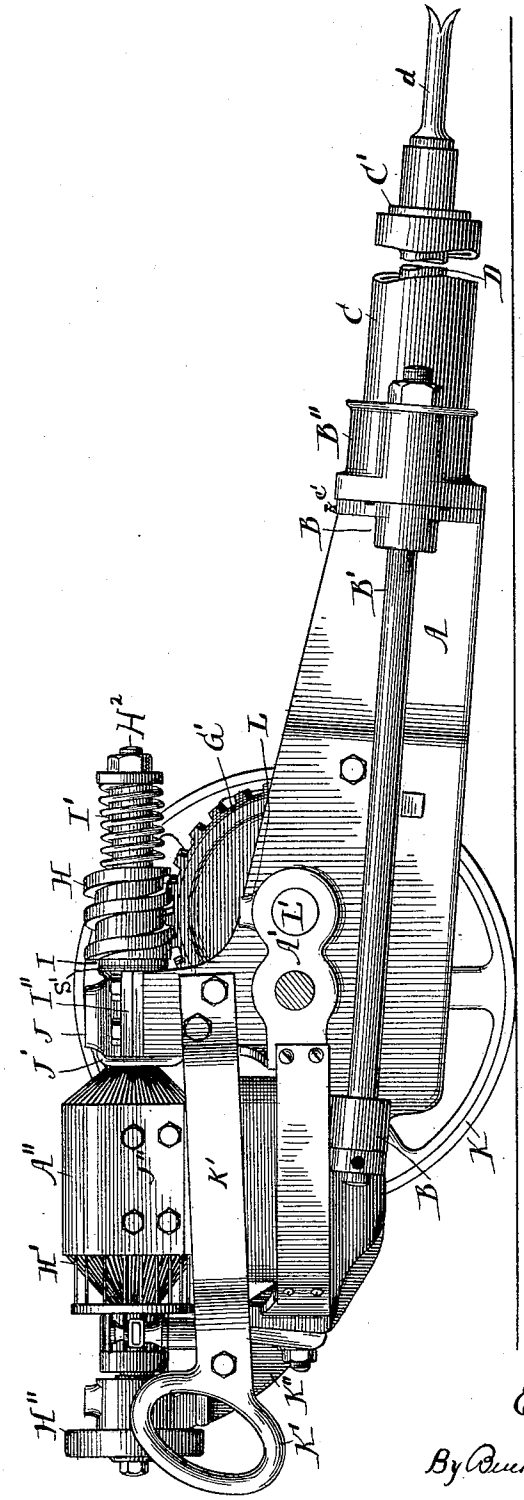
(No Model.) 4 Sheets—Sheet 1.

E. A. SPERRY.

MINERAL DRILLING MACHINE.

No. 459,596. Patented Sept. 15, 1891.

Fig. 1.



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E. A. SPERRY.

