No. 843,159. PATENTED FEB. 5, 1907.

J. G. LEYNER.

MULTIPLE HAMMER PISTON ROCK DRILLING ENGINE.

APPLICATION FILED MAY 9, 1905.

4 SHEETS—SHEET 1.

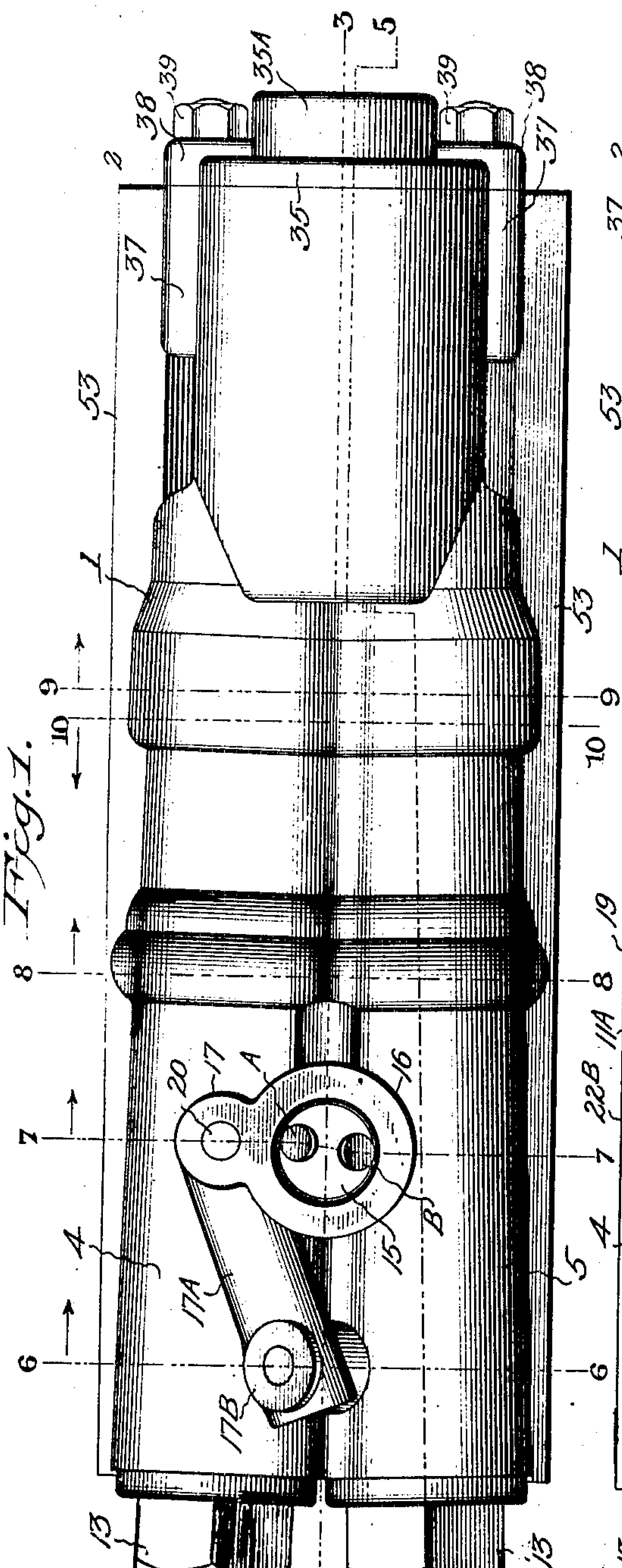

Fig. 1.

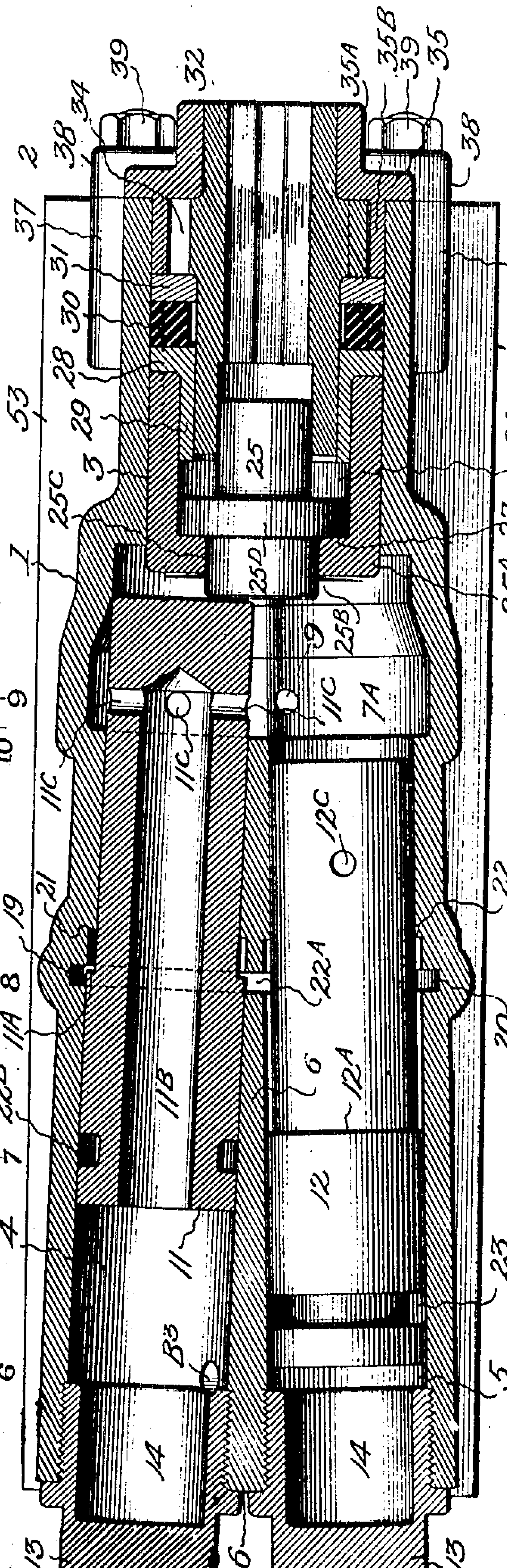

Fig. 2.

