W. H. KELLER.

PNEUMATIC TOOL.

APPLICATION FILED MAY 3, 1907.

949,080.

Patented Feb. 15, 1910.

2 SHEETS—SHEET 1.

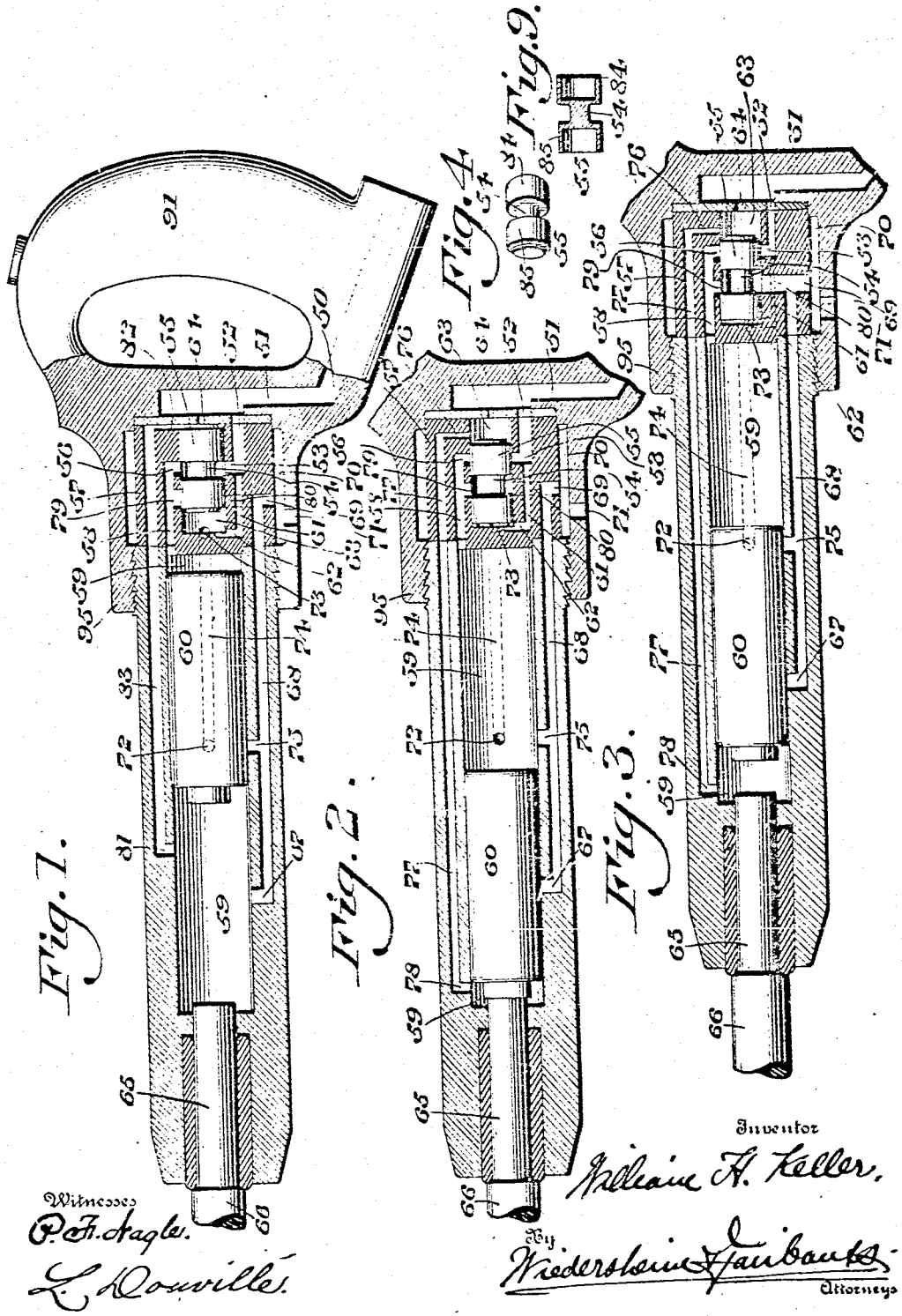

Fig. 1.

