A. M. IRVINE.

POWER ACTUATED HAND TOOL.

APPLICATION FILED MAR. 29, 1912.

1,052,823.

Patented Feb. 11, 1913.

2 SHEETS—SHEET 1

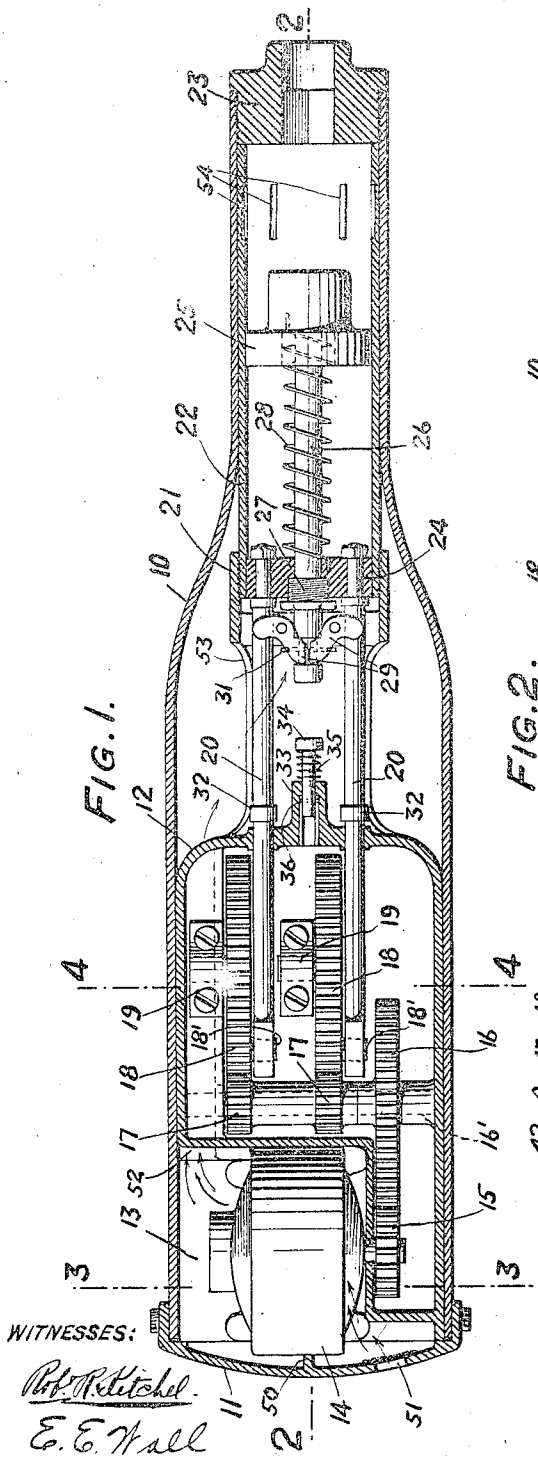

FIG. 1.

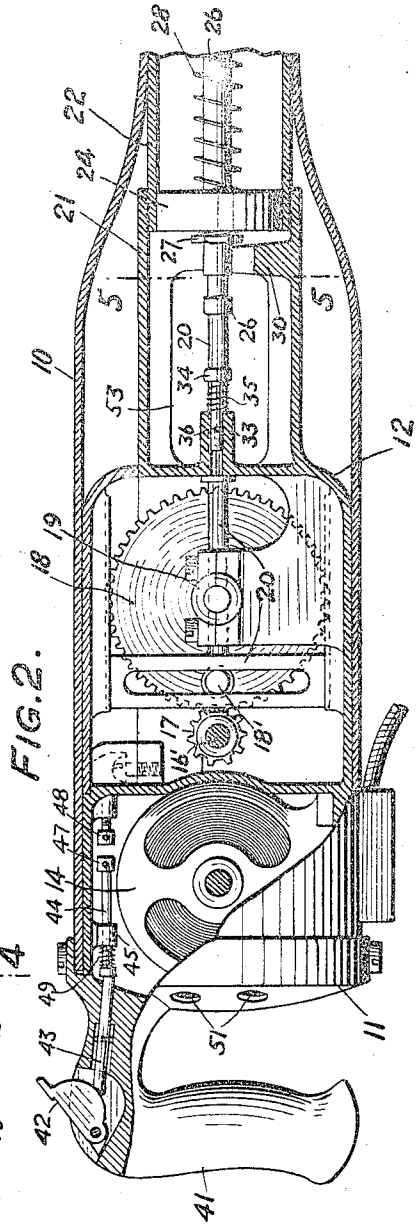

FIG. 2.

