

No. 752,819.

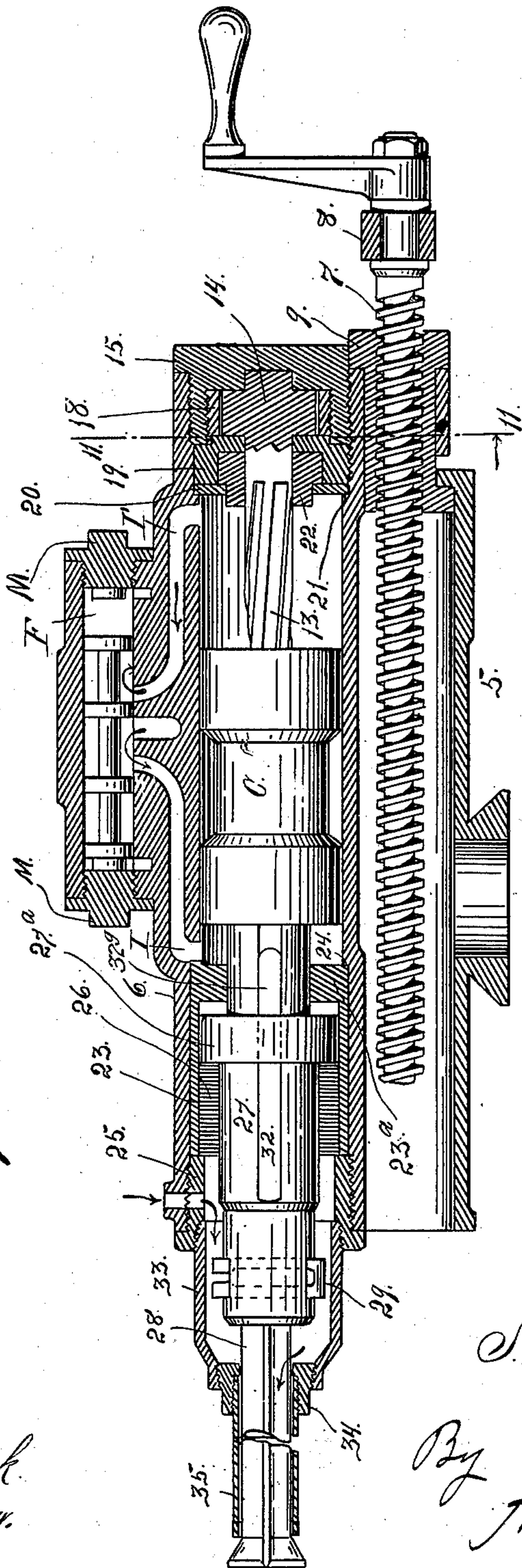
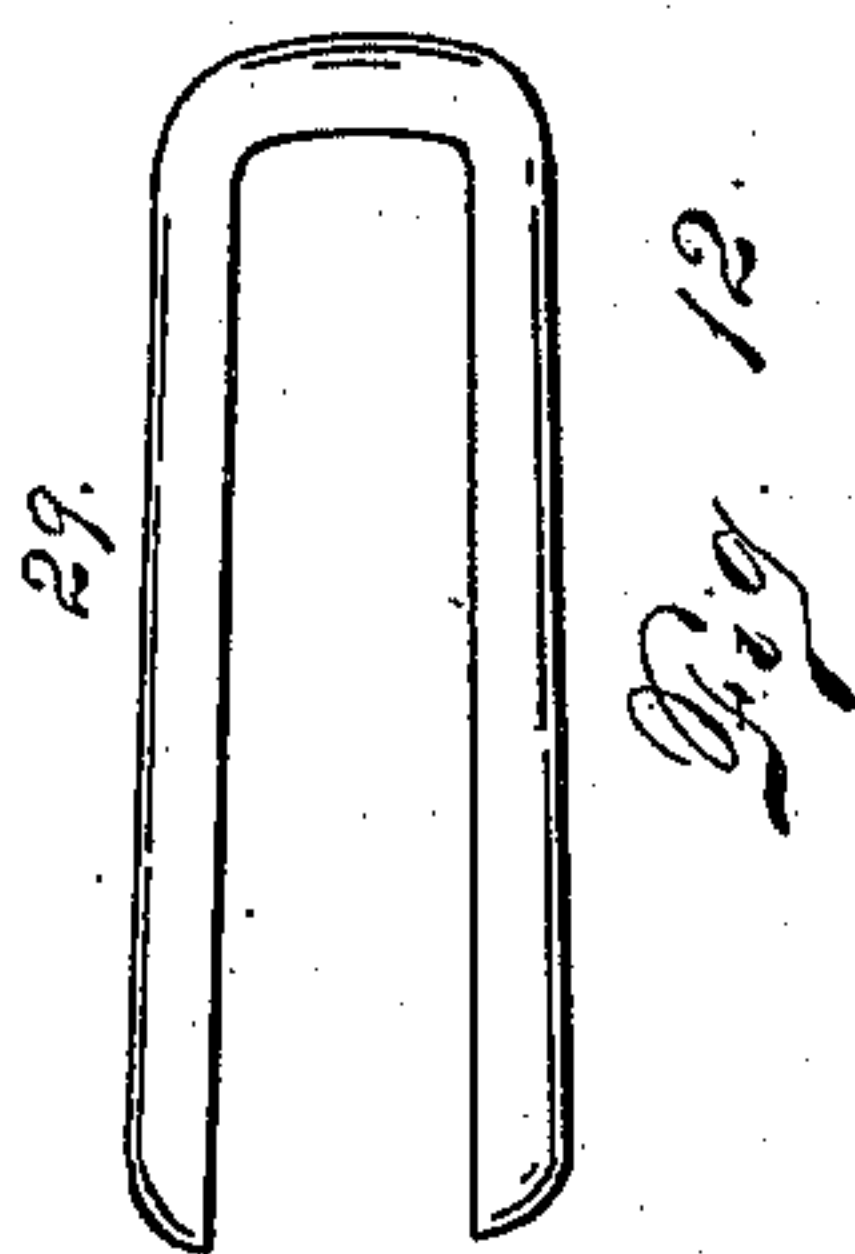
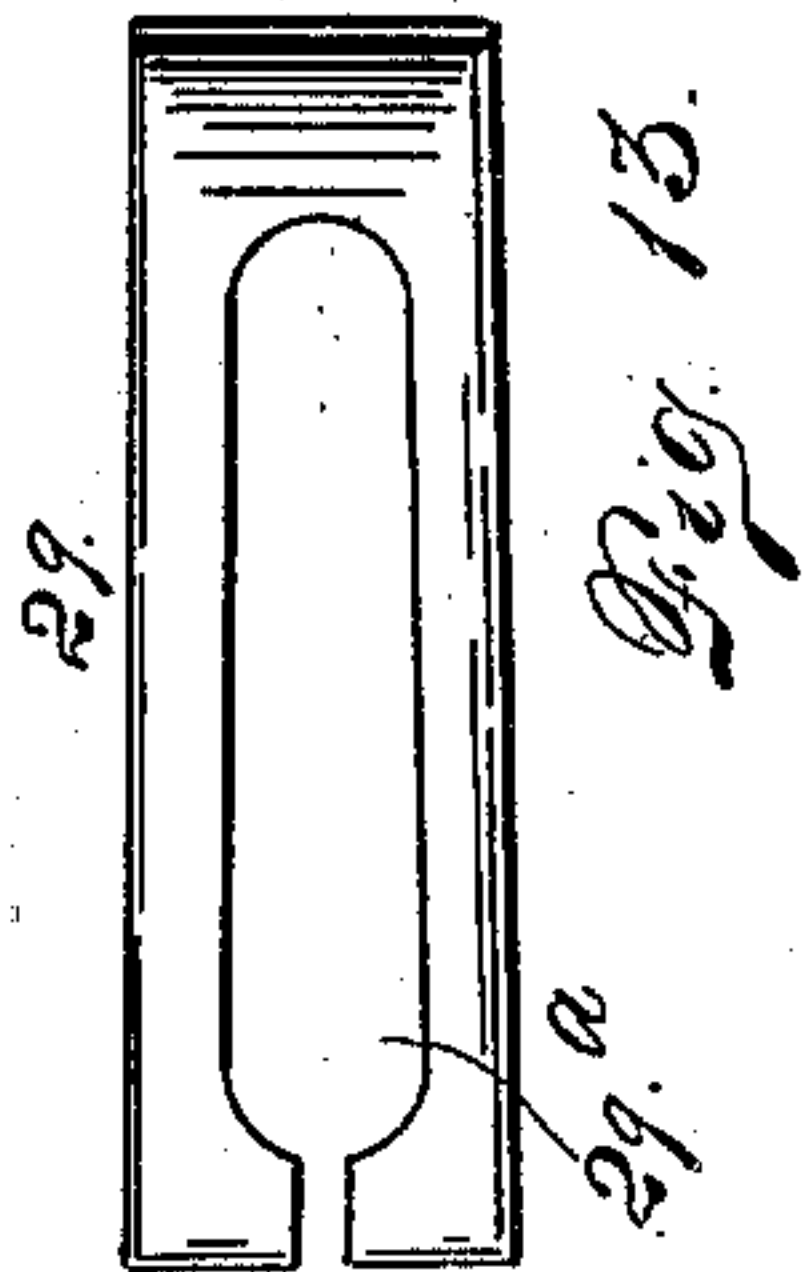
PATENTED FEB. 23, 1904.

