March 21, 1933. G. M. NELL 1,902,574

POWER FEEDING DEVICE

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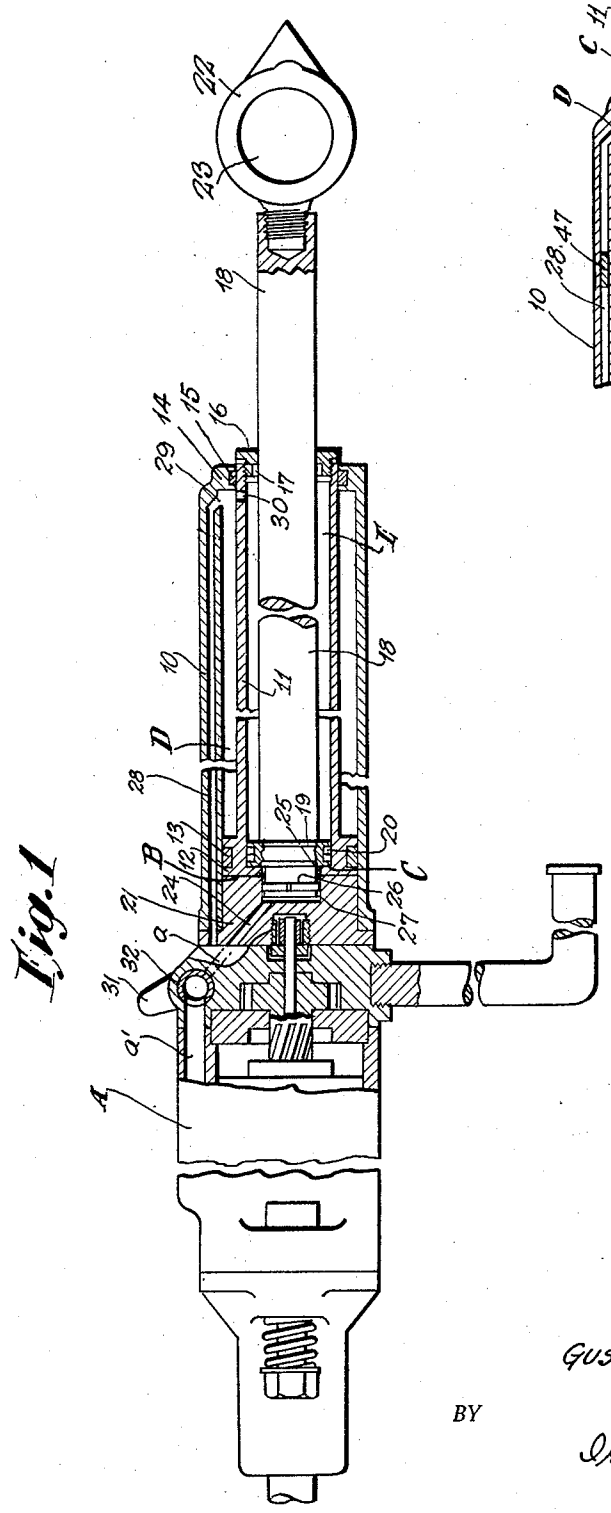


