G. H. CONDICT.

DRILL OR OTHER IMPACT MECHANISM.

APPLICATION FILED MAY 31, 1907.

999,433.

Patented Aug. 1, 1911.

3 SHEETS—SHEET 1.

Fig. 1.

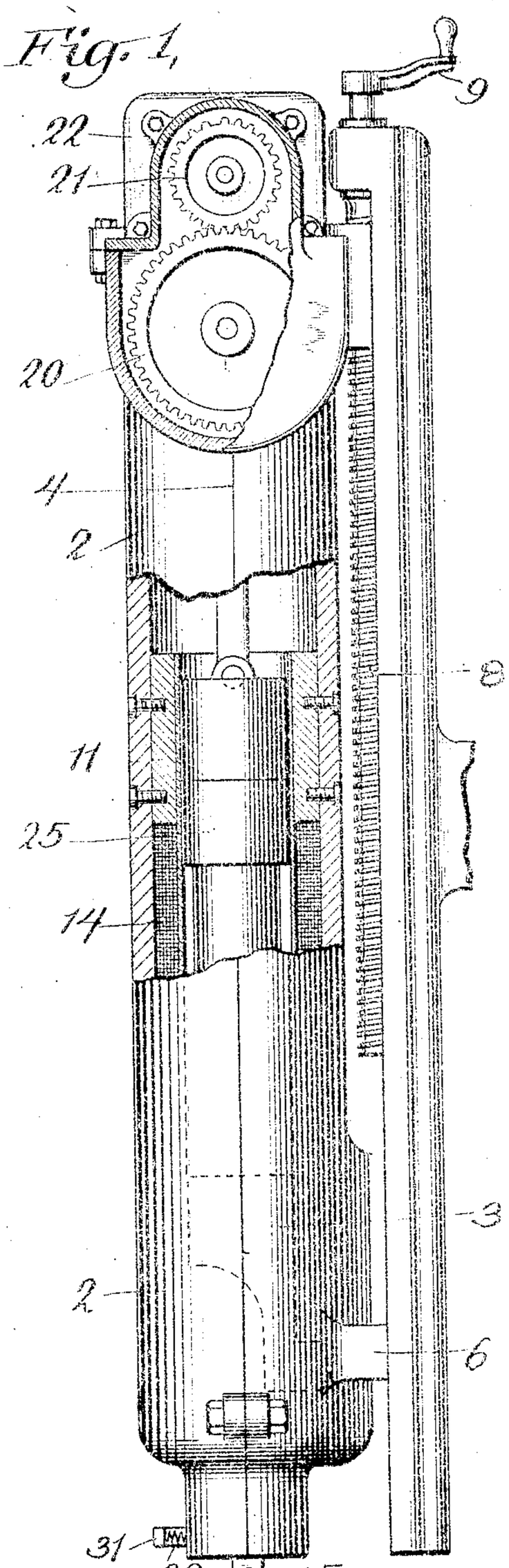
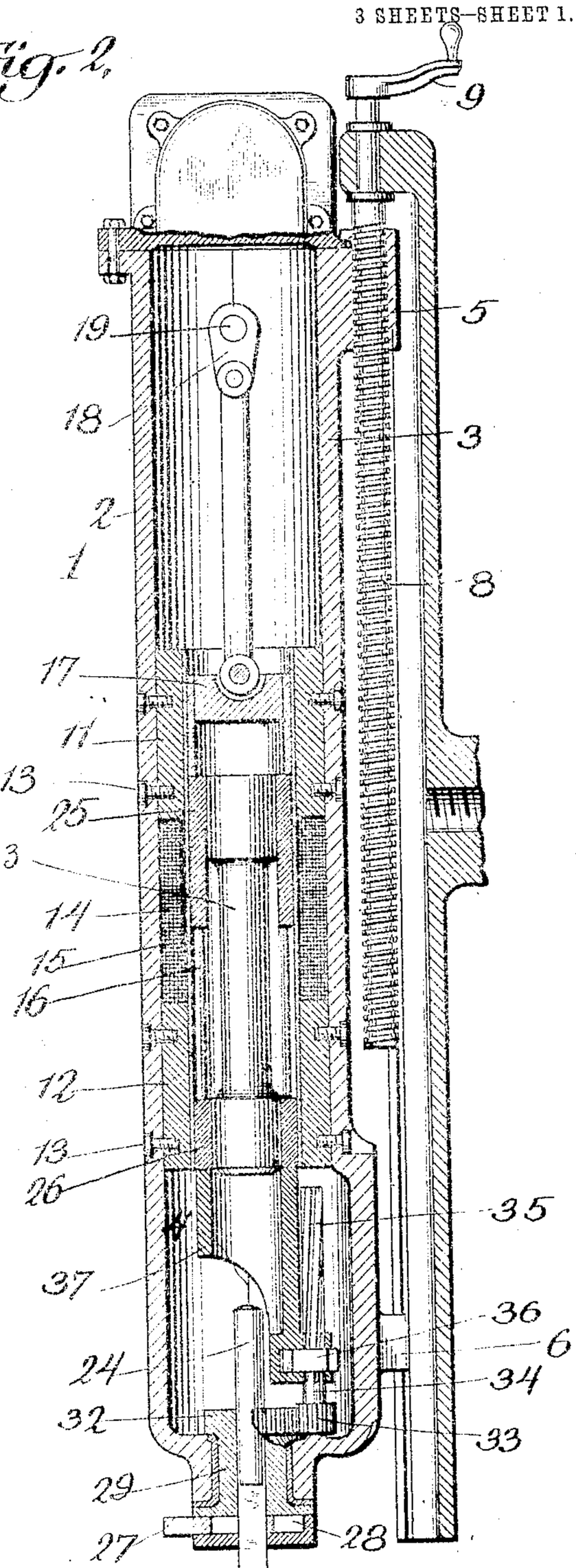


