C. T. CARNAHAN.

FLUID ACTUATED TOOL.

APPLICATION FILED FEB. 12, 1910.

1,030,871.

Patented July 2, 1912.

2 SHEETS—SHEET 1.

Fig. 1.

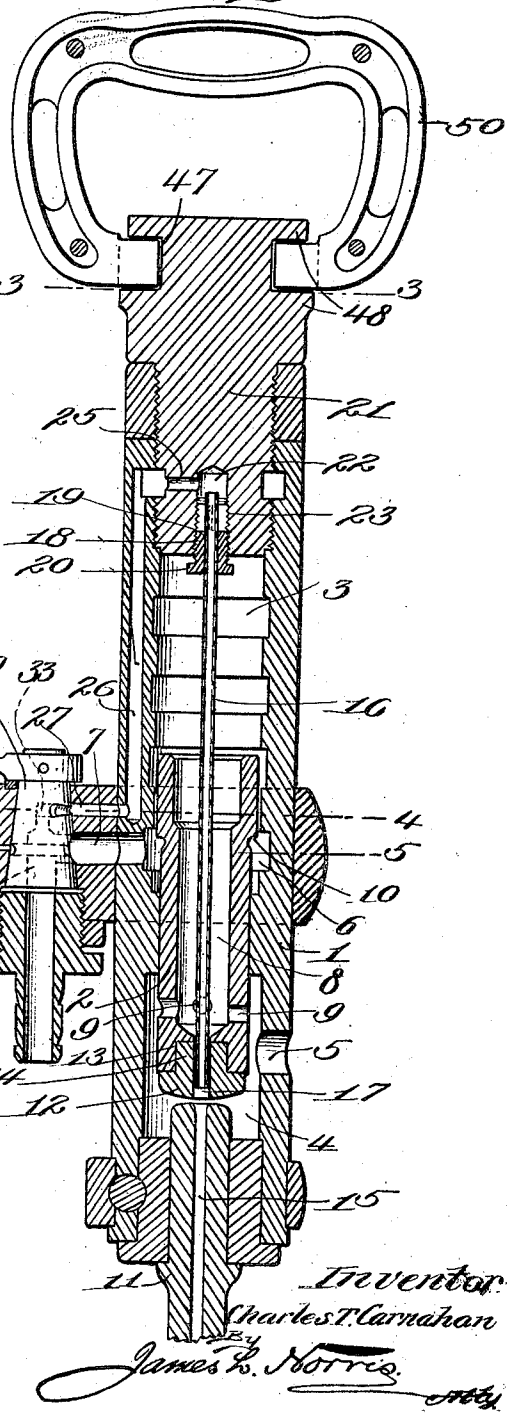


Fig. 2.

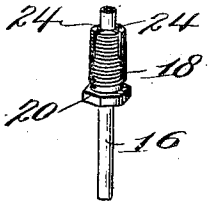
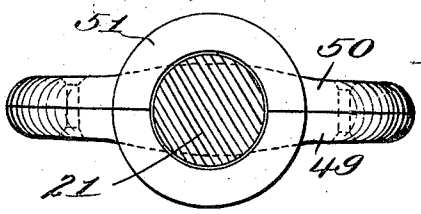


Fig. 3.



Witnesses

B. B. Kesler

Inventor

Charles T. Carnahan

James L. Norris.

Atty.

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2 SHEETS—SHEET 2.

Fig. 4.

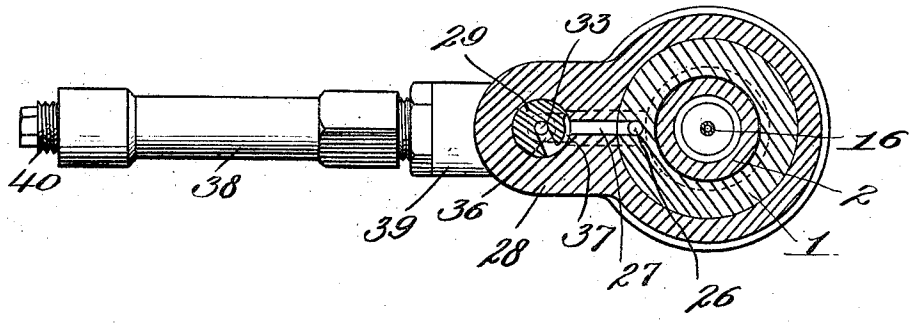


Fig. 5.

