

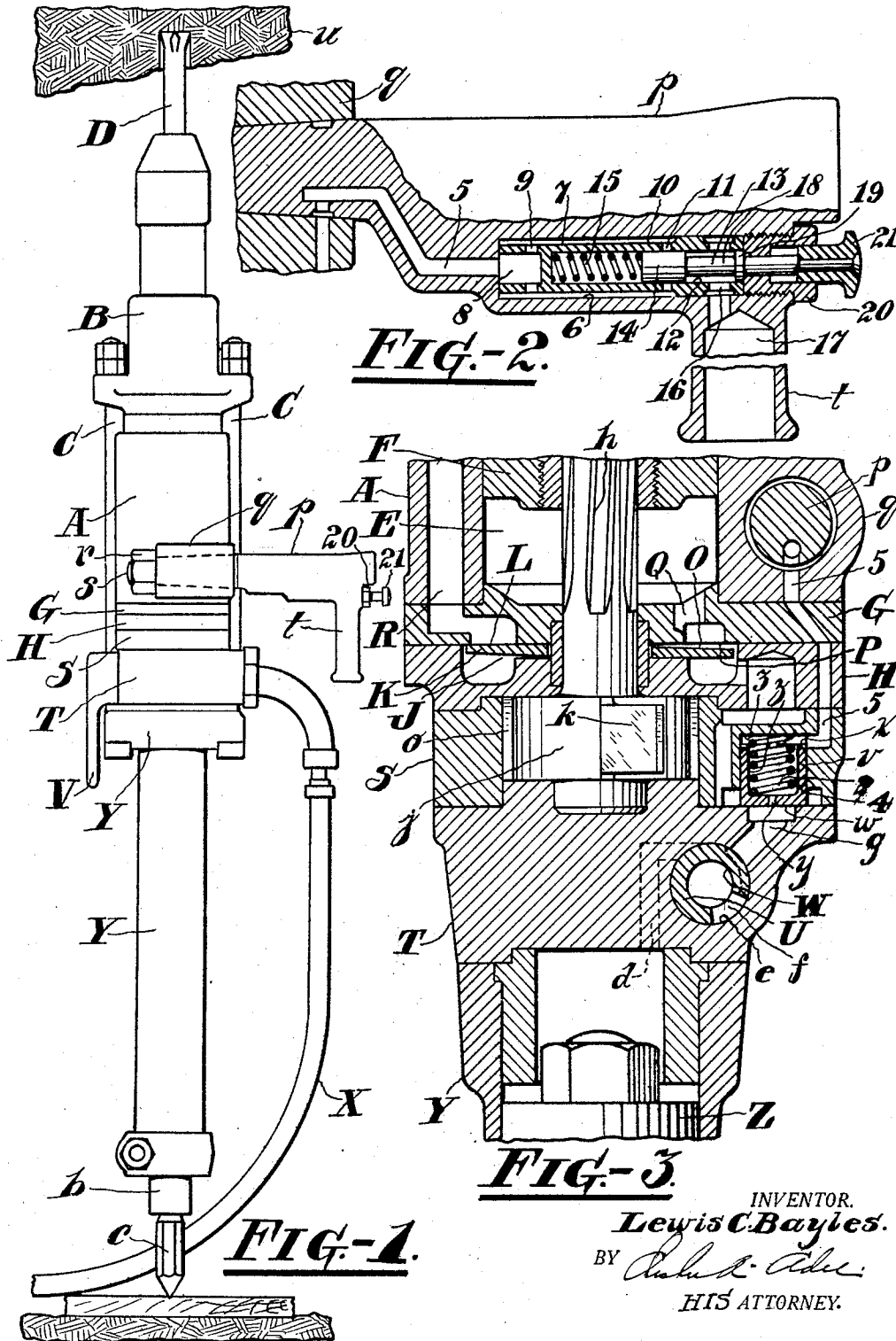
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SAFETY DEVICE FOR ROCK DRILLS

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SAFETY DEVICE FOR ROCK DRILLS

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This invention relates to rock drills, but more particularly to a safety device for fluid actuated rock drills of the stopper type equipped with rotation mechanism for rotating the working implement in the drill hole and also having a rotation handle adapted to be grasped by the operator to hold the rock drill against rotation.