S. W. BROTHERS.  
ROCK DRILLING MACHINE.

APPLICATION FILED FEB. 24, 1903.

NO MODEL.

4 SHEETS—SHEET 1.



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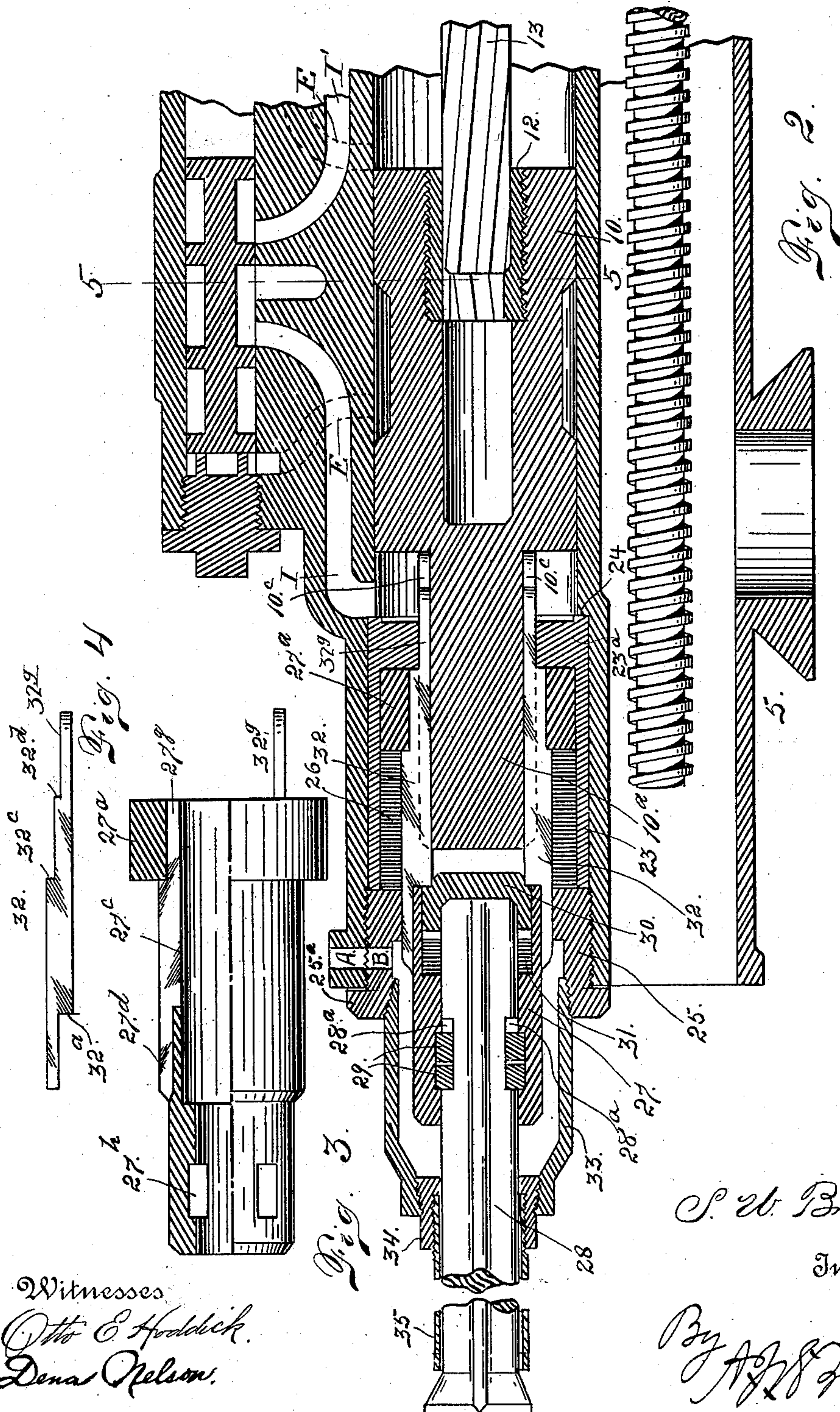
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4 SHEETS—SHEET 2.



