No. 661,927. Patented Nov. 13, 1900.

R. L. AMBROSE.

ROCK DRILL.

(Application filed Dec. 11, 1899.)

(No Model.) 2 Sheets—Sheet 1.

Fig. 2.

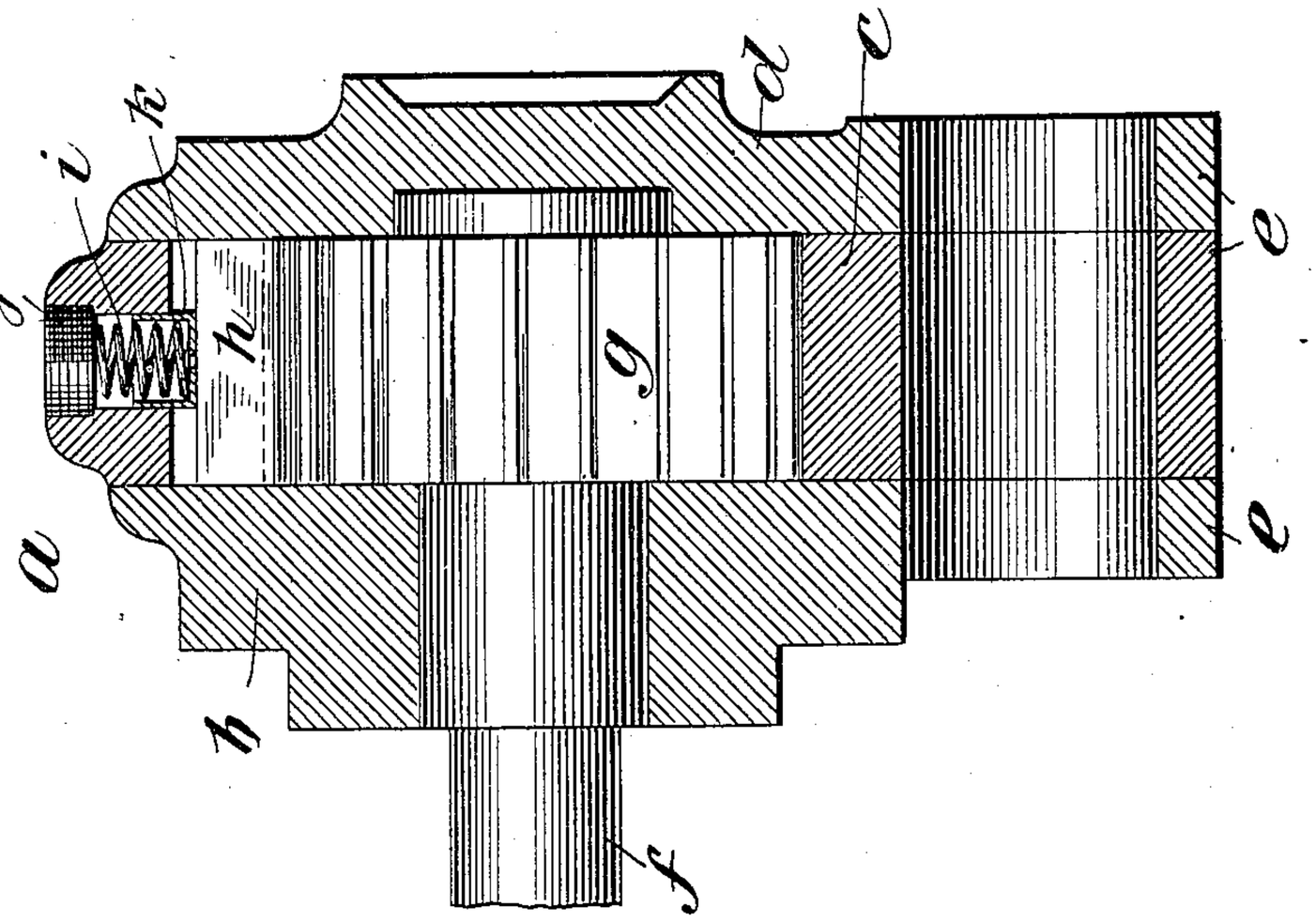

Fig. 1.