Fig. 2.



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3 SHEETS—SHEET 2.

Fig. 3,

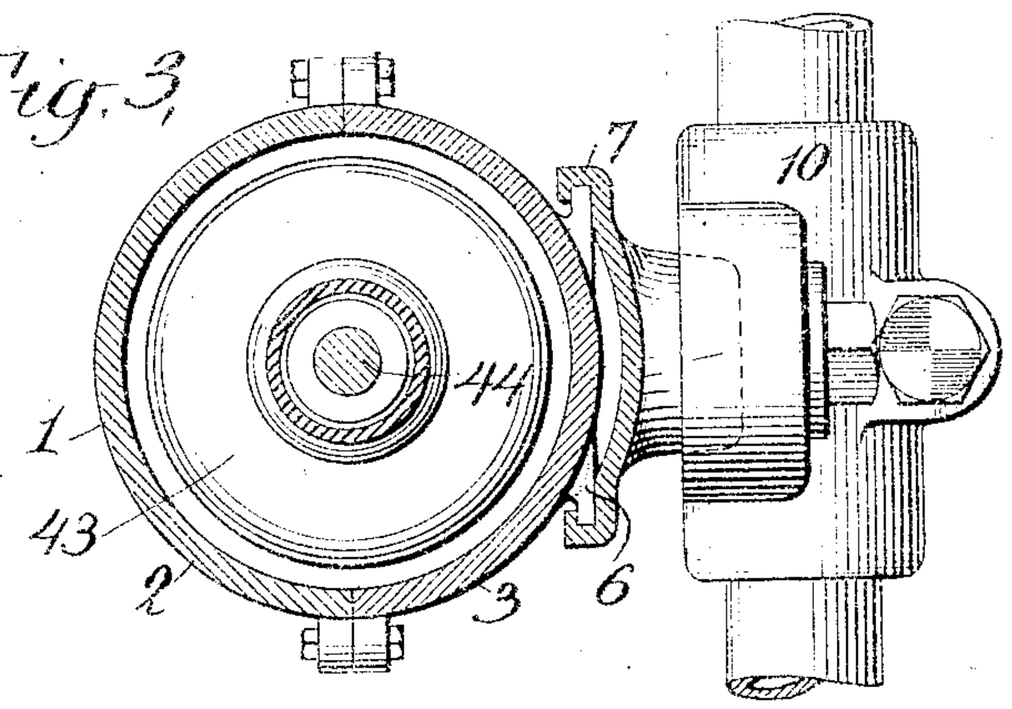


Fig. 4

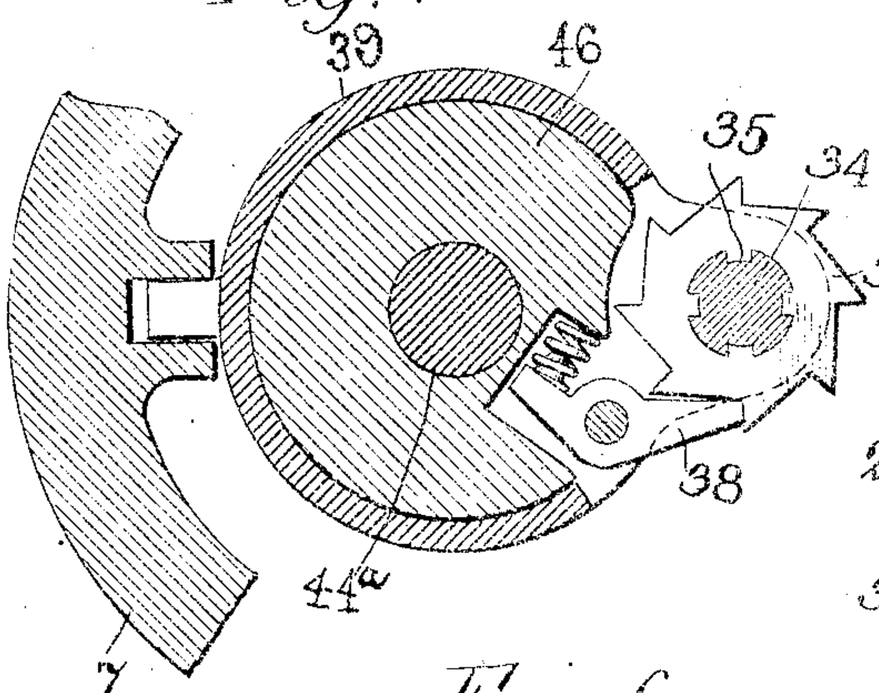


Fig. 5,

