No. 891,472. PATENTED JUNE 23, 1908.

G. A. FOWLER.

VALVE FOR OPERATING ROCK DRILLS.

APPLICATION FILED JULY 10, 1907.

2 SHEETS—SHEET 1.

Fig. 3.

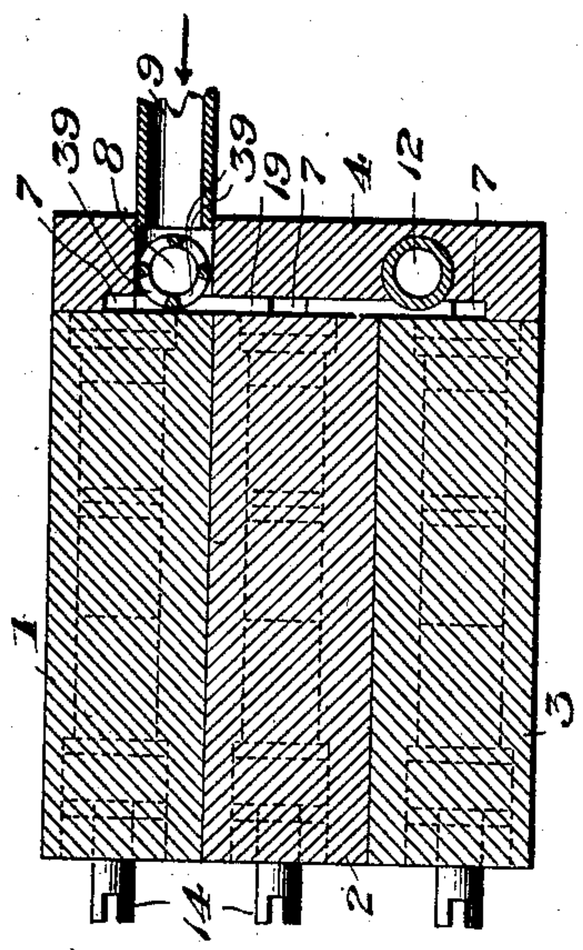



Fig. 4.

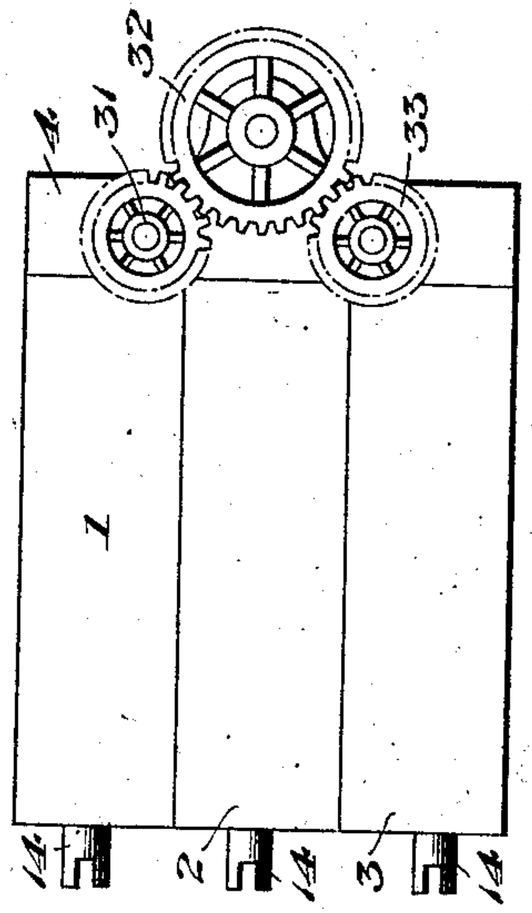



Fig. 1.

