. To a projection 73, of the plate 72, is pivotally secured one end of a lever 74, the other end of which by means of a link 76, is connected with one end of a lever 75, which at its other end is pivotally connected with a bolt or pawl 78, having a range of sliding movement in an extension 79, preferably formed integral with the lug 12, through which the threaded spindle 10, passes. The lever 74, is provided with a roller 81, arranged in the path of a cam or throw portion 82, formed by a depression 83, in the hammer 19.

The roller 81, is held in engagement with the hammer 19, and its throw-portion 82, by a spring 84, carried by the plate 72, and bearing against the lever 75. The threaded spindle 10, is provided with a groove or slot 85, into which the pawl 78, is shifted by the levers 74 and 75, through the intervention of the roller 81, to prevent the rotation of the spindle 10, by the handle 11, and thus the feeding of the hammer in a downward direction in Fig. 1, when the hammer 19, occupies a raised position in the support 14. In this raised position the roller 81, is in engagement with the depression 83, of the hammer 19, thus permitting the levers 74 and 75, under the tension of the spring 84, to hold the pawl 78, in engagement with the groove 85. The groove 85, however, is so shaped in cross-section as well as the end of the pawl 78, as to permit of the feeding of the support 14, in an upward direction in the locking position of the pawl 78. When the hammer 19, is moved downward by the cams 28, the cam or throw portion 82 thereof, is so positioned as to engage the roller 81, and to actuate the levers 74 and 75, to bring the pawl 78, out of engagement with the groove 85, of the threaded spindle 10, before the collar 63, of the chuck 55, strikes the buffer 62, carried by the projection 59, of the support 14, and the cap-plate 61. Due to the arrangement and connection of the compound levers 74 and 75, with their carrying plate 72, a slight movement imparted to the roller 81, by the cam portion 82, of the hammer 19, will cause a comparatively long and at the same time quick movement of the locking pawl 78. Moreover, the movement required to actuate the levers 74 and 75, being comparatively small it follows that the

wear and tear upon the roller 81, cam portion 82 and levers 74 and 75, are appreciably lessened.

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 hammer, means slidably arranged in the hammer, flexible means for yieldingly connecting the slidable means with the hammer, means engaging the slidable means and in conjunction with the flexible means imparting to the hammer a reciprocatory movement, and approximately rigid means carried by the hammer and limiting the travel of the flexible means in the hammer by contacting with the slidable means.

2. In a rock-drill, a hammer, means slidably arranged in the hammer, flexible means for yieldingly connecting the slidable means with the hammer, means engaging the slidable means and in conjunction with the flexible means imparting to the hammer a reciprocatory movement, and approximately rigid means carried by the hammer and adapted to reciprocate the hammer when its resistance against movement overcomes the tension of said springs.

3. In a rock-drill, a hammer having a cam portion, a bed-plate, a support carrying the hammer, feeding means for shifting the support on the bed-plate, feed controlling means carried by the support and arranged when actuated by the cam portion of the hammer to quickly arrest the rotation of the feeding means in one direction, means slidably arranged in the hammer, flexible means for yieldingly connecting the slidable means with the hammer, means engaging the slidable means and in conjunction with the flexible means imparting to the hammer a reciprocatory movement, and approximately rigid means carried by the hammer adapted to reciprocate the hammer when its resistance against movement overcomes the tension of said springs.

4. In a rock-drill, a hammer, means slidably arranged in the hammer, flexible means for yieldingly connecting the slidable means with the hammer, positively driven means, means movably connected with the positively driven means so as to be normally rotated by the same, said positively driven and connected means in conjunction with said slidable means and flexible means adapted to normally impart to said hammer a reciprocatory movement, and said connected means arranged to be disconnected from said driven means when said hammer offers a certain resistance against movement by said flexible means.

5. In a rock-drill, a hammer, means slidably arranged in said hammer, flexible means for yieldingly connecting said slidable means with said hammer, positively driven means,

means movably connected with said positively driven means and adapted normally to be rotated by the same, said positively driven and connected means in conjunction with said slidable means and flexible means adapted to normally impart to said hammer a reciprocatory movement and approximately rigid means carried by said hammer and limiting the travel of said flexible means in said hammer by contacting with said slidable means.