One object of the invention is to instantly stop the rotation mechanism whenever, through the sticking of the working implement in the drill hole or due to other causes, the casing elements of the drilling apparatus tend to rotate relatively to the working implement.

Other objects will be in part obvious and in part pointed out hereinafter.

In the drawing accompanying this specification and forming a part thereof and in which similar reference characters refer to similar parts.

Figure 1 is an elevation in outline of a rock drill of the stopper type having the invention applied thereto,

Figure 2 is a longitudinal elevation partly in section of the rotation handle and a relief valve encased thereby, and

Figure 3 is a sectional elevation of a portion of the rock drill illustrating the course of the pressure fluid from the main supply or throttle valve to the percussive and feeding elements of the drill.

Referring more particularly to the drawing, A designates a percussive cylinder of a rock drill and B a front head which may be clamped to the cylinder by means of side rods C and is adapted to form a guide for a working implement, such as a drill steel D. The drill steel D may be interlockingly engaged with a suitable chuck device (not shown) but which may be adapted to rotate within the front head B in a well known manner to rotate the working implement D.

Within the cylinder A is a piston chamber E to accommodate a hammer piston F reciprocable in the chamber E for delivering blows to the working implement D.

A closure is provided for the rear end of the piston chamber E by a head or plate G

which forms a seat for a valve chest H having a valve chamber J to accommodate a distributing valve K of the oscillatory plate type. The valve K accordingly has a pair of oppositely extending wings L and O which, during the oscillations of the valve, seat alternately upon a seating surface P of the plate G to cut off the admission of pressure fluid to the piston chamber E. Such pressure fluid in the present instance is conveyed into the rear end of the piston chamber E by an inlet passage Q in the plate G and controlled by the wing O of the valve. The supply of pressure fluid to the front end of the piston chamber E for returning the piston is conveyed thereto by a front inlet passage R which extends through the plate G and the cylinder A and is controlled by the wing L of the valve K.

Disposed on the rear end of the valve chest H is a rotation ratchet S upon which is seated a head block T having arranged therein a throttle valve U which controls the admission of pressure fluid into the drill. The throttle valve U, which may be of the rotary type and has a lever V for its manipulation, may be provided with a central passage W into which pressure fluid may be constantly introduced by a supply line or hose X leading from a source of supply (not shown).

The feeding element for advancing the rock drill towards the work in accordance with the penetration of the drill steel D into the work comprises the usual feeding cylinder Y which may be seated against the head block T and, as shown, be clamped thereto by the side rods C. In the feeding cylinder Y is disposed a piston Z having a rod b which carries at its lower or outermost end a pointer c adapted to seat upon the mine floor to support the drilling mechanism. The feeding cylinder Y and the piston Z and associated elements may be of a well known construction in which the piston Z and the feeding cylinder Y are freely rotatable with respect to each other.

In order to maintain a suitable pressure within the feeding cylinder Y to act against the piston Z for elevating or extending the drilling apparatus the head block T is pro-

vided with a supply passage *d* which opens into the feeding cylinder Y with one end and with its other end into the chamber *e* wherein the throttle valve U is arranged. In the wall of the throttle valve U is a port *f* adapted to register with the supply passage *d* and also with a supply passage *g* leading from the valve chamber *e* to the valve chamber J where such pressure fluid is distributed to the ends of the piston chamber E by the distributing valve K.

To the end that rotary movement may be imparted to the working implement D the rock drill is equipped with rotation mechanism comprising a rifle bar *h* wherewith the piston F is slidably interlocked. The rifle bar *h* carries a head *j* having arranged therein the usual spring pressed pawls *k* for engagement with introverted teeth *o* in the rotation ratchet S, the arrangement being such that during the rearward stroke of the hammer piston F the pawls *k* will engage the teeth *o* to maintain the rifle bar *h* stationary. The piston F will then describe a partial revolution and, being interlocked through suitable devices with the working implement D, said working implement will be rotated a corresponding distance to change its position relatively to the work.