Fig. 1

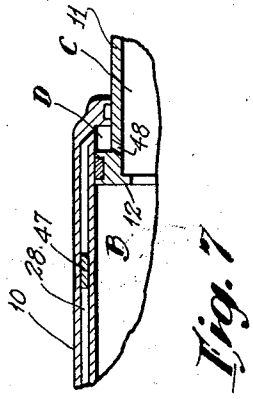


Fig. 7

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Fig. 2

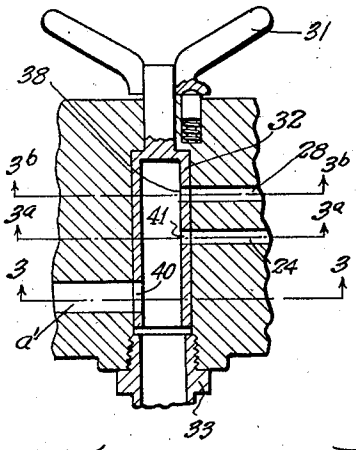


Fig. 3

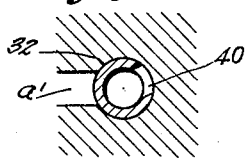


Fig. 3a

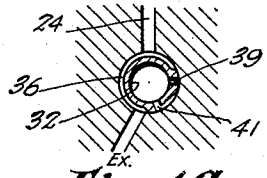


Fig. 3b

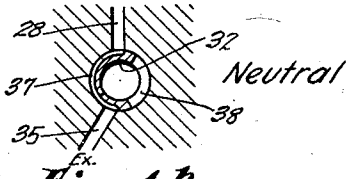


Fig. 4

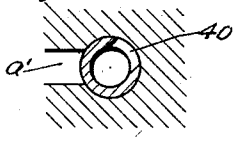


Fig. 4a

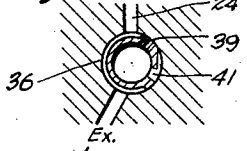


Fig. 4b

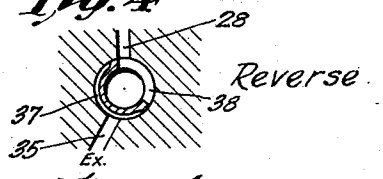


Fig. 5

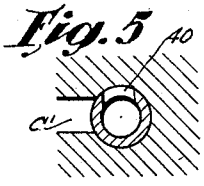


Fig. 5a

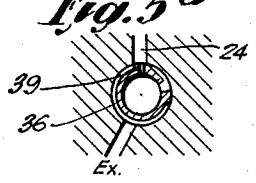
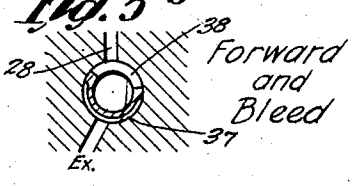


Fig. 5b



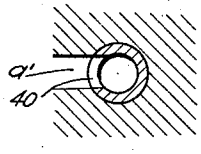


Fig. 6

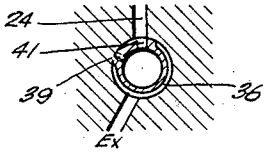


Fig. 6a

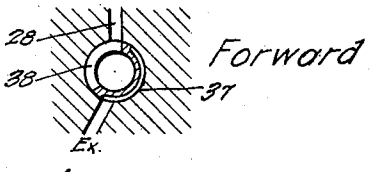


Fig. 6b

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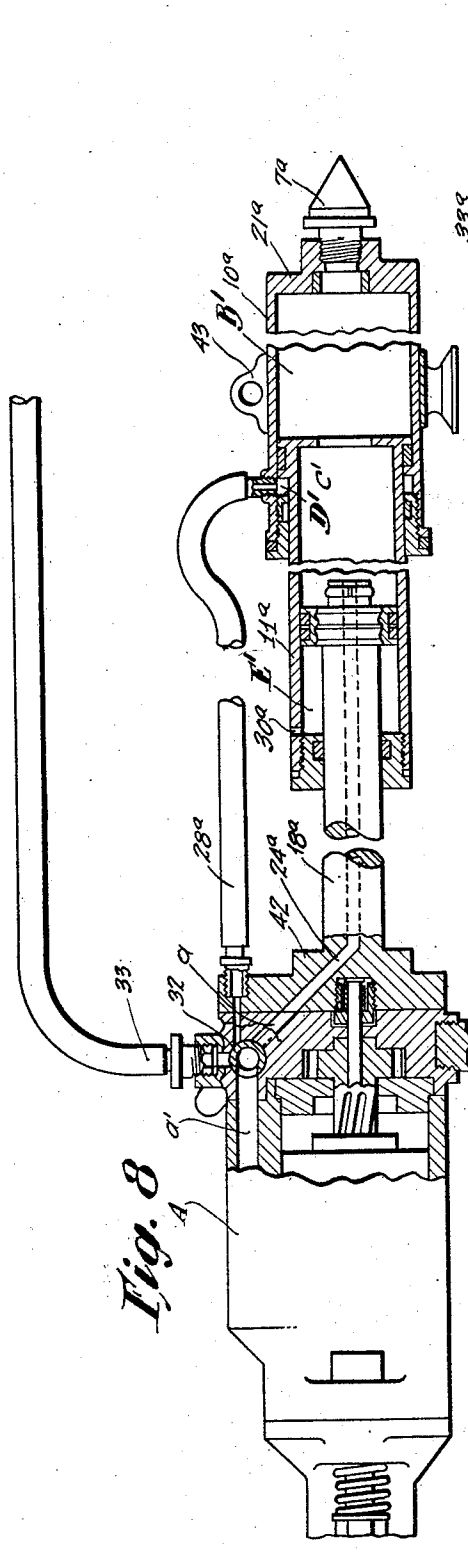