Witnesses

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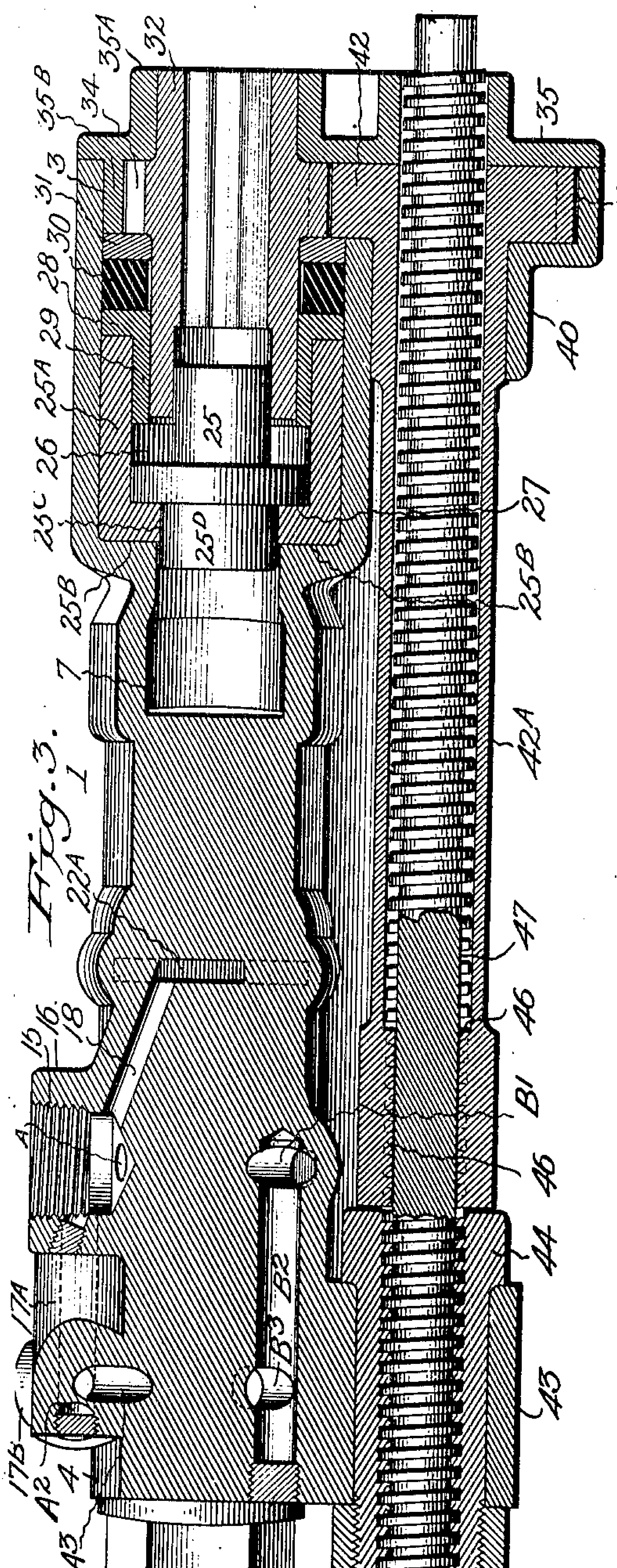