During the forward stroke of the hammer piston F the rifle bar *h* may be partially rotated by the piston F so that none of the kinetic energy of the piston F will be absorbed by the rotation mechanism and, in consequence, the entire force of the hammer piston will be effective for driving the working implement D into the work.

As is customary in drilling apparatus of the character described, the rock drill is provided with a rotation handle designated by *p* which may be secured in any suitable manner to the drill, as for instance, to a boss *q* on the cylinder A and through which it extends. A preferred mode of securing the handle to the boss consists in threading a nut *r* on the end *s* of the rotation handle to seat against the boss. The rotation handle *p* may be of any practical length and has the usual depending grip portion *t* adapted to be grasped by the operator for holding the drilling mechanism against rotary movement.

The operation of the device so far described is as follows: With the throttle valve U in the open position wherein the port *f* registers with the passages *d* and *g*, pressure fluid will flow into the feeding cylinder Y and into the valve chamber J. Pressure fluid admitted into the feeding cylinder will act against the piston Z and will move the drilling apparatus toward the work, such as the rock *u* into which the drill steel D extends.

The pressure fluid flowing into the valve chamber J will be distributed by the valve K to the ends of the piston chamber E to effect reciprocation of the piston F. As here-

inbefore explained, upon each rearward stroke of the piston F the said piston will rotate on the rifle bar *h* and thus rotate the drill steel D, and upon the forward or working stroke of the piston F the rifle bar will then rotate freely for a partial revolution so that the full force of the hammer piston may be delivered against the working implement D.

Obviously, were the drill not restrained in some suitable manner it would rotate about its axis so that, in consequence, no effective rotation of the drill steel D would be obtained. In other words, the drilling apparatus itself would then rotate and the drill steel D would remain stationary with respect to the work. However, by maintaining a grip on the grip portion *t* of the rotation handle the operator will hold the drilling apparatus against rotary movement and the action of the rotation mechanism, such as the rifle bar *h* and the associated elements will be effective to change the position of the working implement D with respect to the work.

During the operation of drilling apparatus of this character and in which the apparatus is supported at one end by the working implement D and at its other end by the pointer C it happens at times that due to various causes, as for instance, breakage of the drill steel or where the drill steel enters a crevice in the rock the drill steel becomes tightly wedged in the drill hole. When this occurs a severe thrust or pull is imparted to the casing elements of the drill by the rotation mechanism, and it happens not infrequently that the rotation handle is jarred out of the operator's hand. The entire mechanism then rotates rapidly about the drill steel and unless the operator is able to quickly withdraw out of the range of movement of the rotation handle *p* said handle may strike him with sufficient force to cause severe injury.

In order to avoid an occurrence of this nature it is contemplated to provide the drill with a device intended to render it immediately inoperative at the instant the operator releases his grip on the rotation handle. To this end a valve *v* is disposed in the rotation ratchet S through which the passage *g* extends to control the flow of pressure fluid through said passage. The valve *v* may, as illustrated, be arranged directly in line with that portion of the passage *g* which lies within the head block T and has a pressure surface *w* constantly exposed to pressure fluid flowing through the passage *g*.

The opposite end of the valve *v* constitutes an actuating surface *x* against which pressure fluid flowing from the passage *g* through a passage or port *y* in the valve *v* may act to close the said valve, that is, to cut off the flow of pressure fluid through the passage *g* to the valve chamber J. In the case where the valve *v* is of uniform diameter

said valve may be provided with a recess *z* to accommodate a compression spring 2 which seats with one end against the valve and with its opposite end against the end wall 3 of the valve chamber 4 wherein the valve *v* is arranged.

Leading from the upper end of the valve chamber 4 and preferably from a point adjacent the wall 3 is a passage 5 which extends through the rotation ratchet S, the valve chest H, the plate G, the cylinder A and the rotation handle *p* and opens into a bore 6 in said rotation handle. Arranged within the bore 6 is a bushing 7 having a recess 8 wherein the passage 5 communicates and in the wall of the bushing 7 are radial ports 9 which afford communication between the recess 8 and longitudinally extending passages 10 in the outer surface of the bushing 7.

