Feb. 14, 1933. E. F. TERRY 1,897,595

VALVE FOR ROCK DRILLS

Filed June 18, 1930

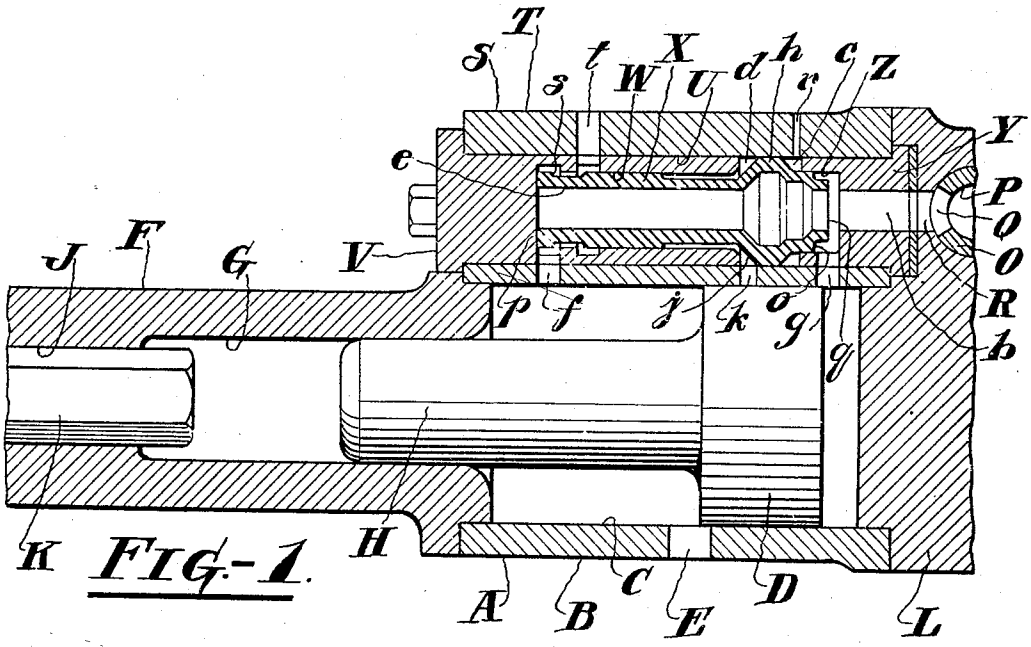

FIG.-1.

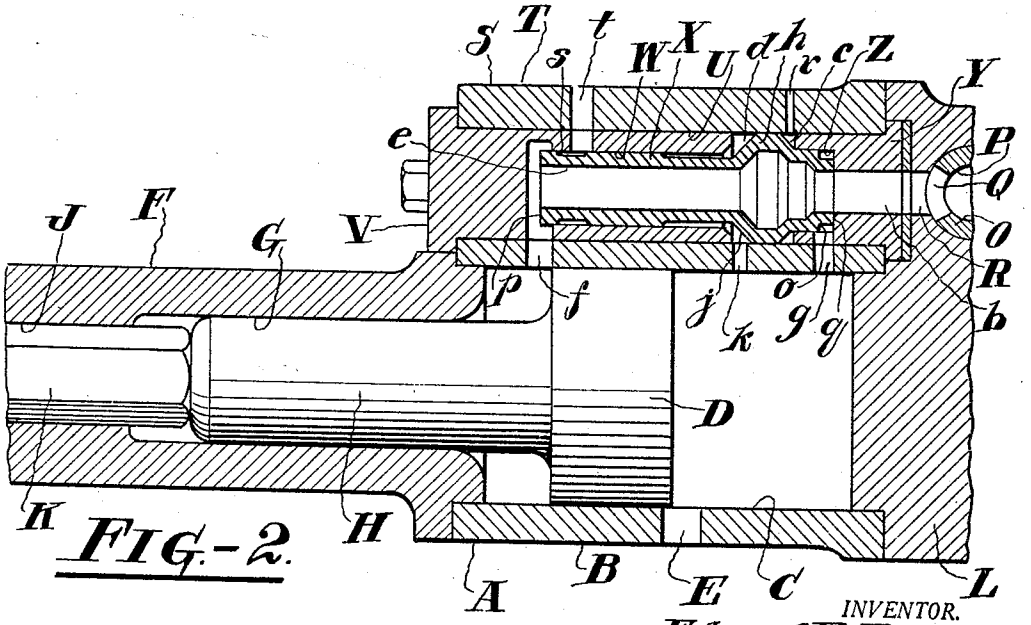

FIG.-2.

INVENTOR.
Edward F. Terry.
BY
HIS ATTORNEY.

