

June 21, 1927.

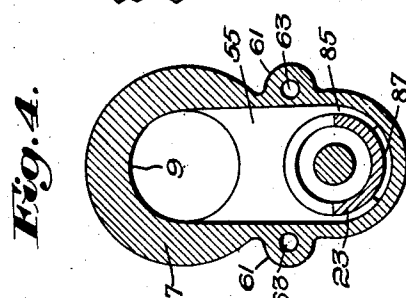
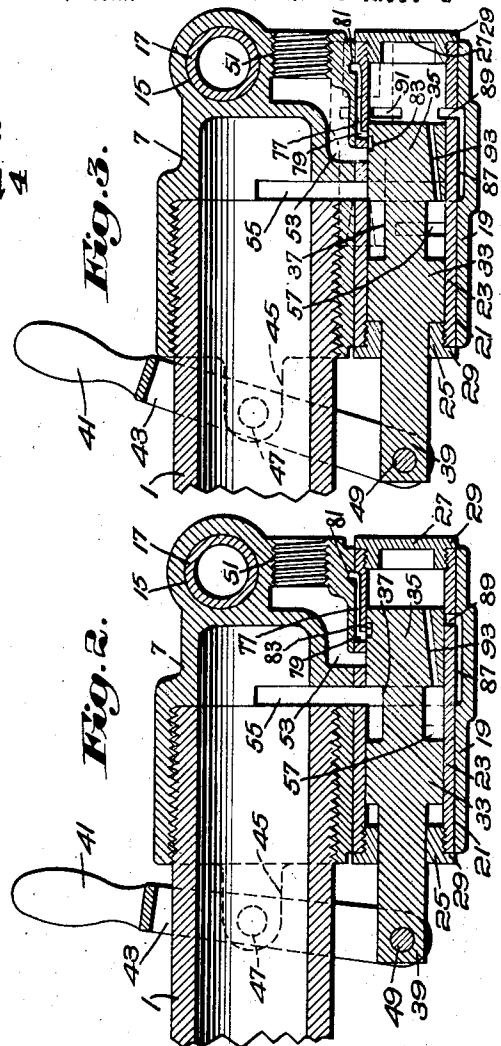
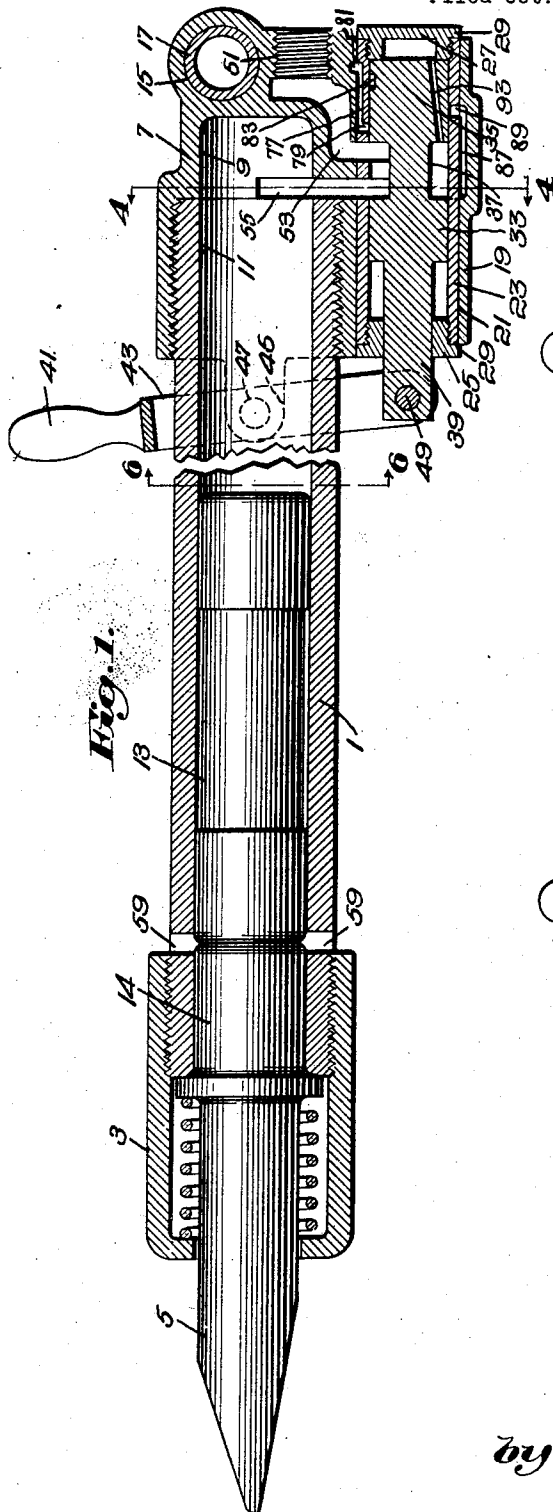
E. H. SHAFF

