G. M. NELL.

VALVE.

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1,352,469. Patented Sept. 14, 1920.

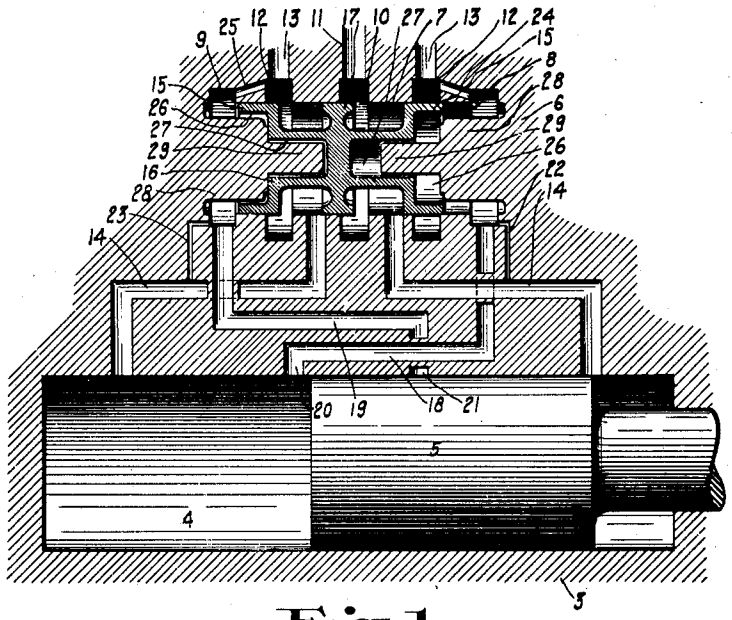


Fig. 1.

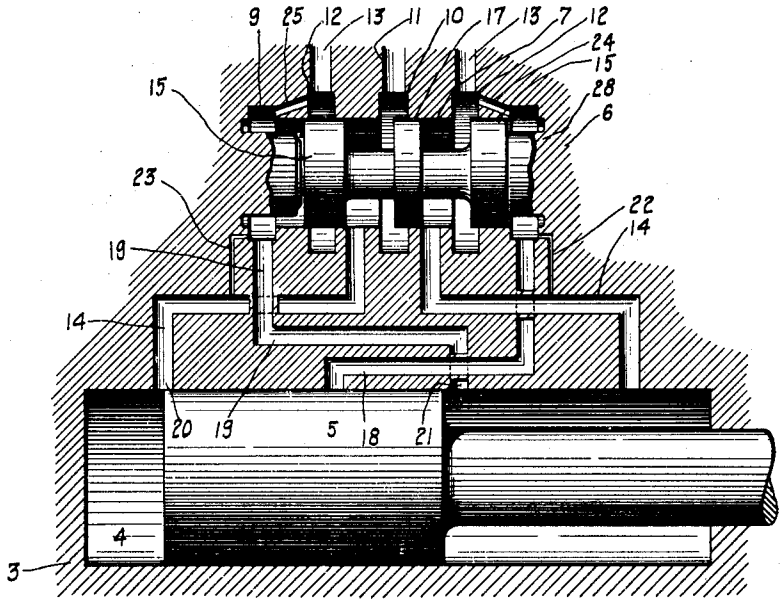


Fig. 2.

INVENTOR.

Gustave M. Nell

BY

ATTORNEY.

UNITED STATES PATENT OFFICE.

GUSTAVE M. NELL, OF DENVER, COLORADO, ASSIGNOR TO THE DENVER ROCK DRILL MANUFACTURING COMPANY, OF DENVER, COLORADO, A CORPORATION OF DELAWARE.

VALVE.

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To all whom it may concern:

Be it known that I, GUSTAVE M. NELL, a citizen of the United States, residing at Denver, in the county of Denver and State of Colorado, have invented certain new and useful Improvements in Valves, of which the following is a specification.

The present invention relates more particularly to distributing valves for fluid operated tools, in which the action of the valve is effected by the fluid under pressure.

The primary object of the present invention is to provide a valve and controlling mechanism therefor that insures the quick and effective action of said valve, irrespective of its position and under different degrees of pressure of the fluid.

An embodiment of the invention is illustrated in the accompanying drawings, wherein:—

Figure 1 is a sectional view somewhat diagrammatic in its character, showing a tool piston and valve mechanism associated therewith, with the piston at the forward end of the stroke and the valve in a position to effect the rearward movement of the piston.