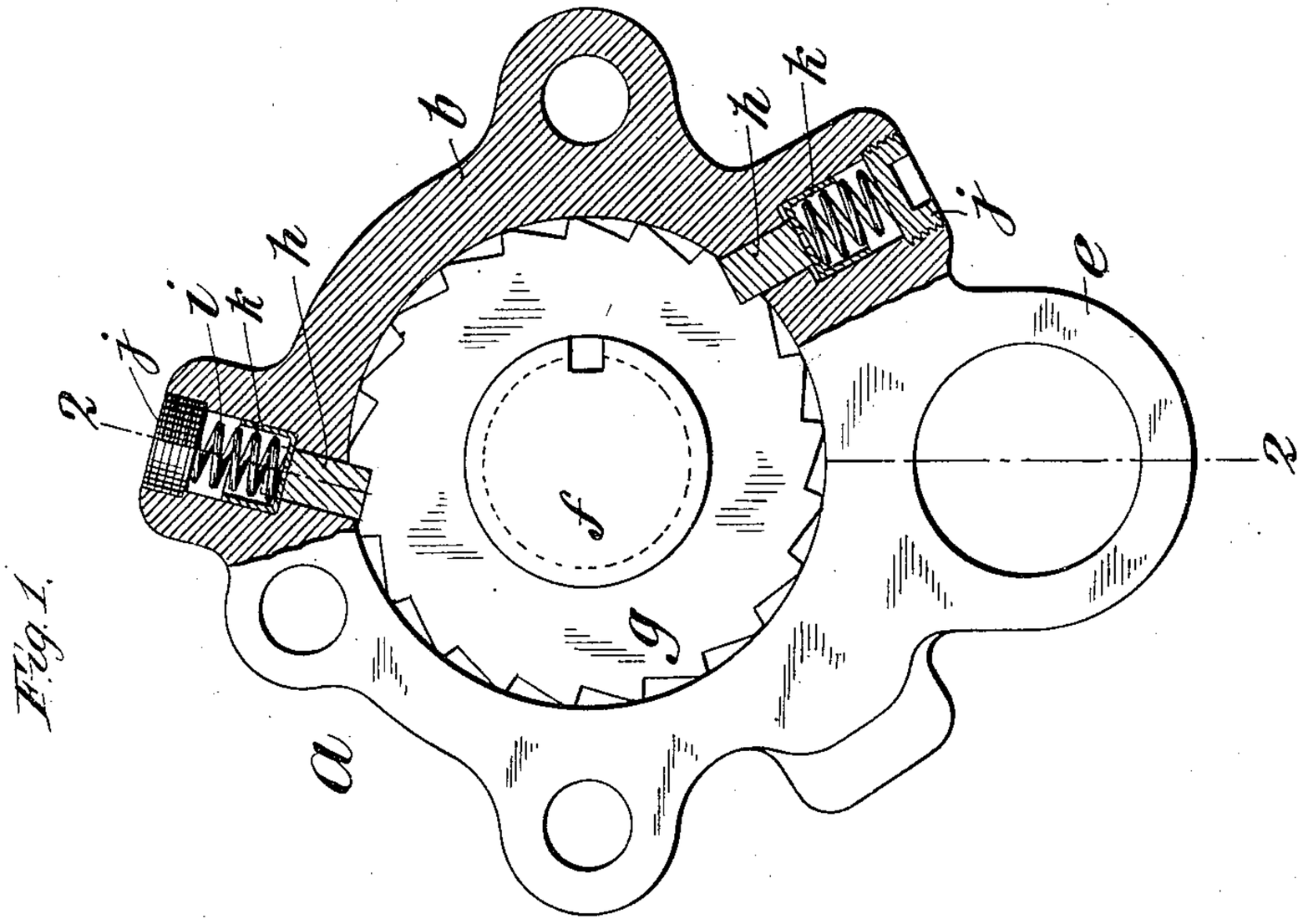

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