Near the opposite or outer ends of the grooves 10 and in the bushing 7 are other radial ports 11 to afford communication between the said grooves 10 and a bore 12 in the bushing and wherein is arranged a reciprocable relief valve 13 having a head 14 which, in the closed position of the valve 13, will overlie the ports 11. A spring 15 is arranged in the bore 12 to act against the head 14 for maintaining the said valve in its closed position. The bushing 7 is, moreover, provided with a port or ports 16 near its outer end to afford communication between the bore 12 and a passage 17 leading through the grip portions *t* to the atmosphere.

Preferably the valve 13 is provided with a reduced or neck portion 18 around which pressure fluid may flow from the ports 11 to the ports 16, and at the end of the neck portion 18 opposite to the head 14 is a flange 19 which, when the valve is closed, abuts a bushing or plug 20 threaded into the outer end of the bore 6 to maintain the bushing 7 in position. A button 21 is disposed on the outer projecting end of the valve 13 in close proximity to the grip portion *t* so that the valve 13 may be readily manipulated by the same hand whereby the grip portion *t* is held.

During the operation of the device and with the throttle valve U in the open position a portion of the pressure fluid flowing through the passage *g* will pass through the port *y* to act against the actuating surface *x*. Such pressure fluid augmented by the spring 2 will maintain the valve *v* seated to prevent the flow of pressure fluid to the valve chamber J. If then pressure is applied to the button 21 to open the valve 13 the pressure fluid entrapped in the upper end of the valve chamber 4 will escape through the passage 5, the recess 8, the ports 9 and 11 and the grooves 10, thence around the stem 18 of the valve and through the port 16 and the passage 17 to the atmosphere. The pressure

fluid acting against the pressure surface *w* will then open the valve *v* and will flow to the valve chamber J where it will be distributed to the ends of the piston chamber for actuating the piston.

As long as the valve 13 remains open the actuating surface *x* will be exposed to substantially only atmospheric pressure and the pressure of the spring 2. In the event that, due to the sticking of the drill steel or other cause, the rotation handle will be jarred out of the operator's hand the spring 15 will instantly close the valve 13. The pressure fluid thereafter flowing through the port *y* will act against the actuating surface *x* and, together with the pressure exerted by the spring 2, will promptly close the valve *v*, thus cutting off the further flow of pressure fluid to the valve chamber J with the result that the percussive element of the drill and therefore the rotation mechanism will instantly come to rest.

Although the invention is shown applied to a rock drill employing rotation mechanism of the rifle bar type in which the piston F serves as the instrumentality for imparting rotary movement to the working implement, it will be obvious to those skilled in the art that the invention would be readily applicable to drilling apparatus employing independent motor driven rotative devices and in which case of course the valve *v* would then serve as a means for cutting off the supply of pressure fluid to such rotation mechanism.

In practice, the present invention has been found to be highly efficient. It altogether eliminates the tendency of the casing elements and therefore of the rotation handle *p* to rotate about the working implement whenever the operator releases his grip on the rotation handle. The device acts quickly to stop the drilling mechanism. In fact, any tendency of the drill to rotate is checked immediately upon release of the button 21 since then the valve 13 will be promptly closed and pressure fluid accumulating in the passages adjacent the actuating surface *x* of the valve *v* will immediately close the said valve. After the working implement D is again released so that full rotation may take place it is merely necessary to open the valve 13 for releasing the pressure fluid acting against the actuating surface. The valve *v* will then be opened by the pressure fluid in the passage *g* and will continue to remain open as long as the valve 13 is held open by the operator.

I claim:

1. In a safety device, the combination of a rock drill and a feeding device therefor, a working implement for the rock drill, pressure actuated means for imparting rotary movement to the working implement, means in the rock drill including a supply

passage for supplying pressure fluid to the pressure actuated means, a valve controlling the supply passage and being normally held open by pressure fluid acting against one end of the valve, and means for subjecting the other end of the valve to pressure fluid to close the valve and thus cut off the supply of pressure fluid to the pressure actuated means.

