

UNITED STATES PATENT OFFICE.

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AUTOMATIC AIR-FEED CONTROL FOR ROCK DRILLS.

1,413,499.

Specification of Letters Patent. Patented Apr. 18, 1922.

Application filed February 25, 1921. Serial No. 447,758.

To all whom it may concern:

Be it known that I, WILLIAM A. SMITH, a citizen of the United States, and a resident of Phillipsburg, county of Warren, State of New Jersey, have invented a certain Automatic Air-Feed Control for Rock Drills, of which the following is a specification.

This invention relates to fluid pressure rock drills of the hammer type, but more particularly to automatic air feed control for the feeding element, which advances the machine. In my co-pending application, Serial No. 447,757 filed February 25, 1921, I have disclosed my automatic air feed control applied to a stope drill as an illustrative example, while in the present application I have disclosed the invention applied to a so-called drifter, or machine adapted to be held in a clamp, as usually used for drilling substantially horizontal and down holes.

In operating a rock drill of the hammer type, whether a stoper, a drifter or other form, having a fluid pressure feeding element, if a soft spot is encountered, the power of the air feed should ordinarily be reduced, but full rotation and hammer power should be retained, or if possible, increased rotation should be produced, to enable the machine to operate in the most efficient manner.

These changes in the air feed control have heretofore been effected by hand to suit the conditions of the work, and one object of the present invention is to enable the air feeding element of a machine adapted to be held in a clamp, to be automatically controlled substantially without hand regulation after the drilling is started.

Another object is to effect the control of such a type of machine by automatic means responsive to the resistance to the rotation and the torque of the rotation motor, for automatically varying the pressure in the air feed cylinder of the feeding element.

To these and other ends, the invention is illustrated in one of its preferred forms in the accompanying drawings, in which—

Figure 1 is a side elevation of a rock drill embodying the invention, partly in longitudinal section;

Figure 2 is an enlarged detail longitudinal sectional elevation through the feeding element on the line 2—2 of Figure 4 looking in the direction of the arrows;

Figure 3 is a detail longitudinal sectional

view through the feeding element partly broken away, and taken on the line 3—3 of Figure 4 substantially at right angles to the plane on which Figure 2 is taken, looking in the direction of the arrows;

Figure 4 is a transverse sectional view on the line 4—4 of Figure 2 looking in the direction of the arrows;

Figure 5 is a view similar to Figure 4 with the feed cylinder relief valve in open instead of closed position;

Figure 6 is a transverse sectional view of Figure 2 on the line 6—6 looking in the direction of the arrows; and

Figure 7 is a view similar to Figure 4 of a modification of the cylinder relief valve.

Referring to the drawings, a rock drill is illustrated in the figures having a cylinder A and front head B provided with the rotation sleeve C through which the drill steel D extends in position to receive the impact blows of the hammer E. An independent fluid actuated rotation motor is shown in this instance for rotating the drill steel, a gear motor being indicated having the gears F, only one of which is shown in Figure 1, in the motor casing formed by the back end portion G of the cylinder. The head block G' is shown located between the cylinder portion G and the sleeve H on the tubular piston rod J operating within the feed cylinder K of the feeding element. The rock drilling machine is adapted to be mounted on and connected to the tubular piston rod J by any suitable means (not shown), and the parts are suitably held together as for instance, by means of side bolts (not shown). In accordance with such construction the longitudinal movement of the piston rod in the feed cylinder K advances the machine to its work.

In this instance, the feed cylinder K is shown held within any suitable and usual clamp L and the feed cylinder is provided with a front head O, bushing P and stuffing Q forming a closure for the front end of the cylinder around the piston rod. The piston rod is provided with a piston R of any suitable or usual construction, and the rear end of the feed cylinder K is provided with the back head S forming a closure for the same.

The tubular piston rod J carries an internal guiding sleeve T having a guide head U provided with the ports V and W, and this guiding sleeve is guided on a longitudinally

stationary but rotatable guide rod X having a guide rod head Z suitably held within the feed cylinder back head S against the inwardly tapered bearing sleeve *a*. A sleeve *b* within the piston is provided with a spring *c* adapted to enter the tapered bore of the bearing sleeve *a* when the piston is retracted in order to hold the parts retracted when the machine is not in use.

10 The guide rod X is provided with a longitudinal groove *d* in which a key *e* within the sleeve *b* is seated so that the piston and piston rod are guided longitudinally on the guide rod X and any tendency of the drilling machine to rotate the tubular piston rod *J* and piston R will tend to rotate the guide rod X and guide rod head Z within the relatively fixed and non-rotatable feed cylinder K.

20 Fluid pressure is supplied to the machine through the usual throttle valve *f* and passes through the passage *g* to the tubular piston rod *J* and thence through the port V in the head U on the guiding sleeve T and then passes through the longitudinal groove *h* in the guide rod X to the rear of the piston R, thus forcing the piston outwardly in the feed cylinder K for feeding purposes.

30 The feed cylinder back head S, as shown, is provided with a valve casing *j* having a valve *k* normally held in closed position by means of the spring *o* beneath the cap *p*. The valve *k* controls the passage *q* communicating with the atmosphere at the atmospheric port *r* and serving to relieve the pressure behind the piston R when the valve *k* is open, as indicated in Figure 5, since the space behind the piston R is then in communication with the passage *q* through the port *s* in the guide rod head Z. There is preferably sufficient clearance *t* between the periphery of the guide rod head Z and the interior of the feed cylinder back head S to afford communication between the port *s* in the guide rod head Z and the passage *q* in the valve casing *j*.