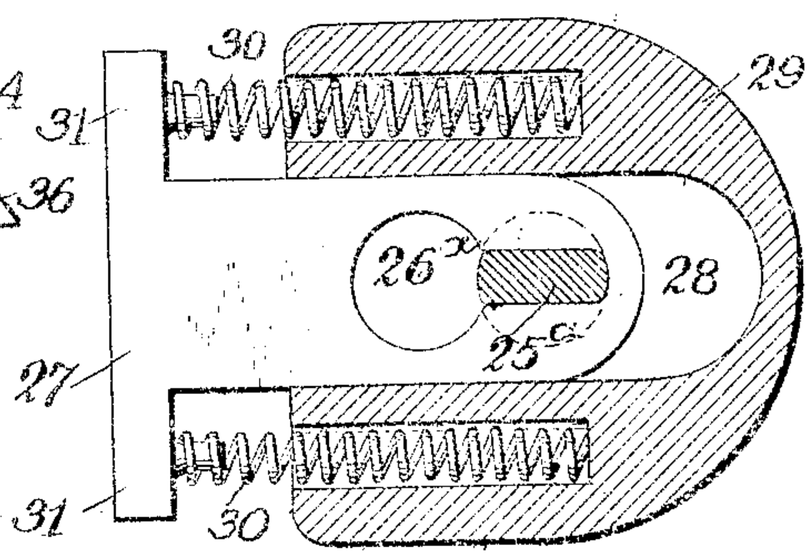


Fig. 6,

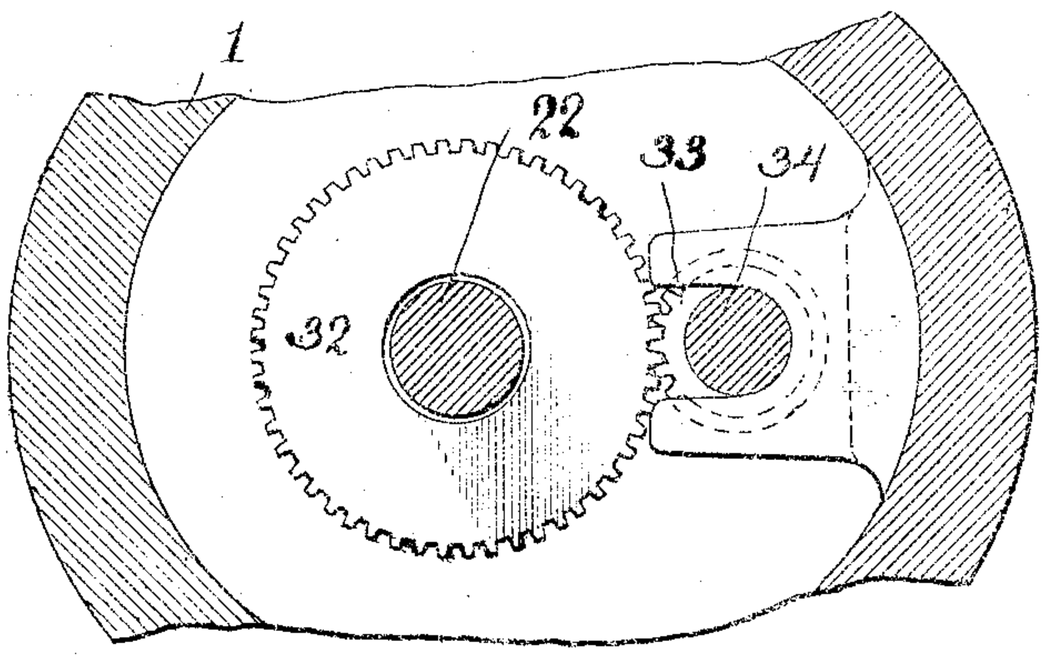
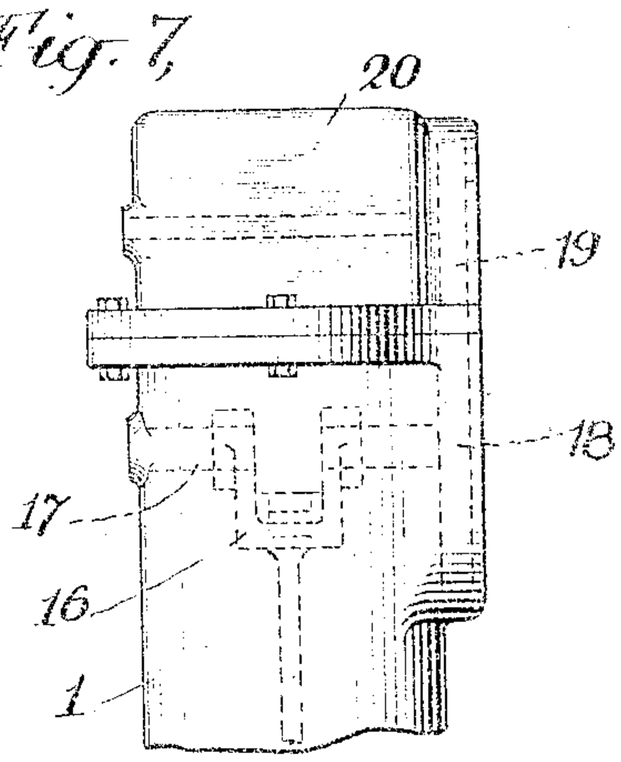


Fig. 7,



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3 SHEETS—SHEET 3.

Fig. 8.

