Dec. 19, 1933. A. N. JACKSON 1,940,304

MACHINE FOR RIVETING, PUNCHING, PRESSING, STAMPING, AND LIKE OPERATIONS

Filed Feb. 2, 1933 2 Sheets-Sheet 1

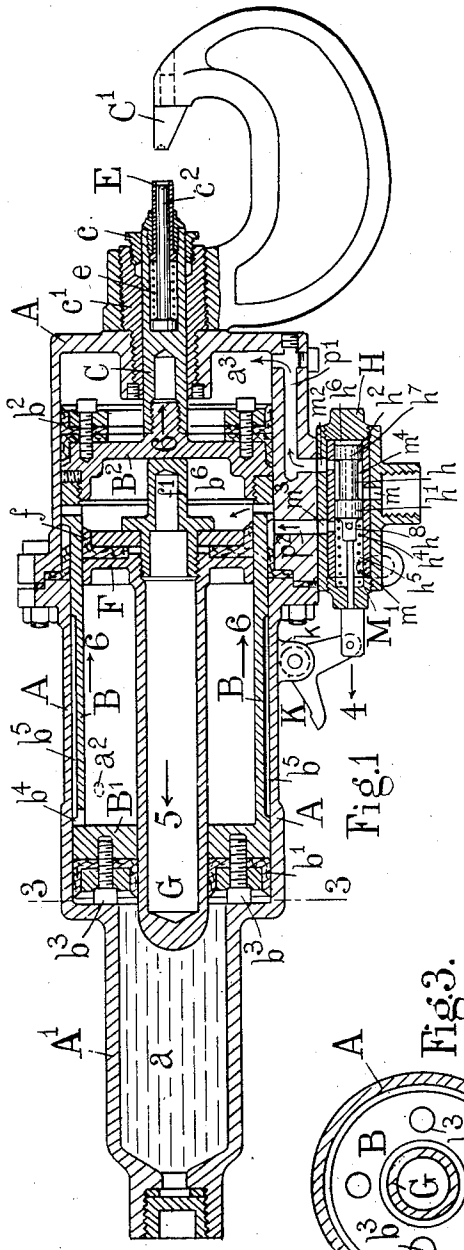


Fig. 1

Fig. 3.

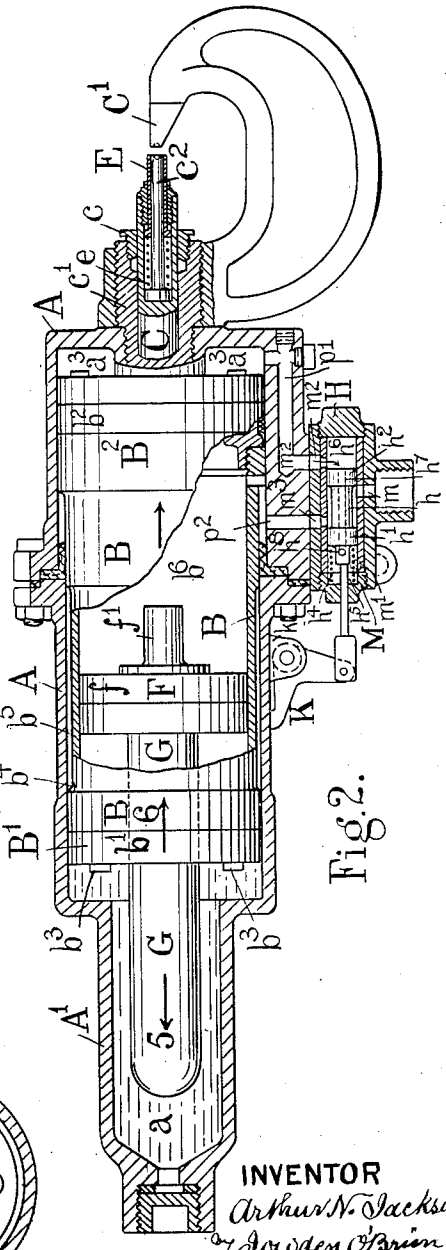


Fig. 2.