The guide rod head Z is provided as shown with a cut away portion *u* adapted to bear upon the end *v* of the valve *k*.

50 When the resistance to rotation of the drill steel is sufficient to cause relative rotary movement between the piston rod J, piston R, guide rod X, guide rod head Z, and the relatively stationary feed cylinder K, the valve *k* will be open to a greater or less extent, according to the movement of the guide rod head Z, thus automatically relieving the pressure in the air feed cylinder K in accordance with the requirements of the work.

65 In order to retract the machine by air pressure at any time desired, a separate valve *w* is mounted in the back head S and controls the atmospheric port *x*. A port *y* in the guide rod head Z affords communi-

70 tion between the longitudinal groove *h* in the guide rod X and a passage *z* in the guide rod head, permitting the air to exhaust through the guide rod head and through the interior of the valve *w* and valve port 3, to the atmosphere through the atmospheric port *x* when the valve *w* is turned to the position indicated in Figure 3. A suitable spring 4 within the guide rod head Z serves to maintain the valve *w* on its seat, and a suitable handle 5 may be provided for manually adjusting the valve *w*. The air passing into the tubular piston J passes out through the port V in the guide rod head U, thence through the longitudinal groove *h* and to atmosphere through the atmospheric port *x*, thus relieving the pressure behind the piston R and permitting the pressure against the front of the piston head R through the ports W in the head U of the guiding sleeve T to retract the machine.

In the modification of the automatic air feed controlling valve shown in Figure 7, the valve casing *j'* is provided with a valve *k'* having a head 6 subjected to live air pressure through the passage 7 and port 8 adapted to be connected with the inlet of the machine in any suitable manner so that the valve is maintained in closed position by fluid pressure instead of by a spring as shown in Figure 4. The space beneath the valve head 6 is preferably vented to atmosphere at the port 9. The operation of the device indicated in Figure 7 is otherwise the same as that described in connection with Figures 4 and 5.

I claim:

1. In a rock drill of the hammer type, the combination with a drill cylinder, of an independent motor for rotating the drill steel, a fluid pressure feeding element for feeding the machine forward, comprising a stationary non-rotatable member, a rotatable and longitudinally movable member connected to the drill cylinder, means for limiting the rotary movement of said longitudinally movable member, means actuated by said rotary movement for automatically controlling the forward feeding of said feeding element in accordance with the resistance to rotation, and additional means for controlling the return movement of said feeding element.

2. In a rock drill of the hammer type, the combination with a drill cylinder, of an independent motor for rotating the drill steel, a fluid pressure feeding element for feeding the machine forward, comprising a stationary non-rotatable member, a rotatable and longitudinally movable member connected to the drill cylinder, means for limiting the rotary movement of said longitudinally movable member, a valve actuated by said rotary movement for automatically controlling the forward feeding of said feed-

ing element in accordance with the resistance to rotation, and an additional valve for controlling the return movement of said feeding element.

5 3. In a rock drill of the hammer type, the combination with a drill cylinder, of an independent motor for rotating the drill steel, a fluid pressure feeding element for feeding the machine forward, comprising a
10 stationary non-rotatable cylinder, a guide longitudinally fixed relatively to the feed cylinder, and having a limited rotary movement within the feed cylinder, a piston and hollow piston rod connected to the drill
15 cylinder and longitudinally movable upon said guide but rotatable therewith, whereby sufficient resistance to rotation of the drill steel causes rotation of the guide and connected parts in the feed cylinder, and means
20 actuated by said rotary movement for automatically controlling the forward feed of the machine.

4. In a rock drill of the hammer type, the combination with a drill cylinder, of an independent motor for rotating the drill steel,
25 a fluid pressure feeding element for feeding the machine forward, comprising a stationary non-rotatable cylinder, a guide longitudinally fixed relatively to the feed cylinder, and having a limited rotary movement within the feed cylinder, a piston and hollow piston rod connected to the drill cylinder and longitudinally movable upon said
30 guide but rotatable therewith, whereby suffi-

cient resistance to rotation of the drill steel 35 causes rotation of the guide and connected parts in the feed cylinder, and means actuated by said rotary movement for automatically controlling the forward feed of the machine, and additional means for controlling the return movement of said feeding element. 40

5. In a rock drill of the hammer type, the combination with a drill cylinder, of an independent motor for rotating the drill steel, 45 a fluid pressure feeding element for feeding the machine forward, comprising a stationary non-rotatable cylinder, a guide longitudinally fixed relatively to the feed cylinder, and having a limited rotary movement within the feed cylinder, a head on
50 said guide at the rearward end of the feed cylinder, a piston and hollow piston rod connected to the drill cylinder and longitudinally movable upon said guide but rotatable therewith, a valve adapted to be actuated by the head on the said guide for controlling the forward feeding of the machine, whereby sufficient resistance to rotation of the drill steel causes rotation of the
60 guide and connected parts and actuates the said feed cylinder controlling valve in accordance with the torque of the rotation motor.

In testimony whereof I have signed this 65 specification.

WILLIAM A. SMITH.