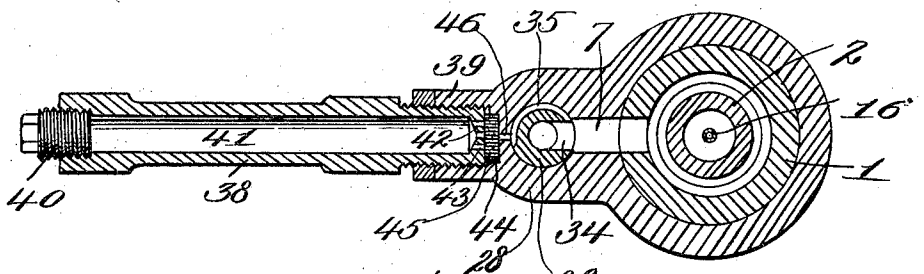
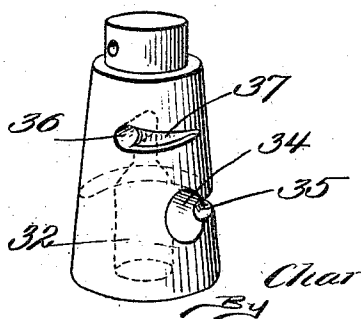


Fig. 6.



Witnesses:

Inventor

Charles T. Carnahan

By James L. Norris.

Atty.

UNITED STATES PATENT OFFICE.

CHARLES T. CARNAHAN, OF DENVER, COLORADO, ASSIGNOR TO C. T. CARNAHAN MANUFACTURING COMPANY, OF DENVER, COLORADO, A CORPORATION OF COLORADO.

FLUID-ACTUATED TOOL.

1,030,871. Specification of Letters Patent. Patented July 2, 1912.

Application filed February 12, 1910. Serial No. 543,535.

To all whom it may concern:

Be it known that I, CHARLES T. CARNAHAN, a citizen of the United States, residing at Denver, in the county of Denver and State of Colorado, have invented new and useful Improvements in Fluid-Actuated Tools, of which the following is a specification.

My present invention relates to improvements in pneumatic or fluid-actuated drills and more particularly to the type known as "sinking" drills in which the apparatus is supported and manipulated manually, and it has for its object primarily to simplify and improve tools of this class whereby efficiency in operation is obtainable, the several operations to be performed with the tool can be accomplished with greater facility, and greater durability is obtained.

One of the principal objects of the invention is to provide a simple and improved device for throttling the motive fluid for the reciprocatory piston or hammer and to control the flow of a fluid, such as air, to the hollow bore of the drill, the same involving a combination throttle valve which receives the motive fluid for the piston or hammer and also the fluid which is to enter the hollow bore of the drill for the purpose of clearing the bore hole from chips or dust, such valve being so ported that before the starting of the piston or hammer, a full flow of fluid is admitted to the hollow drill for the purpose of insuring a cleaning of the bore hole before the starting of the piston or hammer, and a further movement of the throttle valve will admit motive fluid to the piston or hammer to set the latter into operation, a suitable amount of fluid being still admitted to the hollow bore of the drill during the operation of the piston or hammer, the throttle valve being capable of manipulation to appropriately throttle the motive fluid for the piston without discontinuing the flow of fluid to the hollow drill and to throttle the fluid to the hollow drill without cutting off the supply to the piston, and upon shutting off the throttle valve, the piston or hammer ceases its operation before the flow of fluid to the hollow drill is discontinued, the final movement of the throttle valve serving to cut off both the motive fluid for the piston and the cleaning out fluid for the bore hole.

The present invention also provides a throttle valve upon which the fluid under pressure operates in such a manner as to hold such valve tightly upon its seat, thereby preventing any leakage of fluid past the valve, any wear that may occur is automatically taken up and, moreover, shifting of the valve, owing to the vibration of the tool, is prevented.

Other objects of the invention are to provide a simple and improved device for locking a feed tube in proper position with respect to the piston and the bore of the drill whereby the fluid for cleaning out the bore hole may be properly supplied to the bore in the drill, to provide a piston the body of which is formed of a tough material which is capable of resisting crystallization and has a hard metal head permanently united therewith and adapted to engage the drill or steel so as to prevent upsetting of the piston head, and to provide a simple and improved handle which is swiveled upon the body of the tool and is formed in sections which are permanently united when the handle is applied, the use of nuts and other relatively expensive devices as heretofore used for mounting swivel handles upon tools of this class being obviated.