1,633,501

IMPACT TOOL

Filed Oct. 10, 1922

2 Sheets-Sheet 1



Inventor:
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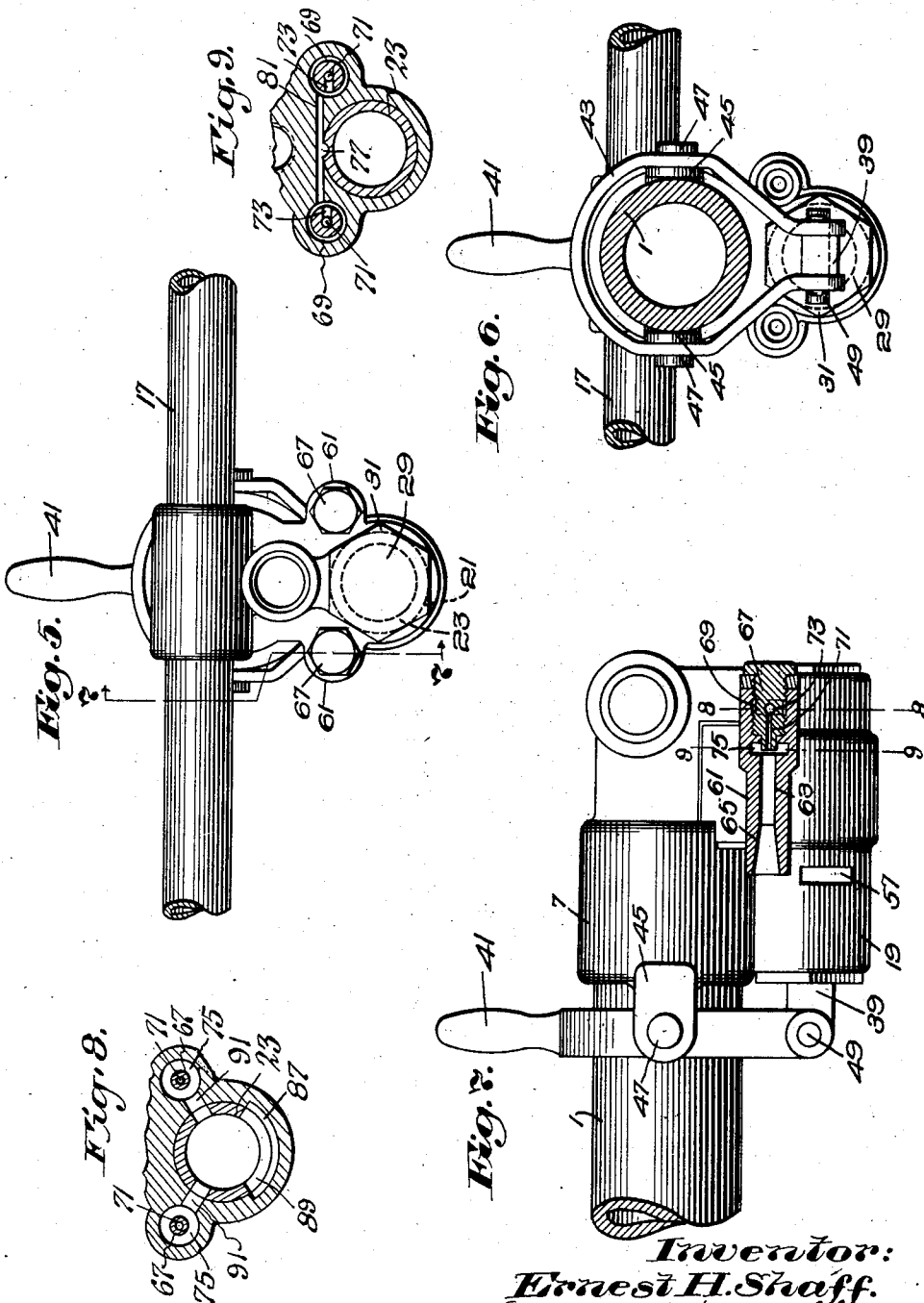
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2 Sheets-Sheet 2