Fig. 2.

Fig. 3.

Fig. 4.

Witnesses

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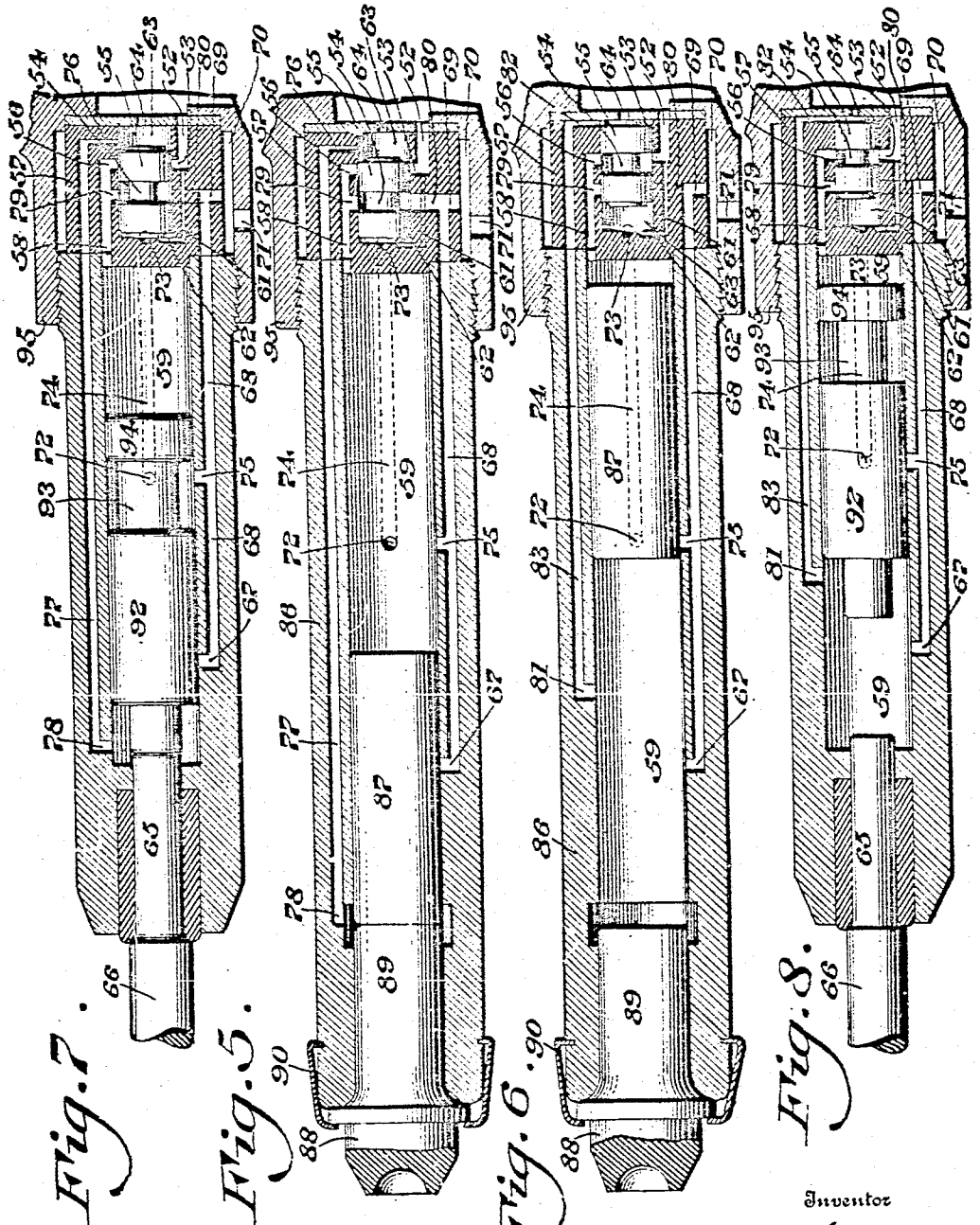

Fig. 7.