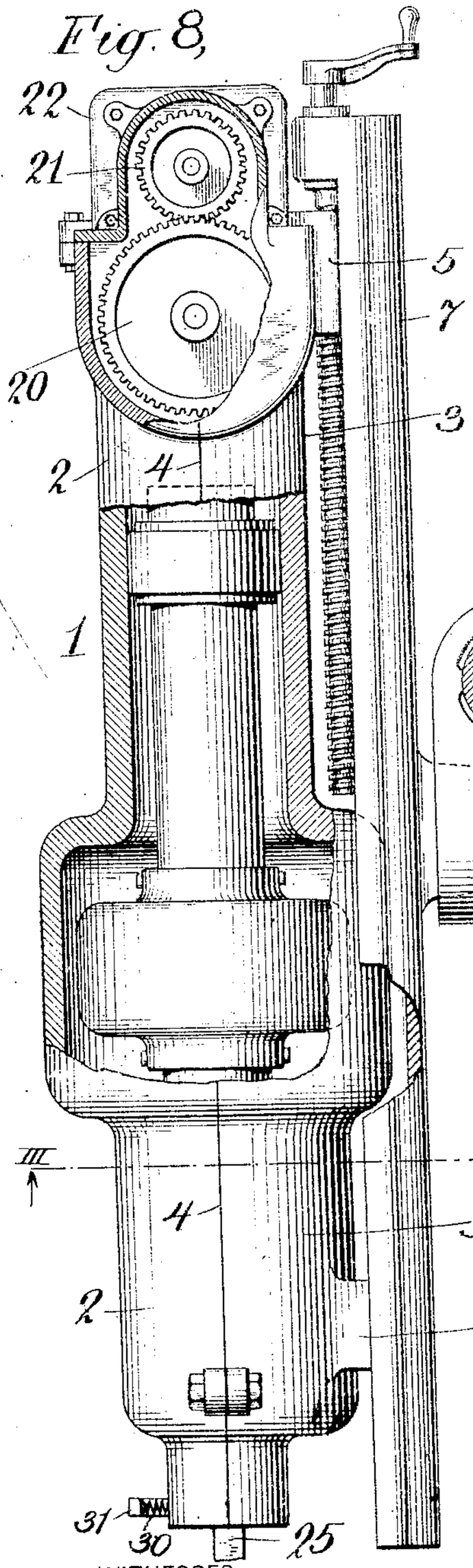
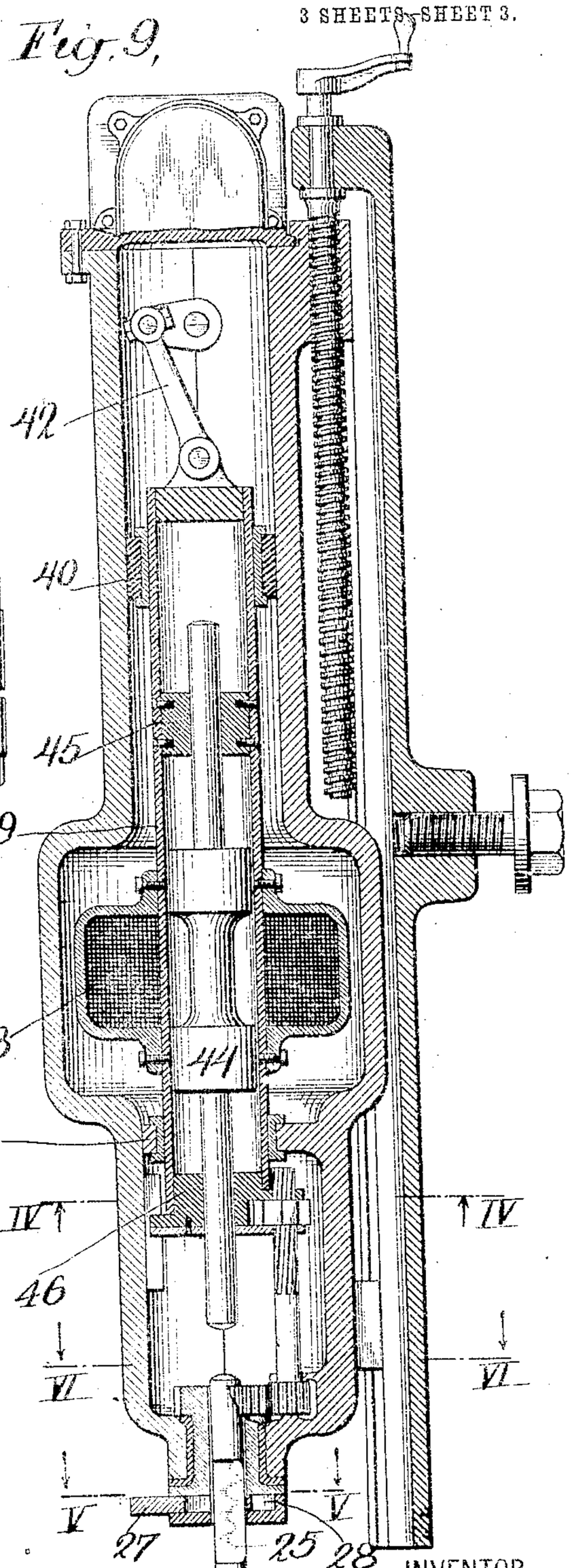


Fig. 9.



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UNITED STATES PATENT OFFICE.

GEORGE HERBERT CONDICT, OF PLAINFIELD, NEW JERSEY, ASSIGNOR TO WILLIAM DULLES, OF ENGLEWOOD, NEW JERSEY.

DRILL OR OTHER IMPACT MECHANISM.

999,433. Specification of Letters Patent. **Patented Aug. 1, 1911.**

Application filed May 31, 1907. Serial No. 376,646.

To all whom it may concern:

Be it known that I, GEORGE HERBERT CONDICT, a citizen of the United States of America, residing in Plainfield, county of Union, and State of New Jersey, have invented certain new and useful Improvements in Drills or other Impact Mechanism, of which the following is a specification, reference being had to the drawings, forming part of the same.