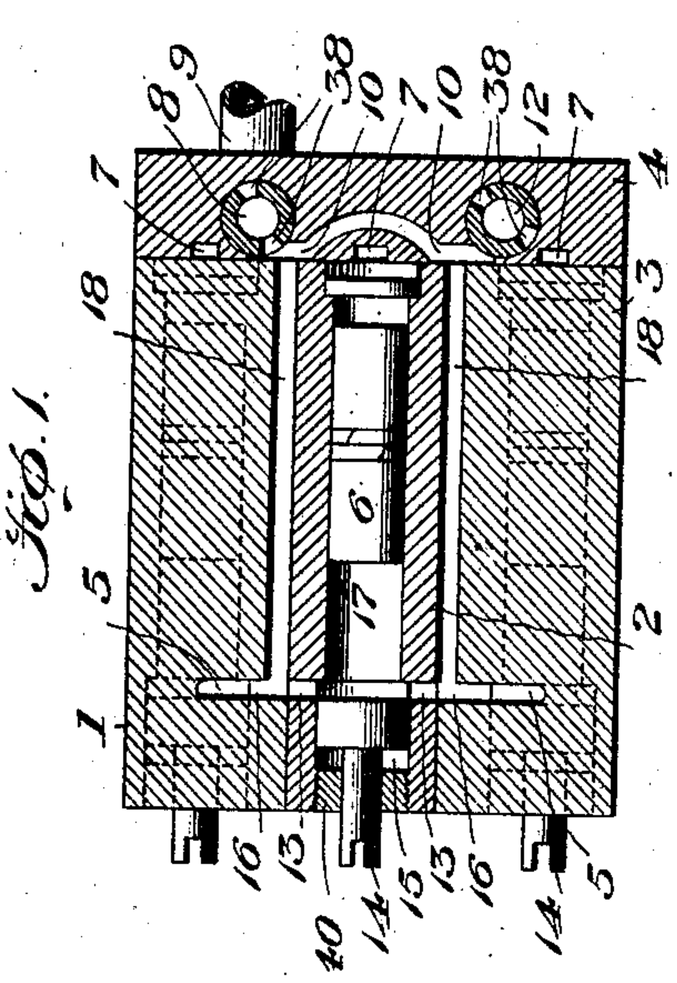
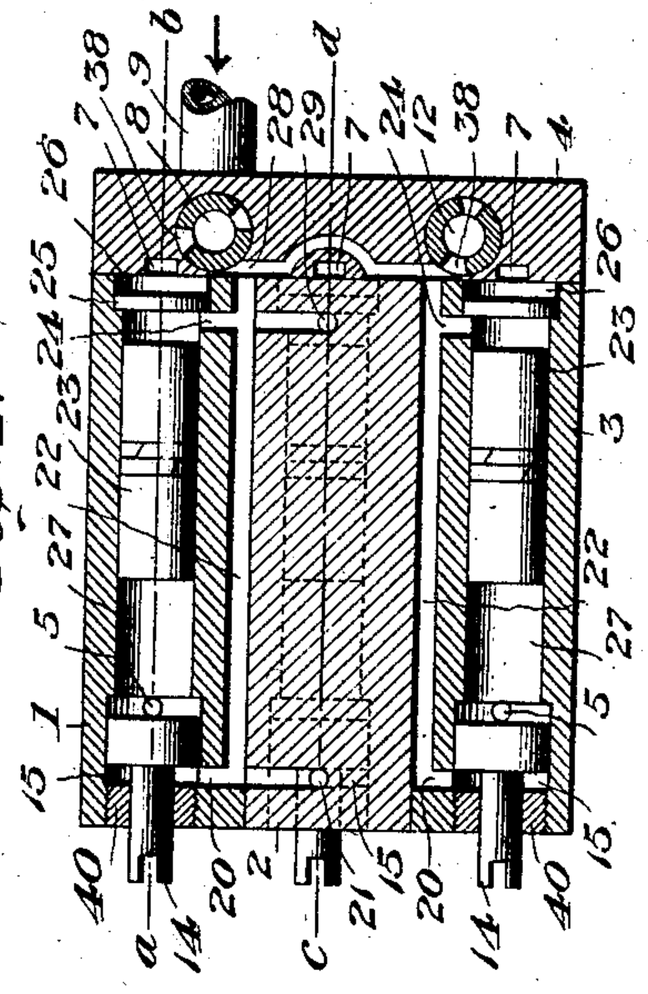



Fig. 2.




Witnesses

Edwin L. Bradford

Anne B. Johnson.

Inventor

George Allen Fowler

By Johnson & Johnson

Associate Attorneys.

No. 891,472. PATENTED JUNE 23, 1908.

G. A. FOWLER.

VALVE FOR OPERATING ROCK DRILLS.

APPLICATION FILED JULY 10, 1907.