Fig. 2 is a similar view, but with the piston in its rear position and the valve in elevation and shifted to a position to deliver motive fluid behind the piston.

Similar reference numerals designate corresponding parts in all the figures of the drawings.

In the embodiment disclosed, a cylinder member, designated generally by the reference numeral 3, is provided with the usual chamber 4, in which a piston 5 is mounted to reciprocate. Associated with the cylinder member is a valve casing 6 provided with a bore 7, the end portions of which constitute spaced pressure chambers 8 and 9. The central portion has an annular groove 10, with which communicates a motive fluid supply port 11, and on opposite sides of the groove 10, are annular channels 12, from which extend exhaust ports 13. Distributing and exhaust-permitting passageways 14 open into the bore 7 between the central groove 10 and the channels 12, said passageways 14 communicating with the piston chamber 4 contiguous to the ends thereof and on opposite sides of the piston 5.

An automatic distributing valve is employed that is located in the bore 7, and comprises terminal heads 15 operating in the chambers 8 and 9 with an integral shank 16 connecting the heads and having a central flange 17 that is movable with the valve to positions on opposite sides of the central groove 10. It will be observed that when the valve is in its left hand position, as shown in Fig. 1, motive fluid supplied through the port 11 can pass freely into the passageway 14 and into the piston chamber 4 in advance of the piston 5, while the space in rear of said piston 5 is open through the passageway 14, bore 7 and left hand exhaust port 13 to the atmosphere. The piston will thus be driven rearwardly. On the other hand, when the piston is in its rear position, as illustrated in Fig. 2, with the valve shifted forwardly, then motive fluid supplied through the port 11, will pass through the left hand passageway 14 and enter the piston chamber 4 behind the piston 5, while the right hand passageway 14 is then open to the right hand exhaust port 13.

For the purpose of effecting the shifting movements of the valve, the following arrangement of passageways and ports is employed. Crossed passageways 18 and 19 connect intermediate portions of the piston chamber 4 with the pressure chambers 8 and 9. That is to say, the pressure chamber 8 has a port 20 opening into the piston chamber 4 to the left of its center and is in communication with the right hand pressure chamber 8. This port 20 is covered by the piston 5 on its rearward movement and is uncovered as it approaches the limit of its forward movement. The passageway 19 has a port 21 opening into the piston chamber 4 to the right of its center and said passageway 19 communicates with the left hand pressure chamber 9. The port 21 is covered by the piston 5 and is uncovered by the front end of said piston as said piston approaches the rearward limit of its movement. It will thus be seen that the motive fluid under pressure which is acting alternately against the opposite ends of the piston 5 has access alternately to the pressure chambers 8 and 9, and consequently against the end faces of the valve. In addition, supplemental ports 22 and 23 open from the distributing passageways 14 into the pressure chambers 8 and 9, and thus permit a relatively small amount of motive fluid to pass into

said chambers whenever the motive fluid has admission to the respective passageways 14. Exhaust ports 24 and 25 open from the pressure chambers 8 and 9 and communicate with the exhaust ports 13. The exhaust ports 24, while of relatively small cross sectional area, are larger than the supplemental ports 22 and 23.

The operation of the valve is as follows: With the ports in the relation illustrated in Fig. 1, as already explained, motive fluid will enter the front end of the piston chamber 4, and drive the piston rearwardly. At the same time a small amount of fluid is entering the pressure chamber 8 through the supplemental passageway 22, and the pressure in said chamber 8 is sufficient to hold the valve in its left hand position, as illustrated. This is due to the fact that while the exhaust port 24 is larger, the expansion of the motive fluid will create a relatively low pressure in the chamber 8, but said pressure is sufficient for the purpose of holding the valve. In this connection, it will be noted that there is but atmospheric pressure in the left hand chamber 9, since it is freely open to atmosphere, and motive fluid under pressure is cut off from said chamber 9. When the piston 5 approaches the limit of its rearward movement, the port 21 will be uncovered and motive fluid under substantially full pressure will thus pass through the passageway 19 into the left hand pressure chamber 9. This pressure being much greater than that in the right hand chamber 8, will cause the movement of the valve to the right or to the position illustrated in Fig. 2. This, it will be noted, immediately opens the exhaust from the front end of the piston chamber 4 and completely relieves the pressure in the right hand chamber 8. Inasmuch as the right hand passageway 14 now becomes an exhaust passageway, the pressure through the passageway 19 into the pressure chamber 9 is eliminated, but the left hand passageway 14 now becomes a supply passageway to the rear end of the piston chamber 4, and consequently a portion of the motive fluid will enter through the supplemental passageway 23 into the chamber 9 and create a low pressure in said chamber that will hold the valve in its right hand position. Obviously this action is repeated.