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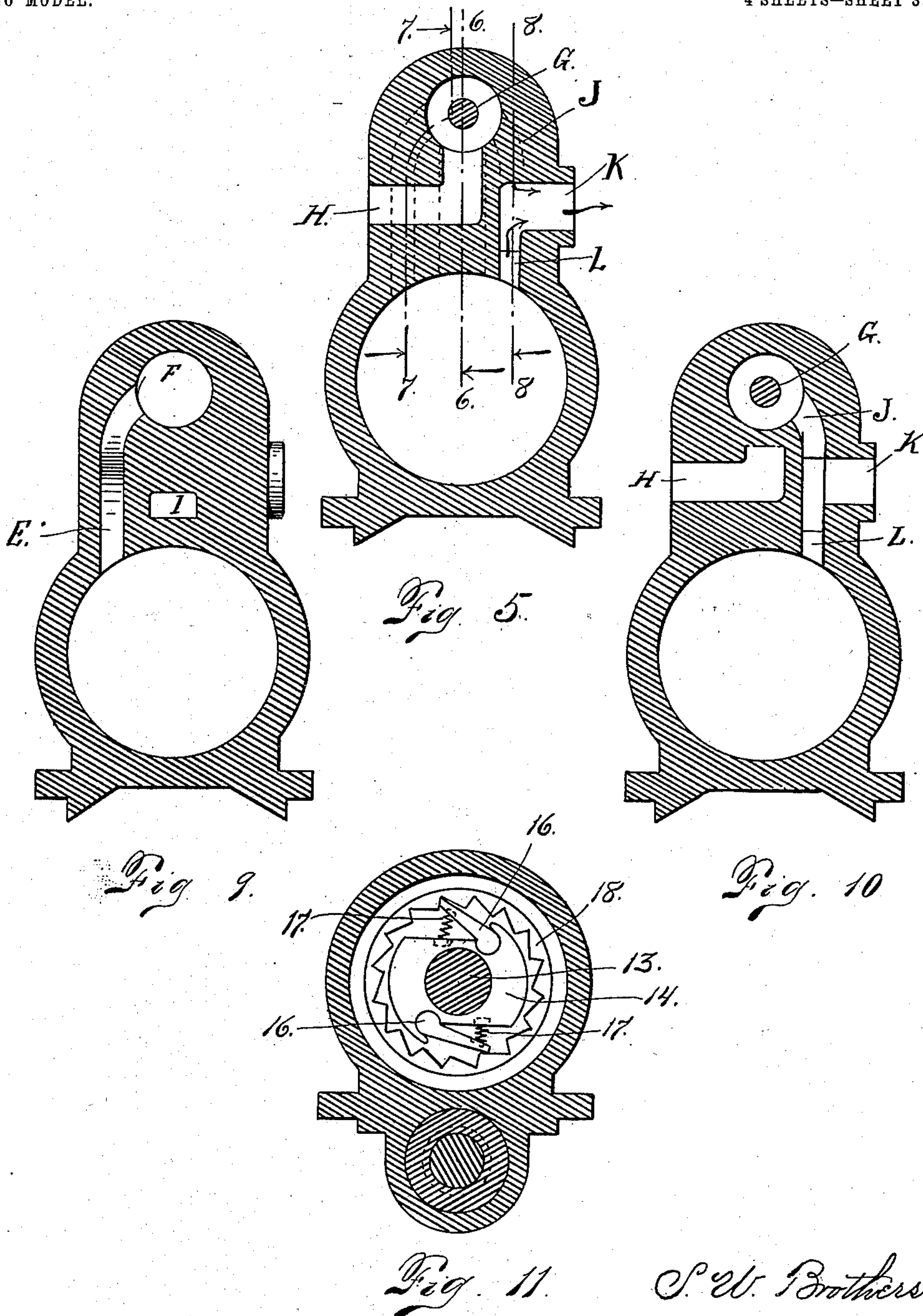
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4 SHEETS—SHEET 3.