2 SHEETS—SHEET 2.

Fig. 6

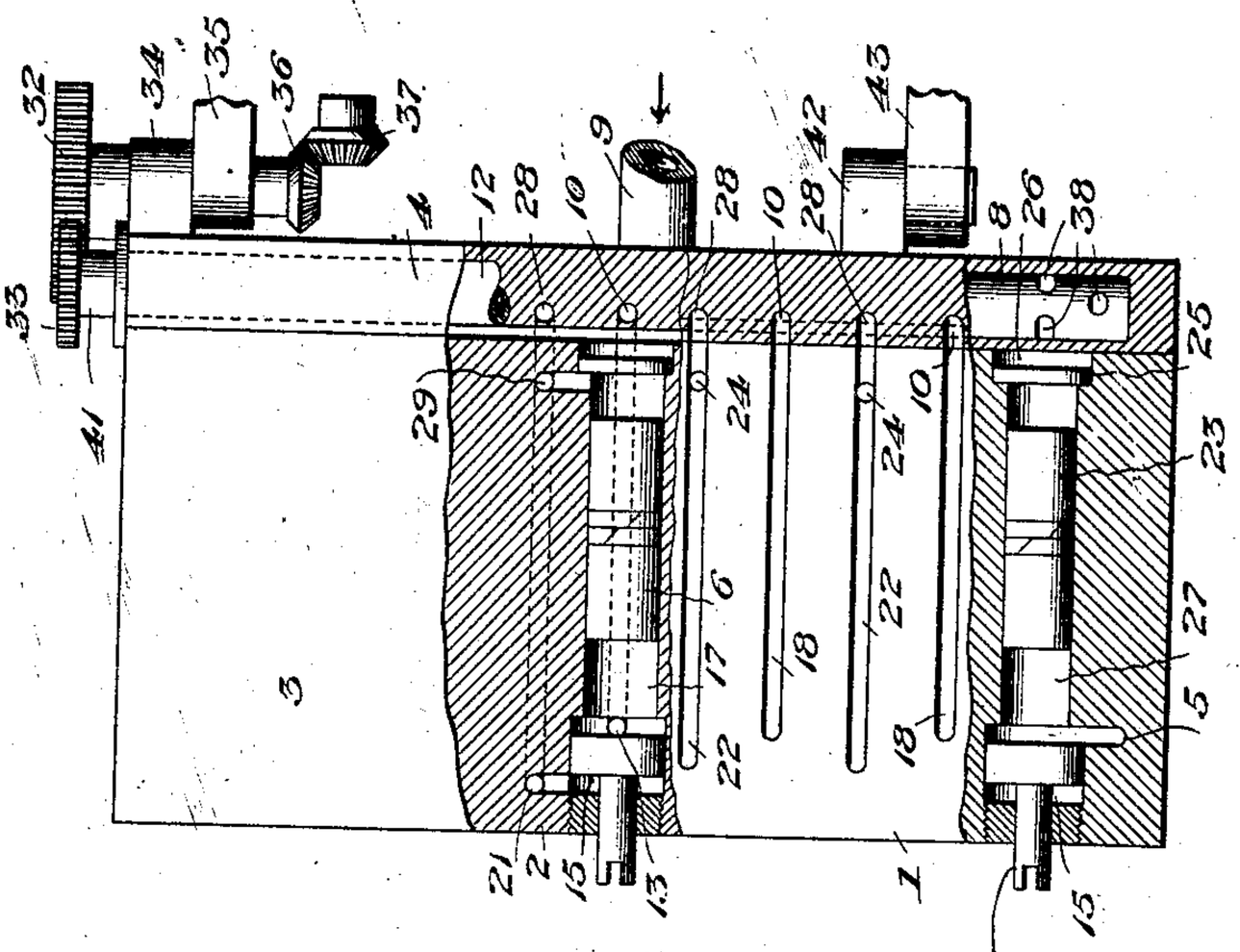



Fig. 5.

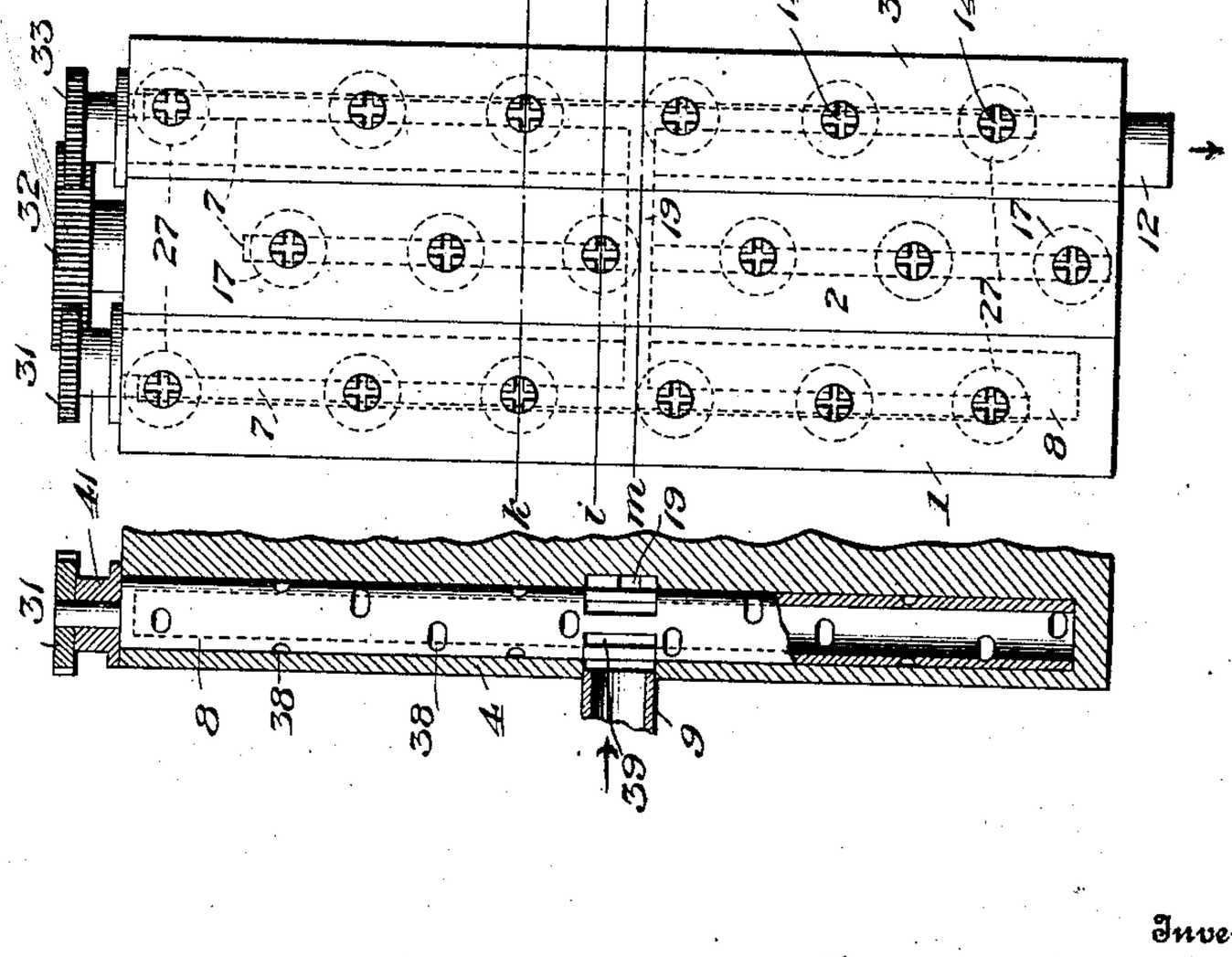



Fig. 7.

Witnesses
Edwin L. Bradford
Anne B. Johnson.

Inventor
George Allen Fowler
By Johnson & Johnson
Associate Attorneys.

# UNITED STATES PATENT OFFICE.

GEORGE ALLEN FOWLER, OF GEORGETOWN, COLORADO, ASSIGNOR OF ONE-HALF TO EDWARD J. WILCOX, OF DENVER, COLORADO, AND ONE-FOURTH TO FRANK V. GOETZ, OF CLEAR CREEK COUNTY, COLORADO.

## VALVE FOR OPERATING ROCK-DRILLS.

No. 891,472. Specification of Letters Patent. Patented June 23, 1908.

Application filed July 10, 1907. Serial No. 383,039.

*To all whom it may concern:*

Be it known that I, GEORGE ALLEN FOWLER, a citizen of the United States, residing at Georgetown, in the county of Clear Creek and State of Colorado, have invented Improvements in Valves for Operating Rock-Drills, of which the following is a specification.