Inventor:
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UNITED STATES PATENT OFFICE.

ERNEST H. SHAFF, OF GRAND HAVEN, MICHIGAN, ASSIGNOR TO WILLIAM H. KELLER, INC., OF GRAND HAVEN, MICHIGAN, A CORPORATION OF MICHIGAN.

IMPACT TOOL.

Application filed October 10, 1922. Serial No. 593,577.

My invention relates to impact tools, and particularly but not exclusively to manually supported impact tools of the hammer type.

5 My invention, which has among its objects the provision of simplicity in construction and efficiency in operation, will be best understood from the following description when read in the light of the accompanying
10 drawing of one specific embodiment of my invention selected for illustrative purposes, while the scope of my invention will be more particularly pointed out in the appended claims.

15 In the drawing:—

Fig. 1 shows a longitudinal section of an embodiment of my invention applied to a rivet breaker type of impact tool;

20 Figs. 2 and 3 are longitudinal sections of the rearward end of the machine corresponding to Fig. 1 with the valve moved to different positions;

Fig. 4 is a section on the line 4—4 of Fig. 1;

25 Fig. 5 is an end elevation of the machine;

Fig. 6 is a section on the line 6—6 of Fig. 1; and

30 Fig. 7 is a side elevation of the rearward end of the machine, parts shown in the section on the line 7—7 of Fig. 5;

Figs. 8 and 9 are sections on the lines 8—8 and 9—9 of Fig. 7.

Referring to the drawing, which as heretofore indicated shows a specific embodiment of one type of my invention, I have provided a cylinder in the form of a tube 1 which is exteriorly screw threaded at opposite ends. The screw threads at the forward end of the cylinder carry the sleeve 3 serving as a retainer for the working tool 5, while the screw threads at the rearward end carry the headblock 7, the latter having a bore 9 which coincides with the bore 11 of the tube. In the cylinder chamber provided
45 by the bores 9 and 11 I mount for reciprocation the hammer piston 13, the latter being arranged to strike at the end of its forward stroke the rearward end of the shank 14 of the working tool, which shank fits the bore
50 11 and is retained therein by the sleeve 3.

For supporting the device the headblock is provided at its rearward end with a transversed bore 15 which receives a hollow bar

17 the projecting ends of which form the supporting handle for the machine.

At one side of the headblock is an enlargement 19 provided with a cylindrical bore 21 through which extends the sleeve 23. The ends of the sleeve 23 are interiorly screw threaded, and receive the screw threaded
60 ends of plugs 25 and 27. The plugs which thus serve to close the ends of the sleeve 23 are provided with hexagonal heads 29, corners 31 of which overlap the edges of the bore 21 and bear on the end surfaces of the
65 headblock adjacent said edges, and thereby serve to prevent movement of the sleeve 23 in the bore 21.

The interior of the sleeve 23 forms a valve chamber in which reciprocates a piston valve
70 for controlling the operation of the hammer piston 13. This controlling valve comprises a forward head 33 and a rearward head 35, the heads being connected by the reduced diameter portion 37 of the valve. The valve
75 stem 39 projecting through a suitable orifice in the plug 25 serves as a convenient means for connecting the valve to the valve controlling member for actuating it.