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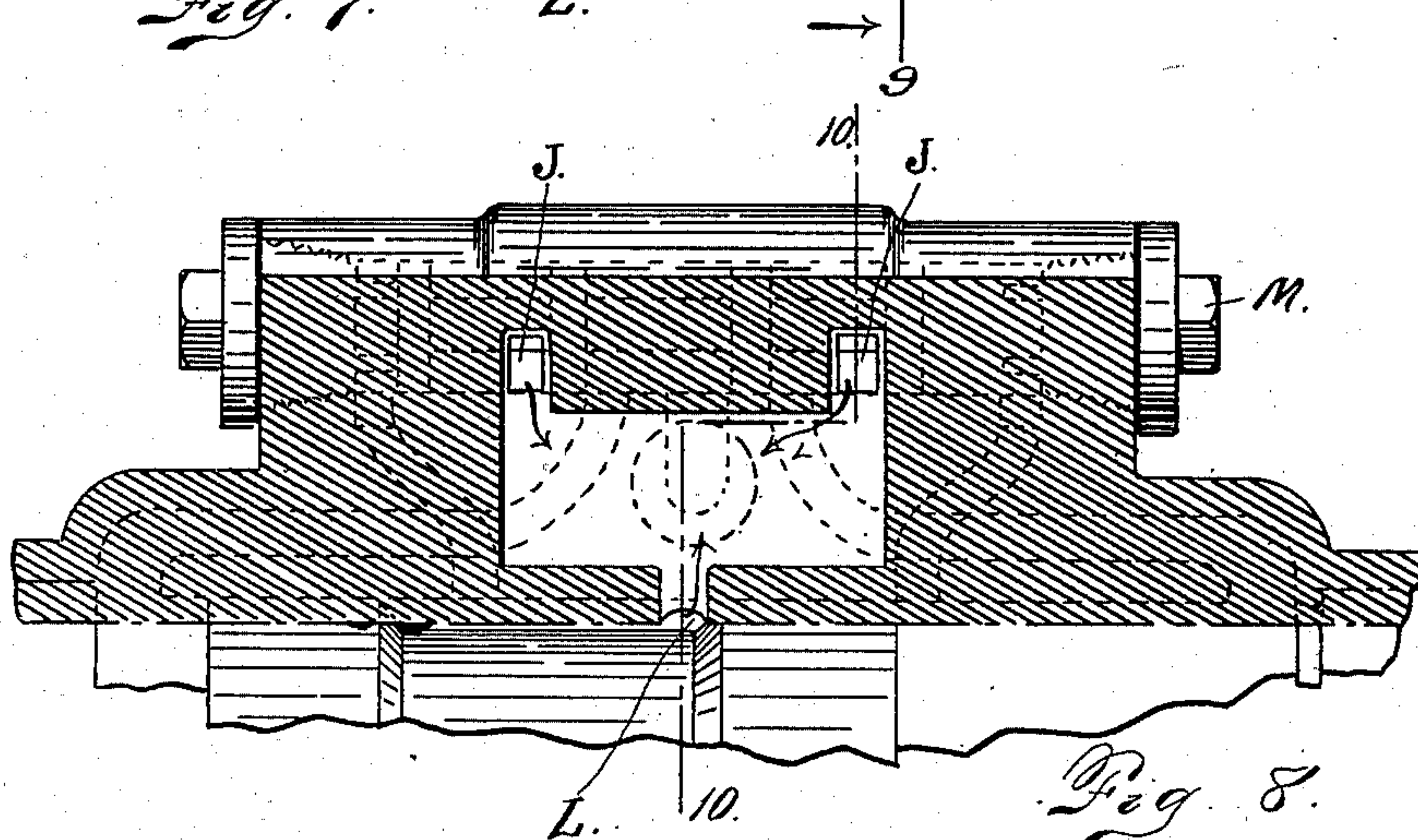
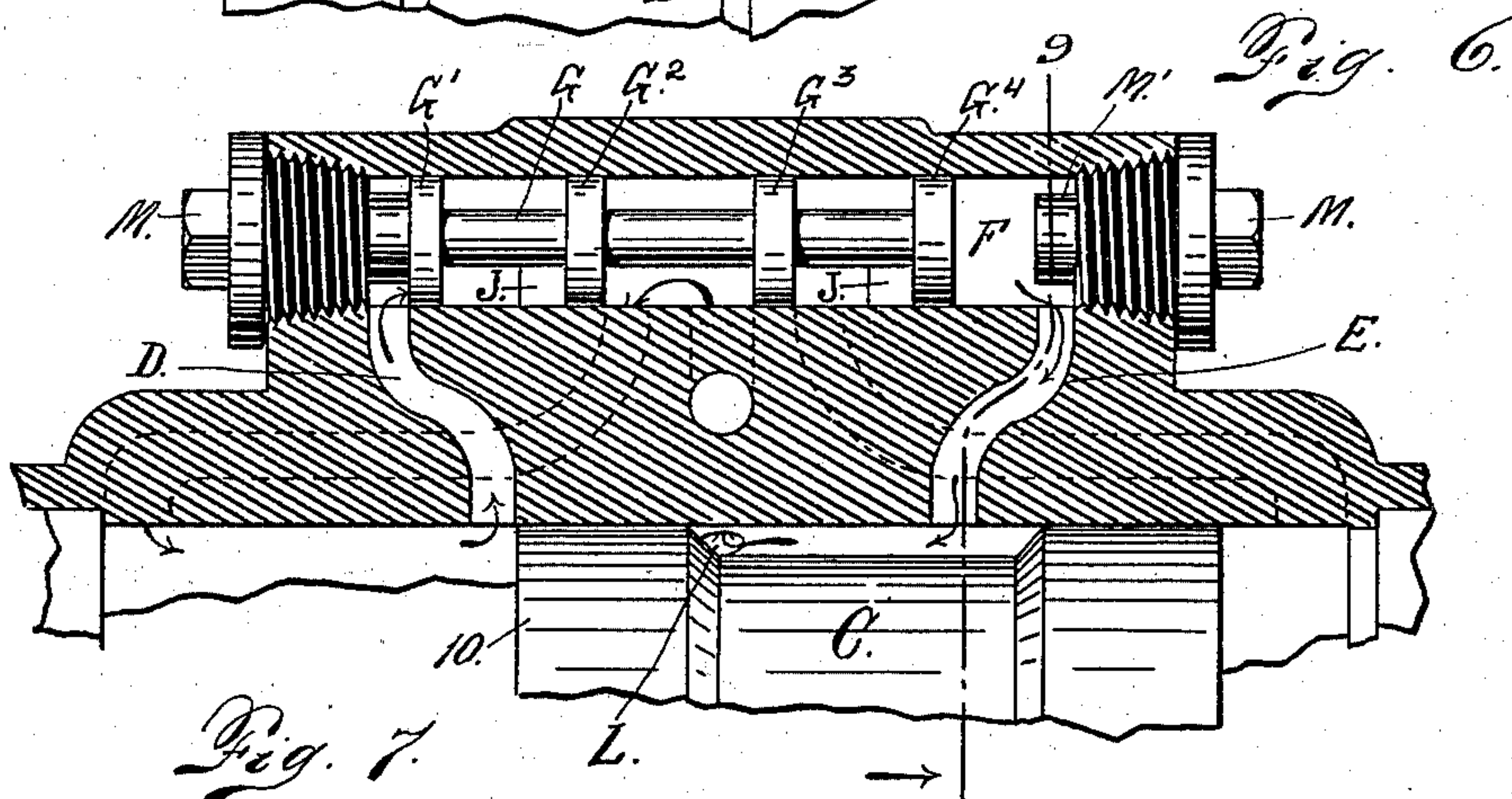
