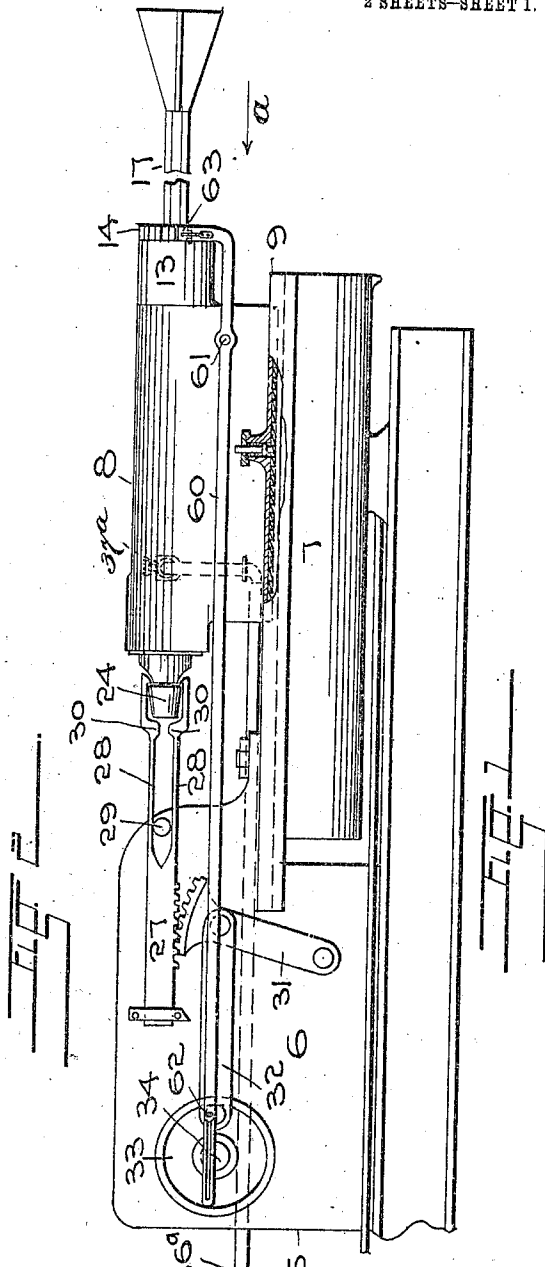
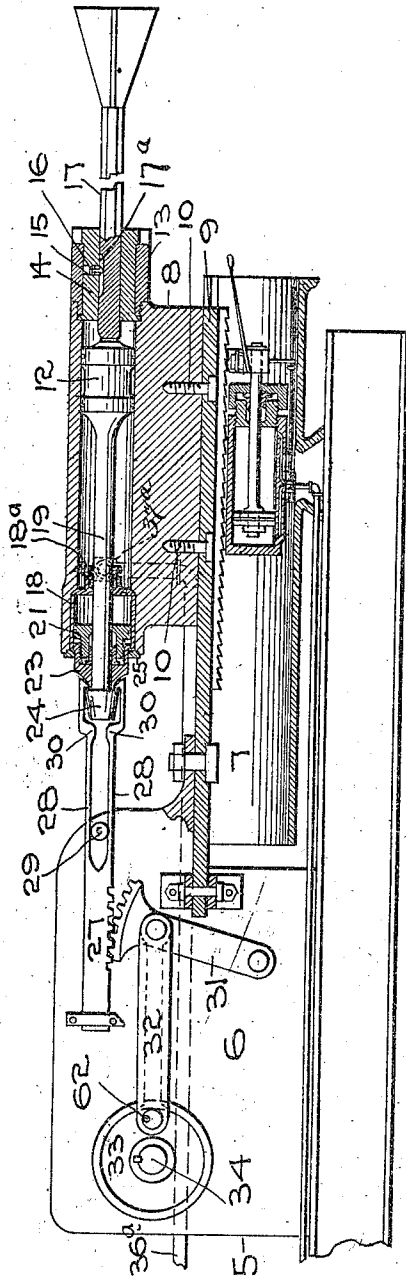


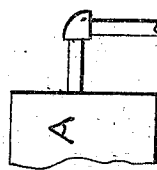
G. R. BENNETT.  
 IMPACT ENGINE.  
 APPLICATION FILED MAY 4, 1908.