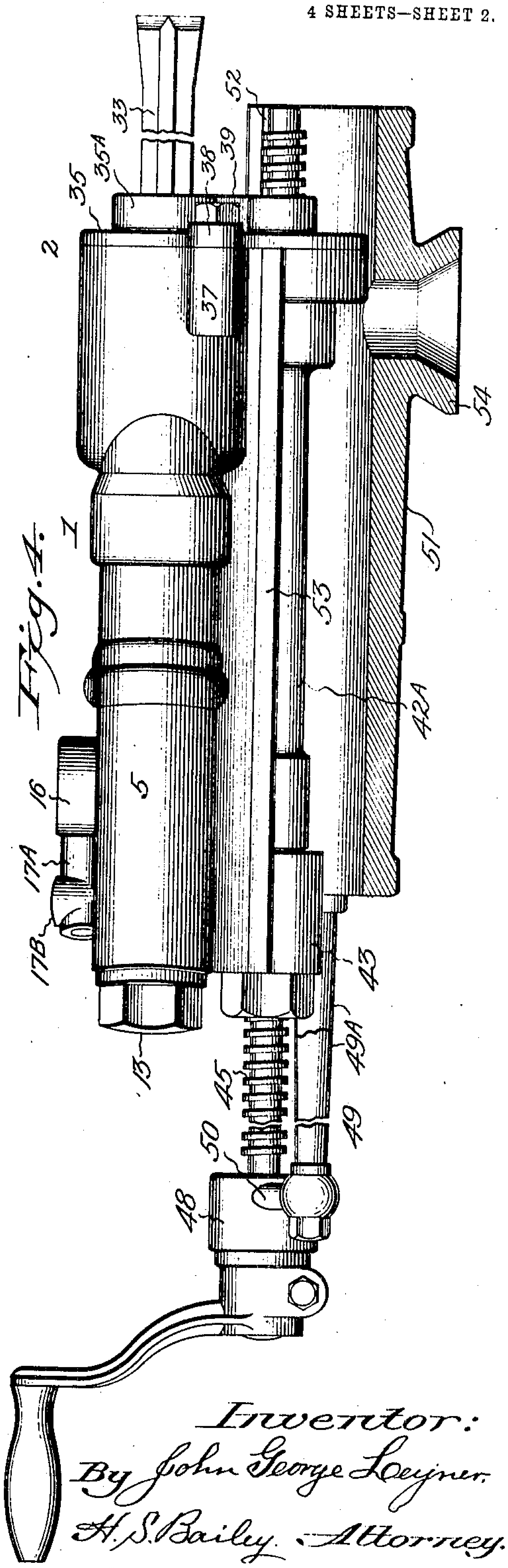

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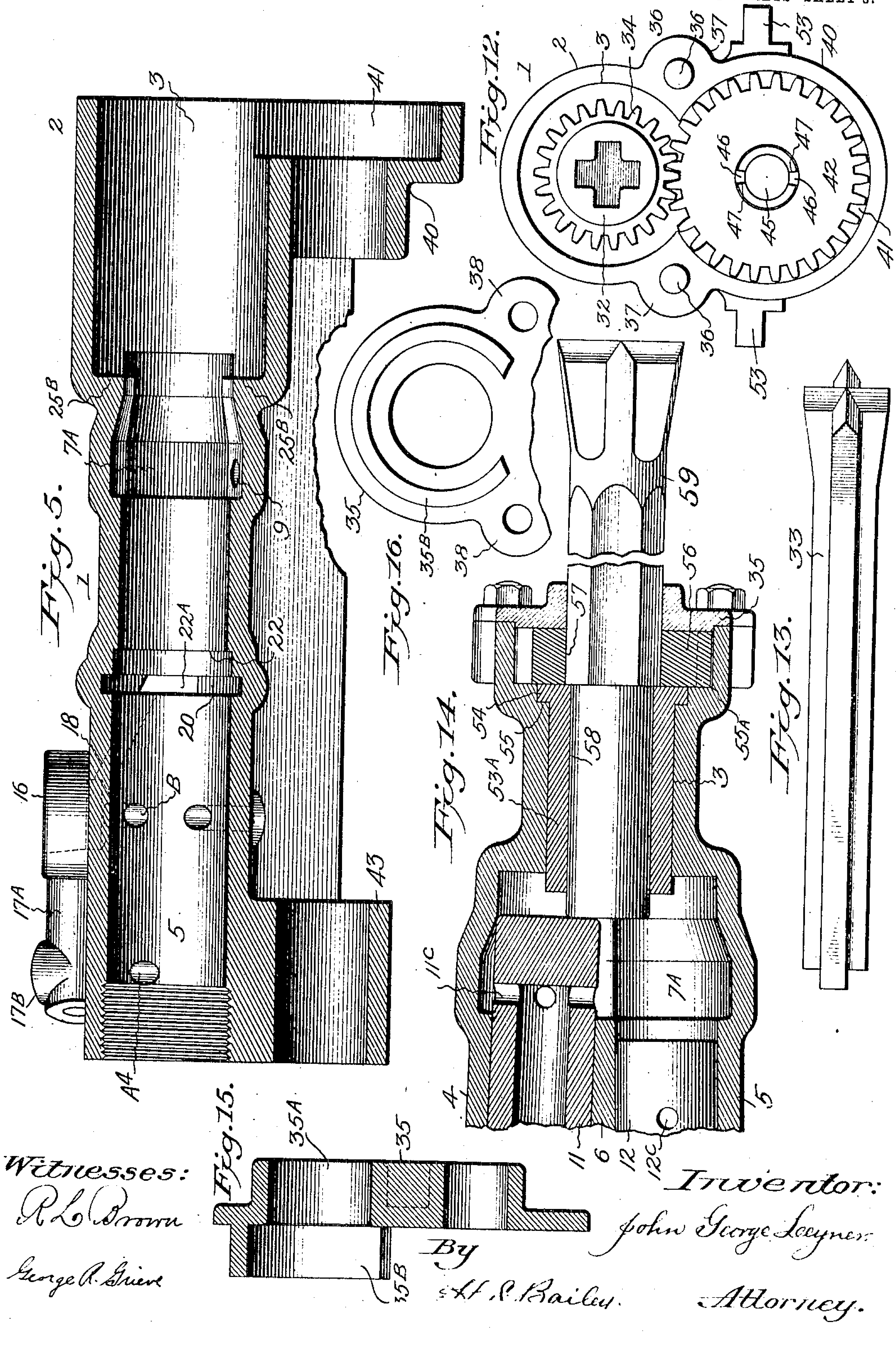

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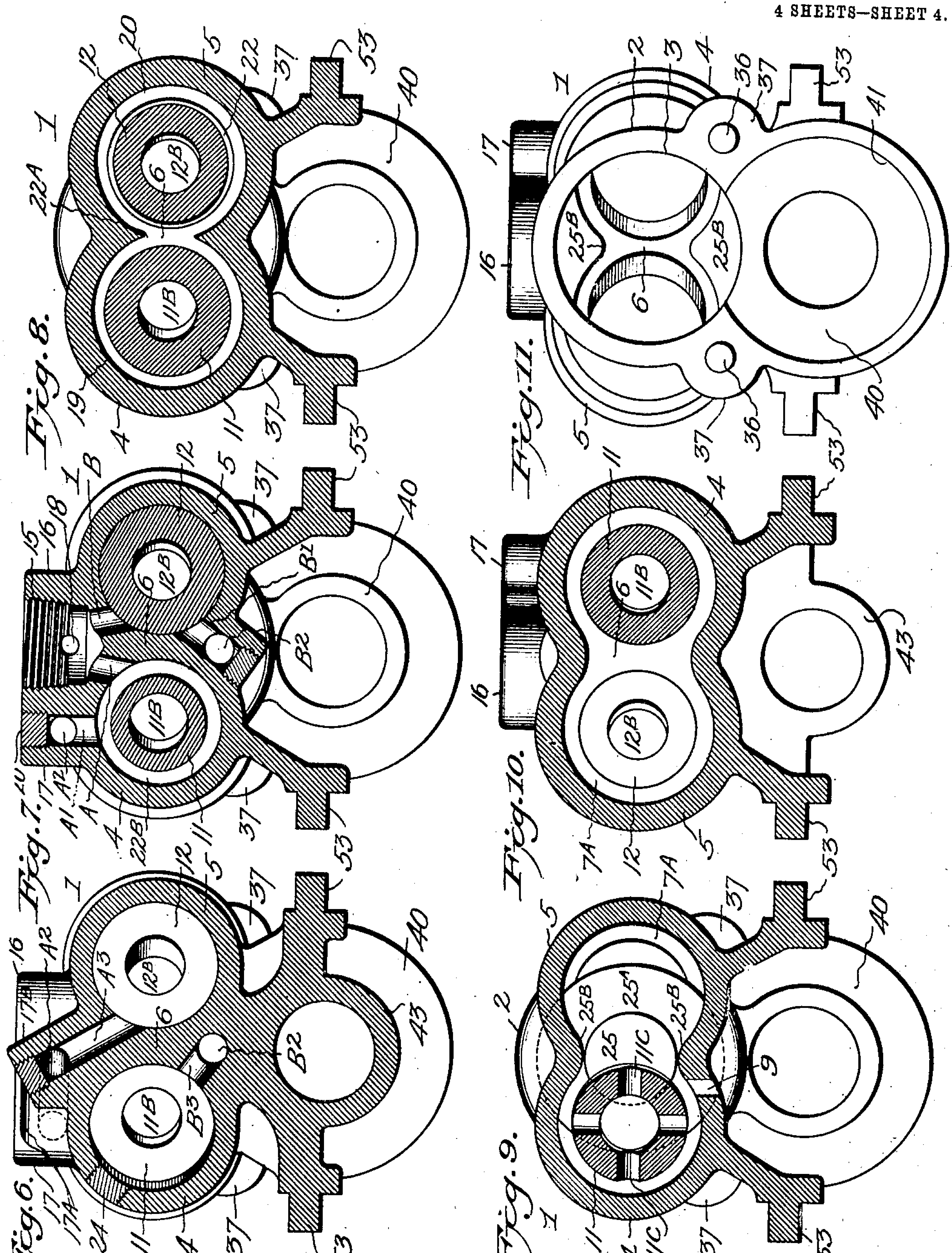