My invention relates to rock drills, in which the drill bit is reciprocated or is struck by a hammer to produce the desired impact on the rock, and the primary object of my invention is to provide an improved operating mechanism for the drill.

In drills of the kind referred to, two methods are commonly employed for reciprocating the drill bit or actuating the hammer. In one of these the moving element is actuated by a crank or equivalent mechanism for converting rotary motion into reciprocatory, the power being usually furnished by an electric motor. Drills of this type are notably convenient, and efficient in operation, but are subject to one drawback in particular, namely, the fact that the impacts of the drill bit or the hammer are communicated to the operating mechanism and other parts of the drill, thus subjecting the same to injurious shocks and vibration. To overcome this difficulty, cushioning devices of various kinds, such as air-cushions, springs, and the like have been used. The other method referred to is to actuate the reciprocating element by means of a solenoid, or electromagnet, the polarity of which is periodically reversed. In this method the injurious vibration and shocks such as are incident to the first-mentioned plan, are largely reduced, but the solenoid method possesses a serious drawback in that a special generator of comparatively low frequency, is necessary, to supply the current for energizing the solenoid. This is for the reason that the current commonly furnished by power and lighting companies is of too high frequency for the best, or in some cases even good, results in the drill. On the other hand, if direct current be employed, with commutating devices for producing the necessary reversals of the current, the usual commutator troubles are liable to be encountered.

I have therefore been led to devise my present invention, by which I am able to combine the more important advantages of both of the types above referred to, and at the same time eliminate their disadvantages. To secure the desired minimum of vibration and shock I employ a solenoid or other suitable electromagnet as the means for effecting the necessary reciprocation of the bit or the hammer, but with this important difference, namely, that in my invention the polarity of the magnet need not be reversed, but may be constant. I can therefore employ direct current for energizing the magnet, thus eliminating the special low-frequency alternator and the commutating devices heretofore commonly considered necessary. Instead, I provide mechanical means for rapidly reciprocating a carrier which loosely supports an impact element or bit so that the latter may have movement relative thereto, and employ a solenoid or other electro-magnet which serves to couple the impact element or bit to the carrier to move in unison therewith, no other means being necessary or employed than the solenoid or magnet for coupling the parts as stated. Hence, so far as communication of vibration and shock from the drill bit or hammer to the rest of the apparatus is concerned, the drill is at least as free from such effects as the former types of solenoid drills. On the other hand, the carrier does not strike a blow upon anything and hence is the source of substantially only such vibration as is incident to its crank or other actuating mechanism.

The preferred form of apparatus thus briefly outlined is illustrated in the annexed drawings, in which—

Figure 1 is a view in side elevation with a portion of the outer casing of the drill broken away. Fig. 2 is a vertical section, showing the operative parts of the drill partly in elevation. Fig. 3 is a section substantially on line III.—III., of Fig. 8. Figs. 4, 5 and 6 are enlarged sections on line IV.—IV., V.—V., and VI.—VI., respectively of Fig. 9, showing different portions of the mechanism for rotating the drill bit. Fig. 7 is a detail view, in side elevation, of the upper part of the drill, showing the position of the driving motor and its operative connection with the rest of the apparatus. Figs.

8 and 9 are views of a modified form of my invention.

The operative parts of the drill are contained in and supported by an outer casing 1, which it will be noted is of general cylindrical contour, although of course, the exact form of the casing is of little consequence as long as it serves the purpose for which it is employed. I prefer to make the casing in two separable longitudinal parts or halves, 2, 3, the line of division between the same being indicated at 4, to permit assemblage of the apparatus and afford quick and easy access to the inclosed parts. The casing is provided at top and bottom with lugs or projections 5, 6, adapted to slide in guides formed on a supporting member 7. Rotatively mounted in the top of the latter is a screw 8, working in the upper casing lug 5 and provided with a hand crank 9, so that the casing and the parts carried thereby can be lowered, in the usual way, as the work of drilling progresses. The supporting member 7 is removably mounted on the usual tripod or other support, a portion of which is indicated at 10, in Fig. 8.

Mounted in the casing, are upper and lower wrought iron collars, 11. 12, spaced apart as shown, and secured rigidly in place by any suitable means, such as bolts 13, let through the casing wall and threaded into said collars.

