

Sept. 29, 1931.

B. V. KORVIN-KROUKOVSKY ET AL

1,825,632

PERCUSSIVE TOOL

Filed Dec. 3, 1927

2 Sheets-Sheet 1

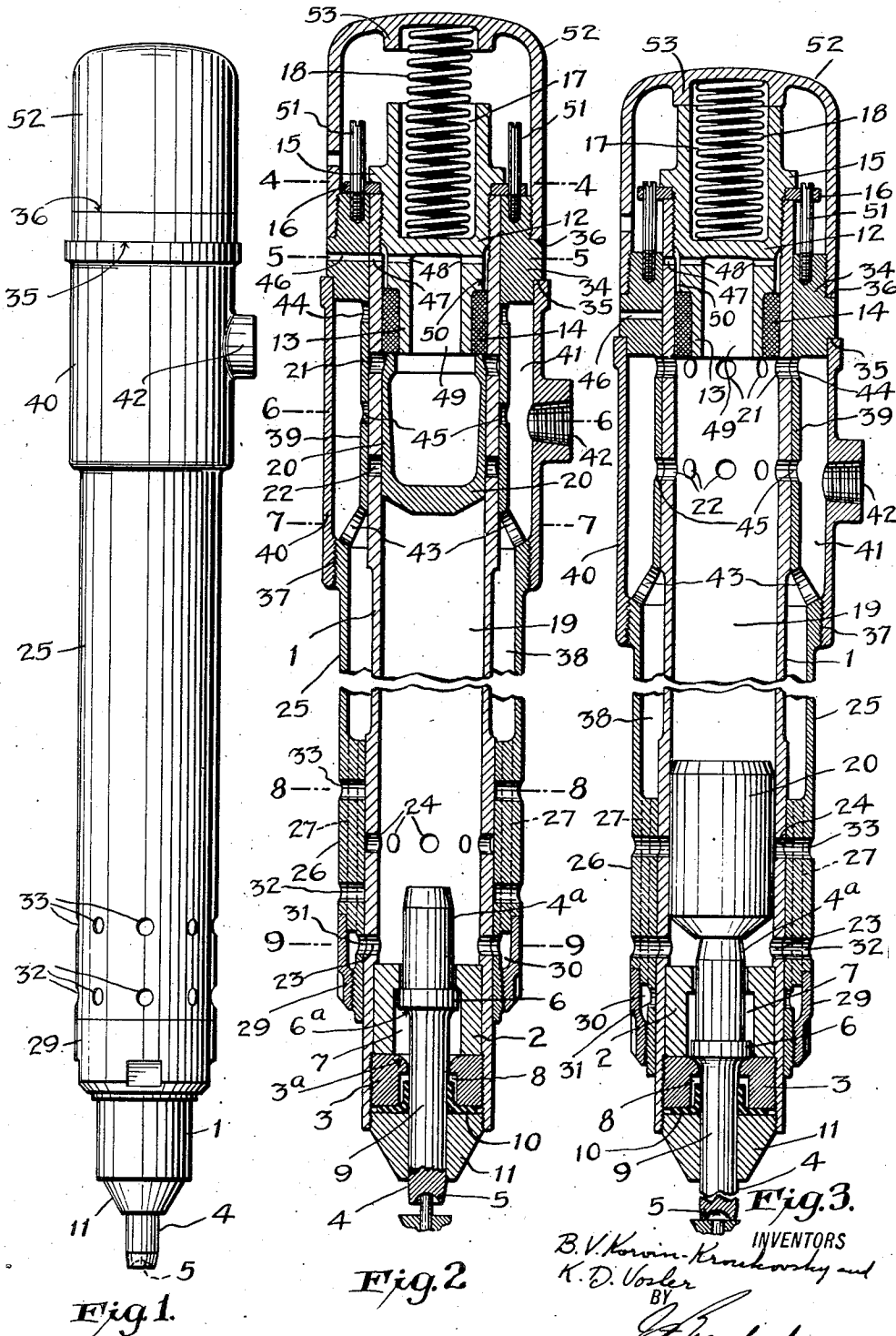


Fig. 1.
Fig. 2.
Fig. 3.
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2 Sheets-Sheet 2

Fig. 4.