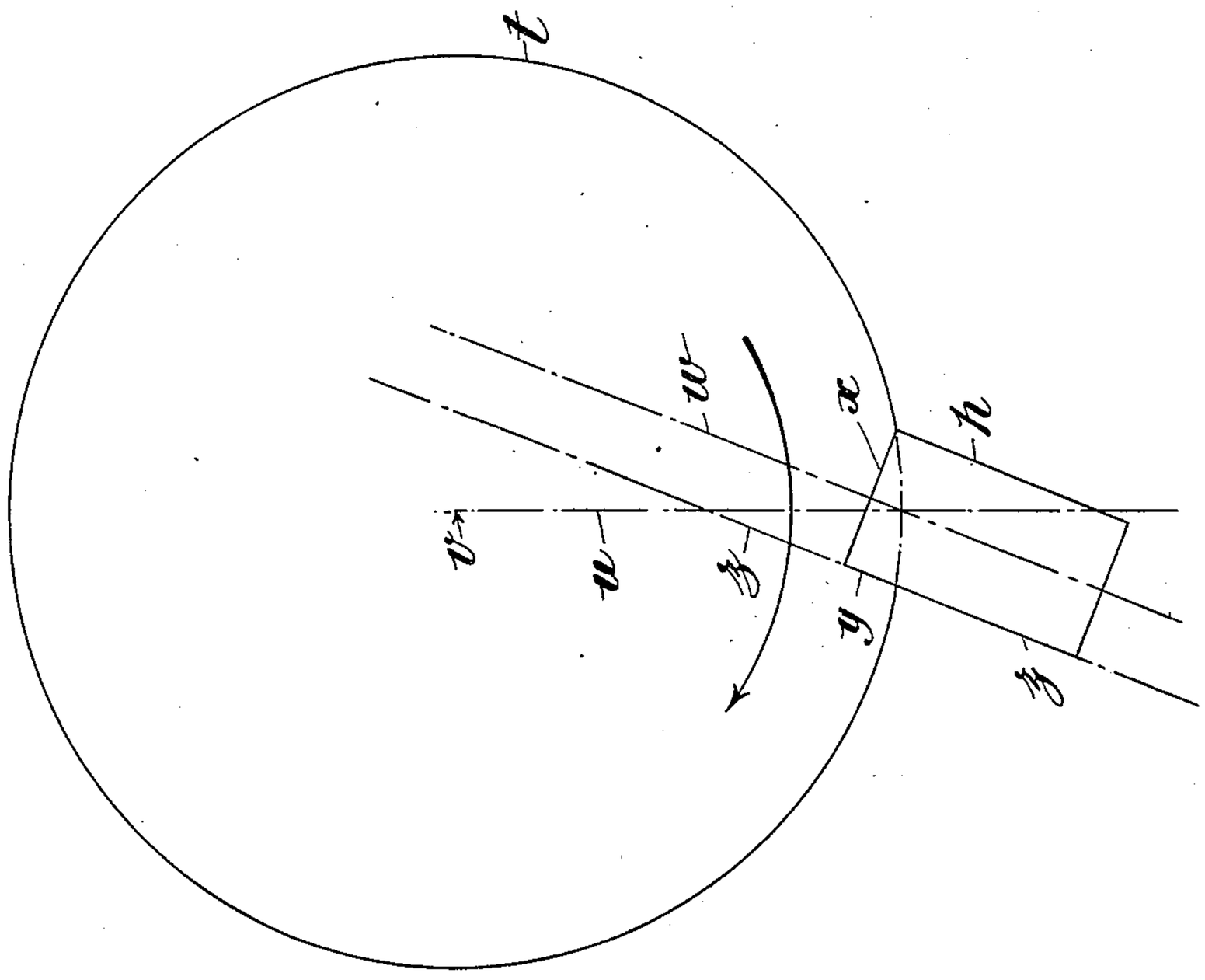
Fig. 3.



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ROCK-DRILL.