For actuating the controlling valve I provide a controlling member herein exemplified by the handle lever 41, the latter having a bifurcated portion 43 which straddles the cylinder just forward of the headblock and is pivotally supported at an intermediate position on ears 45 projecting forwardly from the headblock. The ears 45 carry outwardly projecting trunnions 47 which enter suitable perforations in the handle lever and thus is formed the pivotal support. The end portions of the bifurcation of the handle lever
90 are connected to the end of the valve stem remote from the valve by means of a pin 49 which extends through and projects from the valve stem, and is received in perforations in the ends of the bifurcation. It will be noted that by pivoting the handle lever as described said lever is substantially balanced in its effect on the valve.

At the rearward end of the headblock is
100 an opening 51 for receiving the connection for an air hose constituting a source of motive fluid supply. Connecting the opening 51 with the interior of the valve chamber is a passage 53. Leading from the valve chamber at a point forwardly of the place of com-
105

munication of the passage 53 therewith is a second passage 55 which leads to the cylinder chamber at a point spaced from its extreme rearward end. A third passage 57 connects the interior of the valve chamber at a point forward of the point of communication of the passage 55 therewith to the atmosphere.

With this arrangement of parts it will be clear that with the valve in the position shown by Fig. 1 motive fluid will be conducted from the opening 51 to the rearward end of the cylinder by way of the passage 53, the chamber formed by the reduced diameter portion 37 of the valve, and the passage 55, the passage 57 at this time being closed by the head 33 of the valve; and, further, that with the parts in the position shown by Fig. 2, motive fluid will be conducted from the rearward end of the cylinder to the atmosphere by way of the passage 55, the chamber accorded by the reduced diameter portion 37 of the valve, and the passage 57, the passage 53 in this position of parts being closed by the head 35 of the valve. In practice the valve is moved to the position shown by Fig. 1 to permit motive fluid to drive the piston forwardly to strike the tool, and is moved to the position shown by Fig. 2 to exhaust such motive fluid.

For returning the piston after the motive fluid which has driven the same forwardly is exhausted, I subject the rearward end of the piston chamber to suction. To this end I create a jet of motive fluid and cause the suction induced thereby to create a partial vacuum in the rearward end of the cylinder. For giving effect to the partial vacuum I connect the forward end of the cylinder to any source of relatively low pressure compared to the pressure of the motive fluid supply. In the present embodiment of my invention this connection is exemplified by passages 59 which place the forward end of the cylinder in communication with the atmosphere.

In order to form the ejectors heretofore referred to I provide the opposite sides of the headblock with enlargements 61, each of which is provided with a longitudinal bore 63, the forward end of which is flared as at 65, while the rearward end is enlarged and screw threaded for receiving the plug 67. The plug 67 is provided at an intermediate portion with an annular groove 69, and with an axially located passage 71, the latter being of small bore and leading from the forward face of the plug rearwardly to a transverse passage 73 connected with the annular groove 69. The forward end of the plug is reduced to fit the small diameter portion of the bore 63, the latter being enlarged immediately adjacent the forward end of the plug to form a chamber 75. In

this manner the portion of the bore 63, forwardly of the annular groove 75, forms the combining tube of an ejector, the annular groove 75 the combining chamber of an ejector, and the bore 71 of the plug the nozzle of an ejector.

For supplying the nozzle of the ejector with pressure fluid I provide a passage 77 formed on the outer surface of the sleeve 23 and opening into the valve chamber by means of the radial passage 79 located just rearwardly the point of communication of the passage 53 of the valve chamber, while adjacent the rearward end of the passage 77 the headblock is provided with a transverse passage 81 which intersects the passage 77 and opens into the annular grooves 69 in the plugs 67 of the ejectors. Further the valve head 35 is provided with a recess 83 which, when the valve is moved to the position shown by Fig. 3, establishes communication between the passage 79 and the passage 53 so as to supply motive fluid to the nozzles of the ejectors.

For connecting the combining chambers 75 of the ejectors to the cylinder I provide the bore 21 of the headblock, which bore receives the sleeve 23 with a semi-annular groove 85 communicating with the passage 55. Leading from the semi-annular groove 85 is a longitudinal groove 87 formed in the surface of the bore 23, the rearward end of the groove being placed into communication with the interior of the sleeve 23 by means of a slot 89. Leading from the interior of the sleeve in the plane of the slot 89 are transverse passages 91 which open into the combining chambers 75. In this manner it will be understood that with the parts in the position shown by Fig. 3 not only will motive fluid be supplied to the nozzles of the ejectors, but that in addition the rearward end of the cylinder will be connected to the combining chambers 75 by means of the passage 55, the semi-annular groove 85, groove 87, slot 89, the rearward end of the valve chamber, and passages 91.