The invention which is the subject of this patent relates to valves for operating rock drills and in which pneumatic power is employed to effect a thrusting action of the drills; and my said invention consists of certain novel parts and combination of parts, which are particularly pointed out and designated in the claims concluding this specification.

The drill-hammers or pistons are caused to operate in groups within a block and one of the objects of my improvements is to cause the operation of the drills so that their thrusting blows will alternate and thus reduce the shocks on the mechanism to a minimum. A construction of block having a plurality of chambers each containing a drill carrying chuck and its actuating hammer, the said chambers being so related by passages that communicate with an inlet valve and an exhaust valve, both rotatable together, that the drills are actuated in groups which alternate in striking a blow, said mechanism being cushioned in its blow striking and return movements within the block. The block has a sectional construction which renders it convenient for housing the drill actuating parts, and the power conducting passages by which they are operated.

An important feature of my invention resides in means for pivotally mounting the valved drill-block so that the angle of its operating face may be adjusted and held at the desired angle in relation to the breast wall without interfering with the operation of the drills or the valves and their mechanically operated connections, whereby a high rate of speed and power may be given the drills.

The tubular inlet and the exhaust valves are rotated continuously preferably in the same direction by gear and suitable power connections, and their construction and arrangement in relation to the drill actuating hammers and to passages communicating with both ends of said hammers or pistons to effect their alternate operation, is also a feature of my invention.

The accompanying drawings illustrate my invention of a group of drill actuating hammers and a pair of mechanically operated valves constructed and arranged to operate by pneumatic power all the hammers in groups, in alternate order, and in which,—

Figure 1 is a horizontal transverse section of the swing valved drill block taken on the line *i—j* of Fig. 5 and showing the center drill actuating hammer in elevation and its relation to the gear actuated tubular inlet and exhaust valves and the ports and passages communicating therewith and with the hammer and chuck-head. Fig. 2 is an identical section of the swing valved drill block taken on the line *k—l* of Fig. 5 showing the outside drill actuating hammers in elevation and their relation to the gear actuated tubular inlet and exhaust valves and the ports and passages connected therewith and with the hammers and chuck-head. Fig. 3 is an identical section of the swing valved drill block taken on the line *m—n* of Fig. 5 showing the gear actuated tubular inlet and exhaust valves, the dotted lines showing the relation thereto of the central and side drill operating hammers Fig. 4 shows in top view the swing valved drill block and the gear by which the valves are rotated. Fig. 5 is a front elevation or drill face of the swing drill valve block showing the gear actuated valves in dotted lines and the arrangement of the drill-chucks in three separate and distinct vertical rows. Fig. 6 is a view of the drill block, showing in the upper part a partial side elevation, in the next lower part a partial vertical section on the line *c—d* of Fig. 2, and below this a partial elevation of the inner face of the outer section 1 of the drill block, the lowermost portion showing a partial vertical section taken on the line *a—b* of Fig. 2, both sections showing the drill-hammers in elevation, their chambers and drill chucks and also showing the pivot mountings of the drill block and the gear connections for rotating the valves. Fig. 7 is a vertical section showing the tubular inlet valve in partial elevation and section and a double row of ports arranged therein in spiral form lengthwise of the valve as the means of

actuating the hammers or pistons in continuous succession.

The drill block is preferably formed of four sections or parts 1, 2, 3, and 4, the section 4 being secured to the ends of and covering the rear faces of the three joined sections and all secured together by any suitable means. Each of these block sections is formed with a plurality of horizontally disposed cylindrical chambers arranged in vertical alinement, the chambers 27, in the outer sections 1 and 2 being disposed in the same horizontal planes and each of the chambers 17 in the middle section being disposed below the horizontal plane connecting a pair of chambers 27 in the other sections as in Fig. 5.

The chambers 17 and 27 are each composed of a front portion 15, a rear portion 26, and an intermediate portion. The intermediate portion is of less diameter than either of the portions 15 or 26 and the functions of these separate chamber diameters will be presently stated. The front portion 15, receives a drill-chuck 14, having a head and a drill holding shank, the latter being adapted to be reciprocated through an opening in a screw-threaded plug 40, one of which closes the front end of each chamber. The rear portion 26, receives a disk 25 which is held by pressure in a manner hereinafter indicated, against the shoulder formed at the meeting plane of the rear and intermediate portions of a chamber. Hammers or pistons 6, and 23, are seated respectively in the chambers 17 and 27 and are each adapted as hereinafter explained, to be reciprocated between the head of a drill-chuck 14, and the disk 25.

The rear section 4, of the drill-block, is provided with two circular chambers, one of which extends from the upper surface of the block to a plane near its bottom surface and receives the inlet valve 8 as in Fig. 7; and the other chamber extends completely through said section 4 and receives the exhaust valve 12, whose lower end passes out of the bottom of said section and is open to exhaust to the atmosphere as in Fig. 5. The inlet valve and the exhaust valve are each in the form of a hollow cylinder having a closed upper end and the bore forming the passage for the compressed air. Each valve is provided with diametrically opposed ports 38, which extend from the interior bore through the shell of the valve. These ports 38, of the exhaust valve are in horizontal alinement with the ports 38, of the inlet valve as will be seen in Figs. 1 and 2 and the ports of both valves are spirally arranged for a purpose which I shall presently state. The valve 8, has however, in addition to its ports 38, a plurality of ports 39 all of which are on a horizontal plane and are located mediately of the length of the valve. Through the ports 39 compressed air enters from the inlet valve pipe 9, which has a flexible connection (not shown) for the purpose of permitting the swing adjustment of the drill block.