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UNITED STATES PATENT OFFICE.

JOHN GEORGE LEYNER, OF DENVER, COLORADO.

MULTIPLE-HAMMER-PISTON ROCK-DRILLING ENGINE.

No. 843,159. Specification of Letters Patent. Patented Feb. 5, 1907.

Application filed May 9, 1905. Serial No. 259,613.

To all whom it may concern:

Be it known that I, JOHN GEORGE LEYNER, a citizen of the United States of America, residing at the city and county of Denver and State of Colorado, have invented a new and useful Multiple-Hammer-Piston Rock-Drilling Engine, of which the following is a specification.

My invention relates to improvements in rock-drilling engines; and the objects of my invention are, first, to provide an improved construction of rock-drilling engine having a pair of reciprocatory hammers arranged to strike alternate blows upon the drill-bit or upon an interposed striking-pin; second, to provide an improved construction of rock-drilling engine having a pair of hammer-pistons actuated by fluid motive power, each acting as the valve for the other and arranged to reciprocate in cylinders the axes of which are at an acute angle to each other, so as to deliver alternate blows to the drill-bit. The construction by which I attain these objects and certain other advantageous results will now be described in detail in connection with the accompanying drawings, in which—

Figure 1 is a plan view of the improved multiple-hammer-piston rock-drilling engine detached from its supporting-shell. Fig. 2 is a horizontal longitudinal sectional view thereof. Fig. 3 is a vertical longitudinal sectional view thereof on the line 3 3 of Fig. 1. Fig. 4 is a side elevation of the rock-drilling engine, the supporting-shell being shown in section. Fig. 5 is a vertical longitudinal sectional view through one of the hammer-piston cylinders on the line 5 5 of Fig. 1. Fig. 6 is a transverse sectional view on the line 6 6 of Fig. 1. Fig. 7 is a transverse sectional view on the line 7 7 of Fig. 1. Fig. 8 is a transverse sectional view on the line 8 8 of Fig. 1. Fig. 9 is a transverse sectional view on the line 9 9 of Fig. 1. Fig. 10 is a transverse sectional view on line 10 10 of Fig. 1 looking in the direction of the arrow. Fig. 11 is a front elevation thereof, the front cylinder-head, drill, rotating gears, and hammer-pistons being removed. Fig. 12 is a front elevation of the drilling-engine, the front cylinder-head being omitted. Fig. 13 is a perspective view of the drill-bit used in connection with this drilling-engine. Fig. 14 is a fragmentary plan view of a rock-drilling engine, showing my multiple-hammer pistons arranged to strike directly on the end of a rock-cutting drill-bit, which is supported loosely and revolubly in the drilling-engine in a suitable chuck. In this arrangement the striking-pin and buffer devices of the arrangement shown in Figs. 2 and 3 are dispensed with, and the drill-holding chuck acts as a buffer for the spent blows of the hammer-pistons. Fig. 15 is a vertical sectional view of the front cylinder-head, and Fig. 16 is a rear view of the upper half of said cylinder-head.

Similar letters of reference refer to similar parts throughout the several views.

Referring to the drawings, the numeral 1 designates a casing, preferably a casting, in which at its front end 2 a cylindrical bore 3 is formed, and at its rear end two cylinders 4 and 5 are formed, which are preferably arranged in a horizontal plane side by side. These two cylinders extend rearward from the front central cylindrical bore 3 at a slight diverging angle on opposite sides of the axial center line 3 3 of the front central cylindrical bore 3, and they are also arranged to intersect or converge into each other and into the front central cylindrical bore, preferably with the greater portion of their diameters. These cylinders 4 and 5 are also arranged at an angle relative to each other and to the front cylindrical bore that brings the adjacent sides of their forward ends to intersect each other at about the inner terminal end of the front central cylindrical bore 3, and the partition 6 that separates these two cylinders is terminated a short distance form where it would end if it was extended to where the two cylinders would intersect each other. The stopping off of the end of this partition forms a large aperture 7 from one cylinder to the other at their forward ends. This arrangement of these three cylinders forms quite a large chamber 7^A at their intersecting points. The two angular cylinders are preferably made in two diameters, the larger diameter being at their rear ends. The larger bore of each cylinder is preferably made a little longer than the smaller bore. The chamber 7^A at the forward end portion of the smaller bore of each cylinder forms a large circumferential exhaust-port, one wall of which is preferably formed at the end of the partition that separates the two cylinders. From this wall this exhaust-port extends forward a short distance, its width being sufficient to allow variations of the length of the stroke of the hammer relative to the end of the drill-bit, as will be explained fully hereinafter. From this exhaust-port an exhaust-aperture 9 extends through the shell, preferably at its bottom, centrally between the cylinders to the atmosphere. In these two angular cylinders I fit hammer-pistons 11 and 12, each of which is made in two diameters that meet together at shoulders 11^A and 12^A. These two pistons are adapted to fit the two circumferential bores of each cylinder. Both of these angular-arranged cylinders and both hammer-pistons are of the same size and length. These two pistons are provided with axial ports 11^B and 12^B, that extend into their rear ends to near their front ends, from which radial ports 11^C and 12^C extend through the shells of the hammers. The rear ends of these two circular cylinders are interiorly threaded, and a nut-shaped plug-cylinder head 13 is threaded to each. These nut-shaped plug-cylinder heads are provided with a chamber 14, that extends into them from their inner ends, which act as cushioning-spaces for the motive fluid of the drilling-engine. The cylindrical shell in which these two angular-disposed cylinders are formed is provided with a motive-fluid inlet 15, which is preferably formed in a projecting hub 16, which is preferably positioned on top of the casing centrally of its width and at a short distance from its rear end. A small lug portion 17 is formed on the casing over the cylinder 4 and forms an integral part of the hub 16, and on the casing a cross-lug 17^A is also formed, that connects with and extends rearwardly from the lug 17 at an angle toward the cylinder 5.