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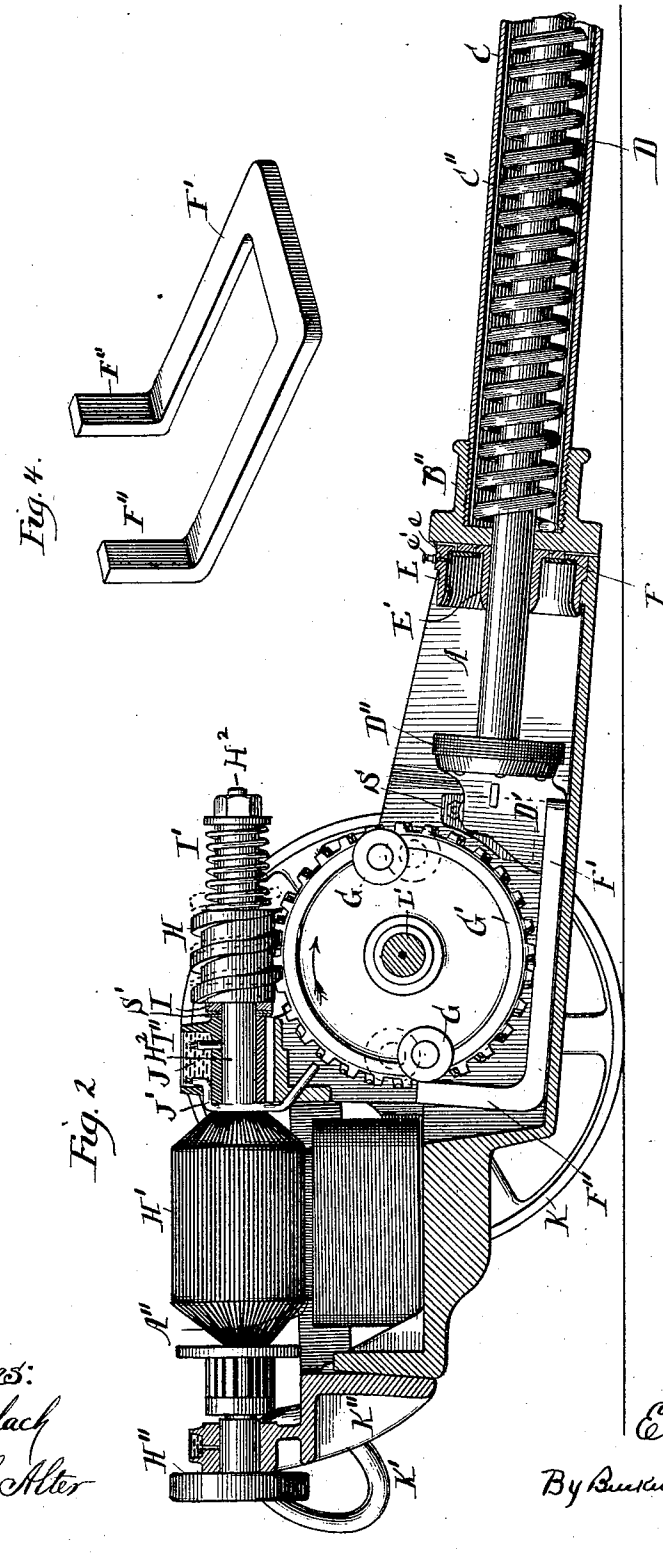

Fig. 4.

Fig. 2.

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E. A. SPERRY.

MINERAL DRILLING MACHINE.

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Fig. 3.

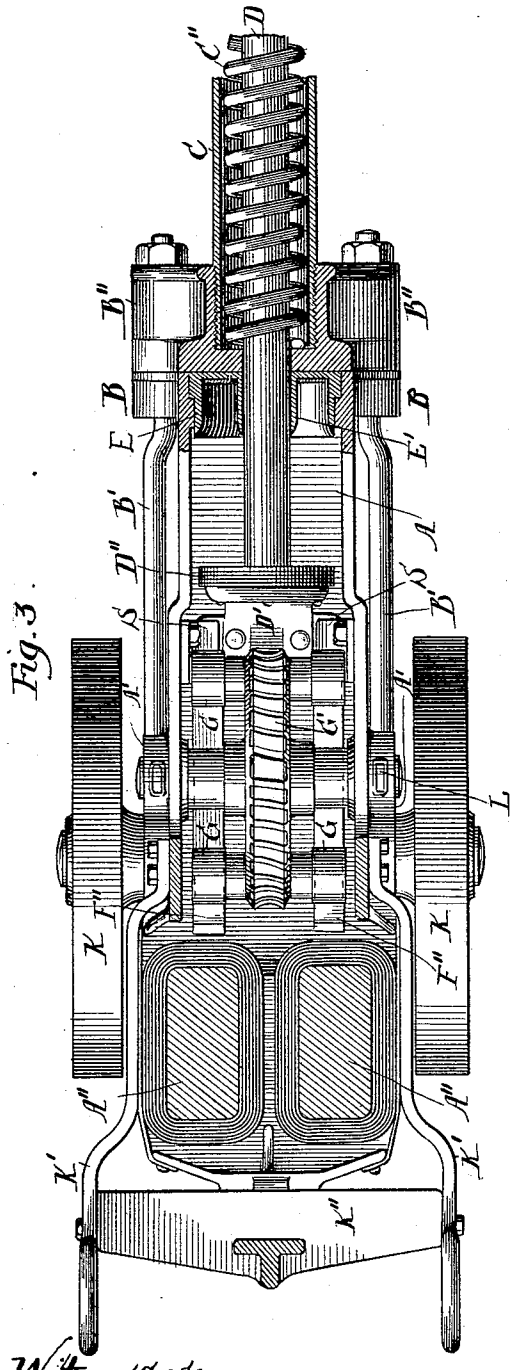


Fig. 6.