1,063,240.

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 2 SHEETS—SHEET 1.



WITNESSES:  
*T. M. Kemp*  
*John Rollander*



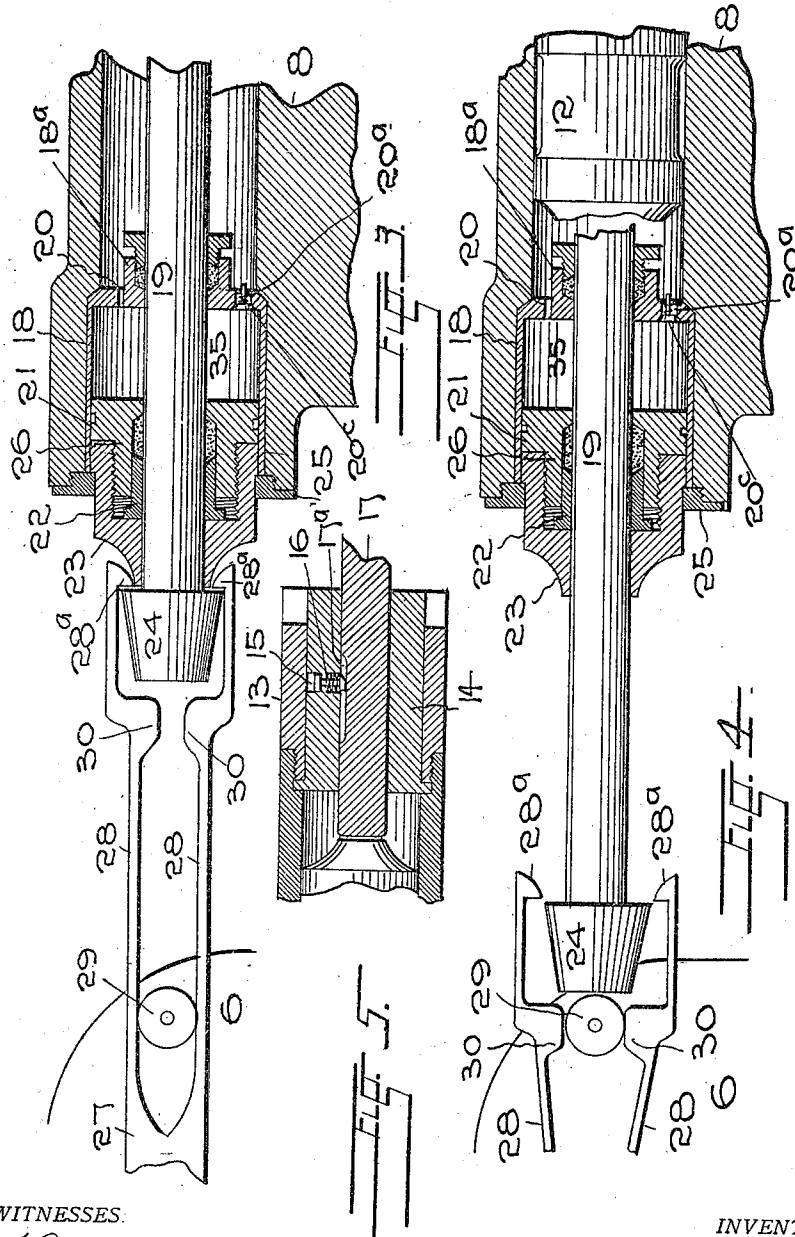
INVENTOR.  
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# UNITED STATES PATENT OFFICE.

GEORGE R. BENNETT, OF DENVER, COLORADO.

## IMPACT-ENGINE.

1,063,240.

Specification of Letters Patent.

Patented June 3, 1913.

Application filed May 4, 1908. Serial No. 430,773.

*To all whom it may concern:*

Be it known that I, GEORGE R. BENNETT, a citizen of the United States of America, residing at Denver, in the county of Denver and State of Colorado, have invented certain new and useful Improvements in Impact-Engines, of which the following is a specification.

