Aug. 21, 1923.

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A. H. TAYLOR

REDUCING VALVE FOR ROCK DRILLS

Filed July 6, 1920

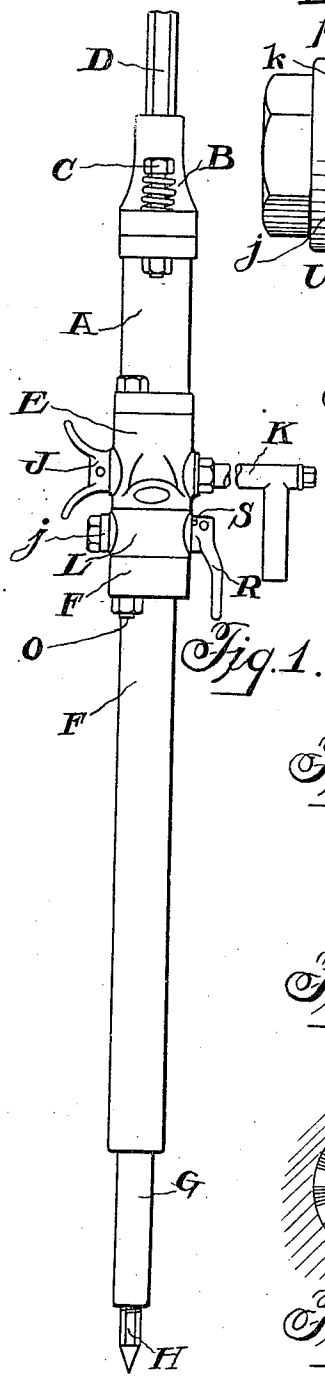


Fig. 1.

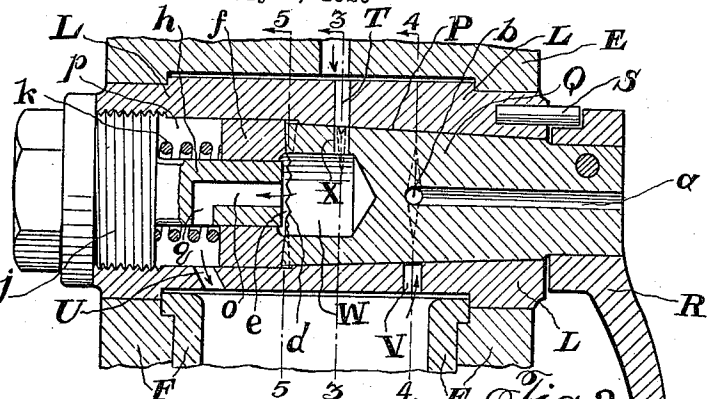


Fig. 2.

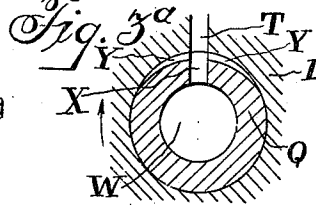


Fig. 3a

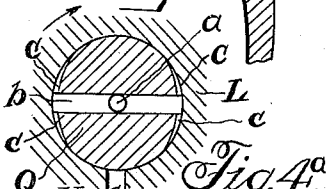


Fig. 4a

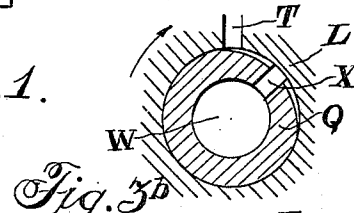


Fig. 3b



Fig. 4b

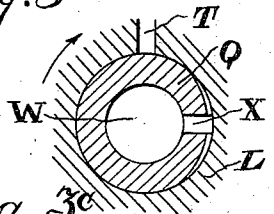


Fig. 3c

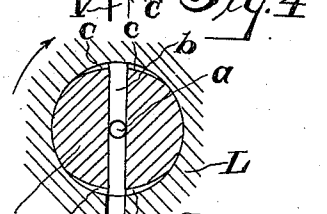


Fig. 4c

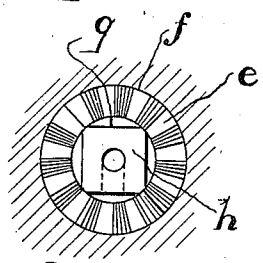


Fig. 5.

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UNITED STATES PATENT OFFICE.

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REDUCING VALVE FOR ROCK DRILLS.

Application filed July 6, 1920. Serial No. 394,274.

To all whom it may concern:

Be it known that I, ALBERT H. TAYLOR, a citizen of the United States, residing at Easton, in the county of Northampton, State of Pennsylvania, have invented a certain new and useful Improvement in Reducing Valves for Rock Drills, of which the following is a specification.

This invention relates to reducing valves, but more particularly to a reducing valve for controlling and regulating the pressure of motive fluid in the feed cylinder of a rock drill of the hammer type, in which the feeding element consists of a cylinder and piston for advancing the machine to its work. The class of rock drills known as stope drills are an example of the machines employing such feeding means, and my invention is particularly adapted to stope drills, although it may be used for other machines.