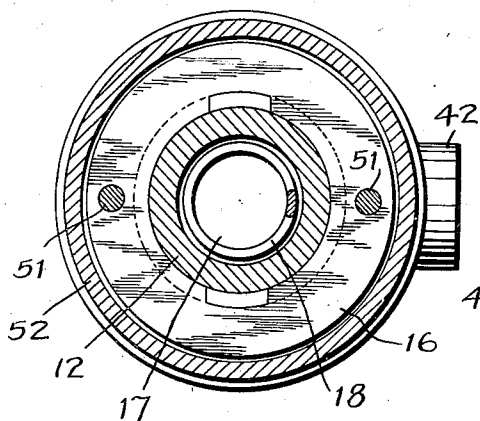


Fig. 5.

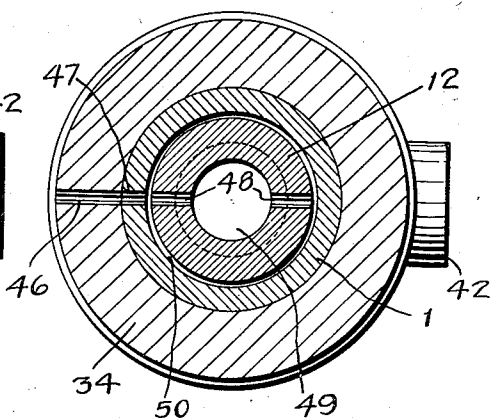


Fig. 6.

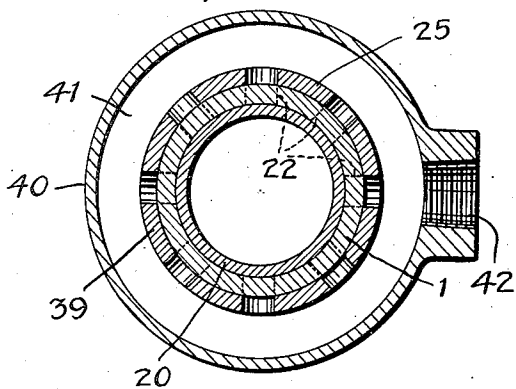


Fig. 7.

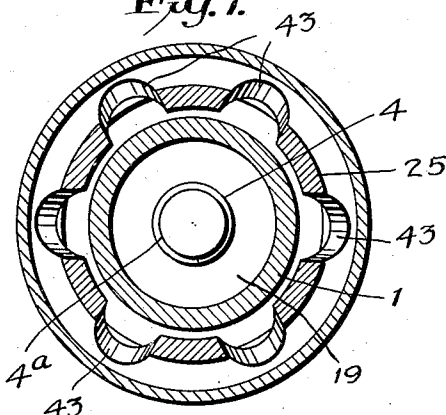


Fig. 8.

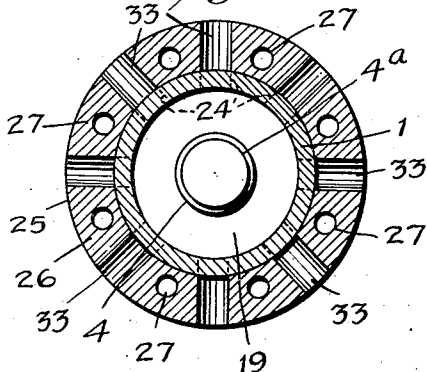
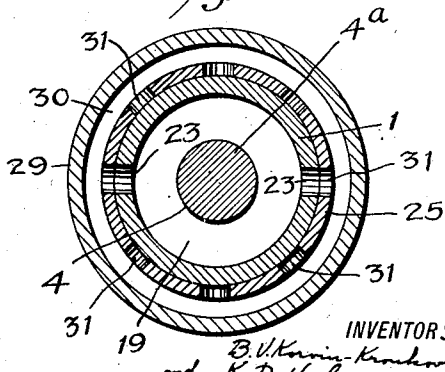


Fig. 9.