To these and other ends, the invention consists in certain improvements, and combinations and arrangements of parts, all as will be hereinafter more fully described, the novel features being pointed out particularly in the claims at the end of the specification.

In the accompanying drawing: Figure 1 represents a central longitudinal section of a sinking drill constructed in accordance with my present invention, the throttle valve being shown in open position to supply motive fluid to the piston and to supply fluid to the hollow drill to clean the bore hole; Fig. 2 is a detail perspective view of a portion of the tube for feeding fluid to the hollow drill, the split clamping nut by means of which such tube is secured to the tool being shown in position on such tube; Fig. 3 represents a section on the line 3—3 of Fig. 1, illustrating the manner in which

the swivel handle is applied to the tool; Figs. 4 and 5 represent sections on the lines 4—4 and 5—5 respectively of Fig. 1; and Fig. 6 is a detail perspective view of the throttle valve removed from the tool.

Similar parts are designated by the same reference characters in the several views.

In the accompanying drawing, I have shown my invention as applied to a hand-operated sinking drill and the construction shown in the drawing is generally preferable, as practice has demonstrated it to be eminently satisfactory. It will be understood, however, that the invention is not limited necessarily to the precise details shown, as certain modifications and changes may be made in order that the invention may be applied to the best advantage according to the circumstances of each particular case.

In the present instance, 1 designates the body of the tool which is in the form of a casing or cylinder to inclose the reciprocatory piston or hammer 2, the casing 1 having a suitable fluid-tight fit with the piston and provides a pressure chamber 3 and an exhaust chamber 4, the latter having one or more suitable vents 5 leading to the atmosphere. The casing is also provided at a point intermediate the pressure chamber 3 and the exhaust chamber 4 with a feed channel 6 for the motive fluid, such motive fluid being supplied to this channel through the passage 7. The reciprocatory piston has a hollow interior chamber 8, and a suitable number of ports 9 are formed in the piston toward the head thereof. Motive fluid is admitted to the interior of the piston and to the pressure chamber 3 from the channel 6 through the ports 9 while the piston is in retracted position, and after the piston has completed its forward or power stroke, such fluid is exhausted from the hollow piston and pressure chamber through the ports 9 into the exhaust chamber 4 and to the atmosphere through the vent 5. An annular piston surface 10 is formed toward the rear of the piston and the motive fluid in the feed channel 6 acts upon this annular piston surface and thereby serves to retract the piston, the piston in practice reciprocating at very high frequency.

One feature of the present invention is that it provides a piston which will not crystallize owing to the blows delivered by it upon the end of the drill rod 11, and this result is attained by forming the body of the piston of tough metal and permanently applying a head 12 of hard metal to the forward end of the piston. Tool steel tempered is preferably used for the head 12 and this head is of slightly smaller diameter than the piston and is permanently fixed to and forms in effect a unitary part of the piston, the forward end of the latter in the present instance being provided with a recess 13 into which a stem 14 on the head 12 is forced or shrunk, the hard tempered head sustaining the force of the blows delivered upon the drill rod without losing its shape and such head is backed up by the relatively tough material composing the body of the piston, the tough nature of the metal composing the body of the piston preventing crystallization. In order to facilitate the drilling operation, the drill rod or steel is provided with a longitudinal bore 15 through which a fluid may flow to the base of the bore hole, thereby removing chips or other broken material from the forward end of the drill rod so that the solid rock or other material to be cut is always presented cleanly to the cutting edges of the drills. According to the present invention, a portion of the motive fluid (preferably air) which is used to propel the piston is employed to clean the bore hole and to effect this result, a fluid-conducting tube 16 extends axially through the hollow piston and its forward end is in alinement with and terminates in immediate proximity to the bore 15 in the drill rod. The hollow formation of the piston accomodates this tube and the hard metal head 12 is provided with a central bore 17 through which this tube extends. The present invention provides a simple and improved means for adjustably mounting this fluid-conducting tube, such means consisting of a nut 18 which is elongated in an axial direction and has a central aperture 19 in which the tube may be engaged adjustably while such nut is free. The exterior of the nut is provided with threads which have preferably a cylindrical pitch, that is to say, the threads are of uniform diameter from end to end of the nut. An angular portion 20 forms a part of the nut and provides means for securing the nut in position. This nut is inserted into the head 21 of the casing, the latter being formed with a central axis passage 22 the walls of which are provided with threads 23 of a tapering pitch. The rear portion of the nut 18 is split, that is, it is formed with a suitable number of longitudinal slots 24 which render such portion of the nut collapsible to such a degree as to obtain a firm grip upon the fluid-conducting tube, and after the nut has been inserted into the bore 22 of the casing head, a tightening of the nut will cause the tapered threads in the casing head to operate upon the slotted portion of the nut and thereby cause the latter to close upon and firmly grip the tube, locking the latter in position so firmly as to prevent loosening. The opening 22 with which the fluid-conducting tube 16 communicates is connected through a passage 25 to a fluid feeding duct 26, the latter being formed preferably in one wall of the casing and leading to a passage 27 which is adjacent to