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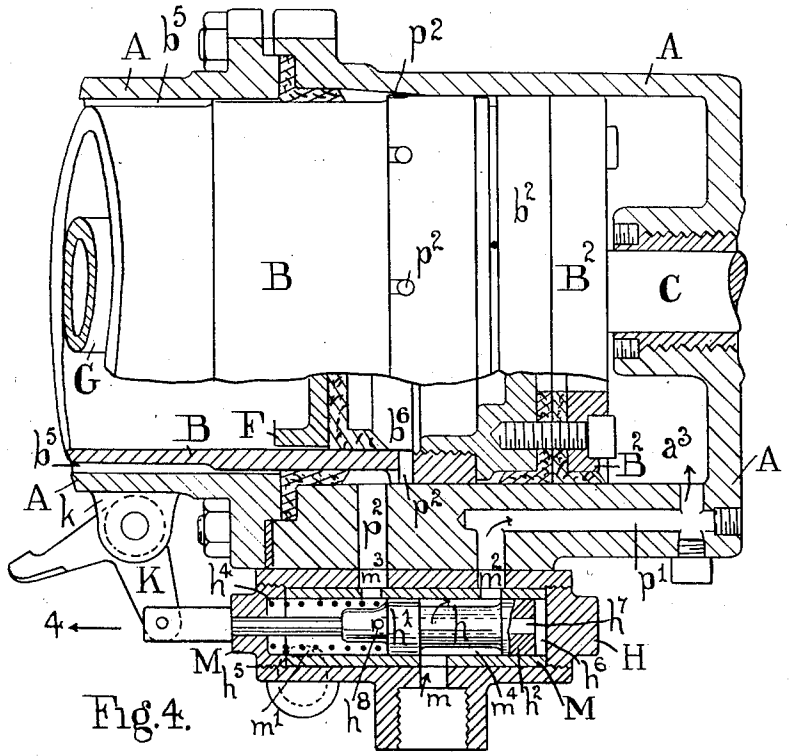


Fig. 4.

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UNITED STATES PATENT OFFICE

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MACHINE FOR RIVETING, PUNCHING, PRESSING, STAMPING, AND LIKE OPERATIONS

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Application February 2, 1933. Serial No. 654,868, and in Great Britain February 23, 1932

3 Claims. (Cl. 138—10)

This invention relates to machines for riveting, punching, pressing, stamping and like operations of the type in which a moderate pressure of air or gas on a piston in a primary cylinder is intensified by the piston rod being extended through the end of the cylinder into a chamber communicating with a second cylinder filled with liquid, the displacement of which liquid causes a piston in the second cylinder to move under a pressure considerably greater than that on the first piston and with a correspondingly shorter stroke.

The disadvantage of machines of this type hitherto employed is that they are too bulky and heavy by reason of their construction to be conveniently held in the hand as required for certain classes of work, notably the riveting of metal aircraft.

According to the present invention a primary inner cylinder, in which is fitted a compressed air operated piston, is arranged externally to work as a hydraulic piston sliding in the outer casing of the machine in the opposite direction to that of the compressed air operated piston.

The invention will be described with reference to the accompanying drawings:—

Fig. 1 is a longitudinal section through the machine showing the position of the parts at the end of the return stroke of the riveting or other tool.

Fig. 2 is a similar longitudinal section showing the position of the parts just before the end of the operative stroke of the riveting or other tool.

Fig. 3 is a transverse section on line 3—3 Fig. 1.

Fig. 4 is an enlarged detailed view of the valve mechanism.

The machine is constructed with a cylindrical casing A in which is arranged a hollow sliding piston B. The end A^1 of the casing A is of less diameter than the main body of the casing and forms a liquid chamber a. The sliding cylinder B is closed at the end adjacent to the liquid chamber a by a piston B^1 provided with a packing ring or leather b^1 to form a tight joint with the inner surface of the cylindrical casing A. The other end of the cylinder B is closed by a second piston B^2 also provided by one or more packing rings or leathers b^2 forming a tight joint with the inner surface of the cylindrical casing A.

The piston B^2 carries a ram C which projects through a suitable packing or stuffing box c in the end of the cylindrical casing A. The ram C may form the moving member of the punching or riveting head, the other member C^1 of which is of the usual construction mounted on a cylindrical sleeve or bush c^1 through which the ram C slides. For a riveting machine, however, it is preferred to form the moving member of the head, as shown in the drawings with a spring actuated plate closer E of known type, which is affixed to the ram C and in which the moving member c^2 of the riveting head can slide. Thus as the end of the operative stroke of the machine is approached the outer end of the plate closer E comes into contact with the surface of the plate being operated on and the further movement of the ram C causes the riveting member c^2 to be moved forward through the plate closer E against the action of the spring e therein. The plates between the two members of the riveting head are thus pressed closely together before the member c^2 acts on the rivet in the plates.