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PERCUSSIVE TOOL

Application filed December 3, 1927. Serial No. 237,440.

The present invention relates to percussive tools and has particular reference to tools of this class used for riveting.

In certain classes of riveting the form of the work and the nature of the metal employed precludes the use of the ordinary form of pneumatic riveter and the principal object of the present invention is the provision of a riveting tool of the pneumatic type which will operate to deliver a single rivet-setting blow. The invention further comprises the novel construction and relation of elements and combinations of parts adapted to most effectively carry out the principal object of the invention.

Particular objects of the invention, having to do with a percussive tool of the single-impact class, are to enable the tool to strike a powerful blow for its size and weight and to keep the size and weight as small as possible; to make the forward stroke of the hammer as free as possible restraining its return stroke; to provide a normally retracted, longitudinally movable casing constituting a distributing valve which encloses a combined reservoir and distributing chamber of large capacity, said chamber having ports at both ends which register directly with ports at opposite ends of the working chamber, these features insuring maximum working force for each blow and avoiding any necessity of long and narrow passages of such character as to offer serious resistance to the admission of air to operate the hammer or to exhaust air from in front of the hammer; to enclose almost the entire length of the inner cylinder and to construct the casing in such manner that the combined reservoir and distributing chamber is formed between the casing and the cylinder, with bearing portions of the casing at opposite ends of this chamber closely fitting the inner cylinder and containing admission and exhaust ports which cooperate with the ports at opposite ends of the working chamber, advantages of these features being not only to simplify construction but also to reduce the area of contact between the outer and inner parts to that needed for distribution ports, thus reducing friction and affording easier operation; to provide effective seals against

leakage of working fluid, and in particular to provide a shock-absorbing and packing gland at the rear end of the working chamber to cooperate with the rear end of the hammer, this packing gland being held in such manner as to prolong its life and its relation to the ports at this end of the working chamber being such that the air passage can not be obstructed by any distortion of the packing; and to construct a riveting tool proper and toolholder in such manner and in such combination with the inner cylinder, the hammer, the longitudinally slidable distributing valve casing and a spring which normally keeps the casing retracted and the hammer therefore at the rear end of the working chamber, that the following advantages are secured: the provision of a large head on the riveting tool to receive the impact of the hammer, limitation of the movement of the riveting tool in both directions, reduction in the diameter of the packing which prevents leakage around the shank, with consequent increase in the effectiveness of this packing, and most importantly such reduction in the unbalanced force of the working fluid which acts to protrude the riveting tool and such relationship between this unbalanced force and the force of the spring acting on the casing or distributing valve, that when the operator pushes forward on the casing the riveting tool must recede to carry its shoulder away from the front stop before the force of the spring can be overcome sufficiently to permit the casing to slide forwardly on the cylinder to open the rearward admission ports and cause the hammer to strike its blow on the riveting tool. Other features will be apparent to those skilled in the art from the drawings and the following description.

A preferred form of apparatus for carrying the invention into effect is illustrated in the accompanying drawings forming a part hereof, and the more specific objects of the invention and the advantages to be derived from its use will become apparent as the ensuing description thereof proceeds.

In the drawings:

Fig. 1 is an elevation of an assembled riveter;

Fig. 2 is a longitudinal central section on an enlarged scale of the device shown in Fig. 1, part being broken out;

Fig. 3 is a view similar to Fig. 2 showing the device in a different operative position; and

Figs. 4 to 9 are transverse sections taken on the respectively numbered lines of Fig. 2.

The riveter comprises an inner cylindrical member formed by a tubular sleeve 1 partly closed at its lower end by the annular block 2, the latter being held in position against a suitable shoulder formed in the sleeve 1 by an annular retaining block 3 threaded into the sleeve.

The riveting tool 4, formed with a depression 5 at one end adapted to engage a rivet head, passes through the blocks 2 and 3 to the interior of sleeve 1, and is provided with a flange 6 intermediate its ends which is received in a recess 7 formed by the differential bore in block 2. The differential bore in block 3 provides a recess 8 around the shank 9 of the tool, in which is located a packing washer 10, secured in position by the threaded locking member 11, the latter preferably being conical in form to provide additional bearing surface for the shank 9.