To summarize the operations hereinbefore explained, it is pointed out that with the valve in the position shown by Fig. 1 motive fluid is admitted to the interior of the cylinder to drive the piston forwardly, the exhaust from the cylinder at this time being closed, and the ejectors being inoperative. After the blow is struck the valve is moved to the position shown by Fig. 2 which connects the interior of the cylinder with the atmosphere by way of the passages 55, the chamber about the reduced diameter portion 37 of the valve and the passage 57 which exhausts the motive fluid which has acted to drive the piston forwardly. The valve is now moved to its position shown by Fig. 3 which interrupts the connection

between the rearward end of the cylinder and the atmosphere and connects the nozzles of the ejectors to the motive fluid supply and the interior of the cylinder to the combining tubes of the ejectors. This creates a partial vacuum in the rearward end of the cylinder and causes the atmospheric pressure acting on the forward end of the piston to return the latter to its initial position.

For improving the operation of the device I provide means for automatically moving or tending to move the valve from the position shown by Fig. 1 to that shown by Fig. 2. In the present form of my device for this purpose I form through the head of the valve a passage of small diameter. With this construction, when the valve is moved into the position shown by Fig. 1, motive fluid passes through the passage to the chamber at the rear of the valve, which moves the valve to the position shown by Fig. 2, so as to cut off the inlet of air to the cylinder and open it to exhaust. This of course also opens the space at the rear of the valve to the atmosphere and exhausts the air previously admitted to said space.

I have found that by making the valve move or tend to move automatically from the position shown by Fig. 1 to the position shown by Fig. 2 that the recoil heretofore incident to this type of machine is practically eliminated. This follows from the fact that it eliminates the tendency of the operator not to move the valve to return the piston until he is conscious of the blow. Specifically, I have found that when the valve is moved into the position shown by Fig. 1, the piston almost instantly strikes the tool and if the valve is kept in this position long enough the cylinder fills up with air at high pressure and causes a violent recoil. With the present arrangement however the valve will be moved to exhaust the cylinder before the recoil can take place; and further, when the valve reaches the position shown by Fig. 2 the tendency of the operator is to keep the valve in that position for sufficient time to enable the cylinder to fully exhaust before the valve is moved to the position shown by Fig. 3, which results in the piston being returned more quickly.

Although I have described for purposes of illustration one specific embodiment of one type of my invention it is to be understood that I am not limited thereby to its particular mechanical details, but within the scope of my invention wide deviations may be made therefrom without departing from the spirit of my invention.

Claims:

1. An impact tool having, in combination, a cylinder, a hammer piston, a tool for actuation by said hammer piston, means forming an ejector, a source of pressure fluid

supply, piston actuating means including a coordinated controlling valve mechanism and means forming ports and passages controlled by said valve mechanism, said valve mechanism operative for effecting by said ports and passages alternate admission of pressure fluid from said source to an end of said cylinder and admission of pressure fluid from said source to said ejector with connection of the latter to said end of said cylinder, said valve mechanism also operative to effect by said ports and passages exhaust of said pressure fluid admitted to said cylinder by passages independent of said ejector.

2. An impact tool having, in combination, a cylinder, a hammer piston, a tool for actuation by said hammer piston, means forming an ejector, a source of pressure fluid supply, piston actuating means including a coordinated controlling valve mechanism and means forming ports and passages controlled by said valve mechanism, said valve mechanism operative for effecting by said ports and passages alternate admission of pressure fluid from said source to an end of said cylinder and admission of pressure fluid from said source to said ejector with connection of the latter to said end of said cylinder, said valve mechanism having a position in which said ports and passages are inoperative to admit pressure fluid to said end of said cylinder and to said ejector, said ports and passages when said valve is in said position connecting said end of said cylinder to the atmosphere.