The motive-fluid inlet-aperture 15 is interiorly threaded to receive a hose connection. The aperture 15 extends into the hub only a short distance, and an inlet-port 18 is drilled at an angle through the hub and casing into circumferential ports 19 and 20, that are formed in both cylinders a short distance to the rear of the shoulders 21 and 22, that are formed in the cylinder at the intersection of its two diameters and which consist of circumferential grooves in the periphery of the cylinders. These ports are connected together by an aperture 22^A, that is formed through the partition 6. From the bottom of the inlet-aperture 15 two inlet-ports are formed, which I will designate A and B. The inlet-port A connects, through the cylindrical bore 4, with a port A′, which is drilled down through the lug 17 into the cylinder 4, the entrance to which is threaded and plugged by a threaded plug 20. (See Fig. 7.) The port A′ registers with a port A^2, that is drilled through the lug 17^A from its end to intersect the port A′. The outer end of the port A^2 is plugged up. This port A^2 intersects a port A^3, that is drilled down through a boss 17^B, that is formed on the end of the lug 17^A. This port A^3 is drilled at an angle that will bring it out into the cylinder 5 near its rear end. The port B connects, through the cylinder 5, with the port B′, (see Fig. 7,) which is intersected by a port B^2, that is drilled longitudinally through the shell between the two cylinders until it intersects a port B^3, which enters the rear end of the cylinder 4 in the same position as the port A^3 enters the cylinder 5. The ports A and B, however, do not register opposite each other, the port A being placed a trifle forward of the port B toward the front end of the cylinders, the object of this arrangement being to prevent the centering or locking of both pistons, so that they will be sure to start in any position relative to each other they may assume. Thus if the drill was turned vertically upward, so that the hammer-pistons both dropped to the rear end of their cylinders and were not in operation, the inlet-port B would be covered up by the largest diameter portion of the hammer-piston 12, as the forward edge 12^A would extend over it. The port A, however, is placed forward of the port B sufficient to enable a portion of it to extend over the edge 11^A of the hammer-piston 11 and be open to the space surrounding the smaller diameter of the hammer-piston 11. This arrangement of the port A permits the motive fluid to flow from the port A around the smaller part of the hammer-piston 11 into port A′ and through cross-port A^2 into and through port A^3 into the rear end of the cylinder 5, which starts the hammer-piston 12 forward, and, driving its forward stroke, it acts as a valve to start the hammer-piston 11, as will be fully explained hereinafter. If both hammer-pistons were at the forward end of the drill, as would be the case if the drill was inclined downward and was inoperative, and the striking-pin also dropped down in the buffer-sleeve 25^A so that the hammer-pistons rested against the end of the steel buffer-sleeve, they would be far enough forward to bring the edges of their shoulders 11^A and 12^A past the ports 21 and 22, respectively, and they would not start back quickly, but might start slowly from the forward leakage of the motive fluid; but the instant the drill-bit was fed forward by the feed-screw against rock it would raise the striking-pin against the hammers, and their shoulders 11^A and 12^A would be moved back past these ports into their normal operative positions and would immediately start on their rearward stroke, and the hammer-piston 12 would be started forward first, as it would receive the motive fluid from the inlet-port A, as above described, and the hammer-pistons would immediately start to reciprocate in opposite directions in successive alternate order. These two ports register with two circumferential ports 22^B and 23, formed in the hammer-pistons 11 and 12, respectively, adjacent to their rear ends and positioned to register with said ports A and B when the hammer-pistons are at the end of their forward drill-driving strokes. The port B^3 is drilled through the shell of the cylinder 4, and its entrance is threaded and plugged by a threaded plug 24. This series of ports admits the motive fluid in alternate order to the two cylinders through the medium of the two pistons, which reciprocate in opposite directions simultaneously and in the following manner: Assuming that the pistons 11 and 12 are in the positions shown in Fig. 2, the motive fluid enters the port A and flows around the circumferential port 22^B into the port A′, from which it flows into the crossover-port A^2 into the port A^3 and into the cylinder 5 at the rear end of the hammer-piston 12, which has not quite reached the end of its rearward stroke, but is in the same relative position as the hammer-piston 11, which has not quite reached the end of its forward stroke. Consequently the motive fluid, which may be compressed air, flows in behind the hammer-piston 12 and cushions its rearward stroke and starts it forward at the same time the piston-hammer 11, which is at the forward end of its stroke and which has struck its blow, has its exhaust-ports 11^C registering with the exhaust-chamber 7^A and the air that drove it forward has escaped through the exhaust-aperture 9 to the atmosphere and the pressure is removed from its rear end, and a portion of the air flowing into the inlet-aperture 15 flows through the ports 18 and 19 to the front of the shoulder 11^a of the piston 11, and it is moved rearward and closes the air-inlet port A′ as it passes over it. Consequently the hammer-piston is moved rearward by the air flowing to the front of its shoulder 11^A, and it acts as a valve to admit and control the forward striking movement of the hammer 12. In the same manner the hammer-piston 12 acts as a valve for the hammer-piston 11, as when the hammer-piston 12 is at the forward end of its stroke the air behind it is exhausted through its axial port 12^B and out of its radial exhaust-ports and through the exhaust port and aperture to the atmosphere. The air then enters the port B and flows through the ports B′ and B^2 and B^3 into the rearward end of the cylinder 4 and starts the hammer-piston 11 forward, while the air entering the ports 18 and 20 to the front of the shoulder 12^A of the hammer-piston 12 moves it rearward. Thus the two pistons are reciprocated in successive alternate order simultaneously, and each piston strikes at each reciprocal stroke a blow directly against the shank end of a rock-cutting drill-bit or against the adjacent end of a striking-pin, through the medium of which the blows of the hammer-pistons are imparted to the shank end of a rock-cutting drill-bit. I preferably use, however, a striking member or pin 25 for driving the drill-bit, and preferably arrange it as follows: In the front cylindrical bore of the casing I place a buffer-sleeve 25^A, which fits loosely and slidably in the bore and extends a short distance from the rear end of the cylindrical bore in which it rests into and slightly beyond the end of the chamber formed by the intersection of the two angularly-disposed cylinders and against shoulders 25^B at the junction of these three cylinders, that permits the sleeve to project into the reciprocal path of the two pistons. These shoulders are formed by the contour of the exhaust-chamber, which is in the shape of the figure 8, the wall between the two portions of the chamber being cut away centrally where the chambers intersect. (See Fig. 9.) The buffer-sleeve 25^A is provided with an axial bore of two diameters 25^C and 26, the smallest of which extends into it from its hammer-striking end. This bore 25^C extends into the buffer-sleeve but a short distance, and it is intersected by the larger bore 26, which extends into the sleeve from its rear end the greater portion of its length and intersects the smaller bore 25^C with a square shoulder 27. This buffer-sleeve occupies a portion of the front cylindrical bore 3. At its front end a steel buffer-ring 28, that fits snugly but loosely in the cylinder, is placed, which is provided with a thin hub portion 29, that extends into the larger bore 26 of the steel buffer-sleeve a portion of its length, thus leaving a space between the end of the sleeve and the square shoulder 27. This steel ring I term a "buffer-hub" ring. Against the front side of this steel ring a rubber buffer-ring 30 is placed in the cylinder 3, and against the rubber ring a steel washer 31 is placed, which also fits snugly in the cylinder.