Above the flange 6 the tool is preferably formed with an enlarged diameter to form a head or anvil 4^a of relatively large area, while the lower face of flange 6 is preferably filleted as at 6^a to seat against a correspondingly formed face 3^a on block 3.

At its upper end, the sleeve 1 is closed by the threaded block 12 having an annular flange 13 extending within the sleeve and spaced from the inner face thereof to form a recess in which is located the packing 14. Beyond the end of the sleeve the block 12 is flanged as at 15, the flange serving to secure an annular guide plate 16, and the outer end of the block is provided with a deep central recess 17 serving to hold the coil spring 18. The purpose of the plate and spring will appear later.

The blocks 2 and 12 define the end of a working chamber 19 in which is located the piston or hammer 20, the latter preferably being in the form of a hollow cup the upper edge of which strikes the packing 14 when the piston is at the upper end of its stroke, as shown in Fig. 2.

The sleeve 1 is provided with a set of radial ports 21 immediately below the packing 14, and a second set of ports 22 are located below ports 21 but above the lower end of a piston 20 when the latter is in its upper position. At the lower end of the sleeve a set of ports 23 are provided just above block 2, and another set 24 are located above ports 23.

An outer sleeve 25, having a close sliding fit with the sleeve 1, is provided with a thickened wall 26 at its lower end, through which

are drilled a plurality of longitudinal passages 27. Below the portions 26, the sleeve is exteriorly threaded and shouldered to receive the cap 29, which with the sleeve defines an annular chamber 30 in communication with the holes 27, and through ports 31 and ports 23 with the working chamber 19. Two sets of ports 32 and 33 pass radially through the portion of the sleeve 26 between the passages 27, as will be clear from Fig. 8, these ports being located so that they may be brought into registry respectively with the sets of ports 23 and 24 in sleeve 1.

The sleeve 25 is provided at its upper end with a head 34 of enlarged diameter, shouldered on its opposite faces at 35 and 36, and some distance below the head 34 is enlarged and threaded as at 37. As will be noted from Fig. 2, the sleeve 25 above portion 26 is counterbored to provide a relatively large annular chamber 38 between the inner and outer sleeves. Just above the enlargement 37 the sleeve 25 is formed with a short conical section to reduce the inner diameter of the upper portion 39 of the sleeve, bringing it into bearing engagement with the sleeve 1.

A sleeve 40, seated at one end against the shoulder 35 and at its other end threaded on the enlargement 37, together with the portion 39 of the sleeve, forms an annular chamber 41 adapted to be connected with a source of working fluid, ordinarily compressed air, by way of the inlet connection 42 provided in sleeve 40.

Chambers 38 and 41 are placed in communication by a number of ports 43 formed in the conical section of sleeve 25, as will be clearly seen from Figs. 2 and 7.

The portion 39 of sleeve 25 is provided with sets of ports 44 and 45, arranged to register with ports 21 and 22 of sleeve 1 when the lower ports 23, 24, and 32, 33 are brought into registry, and the head 34 has a port 46 arranged to register with a port 47 in sleeve 1 when the latter and sleeve 25 are in the position shown in Fig. 2. A series of small ports 48 provide communication between the recess 49 in the block 12 with an annular clearance space 50 above packing 14.

The head 34 is drilled to receive a number of studs 51 passing with a sliding fit through suitable holes in the plate 16 and preventing rotation of sleeve 25 with respect to sleeve 1.

A cap 52 provided with a spring retaining recess 53 is screwed against shoulder 36 of head 34, the length of the cap being such that when assembled the spring 18 is under compression and holds the inner and outer sleeve members of the riveter in the position shown in Fig. 2.