Fig. 5.

Fig. 6.

Fig. 8.

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UNITED STATES PATENT OFFICE.

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PNEUMATIC TOOL.

949,080. Specification of Letters Patent. Patented Feb. 15, 1910.

Application filed May 3, 1907. Serial No. 371,754.

To all whom it may concern:

Be it known that I, WILLIAM H. KELLER, a citizen of the United States, residing in the city and county of Philadelphia, State of Pennsylvania, have invented a new and useful Improvement in Pneumatic Tools, of which the following is a specification.

My invention relates to a novel construction of a pneumatic tool and a valve mechanism for a pneumatic tool wherein cost of production is reduced to a minimum and the construction greatly simplified.

Many attempts have heretofore been made to produce a valve mechanism which will accomplish the desired results, but so far as I am aware it has hitherto been considered impossible and impracticable to employ the same valve mechanism for both a long stroke or short stroke hammer, irrespective of whether the piston be grooved or ungrooved.

In my present invention I have succeeded by my novel construction of valve, valve box and its adjuncts, in producing a tool wherein the necessity of fitting a cap on the valve box can be avoided, since the said cap can be dispensed with and I also employ a balanced valve of symmetrical construction having both ends constructed alike and wherein the valve can be inserted in the valve box, either end foremost, and wherein the same type of valve and valve box can be applied to a short stroke or to a long stroke tool and a solid piston or a grooved piston may be employed with equal facility.

So far as I am aware, I am the first in the art to produce a valve mechanism having a valve with but two heads or pressure areas wherein it is possible to secure any desired length of stroke without materially changing the whole construction of the cylinder and ports. In many pneumatic tools as heretofore constructed wherein a fluid actuated valve is used to control the movement of the hammer or piston, the valve has been moved either in an opposite direction or a right angle to the movement of said hammer or piston in which case the blow of the hammer will naturally interfere with the regular and uniform movement of the valve, if the latter does not move in the same direction as the piston, and if the valve does not work regularly and uniformly the reciprocations of the piston will be irregular which is a very objectionable feature and very often renders the use of pneumatic hammers impracticable. This irregular movement of the piston sometimes also causes the valve to break or become injured and thus shortens the life of the tool, since it will be apparent that if the valve moves in the opposite direction to the piston shortly before the latter strikes the chisel or if the valve should move in an opposite direction to the piston at the moment that the piston delivers its blow the valve will be liable to rebound from its seat, reopen ports that should be closed and cause the tool to jump; or in other words, the cylinder or casing will move away from the chisel or the working tool, because the exhaust from the back end does not occur at the right time. Now, since hammers of the character of my novel construction under consideration strike from two to three thousand blows per minute, it will be readily seen how wearing this irregular movement will be both on the valve and the operator. By my novel invention, however, before the hammer strikes the chisel or working tool, the valve will move in the same direction and when the blow is delivered to the working tool the valve following the piston, the blow instead of rebounding the valve from the seat will serve to hold said valve more firmly seated, whereby all the ports are positively opened at the right time, the movement of the hammer is regular and unobstructed under all conditions and the jumping or fluttering of the valve which has heretofore been an objectionable feature in most pneumatic hammers is overcome.

A very objectionable feature in many pneumatic tools now on the market arises from the excessive shock and vibration caused by the rapid reciprocations of the piston and for the other reasons before specified which, in my present invention are reduced to a minimum whereby my invention can be applied not only to light work such as cutting or dressing stone and calking boilers or vessels, but for chipping and riveting on metal and for performing various kinds of work ordinarily heretofore performed by simple hand tools and a mallet or hammer.