The steel buffer-hub-ring 29, the rubber buffer-ring 30, and the steel washer 31 are all provided with axial apertures of the same diameter, and through them I extend one end of a cylindrical sleeve 32, which contains an axial aperture that is arranged and adapted to hold the rock-cutting drill-bit 33, and which I term a "drill-bit-holding" chuck. The inner end of this drill-bit-holding chuck fits loosely and rotatably in the axial apertures of these buffers and the washer and extends within the steel buffer-sleeve to close to the inner end of the steel buffer hub-ring 29. Within the steel buffer-sleeve and the inner end of the drill-bit-holding chuck I fit loosely and slidably the striking-pin 25, which preferably consists of a short slug or stud member, the striking end of which fits loosely in the small axial bore of the steel buffer-sleeve and normally projects beyond the steel buffer-sleeve into the reciprocating path of the two piston-hammers a short distance. A collar 25^D is formed on the stud, which is designed to fit loosely in the large axial bore of the buffer-sleeve and to bear against the inner shoulder 27 of the steel buffer-sleeve when the striking end of the stud is projecting into the reciprocal path of the hammers far enough to receive the full force of their blows. From the collar the stud extends loosely and slidably into the adjacent end of the drill-holding chuck. The striking-pin is, however, made a little larger in diameter than the drill-bit-holding aperture in the chuck, and the inner end of the chuck is provided with a counterbore to receive it, which is made enough longer than that portion of the striking-pin that extends into the chuck to allow it a short reciprocal movement in it. The collar of the striking-pin rests within the sleeve between the shoulder 27 and the ends of the hub of the steel buffer hub-ring, and the thickness of the collar is arranged to leave a space at the side of the collar for the collar to move reciprocally in a distance sufficient to compensate for the variable and irregular feeding of the drill-bit forward into the rock relative to the speed it is cutting into the rock and the driving-forward movement of the striking-pin by the blows of the hammer. The drill-holding chuck is provided with a toothed gear 34, which comprises a disk portion that is preferably formed integral with it intermediate of its ends. The gear portion of the chuck is positioned to extend from the end of the cylinder-bore 3 to and against the steel washer 31. To the end of the front cylinder 3 I secure a cylinder-head 35, preferably by means of stud-screws 36, which are threaded to the lugs 37 of the cylinder and extend loosely through lug portions 38, formed on the cylinder-head. Nuts 39 are threaded to the end of the studs and clamp the cylinder-head to the cylinder. This front cylinder-head is provided with a hub portion 35^a, and the chuck extends beyond the gear to the end of the hub. The chuck-gear is not large enough in diameter to fill the cylinder, and a hub 35^B is formed on the inside of the cylinder-head, which surrounds the gear loosely and fills the space between it and the cylinder and extends to and against the steel washer, thus forming an abutment for all of the buffer-washers. The front end of the cylinder is provided with a depending lug 40, which is provided with an axial aperture 41, in which a gear 42 is rotatably mounted. The rear end of the casing is also provided with a depending lug 43, which contains an aperture in axial alinement with the aperture 41 in the lug 40 of the front end of the casing. A nut 44 is secured in the aperture of the lug 43, and a feed-screw 45 is threaded to the nut and extends to and through the gear 42 loosely. The front cylinder-head extends down over the depending lug and confines the gear in the lug, and an aperture is formed in the cylinder-head, through which the feed-screw extends loosely. The gear is provided with a long sleeve or hub 42^A, which extends from the gear loosely over the feed-screw to the nut. At its end portion it is provided in its inner periphery with two oppositely-arranged inverted key-lugs 46, which fit loosely and slidably into two oppositely-arranged key-ways 47, formed on the opposite sides of the feed-screw. The opposite end of the feed-screw is rotatably mounted in a block 48, which is supported by a bracket 49, formed of two rearwardly-extending rods 49^A and a cross-bar 50. This bracket is secured to a shell 51, which is provided at its opposite sides with guideways 52, and on the opposite sides of the bottom of the cylinder's casing slide-ways 53 are formed, which fit slidably in the guideways of the shell. The bottom of this supporting-shell is provided with a fan-tailed hub 54, which is adapted to be clamped by a chuck of a suitable supporting-column.