SPECIFICATION forming part of Letters Patent No. 661,927, dated November 13, 1900.

Application filed December 11, 1899. Serial No. 739,873. (No model.)

To all whom it may concern:

Be it known that I, ROBERT L. AMBROSE, a citizen of the United States of America, and a resident of North Tarrytown, county of Westchester, and State of New York, have invented certain new and useful Improvements in Rock-Drills, of which the following is a specification, reference being had to the accompanying drawings, forming a part thereof.

My invention relates to rock-drills, and particularly to ratchet mechanism therefor.

In a rock-drill in order to obtain the desired results in drilling it is necessary to intermittently rotate the drill-bar, and the most successful way of accomplishing this has been found to be by mounting a ratchet-wheel to rotate with a rotating bar which is spirally grooved and splined to a fixed nut secured to the piston which carries the drill-bar and by mounting one or more pawls in the drill cylinder-head or some part stationary therewith.

The piston in moving longitudinally in one direction is compelled to partially rotate by reason of the ratchet-wheel upon the rotating bar being locked by the pawl or pawls from itself rotating in such direction and of the spiral spline connection between the piston and the rotating bar. In moving longitudinally in the opposite direction the piston, through the said spiral spline connection with the rotating bar and by reason of the fact that the friction between it and the cylinder is greater than the friction in the ratchet mechanism, rotates the said ratchet-wheel, causing it to advance one or more teeth under the said pawl or pawls, according to the pitch of the spiral splines. All this is old in the art and too well known to require detailed description or illustration, except as to such parts as are changed or differently constructed according to my invention.

The objection to the above mechanism as ordinarily constructed lies in the weakness of the teeth of the ratchet-wheel, and particularly in the liability of breakage of the pawl or pawls.

It is desirable to rotate the drill-bar but slightly at each stroke, and to so do necessarily limits the size of the teeth upon the ratchet-wheel. It is essential, therefore, to so construct them as to give them the greatest strength and the least liability to break. To accomplish this, acute angles must be avoided, and in my special construction, to be hereinafter fully described, I have so constructed and arranged the said teeth. The most serious problem, however, is the construction and arrangement of the pawl or pawls. In order to obtain sufficient strength, it has been common hitherto to employ a hinged pawl or pawls. The objections to the use of such pawls are numerous. First, the said pawls occupy so much space that practically it is impossible to use more than two of them, while it is extremely desirable to use three in order that the "load" may be evenly distributed; secondly, it is difficult to arrange a suitable return-spring for the pawls and one which will not get out of order or break owing to the curvilinear movement of the said pawls, and, thirdly, the pawls have to be arranged in suitable chambers and room left for them to play therein, which causes a space to be left in which the air from within the cylinder can pass and into which it will pass at such times as it is desired to lock the air in the cylinder in order to cushion the piston upon its return stroke.

A pawl or pawls having a rectilinear movement toward and away from the face of the ratchet-wheel and whose axis of movement is radial might obviate the above three mentioned difficulties. Such pawl, however, provided with an acute-angled face would be very liable to fracture. Pawls used in this connection, by reason of the extreme conditions to which they are subjected, have necessarily to be hardened or tempered. In such hardening or tempering, as is well known, the less acute the angles of the parts the less liability to internal strain due to the uneven chilling thereof. Further, the less acute the angles the more evenly disposed the metal, and hence the stronger the part.

I have then, according to my invention, provided the rock-drill with a plurality of spring-actuated pawls mounted in the drill-cylinder head or in some part secured against rotation with the cylinder-head and arranged that the same shall have a rectilinear movement toward and away from the face of the ratchet-wheel, which movement shall be more nearly

radial than tangential, whereby that face of a tooth which is more nearly tangential shall be constituted the lifting-face and that face of the tooth which is more nearly radial shall be constituted the locking-face, the axis of the said movement of the pawl being in a line which is eccentric of the axis of the ratchet-wheel. The effect of the above is to enable me to use as a pawl a block rectangular in cross-section and to construct the ratchet-wheel with teeth of greatly-increased strength.