3. An impact tool having, in combination, a cylinder, a hammer piston, a tool for actuation by said hammer piston, means forming an ejector, a source of pressure fluid supply, piston actuating means including a coordinated controlling valve mechanism and means forming ports and passages controlled by said valve mechanism, said valve mechanism operative for effecting by said ports and passages alternate admission of pressure fluid from said source to an end of said cylinder and admission of pressure fluid from said source to said ejector with connection of the latter to said end of said cylinder, said valve mechanism having a position in which said ports and passages are inoperative to admit pressure fluid to said end of said cylinder and to said ejector, said ports and passages when said valve is in said position connecting said end of said cylinder to the atmosphere independently of said ejector.

4. An impact tool having, in combination, a cylinder, a hammer piston, a tool for actuation by said hammer piston, means forming an ejector, a source of pressure fluid supply, piston actuating means including a coordinated controlling valve mechanism and means forming ports and passages controlled by said valve mechanism, said valve mechanism

nism operative for effecting by said ports and passages alternate admission of pressure fluid from said source to an end of said cylinder and admission of pressure fluid from
 5 said source to said ejector with connection of the latter to said end of said cylinder, said valve mechanism also operative to enforce by said ports and passages exhaust of the pressure fluid admitted to said end of
 10 said cylinder before pressure fluid may be admitted to said ejector.

5. An impact tool having, in combination, a cylinder, a hammer piston, a tool for actuation by said hammer piston, means forming
 15 an ejector, a source of pressure fluid supply, piston actuating means including a coordinated controlling valve mechanism and means forming ports and passages controlled by said valve mechanism, said valve mechanism operative for effecting by said ports
 20 and passages alternate admission of pressure fluid from said source to an end of said cylinder and admission of pressure fluid from said source to said ejector with connection of the latter to said end of said cylinder, said
 25 valve mechanism also operative to enforce by said ports and passages exhaust of the pressure fluid admitted to said end of said cylinder before pressure fluid may be admitted to said ejector and by passages independent of said ejector.
 30

6. An impact tool having, in combination, a cylinder, a hammer piston, a tool for actuation by said hammer piston, means forming
 35 an ejector, a source of pressure fluid supply, piston actuating means including a coordinated controlling valve mechanism and means forming ports and passages controlled by said valve mechanism, said valve mechanism operative for effecting by said
 40 ports and passages alternate admission of pressure fluid from said source to an end of said cylinder and admission of pressure fluid from said source to said ejector with connection of the latter to said end of said cylinder, said valve mechanism having operating
 45 positions for successively effecting by said ports and passages the admission of pressure fluid to said cylinder, then the exhaust of said pressure fluid, and finally admission of pressure fluid to said ejector and connection of
 50 said ejector to the end of said cylinder.

7. A hand held impact tool having, in combination, a cylinder, a hammer piston, a
 55 tool for actuation by said hammer piston, means forming an ejector, a source of pressure fluid supply, piston and ejector actuating means including a coordinated controlling valve mechanism and means forming
 60 ports and passages controlled by said valve mechanism, said valve mechanism having two operating positions operative to effect by said ports and passages alternate admission of pressure fluid to an end of said cylinder and operation of said ejector to effect

creation of a partial vacuum in said end of said cylinder, and a third operating position intermediate said two positions for connecting said end of said cylinder to the atmosphere.
 70

8. A hand held impact tool having, in combination, a cylinder, a hammer piston, a tool for actuation by said hammer piston, means forming an ejector, a source of pressure fluid supply, piston and ejector actuating means including a coordinated controlling valve mechanism and means forming
 75 ports and passages controlled by said valve mechanism, said valve mechanism having two operating positions operative to effect by said ports and passages alternate admission of pressure fluid to an end of said cylinder and operation of said ejector to effect creation of a partial vacuum in said
 80 end of said cylinder, and a third operating position intermediate said two positions for causing said ports and passages to connect said end of said cylinder to the atmosphere by passages independent of said ejector.
 85

9. An impact tool having, in combination, a cylinder, a hammer piston, a tool for actuation by said hammer piston, an ejector having means forming a jet orifice and a suction orifice, a source of pressure fluid supply; means forming passages for connecting
 90 said source to an end of said cylinder and to said jet orifice, said end of said cylinder to said suction orifice and to the atmosphere, and said suction orifice to the atmosphere; the last named means including a relatively
 95 movable controlling valve and valve casing having formed therein cooperating ports for causing said valve in one position thereof relative to said casing to connect said source of supply to said end of said cylinder, when
 100 in another relative position to interrupt the connection between said source and said end of said cylinder and to connect said end to the atmosphere, and when in still another relative position to cause said end of said
 105 cylinder to be connected to the atmosphere by way of said suction orifice and live pressure fluid to flow through said jet orifice.