Looking at Fig. 3, it will be seen that the ports 39, permit the continuous passage of compressed air into the central bore of valve 8, and also beyond this valve into a horizontally disposed passage 19, which connects with vertically disposed passages 7, one of which is provided for each vertical series of rear chambers 26, which are thus kept under a constant pressure of air, this pressure holding the disks 25, against the shoulders of the chambers, and forming thereby the air cushion for the rearward stroke of the pistons. The passages 7, and 19 are for convenience formed in the inner face of the rear section 4. This section is also provided with horizontally disposed passages 10, and 28 which alternate vertically in section 4 as seen in Fig. 6, each of these passages being on a horizontal plane which passes through alining ports 38 in valves 8 and 12. The passages 10 and 28 at their extremities, are adapted to register with the ports 38 of inlet and exhaust valves when they have been rotated to a registering position; it will however, be understood that when a port 38, in one of the valves, is in communication with a horizontal passage 10, or 28, the port 38, in the other valve, in horizontal alinement with the first indicated port 38, is positioned to be out of register with the said horizontal passage thus closing one end of this passage.

The passages 10, near each end thereof, connect with passages 18, one of which extends along the inner face of section 1, and the other extends along the inner face of section 3. The passages 18, at their forward ends each connects with a transverse passage 16, one end 13 of which communicates with the front portion 15 of chamber 17, at the rear of the chuck-head, and the other end of passage 16 terminates in a vertical extension 5, which communicates with the front portion 15 of chambers 27.

The passages 28, near each end thereof, connect with passages 22, one of which extends along the inner face of block 1, and the other along the inner face of block 3. Each of the passages 22 connects with a transverse passage 24 which enters the chambers 27, at a point immediately forward of the disk 25; and the passages 22 also connect with transverse passages 20, which enter the forward portions 15, of the chambers 27, at a point immediately to the rear of the plugs 40. One of the passages 22 is also in communication with transverse passages 21 and 29, each of which terminates in downward extension, that of passage 21 entering the front portion 15 of chamber 17, immediately to the rear of its closing plug 40; and that of passage 29 entering the chamber 17, immediately in front of the disk 25.

The inlet valve 8, and the exhaust valve, are each held in their chambers by a collar-bearing 41 which is secured in a suitable manner to the upper face of the drill-block, a journal from each valve extending through its collar-bearing and carrying at its upper extremities a gear-wheel, the gear-wheel 31 of the inlet valve, and the gear-wheel 33 of the exhaust valve, being in mesh with a spur-gear 32, mounted on the upper end of a shaft, which is journaled in a bearing 34, carried by the drill-block, and also journaled in a bearing 35, carried by the machine, and upon which the block bearing 34 rests. The lower end of this shaft has secured thereto a bevel gear 36 which is in mesh with a bevel gear 37, actuated by power. The importance of this system of gearing in connection with the valves is that the valves are thereby rotated by positive mechanical means, in contradistinction to being rotated by fluid pressure. The drill-block is pivotally supported by means of the connection 34, 35 and the shaft passing therethrough, and also by means of a lower hinge composed of an arm 42, having a pintle member and carried by the drill-block and resting upon an arm 43, and it will be understood that the block supporting arms 35 and 43, are members of a machine not shown—on which the drill-block is mounted and carried.

In use, the drill-block, supported preferably in the manner stated, is brought into operative contact with the surface to be operated upon, a breast wall in a tunnel for instance, and the valve, (not shown) controlling the inlet pipe 9, which is in communication with the compressed air supply being open, the gears 31 and 33 are simultaneously rotated by the spur-gear 32, to the shaft of which power is imparted by the bevel-gear 37 the latter being actuated by mechanism (not illustrated) carried by the machine as stated.

The inlet and exhaust valves are positioned primarily so that when a port 38 in one valve is in communication with one end of a horizontal passage in section 4, the horizontally alining port 38 in the other valve is out of communication with the other end of the horizontal passage, the solid portion of the latter valve closing this end of the passage. This will be seen in Figs. 1 and 2. With this understanding, it will be now assumed that the valves have been turned to the position shown in Figs. 1 and 2, which represent the pistons as having struck the drill-chucks, and as returning to their initial position. A port 38 of inlet valve 8, is in communication with one end of passage 10, the other end of this passage being closed by the exhaust valve. Compressed air being always present, during the operation of the device, in the cylindrical bore of the inlet valve, now passes therefrom, through port 38 of the inlet valve into passage 10, thence into both passages 18, from whence it flows through the transverse passages 13 to the center chamber 17, and also through the transverse passages 16 and their upwardly extending continuations 5, to the outer chambers 27. The compressed air thus enters the chambers 17, and 27 immediately behind the head of the drill-chucks, and between them and their actuating hammers. This causes the hammers to travel to the rear, their travel in this direction being stopped by contact with the disk 25 which as before explained being pressed forward by a constant air-pressure, forms an air cushion for the rearward stroke of the hammers. While the compressed air was entering between the chuck-heads and hammers as just stated, and as illustrated in Fig. 1, compressed air which had been used during the previous forward movement of the hammers was being exhausted, by the system of ports and passages shown in Fig. 2, from the same three chambers. The system of passages shown in Fig. 2, extend as stated to the same three chambers, considering the chambers as a whole and not their subdivision into portions as do the passages shown in Fig. 1. These systems of passages are therefore on different horizontal planes, the system shown in Fig. 2 being above those shown in Fig. 1, the vertical passages 21 and 29 extending down to the center chamber shown in Fig. 1, whose drill is actuated in unison with the drills of the outer chambers shown in Fig. 2; and the passages 5 of the system shown in Fig. 1 extending upward from the plane of the chamber therein shown to the bottom of the outer chambers shown in Fig. 2.