Assuming the device connected to a source of working fluid supply such as compressed air, the operation is as follows:

Air admitted through inlet 42 fills cham-

ber 41, and passes through ports 43, chamber 38, and passages 27 to the annular chamber 30, from which it is admitted to the working chamber 19 below piston 20 through ports 31 and 23, the latter being brought into registry by the action of spring 18. The admission of air below piston 20 drives the latter to the top of its stroke and forces the tool 4 out of the chamber until the filleted shoulder of flange 6 seats against the retaining block 3. The packing 10 effectively seals the lower end of the working chamber, while the upper end of the chamber is sealed by packing 14, rendered more effective by the spreading action of the upper edge of piston 20 forced against it by the pressure in chamber 19 below the piston. However, the packing is not actually spread because it is confined between rigid concentric walls. In this connection it is particularly to be noted that the tight seal between the upper end of the piston and the packing prevents the escape of air through the recess 49, which is vented to atmosphere to prevent building up of pressure above the piston due to leakage.

It is further to be noted that the diameter of the shank portion 9 of the tool 4 is relatively small, and as the tool is a loose fit in block 2 above this portion, the only unbalanced force acting on the tool is that produced by pressure acting on an area equal to that of the shank.

It will thus be seen that after air is admitted to the riveter, the tool 4 may be readily retracted by the operator against the air pressure to the position shown in Fig. 2.

The strength of spring 18 is such that the tool may be retracted by the initial application of pressure by the operator without moving sleeves 1 and 25 relative to each other, and after the initial pressure is exerted the riveter assumes what may be termed a "set" position such as is shown in Fig. 2. Further pressure on the part of the operator compresses spring 18, and moves the sleeve member 25 longitudinally with respect to sleeve 1 to the position shown in Fig. 3. This motion causes the following action to take place, (a) the recess or chamber 49 above piston 20 is closed by the movement out of registry of ports 46 and 47 and simultaneously the lower end of the chamber 19 is cut off from the working fluid by the movement out of registry of the sets of ports 23 and 31, (b) the sets of ports 32, 33, 44 and 45 are brought simultaneously and respectively into engagements with the sets of ports 23, 24, 21 and 22 and by this action the working chamber 19 is vented below piston 20 to the atmosphere, while air is initially admitted above the piston through ports 21 and after the piston has moved downward a short distance additional air is admitted above it through the subsequently uncovered ports 22.

Impact of the piston 20 against the tool head 4^a serves to set the rivet and it is obvious that the effectiveness of a given tool depends upon the amount of force which can be exerted on the piston and the consequent velocity attained. In order to secure the maximum effectiveness of the piston, the pressure drop in the working chamber during the piston stroke should be reduced to a minimum and in the present case this is accomplished by the provision of the large annular chambers 41 and 38 which are in free communication with the working chamber during the piston stroke and which act as reservoirs for supplying the latter chamber. This is an important feature of the construction and it has been found in actual practice that these reservoir chambers must be substantially larger than the working chamber if their effectiveness is to be fully realized. For example, with a working chamber of 14 cubic inches capacity, the reservoir chambers should have a combined capacity of approximately 24 cubic inches to be most effective. If made smaller, their effectiveness is decreased, while additional volume will serve only to increase the size and weight of the riveter without producing additional effectiveness.

When pressure on the part of the operator is relieved after the rivet-setting blow has been struck, the spring 18 returns the sleeve members 1 and 25 to the position shown in Fig. 2, this action first moving the sets of main ports out of registry and then bringing ports 46 and 47 into registry at the same time that ports 23 are brought into registry with the ports 31. Air under pressure is then admitted below the piston 20, the latter being forced to its upper position without shock because of the air trapped above it in the working chamber, which can escape only through the relatively small vent port 46.

The riveter is then in readiness for the cycle of operations to be repeated, and it will be obvious from the disclosure that with the large bearing surfaces provided between the sleeves, and the manner in which the working cylinder is constructed, that the air leakage from the riveter when it is inactive will be negligible. Obviously, packing may be employed between the sliding surfaces of the two sleeves, but with the design shown, a simpler and more compact device is obtained.

Many variations and changes in the details of the form and arrangement of the preferred form may be made without departing from the invention, which is to be understood as limited only by the scope of the appended claims.