the passage 7 through which the motive fluid is suppiied to the piston.

A controlling valve casing 28 is rigidly connected to the body or casing of the tool and the passages 7 and 27 communicate with such casing. The controlling valve shown in the present instance is so constructed that it is capable of not only throttling or controlling the flow of motive fluid to the piston, but it also serves to regulate or control the flow of fluid to the hollow drill for the purpose of cleaning the bore hole. In the present instance, this controlling valve consists of a tapered plug 29 which is rotatably fitted into a correspondingly formed valve seat in the casing 28. This controlling valve is provided toward its smaller end with an appropriate handle 30 by means of which it may be manipulated. The larger end of the tapered valve plug, however, is exposed to the fluid pressure which serves to operate the tool, the action of the fluid pressure upon the larger end of the plug-shaped valve serving to automatically press this valve tightly and firmly upon its seat so as to maintain a fluid-tight fit or seating of the valve and, moreover, accidental shifting of the valve due to the vibration of the tool is prevented. In the present instance, a pipe fitting 31 is tapped into the casing 28 at the side opposite to that upon which the handle 30 is rotated, this fitting providing means for the attachment of a hose or pipe by means of which the motive fluid may be conducted to the tool. The controlling valve is provided with an axial passage 32 which leads into the same from the larger end thereof and receives the motive fluid from the fitting 31, and a reduced extension 33 of this passage leads toward the reduced end of the valve and serves to supply the fluid for cleaning the bore hole. A radial or lateral port 34 leads from the central axial passage 32 to the circumference of the valve and when this radial port registers with the passage 7, a full flow of motive fluid is supplied to the piston. A groove 35 is formed in the circumference of the valve and extends from the port 34 to a point approximately diametrically opposite thereto and the purpose of this groove will be hereinafter described. A second but smaller radial port 36 leads from the reduced portion 33 to the axial passage in the valve to the periphery of the latter and this port communicates with a groove 37 which extends part way around the circumference of the valve. This groove 37 preferably becomes narrower in width as it leaves the port 36, as shown, and such groove and port serve to convey fluid to the hollow drill for the purpose of cleaning the bore hole. The handle 30 attached to the controlling valve is turnable through an angle approximately of 90°

In tools of this class, a turning handle is provided whereby the tool may be rotated about the drill rod as an axis, such handle extending radially with respect to the tool casing. In the present instance, I provide a combined turning handle and lubricator which is in the form of a tube 38 one end of which is threaded into a sleeve-like portion 39 formed as a part of the controlling valve casing and the opposite end may be provided with a removable plug or its equivalent 40 which serves as a removable closure through which the lubricant-containing reservoir 41 formed by the tube 38 may be introduced. That end of the reservoir which is threaded into the controlling valve casing has a head 42 the outer face of which is preferably flat and a suitable number of apertures 43 extend through this head. A recess 44 is formed in the controlling valve casing directly opposite to the flat face of the head 42 and a disk 45 of porous material such, for instance, as sole leather, is inserted in the recess 44 and is arranged to bear upon the flat face of the head 42. The pressure upon the disk 45 may be adjusted by means of the threaded connection between the lubricant-containing reservoir and the controlling valve casing, and by adjusting the pressure on such disk, the feed of the lubricant may be regulated, a lock nut being shown for maintaining such an adjustment. The controlling valve casing is provided with a port 46 which provides communication between one side of the disk 45 and the groove 35 formed in the periphery of the controlling valve.