To the above ends my invention consists broadly of a novel construction of a two piston valve and valve box, said valve being capable of being inserted either end first, into the valve box and requiring no machine work of the character required when a valve box comprising three or more parts is used.

It further consists of a novel construction

of a tool cylinder, valve box and valve and co-acting ports and passages in said cylinder and valve box.

It further consists of other novel features of construction, all as will be hereinafter set forth.

Figure 1 represents a longitudinal sectional view of a pneumatic tool and its adjuncts embodying my invention, the piston and valve being shown in their rearward position. Fig. 2 represents a longitudinal section similar to Fig. 1 but showing the section taken on a different line and the piston and the valve in their extreme forward position. Fig. 3 represents a section taken on the same line as Fig. 2 but showing the valve in its forward position and the piston just starting its rearward movement. Fig. 4 represents a perspective view of my novel construction of valve employed in detached position. Fig. 5 represents a longitudinal sectional view of a long stroke pneumatic riveting hammer embodying my invention, the piston and valve being shown in their extreme forward position. Fig. 6 represents a sectional view taken on a different line from Fig. 5 and showing the piston and valve in the rearward position they assume. Fig. 7 represents a sectional view of my invention, embodied in a short stroke chipping hammer having a grooved piston, the piston and valve being shown in their extreme forward position. Fig. 8 represents another view similar to Fig. 7 but showing the valve and piston in a different position. Fig. 9 represents a sectional view of another embodiment of a valve which may be employed.

Similar numerals of reference indicate corresponding parts in the figures.

Referring to the drawings:—In the detailed description of my novel construction, I shall trace the course of the motive fluid from its entrance into the handle which may be of any suitable or conventional construction and shall describe the passage of the motive fluid from the time it enters the handle, passes through and beyond the valve on either side thereof and during its inlet to either side of the piston and shall trace the exhaust of the motive fluid from both ends of the piston and valve.

Referring first to Figs. 1 to 4 inclusive, it will be seen that when the parts are in the position seen in Fig. 1, the motive fluid enters the pressure supply duct 50 in the handle and flows thence into the passage 51 and thence into the passage 52 of the valve box and through the port 53 around the groove 54 of the valve 55, assuming the latter to be in its rearmost position as seen in Figs. 1 and 3. The motive fluid then passes through the port 56 of the valve box 57 and the passage 58 into the rear portion of the piston chamber 59 and assuming that the piston 60 is in the position seen in Fig. 1, said piston will be driven forwardly from the position seen in Fig. 1 into the position seen in Fig. 2. It will be observed that the passages 61 and 62 of the valve box are always open to live air pressure and that when the valve is in the position seen in Fig. 1, live air can pass freely through said passages 61 and 62 to the forward or left hand portion of the valve chamber 63, it being also apparent that live air pressure is always being exerted through the port 64 upon the rear end of the valve 55. As the piston 60 moves toward the shank 65 of the working tool 66, the exhaust from the forward end of the piston flows through the port 67 and passage 68 and port 69 into the annular chamber 70 and thence to the atmosphere through the exhaust ports 71. After the piston has moved into the position seen in Fig. 2, the port 72 is uncovered by the piston moving beyond it, whereby live air is permitted to flow through the port 73, passage 74 and port 72 into the piston chamber 59 and thence through the port 75 and passage 68, port 69, annular chamber 70 and main exhaust ports 71. The pressure upon the forward end of the valve 55 is now relieved whereupon the constant live pressure exerted through the live air port 64 will force the valve 55 forwardly into the position seen in Fig. 2. The piston 60 and the valve 55 being now in their forward position, the live air now flows from the valve chamber 63, thence through the port 76, passage 77 and port 78 to the forward end of the piston chamber 59 whereby the piston 60 is caused to move from the position seen in Fig. 2 rearwardly into the position seen in Fig. 1. While the piston is moving from the position seen in Fig. 2 to the position seen in Fig. 1, the exhaust from the rear or right hand end of the piston takes place at first through the port 75, passage 68, port 69, annular chamber 70 and ports 71 to the atmosphere. After the piston has moved rearward or toward the handle sufficiently to cover the port 75 as seen in Fig. 3, the exhaust continues to take place through the passage 58, port 79, groove 54 of the valve and port 80, annular chamber 70 and ports 71 to the atmosphere. The piston 60 has now moved rearwardly into the position seen in Fig. 1, so that it uncovers the port 81, thereby permitting air in the rear or right hand portion of the valve chamber to escape through the passages 82 and 83 and port 81 into the chamber 59 and thence through the port 67, passage 68, port 69, annular chamber 70, and through the ports 71 to the atmosphere, thereby causing the valve to move from the position seen in Fig. 2 into the position seen in Fig. 1 by reason of the constant live air pressure on the forward end of the valve which is permitted through passages 61 and 62.