10. An impact tool having, in combination, a cylinder, a hammer piston, a tool
 110 for actuation by said hammer piston, an ejector having means forming a jet orifice and a suction orifice, a source of pressure fluid supply; means forming passages for connecting said source to an end of said cylinder and to said jet orifice, said end of said
 115 cylinder to said suction orifice and to the atmosphere, and said suction orifice to the atmosphere; the last named means including a relatively movable controlling valve and valve casing having formed therein cooperating ports for causing said valve in one position thereof relative to said casing to connect said source of supply to said
 120 end of said cylinder, when in another rela-
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tive position to interrupt the connection between said source and said end of said cylinder and to connect said end to the atmosphere independently of said ejector, and when in still another relative position to cause said end of said cylinder to be connected to the atmosphere by way of said suction orifice and live pressure fluid to flow through said jet orifice.

11. An impact tool having, in combination, a cylinder, a hammer piston, a tool for actuation by said hammer piston, a source of pressure fluid supply, a controlling valve, an ejector having a jet orifice and a suction orifice; conduit means connecting said source of supply to said valve, and connecting said valve to one end of said cylinder, the atmosphere, and said jet and suction orifices; passages in said valve for cooperation with said conduit means; said conduit means and passages having cooperating ports to cause said valve when in one position to connect said source of supply to said end of said cylinder, when in a second position to interrupt the connection between said source of supply and said end of said cylinder and to connect said end to the atmosphere, and when in a third position to connect said source of supply to said jet orifice and said end of said cylinder to said suction orifice while interrupting the connection between said source of supply and said end of said cylinder.

12. In a hand held impact tool, the combination with a cylinder and a hammer piston, of an ejector, a source of motive fluid supply, means including a controlling valve and ports and passages controlled thereby for alternately admitting motive fluid from said source to one end of said cylinder and exhausting said end and for creating suction in said end by said ejector; said valve having one position to effect supply of motive fluid to said end of said cylinder to cause the piston to make its power stroke, a second position to effect interruption of said supply and connection of said end of said cylinder to the atmosphere for exhausting the motive fluid admitted in the first position of said valve, and a third position to effect interruption of said supply to said cylinder and interruption of that connection to the atmosphere effected in the second position, said valve in said third position also effecting connection of the ejector to the source of supply for creating a suction in said end of said cylinder for returning said piston.

13. In a hand held impact tool, a cylinder, a hammer piston in said cylinder, an ejector, a source of motive fluid supply, means including a controlling valve and ports and passages controlled thereby for alternately admitting motive fluid from said source to one end of said cylinder and exhausting said

end and for creating suction in said end by said ejector, said valve having an intermediate position and a position on each side of said intermediate position, said valve in its intermediate position causing said ports and passages to exhaust said end of said cylinder, in one of its other positions causing said ports and passages to connect said source of motive fluid supply to said end of said cylinder for causing the piston to make its power stroke, and in the remaining of its other positions causing said ports and passages to connect said source of motive fluid supply and said end of said cylinder to said ejector for subjecting said cylinder to suction for returning said piston.

14. In a hand held impact tool, a cylinder having a hammer piston therein, a valve chamber, said cylinder having openings at opposite ends and being imperforate between said openings, one of said openings leading to the atmosphere and the other to said valve chamber, means forming an ejector, a source of motive fluid supply, a valve in said valve chamber, means forming ports and passages controlled by said valve for effecting in one position of said valve admission of motive fluid from said valve chamber to said cylinder by way of the opening leading to said chamber from said cylinder, in another position of said valve connection of the last named opening to the atmosphere, and in a third position of said valve connection of said last named opening to said ejector and supply of motive fluid to said ejector.