My invention relates to certain new and useful improvements in impact engines of the class characterized by a suitable housing inclosing a reciprocatory hammer or piston, which, being actuated by a fluid, motive agent, delivers a succession of impacting blows upon the shank of a drill or other tool, loosely introduced into one of the ends of the housing.

The object of the present invention is to provide an engine of the class named in which the compression chamber, included in its construction, is, during the operation, continuously supplied with a quantity of motive fluid under compression, the said engine having means adapted to retract the piston and thus further increase the density of the said quantity of fluid which, when the piston is subsequently liberated, will, by its expansive action, impart a forward impetus thereto, causing it to impinge upon the drill steel or other tool with a force proportionate to the increased effective pressure of the compressed fluid.

The quantity of motive fluid contained in the compression chamber is used repeatedly and is replenished only when, by leakage, condensation, or the radiation of heat resulting from compression, its density is reduced below the predetermined degree of pressure and my engine is, for this reason, most economical in use, while the blow delivered during each reciprocating movement of the hammer is, by reason of the increased degree of density of the expansive fluid, more effective than in an engine in which the motive agent is exhausted after each impact or in one in which atmosphere compressed by the rearward movement of the piston, is utilized to impart to the latter the impetus required to forcibly engage the tool.

Further objects of my invention are to provide an apparatus of the class named, the mechanical parts of which combine simplicity of construction with great practicality in use; to provide means whereby excessive forward motion of the piston is automatically prevented from being communi-

cated to the stationary parts of the engine; to construct a simple and highly effective device whereby the engine is fed toward the face of the material engaged by the working end of its tool, and to furnish an automatic contrivance to impart a partial rotation to the latter during each movement of the hammer.

I attain these objects by the mechanism illustrated in the accompanying drawings in the various views of which like parts are similarly designated and in which—

Figure 1—represents a side elevation of the improved engine, Fig. 2—a similar view with the piston-housing, feed cylinder and the adjacent portion of the supporting base in section, Figs. 3 and 4—enlarged sectional views of the rear portion of the hammer-housing with the hammer-rod and the retraction means shown in their extreme positions, and Fig. 5—an enlarged, fragmentary, sectional view of the front end of the housing.

Referring to the drawings let the reference numeral 5 designate a stationary base, suitably secured and comprising an upright frame 6 upon which the actuating mechanism is mounted and a therewith detachably connected, trough shaped, horizontal member 7 upon which the hammer housing is slidably supported. This housing consists of two superposed members 8 and 9 which are connected by means of bolts 10, the upper member being formed with a horizontal, cylindrical bore in which the piston or hammer 12 is fitted.

The front portion of the bore is slightly enlarged and formed with a screw thread for the reception of a correspondingly threaded, hollow cylindrical extension 13 which serves as a support for the tool chuck 14. Said chuck has at its rearmost end, a surrounding flange which, projecting between the shoulder in the bore formed by the enlarged portion above referred to, and the adjacent end of the extension 13, holds the chuck against longitudinal movement while allowing it to rotate within the part in which it is supported. The chuck is formed at its foremost end, with a series of ratchet teeth which serve to impart a rotary movement to the tool, as will hereinafter be described, and is furthermore provided with an opening 15 which extends laterally through its circumferential wall and is occupied by a headed, spring-actuated pawl

36, the lower, beveled extremity of which projects, in practice, beyond the inner surface of the chuck and into a longitudinal groove 17<sup>a</sup> in the shank of the tool 17. The pawl 16, being thus arranged, connects the tool with the chuck against independent rotation while permitting it to move longitudinally for a distance limited by the length of the slot 17<sup>a</sup>, and the tool may, at the same time be withdrawn from the chuck by pulling it forcibly outwardly, or replaced therein by pushing it inwardly, each of which actions will cause the pawl 16 to temporarily recede into the passage through which it projects.

The rearmost portion of the cylinder bore is enlarged and fitted with a bushing 18 whose closed inner extremity abuts against the shoulder formed by the enlargement of the bore and is provided with a centrally disposed stuffing box 18<sup>a</sup> through which the rod 19, which forms part of the hammer 12, projects. The closed end of the bushing 18 is furthermore provided with two apertures 20 and 20<sup>a</sup> of different diameters, the larger one 20<sup>a</sup> of which, is formed with a valve seat to receive the spring controlled, inwardly moving check valve 20<sup>c</sup>.