The present invention also provides a simple and improved construction of swivel handle which is attached to the head end of the casing and permits the tool to be rotated by means of the turning handle and about the drill rod as an axis. In the present instance, the head 21 of the casing is formed with a circular channel 47 which channel is preferably turned in the solid stock composing the head 21 forming two integral permanently related shoulders 48. The handle is composed of two complemental sections 49 and 50 which may be duplicates and are in the form of a handgrip. Each section has a semi-circular portion which is inserted in the channel 47 while the two sections of the handle are separate. When the two sections of the handle are brought together and riveted or permanently united, the complemental semi-circular portions upon the handle sections will form a complete ring 51 which lies in the channel 47 and is permanently confined between the shoulders 48, a swivel handle mounting being thereby provided which obviates the use of nuts and other expensive and complicated devices which are liable to loosen.

In operation, the piston reciprocates at

high frequency and in the usual manner delivers successive blows upon the drill rod. Assuming, however, that the handle of the controlling valve is in a position, say, at right angles to the length of the tubular receptacle 38 which also forms the turning handle, the motive fluid is cut off both from the piston and from the passages which conduct fluid to the hollow drill for the purpose of cleaning the bore hole. Upon turning the controlling valve handle toward a position parallel to the turning handle, the port 33 is first brought into communication with the passage 27, thereby admitting fluid at full pressure to the hollow drill before the piston starts to operate whereby a thorough cleaning of the bore hole, preparatory to the drilling operation, is insured. When the handle of the controlling valve occupies the position shown in Figs. 1, 4 and 5, fluid at full pressure is admitted both to the hammer and the hollow drill. Upon turning the handle of the controlling valve still farther, the flow of fluid to the hollow drill rod is partially cut off owing to the narrowing of the circumferential groove 37, but a full flow of motive fluid is still supplied to the piston, the normal operating position of the controlling valve serving to admit sufficient fluid to the hollow drill to clear the hole properly in hard rock but a full flow of motive pressure is admitted to the piston. It is, therefore, possible to cut off fluid from both the piston and the hollow steel. Fluid such as air, can be drawn with full force through the hollow drill without operating the piston and when the controlling valve is opened, a full flow of fluid must be drawn through the hollow drill before the hammer can start. The blow of the piston can be throttled so that it will strike as hard as desired, and still a full flow of fluid can be admitted to the hollow drill rod. Moreover, while the piston is operating with full force, the fluid flowing to the hollow drill rod can be regulated as desired. Upon turning off the valve the piston ceases operation before the fluid ceases its flow to the hollow drill rod so that a thorough cleaning of the bore hole is insured both before the starting of the tool and after the operation of the tool has been discontinued.

The lubricant-containing reservoir communicates with the passage 7 which supplies motive fluid to the piston while the controlling valve is in open position. The reciprocatory movements of the piston combined with the intermittent use of motive fluid produce fluctuations of pressure in the passage 7. During those periods when the motive fluid pressure in the passage 7 is relatively high, there will be a flow of air through the disk 45 and apertures 43 into the lubricant-containing reservoir 41. Upon a drop in pressure, however, which occurs upon each stroke of the piston, the air thus entering the reservoir 41 will expand and thereby force a certain unit of the lubricant through the apertures 43 and the porous disk 45 and flowing through the passage 46 and groove 35, such lubricant will reach the motive fluid supply passage 7 from which passage the lubricant is carried to the moving parts of the piston. The pulsations or variations in fluid pressure occur at a frequency corresponding to the speed of movement of the piston, so that the quantity of lubricant supplied to the piston will be commensurate with the requirements.

I claim as my invention:

1. The combination of a fluid-actuated tool having a casing, an operating element therein, a drill rod having a bore for conducting fluid to the bore hole, and a single fluid-controlling valve having ports one of which is provided with a throttling passage, said valve arranged to admit a flow of fluid to the bore of the drill rod to subsequently admit motive fluid to the operating element and then to throttle the fluid admitted to the drill rod when said valve is moved in one direction.

2. The combination with a fluid-actuated tool having a casing, an operating element mounted therein, and a drill rod having a bore for conducting the fluid to the bore hole, of a single fluid controlling valve having ports one of which has a throttling passage arranged when the valve is opened to first admit a full flow of fluid to the bore of the drill rod, to subsequently admit and throttle motive fluid to the operating element, and to throttle by said passage the flow of fluid to the bore hole.