It will further be understood by reference

to Fig. 4 that my novel construction of valve mechanism comprises essentially the valve 55 having the outer heads or pressure areas 84 and 85 preferably of equal diameter, joined together by the groove 54, although it will be evident that this construction can be modified.

It will be seen from the foregoing that the valve of my novel construction of valve mechanism is symmetrical at both ends and has constant pressure on both ends and is shifted by intermittent exhaust at both ends. By making the valve as described the same can be cheaply produced by automatic machinery and by reason of its being solid it is exceedingly durable under all conditions and since the valve is constructed the same at both ends, it can be inserted in the valve box either end foremost so that there is no possibility of the tool being improperly assembled in case the valve and valve box are disconnected for the purpose of inspection or repairs. I can employ the same type of valve mechanism for a long or short stroke or for any length of stroke which it is desired to impart to the piston and it will be further apparent that the stroke of the piston is not limited by the length of the piston. By constructing the valve and valve box in the manner described, I am enabled if desired to have a valve mechanism consisting of only two parts, the valve and the valve box and since the piston and valve simultaneously move in the same direction or in unison vibration is reduced to a minimum. By reason of the novel construction and collocation of the ports and passages intermediate the valve and piston, the tool will readily start in any position in which it may be held in the hands of the workman.

In the construction seen in Figs. 5 and 6, I have shown my novel valve mechanism as applied to a long stroke tool, that is a tool having a cylinder 86 of such length that the stroke of the piston is considerably in excess of its own length and since my same novel valve mechanism can be employed in this type of tool, as already described, I have designated all the parts comprising the same, seen in Figs. 5 and 6, by the same reference letters as used for corresponding parts in the corresponding Figs. 2 and 1 respectively. In Figs. 5 and 6 I have shown the piston employed as comprising a plain, ungrooved, solid, cylindrical bolt 87 of uniform diameter throughout its length both ends being of approximately the same contour and diameter. I have shown the type of tool illustrated in Figs. 5 and 6 as being equipped especially for riveting, the riveting die being indicated at 88 and having the shank 89 projecting into the end of the tool cylinder 86, said riveting die being held in position by means of the clip or clamp 90 of the usual construction. I have shown the handle 91 as omitted from Figs. 5 to 8 inclusive, although it will of course be understood that a handle is to be employed in conjunction with all of these tools when the same are used for metal work.

In the construction seen in Figs. 7 and 8, I have shown another embodiment of the principle of my invention as applied to a short stroke chipping or calking hammer wherein the piston 92 having a groove 93 is employed, said groove connecting the smaller head 94 of the piston to the body of the latter. I have shown precisely the same type and arrangement of valves, ports and passages as appears in Figs. 1 to 4 already described and I have consequently lettered the corresponding parts with corresponding reference figures and inasmuch as the same cycle of operation and the same coacting ports and passages are employed throughout the tool seen in Figs. 7 and 8, as is employed in the tool seen in Figs. 1, 2, 3, 5 and 6, I have deemed it unnecessary to describe Figs. 7 and 8 in detail or to illustrate the same by a view similar to Figs. 1 to 6, since the corresponding parts will all appear substantially the same.