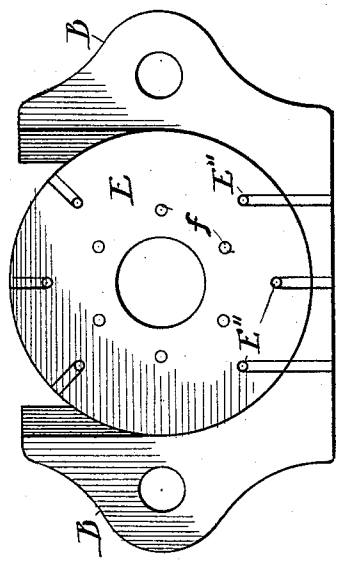
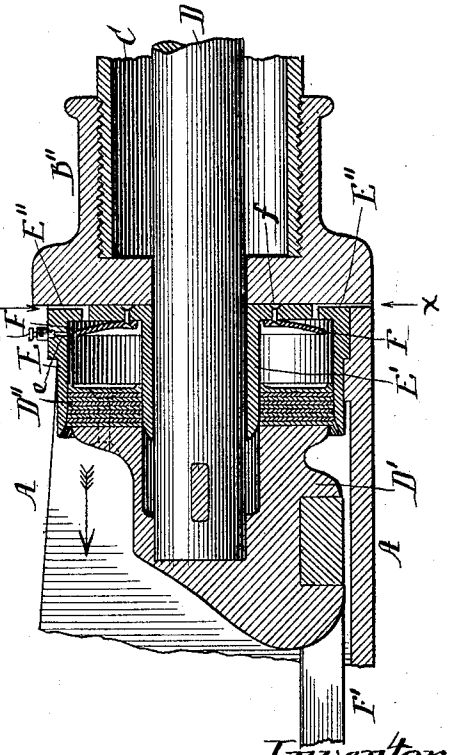


Fig. 5



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(No Model.) 4 Sheets—Sheet 4.

E. A. SPERRY.

MINERAL DRILLING MACHINE.

No. 459,596. Patented Sept. 15, 1891.

Fig. 8.

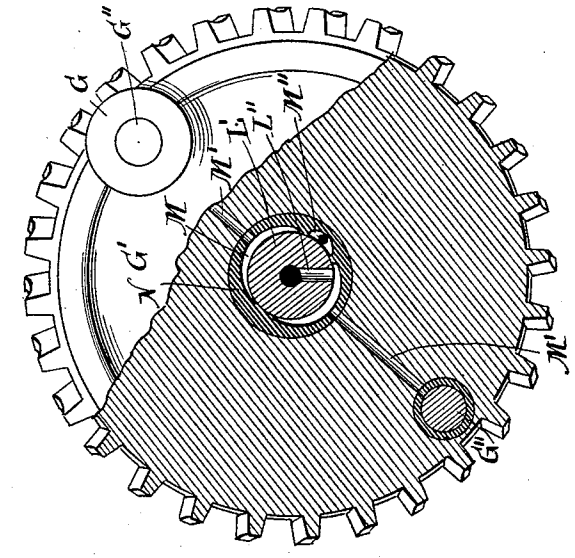


Fig. 7.

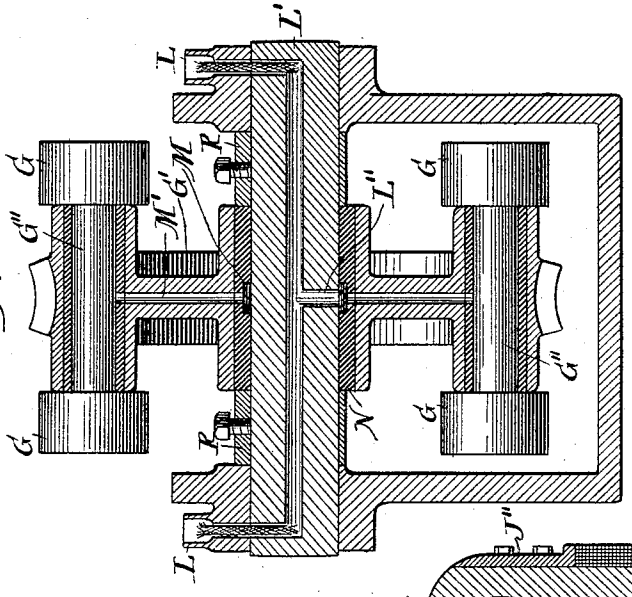
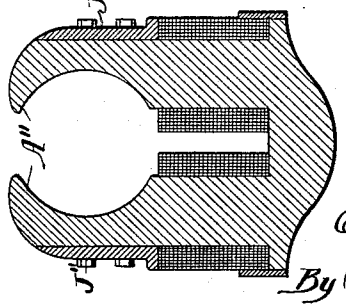


Fig. 9.