Fig. 8

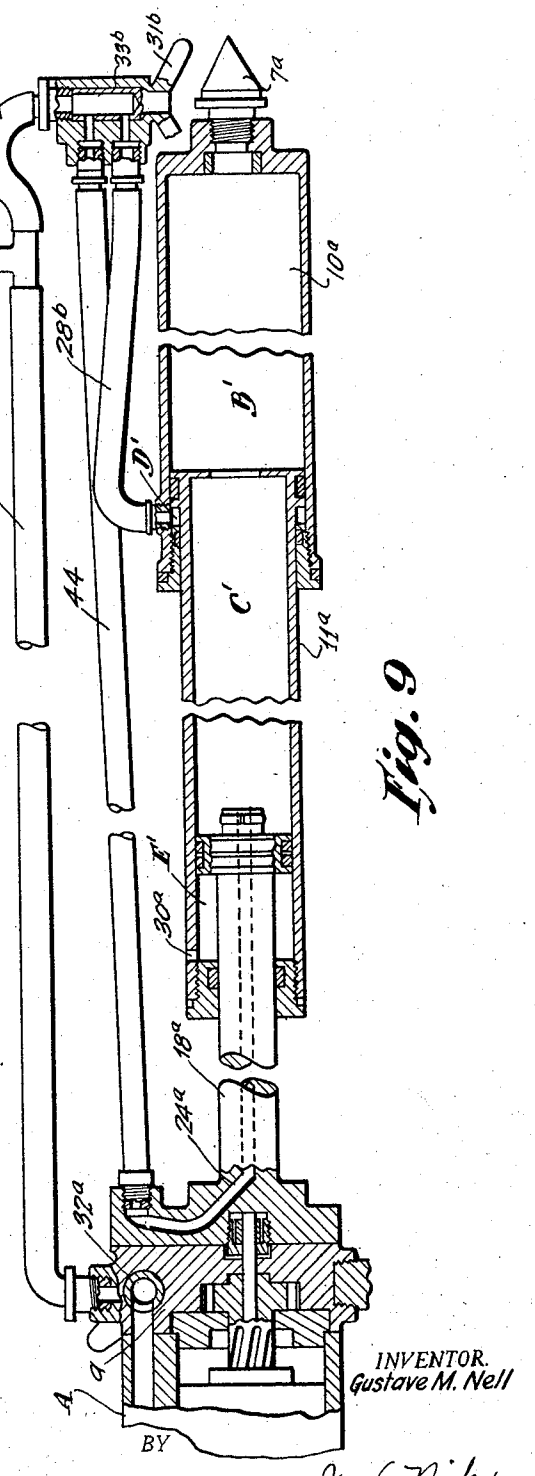


Fig. 9

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UNITED STATES PATENT OFFICE

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POWER FEEDING DEVICE

Application filed October 23, 1929. Serial No. 401,747.

This invention relates to apparatus for drilling rock and other hard formations in mining, quarrying, tunnelling and similar operations and more particularly to power means for feeding or advancing the drilling machines to the work.

One of the objects of the invention is to provide simple feeding mechanism which shall have much less overall length when collapsed than conventional drill feeds and with only a nominal increase in weight. Another object is to secure minimum collapsed length and weight with a minimum of complications. Another object is to effect a more even power application for extended movement by at least a partial balancing of opposing pressure areas, and to provide a power collapse or "pull-back" of the device. Still another object is to widen the scope of application of power feed drills and to permit their use in very restricted places and in all directions from vertically up to vertically down with a minimum of manual labor. Other objects will be apparent from the detailed description which follows.

In order to illustrate the invention concrete embodiments thereof are shown in the accompanying drawings, in which:

Fig. 1 is a sectional view partly in elevation of a stoper drill equipped with a power feed, the latter being shown in collapsed position;

Fig. 2 is a diagrammatic sectional view of a single control valve for both the percussive motor and the power feed, the valve being in forward or operating position for motor and feed;

Figs. 3, 3*a* and 3*b* are transverse sectional views substantially on the lines 3—3, 3*a*—3*a* and 3*b*—3*b* of Fig. 2 but showing the valve in neutral position;

Figs. 4, 4*a* and 4*b* are sectional views similar to Figs. 3, 3*a* and 3*b* showing the valve in reverse position.