Patented Feb. 14, 1933 1,897,595

UNITED STATES PATENT OFFICE

EDWARD F. TERRY, OF EASTON, PENNSYLVANIA, ASSIGNOR TO INGERSOLL-RAND COMPANY, OF JERSEY CITY, NEW JERSEY, A CORPORATION OF NEW JERSEY

VALVE FOR ROCK DRILLS

Application filed June 18, 1930. Serial No. 461,998.

This invention relates to rock drills, but more particularly to a distributing valve for rock drills of the fluid actuated type.

One object of the invention is to obtain a light weight valve capable of a quick and positive action in order to effect the distribution of pressure fluid to the ends of the cylinder in a manner to insure a rapid action of the hammer piston.

Another object is to insure against trembling of the valve in its limiting positions and during the time pressure fluid is being admitted into the cylinder, and still another object is to assure a heavy and powerful working stroke of the hammer piston.

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

In the drawing accompanying the specification and in which similar reference characters refer to similar parts,

Figure 1 is a longitudinal sectional elevation of a rock drill equipped with a valve constructed in accordance with the practice of the invention and showing the valve in position to admit pressure fluid into the cylinder of the rock drill for impelling the hammer piston on its working stroke, and

Figure 2 is a similar view showing the distributing valve in position to admit pressure fluid into the cylinder for actuating the hammer piston on its return stroke.

Referring more particularly to the drawing, A designates generally a rock drill comprising a cylinder B having a piston chamber C therein to accommodate a reciprocatory hammer piston D. The cylinder B is in this instance provided with a free exhaust port E which is controlled by the piston D.

For the sake of simplicity of illustration the cylinder B is shown as being provided with a closure at its front end in the form of a front head F connected directly to the cylinder B in any well known manner, and having, in this instance, a bore G to receive slidably an extension H carried by the piston D. The forward portion of the bore G, such as that designated by J, may be of suitable polygonal form to accommodate a working implement, only the shank K of which is shown and against which the hammer piston D delivers its blows.

A convenient closure may be provided for the rear end of the cylinder B in the form of a back head L which may also be suitably secured to the cylinder B and in this instance serves as a housing for a throttle valve O whereby the admission of pressure fluid into the rock drill A may be controlled.

In the drawing the throttle valve O is illustrated as being of the rotary type and said throttle valve accordingly has a central chamber P which may be in constant communication with a source of pressure fluid supply in a manner well known. In the wall of the throttle valve O is a port Q which is adapted to register with a supply passage R in the back head L.

The valve mechanism constructed in accordance with the practice of the invention and which is designated generally by S comprises a valve chest T shown in this instance as being arranged on the side of the cylinder B and having a bore U which preferably extends entirely through the valve chest T. Disposed in the front end of the bore U to form a closure therefor is a plug or bushing V having a bore W therein to act as a guide for the front end of a distributing valve X whereby the distribution of pressure fluid to the ends of the piston chamber C is controlled.

In the rear end of the bore U is a bushing Y having a bore Z to act as a guide for the rear end of the valve X. The bushing Y also has a passage *b* which registers with the passage R to form an extension therefor for conveying pressure fluid from the throttle valve O to the valve chamber *c* consisting of the bores W and Z and, in this instance, of a portion *d* of the bore U lying between the inner or adjacent ends of the bushings V and Y.

The valve X is shown as being of the tubular type having a bore *e* extending entirely therethrough to supply pressure fluid directly from the passage *b* to a front inlet passage *f* leading from the front end of the valve chamber *c* to the corresponding end of the piston chamber C. From the rear end of the valve chamber *c* to the corresponding end of

the piston chamber L leads a rear inlet passage *g* to which pressure fluid is supplied directly from the rear end of the valve chamber *c*.

The valve X is provided with an enlargement *h* between its ends adapted to lie in the enlarged portion *d* of the valve chamber *c*. The front end of the enlargement *h* constitutes an actuating surface *j* against which pressure fluid is intermittently directed by a kicker passage *k* leading from a point in the piston chamber C rearwardly of the exhaust port E to the front end of the enlarged portion *d*.

The valve X is provided with a second actuating surface *o* preferably located near the rear end of the valve and opposing the actuating surface *j*. The actuating surface *o* is in the form of a shoulder near the rear end of the valve X and in constant communication with the rear end of the piston chamber C so that said shoulder *o* will be constantly exposed to whatever pressure may exist in the rear end of the piston chamber C.

The front and rear ends of the valve X constitute holding surfaces *p* and *q* respectively against which pressure fluid flowing over those ends of the valve X may act for holding the valve momentarily immovable in its limiting positions during the time pressure fluid is being admitted to the ends of the piston chamber C adjacent thereto. The holding surfaces *p* and *q* or, in other words, the ends of the valve X are also adapted to seat against the ends of the valve chamber *c* to limit the travel of the valve and to cut off the flow of pressure fluid into the ends of the piston chamber.