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THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

UNITED STATES PATENT OFFICE.

ELMER A. SPERRY, OF CHICAGO, ILLINOIS.

MINERAL-DRILLING MACHINE.

SPECIFICATION forming part of Letters Patent No. 459,596, dated September 15, 1891.

Application filed January 15, 1891. Serial No. 377,921. (No model.)

To all whom it may concern:

Be it known that I, ELMER A. SPERRY, a citizen of the United States, residing at Chicago, Cook county, Illinois, have invented certain new and useful Improvements in Mineral-Drilling Machines, of which the following is a specification, reference being had to the accompanying drawings, in which similar letters of reference indicate like parts in all the figures.

My invention relates particularly to that class of mineral-drilling machines in which work is done by successive blows of a reciprocating drill and drill-rod which are alternately retracted and released by rotating mechanism; and its object is to reduce the shock of engagement of the parts at retraction, to provide for quick and sudden release of the drill-rod for its forward projection, to equalize the strains on the mechanism, and to provide means for receiving the force of the blow without shock to the machine when resistance is not met by the drill-point. This I do by the use of the mechanism shown in the drawings, and in which—

Figure 1 is a side elevation of a mineral-drilling machine embodying my improvements. Fig. 2 is a similar view shown partially in longitudinal vertical section. Fig. 3 is a top view shown partially in longitudinal lateral section. Fig. 4 is a perspective view of the angle-bar or fingers which I attach to the cross-head of the drill-rod for purposes to be explained hereinafter. Fig. 5 is a partial longitudinal vertical section drawn on an enlarged scale, illustrating particularly the cross-head and its air-cushion. Fig. 6 is a cross-section of Fig. 5 on the line $x\,x$. Figs. 7, 8, and 9 show details of construction, as more fully explained hereinafter.

In the figures, A is the main frame of the machine, preferably having formed integral therewith the field-magnets A″, the journal-bearings A′, and the lugs B, Fig. 3.

B′ B′ are two rods extending lengthwise with the machine and serve to stiffen the frame and to secure thereto the detachable head B″, having rigidly attached thereto the sleeve C, inclosing the forward part of the drill-bar D and the spring C″.

The rotating mechanism for imparting reciprocating motion to the projectile is shown in the engaging wheel G′, centrally mounted within the frame, preferably on a fixed shaft, which is attached to the frame at the journal-boxes A″ by means of set-screws or other suitable device. The engaging wheel G′ has journaled therein at a distance from its center laterally-projecting shafts G″, preferably carrying upon their outer ends the rollers G. I prefer to have the rollers fixed to the shafts, which latter may rotate within the bearings in the wheel, thereby securing a large bearing-surface; but I do not limit myself to this construction. If I desire, I may fix the shafts in the wheel and attach the rollers loosely to their projecting ends, or I may use fixed pins.

The engaging wheel G′ may be driven from the motor by any suitable connecting device. I prefer the worm H, mounted directly upon the shaft of the armature H′ of an electric motor, upon which is also mounted a fly-wheel H″. The worm is preferably mounted loosely upon a feather in the armature-shaft, so as to slide longitudinally against an abutment I, preferably part of the shaft, where it is held by a spring I′. The armature-shaft is journaled at the back of the fly-wheel and also between the armature and the abutment I in a journal-bearing I″, in the cap of which is an oil-cavity J, which serves also to oil the worm-gear by a tube and wick J′.

The oiling device for the rotating shafts consists of the oil-cup L, forming a portion of the side frame at the journal-box. The shaft of the engaging wheel G′ does not turn, but is rigid and is bored for the oil-passage from either box. The center bore is met by cross-bores L″ in the center, which lead to two systems of passages, one shown at N, which is connected by the ducts M′ to the shafts G″, and the other duct M″, which leads lengthwise of the journal in the wheel G′ to oil its bearing.