We claim:

1. In a single impact tool of the class described, an inner member forming a ported working chamber, a piston reciprocable in said chamber, an outer member forming a

ported reservoir to which working fluid is admitted, said reservoir having a volume substantially greater than the volume of the working chamber, and said outer member being manually movable longitudinally with respect to said inner member to admit working fluid through the ports from the reservoir to the working chamber during the full stroke of said piston.

2. In a single impact tool of the class described, an inner member forming a working chamber ported adjacent to its opposite ends, a piston reciprocable between said ports, an outer member having a portion spaced from the inner member to form therein with an annular reservoir around said inner member, said outer member being movable longitudinally with respect to the inner member and ported to form a distributing valve for admitting working fluid directly from the reservoir to the ports at both ends of the working chamber.

3. In a single impact tool of the class described, an inner sleeve member forming a cylindrical working chamber having ports adjacent to opposite ends thereof, an outer sleeve member encompassing substantially the entire length of the inner member and movable longitudinally with respect thereto, said outer member being formed with cylindrical bearing surfaces at its ends, said surfaces engaging the inner member and being recessed intermediate said surfaces to form with said inner member an annular reservoir for working fluid, ports communicating with the opposite ends of said reservoir and adapted to register with said first named ports, and an inlet for admitting working fluid to said reservoir.

4. In a single impact tool of the class described, an inner sleeve member forming a cylindrical working chamber having a plurality of ports adjacent to its lower end, an outer sleeve member encompassing the inner member and movable longitudinally with respect thereto, said outer member having a thickened portion forming a cylindrical bearing surface engaging the inner member and a recessed portion at one side of the thickened portion forming with said inner member an annular reservoir for working fluid, means forming an annular chamber in said outer member at the opposite side of the thickened portion, spaced longitudinally disposed passages connecting the reservoir and said annular chamber, ports in the wall of said last named chamber adapted to register with said first named ports in one position of the outer member to admit working fluid from the reservoir to the working chamber, and ports through the thickened portion of the outer member adapted to register with said first named ports in a second position of the outer member to vent the working chamber directly to the atmosphere.

5. In a single impact tool of the class described, a sleeve forming a working cylinder, a piston reciprocable in said cylinder, means normally admitting working fluid to one end of said cylinder to force said piston to the other end thereof, means comprising a metallic cylinder head having a port of restricted area therethrough for venting the other end of said cylinder when fluid is admitted to the first named end of the cylinder, and packing means separated from said port by a portion of said head, said piston seating against said packing means to prevent leakage through said venting means.

6. In a single impact tool of the class described, a sleeve forming a working cylinder having ports adjacent to opposite ends thereof, a block secured to one end of the sleeve to close the cylinder, said block being provided with a vent providing communication between the cylinder and the atmosphere, an annular faced piston reciprocable in said cylinder, means for admitting working fluid to one side of said piston to force it to the vented end of the cylinder, and packing means at the end of the cylinder against which the annular face of said piston is forced, whereby a seal is formed preventing the leakage of working fluid past the piston and through said vent.

7. In a single impact tool of the class described, a sleeve forming a working cylinder, a block secured to said sleeve and closing one end of the cylinder, said block being provided with an inwardly extending annular flange spaced from the inner wall of the cylinder, packing located in the space between the cylinder and flange, a piston reciprocable in said cylinder, said piston having an annular face adapted to engage said packing, and means for admitting working fluid to said cylinder to force the piston to a seat against said packing.

8. In a single impact tool of the class described, the combination of a sleeve forming a working cylinder, a block secured to said sleeve and closing one end of the cylinder, said block being provided with a centrally located vent adapted to communicate with the atmosphere and having a portion spaced from the inner wall of the cylinder, packing located in the space between the cylinder and the block, and an annular faced piston reciprocable in the cylinder and adapted to engage said packing.