In order to lighten the valve, eliminate too great a body of motive fluid in each of the pressure chambers 8 and 9, and to secure a slight cushioning effect to the valve, said valve is hollowed out. To this end, the heads 15 are recessed, as illustrated at 26, and the shank 16 is provided with recesses 27 opening into the recesses 26, but separated at their inner ends. Plugs project into the pressure chambers 8 and 9 and comprise base portions 28 that enter the recesses 26 with terminal portions 29 that enter the recesses 27 of the shank. The different portions of these plugs are, however, of less diameter than the recesses they enter, so that the motive fluid which enters the respective pressure chambers 8 and 9, has complete access to the entire opposing surfaces of the valve. It will also be noted that these opposing surfaces are co-extensive and that the initial moving pressure and the secondary holding pressure acts in each instance against the same surface.

From the foregoing, it is thought that the construction, operation and many advantages of the herein described invention will be apparent to those skilled in the art, without further description, and it will be understood that various changes in the size, shape, proportion, and minor details of construction, may be resorted to without departing from the spirit or sacrificing any of the advantages of the invention.

Having thus fully described my invention, what I claim as new, and desire to secure by Letters Patent is:—

1. The combination with a cylinder member and a movable piston therein, of a valve casing having spaced pressure chambers, a valve in the casing controlling the distribution of motive fluid to and its exhaust from the cylinder member, said valve having opposite pressure surfaces in the different pressure chambers respectively, means controlled by the piston for admitting fluid under pressure to the chambers and against the pressure surfaces of the valve, and means controlled by the valve for admitting fluid under pressure to the chambers and against said same pressure surfaces of the valve.

2. The combination with a cylinder member and a movable piston therein, of a valve casing having spaced pressure chambers, a valve in the casing controlling the distribution of motive fluid to and its exhaust from the cylinder member, said valve having opposite pressure surfaces in the respective pressure chambers respectively, means controlled by the piston for admitting fluid under pressure to the chambers alternately and against the pressure surfaces of the valve to shift said valve, means controlled by the valve when so shifted to alternately relieve the fluid pressure thereagainst that caused its shifting movement, and means controlled by the valve when so shifted to admit fluid under pressure alternately against the same pressure surfaces to hold the valve in its shifted position.

3. The combination with a cylinder member and a movable piston therein, of a valve casing having spaced pressure chambers, distributing and exhaust passageways between the casing and cylinder member on opposite sides of the piston, said valve casing having

a main supply port and exhaust permitting means, a shiftable valve in the casing controlling the distributing and exhaust passageways, and having oppositely disposed pressure surfaces in the chambers respectively, crossed passageways covered and uncovered by the piston and extending between the cylinder member and the chambers, and ports between the distributing passageways and the chambers.

4. The combination with a cylinder member and a movable piston therein, of a valve casing having spaced pressure chambers, distributing and exhaust passageways opening into the valve casing between the chambers and extending to the cylinder member on opposite sides of the piston, said valve casing having a main supply port and exhaust permitting means, a shiftable valve in the casing controlling the distributing and exhaust passageways and having oppositely disposed pressure surfaces in the chambers respectively, crossed passageways opening into the cylinder member between the distributing and exhaust passageways and covered and uncovered by the piston, said crossed passageways opening into the pressure chambers and delivering fluid under pressure alternately against the pressure surfaces of the valve, and supplemental passageways between the distributing passageways and the chambers for continuing pressure alternately against the same pressure surfaces of the valve when the initial pressure through the crossed passageways has been relieved.

5. The combination with a cylinder member, of a piston operating therein, a valve casing having spaced pressure chambers, a valve in the casing controlling the supply of motive fluid to the cylinder member, said valve having oppositely disposed pressure surfaces of substantially equal area in the chambers, and means controlled by the piston for supplying the chambers alternately and against said pressure surfaces an initial shifting pressure and a secondary holding pressure, the initial pressure being delivered to one of the chambers and against the surface therein while the holding pressure is in the opposite chamber against said surface therein and overcoming said holding pressure to shift the valve.