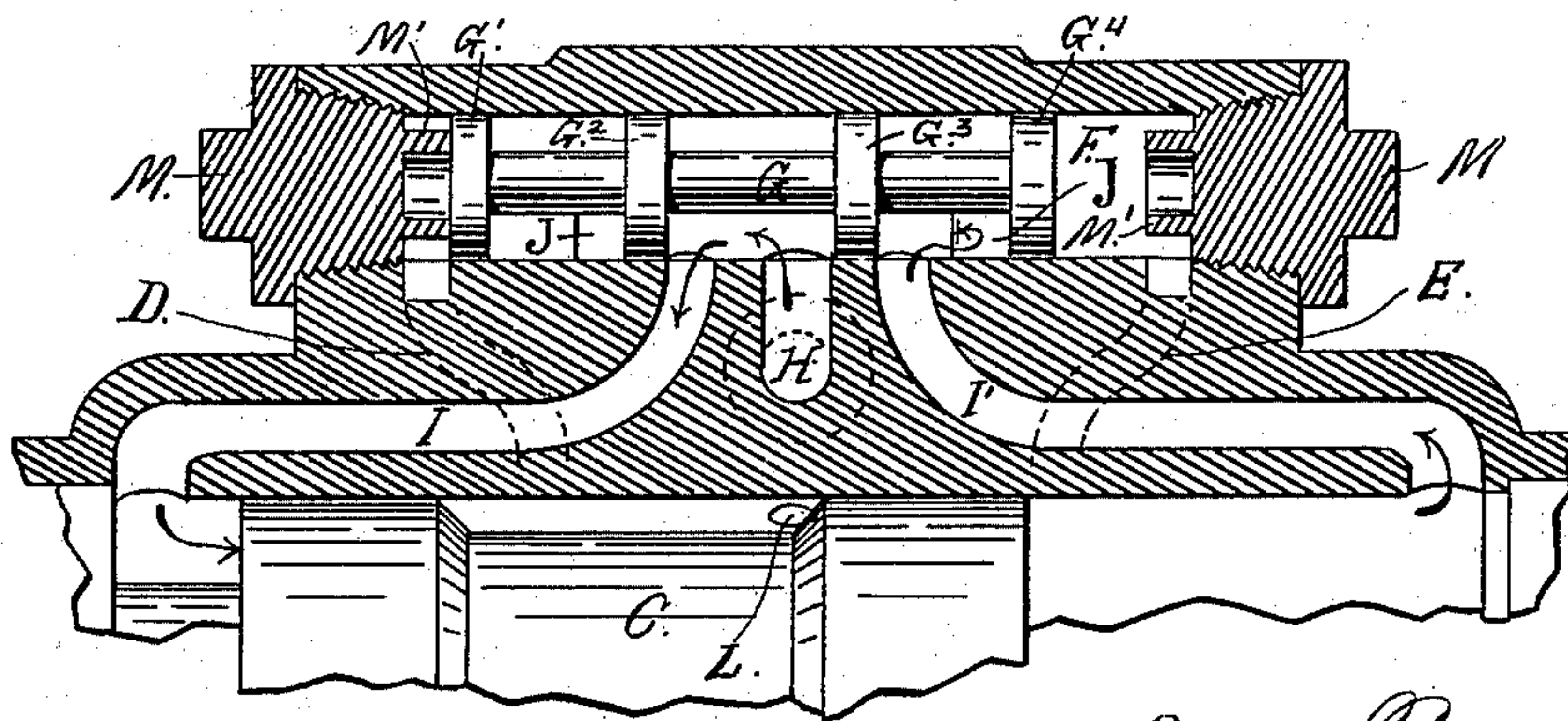
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4 SHEETS—SHEET 4.