The maintenance of a substantially fixed pressure in the air feed of a stope drill has not fully met the requirements of operation, for, although it is generally desired to carry a pressure in the air feed lower than the supply pressure, still it is desirable that the pressure in the air feed increase to a certain extent, but not as much as the supply pressure increases. Furthermore if the supply pressure falls there is no way to produce a corresponding drop in pressure in the feed cylinder except as the pressure is reduced by the tool advancing into the rock.

In a certain class of machines the pressure in the feed cylinder has been held at a certain amount below that in the supply in accordance with the setting of a spring. But in the case of high supply pressure, a considerable reduction in pressure in the feed cylinder is needed, while at lower pressures in the supply, it is desirable to have practically the same pressure in the air feed. This type of valve also has the same disadvantage as the previous one mentioned, namely, that a sudden drop in supply pressure produces no corresponding drop in the air feed cylinder. If the operator observes that the air feed is too strong, he releases the spring pressure on the valve. But the air in the air feed is trapped and the desired reduction in pressure does not follow in which case the operator continues to reduce the spring tension. Finally, when the pressure in the air feed has been reduced by leakage, or by the tool advancing to its work the operator finds that he has reduced the spring pressure far below that required and he must again adjust the spring to suit the lowered supply pressure. The difficulties are also present in the design first mentioned, for maintaining a substantially fixed pressure in the air feed.

Another trouble with both the designs mentioned, is the fact that it is almost impossible to make either type of valve air tight and as the requirements of the air feed represent a comparatively small volume, especially when drilling the hard rock, the slight leakage past the valve more than equals the advance made by the piston in the feed cylinder, the result being that the pressure in the feed cylinder is generally very close to that in the supply regardless of how the spring is set.

Still another means of maintaining a reduced pressure in the feed cylinder is to provide a constantly open port from the feed cylinder to the atmosphere and vary the size of the opening by making the supply with the feed cylinder under the control of the operator. This has the disadvantage of being very wasteful of motive fluid owing to the fact that a leakage port large enough to meet all requirements is open at all times.

The conditions mentioned in the last paragraph have also been reversed and a constant supply to the air feed has been maintained while the size of the leakage port to the atmosphere is adjusted by the operator. This is also very wasteful of motive fluid as the supply port must be large enough to take care of all conditions, such as a leaky piston and is therefore much in excess of that normally required, with the result that the excess is allowed to escape.

The primary objects of the present invention are to overcome the difficulties and disadvantages present in the types of reducing valves heretofore used for controlling and regulating the pressure of motive fluid in the feed cylinder of a rock drill.

In accordance with the present invention, the supply to the air feed is fully open in the initial position of the valve, and by turning the valve, the supply is gradually diminished until reduced to only a small fraction of the full opening. Further turning of the valve continues to decrease the supply opening and at the same time, the leak opening or communication from the air

feed cylinder to the atmosphere starts to open and continues to gradually open as the supply decreases. Before the leak port is fully open the supply is entirely closed. When the valve has been turned to its full limit of travel or rotation, the leak port is fully open and the supply is closed.

I am enabled to produce a corresponding drop in pressure in the feed cylinder if the supply pressure falls. This reduction in pressure is effected by cutting down the supply port which admits live air to the air feed and at the same time opening the port to vent the pressure from the feed. I obviate the necessity of spring adjustments and avoid waste of fluid under pressure while at the same time producing a valve which is simple in construction, efficient in operation and substantially fully meets all the requirements of the air feed in operation.

Further objects of the invention will hereinafter appear and to all of these ends the invention consists of combinations of elements, arrangement of parts and features of construction substantially as hereinafter fully described and claimed in this specification and shown in the accompanying drawings in which,

Figure 1 is a side elevation of a stope drill having my reducing valve applied thereto,

Figure 2 is an enlarged longitudinal sectional view through the valve chest and valve,

Figures 3^a, 3^b, and 3^c show diagrammatically three different positions of the valve with relation to the inlet port taken on the line 3—3 of Figure 2,

Figures 4^a, 4^b, and 4^c show diagrammatically three positions of the valve with relation to the exhaust port taken on the line 4—4 of Figure 2 or bleader from the air feed cylinder, and

Figure 5 is a detail view of the valve on the line 5—5 of Figure 3.

Referring to the drawing Figure 1 shows a stope drill selected to illustrate the invention, and having the hammer cylinder A provided with the front head B adapted to be connected to the cylinder by means of the usual side bolts C. The drill steel D carried in the front head B is shown broken away for convenience. The machine is provided with the usual back end portion E and the feed cylinder F having the piston rod G provided with the usual rock engaging point H. The throttle J controls the supply of motive fluid for the machine and K represents the handle for the machine adapted to be grasped by the operator.

My improved reducing valve is preferably seated in a valve chest L adapted to be located between the percussive element represented by the cylinder A, and the air feed element F of the rock drill, as shown, the parts being held together as by means of the bolts O. The valve chest L or its equivalent could be arranged in any suitable location on the machine but is preferably built into the machine so that it is not liable to damage or destruction. The valve chest L may either be a separate piece as shown or it may be encased in the back end portion or head portion E of the cylinder.