So far as I am aware, I am the first in the art to devise a valve mechanism employing a valve having but two heads which can be used interchangeably with cylinders of varying lengths as will be apparent from Figs. 1 to 3 and 5 to 9 and my claims to these features are therefore to be interpreted with corresponding scope.

While I have shown the tool cylinder and valve box and valve as being assembled by merely screwing the handle and sleeve 95 in position upon the tool cylinder, it will be evident that various other means of securing the handle, tool cylinder, valve box and valve in assembled position may be employed without departing from the spirit of my invention.

I desire to lay special emphasis upon the cheapness with which my valve mechanism can be produced since the cap or cover which I have shown for the rear end of the valve box may be dispensed with if desired in which case the inner wall of the handle would serve as a cover for the valve box, said inner wall thus forms a stop for the rearward movement of the valve and also serves to contain the port 64 through which live motive fluid is constantly acting. Furthermore, it will be apparent that when the valve is in one position it will be held in that position positively and firmly and cannot be moved or shaken, since there is absolute exhaust on one end of the valve and absolute pressure on the other end as long as the proper ports are covered and vice versa when they are opened.

It will be evident that in my invention I accomplish the same result with a valve

having but two equal pressure areas that has heretofore only been possible where a valve having differential pressure areas or more than two heads was employed; also that the latter construction is considerably more expensive and complicated and less durable than that employed in my invention.

It will be apparent that a plurality of ports and passages corresponding to the ones shown may be employed and that the length and diameter of these ports may be proportioned by the constructor to suit the requirements of the occasion and I do not, therefore, desire to be limited in every instance to the exact construction I have herein shown and described.

It will be apparent to those skilled in the art, that while I have shown in the present embodiment of my invention, the valve box as being made separate from the cylinder, I may, if I desire, without departing from the spirit of my invention, dispense with the feature of a separate valve box and form the ports and passages immediately controlled by the valve in the rear end of the cylinder and it will be also understood that I may locate the valve transversely of the line of movement of the piston instead of placing the same in alinement with the piston as illustrated.

In the construction seen in Fig. 9, I have shown the valve seen in Fig. 4 as having its heads hollowed for the purpose of making the valve as light as possible so that the same will readily respond to variations of pressure. It will be further apparent that by making the ends or heads of the valve hollow, whereby the same is somewhat lightened, the speed of reciprocations of the valve and piston will be considerably increased, as will be apparent to those skilled in the art.

In a contemporaneously pending application filed by me January 9, 1906, Serial No. 295,230, I have shown a novel valve mechanism wherein the valve consists of three heads of uniform diameter and wherein the exhaust from both ends of the piston is in this embodiment, caused to pass by or be controlled by the valve. In my present invention it will be apparent that the exhaust from the forward end of the cylinder can escape through the port 67, passage 68 and port 69, chamber 70 and port 71 to the atmosphere, without passing through or being controlled by the valve, whereby a very free exhaust is always permitted from the forward end of the piston which is a very important consideration in tools of this character, since it is essential that during the forward blow of the piston, the exhaust from the forward end of the cylinder may freely escape to the atmosphere.

It is to be understood that in the claims where I refer to the rear head of the valve I refer to the head of the valve nearest to the handle or the opposite end of the tool from that in which the working tool is held.

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

1. In a portable pneumatic tool adapted to be manually held, a cylinder, a piston therein having an equal pressure area at each end, a balanced valve located at the rear of said cylinder and in alinement with said piston and having two heads and a neck joining said heads, the rear head of said valve controlling the motive fluid to advance and return the piston, means for directing constant pressure upon the outer area of each head of said valve, and means for creating an exhaust passage intermittently at each end of said valve, in combination with a handle for maintaining said valve and cylinder in assembled position.