Figs. 5, 5*a* and 5*b* are sectional views showing the valve in forward and bleed position;

Figs. 6, 6*a* and 6*b* are sectional views showing the valve in forward position as in Fig. 2;

Fig. 7 is a fragmentary sectional view of the power feed device in which the power collapsing feature is eliminated;

Fig. 8 is a view similar to Fig. 1 but showing the feed device reversely arranged and partly extended; and

Fig. 9 discloses the same feed arrangement as shown in Fig. 8 and differs only in the method of controlling the percussive motor and the feed device.

In its essentials, the power feed device comprises a plurality of nested telescoping members. The outmost, or largest member in a transverse sense, may be a cylinder 10 within which reciprocates a hollow piston 11 having a head 12 provided with suitable packings 13. An inwardly directed flange 14 on the free end of cylinder 10 provided with a packing 15 forms a slidable bearing for piston 11 and a stop for piston head 12. A closure bushing 16 is secured in the outer end of piston 11 and is provided with packing 17 to form a combined bearing and stop for the third member of the power feed, namely, piston 18, which is provided with a head 19 slidably within piston 11 and having packings 20. The rearward end of main cylinder 10 has an abutment plug 21 by which the entire feeding device is suitably secured to backhead *a* of a conventional rock drill A. In order that the machine may function after the manner of "direct feed", the outer member 18 of the feed device may be equipped with a feed point 22 to rest upon the rock in the customary manner with rock drill stopers. The point may also have a hole 23 therethrough to be used in any manner desired, as for a rope, a peg in the ground, or a bolt on a rock drill column, to offer a point of support both when the feed is extended and collapsed.

For the forward or extended movement of the feed device motive fluid admitted through passage 24 in plug 21 has direct access to the large chamber B of cylinder 10 to force piston 11 outwardly. Chamber B communicates directly at all times with chamber C of piston 11 by large port 25 in the rear end or stop flange of the latter thereby to move piston 18 outwardly. When the feed device is collapsed, as shown in Fig. 1, a

spring clip 26 on an extension of head 19 of piston 18 projects through the open port 25 in the stop flange and establishes frictional engagement with the walls of a cooperating socket 27 in plug 21. For a power collapse of the feed device, a motive fluid passage 28 extends axially through the wall of cylinder 10 and communicates by port 29 adjacent flange 14 with the variable volume annular chamber D formed between piston 11 and cylinder 10. When hollow piston 11 is fully telescoped within cylinder 10 (Fig. 1) a port 30 through the wall of the piston 11 permits motive fluid in chamber D to pass into the variable volume annular chamber E formed between pistons 18 and 11.

By preference a single manually operated valve member or lever 31 is arranged to control the operation of both the percussive tool A and the power feed. To this end a single hollow oscillatory valve 32 having three operating zones is provided under control of handle 31 and is diagrammatically illustrated in Fig. 2 of the drawings. While this valve may be located at any place most convenient for the operator, it is shown in Figs. 1 and 8 in the backhead of percussive motor A. Fluid under pressure, such as compressed air, is directed by a suitable inlet connection 33 to the central bore of valve 32 whence its distribution is controlled at the first zone to passage a' leading to the percussive motor (Figs. 3–6), at the second zone to passage 24 leading to chamber B of the feeding device for the extended movement of the piston (Figs. 3a–6a), and at the third zone to passage 28 leading to chamber D for the retracting or collapsing movement of the feed device (Figs. 3b–6b). Valve 32 also controls an exhaust port 34 (Figs. 3a–6a) for passage 24 and an exhaust port 35 (Figs. 3b–6b) for passage 28.

There are four operating positions of control valve 32, namely, neutral position (Figs. 3, 3a and 3b); reverse position (Figs. 4, 4a and 4b); forward and bleed position (Figs. 5, 5a and 5b); and forward position (Figs. 2, 6, 6a and 6b). The operation of the stoper shown in Fig. 1 will be explained in connection with these positions of the valve. With the parts in collapse position (Fig. 1) and with valve 32 in its neutral position, no motive fluid is being admitted to passage a' (Fig. 3) for the percussive motor, passage 24 is connected to exhaust 34 by a groove 36 in the exterior of the valve (Fig. 3a) and passage 28 is connected to exhaust 35 by a similar groove 37 in the valve. Hence, all the chambers of the feeding device are connected to exhaust and the feed is inoperative. In the next, or reverse position of the valve, there is no change in the situation except that passage 28 leading to chamber D and thence to chamber E is cut off from exhaust 35 (Fig. 4b) and connected to the source of motive fluid by port 38 in the valve. Since the feed is already in its collapsed position no movement can take place.