The exhausting of the three chambers by the parts in the position illustrated in Fig. 2, is accomplished in the following manner: When the valves had been turned to the position shown in Figs. 1 and 2, the ports 38 in each valve, by reason of their spiral arrangement do not all aline vertically, hence while the ports 38 in Fig. 1, occupied the position shown therein, the ports 38 on a plane above that of Fig. 1 occupied the position shown in Fig. 2. In this position the solid portion of the inlet valve closes the inlet end of passage 28 thereby preventing the entrance of compressed air and one of the ports 38 of the exhaust valve is in communication with the other end of passage 28, thereby connecting that passage, through the bore of the exhaust valve, with the atmosphere. The passage 28, by means of the connecting passages 22, and their transverse connections 24 and 20, exhaust from the chambers 27 at a point to the rear of the pistons 23, and immediately in front of the disks 25, this being accomplished through the ports 24; and the passages 20 exhaust from the front portions of chambers 27 at a point between the heads

of the chucks and the plugs 40. The branches 21 and 29 of one of the passages 22 exhaust respectively the front portion 15 or chamber 17, and the intermediate portion of this chamber between the rear of its hammer 6, and disk 25. The explanation so far covers the admission of compressed air to drive the hammers 6 and 23, of the three chambers considered, back to their initial position, and it also covers the simultaneous exhausting of compressed air from these chambers from the rear of the hammers and from in front of the chuck-heads. If the inlet and exhaust valve be now considered as having been rotated a quarter of a turn beyond the positions shown in Figs. 1 and 2, it will be evident that in Fig. 1 the solid portion of inlet valve will have closed the inlet end of passage 10, and a port 38 of the exhaust valve will have registered with the exhaust end of passage 10, and in Fig. 2 a port 38 in inlet valve will have registered with passage 28, and a solid portion of the exhaust valve will have closed the exhaust end of this passage. With this position of the parts the passage 10 will now exhaust compressed air from the chambers 17 and 27 between the rear of the chuck-heads and the front of the hammers and the passage 28 will simultaneously admit compressed air to the rear of the hammers between them and the disks 25, driving the hammers forward, and the passages 28 will at the same time admit compressed air in front of the chuck-heads to cushion them against the blow of their hammers. This completes one cycle of movements; and it will be therefore seen that the passages 10 and 28 with their respective connections act alternately as inlet and exhaust passages; and as each of the valves 8 and 12 are provided with diametrically opposed ports 38, each of the passages 10 and 28, during a complete revolution of the valves, will act twice as an inlet and twice as an exhaust passage.

The explanation of the operation has so far been confined to three chambers; two outer chambers 27 and a central chamber 17; but as before explained the chambers with their operating parts are arranged in vertical series, and the passages 10, 28, and their connecting branches are likewise repeated vertically, the passages for each transverse group of the drills being identical with the passages explained in detail. It now remains to be said that all of the hammers do not move forward simultaneously; but one transverse group of three hammers move forward to strike their drill-chucks while the transverse group of hammers next below, move backward to their initial position. This alternate operation of the groups is accomplished by means of the spiral arrangement of the ports 38 in the inlet valve and in the exhaust valve. By this arrangement these ports are in engagement with alternate passages 10, likewise with alternate passages 28; and at one time the first, third, and fifth transverse groups of hammers move forward to strike their drill-chucks, while the second, fourth and sixth transverse groups of hammers move backward to their initial positions and vice versa. The object and result of this is to relieve the block and its working parts from the shock of the blows delivered in one direction, for the opposing blows counter balance and relieve the block from one sided strain; while the air cushions formed in front of the head of the drill-chuck and at the back of the disks take up the impact of the blows and save the block-parts from being injured. It might be said that the air cushion in the front portion of each chamber 15 might reduce the desired force of the hammer blow on chuck-head because the pressure is equal in chambers 15 in front of the chuck-head and back of the hammers in the chambers 17 and 27. But the fact is, the drills are at all times of the operation within one-fourth inch or less, of the rock, while the area of the chuck-head on the cushion side is much less than the area of the hammer due to the fact that the area of the shank of the drill-chuck not being subjected to the pressure of compressed air, reduces by that much the area of the chuck-head under pressure; and further, the cushion chambers are not cut off from air passages leading thereto by chuck-head, so that the slight compression of air in the chambers and long air passages is only sufficient to protect the front head 40, should the drill not reach the breast of rock. It will be noted that the momentum acquired by the hammers due to their travel under pressure aids in preponderating to the desired extent over the pressure in front of the chuck-heads. The formation of the block into sections is for the convenient and accurate construction and registering relation of the ports and their communicating passages.

The provision of pivotally mounting the valved drill-block allows it to be swung to the right or to the left to adjust it and to bring its face at the desired angle to the work and in reversing the travel of the block when it has reached the limit of its movement along the breast to the side wall, so that the drills are caused to travel laterally back and forth as they are advanced in the work. It will be understood that any suitable means may be provided whereby the lateral swing or adjustment of the pivotally mounted drill-block can be effected and controlled. For instance the swing adjustment of the block can be made by the attendant using his hands applied to either side of the block at its front and thus swing it the desired distance while the gearing, the weight of the block and the friction of its pivotal mounting of the block will hold it in a set position.

Obviously since the ports in each of the valves are arranged diametrically opposite, the valves may be rotated in either direction.

Referring to Fig. 6, it will be noted that the center of the pivotal mounting of the drill-block, and the center of the spur-gear 32 which drives the gears of the inlet and exhaust valves, are coincident, thus the valve gear connection will be maintained throughout all adjustments of the block.

A novel and advantageous feature of my invention is, that a pair of mechanically operated valves are adapted to operate any desired number of hammers by air pressure in one body by means of communicating ports and passages whereby the power is distributed to the hammers, so that they operate as described; while the valves may be rotated in either direction and accomplish the same result.