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# UNITED STATES PATENT OFFICE.

SANFORD W. BROTHERS, OF DENVER, COLORADO.

## ROCK-DRILLING MACHINE.

SPECIFICATION forming part of Letters Patent No. 752,819, dated February 23, 1904.

Application filed February 24, 1903. Serial No. 144,889. (No model.)

*To all whom it may concern:*

Be it known that I, SANFORD W. BROTHERS, a citizen of the United States of America, residing in the city and county of Denver and State of Colorado, have invented certain new and useful Improvements in Rock-Drilling Machines; and I do declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, and to the letters and figures of reference marked thereon, which form a part of this specification.

My invention relates to improvements in rock-drilling machines; and it consists of the features, arrangements, and combinations hereinafter described and claimed, all of which will be fully understood by reference to the accompanying drawings, in which is illustrated an embodiment thereof.

In the drawings, Figure 1 is a vertical longitudinal section taken through my improved machine, the reciprocating parts being shown in elevation. Fig. 2 is a fragmentary view of the same on a larger scale. Fig. 3 is a detail view of the chuck, shown partly in section and on the same scale as in Fig. 2. Fig. 4 is a detail view of one of the keys for locking the piston and chuck together during rotary action. Fig. 5 is a cross-section taken on the line 5 5, Fig. 2, the piston being removed. Figs. 6, 7, and 8 are sections taken on the lines 6 6, 7 7, and 8 8, respectively, of Fig. 5 viewed in the direction of the arrows. Fig. 9 is a section taken on the line 9 9, Fig. 7. Fig. 10 is a section taken on the line 10 10, Fig. 8. Fig. 11 is a section taken on the line 11 11, Fig. 1. Figs. 12 and 13 are detail views of the key for locking the drill-bit or steel in place in the shank. These views are taken at right angles to each other.

The same reference characters indicate the same parts in all the views.

Let the numeral 5 designate the guide-shell, upon which is slidably mounted the casing 6, which is moved back and forth on the shell by means of a feed-screw 7, journaled at 8 and threaded in a depending nut 9, mounted on the casing in the usual manner. Located within the cylindrical chamber of the casing is a

reciprocating piston 10, into which is screwed from the rear a nut 12, interiorly grooved to engage a raffle-bar 13, whose rear extremity is provided with a head 14, located in a chamber formed in the cap 15, screwed into the rear extremity of the casing. This head 14 carries two dogs or pawls 16, engaged by springs 17, adapted to press them outwardly. Into the head or cap 15 from the inside is screwed by a left-hand thread a ratchet-bushing 18, whose teeth are engaged by the dogs 13, which lock the raffle-bar against rotation in one direction—namely, toward the left, as indicated by the arrow, referring to Fig. 11 of the drawings. By reason of the left-hand thread of the ratchet-bushing the latter is prevented from unscrewing from the cap during the strain or pressure thereon incident to the rearward movement of the piston, whose tendency would be to turn the raffle-bar toward the left, referring to Fig. 11; but as the dogs lock the raffle-bar from turning in this direction the piston, together with the chuck connected therewith, as hereinafter explained, is compelled to rotate toward the right, still referring to Fig. 11 of the drawings. During the forward movement of the piston, however, the raffle-bar is free to rotate in the head and the piston moves forwardly without any rotary movement, as will be readily understood.

In front of the head 14 of the raffle-bar is located a sleeve 19, which is locked in place by a washer 20, engaging a shoulder 21 on the casing in front of the washer. A rubber cushion or buffer 22 surrounds the raffle-bar, engages the sleeve 19 in the rear and the washer 20 in front, the latter holding the buffer in position. This buffer protrudes forwardly through the washer, whereby it is adapted to engage the piston during the rearward stroke of the latter. The forward portion 10<sup>a</sup> of the piston is reduced or made smaller than its body part. This reduced portion is fitted into a collar 23<sup>a</sup> of a bushing 23, the latter being fitted into the forward portion of the casing and engaging a shoulder 24 thereon, located in the rear of the collar and locking the bushing against rearward movement. This bushing is locked in place from the front by a sleeve 25, screwed into the front end of the



casing. This sleeve 25 is thicker than the bushing and forms a stop in front for a rubber buffer 26, whose rear extremity engages a shoulder 27<sup>a</sup>, formed on the rear end of the  
 5 chuck 27. This chuck is hollow and is entered from the rear by the reduced portion 10<sup>a</sup> of the piston and from the front by the drill, steel tool, or bit 28.

The drill-bit is locked in the chuck by a U-  
 10 shaped key 29, inserted in slots 27<sup>b</sup>, formed in the forward extremity of the chuck and engaging recess 28<sup>a</sup>, formed in the opposite sides of the bit, whereby the latter is prevented from slipping out of the chuck. Each arm of  
 15 the U-shaped key is bifurcated, as shown at 29<sup>a</sup>, (see Fig. 13,) and the key is so arranged that these arms form a yielding stop to the bit when the latter has reached the forward limit of the movement allowed by its key en-  
 20 gaging its recesses. These recesses 28<sup>a</sup> are of greater length than the width of the key to allow the drill-bit a normal working movement without moving the chuck longitudinally. When the cutting extremity of the bit is  
 25 pressed against the rock, the recesses 28<sup>a</sup> extend rearwardly from the key, (see Fig. 2,) whereby the bit is allowed a predetermined forward movement without striking the key, which movement is sufficient for ordinary  
 30 purposes—that is to say, when cutting rock of uniform hardness. If, however, the bit strikes a soft spot in the rock, the piston or hammer will drive it abnormally forward, bringing the shoulders at the rear extremities  
 35 of the recesses 28<sup>a</sup> into contact with the key, which yields by virtue of its bifurcated arms and prevents injury to the mechanism by shock, concussion, or jar. This shock is further relieved by the rubber buffer 26, against  
 40 which the shoulder 27<sup>a</sup> of the chuck bears, as aforesaid.

Located within the chuck and fitting over the rear extremity of the bit is a cup-shaped cap 30, upon which the forward extremity of  
 45 the piston-hammer strikes or impinges in delivering its blows to the bit during the operation of the machine. This blow-receiving cap enters an interior annular recess formed in the chuck, and in this recess forward of the  
 50 cap is located a rubber buffer 31. Normally or when the drill-bit is at its rearward limit of movement there is a space between the cap 30 and the buffer 31; but this space is of less width than the space in the rear of the key 29.  
 55 Hence the cap will strike the buffer 31 before the drill-bit strikes the key. It will therefore be understood that the buffer 31 and the yielding key 29 cooperate to cushion the blows of the hammer-piston.