Slidably fitted within the bushing 18 is a piston 26 which being composed of a stuffing box 21, a therewith associated gland 22 and a driving nut 23 in engagement with the latter, forms an air tight bearing for the before mentioned hammer rod whose outer extremity, extending beyond the housing 8, terminates in an enlarged, conical head 24. A nut 25 screwed into the threaded outermost portion of the enlargement of the bore in the hammer-housing, secures the bushing and also limits the outward movement of the piston 26 by engagement with a circumferential ridge on the driving nut 23, which forms part thereof.

Slidably mounted upon the upright 6 of the base of the machine and in axial alignment with the hammer-rod 19, is a rack 27, terminating in a pair of spring jaws 28, the free extremities of which embrace the head 24 of the hammer-rod 19 and are formed with inwardly turned bills 28<sup>a</sup> to engage the foremost vertical face thereof. The resilient jaws 28 of the rack 27 are engaged and supported by an interposed roller 29 which is rotatably mounted upon the upright 6 and which, by engagement with the partly inclined edges of inwardly projecting bosses 30 on the jaws, serves to diverge the latter when in their rearmost position, for the purpose of releasing the head 24 which, normally, is engaged thereby. The teeth of the rack 27 are in mesh with those on the segmental extremity of a rocker arm 31, whose opposite end is pivotally secured upon the upright 6 and which is connected by means of a pitman 32 with the wrist of

a crank-wheel 33 upon a shaft 34 which is operatively connected with a conveniently located motor or other source of energy.

The portion of the interior of the housing 8, between the hammer and the closed extremity of the bushing 18, which will be termed the compression chamber of the engine, is, during the operation of the apparatus, in continuous communication with an air-compressor, steam boiler or other source of motive fluid, (denoted in Fig. 1 of the drawings by the letter A) with which it is connected by means of a conduit 36<sup>a</sup>. The motive fluid which is thus continuously conveyed under pressure into the compression chamber normally maintains the hammer 12 in its foremost position in engagement with the extremity of the tool shank 17 which protrudes beyond the chuck 14.

During each revolution of the shaft 34, the rack 27, whose resilient jaws 28 engage the head 24, as hereinbefore described, draws the piston 12 rearwardly, to further compress the motive fluid confined between its end and that of the bushing 18, until at the end of its stroke the jaws 28, by engagement of the bosses 30 with the roller 29, are spread apart to liberate the piston which, impelled by the expansive force of the compressed fluid, is projected in the opposite direction to forcibly impinge upon the end of the tool 17, which, in consequence, penetrates the substance engaged by its opposite extremity. As the shaft 34 revolves continuously, the drill steel or other tool will thus be subjected to a rapid succession of violent concussions and the quantity of fluid contained in the compression chamber, which produces this effect, is used repeatedly, being maintained at an even pressure by constant communication of the said chamber with the source from which it is derived. The auxiliary chamber 35, formed in the bushing 18 between its closed end and the opposite face of the piston 26 is likewise filled with motive fluid which flows thereinto through the valve-controlled opening 20<sup>a</sup> and if, by reason of a diminished resistance to the progress of the tool, in the substance engaged by its working extremity, the latter's longitudinal movement exceeds its predetermined length, the forward motion of the hammer is automatically arrested by the engagement of the head 24 on the rod 19 with the opposed end of the nut 23, which, forming part of the piston 26, forces the latter inwardly against the air confined in the auxiliary chamber 35, which having no outlet other than the small aperture 20, provides a cushion which receives the impact of the hammer and thus prevents the latter from violent contact with the chuck 14 at the foremost end of the bore in which it travels. As the interior diameter of the bushing 18 exceeds that of the bore in the

housing 8, the air pressing upon the larger area of the piston 26, will at once return the hammer to its normal position of rest.