A piston F provided with the usual packing ring or leather f is mounted to slide inside the hollow sliding cylinder B. The piston F carries a hollow ram G which projects through the piston B^1 into the liquid chamber a in the end A^1 of the casing A. The piston B^1 is provided with a ring of cup screws b^3 having heads with hexagonal recesses therein and the heads of the screws b^3 form stops for the piston B^1 and prevent the latter from coming into contact with the outer casing A.

The piston F is formed with a projection f^1 which comes into contact with the interior face of the piston B^2 to limit the return stroke of the piston F.

One or more holes b^4 are formed at the end of the cylinder B adjacent to the piston B^1 communicating with the narrow annular space b^5 surrounding the cylinder B between the two pistons B^1 and B^2. The annular space b^5 communicates with the atmosphere through a hole a^2 (shown in dotted lines in Fig. 1) so that as the piston F moves relatively to the cylinder B there is no compression of the air within the cylinder, the air being expelled and drawn in through the holes b^4.

A valve H arranged near the riveting head end of the casing A is adapted to control the supply of the compressed air operating the machine to the space a^3 between the piston B^2 and the end of the casing A and to the space b^6 between the piston F and the interior face of the piston B^2. This valve is of the slide valve type and comprises a rod h having two cylindrical closure members h^1 and h^2, the rod being moved in the direction of the arrow 4 by a trigger K pivotally mounted on a lug k affixed to the casing A and

in the reverse direction by the spring h^4 when the pressure on the trigger is released. The stationary cylinder M in which the rod h and the cylindrical closure members h^1 and h^2 slide is formed with an inlet port m, an exhaust port m^1, a port m^2 connected by the passages p^1 with the space a^3 between the piston B^2 and the end of the casing A, and a port m^3 connected by the passage p^2 with the space b^6 between the piston F and the interior face of the piston B^2.

The inlet port m is always in communication with the supply of compressed air operating the machine and is always open to the annular space m^4 between the two closure members h^1 and h^2 whatever position the latter may occupy. The exhaust port m^1 opens into the space h^5 at the trigger end of the valve and this space communicates with the space h^6 at the other end of the valve by a longitudinal passage h^7 in the rod h and a number (preferably four) of transverse holes h^8. The exhaust port m^1 preferably communicates with a silencer for the exhausted air but it may communicate directly with atmosphere if so desired.

The ports m^2 and m^3 communicating with the spaces a^3 and b^6 respectively are so spaced that the port m^2 is cut off from the annular space m^4 before the port m^3 is open thereto and vice versa when the valve is moved in the opposite direction.

Fig. 1 shows all the parts of the machine in the position they occupy at the end of the backward stroke of the riveting ram C, the space a^3 between the piston B^2 and the end of the cylinder A being in communication with the supply of compressed air through the inlet port m, port m^2 and passages p^1. To cause the next operative or forward stroke of the ram C, the trigger K is moved into the position shown in Fig. 2 thereby moving the slide valve into the position also shown in Fig. 2. This movement of the slide valve cuts off the port m^2 from the inlet port m and opens into the space h^6 so that it is in communication with the exhaust port m^1 through the passage h^7 and holes h^8. At the same time the port m^3 is cut off from the exhaust port m^1 and put into communication with the inlet port m through the annular space m^4 thereby allowing the compressed air to pass along the passages p^2 to the rear of the piston F.

The pressure on the rear of the piston F causes the latter to move relatively to the cylinder B in the direction of the arrow 5. This movement of the piston F causes the ram G to enter the liquid chamber d and displace the liquid therefrom causing a pressure on the face of the piston B^1 at the end of the cylinder B, thereby causing the cylinder B to be moved in the direction of the arrow 6. The movement of the piston F continues until it comes into contact with the inner face of the piston B^1 and during the whole movement of the piston F the liquid displaced by the ram G causes the piston B^1 and cylinder B to move in the opposite direction to that of the piston F. As the area of the piston B^1 is considerably greater than the area of the ram G the distance moved by the cylinder B will be proportionately less than the movement of the piston F but the pressure exerted by the cylinder B will be proportionately greater than that exerted on the piston F by the compressed air.