60 The manner of connecting the chuck with the piston, whereby as the latter is rotated by virtue of its engagement with the raffle-bar a corresponding movement will be imparted to the chuck and drill-bit, will now be described.  
 65 This chuck is slotted, as shown at 27<sup>c</sup>, exteri-

only grooved, as shown at 27<sup>d</sup>, and interiorly grooved, as shown at 27<sup>e</sup>, on opposite sides to form ways or seats for keys 32, each of which is provided with shoulders 32<sup>a</sup>, 32<sup>c</sup>, and 32<sup>d</sup>. The shoulder 32<sup>a</sup>, which is foremost, engages  
 70 the shoulder of the chuck forward of the slot 27<sup>c</sup> and projects inwardly to engagement with the rear extremity of the cap 30, whereby the latter is held in place when the parts are assembled. The shoulder 32<sup>c</sup>, which is inter-  
 75 mediate the other two shoulders, engages the collar of the chuck in front, while the shoulder 32<sup>d</sup>, which is rearmost, engages the front face of the collar 23<sup>a</sup> of the bushing 23 when the mechanism is assembled. The rear ex-  
 80 tremities 32<sup>e</sup> of the keys project beyond the chuck. These keys also engage grooves 10<sup>c</sup>, formed in the opposite sides of the reduced portion 10<sup>a</sup> of the piston, whereby the chuck and piston are interlocked and caused to ro-  
 85 tate in unison, while the piston is allowed to reciprocate without destroying this interlocking relation.

The sleeve 25 is provided at its forward extremity with a shoulder 25<sup>a</sup>, which engages  
 90 the front end of the casing. Into this front end of the sleeve 25 is screwed a housing 33, whose forward extremity is interiorly threaded to receive a sleeve 34, which is screwed there-  
 95 into. Into this sleeve 34 is screwed the rear extremity of a tube 35, which surrounds the drill-bit and closes the longitudinal grooves of the bit exteriorly, forming ways for water or air introduced by way of registering openings  
 100 A and B, formed in the casing and sleeve 25 and flowing through the housing 33 to the grooves of the bit for the purpose of cleaning out the hole in the rock or removing the chip-  
 105 pings or cuttings formed therein during the drilling operation.

The central portion of the enlarged or body part of the piston is provided with a circumferential recess C, communicating alternately with the short passages D and E, leading from  
 110 the opposite extremities of the chamber F of the reciprocating slide-valve G. This valve consists of a stem provided with four separated disks or enlargements which fit the walls of the valve-chamber. These disks are design-  
 115 ated G<sup>1</sup>, G<sup>2</sup>, G<sup>3</sup>, and G<sup>4</sup>, respectively. The fluid for operating the piston is introduced by way of a port H and passes between the disks G<sup>2</sup> and G<sup>3</sup> of the slide-valve and passes thence by way of a passage I or I' to one or the other  
 120 extremity of the piston-chamber, according to the position of the piston. If the latter is at its forward limit of movement, the actuating fluid passes through the passage I to the forward extremity of the piston-chamber and drives the piston rearwardly, as indicated in  
 125 Figs. 6 and 7. During the rearward movement of the piston the exhaust from the rear extremity of the piston-chamber escapes through the passage I' into the space between the disks G<sup>3</sup> and G<sup>4</sup> and thence through the  
 130



passage J to the exhaust-port K. As soon as the piston has moved rearwardly far enough to uncover the passage D the fluid flows to the forward extremity of the valve-chamber and drives the valve rearwardly, cutting off the passage I from the inlet-port H and opening communication between the passage I' and the inlet-port. At the same time communication is opened between the passage I and the exhaust-passage J' and closed between the passage I' and the exhaust-passage J. As soon as this occurs the piston begins its forward movement. The exhaust from the extremities of the valve-chamber after entering the groove C escapes to the exhaust-port K by way of a port L.

The extremities of the slide-valve chamber are closed by screw-plugs M, whose inner extremities are provided with caps M', which catch the air and cushion the valve as it reaches its limit of movement in both directions.

From the foregoing description the use and operation of my improved drill will be readily understood. As the piston reciprocates by virtue of the action of the fluid thereon, as heretofore explained, blows are delivered in rapid succession upon the cap 30, covering the rear extremity of the drill-bit, whereby the forward extremity of the latter is made to perform the rock-cutting function. During each rearward movement of the piston the engagement of its nut 12 with the raffle-bar gives the piston a partial rotary movement, which is communicated to the chuck and drill-bit by virtue of the interlocking relation existing between the piston and chuck.

Attention is called to the fact that the tube 35 is connected with the casing through the instrumentality of the two parts 33 and 34, and by virtue of this connection it becomes practicable to quickly gain access to the fastening device 29 for the purpose of detaching a drill-bit from the chuck and substituting another. This is an important feature, since these drill bits or tools soon become dull by usage and must be removed for sharpening purposes. The housing 33 is connected with the part 25 by a right-hand thread, while the sleeve 34 is connected with the housing by a left-hand thread. The tube 35 may be fastened to the part 34 in any suitable manner, whereby the two parts rotate together or act in unison. When it is desired to gain access to the fastening device 29, the part 34, together with the tube 35, is detached from the part 33 by turning the parts 35 and 34 toward the left, whereby they move inwardly toward the chuck. The part 33 is then turned in the same direction, whereby it is caused to move outwardly from the part 25 until detached. The part 33 may then be slipped down over the tube 35, giving the operator access to the fastening device 29 for the purpose stated. It may be assumed that the tube 35 extends to the cutting-head of the bit, in which event

the tube cannot be moved toward the cutting-head for the purpose of detaching the parts. Hence the necessity of the double coupling or the housing connection between the tube and the casing, whereby the housing is detachably connected with the casing and the tube detachably connected with the housing.

Having thus described my invention, what I claim is—

1. In a rock-drilling machine, the combination with the casing and a reciprocating piston therein, of a drill-holding chuck, and means for connecting the piston and chuck whereby they rotate together, but have independent longitudinal movement, said means comprising detachable keys mounted in seats formed in the chuck and engaging seats or grooves formed in the piston.