15. In a hand held impact tool, a cylinder, a hammer piston therein, said cylinder having at opposite ends fluid conducting passages for the fluid actuating said piston and being imperforate between its ends, means including a valve and ports and passages controlled thereby, said valve being movable for effecting by said ports and passages admission of motive fluid to one end of said cylinder for causing said piston to make its power stroke and for then exhausting said end, and means including an ejector and ports and passages controlled by said valve for subjecting said end to suction when said piston is to be returned to said end after exhausting said end.

16. A hand held impact tool having, in combination, a cylinder, a piston therein, means including ports and passages and a manually operated distributing valve for controlling the motive fluid for actuating said piston, said valve having a neutral position in which the flow of motive fluid is interrupted and a position at each side of said neutral position for causing flow of motive fluid for effecting movement of said piston in opposite directions, and means forming an expansible chamber device for moving said valve from one of the last named

positions to said neutral position, said last mentioned means comprising ports and passages controlled by said valve.

17. A hand held fluid actuated hammer having, in combination, a cylinder, a hammer piston; and means for effecting actuation of said piston in opposite directions including a motive fluid supply connection, a manually actuated valve, and motive fluid conducting ports and passages controlled by said valve; said valve at one end of its travel rendering said means operative to admit motive fluid from said connection to said cylinder to cause the stroke of said piston in one direction, at an intermediate position rendering said means operative to exhaust the motive fluid admitted to said cylinder, and at the opposite end of its travel rendering said means operative to effect flow of motive fluid from said connection for effecting a return stroke of said piston.

18. A hand held fluid actuated hammer having, in combination, a cylinder, a hammer piston, a tool operated upon by said hammer piston, a source of motive fluid supply, a manually actuated valve and ports and passages controlled thereby, means forming an ejector; said valve at one end of its travel causing said ports and passages to supply motive fluid from said source to said cylinder for causing the power stroke of said piston, at a position intermediate the ends of its travel causing said ports and passages to exhaust said fluid admitted to said cylinder, and at the opposite end of its travel causing said ports and passages to supply said ejector with motive fluid for effecting suction in said cylinder for causing a return of said piston.

19. A hand held fluid actuated hammer having, in combination, a cylinder, a hammer piston in said cylinder, a manually operated controlling valve, a source of motive fluid supply, means forming ports and passages controlled by said valve for effecting action of said piston by motive fluid from said source, said valve at one end of its travel causing said ports and passages to admit motive fluid from said source to said cylinder to effect the power stroke of said hammer piston; means including cooperating opposed pressure surfaces and conduit means controlled by said valve for causing fluid pressure to build up between said pressure surfaces when said valve is at said end

of its travel for urging movement of said valve from said end to a position intermediate the ends of its travel, said valve when in such intermediate position exhausting from said cylinder the fluid causing said power stroke of the piston and exhausting the fluid from between said pressure surfaces.

20. A hand held fluid actuated hammer having, in combination, a cylinder, a hammer piston in said cylinder, a source of motive fluid supply, a manually controlled valve and ports and passages controlled thereby for effecting actuation of said piston, manually actuated means for moving said valve, said valve having a position to effect by said ports and passages exhaust of the rearward end of said cylinder and having an end position to effect supply of said rearward end with motive fluid from said source, means including opposed pressure surfaces and ports and passages controlled by manual movement of said valve for creating when said valve is in said end position a force urging movement of said valve from said end position to its first named position, said means permitting unobstructed manual movement of said valve toward said end position.

21. A hand held fluid actuated hammer having, in combination, a cylinder, a hammer piston, a source of motive fluid supply, an ejector, a manually operated valve having two end positions and an intermediate position, a pressure surface for said valve, and ports and passages controlled by said valve, for causing said valve in one end position to supply the rearward end of said cylinder with motive fluid for driving said hammer forward and for causing said motive fluid to act against said pressure surface of said valve for urging said valve toward its intermediate position, said valve when moved to its intermediate position exhausting the rearward end of said cylinder and the motive fluid acting against said pressure surface, said valve when moved to its other end position supplying motive fluid to said ejector and connecting the suction orifice of said ejector to the rearward end of said cylinder.

In testimony whereof, I have signed my name to this specification.

ERNEST H. SHAFF.