I wish it to be understood that I do not desire to be limited to the exact details of construction shown and described, for obvious modifications will occur to a person skilled in the art.

I claim:

1. In a device of the character described, a block having a plurality of chambers, and motor fluid passages communicating with each chamber at each end thereof, a piston-hammer arranged to operate in each chamber, the chambers, the passages and the drill-chucks arranged in operative groups, and a pair of mechanically rotating valves each having ports arranged to cause the operation of the drill-chucks in groups which alternate in striking a blow.

2. In a device of the character described, a block having a plurality of chambers and motor fluid passages communicating with each chamber, a piston-hammer operatively mounted in each chamber, and a pair of valves mounted in the block and each having ports arranged and caused to control the flow of the motor fluid through the passages to actuate the drills in alternate groups, means for continuously rotating the valves, and means for connecting them to effect their rotation in unison.

3. In a device of the character described, a block, having a plurality of chambers therein, a hammer for each chamber, and a drill-chuck for each hammer, said block having passages communicating with the chambers, and valves including means in association therewith for mechanically controlling air under compression to the passages and to its exhaust therefrom that the drills are actuated in groups which alternate in striking a blow.

4. In a device of the character described, a block having a plurality of chambers therein, a hammer for each chamber, and a drill for each hammer, said block having passages leading to each end of each chamber, and positively operated valves including means in association therewith for mechanically controlling a supply of air under compression to the passages and its exhaust therefrom whereby the hammers are driven forward to strike a blow and are then returned to their initial position.

5. In a device of the character described, a block having a plurality of chambers therein, a plurality of hammers one operative in each chamber, a drill-chuck for each hammer, an inlet valve and an exhaust valve including means in association therewith for mechanically controlling a supply of air under compression to actuate said hammers, said block having passages leading from said valves to each end of each chamber, the inlet and the exhaust valve controlling the hammers in groups and causing the alternate operation of the groups of drills.

6. In a device of the character described, a block having a plurality of chambers therein, a hammer in each chamber, a drill chuck for each hammer, an inlet valve, an exhaust valve each valve having spirally arranged ports, said block having a passage leading from each chamber at a point between the chuck-head and the hammer and connecting with the inlet valve and with the exhaust valve, and having a second passage leading from each chamber at a point in front of the chuck-head and also at a point back of the hammer and communicating with the inlet valve and with the exhaust valve, and means in association therewith for mechanically controlling a supply of air under compression to actuate said hammers, the passages being so disposed with reference to the ports of the valves that the hammers are operated in groups which alternate in striking a blow.

7. A drill block formed of a plurality of longitudinal sections joined side by side and a transverse end section, and having a series of chambers one above the other in each longitudinal section, a drill holding chuck and its operating hammer in each chamber, an inlet valve, an exhaust valve, both valves being located in the end section of the block and each valve being formed of a pair of rotatable hollow cylinders having ports formed in the shell and spirally arranged in each valve, said block having passages formed in the inner face of the end section and extending from the inlet valve to the exhaust valve, each passage being in horizontal alinement with alining ports in the inlet and exhaust valves, said block having also passages formed in the inner faces of the longitudinal sections of the block and connecting with the transverse passages in the end section, two of these passages being provided for each transverse groups of chambers, one of which is in each longitudinal section, one of these longitudinal passages leading from its chambers at a point between the chuck-heads and the hammers

and communicating with one of the transverse passages in the end section the other longitudinal passage communicating with the same chambers at two points one in front of the chuck-heads and the other back of the hammers and communicating with a second passage in the end section; air under compression supplied to the inlet valve, and means for positively and simultaneously operating the valves, the passages being controlled by the valves to act alternately as inlet and exhaust passages, and the transverse groups of drills are caused to alternate in striking a blow.

8. A block having a chamber therein, a drill holding chuck and its operating hammer mounted in the chamber, an inlet valve, an exhaust valve, said block having a passage leading from the chamber at a point between the drill-chuck and hammer and communicating with the inlet valve and with the exhaust valve said block having also a second passage leading from the chamber at two points one in front of the chuck and the other back of the hammer and communicating with the inlet valve and with the exhaust valve, and means for synchronously operating the valves.

9. A block having a chamber therein, a drill-holding chuck and its operating hammer, an inlet valve, and an exhaust valve, said block having a passage leading from the chamber at a point back of the chuck-head and in front of the hammer and communicating with the inlet valve and with the exhaust valve, and having also a second passage communicating with the chamber at two points one in front of the chuck and the other back of the hammer and communicating with the inlet valve and with the exhaust valve, a constantly maintained fluid cushion supplied at the rear of the chamber, and means for mechanically operating the inlet valve and the exhaust valve.

10. A block having a cylindrical chamber therein, each end portion whereof is of greater diameter than the intermediate portion, a hammer adapted to be reciprocated in the intermediate portion of said chamber, a drill-holding chuck having a head adapted to be reciprocated in the front end portion of said chamber, a disk seated in the front of the rear end portion of said chamber against the shoulder formed by the intermediate portion thereof, the block having a duct communicating with the rear end portion of the chamber at the rear of the disk, an inlet valve and an exhaust valve the inlet valve being in constant open communication with the duct communicating with the rear end portion and maintaining constant pressure against the rear of the disk therein said block having a passage 13, 18 and 10 leading from the front portion of the chamber at a point back of the chuck-head and communicating with the inlet valve and with the exhaust valve, said block having also a second passage 20, 22, 24 and 28 communicating with the front end portion of the chamber in front of the chuck-head and communicating also with the rear end of the intermediate portion of the chamber and communicating also with the inlet valve and with the exhaust valve, a suitable actuating fluid inlet to the inlet valve, and a power driven shaft and gearing for simultaneously operating the valves so that the two passages are placed alternately in communication with the motive fluid supply and with the atmosphere the ports of the valves being so arranged that when the inlet valve is admitting motive fluid to either passage the exhaust valve has closed the exhaust end of that passage and when the exhaust valve is exhausting a passage the inlet valve has cut off the motive fluid supply from this passage.