In order to assure against the presence of pressure fluid such as that which may leak along the cooperating surfaces of the valve and the bore Z in the bushing Y into the rear end of the enlarged portion *d* the valve chest T is provided with a vent *r* to assure atmospheric pressure on the rear end of the enlarged portion *h*.

To the end that the hammer piston D may deliver a heavy blow against the working implement unimpeded by compression in the front end of the piston chamber C, the valve X is provided with a neck *s* to afford communication between the inlet passage *f* and an exhaust passage *t* in the valve chest T and leading to the atmosphere.

The operation of the device is as follows: With the valve X in its foremost limiting position as illustrated in Figure 1, pressure fluid will flow from the passage *b* through the rear end of the valve chamber *c*, thence through the rear inlet passage *g* into the rear end of the piston chamber C to impel the piston D forwardly against the working implement. During the time the valve X is in this position the neck *s* will establish communication between the front inlet passage *f* and the exhaust passage *t* so that as the piston D proceeds forwardly the air in the front end of the piston chamber C will be expelled through these channels to the atmosphere instead of being compressed. The valve X will meanwhile be held immovable by the force of the pressure fluid acting against the holding surface *q* and the actuating surface *o*.

As the piston D proceeds forwardly and before it uncovers the exhaust port E said piston will uncover the kicker passage *k*. Pressure fluid will then flow from the rear end of the piston chamber into the enlarged portion *d* to act against the actuating surface *j*. Inasmuch as the area of the actuating surface *j* exceeds somewhat the combined areas of the actuating surface *o* and the holding surface *q* the valve X will then be moved to its rearmost limiting position as illustrated in Figure 2.

Immediately after the pressure fluid has been admitted into the enlarged portion *d* to throw the valve rearwardly the piston D will uncover the exhaust port E. Pressure fluid utilized for actuating the piston D forwardly, together with that utilized for throwing the valve X rearwardly, will then be exhausted to the atmosphere.

The uncovering of the exhaust port E will preferably take place at about the same time the hammer piston D delivers its blow against the working implement. At the same time the valve X will have been moved to its rearmost position so that an ample supply of pressure fluid will be admitted into the front end of the piston chamber C to instantly return the piston to its initial position after the said piston D has delivered its blow against the working implement. In the new position of the valve communication will be cut off between the front inlet passage *f* and the exhaust passage *t* by the front end of the valve X so that there will therefore be no escape of live pressure fluid through these channels.

During the rearward stroke of the piston D the air entrapped in the rear end of the piston chamber C by the piston after said piston has covered the exhaust port E will be compressed. Such compression will act against the actuating surface *o* tending to throw the valve X again forwardly. The valve X however, will be held in the rearward position by the pressure fluid acting against the holding surface *p* until the piston D uncovers the exhaust port E. After the piston D has uncovered the exhaust port E there will be an abrupt drop in pressure in the fluid acting against the holding surface *p* so that the compression acting against the actuating surface *o* may start the valve X forwardly.

Immediately upon unseating the valve the

holding surface *q* will also be exposed to pressure fluid under line pressure as will also be the actuating surface *o* so that the valve will be quickly moved forwardly against the front end of the valve chamber *c*. In this way the undue loss of pressure fluid from the front end of the valve chamber directly through the front end of the piston chamber to the atmosphere will be prevented.

I claim:

In a fluid actuated rock drill, the combination of a cylinder having an exhaust port and a reciprocatory piston in the cylinder, a free exhaust port for the cylinder, a valve chest having a valve chamber, front and rear inlet passages leading from the ends of the valve chamber to the cylinder, a distributing valve in the valve chamber having a bore in constant communication with a source of pressure fluid supply, the ends of the valve and valve chamber cooperating to control the admission of pressure fluid into the inlet passages, an actuating surface on the valve exposed to compression from the rear end of the cylinder to actuate the valve for admitting pressure fluid into the rear end of the cylinder and being exposed to pressure fluid flowing into the rear end of the cylinder to assist in holding the valve, a second actuating surface on the valve, a kicker passage in the cylinder for conveying pressure fluid from a point in the cylinder rearwardly of the exhaust port to the valve chamber to expose the second mentioned actuating surface to pressure fluid for actuating the valve to admit pressure fluid to the front end of the cylinder, holding surfaces on the ends of the valve alternately exposed to pressure fluid for holding the valve in the limiting positions, an exhaust port in the valve chest, and a neck on the valve to establish communication between the last said exhaust port and the front inlet passage to afford an outlet for compression in the front end of the cylinder.

In testimony whereof I have signed this specification.

EDWARD F. TERRY.