Continuing the counter-clockwise movement of the valve we next come to the forward and bleed position (Figs. 5, 5a and 5b). There is still no admission of motive fluid to passage a' of the motor but a restricted admission port 39 in valve 32 (Fig. 5a) is brought into communication with passage 24 while exhaust groove 36 around the valve is still open slightly, so that a reduced pressure of motive fluid builds up in chambers B and C gradually to extend the parts of the feeding device. It is to be noted from Fig. 5a that motive fluid continues to be fed through port 38 of the valve to passage 28 and thence to chambers D and E, which is for the purpose of making a more uniform feed due to a partial equalizing of the pressures on the opposite sides of piston heads 12 and 19.

The gradual extending of the feed is to bring motor A into contact with the work. Thereupon the counter-clockwise movement of the valve is continued into the forward position (Figs. 6, 6a and 6b). In this position motive fluid is admitted in desired amount to passage a' by port 40 in the valve to set the percussive motor in operation. The feeding of motive fluid to passage 24 is brought to full amount by port 41 in the valve, the exhaust groove 36 being wholly out of contact with passage 24 so that the feed device is extended as fast as the work performed by drill A will permit. Motive fluid is still fed to passage 28 in chamber D by port 38 in the valve (Fig. 6b) for partially equalizing the opposing pressure on the other side of piston head 12 so as to make the feed pressure more nearly equal or minimize the difference between the effective feeding areas of piston 11. This same partial equalizing of pressures for piston head 19 of piston 18 continues so long as piston 11 is far enough within cylinder 10 to place port 30 in communication with chamber D. When piston 11 is forced slightly out of cylinder 10, port 30 is open to atmosphere and there is no longer any opposition to the outward movement of piston 18. When it is desired to collapse the feed the throttle valve is turned in a counter-clockwise direction and the reversal of the cycle takes place.

In Fig. 8 the attachment of the feeding device is the reverse of that shown in Fig. 1 in that small piston 18a is provided with a head or abutment 42 which is attached to backhead a of drill A and large cylinder 10a rests upon the ground as with a point 7a mounted in plug end 21a, or is held in a conventional clamp 43 attached to an ordinary column so as to offer support both for extension and collapse of the feed. With this reverse arrangement passage 24a which supplies motive fluid for the extension of the

feeding device is formed as a bore in small piston 18*a* which opens directly into chamber C′ of piston 11*a* rather than into chamber B′ of cylinder 10. A flexible connection or pipe 28*a* may serve to direct motive fluid to chamber D′ for the collapsing of the feed, communication being established between chambers D′ and E′ by port 30*a* in piston 11. The controlling of the feed and motor is by a single control valve 32 identical in operation with that described in the form of the invention shown in Fig. 1.

Fig. 9 shows the same reverse feed as disclosed in Fig. 8 but illustrates a different method of supplying motive fluid to the feed and to the drill. Throttle valve 32*a* in backhead *a* of drill A controls the operation of the percussive motor alone. A separate valve 32*b* independently operated by handle 31*b* controls the admission of motive fluid to a flexible conduit 28*b* which opens into chamber D′. With this arrangement, control of the feeding device is entirely independent of control of percussive motor A. The operative positions of the feed control valve 32*b* correspond with Figs. 3*a*–6*a* and 3*b*–6*b*. Motive fluid may be supplied to valves 32*a* and 32*b* by branches 45 and 46 respectively from main supply conduit 33*a*.

When the stoping machine is operated vertically with point 7 or 7*a* resting on the floor the pull back or collapse under power of the feeding device is of no great value and in those instances where all rock drill holes are put in vertically, or approximately so, passage 28 (Fig. 7) may be closed by a plug 47. A crossport 48 is then made in the wall of piston 11 to establish communication between chambers C and D thereby to effect the partial equalizing of pressures referred to above, so as to permit more accurate control of the feeding device.