The rock-cutting drill-bit 33 consists of a bar of any of the merchantable forms of cross-section of drill-bit tool-steel in use, it only being necessary to make the axial aperture in the drill-holding chuck of the same form as the cross-section of the tool-steel used for the drill-bit. The shank end of the drill-bit is inserted in the aperture of the chuck loosely against the end of the striking-pin, and it may be provided with a collar or with projections positioned at a predetermined distance from its end and adapted to rest against the end of the chuck and to define the distance the shank shall extend into the chuck and into driving relation with the hammer-pistons, if desired, in case the striking-pin was dispensed with. It is not necessary to use a collar or projections on the shank of the drill-bit when the striking-pin is used, and one of the great advantages in using a striking-pin is that it enables me to use drill-bits as they are cut from the merchantable bars of tool-steel in their natural condition without machine or forge work of forming a collar or projecting lugs of any kind on their shank or striking ends and dispensing with all work on them except what is necessary to form the rock-cutting lips on one end. I preferably use, however, for the drill-bit the cruciform drill-bit tool-steel in common use in rock-drilling engines, as shown in Fig. 13, and make the axial aperture in the drill-holding chuck of cruciform shape in cross-section, as shown in Fig. 12, to receive loosely the shank end of the drill-bit, which is simply inserted against the striking-pin and is held from turning in the chuck by the introverted lips of the cruciform-shaped aperture. This type of a drill-bit and drill-holding chuck and the striking-pin and the general features of the buffer mechanism and also the feed-screw rotation of the drill-bit form essential features of and are fully illustrated and described in my applications, Serial Nos. 253,409, filed April 3, 1905, and 213,988, filed

June 24, 1904, now pending in the United States Patent Office.

In Fig. 14, which is a fragmentary plan view similar to Fig. 2, I illustrate a slightly-different arrangement of the drill-bit and the drill-bit-holding chuck and drill-bit-rotating gear from that shown in Figs. 2 and 3. In this arrangement the striking-pin and the steel buffer-sleeve and the hub-ring buffer and the rubber buffer-ring and steel washer are dispensed with and the front end of the cylindrical bore 3 is made smaller and receives a drill-holding chuck 53^A, which is pressed into it and which is provided with a collar 54 on its front end, that is seated in a stepped counterbore 55 at the forward end of the bore 3, in which the body of the chuck is placed. A counterbore 55^A of larger diameter than the bore 3 and step 55 is formed in the outer end of the casing, and a gear 56 is revolubly seated in it at the side of the chuck. This gear is provided with an axial aperture 57 of a polygonal form of cross-section, preferably a hexagon-shaped aperture, while the chuck is provided, preferably, with a round axial aperture 58. The front cylinder-head 35^A is secured to the end of the casing in a manner similar to that shown in the other arrangements of the drill. The gear 56 meshes with the gear 42 and is rotated by the feed-screw in the same manner as shown in Figs. 2 and 3. The drill-bit 59 is, however, provided with a round hammer-piston-striking shank end portion that projects loosely into and through the chuck into the reciprocal paths of the two hammer-pistons, and it is also provided with a hexagon portion that extends loosely into the hexagon aperture in the gear, which keys it so that it is rotated with the chuck. This hexagon portion extends through the gear against the adjacent end of the chuck. The drill-bit is thus free to be inserted and withdrawn instantly by hand, as either the drill shown in the Figs. 2, 3, 13, or 14.

The operation of my multiple-hammer-piston motive-fluid-controlled rock-drilling engine is as follows: The rock-drilling engine is mounted on a supporting-column, with its rock-cutting drill-bit in operative relation to rock. The feed-screw is then rotated to feed the cylinder through its supporting-shell until the cutting-points of the drill-bit bear against the rock and its shank end pushes against the end of the striking-pin, and it is held against the inner shoulder 27 of the steel buffer-sleeve and the striking end of the striking-pin in the reciprocal path of the hammer-pistons. The motive fluid, which is compressed air, is then turned on and flows through the ports, as above described, causing the hammer-pistons to reciprocate and strike against the striking-pin in successive alternate order, each hammer-piston striking on about one-half of the end of the striking-pin adjacent to it. The blows of the hammer-pistons against the striking-pin are imparted against the end of the drill-bit, which is driven into the rock. The feed-screw is then rotated to feed the drill-cylinder and drill-bit forward as fast as the drill-bit cuts into rock, and at the same time the rotatory movement of the feed-screw through the gear 42, which is feathered to the feed-screw at the outer end of its hub portion, is rotated with the feed-screw, and its rotative movement is imparted to the chuck-gear and drill-bit-holding chuck and through the medium of the drill-bit-holding chuck to the drill-bit. Consequently while the drill-bit is being fed forward by the rotation of the feed-screw it is also being continuously rotated by the feed-screw's rotative movement, and at the same time the two pistons are striking in alternate order with great rapidity and in perfect unison and twice as fast as one hammer-piston would strike in a single-cylinder hammer-piston drill, and they are also each striking just as hard and effective drill-bit-driving blows against the striking-pin as one hammer-piston would strike in a single-cylinder drill.

While I have preferably illustrated and described the preferred construction and arrangement of my multiple-hammer piston-drill applied to a duplex or twin hammer piston-drill, I do not wish to be limited to the exact arrangement and construction shown, as my invention may be embodied in structures differing in detail and arrangement from that shown and as far as certain features are concerned is applicable to rock-drilling engines operated by steam, electricity, or manual power.

Having described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. A rock-drilling engine, comprising a casing containing two cylinders arranged at an acute angle to each other, a hammer-piston in each of said cylinders, means to secure a drill in the front end of said casing and means to reciprocate said hammer-pistons to deliver alternate blows upon said drill.

2. A rock-drilling engine, comprising a casing containing two cylinders arranged at an acute angle to each other, a hammer-piston in each of said cylinders, a drill-holding chuck in the front end of said casing, a striking-pin and means to maintain it in alinement with said chuck, and means to cause said hammer-pistons to deliver alternate blows upon said pin.

3. A rock-drilling engine, comprising a casing containing two cylinders arranged at an acute angle to each other, a hammer-piston in each of said cylinders, a drill-holding chuck in the front end of said casing, a striking-pin and means to maintain it in alinement with said chuck, means to cause said hammer-pistons to deliver alternate blows

upon said pin, means to support said casing and means to simultaneously feed said casing and rotate said chuck.