To impart to the tool 17 the partial rotation required in the production of a circular hole in the material upon which it impinges, I have provided a lever 60, which is fulcrumed at 61 upon the side of the piston housing 8. One end of this lever has a longitudinal slot through which projects a supplementary wrist 62 on the crank wheel 33 which preferably is secured into the wrist pin which engages the pitman 32. The opposite extremity of the lever carries a pawl 63, which, by the action of a spring, is held in constant engagement with the peripheral ratchet teeth upon the protruding portion of the chuck 14, so that, during each revolution of the shaft 34, the latter revolves a distance equal to the length of one or more of its teeth, carrying the tool, which projects through its bore, with it.

It will be understood that my invention is applicable with equal results to a drilling machine of the class in which the drill steel is directly connected with the operating mechanism, the piston 12 being in this case provided with means to grip the extremity of the tool which has a reciprocatory movement in a bearing at the end of the housing, the equivalent of the chuck 14 in the present construction.

As the operation of the apparatus has been referred to at intervals in the course of the foregoing description, no further explanation with respect thereto will be necessary at this point, and it should be understood that, while I have shown and described my invention in the best form now known to me, variations in the arrangement and construction of the various parts included in my machine, may be availed of within the spirit of my invention.

Having thus described my invention what I claim is:—

1. The combination, with a source of expansible fluid, of a housing communicating therewith, and including principal and auxiliary chambers having port communication with each other, an element disposed for reciprocation in the principal chamber and having a member extending through the auxiliary chamber, means for propelling said element against the fluid contained in said housing, a member movable within the auxiliary chamber, and means provided upon the first-named member for actuating the second-named member during excess movement in the working stroke of said element, whereby the fluid contained in said auxiliary chamber is converted into a cushion to oppose such excess movement.

2. The combination, with a source of expansible fluid, of a housing communicating therewith and including principal and aux-

iliary chambers having port communication with each other, an element disposed for reciprocation in the principal chamber, means for propelling said element against the fluid contained in said housing, an element disposed for reciprocation in the auxiliary chamber for converting the fluid contained therein into a cushion during excess movement in the working stroke of the first named element, to oppose such movement, and means for actuating the second-named element.

3. The combination, with a housing divided into communicating chambers, of means for conducting motive fluid thereinto, a piston disposed for reciprocation in one of said chambers, and having a rod extending through the other chamber, a piston disposed for reciprocation in the second chamber, means provided upon said rod for engaging the second piston, to actuate the same during excessive movement of the first piston in one direction and thereby convert the fluid contained in said second chamber into a cushion to oppose such excessive movement, and means for propelling said rod and piston in the opposite direction against the action of the fluid, and for liberating the same at a predetermined point in such movement.

4. The combination, with a housing divided into communicating chambers, of means for conducting motive fluid thereinto, a piston disposed for reciprocation in one of said chambers and having a rod extending through the other chamber, a piston disposed for reciprocation in the second chamber, a head provided upon said rod and adapted to impact against the second piston to actuate the same during excessive movement of the first piston in one direction, and thereby oppose such excessive movement, and means for propelling said rod and piston in the opposite direction against the action of the fluid and for liberating the same at a predetermined point in such movement.

5. The combination with a source of expansible fluid, of a housing in communication therewith and including principal and auxiliary compression chambers, communicating by a valve-controlled air inlet and an outlet of less diameter, an element disposed for reciprocation within the principal chamber and having a member projecting through the auxiliary one, a piston, whose area exceeds that of the element, mounted for reciprocation in the auxiliary chamber, means to propel the said element against the fluid contained in the housing, the said member being adapted to impingingly engage the said piston during motion of the said element in opposite direction in excess of a predetermined stroke.

6. The combination with a source of ex-

pansible fluid, of a housing in communication therewith and including principal and auxiliary compression chambers, communicating by a valve-controlled air inlet and an outlet of less diameter, an element disposed for reciprocation within the principal chamber and having a member projecting through the auxiliary one, a piston, whose area exceeds that of the element, mounted for reciprocation in the auxiliary chamber, and comprising a stuffing box and therewith associated gland whereby the said member

is supported, means to propel the said element against the fluid contained in the housing, its member being adapted to impingingly engage the piston during motion thereof in opposite direction in excess of a predetermined stroke. 15

In testimony whereof I have affixed my signature in presence of two witnesses. 20

GEORGE R. BENNETT.

Witnesses:

G. J. ROLLANDET,  
K. M. STUMP.