3. The combination of a fluid-actuated tool having a casing, an operating element therein, a drill rod having a bore for conducting fluid to the bore hole, and a fluid-controlling valve having ports and a throttling passage communicating with a source of fluid pressure supply and arranged to first admit fluid to the bore of the drill rod and to subsequently admit motive fluid to the operating element and throttle but not wholly shut off fluid flowing to the bore of the drill rod when such valve is moved to set the tool into operation.

4. The combination of a fluid-actuated tool having a casing, an operating element therein, a drill rod having a bore for conducting fluid to the bore hole, and a controlling valve having one port for admitting motive fluid to the operating element and having another port and throttling passage for admitting and throttling fluid to the bore of the drill rod, the second port and throttling passage adapted to permit throttling of the motive fluid to the operating element while fluid continues to flow to the bore of the drill rod.

5. The combination of a fluid-actuated tool comprising a casing, an operating element therein, and a drill rod having means for conducting fluid to the bore hole, of a controlling valve embodying a rotatable member provided with a passage to receive fluid under pressure and provided with a port to admit motive fluid to the operating element, and a second port for admitting and throttling fluid to the bore hole, the second port having a circumferentially extended feed groove whereby the valve may be adjusted to throttle the motive fluid for the operating element and fluid may continue to flow to the bore hole.

6. The combination of a fluid-actuated tool comprising a casing having passages therein for motive fluid and fluid adapted to be conducted to the bore hole, and a controlling valve embodying a rotatable plug having a passage adapted to receive fluid under pressure and provided with one port for supplying motive fluid to one of the passages in the casing and having a second port for supplying motive fluid to another of said passages in the casing, the second port of the plug communicating with a circumferentially extended groove which diminishes in cross section in a direction from said port.

7. The combination of a fluid-actuated tool having a casing provided with passages for motive fluid and fluid to be conducted to the bore hole, an operating element within said casing, and a fluid-controlling valve embodying a rotatable plug fitted in said casing and provided with ports for the motive fluid and the fluid for the bore hole respectively, one of said ports being in advance of the other port and provided with a throttling passage so that when the plug is turned in one direction, a full flow of fluid will be admitted to the bore hole, a further movement of the valve will admit fluid to the operating element and such fluid to the operating element can be throttled while the fluid flows full force to the bore hole, and a further movement of the valve will throttle the fluid to the bore hole through said throttling passage while the motive fluid flows full force to the operating element.

8. The combination of a fluid-actuated tool comprising a casing provided with one passage for motive fluid and another passage for fluid to be conducted to the bore hole, an operating element mounted in said casing, and a single fluid-controlling valve having ports adapted to coöperate with the passages of the casing, the port for supplying fluid to the bore hole being in advance of the port for the motive fluid and having a throttling passage so that when the valve is moved in one direction, a full flow of fluid will be first admitted to the bore hole, then motive fluid will be admitted to the operating element and throttled while fluid continues to pass to the bore hole, and further movement of the valve will throttle the fluid flowing through said throttling passage to the bore hole while a full flow of fluid is admitted to the operating element.

9. The combination of a fluid-actuated tool having a casing, an operating element therein, a drill rod having a bore for conducting fluid to the bore hole, and a fluid-controlling valve having a port arranged to admit a flow of motive fluid to said operating element and also a port and throttling passage capable of admitting and throttling a flow of fluid to the bore of the drill rod while a full flow of motive fluid is admitted through such valve to the operating element.

10. The combination of a fluid-actuated tool having a casing, an operating element therein, means having a conduit for conducting fluid to the bore hole, and a fluid-controlling valve having ports for admitting fluid to the bore hole and operating element, said ports being located one in advance of the other and one of said ports having a throttling passage whereby movement of the valve in one direction will first admit a full flow of fluid to the bore hole, further movement of the valve will admit motive fluid to the operating element, and further movement of the valve will throttle the fluid to the bore hole.

11. The combination of a fluid-actuated tool having a casing, an operating element therein, the casing being provided with means for conducting motive fluid to the operating element, and fluid to the bore hole, and a fluid controlling valve having a single fluid inlet and ports leading therefrom and arranged one in advance of the other, the port in advance also having a throttling passage whereby movement of the valve in one direction will first admit a full flow of fluid to the bore hole, motive fluid will be subsequently admitted to the operating element, and then fluid to the bore hole will be throttled through said throttling passage while motive fluid continues to flow to the operating element.

In testimony whereof I have hereunto set my hand in presence of two subscribing witnesses.

CHARLES T. CARNAHAN.

Witnesses:
H. G. PHILLIPS,
MARGARET MUNSON.