9. In a single impact tool of the class described, an inner sleeve member forming a cylindrical working chamber having a plurality of ports adjacent to each end thereof, a piston reciprocable in said chamber, a manually movable ported outer sleeve member adapted to control the admission and exhaust of working fluid to and from said chamber, the ports in the outer member being arranged so that at one end of the chamber working

fluid is admitted through a greater port area than that through which it is exhausted and at the other end of the chamber working fluid is exhausted through a greater port area than that through which it is admitted.

10. In a single impact tool of the class described, a sleeve member forming a working chamber having a plurality of ports with a relatively large total area adjacent to opposite ends thereof, a piston reciprocable in said chamber, means for alternately admitting and exhausting working fluid from the ports at one end of the cylinder and for admitting working fluid through the ports at the other end of the cylinder, and means comprising a port of restricted area for exhausting working fluid from the last named end of the chamber, whereby the escape of working fluid from one end of said chamber and the motion of the piston toward that end of the chamber is retarded.

11. A percussive tool of the single-impact class, comprising, in combination, an inner cylinder forming a working chamber ported at its opposite ends, a hammer in said working chamber, a normally retracted slidable casing encompassing almost the entire length of said inner cylinder, said casing forming a distributing valve enclosing a combined reservoir and distributing chamber of large capacity having admission ports and exhaust ports at both ends to register in alternation with the ports of the inner cylinder.

12. A percussive tool of the single-impact class, comprising, in combination, an inner cylinder forming a working chamber ported at its opposite ends, a hammer in said working chamber, a normally-retracted slidable casing encompassing almost the entire length of said inner cylinder and enclosing a combined reservoir and distributing chamber of large capacity, which reservoir is formed between the casing and the inner cylinder and surrounding the latter, said casing having bearing portions at its opposite ends closely fitting the inner cylinder and each of said bearing portions having admission ports and exhaust ports to register in alternation with the ports of the inner cylinder, the forward and rearward admission ports communicating with the opposite ends of said combined reservoir and distributing chamber and the forward exhaust ports opening directly to the atmosphere.

13. In a percussive tool of the single-impact class, the combination of an inner cylinder forming a working chamber, a hammer normally at the rear end of said working chamber, said cylinder being ported at both ends, the ports at its rear end consisting of separate admission and exhaust ports in different zones, a packing held in the rear end of said cylinder between these admission and exhaust ports to cooperate as a seal with the hammer, and a normally-retracted longitu-

dinally slidable casing surrounding said inner cylinder and constituting a distributing valve, said casing having separate admission and exhaust ports to cooperate with the separate admission and exhaust ports at the rear end of the inner cylinder.

14. A percussive tool of the single-impact class, comprising, in combination, an inner cylinder forming a working chamber, a hammer normally at the rear end of said working chamber, said cylinder being ported at both ends, the ports at its rear end consisting of separate admission and exhaust ports in different zones, a packing held in the rear end of said cylinder between said admission and exhaust ports to cooperate as a seal with the hammer, and a normally retracted slidable casing encompassing almost the entire length of said inner cylinder, said casing forming a distributing valve enclosing a combined reservoir and distributing chamber of large capacity having admission and exhaust ports at both ends to register in alternation with the ports of the inner cylinder.

15. In a percussive tool of the single-impact class, the combination of an inner cylinder forming a working chamber ported at both ends, a hammer normally at the rear end of said chamber, a slidable casing surrounding said inner cylinder and constituting a distributing valve, a spring interposed between said cylinder and said casing and normally keeping said casing retracted, a tool-holder in the forward end of said cylinder, a riveting tool guided for limited movement in said tool-holder, said riveting tool having a head projecting into the working chamber, a reduced shank and an intermediate collar, said tool-holder containing a balancing chamber which is in free communication with the working chamber and the ends of which cooperate as stops with said collar, and a packing through which said shank passes below said balancing chamber, the relation of the areas of the riveting-tool above the packing being such that the unbalanced force of the working fluid acting on said riveting tool to protrude the same is less than the force of the spring which normally keeps the distributing-valve or casing retracted, so that when the operator pushes forwardly on the casing the riveting tool in contact with the work must recede relatively to the tool-holder before movement of the casing on the cylinder results in admission of working fluid to cause the hammer to strike a blow.

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