I further arrange the springs, which tend to force the pawls inwardly, in suitable cups, such cups so arranged that they will prevent the escape of the springs from the interior of the cylinder-head should the pawl against which it is bearing be removed for any purpose whatsoever; and my invention further consists in certain details of construction and combination of parts to be hereinafter more fully described.

I will now proceed to describe my invention with reference to the accompanying drawings and will then point out the novel features in the claims.

Figure 1 is a face view, partly in section, of a ratchet mechanism embodying my invention. Fig. 2 is a transverse section of the same, the plane of section being taken upon the line 2 2 of Fig. 1. Fig. 3 is a diagrammatic view illustrating the principles involved.

Similar reference characters designate corresponding parts throughout the several views.

Reference character *a* designates the upper cylinder-head of a rock-drill as a whole. It comprises three parts—the cylinder-head proper, *b*, the ratchet box or casing *c*, and the ratchet-box cap or cover *d*. These three parts are usually bolted together and secured to the upper end of the cylinder of the rock-drill by bolts passing through apertures in lugs, with which the several parts are provided. The three parts are also provided with lugs *e*, the apertures of which coincide, as shown, and which are together arranged to receive the feed-nut for engaging the feed-screw. Neither feed-nut nor feed-screw is shown, they being well known and forming no part of this invention. Reference character *f* designates the rotating bar, a portion only of which is here shown and which is spirally splined to and operates in conjunction with the reciprocating piston, all in a manner well known, to intermittently rotate the drill-bar.

g designates a ratchet-wheel which is secured to rotate with the rotating bar. The said ratchet-wheel is mounted within the said said ratchet-box *c* and between the head *b* and the cover *d*. The ratchet-wheel substantially fits the said ratchet-box diametrically, so that the face of the teeth will rotate in close proximity to the inner face of the ratchet-box *c*.

h designates pawls, of which I may use one or more, but of which I preferably use three, as shown. The pawls consist each of a rectangular block having that face which is against the teeth of the ratchet-wheel perpendicular to the line of movement of said pawl. By reason of this squared end the pawls present a surface the entire thickness of the block, which must be sheared off before the pawl will give way. A pawl which has its end cut at an acute angle may easily be broken across the corner at a point which is narrower than the full width of the block, and this is all the more likely on account of the fact that this part is likely to have been made the hardest and hence the most brittle in the tempering process to which said pawls are subjected. The use of a square-ended pawl in this connection is hence very desirable. I will now proceed to describe my improved construction and arrangement of parts which will permit of such use.

The before-mentioned pawls are mounted in the cylinder-head *a* and are guided endwise between the two heads *b* and *d*. Sidewise they are guided in suitable ways cut in the inner wall of the ratchet-box *c* and which extend the entire width thereof. These ways are so cut that the said pawl-block shall have its squared end flat against that face of a tooth of the ratchet-wheel which is the more nearly tangential at the moment that that face of the adjacent tooth is against the side of the pawl. As a result it will be seen that the axis of the line of movement will be eccentric of the axis of the ratchet-wheel. In Fig. 3 I have shown a diagram illustrative of this arrangement. *t* is a circle representing, for instance, the peripheral circle of the ratchet-wheel. *u* is a line radial of the said circle and intersecting the center of the circle at *v*, which may be considered the axis of the ratchet-wheel. *h* is one of the before-mentioned pawls, and *w* designates its axis of movement. It will be seen that by placing that end of the pawl which is perpendicular to its line of movement flat against that face of a tooth which is the more nearly tangential at the moment that the working or side face of the pawl is against that face of a tooth which is the more nearly radial the said axis of movement *w* will be in a line which is eccentric of the axis *v* of the ratchet-wheel. *x* designates that face which is the more nearly tangential and which is the lifting-face of the tooth, and *y* designates that face which is the more nearly radial and which is the working face of the tooth.