6. The combination with a cylinder member, of a piston operating therein, a valve casing having spaced pressure chambers, a valve in the casing controlling the supply of motive fluid to the cylinder member, said valve having oppositely disposed pressure surfaces of substantially equal area in the chambers, and means controlled by the piston for supplying the chambers alternately and against said pressure surfaces an initial shifting pressure and a secondary holding pressure, the initial pressure being delivered to one of the chambers and against the surface therein while the holding pressure is in the opposite chamber against said surface therein and overcoming said holding pressure to shift the valve, and means permitting a constant exhaust from the pressure chambers.

7. The combination with a cylinder member and a movable piston therein, of a valve casing having spaced pressure chambers, a valve in the casing controlling the distribution of motive fluid to and its exhaust from the cylinder member, said valve having opposite pressure surfaces in the respective pressure chambers respectively, means controlled by the piston for admitting fluid under pressure to the chambers and against the pressure surfaces of the valve, means controlled by the valve for admitting fluid under pressure to the chambers and against said same pressure surfaces of the valve, and means for permitting constant exhaust from said pressure chambers.

8. The combination with a cylinder member and a movable piston therein, of a valve casing having spaced pressure chambers, distributing and exhaust passageways between the casing and cylinder member on opposite sides of the piston, said valve casing having a main supply port and exhaust permitting means, a shiftable valve in the casing controlling the distributing and exhaust passageways and having oppositely disposed pressure surfaces in the chambers respectively, crossed passageways covered and uncovered by the piston and extending between the cylinder member and the chambers, ports between the distributing passageways and the chambers, and exhaust ports of greater area than said foregoing ports opening into the chambers.

9. The combination with a cylinder member and a movable piston therein, of a valve casing having spaced pressure chambers, distributing and exhaust passageways opening into the valve casing between the chambers and extending to the cylinder member on opposite sides of the piston, said valve casing having a main supply port and exhaust permitting means, a shiftable valve in the casing controlling the distributing and exhaust passageways and having oppositely disposed pressure surfaces in the chambers respectively, crossed passageways opening into the cylinder member between the distributing and exhaust passageways and covered and uncovered by the piston, said crossed passageways opening into the pressure chambers and delivering fluid under pressure alternately against the pressure surfaces of the valve, supplemental passageways between the distributing passageways and the chambers for continuing pressure alternately against the same pressure surfaces of the valve when the initial

pressure through the crossed passageways has been relieved, and exhaust ports in constant communication with the chambers and of greater area than the supplemental passageways.

10. The combination with a cylinder member and a movable piston therein, of a valve casing having spaced pressure chambers, a valve in the casing controlling the distribution of motive fluid to the cylinder member, and having its ends operating in the chamber, means for supplying fluid under pressure to the chambers to effect the action of the valve, the ends of the said valve being recessed to lighten the same, and filling plugs projecting into the chambers and entering the recesses of the valve, said plugs permitting the free passage of the motive fluid thereabout to all parts of the recesses to act against the entire opposing end surfaces of the valve.

11. The combination with a cylinder member and a movable piston therein, of a valve casing having spaced pressure chambers, a valve in the casing controlling the distribution of motive fluid to the cylinder member, including end heads operating in the chambers and a reduced shank connecting the end heads, said heads having end recesses and said shanks having recesses of less diameter communicating with the head recesses but separated from each other, plugs projecting into the chambers and having base portions of less diameter than the head recesses and entering the same, said plugs also having terminal portions of less diameter than the shank recesses and entering said latter recesses, and means for supplying fluid under pressure to the chambers to effect the action of the valve.

12. The combination with a cylinder member and a movable piston therein, of a valve casing having spaced pressure chambers, a valve in the casing controlling the distribution of motive fluid to the cylinder member, including end heads operating in the chambers and a reduced shank connecting the end heads, said heads having end recesses and said shanks having recesses of less diameter communicating with the head recesses but separated from each other, plugs projecting into the chambers and having base portions of less diameter than the head recesses and entering the same, said plugs also having terminal portions of less diameter than the shank recesses and entering said latter recesses, crossed passageways uncovered and covered by the piston and opening into the valve chambers to supply motive fluid thereto alternately said plugs permitting such motive fluid to enter the recesses of the valve heads and shank, supplemental supply passageways from the distributing means to the chambers, and exhaust passageways from the chambers.

In testimony whereof I affix my signature in the presence of two witnesses.

GUSTAVE M. NELL

Witnesses:
F. H. SCHWARTZ,
R. R. MAYTHER.