Whenever the holes to be drilled are slightly out of or below horizontal, the power collapse is of great importance and the outer end of the feeding device is held against longitudinal displacement by means of a peg or stake loosely entering hole 23 (Fig. 1) or the same result may be secured by attachment of the feed to a mining column as by clamp 43 (Fig. 8) or in any other well-known manner familiar to those experienced in the mining art.

The many advantages of the present invention will be apparent to those skilled in the art. As compared with the conventional two-part rock drill feed, the present form is approximately one-half the length of the former when both are collapsed, but of equal length when extended. This makes the improved feed of great value when drilling must be done in very restricted places. The ease of control reduces manual labor and the compactness, simplicity, and strength of the parts hold upkeep and repair expense to a minimum.

The feeding device may have a variety of applications in drilling work and may be connected to a drill in many ways. While the invention has been herein disclosed with particular reference to its application to percussive tools for stoping, it is to be understood that it is capable of many other applications and uses. Hence, the claims are to be given a broad construction and are not to be limited merely to the particular forms and arrangements herein shown.

I claim as my invention:

1. In combination, in a rock drill, a fluid pressure percussive motor, a fluid pressure power feed for advancing said percussive motor and retracting it from the work, said feed comprising at least three nested telescoping members capable of extending to a length equal to at least twice its length when collapsed, and a single manually operated valve for controlling both said percussive motor and said feed, said valve having three control zones motive fluid, control means in each of said zones one zone controlling the operation of said percussive motor, another zone controlling the extending of said feed and the third zone controlling the retracting or collapsing of said feed, vent means under control of said valve in said second and third zones, said valve being arranged to admit pressure fluid at the third zone in all positions except neutral.

2. In combination, in a rock drill, a fluid pressure percussive motor, a fluid pressure power feed for advancing said percussive motor and retracting it from the work, said feed comprising at least three nested telescoping members capable of extending to a length equal to at least twice its length when collapsed, fluid pressure supply means extending to said motor and to said power feed, and a single manually operated valve having at least three control positions for controlling the operation of both said percussive motor and said feed, said valve having three control zones for said fluid pressure supply means, one zone controlling the operation of said percussive motor, another zone controlling the extending of said feed and the third zone controlling the retracting or collapsing of said feed, said valve being arranged to admit pressure fluid at all zones when in "forward" or feed-extending position.

3. In combination, in a rock drill, a fluid pressure percussive motor, a fluid pressure power feed for advancing said motor to and retracting it from the work, said feed having nested telescoping members comprising a cylinder, a hollow piston reciprocable in said cylinder, a second piston reciprocable within said hollow piston, said hollow piston serving as a conduit between said cylinder and said second piston, means utilizing said

conduit for releasably maintaining said members in collapsed position, means for conducting motive fluid to the interior of said cylinder to extend said members, means utilizing motive fluid to retract said members, and a single manually operable valve having three control zones through which the operation of said motor and the extending and contracting of said feed are controlled, the admission port for said motor being connected to one zone and said second-named and said third-named means being connected to the other zones respectively, said valve being arranged to pass motive fluid at one of said zones in all positions except "neutral".

4. In a rock drill having a fluid pressure percussive motor and a fluid pressure power feed for advancing the motor toward and retracting it from the work, a single manually operable valve for controlling the operation of both said motor and said feed having fluid pressure control means disposed in three zones and venting means in two of said zones, said valve being constructed and arranged to pass motive fluid at one of said vented zones in all of its control positions except one.

5. In a rock drill having a fluid pressure percussive motor and a fluid pressure power feed for advancing the motor toward and retracting it from the work, a single manually operable valve for controlling the operation of both said motor and said feed having fluid pressure control means disposed in three zones and venting means in two of said zones, said unvented zone for controlling the motor and said vented zones for controlling the extending and retracting of the power feed, said valve being constructed and arranged to pass pressure fluid at all zones when in "forward" or feed extending position.

6. In a rock drill having a fluid pressure percussive motor and a fluid pressure power feed for advancing the motor toward and retracting it from the work, a single manually operable valve for controlling the operation of both said motor and said feed having fluid pressure control means disposed in three zones and venting means in two of said zones, said unvented zone for controlling the motor and said vented zones for controlling the extending and retracting of the power feed, said valve being constructed and arranged to pass pressure fluid at all zones when in "forward" or feed extending position and at one of said vented zones in all positions except "neutral".

Signed by me at Detroit, county of Wayne and State of Michigan this 18 day of October, 1929.

GUSTAVE M. NELL.