2. In a portable pneumatic tool adapted to be manually held, a cylinder, a piston therein having an equal pressure area at each end, a balanced valve located at the rear of said cylinder, and having two heads and a neck joining said heads, the rear one of said heads controlling admission of motive fluid to advance and return the piston, means for directing constant pressure upon the outer area of each head of said valve, means for creating an exhaust passage intermittently at each end of said valve, and an exhaust passage for the rear end of said piston controlled by said valve, in combination with a handle for maintaining said valve and cylinder in assembled position.

3. In a portable pneumatic tool adapted to be manually held, a cylinder, a piston therein having an equal pressure area at each end, a balanced valve located at the rear of said cylinder and having two heads and a neck joining said heads, the rear one of said heads controlling admission of motive fluid to advance and return the piston, means for directing constant pressure upon the outer area of each head of said valve, means for creating an exhaust passage intermittently at each end of said valve, an exhaust passage for the rear end of said piston controlled by said valve, and an exhaust for the front end of said piston uncontrolled by said valve, in combination with a handle for maintaining said valve and cylinder in assembled position.

4. In a portable pneumatic tool adapted to be manually held, a cylinder, a piston, a valve comprising two heads of equal area, the rear head controlling admission of motive fluid to advance and return the piston, a neck joining said heads, and exhaust passages for the front and rear ends of said piston, one exhaust passage being controlled

by said valve; and the other exhaust passage being uncontrolled by said valve, in combination with a handle for maintaining said valve and cylinder in assembled position.

5. In a portable pneumatic tool adapted to be manually held, a cylinder, a piston, a valve comprising two heads of equal area, the rear head controlling admission of motive fluid to advance and return the piston, a neck joining said heads, an exhaust passage for the front and rear ends of said piston, the rear exhaust passage being controlled by said valve, and the front exhaust passage being uncontrolled by said valve, in combination with a handle for maintaining said valve and cylinder in assembled position.

6. In a portable pneumatic tool adapted to be manually held, a cylinder, a piston therein having equal pressure areas, a balanced valve located at the rear of said cylinder, and having two heads and a neck joining said heads, the rear head controlling the admission of motive fluid to advance and return the piston, means for directing constant pressure upon the outer area of each head of said valve, and means for creating an exhaust passage intermittently at each end of said valve, in combination with a handle for maintaining said valve and cylinder in assembled position.

7. In a portable pneumatic tool adapted to be manually held, a valve for controlling ports common thereto and to a piston, and consisting of two heads of uniform diameter joined by a neck, the rear head controlling the admission of motive fluid to advance and return the piston, ports and passages controlled by one of said heads for admitting live motive fluid to both advance and return the piston, ports and passages for the exhaust from the rear of the piston controlled by the other of said heads, and means uncontrolled by said valve for permitting the exhaust from the front of the piston, in combination with means for maintaining said valve in alinement with said piston.

8. In a portable pneumatic tool adapted to be manually held, a valve for controlling ports common thereto and to a piston, and consisting of two heads joined by a neck, the rear head controlling the admission of motive fluid to advance and return the piston, ports and passages controlled by one of said heads for admitting live motive fluid to both advance and return the piston, ports and passages for the exhaust from the rear of the piston controlled by the other of said heads, and means for permitting the exhaust from the front of the piston, in combination with means for maintaining said valve in alinement with said piston.

9. In a portable pneumatic tool adapted to be manually held, a valve for controlling ports common thereto and to a piston, and consisting of two heads joined by a neck, the rear head controlling the admission of motive fluid to advance and return the piston, ports and passages controlled by one of said heads for admitting live motive fluid to both advance and return the piston, ports and passages for the exhaust from the rear of the piston controlled by the other of said heads, means for permitting the exhaust from the front of the piston, means for admitting live motive fluid constantly to both ends of the valve, and passages controlled by the piston for permitting intermittent exhaust from the ends of said valve, in combination with a handle for maintaining said valve in alinement with said piston.