Located within the casing, and in the space between the collars 11 and 12, is an annular electro-magnet or solenoid 14, of substantially the same internal diameter as said collars and of general shape such as to snugly fit in the space between said collars, so as to have no movement relative to the casing. In other words, the solenoid or magnet is fixed or rigidly mounted in the casing and maintains the position set forth throughout the operation of the machine. Suitable connections not shown are provided for energizing this magnet, and it will be apparent that when the said magnet is energized, the surrounding casing becomes the field of which the collars 11, 12, constitute the pole-pieces.

Extending through the alining openings in the pole-pieces and the solenoid is a closely fitting cylinder or sleeve 15 of brass or other metal of non-magnetic qualities, and mounted to reciprocate through the passageway thus formed is a mechanically operated carrier adapted to carry an impact element or bit so as to impart the desired reciprocations to the latter. This carrier consists of a tubular or hollow element 16 of brass, having rigidly connected to its upper end a head 17, also of brass. For the purpose of reciprocating the carrier, the head 17, is connected with a crank 18 on a shaft 19 journaled in opposite sides of the casing. At one end of the shaft is a gear 20, meshing with the driving gear 21 of a motor inclosed in a case 22 mounted on the top of the drill casing 1. The motor may of course be of the alternating or the direct current type, and may be connected with a source of current in any suitable way, not shown.

Arranged to reciprocate inside the field core or carrier 16 is a plunger 23, constituting the armature of the solenoid or magnet, and the impact element which strikes the drill bit 24, said plunger being disposed to slide in bearing sleeves or pole pieces 25. 26. of wrought iron secured in and to the upper and lower ends of the carrier respectively. It will be seen, upon reference to the drawings, that there is no operative mechanical connection between the plunger and the rest of the apparatus, the former being free to reciprocate independently of the latter.

The collars or sleeves 25. 26. are so connected and arranged upon the carrier as to have their outer cylindrical faces in close proximity to the lining sleeve 15. As the carrier reciprocates the magnetic field or circuit of the solenoid or magnet will include said collars, and constitute them magnets to attract the plunger and couple the latter with the carrier, so that said plunger will travel in substantial unison with the carrier during the drilling operation.

The drill bit 24 is chamfered near its upper end to provide a flat portion 25ª which fits loosely a slot extending laterally from a circular aperture 26ª (Fig. 5) in a plate 27. The latter is movably mounted in a recess 28 in the bottom of a chuck 29, rotatively carried in the lower end of the casing 1. The plate 27 is held in its outermost position, with its slot engaging the chamfered portion of the drill bit, by springs 30 bearing on lugs 31 on the said plate, the result being that while a slight up and down play of the bit is permitted it can not rotate relatively to the chuck 29. At the top of the chuck is a gear 32, meshing with a pinion 33 on a vertical shaft 34, (Figs. 2, and 6) the upper end of which is provided with inclined or helical grooves 35 engaged by corresponding ribs on the inner surface of a ratchet 36. The latter is carried in the head in a bracket 37 of bronze secured to the sleeve 26, and is engaged by a pawl 38, but is capable of sliding movement on the grooved end of shaft 34 as the carrier 16 reciprocates. It will therefore be evident that as the ratchet descends with the carrier 16 the effect of the inclined grooves 35 would be to cause either the ratchet 36 or the shaft 34 or both to turn, as will be readily understood; but as the drill bit rests on the bottom of the bore in the rock, the engagement of the bit therewith offers sufficient resistance to prevent the shaft 34 from rotating, since the ratchet offers practically no

resistance to the turning effort. The ratchet therefore turns on the down-stroke of the carrier, but on the up-stroke the pawl 38 holds the ratchet from turning in the opposite direction, as would otherwise happen; hence the shaft 34 must turn, and give the bit a slight movement of rotation, the extent of which depends, of course, on the pitch or angle of the grooves 35 with the vertical, the extent of the upward movement of the ratchet, and the ratio of the gear 32 to the pinion 33. In this way the bit is given a slight turn at each upward movement of the hammer 23, since the latter, as will be explained hereinafter, follows the movement of the carrier or core 16.

Assuming now that the soleniod 14 is connected in any suitable way, not shown, with a source of direct current the polarity of the magnet will therefore be constant. But as the carrier reciprocates, the impact element 23, under the magnetic attraction of the solenoid exerted thereon through the collars 25, 26, will be magnetically coupled to the carrier and be moved in substantial synchronism or unison therewith. With the parts in the position shown in Fig. 2, and the carrier descending, it is evident that while the latter is slowing up before the reversal of its motion takes place the momentum of the hammer will throw it down in advance of the carrier and cause it to strike the drill bit or other element. Upon the return movement of the carrier 16, the bit or impact element 23 will be raised therewith under the influence of the solenoid or magnet 14 through the collars, and moved upwardly or rearwardly until the overthrow of the crank 18 causes the carrier 16, and impact element or bit 23 to descend in substantial synchronism or unison to repeat the blow. The operation just stated is continued as long as the shaft is rotated and the solenoid 14 is energized.