The reciprocating drill-rod is shown at D within the sleeve C, and is provided upon its inner end within the frame with cross-head D′, and to which it is keyed or otherwise suitably attached, and to which is also attached the rearwardly-extending bifurcated plate F′, having its rear ends bent upward to about a right angle to the path of reciprocation, forming contact-surfaces adapted to be engaged by the lateral projections on the en-

gaging wheel G′. The parts are so arranged that the plane of rotation of the engaging wheel G′ lies between the paths of reciprocation of the contact-surfaces F″ F″ of the reciprocating drill-rod, and the oppositely-lateral projections engaging simultaneously with the contact-surfaces F″ F″ causes the draft of retraction to be equally disposed on each side of the engaging wheel and the line of reciprocation of the drill-rod, preventing unequal wear and preserving the alignment of the parts.

Upon the cross-head D′ is mounted a plunger D″, which is adapted to co-operate with a dash-pot or air-chamber E to form an air-cushion for the drill-rod to relieve the machine from the shock of the blow. I provide as a part of the dash-pot a sort of collar E′, through which the drill-rod reciprocates, and provide the plunger with an aperture at its center, which allows it to move freely over the collar, thus forming an air-cushion, preferably annular, whose side walls and base are stationary, and dispensing with the inconvenience of and necessity for packing around the reciprocating drill-rod. I preferably form the air-chamber E separable from the frame of the machine and place it against the head B″, which sustains the force of the blow, and I retain the chamber in position against the force of withdrawal of the plunger by the laterally-projecting flange, (shown in Figs. 2, 3, and 5,) which fits into a corresponding groove in the frame. This separable feature of the air-chamber enables me to construct it of different material from the head, I preferring to construct the head of iron and the chamber of brass, and it also enables me to remove and replace the chamber in case of wear. To allow the free ingress of the air while withdrawing the plunger, I provide air-ducts E″, entering the base of the dash-pot, and to prevent egress of air on the return of the plunger I preferably cover the mouths of the ducts with a valve F, generally made of leather in the form of a flat ring, secured near its center edge by rivets.

For the purpose of enabling me to adjust the pressure within the dash-pot to variable spring and weight of drill-rod, that I find best in practice is to provide an opening or duct *e*, which is provided with any suitable means for regulating the flow of air through it—such, for instance, as a stop-cock *e′*, which can be closed entirely or opened partially or fully, as occasion may require. One of the advantages of the air-duct *e* with its adjustably-regulated size of opening is that when the force of the projectile is so great that the air-cushion causes a rebound which disarranges the engagement of the mechanism the stop-cock can be adjusted to reduce the elasticity of the cushion. The position of the air-chamber surrounding the drill-rod is of advantage in equalizing the strains.

The operation of my device will be largely understood from the foregoing description and the drawings. The revolutions of the motor-shaft and worm cause wheel G′ to rotate in the direction indicated by the arrow in Fig. 2. Rollers G engage with the contact-surfaces F″, drawing cross-head, plunger, and drill-rod backward against the pressure of the spring C″ from a position shown approximately in Fig. 5 to that shown in Figs. 2 and 3, thus accumulating in the compressed spring the force which is to deliver the blow. If the engaging wheel G′ rotated at a constant speed upon its axle, the forward movement of the drill-rod would commence when the point of greatest retraction had been reached, but would not attain its full release until the wheel had rotated sufficiently to allow the highest point of the contact-surface F″ to pass under the roller with which it was in contact, when its full release would occur. To avoid this gradual release of the reciprocating drill-rod from its contact with the engaging wheel is one of the principal objects of my invention, and I accomplish this by so arranging the engaging wheel that after the point of greatest retraction had been reached it is capable of a more than normal speed under the action of the reciprocating drill-rod forced forward by the powerful spring, so that the upper corners of the contact-surfaces F″ immediately after the point of greatest retraction has been reached instantly forces the rollers G and wheel G′ to the position shown by the dotted lines in Fig. 2, resulting in the sudden release of the engaging parts, and this forward rotation of the wheel G′ is permitted by the sliding connection between the worm H and its shaft, so that it takes the position shown by the dotted lines, its position against the abutment being resumed by the action of the spring I′ or its combined action with that of the rotating worm. It will be observed that, although the pin is circular so far as its own center is concerned, the engaging part of its circumference is eccentric with the center of rotation of the wheel, and therefore the action of the pin is cam-like in its nature, and I consider this feature of permitting a sudden acceleration in the speed of the engaging-wheel in the direction of its rotation after the point of greatest retraction of the drill-rod has been reached as of great importance in effecting its quick release, and I do not limit myself in its application to the specific form shown in the drawings, but may apply it to all machines of this class when there is retraction of the drill-rod by contact with an engaging wheel and release by separation therefrom, whether the engaging wheel be in the form of a cam, pin, helix, or whatever form when the surfaces in contact are rounded and the action cam-like in its nature, and whether the rounded contact-surface be upon the engaging wheel or upon the drill-rod—as would be the case, for instance, if the upper corner of the angle-pieces F″ should be worn rounded—the advantage offered by a sudden acceleration in