2. In a safety device, the combination of a rock drill and a feeding device therefor, a working implement for the rock drill, pressure actuated means for imparting rotary movement to the working implement, means in the rock drill including a supply passage for supplying pressure fluid to the pressure actuated means, a valve controlling the supply passage and being normally held open by pressure fluid flowing through the supply passage and acting against one end of the valve, means for subjecting the other end of the valve to pressure for closing the valve, and control means for controlling the pressure acting against the last said valve end.

3. In a safety device, the combination of a rock drill and a feeding device therefor, a working implement for the rock drill, pressure actuated means for imparting rotary movement to the working implement, means in the rock drill including a supply passage for supplying pressure fluid to the pressure actuated means, a valve controlling the supply passage and having a pressure surface constantly exposed to pressure fluid for opening the valve, an actuating surface on the valve normally exposed to atmospheric pressure, and means for subjecting the actuating surface to pressure fluid to close the valve and thus cut off the supply of pressure fluid to the pressure actuated means.

4. In a safety device, the combination of a rock drill and a feeding device therefor, a working implement for the rock drill, pressure actuated means for imparting rotary movement to the working implement, means in the rock drill including a supply passage for supplying pressure fluid to the pressure actuated means, a valve controlling the supply passage and having a pressure surface constantly exposed to pressure fluid for opening the valve, an actuating surface on the valve normally exposed to atmospheric pressure, means for subjecting the actuating surface to pressure fluid to close the valve and thus cut off the supply of pressure fluid to the pressure actuated means, and a spring acting against the valve to augment the pressure fluid acting against the actuating surface.

5. In a safety device, the combination of a rock drill and a feeding device therefor, a working implement for the rock drill, pressure actuated means for imparting rotary movement to the working implement, valve

means for controlling the supply of pressure fluid to the said pressure actuated means and having an actuating surface, and control means for subjecting the actuating surface to pressure fluid to actuate the valve means for cutting off the supply of pressure fluid to the pressure actuated means.

6. In a safety device, the combination of a rock drill and a feeding device therefor, a working implement for the rock drill, pressure actuated means for imparting rotary movement to the working implement, valve means normally held open by and controlling the flow of pressure fluid flowing to the pressure actuated means, an actuating surface on said valve means, a passage for constantly conveying pressure fluid to the actuating surface, an atmospheric vent for the actuating surface, and a relief valve to control the vent.

7. In a safety device, the combination of a rock drill and a feeding device therefor, a working implement for the rock drill, pressure actuated means for imparting rotary movement to the working implement, a valve to control the supply of pressure fluid to the pressure actuated means, a pressure surface on the valve constantly exposed to pressure fluid to hold said valve open, an actuating surface on the valve, a passage in the valve to convey pressure fluid to the actuating surface, an atmospheric vent for the actuating surface, a relief valve to control the vent and being normally held open to afford communication between the actuating surface and the atmosphere, and means to close the relief valve upon release thereof, thereby entrapping pressure fluid in the vent to act against the actuating surface for closing the first said valve.

8. In a safety device, the combination of a rock drill and a feeding device therefor, a working implement for the rock drill, pressure actuated means for imparting rotary movement to the working implement, a valve to control the supply of pressure fluid to the pressure actuated means, a pressure surface on the valve constantly exposed to pressure fluid to hold said valve open, an actuating surface on the valve, a passage in the valve to constantly convey pressure fluid to the actuating surface, an atmospheric vent for the actuating surface, a relief valve to control the vent and being normally held open to afford communication between the actuating surface and the atmosphere, a spring to close the relief valve upon release thereof, thereby entrapping pressure fluid in the vent to act against the actuating surface for closing the first said valve, and a spring to augment the pressure fluid acting against the actuating surface.

9. In a safety device, the combination of a rock drill and a feeding device therefor, a working implement for the rock drill, pres-

sure actuated means for imparting rotary movement to the working implement, distributing means for distributing pressure fluid to the pressure actuated means, a rotation handle for the rock drill, a pressure actuated valve for controlling the supply of pressure fluid to the distributing means, and means associated with the rotation handle for controlling the pressure actuated valve.

5 In testimony whereof I have signed this specification.

LEWIS C. BAYLES.

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