It might be stated that when the carrier 16 has about reached the limit of its downward stroke and thereby decreased in speed, as the crank is about to turn on its upstroke, the momentum gathered by the element 23 may cause it to gain upon the carrier and move in advance thereof, but it will be seen that when the blow has been delivered that the element 23 will not only rebound to a degree, being loosely mounted on the carrier 16, but will also be raised under the influence of the magnet or solenoid to substantially its initial position with relation to the carrier.

By mounting the impact element 23 loosely within the carrier and providing the improved means for causing them to move in substantial unison, a great advantage is attained in that upon the delivery of the blow the rebound of the element 23, independently of the carrier, relieves said carrier and its operating mechanism of a great part of the shock to which it would be subjected were the carrier and element 23 rigidly or positively connected.

In Figs. 8 and 9 of the drawings I have shown a modified form of the invention: In this embodiment, the casing and parts appertaining thereto are substantially the same in construction as the corresponding parts heretofore described and it is therefore unnecessary to repeat such description. The modified form contemplates the mounting of the solenoid directly upon the carrier so as to reciprocate therewith instead of making the same stationary on the support, and in the illustration made 39 designates the tubular carrier reciprocably mounted in the casing and guided by upper and lower guide collars 40. 41 at the upper and lower portions of the casing, the carrier being connected to a crank movement indicated generally at 42 by means of which it is reciprocated. As shown, the carrier has mounted thereon an annular magnet 43 through which it passes, the same being located in an enlarged portion of the casing as shown, and within the carrier, is loosely mounted an impact element 44 constituting the armature of the magnet. The axial portions 44^a of the impact element are mounted to slide in a bearing sleeve 45 secured in and to the upper part of the carrier, and a head 46 secured in the lower end of the carrier, the latter also serving to retain the impact element in the carrier. It will be apparent that the solenoid being energized, that it will serve by its magnetic influence to couple the impact element or bit to the carrier during the reciprocations of the latter.

What I claim is:

1. The combination of a reciprocatory carrier or field core having separated pole pieces, an impact element moving with the carrier or field core and having magnetizable parts in proximity to said pole pieces, said pole pieces being connected by means serving to make gaps in the magnetic circuit, and a fixed electromagnet acting through said pole pieces to couple the reciprocating carrier or field core and impact element to cause them to move in unison.

2. In combination with a fixed electromagnet, a reciprocatory carrier or field core having mechanically connected separated pole pieces forming part of the magnetic circuit of said electromagnet, and a movable impact element closing the magnetic circuit from pole piece to pole piece whereby said impact element will be caused to move in unison with the reciprocatory carrier or field core.

3. The combination with a coil of a field core within the field of said coil, said field core consisting of magnetizable pole pieces separated and connected by a non-magnetic

connecting piece, means for causing the field core to be reciprocated, and a movable armature within said field core.

4. The combination of a reciprocatory carrier or field core having separated pole pieces connected by a non-magnetic connecting piece, an impact element moving with the carrier or field core and having magnetizable parts in proximity to said pole pieces, and a fixed electromagnet acting through said pole pieces to couple the reciprocating carrier or field core and impact element to cause them to move in unison.

5. The combination of a fixed electromagnet, a reciprocatory carrier or field core having pole pieces arranged in the magnetic circuit of said magnet and non-magnetically connected together, and a magnetizable impact element movably mounted in said pole pieces, whereby the magnetic circuit of the electromagnet, through the pole pieces and the impact element, will couple the impact element and the reciprocatory carrier together.

6. The combination of an annular electromagnet, a hollow cylinder of non-magnetic material mounted to reciprocate within said electromagnet, magnetizable annular pole pieces carried by said cylinder, and a magnetizable impact element movably mounted within the pole pieces.

7. The combination of a casing, an annular electromagnet fixed to said casing, a hollow cylinder of non-magnetic material mounted to reciprocate inside said electromagnet, magnetizable annular pole pieces carried by the cylinder, and a magnetizable impact element movably mounted within the pole pieces.

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