11. A block having a plurality of hammer-chambers therein in groups a drill-chuck in each chamber, an actuating hammer for each drill-chuck, an inlet and an exhaust valve having ports and housed within said block, said block having passages communicating with each end of each hammer-chamber and with the ports in said inlet and exhaust valves, and gear connecting the valves, whereby the valves are positively rotated together.

12. A block, having a plurality of hammer-chambers therein in groups, a drill-chuck for each chamber, an actuating hammer for each drill-chuck, an inlet valve and an exhaust valve having ports and housed within said block, said block having passages communicating with each end of each hammer and with ports in said inlet and exhaust valves, and power operated gear connecting the valves, a pivotal mounting for the block, the center of said pivotal mounting and the center of the valve rotating gear being coincident, whereby the valve gear connections will be maintained in any adjustment of the block on its pivotal mounting.

13. In a device of the character described, a block having a plurality of chambers therein a drill and its operating hammer in each chamber, said block having passages leading to each end of each chamber whereby the drills are arranged to operate in transverse groups in said block, an inlet valve having inlet ports mediately of its length and tubular from end to end, and distributing ports extending from the mediate ports to each end of said valve and having communication with each chamber of each group of drills, and a tubular exhaust valve having communication with each chamber of each group of drills and exhausting at its open lower end outside of the block, the ports in the valves being arranged in registering relation to the said passages.

14. In a drill-block, having a plurality of chambers, a drill-chuck and a hammer in each chamber, an inlet valve and an exhaust valve each formed of a hollow cylinder closed at one end and having ports through its shell the valves being seated in circular chambers formed in the block the chamber for the inlet valve extending partially through the block and the chamber for the exhaust valve extending through the block the open end of the exhaust valve projecting beyond the bottom of the block and the interior bore of each valve forming a fluid passage which is in constant communication with the ports in the shell the valves, and means for holding the valves in place in the block and mechanical means for operating the valves.

15. A drill block comprising a central vertical section, connected outer vertical sections and a transverse end section, the central and outer sections having horizontally disposed cylindrical chambers therein, the chambers of a section being in vertical alinement therein and the chambers of the outer sections being in horizontal alinement and each chamber in the central section being disposed below the horizontal plane connecting alining chambers in the outer sections, a drill carrying-chuck and its reciprocatory actuating hammer mounted in each chamber, an inlet valve and an exhaust valve mounted in the end section each valve being in the form of a hollow cylinder having ports throughout its length the said block having horizontal passages leading from the ports of the valves to the chambers the ports controlling the horizontal passages to cause the drills to actuate in groups, said groups alternating in striking a blow each group comprising three drills one in each section the two outer ones being in horizontal alinement and the drill in the central section being immediate below the horizontal plane connecting the outer drills.

16. In a device of the character described, a block having a plurality of chambers, a drill-carrying chuck, and its actuating hammer fitted in each chamber, an inlet valve, and an exhaust valve, each having a plurality of ports, and means for mechanically actuating the valves, the said block having passages extending from the chambers to the inlet-valve and exhaust valve, the chambers being so related through the medium of the passages and valves that the drills are actuated in groups which alternate in striking a blow.

17. In a valve for operating rock drills, a plurality of hammers, a drill carrying chuck-head for each hammer housed within the block, said block having passages communicating with each end of each hammer and each side of each chuck-head, a pair of valves housed within the block at right angles to the movements of the hammers and having ports communicating with said passages, and spur-gearing mounted on the block connecting the pair of valves and rotating them continuously in the same direction and a power operated shaft for operating said gearing.

18. A drill block formed of a plurality of longitudinal sections joined side by side, each section containing a hammer, and a hammer actuated chuck, said block having passages leading to each chamber, and a transverse block section flanking the ends of said longitudinal sections, a pair of valves housed within said end section at right angles to the axis of said hammers, and having ports communicating by a passage common to both valves and which communicates with the passages by which compressed air is delivered to and exhausted from the chambers.

19. In a drill-block having a plurality of chambers, a hammer for each chamber, a drill-chuck for each hammer, an inlet valve and an exhaust valve each formed of a hollow cylinder closed at one end and having ports through its shell and seated in circular chambers formed in the block, the interior bore of each valve forming a fluid passage which is in constant communication with the ports in the shell of the valves, said block having connecting fluid operating passages for the chambers and valve ports, means for holding the valves in the block, and a power driven shaft for mechanically rotating the valves.

20. In an impact tool having a plurality of chambers, a drill-chuck and a hammer for each chamber, a pair of coöperating mechanically actuated rotary valves for receiving and distributing the operating motive fluid for the hammers and exhausting it therefrom said block having chamber connecting passages having communication with said pair of valves for supplying the motive fluid to the hammers, substantially as described.

21. In an impact tool having a plurality of chambers arranged in vertical groups, a drill-chuck and a hammer for each chamber, a pair of coöperating mechanically actuated rotary valves, the inlet valve having ports for receiving and distributing the operating motive fluid to each hammer, and the exhaust valve having ports corresponding and in communication with each hammer-chamber, said block having a chamber connecting passages having communication with said pair of valves for supplying the motive fluid to the hammers, and means for connecting and rotating the pair of valves together.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

GEORGE ALLEN FOWLER.

Witnesses:
HENRY KNEISEL,
EMIL H. ANDERSON.