6. In a rock-drill, a hammer carrying a tool, a support carrying the hammer and tool, means slidably arranged in the hammer, flexible means for yieldingly connecting the slidable means with the hammer, means engaging the slidable means and in conjunction with the flexible means imparting to the hammer a reciprocatory movement, approximately rigid means carried by the hammer and adapted to reciprocate the hammer when its resistance against movement overcomes the tension of said springs, and means carried by the support and surrounding the tool adapted to impart to the same when reciprocated a rotary step-by-step movement, and said connected means arranged to be disconnected from said driven means when said hammer offers a certain resistance against movement by said approximately rigid means and slidable means.

7. In a rock-drill, a bed-plate, a support arranged on said bed-plate, a threaded spindle having a groove carried by said bed-plate engaging said support and adapted when rotated to actuate said support on said plate, a hammer having a cam-portion movably connected with said support, means for actuating said hammer, and levers whereof one is provided with a pawl, said levers arranged when actuated by the cam-portion of such hammer to quickly bring said pawl into engagement with the groove of said spindle so as to prevent rotation of the same in one direction.

8. In a rock-drill, a hammer, means slidably arranged in the hammer, flexible means for yieldingly connecting the slidable means with the hammer, positively driven means, means for engaging the slidable means, means for coupling the driven means with the engaging means so as to be normally rotated by the same, said driven and engaging means when coupled in conjunction with the slidable means and flexible means adapted to impart to the hammer a reciprocatory movement.

9. In a rock-drill, a hammer having partition walls, a rod having a block and collars arranged in the hammer and passing through the partition-walls thereof, springs carried by said rod and respectively engaging the block and one of said partition-walls from opposite sides to flexibly connect the hammer with the rod, buffers carried by the other of

said partition walls and arranged between certain of the collars of said rod, a cam connected with said rod by engaging the block thereof, said rod when actuated by said cam in conjunction with said springs adapted to impart to said hammer a reciprocatory movement, and said buffers adapted to limit the movements of the springs in said hammer.

10. In a rock-drill, a hammer carrying a tool, a support carrying the hammer and tool, means slidably arranged in the hammer, flexible means for yieldingly connecting the slidable means with the hammer, means engaging the slidable means and in conjunction with the flexible means imparting to the hammer a reciprocatory movement, approximately rigid means carried by the hammer and adapted to reciprocate the hammer, when its resistance against movement overcomes the tension of said springs, and means carried by the support and surrounding the tool adapted to impart to the same when reciprocated a rotary step-by-step movement, and said connected means arranged to be disconnected from said driven means when said hammer offers a certain resistance against movement by said approximately rigid means and slidable means, and to actuate the same when the resistance against movement overcomes the tension of said springs.

11. In a rock-drill, a hammer having partition-walls, a rod having a block and collars arranged in said hammer and passing through the partition-walls thereof, springs carried by said rod and respectively engaging said block and one of said partition-walls from opposite sides to flexibly connect the hammer with said rod, buffers carried by the other of said partition-walls and arranged between certain of the collars of said rod, a cam-disk and a positively driven disk, spring controlled means carried by the cam-disk engaging said driven-disk and adapted to normally connect the disks with each other, said cam-disk engaging the block and by the same said rod and when rotated adapted in conjunction with the springs to impart to said hammer a reciprocatory movement, said buffers adapted to limit the movement of the springs in said hammer.

12. In a rock-drill, a hammer, means slidably arranged in the hammer, flexible means for yieldingly connecting the slidable means with the hammer, positively driven means, means for engaging the slidable means, means for coupling the driven means with the engaging means so as to be normally rotated by the same said driven and engaging means when coupled in conjunction with the slidable means and flexible means adapted to impart to the hammer a reciprocatory movement, and to actuate the same when the resistance offered by the hammer overcomes the tension of said springs.