The valve chest L as shown in detail in Figure 2, is formed with a transverse tapered valve hole P for receiving a tapered plug valve Q having the operating handle R, the rotative movement of the valve being limited by any suitable means as the stop pin S.

The valve chest L and the plug valve Q are provided with suitable ports and passages adapted to fully open the supply to the air feed element of the machine and close the exhaust from said element when the valve is in one position, rotation of said plug Q gradually decreasing the supply opening until it approaches a minimum and further rotation from this point gradually closing the supply entirely and gradually opening the exhaust until the same is fully opened. In order to accomplish this cycle the supply and exhaust ports preferably lie in different longitudinally separate sections of the plug valve. In addition, means are also preferably provided for retaining the valve in different desired positions of rotation.

One suitable and preferable arrangement of ports and passages is that shown in Figure 2 and illustrated diagrammatically in Figures 3^a, 3^b, 3^c, and 4^a, 4^b and 4^c.

The valve chest L is provided with an inlet port T affording communication between the motive fluid supply of the machine and the tapered valve hole P. An admission port U leads from the valve hole P to the air feed element F, and an exhaust port V leads from the air feed element to the valve hole. The plug valve Q is provided with the bore W at one end having a port X terminating in tapered slots Y in the periphery of the plug so that as the valve is rotated in either direction from the full open position indicated in Figure 3^a, the supply will gradually be cut off.

The valve plug Q is also provided with a longitudinal exhaust passage-way *a* open to atmosphere at its outer end and communicating at its inner end with a transverse passage-way *b* passing through the plug and terminating in tapered slots *c* in the periphery of the valve so that as the valve is rotated in either direction from the position of Figure 4^a the exhaust is gradually opened.

The valve plug Q and its corresponding parts may be constructed in different ways, one preferable construction being that

shown in Figure 2 in which the inner or large end of the tapered plug is corrugated at *d* and adapted to cooperate with the corrugations *e* on the meeting face of a stop member having a squared bore *g* adapted to receive the squared stem *h* of a screw threaded removable plug *j*. A spring *k* surrounding the stem *h* is adapted to be compressed between the plug *j* and the stop member *f* and constantly presses the stop member against the end of the valve plug Q. The stem *h* is hollow as shown at *o* and communicates with the chamber *p* in the valve chest by means of opening *q*, so that with the valve plug Q in the position shown in Figures 2 and 3[a], free communication is afforded from the motive fluid supply of the machine through the inlet port T in the valve chest, to and through the port X and bore W of the valve plug and from thence through the passage *o*, port *q* in the stem *h*, to the admission port U in the valve chest and into the feed cylinder F. The valve plug Q is retained in any desired relative position by engagement between the corrugated surfaces of the valve plug and the stop member *f*, although any other suitable means may be provided for accomplishing this purpose.

In the operation of the device, and with particular reference to Figure 2 and the diagrammatic views, let it be assumed that the valve is in position as indicated in Figure 2 in which case the supply to the feed element or feed cylinder F is fully open through the admission port U as indicated in Figure 3[a], while the exhaust port V is fully closed. Rotation of the valve plug Q clockwise for instance as the diagrammatic figures are viewed will bring the valve to an intermediate position, in which the inlet port T has been gradually closed but is still partially open as indicated in Figure 3[b] while the exhaust port V has been partially opened as indicated in Figure 4[b]. Continued rotation of the valve Q in the same direction will fully close the inlet port T as indicated in Figure 3[c], which closure takes place before the exhaust port V is fully open as indicated in Figure 4[c]. One of the primary features of the present invention resides in the fact that the supply through the inlet port T is gradually closed to a small fraction of the full opening as indicated in Figure 3[b] before the leak or exhaust port V starts to open as indicated in Figure 4[b].

Another important feature of the invention resides in the fact that all the motive fluid admitted through the valve is led directly into the air feed cylinder F and separate ports and passages are provided through which the desired amount of motive fluid is permitted to escape directly from the air feed cylinder to the atmosphere. By this means there is no direct connection from the supply to the exhaust, but the motive fluid must first pass through the air feed cylinder and waste is prevented, with more efficient regulation and control of the air feed.

I claim:

In a reducing valve controlling the air pressure in the air feed element of a rock drill of the hammer type, a valve chest formed with a valve hole for receiving a two part plug valve, one part having longitudinal movement and being spring pressed against the other rotatable part, the meeting faces of the two parts being serrated or toothed, whereby the rotatable part is retained in different desired positions of rotation, ports and passages in the valve chest and in the plug valve adapted to fully open the supply to the air feed element when the valve is in one position, rotation of the plug gradually decreasing the supply opening until it approaches a minimum, further rotation from this point gradually closing the supply entirely and gradually opening the exhaust until the same is fully open.

In testimony whereof I have signed this specification.

ALBERT H. TAYLOR.