4. In a rock-drilling engine, a casing, means to support a drill in the front end thereof, a pair of guideways in said casing converging toward the front end thereof, a reciprocatory hammer mounted in each of said guideways and means to cause said hammers to deliver alternate blows upon said drill.

5. In a rock-drilling engine, a drill-holder, a pair of hammers guided to reciprocate along lines converging toward said holder and means to cause said hammers to deliver alternate blows to the drill.

6. In a rock-drilling engine, the combination of a support, a casing reciprocally mounted on said support, a drill-chuck in said casing, means to feed said casing along said support and to simultaneously rotate said chuck, a pair of hammers mounted to reciprocate in said casing along lines converging toward said chuck and means to cause said hammers to deliver alternate blows to a drill held in said chuck.

7. In a rock-drilling engine, a casing comprising two cylinders arranged at an acute angle to each other, a drill-chuck in the front end of said casing the axis of which bisects said angle, a hammer-piston in each cylinder and means to convey a motive fluid to said pistons comprising ducts in said casing and grooves in said pistons, arranged so that said pistons are simultaneously reciprocated in opposite directions to deliver alternate blows to the drill in said chuck.

8. In a rock-drilling engine, a casing comprising two cylinders arranged at an acute angle to each other, a drill-chuck in the front end of said casing the axis of which bisects said angle, a striking-pin maintained in axial alinement with said chuck, a hammer-piston in each cylinder and means to convey a motive fluid to said pistons comprising ducts in said casing and grooves in said pistons, arranged so that said pistons are simultaneously reciprocated in opposite directions to deliver alternate blows to the said striking-pin.

9. In a rock-drilling engine, the combination of a support, a casing mounted thereon comprising two cylinders arranged at an acute angle to each other, a drill-chuck rotatably mounted in the front end of said casing, a striking-pin maintained in axial alinement with said chuck, a hammer-piston in each of said cylinders, means to convey motive fluid to said casing to reciprocate said hammer-pistons in opposite directions to deliver alternate blows to said striking-pin and means to feed said casing along said support and to simultaneously rotate said chuck.

10. In a rock-drilling engine, the combination of a casing containing a plurality of cylinders, each having a hammer-piston therein, said cylinders and pistons having ducts formed therein to convey a motive fluid to simultaneously reciprocate said pistons in opposite directions, a drill-chuck arranged in the front end of said casing, a striking-pin reciprocally mounted in said chuck, and buffer devices for said pistons and striking-pin.

11. In a rock-drilling engine, the combination of a casing containing two cylinders, a hammer-piston in each cylinder, said casing having ducts to convey motive fluid to said pistons, a chuck in the front end of said casing, a striking-pin reciprocally mounted in said chuck, buffer devices for said pistons and striking-pin, a support for said casing, a feed-screw to feed said casing along said support and intermeshing gears on said chuck and feed-screw, whereby said chuck is rotated as said casing is fed.

12. In a fluid-controlled rock-drilling engine, a casing, two cylinders in said casing, each having a hammer-piston, a rotatable chuck in said casing, a drill arranged to be supported by said chuck, a striking-pin reciprocally supported in said casing and having one end projecting into said chuck in operative striking relation to said drill, a buffer surrounding said striking-pin and arranged to cushion the spent blows of said hammer-pistons and said striking-pin, a feed-screw for feeding said drill, and gears connected with said feed-screw and chuck for rotating said drill.

13. In a fluid-controlled rock-drilling engine, the combination with the supporting-shell and the casing, having a pair of cylinders, each cylinder of which is provided with a hammer-piston, and fluid-ducts leading from a source of supply arranged and adapted to reciprocate said hammer-pistons in opposite directions in alternate order, a steel buffer-sleeve in said cylinders slidably mounted therein and provided with a bore of different diameters and projecting at one end into the reciprocal path of said hammer-pistons, a steel ring at the opposite end of said buffer-sleeve, having a hub that projects into the large bore of said sleeve, a space in said buffer-sleeve between the hub of said ring and the bottom of the large bore of said buffer-sleeve, a rubber buffer-ring at the end of said hub-ring, a steel washer at the end of said rubber buffer, a chuck extending at one end through said steel washer, and rubber buffer-ring, and hub-ring, into the large bore of said steel buffer-sleeve, to near the end of the hub of said hub-ring, a drill in said chuck, a striking-pin extending in said steel buffer-sleeve and into said chuck, having its front end projecting through the small bore of said steel buffer-sleeve into the reciprocal path of said hammer-pistons, and a collar intermediate of its ends extending into the large bore of said

steel buffer-sleeve, there being an operative drill-driving space in said steel buffer-sleeve between the collar and the adjacent end of the hub of said hub-ring, the opposite end of said striking-pin projecting slidably into said chuck in operative striking relation to said drill, a front cylinder-head secured to the end of said cylinder, a hub-abutment portion extending to said steel washer, a feed-screw connected to said shell and casing and arranged to feed said drill, and means connected to said feed-screw and chuck for rotating said drill, substantially as described.

14. In a fluid-controlled hammer-piston drill, a casing, a chuck revolubly mounted in said casing, a drill in said chuck, two cylinders in said casing, having two pistons, arranged to reciprocate in opposite directions, and to drive said drill, a steel buffer-sleeve in said casing arranged to receive the spent blows of said hammer-pistons, a striking-pin slidably mounted at one end in said buffer-sleeve and slidably mounted at its opposite end in said chuck, against said drill, a buffer-ring arranged to cushion the spent blows of said striking-pin, a rubber ring arranged to resiliently cushion the movements of said buffer sleeve and ring, an abutment for said rubber buffer-ring, a feed-screw for feeding the drill, and means connected with said feed-screw and said chuck for rotating said drill.

15. In a fluid-controlled piston-drill, the combination of a casing containing two cylinders, a piston reciprocably mounted in each cylinder, said casing having fluid-ducts leading from a source of supply, a chuck rotatably mounted in the front end of said casing to hold a drill, a buffer-sleeve in said casing in axial alinement with said chuck, a buffer-ring and washers surrounding said chuck at the end of said sleeve, and a striking-pin reciprocably supported by said sleeve and chuck to engage the end of a drill in said chuck and to receive the blows of said pistons and deliver them to the drill.

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

JOHN GEORGE LEYNER.

Witnesses:
R. L. Brown,
George R. Grieve.