I preferably so construct the teeth of the ratchet-wheel and so mount the pawl that the working face of the pawl is and has a movement in a line which would pass upon that side of the axis of the ratchet-wheel which is in a direction opposite to the direction of the rotation of the ratchet-wheel. In the diagram, *z* designates the line of the working face of the pawl *h*, and said line, as will be seen, upon being produced passes the axis of the ratchet-wheel upon that side thereof

which is opposite to the direction of rotation of the ratchet-wheel. Such direction of rotation is indicated by an arrow in Fig. 3.

It will be seen that not only does the foregoing arrangement permit a pawl to be made which is very much stronger, but also permits the making of very much stronger teeth upon the ratchet-wheel, the said teeth being undercut in no part whatever. The pawls are pressed inwardly against the face of the ratchet-wheel by means of helical springs *i*, one for each pawl being preferably provided, though of course there may be more, if desired. These springs are mounted in cylindrical housings in the ratchet-box *c*. The diameter of these housings is greater than the width of the pawlways, and the diameter of the springs is preferably also greater than such width. Hence if the pawl be removed through the interior of the ratchet-box they will not be accidentally displaced through the pawlways. Furthermore, I have found that if the springs be of too small a diameter they are liable to become gummed up by oil and dirt which works into the housing and in time tends to set. The use of a larger pawl overcomes this difficulty to a considerable extent.

A suitable cap *j* is provided for each housing and is preferably tapped into the ratchet-box from the outside and allowed to fetch up against a shoulder. This cap closes the outer end of the spring-housing and forms a backstop for the spring contained therein. A square socket is shown, or equivalent means may be employed, by which the said cap may be screwed into place.

k designates a follower arranged to slide freely in the spring-housing and is located between the inner end of the spring and the outer end of the pawl. It is here shown as cup-shaped and receives one end of the spring *i*, transferring the pressure thereof to the said pawl. The diameter of the follower is greater than the thickness of the pawl and hence of the width of the pawlways. Thus the said follower will retain the spring from displacement regardless of the diameter of the spring. If, therefore, the follower be employed, it is not entirely essential, though it is preferable, that the diameter of the spring itself be greater than the width of the pawlways. The pawls are of course both removed from and inserted through the interior of the ratchet-box *c* before the insertion or after the removal of the ratchet-wheel.

I have shown and preferably provide three pawls equidistantly around the ratchet-wheel and so arrange them that they are all in engagement with the teeth of the ratchet-wheel at the same time. Such arrangement largely augments the strength of the parts and saves side thrust. These parts require to be of great strength for practical use. The drill will often strike on a portion of rock which is oblique or which is hard on one side and soft on the other. The consequence of this is that the ratchet-teeth and the pawls are called upon to stand an enormous shock, and they must be so constructed as to stand this shock. For this they require a maximum of strength, and I have shown and described a ratchet mechanism which fulfils these requirements to the highest degree and which at the same time combines simplicity and cheapness of construction.

For the purposes of this specification and claims I have described the pawls and ratchet as being mounted in the cylinder-head. The ratchet-wheel I have described as rotating freely therein except for its engagement with the pawls engaging therewith and the pawls mounted therein and having a movement toward and away from the ratchet-wheel.

For the same purposes I have shown and described the three parts *b*, *c*, and *d* as constituting an upper cylinder-head as a whole. It may be of one piece; but for purposes of manufacture it is preferable to make it as shown. The ratchet-box being a separate piece, the pawlways may easily be milled right across, which is a very inexpensive undertaking compared with the cutting of such ways were this not a separate part.

It is of course understood that the pawls may be mounted on or in any part which is secured with the cylinder-head against rotation irrespective of whether it is a part of or secured directly to the cylinder-head or not and that the ratchet-wheel may likewise be suitably arranged where desired, provided it is secured to rotate with the rotating bar.

What I claim is—

1. In a rock-drill, the combination with a rotating bar and a ratchet-wheel secured to rotate therewith, of a spring-actuated pawl mounted in the drill cylinder-head and having a rectilinear movement therein toward and away from the face of the ratchet-wheel, that end of the pawl engaging the teeth of the ratchet-wheel being perpendicular to the line of movement of the said pawl, and arranged to engage with that face of a tooth of the ratchet-wheel, which is the more nearly tangential, said face constituting the lifting-face of the said tooth.