13. In a rock-drill, a hammer having par-

tition-walls, a rod having a block and collars arranged in the hammer and passing through the partition-walls thereof, springs carried by said rod and respectively engaging the block and one of said partition-walls from opposite sides to flexibly connect the hammer with the rod, buffers carried by the other of said partition walls and arranged between certain of the collars of said rod, a cam connected with said rod by engaging the block thereof, said rod when actuated by said cam in conjunction with said springs adapted to impart to said hammer a reciprocatory movement, and said buffers adapted to limit the movements of the springs in said hammer, and said spring controlled means adapted to disconnect the cam-disk from the driven disk when the hammer resists movement by said buffers.

14. In a rock-drill, a hammer having partition-walls and carrying a tool, a support for the hammer and tool, a cam-disk, a rod having means engaging the cam-disk and collars passing through the partition walls of the hammer, springs carried by the rod and respectively engaging the connecting means and one of said partition-walls from opposite sides to flexibly connect the hammer with the rod, buffers carried by the other of said partition-walls and arranged between certain of the collars of the rod, means for rotating the cam-disk, said disk when rotated adapted to impart by said rod and springs to the hammer and tool a reciprocatory movement, and means surrounding the tool and carried by the support adapted to impart to the tool, when reciprocated, a rotary step-by-step movement.

15. In a rock-drill, a hammer having partition-walls and a cam portion, a bed-plate having a threaded and grooved spindle, a support carrying the hammer and shifted on said bed-plate by engaging the spindle, a cam-disk, means for rotating the disk, a rod movably passing through the partition-walls of the hammer having collars and means for engaging the disk springs carried by the rod and respectively engaging the connecting means and one of the partition-walls from opposite sides to flexibly connect the hammer with the rod, said rod, when actuated, by the cam in conjunction with the springs adapted to impart to the hammer a reciprocatory movement, levers carried by the support having a pawl and adapted, when actuated, by the cam-portion of the hammer to bring the pawl into engagement with the groove of the threaded spindle to prevent rotation of the same in one direction.

16. In a rock-drill, a hammer having a partition-wall and carrying a tool, a support for the hammer and tool, a rod having a block and a collar arranged in the hammer and passing through the partition-wall thereof, springs carried by the rod and re-

spectively engaging the block and partition-wall from opposite sides to flexibly connect the hammer with the rod, a positively driven disk forming a fly-wheel having teeth, a
5 cam-disk engaging the block of the rod, spring controlled bolts carried by the cam-disk and by engaging the teeth of the driven disk forming in conjunction therewith a
10 coupling between the cam-disk and driven disk, said cam-disk when rotated by the driven-disk in conjunction with the rod and springs adapted to impart to the hammer
and its tool a reciprocatory movement, and said spring controlled bolts adapted when
15 the resistance of the hammer and tool against movement overcomes the tension of the bolt springs to permit disengagement of the driven disk from the cam-disk.

17. In a rock-drill, a support, a shaft carried by the support, a disk forming a fly-wheel secured to the shaft and having a flanged toothed portion, a cam-disk having
20 pockets loosely mounted on the shaft and surrounded at the periphery by the flanged portion of the disk, bolts and springs
25 mounted in the pockets of the cam-disk, said springs adapted to movably hold the bolts

in engagement with certain of the teeth of said disk, a hammer having a partition-wall and carrying a tool slidably arranged in
30 said support, a rod having a block engaging said cam-disk and a collar arranged in the hammer and passing through the partition-wall thereof, a set of springs carried by the
rod and respectively engaging the block and
35 partition-wall from opposite sides to flexibly connect the hammer with said rod, said cam-disk when rotated by the driven disk in conjunction with said rod and said set of springs
adapted to impart to the hammer a reciprocatory movement, and said bolts adapted to
40 permit a rotation of the disk by the shaft independent of said cam-disk when the resistance offered by the hammer against movement overcomes the tension of said bolt
45 springs.

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

ROBERT A. FOWDEN.

Witnesses:

THOMAS M. SMITH,
WILHELM VOGT.