2. The combination with the casing, of a reciprocating piston, means for rotating the same, a drill-holding chuck, and detachable keys connecting the chuck and piston causing them to rotate in unison, while allowing the two parts independent movement longitudinally.

3. The combination with the casing and drill-bit, of a hollow chuck open at both ends to receive the drill-bit and piston, respectively, a reciprocating piston entering the chuck from the rear and adapted to act on the drill-bit, and detachable longitudinally-disposed interlocking keys engaging seats formed in the adjacent parts of the chuck and piston, whereby the two parts are allowed independent longitudinal movement but caused to rotate in unison.

4. The combination with the casing, of a reciprocating piston having a reduced forward portion, a chuck open in the rear to receive the reduced part of the piston, the chuck being slotted to form a key-seat, and a detachable longitudinally-disposed key located in said seat, said key extending rearwardly from the chuck and engaging a longitudinal groove formed in the reduced part of the piston whereby the latter is allowed to reciprocate independently of the chuck, while the two key-connected parts are caused to rotate in unison.

5. The combination with a suitable casing and drill-bit, of a hollow open-ended chuck revolubly mounted in the casing, locked against rearward movement, and yieldingly retained in front, the drill-bit being inserted in the forward extremity of said chuck and secured to have a limited independent movement, and a reciprocating piston having a reduced forward extremity entering the chuck from the rear and acting on the drill-bit, and means for interlocking the piston and chuck to cause them to rotate in unison while they are allowed independent longitudinal movement, said means comprising detachable keys mounted in the chuck, extending rearwardly therefrom and engaging counterpart seats or grooves formed in the piston.



6. The combination with the casing, of a bushing located in its forward portion, the said bushing engaging a shoulder on the casing for locking the bushing against rearward movement, a sleeve inserted in the forward extremity of the casing for locking the bushing against forward movement, the rear extremity of the bushing having an interiorly-projecting collar, a hollow open chuck inserted in the front end of the casing and whose rear extremity is provided with a collar engaging the interiorly-projecting collar of the bushing, an elastic buffer surrounding the chuck within the bushing and located between the chuck-collar and the rear extremity of the sleeve, and a cap applied to the rear extremity of the drill-bit and occupying a counterbore formed in the chuck, the cap being arranged to receive the blows of the piston-hammer.

7. The combination with a casing, a drill-bit and a piston-hammer, of a drill-chuck open in front to receive the drill-bit and in the rear to receive the piston-hammer, and a cap applied to the rear extremity of the drill-bit and located in a counterbore formed in the chuck and relatively movable in the chuck.

8. The combination with the drill-bit, of an open-ended chuck adapted to receive the drill-bit in front, of means for connecting the drill-bit with the chuck to allow the bit a limited longitudinal movement, a cap located in the chuck and engaging the rear extremity of the drill-bit, a yielding buffer surrounding the drill-bit forward of the cap and engaging an interior shoulder formed around the chuck, and means connected with the chuck for locking the cap against rearward movement.

9. The combination with a drill-bit, of an open-ended chuck, means for locking the drill-bit in the chuck, and a loose cap located in the chuck and engaging the rear extremity of the drill-bit.

10. The combination with a drill-bit, of a chuck adapted to receive and hold the drill-bit, the latter being allowed a limited independent movement, an annular recess formed in the chuck around the drill-bit, a yielding buffer located in said recess, and a relatively movable cap located in the chuck and covering the rear extremity of the drill-bit, the said cap being located in the rear of the buffer and adapted to engage the latter before the drill-bit has reached the limit of independent movement permitted by the chuck.

11. The combination with a drill-bit and chuck, of a U-shaped device adapted to secure the drill-bit in the chuck, the latter having transverse slots to receive the arms of said device, and the drill-bit having recesses formed in its opposite sides, which recesses the arms of the fastening device engage, the arms of said device being constructed to yield when engaged by the rear shoulders of the recesses in the bit.

12. The combination with a drill-bit and

chuck, of a U-shaped fastening device, having bifurcated arms to cause the said arms to yield, the drill-bit having recesses in its opposite sides, the chuck having openings to receive the arms of the folding device, which arms engage the recesses of the drill-bit, the length of the recesses being greater than the width of the arms located in the chuck and applied to the rear extremity of the drill-bit, and a buffer located in the chuck forward of said cap, the latter being arranged to engage the cap before the rear shoulders of the recesses engage the said arms of the fastening device.

13. A U-shaped device for fastening a drill-bit into its chuck, the arms of said device being bifurcated to cause them to yield for the purpose set forth.

14. The combination with the casing, the drill-bit and chuck, of means for connecting the drill-bit and chuck, a tube surrounding the bit, and a coupling interposed between the tube and casing and surrounding the means for connecting the drill-bit and chuck, one extremity of the coupling being detachably connected with the casing and the other extremity of the coupling detachably connected with the tube.

15. The combination with the casing and drill-bit, a chuck, and means for connecting the drill-bit with the chuck, of a tubular covering surrounding the bit, and a housing detachably connected with the casing and surrounding the means for connecting the chuck and drill-bit, the tubular cover being detachably connected with the housing.

16. The combination with the casing, the drill-bit, a tube surrounding the bit, a chuck, and means for connecting the drill-bit with the chuck, of a housing interposed between the tube and the casing, detachably connected with both and surrounding the means for connecting the drill-bit with the chuck.

17. In a rock-drilling machine, the combination with the casing, a tool-holder located in the casing and projecting therefrom, a tool or bit connected with the holder, and a tube surrounding the bit, of a housing interposed between the tube and casing and detachably connected with both, the said housing surrounding the portion of the tool-holder where the connection is made with the tool.

18. In a rock-drilling machine, the combination with the casing, a chuck located therein and projecting therefrom, a drill-bit, a detachable fastener connecting the bit with the chuck, and a tube surrounding the bit, of a housing interposed between the tube and casing and detachably connected with both by means of right and left screw-threads.

In testimony whereof I affix my signature in presence of two witnesses.

SANFORD W. BROTHERS.

Witnesses:

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