2. In a rock-drill, the combination with a rotating bar and a ratchet-wheel secured to rotate therewith, of a spring-actuated pawl mounted in the drill cylinder-head and having a rectilinear movement therein toward and away from the face of the ratchet-wheel, the axis of said movement being in a line which is eccentric of the axis of the ratchet-wheel, the inner end face of said pawl being at right angles to said line of movement and arranged to engage with that face of a tooth of the ratchet-wheel which is the more nearly tangential, said face constituting the lifting-face of said tooth.

3. In a rock-drill the combination with a rotating bar and a ratchet-wheel secured to rotate therewith, of a spring-actuated pawl mounted in the drill cylinder-head and having a rectilinear movement therein toward and

away from the face of the ratchet-wheel, the working face of the pawl having a movement in a line which passes the axis of the ratchet-wheel upon that side thereof which is in a direction opposite to the direction of rotation of the ratchet-wheel.

4. In a rock-drill, the combination with a rotating bar and a ratchet-wheel secured to rotate therewith, of a pawl mounted in ways in the drill cylinder-head and having a rectilinear movement therein toward and away from the face of the ratchet-wheel, and a helical spring mounted in the drill cylinder-head and adapted to press the said pawl inwardly against the face of the ratchet-wheel, and means to limit the inward movement of the spring whereby the said spring will be retained from accidental displacement through the pawlways, after the said pawl has been removed.

5. In a rock-drill, the combination with a rotating bar and a ratchet-wheel secured to rotate therewith, of a pawl mounted in ways in the drill cylinder-head and having a rectilinear movement therein toward and away from the face of the ratchet-wheel, and a helical spring mounted in the drill cylinder-head and adapted to press the said pawl inwardly against the face of the ratchet-wheel, the said spring being of such size diametrically as will prevent the same from accidental displacement through the pawlways, after the said pawl has been removed.

6. In a rock-drill, the combination with a rotating bar and a ratchet-wheel secured to rotate therewith, of a pawl mounted in the drill cylinder-head and having a rectilinear movement therein toward and away from the face of the ratchet-wheel, a helical spring mounted in the drill cylinder-head and adapted to press the said pawl inwardly against the face of the said ratchet-wheel, and means interposed between the said pawl and the said spring whereby the spring is retained from accidental displacement through the pawlways after the said pawl has been removed.

7. In a rock-drill, the combination with a rotating bar and a ratchet-wheel secured to rotate therewith, of a pawl mounted in the drill cylinder-head and having a rectilinear movement therein toward and away from the face of the ratchet-wheel, a helical spring mounted in the drill cylinder-head and adapted to press the said pawl inwardly against the face of the said ratchet-wheel, and a follower interposed between the inner end of the spring and the outer face of the pawl, the said follower being of greater width than the width of the pawlways.

8. In a rock-drill, the combination with a rotating bar and a ratchet-wheel secured to rotate therewith, of a pawl mounted in the drill cylinder-head and having a rectilinear movement therein toward and away from the face of the ratchet-wheel, a helical spring mounted in the drill cylinder-head and adapted to press the said pawl inwardly against the face of the said ratchet-wheel, and a cup-shaped follower interposed between the inner end of the spring and the outer face of the pawl, the said cup-shaped follower being of greater width than the width of the pawlways.

9. An upper cylinder-head for a rock-drill comprising three pieces: a cylinder-head proper, a ratchet-box, and a cover therefor; the said ratchet-box having a cylindrical bore therethrough, adapted to receive a ratchet-wheel, and having a plurality of pawlways, each adapted to receive a rectangular pawl-block, communicating with the said cylindrical bore and extending the entire width of the ratchet-box, and a plurality of cylindrical spring-housings, one for each of the said pawlways, the diameter of the said spring-housings being greater than the width of the said pawlways.

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