Since the moving member c^2 of the riveting or punching head is carried by the ram C at the front end of the machine, the member c^2 will be moved forward by the movement of the cylinder B, its stroke being equal to the stroke of the cylinder B and after the movement of the plate closer E has been arrested the continued movement of the ram C will cause the end of the member e^2 to press on to the rivet and rivet together the two plates placed between the member c and C^1 of the head.

After the riveting has been completed the trigger K is released and the spring h^4 returns the valve H to the position shown in Fig. 1, thereby putting the space a^3 behind the piston B^2 again into communication with the compressed air supply and the space b^6 behind the piston F into communication with the exhaust port m^1. The pressure of the air on the piston B^2 causes the latter to return the cylinder B to its initial position, expelling the liquid from the front of the piston B^1 and causing it to return into the liquid chamber a. As the pressure is removed from the face of the piston F and the space b^6 behind it is open to the exhaust port m^1 of the valve H, the liquid entering into the chamber a will return the ram G and piston F in the cylinder B until the projection f on the piston F again comes into contact with the interior face of the piston B^2. The backward movement of the cylinder B carries with it the punching or riveting ram C, the plate closer E and moving member c^2 so that when the cylinder B has reached the end of its backward stroke all the parts of the machine again occupy their initial positions as shown in Fig. 1 ready for the next operative stroke.

Although the invention has been hereinbefore described as mainly applicable for a riveting or punching machine it is equally applicable to a machine for pressing, stamping and similar operations.

What I claim as my invention and desire to protect by Letters Patent is:—

1. A machine of the type referred to for riveting, punching, pressing, stamping and like operations comprising the combination with an outer cylindrical casing of an inner cylinder sliding within the outer casing, a piston controlled by compressed air arranged within the sliding cylinder, a liquid chamber at one end of the outer casing, a ram affixed to the piston in the cylinder adapted to enter the liquid chamber to expel the liquid therefrom and cause it to exert an hydraulic pressure on the end of the sliding cylinder whereby the later is moved with a smaller stroke but greater pressure in the opposite direction to the piston, and an operating head having a fixed member carried by the outer casing and a moving member connected to the sliding cylinder.

2. A machine of the type referred to for riveting, punching, pressing, stamping and like operations comprising the combination with an outer cylindrical casing of an inner cylinder sliding within the outer casing, a piston controlled by compressed air arranged within the sliding cylinder, a liquid chamber at one end of the outer casing, a ram affixed to the piston in the cylinder adapted to enter the liquid chamber to expel the liquid therefrom and cause it to exert an hydraulic pressure on the end of the sliding cylinder whereby the latter is moved with a smaller stroke but greater pressure in the opposite direction to the piston, an operating head having a fixed member carried by the outer casing and a moving member connected to the sliding cylinder, and a slide valve which admits compressed air alternatively to the face of the piston in the inner cylinder for the forward stroke of the sliding member of the operaing head and to the rear of

the inner cylinder for the return or backward stroke thereof and which also puts the piston and the end of the cylinder alternately into communication with the atmosphere according to the direction of movement of the sliding member of the operaing head.

3. A machine of the type referred to for riveting, punching, pressing, stamping and like operations comprising the combination with an outer cylindrical casing of an inner cylinder sliding within the outer casing, a piston controlled by compressed air arranged within the sliding cylinder, a liquid chamber at one end of the outer casing, a ram affixed to the piston in the cylinder adapted to enter the liquid chamber to expel the liquid therefrom and cause it to exert an hydraulic pressure on the end of the sliding cylinder whereby the latter is moved with a smaller stroke but greater pressure in the opposite direction to the piston, an operating head having a fixed member carried by the outer casing and a moving member connected to the sliding cylinder, a slide valve which admits compressed air alternatively to the face of the piston in the inner cylinder for the forward stroke of the sliding member of the operating head and to the rear of the inner cylinder for the return or backward stroke thereof and which also puts the piston and the end of the cylinder alternately into communication with the atmosphere according to the direction of movement of the sliding member of the operating head, a pivoted lever for moving the sliding valve to cause the operative stroke of the sliding member of the operating head and a spring for moving the sliding valve in the reverse direction.

ARTHUR NEWTON JACKSON.