the motion of the engaging wheel would still exist, and the surfaces in contact with the mechanism herein referred to will generally be rounded, if not by original design, then by wear of the parts.

The number of blows which the machine can deliver to the best advantage is from one hundred and forty to one hundred and sixty per minute. By arranging the engaging wheel G′ with projections diametrically opposite as well as laterally opposite two reciprocations of the drill-rod will be given for one revolution of the engaging wheel G′, and therefore in giving the proper number of blows I am enabled to make the speed of the engaging wheel one-half of what it would be if there were but one pair of contact projections, thus reducing greatly the shock of contact of the parts, while securing sudden projection of the drill-rod, as hereinbefore explained.

I claim—

1. In a mineral-drilling machine in combination with motive power, a drill-rod, means for projecting the drill-rod, and an engaging wheel provided with a curved contact-surface adapted to retract the drill-rod by contact therewith in cam-like action and to release it by separation therefrom, a separable driving connection between the motive power and the engaging wheel, whereby the speed of the latter may be accelerated under the action of the drill-rod after it has reached the point of its greatest retraction.

2. In a mineral-drilling machine, in combination with motive power, a drill-rod, means for projecting the drill-rod, and an engaging wheel provided with a curved contact-surface adapted to retract the drill-rod by contact therewith in cam-like action and to release it by separation therefrom, and a separable driving connection between the motive power and the engaging wheel, whereby the speed of the latter may be accelerated under the action of the drill-rod after it has reached the point of its greatest retraction, with an elastic device to restore the engaging wheel to its normal position.

3. In a mineral-drilling machine, the combination of the drill-rod D, means for projecting the drill-rod, the engaging wheel G′, carrying the pins G, the worm H, the abutment I, and the motor H′, with sliding connections between the worm and its shaft, whereby the speed of the wheel G′ may be accelerated under the action of the drill-rod after the point of its greatest retraction has been reached.

4. In a mineral-drilling machine, the combination of the drill-rod D, means for projecting the drill-rod, the engaging wheel G′, carrying the pins G, the worm H, the abutment I, and the motor H′, with sliding connections between the worm and its shaft, whereby the speed of the wheel G′ may be accelerated under the action of the drill-rod after the point of its greatest retraction has been reached, and the spring I′ for restoring the worm to its normal position.

5. In a mineral-drilling machine, the combination of the motor, the worm upon the shaft thereof, the worm-gear adapted to engage with and retract the drill-rod, sliding connections between the worm-gear and its shaft to permit an acceleration in the speed of the worm-gear, and a retaining-abutment on the shaft on one side of the worm.

6. In a mineral-drilling machine, the combination of a motor, a worm upon the shaft thereof, a worm-gear adapted to engage with and retract the drill-rod, sliding connections between the worm-gear and its shaft to permit an acceleration in the speed of the worm-gear, an abutment on one side of the worm on the shaft, and a spring to restore the worm to its normal position.

7. In a mineral-drilling machine, in combination with motive power, a drill-rod, means for projecting the drill-rod, a power-driven contactor with curved face adapted to retract the drill-rod by contact therewith and to release it by separation therefrom, and separable power driving connections between the contactor and the motive power, whereby the speed of the contactor may be accelerated under the action of the drill-rod after it has reached its point of greatest retraction.

8. In a mineral-drilling machine, a frame, a drill-rod moving therein, an air-chamber surrounding the drill-rod, consisting of an outer and inner wall, and a connecting-base provided with one or more openings covered with a suitable valve, in combination with a plunger fitting said air-chamber, one of the elements of which is mounted upon the frame, the other being mounted upon the drill-rod.

9. In a mineral-drilling machine, an air-chamber surrounding the drill-rod, consisting of an outer and an inner wall and a connecting-base, said air-chamber detachably secured to the frame and provided with one or more openings covered with a suitable valve, in combination with a plunger on the drill-rod.

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