10. In a portable pneumatic tool adapted to be manually held, a balanced valve, composed of two ungrooved heads and a neck joining said heads, the rear head controlling admission of motive fluid to advance and return the piston, a valve box for said valve, means for directing constant pressure upon the heads of said valve, and means for creating an exhaust passage intermittently at each end of said valve, said valve and valve box being in alinement with their piston, and a handle for maintaining such alinement.

11. In a portable pneumatic tool adapted to be manually held, a cylinder, a piston therein, a valve chamber, a valve in said chamber in alinement with said piston and comprising two heads of uniform diameter joined by a neck, the rear head controlling admission of motive fluid to advance and return the piston, an inlet port in said valve chamber controlled by said valve, ports and passages controlled by said valve for leading the motive fluid toward and away from the ends of said piston, ports leading into the front and rear portion of said valve chamber for admitting live motive fluid constantly to the ends of said valve, and passages controlled by the piston for permitting intermittent exhaust from the ends of said valve, in combination with a handle for maintaining said valve and cylinder in assembled position.

12. In a portable pneumatic tool adapted to be manually held, a cylinder, a piston therein, a valve box having a valve chamber, a valve in said chamber comprising two heads joined by a neck, the rear head controlling admission of motive fluid to advance and return the piston, an inlet port in said box controlled by one of said heads, ports and passages controlled by one of said heads for leading motive fluid toward and away from the ends of said piston, ports leading into the front and rear portions of said valve chamber for admitting live motive fluid constantly to the outer ends of

said valve, and passages controlled by the piston for permitting intermittent exhaust from the ends of said valve, in combination with means for maintaining said valve in alinement with said piston.

13. In a portable pneumatic tool adapted to be manually held, a valve for controlling ports common thereto and to a piston and consisting of two heads joined by a neck, the rear head controlling admission of motive fluid to advance and return the piston, the outer ends of said valve being always exposed to live fluid pressure and intermittently to the exhaust, and said valve being located exteriorly to said piston in alinement therewith and adapted to move in the same direction as said piston, in combination with a handle for maintaining such alinement.

14. In a portable pneumatic tool adapted to be manually held, a cylinder, a piston, a valve comprising two heads of equal pressure areas, the rear head controlling admission of motive fluid to advance and return the piston, and a neck joining said heads, the exhaust from one end of said piston being controlled by said valve and the exhaust from the other end being uncontrolled by said valve, in combination with a handle for maintaining said valve and cylinder in assembled position.

15. In a portable pneumatic tool adapted to be manually held, a cylinder, a piston therein, a valve box, a solid balanced valve therein having two heads of uniform diameter, the rear head controlling admission of motive fluid to advance and return the piston, said valve moving in substantial alinement with said piston, means for directing constant pressure upon each outer head of said valve, and means for creating exhaust intermittently at each end of said valve, whereby the same valve and valve box can be used interchangeably with a solid or ungrooved piston, or with a long stroke or short stroke cylinder, in combination with a handle for maintaining said valve and cylinder in assembled position.

16. In a portable pneumatic tool adapted to be manually held, a cylinder, a reciprocating piston therein, a valve box in alinement with said cylinder, the bottom of said valve box having ports communicating directly with the interior of said cylinder, a valve composed of two ungrooved heads and a neck joining said heads located in said valve box, the rear head controlling admission of motive fluid to advance and return the piston, means for directing constant pressure upon the heads of said valve, a live air inlet in said valve box casing controlled by the head farthest from said cylinder, an exhaust passage from one end of said piston controlled by said valve, and an exhaust passage from the other end of said piston communicating with the atmosphere without contacting with said valve.

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