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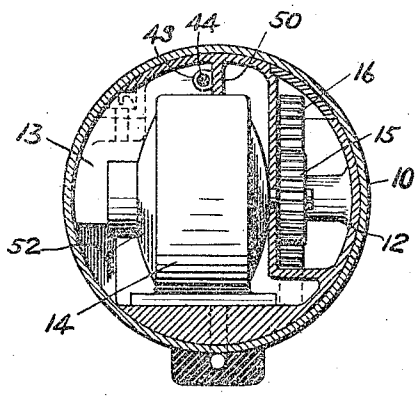

FIG. 3.

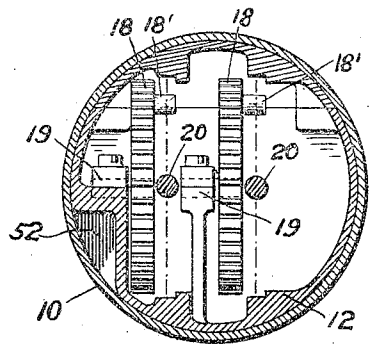

FIG. 4.

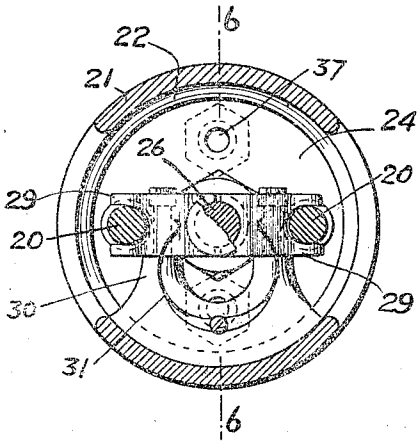

FIG. 5.

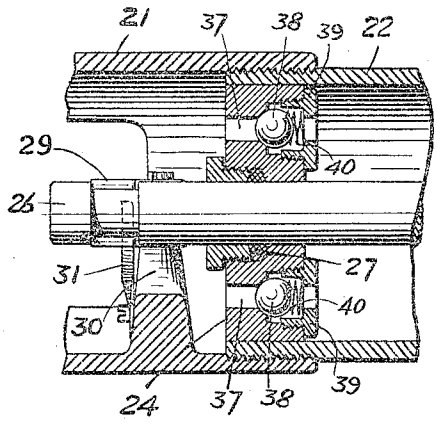

FIG. 6.

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POWER-ACTUATED HAND-TOOL.

1,052,823. Specification of Letters Patent. Patented Feb. 11, 1913.

Application filed March 29, 1912. Serial No. 687,278.

To all whom it may concern:

Be it known that I, ALBERT M. IRVINE, a citizen of the United States, residing at Philadelphia, county of Philadelphia, and State of Pennsylvania, have invented a new and useful Improvement in Power-Actuated Hand-Tools, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings, which form a part of this specification.

The object of my invention is to produce a tool for riveting, calking, chipping, etc., in which the striking hammer-piston will be operated pneumatically but which will be primarily actuated electrically. It is well known that electrically operated tools of this character possess certain advantages both with respect to cost of installation and economy, and also that pneumatically operated hammers are usually of greater efficiency.

The more specific object of my invention is to provide a tool carrying a motor for generating the power required to reciprocate the hammer and by means of said motor compressing air which serves to propel the hammer forward against the chisel or other tool to be actuated.

A preferred embodiment of my invention is shown in the accompanying drawing, in which—

Figure 1 is a longitudinal section through the machine; Fig. 2 is a partial longitudinal section on the line 2—2 of Fig. 1; Figs. 3 and 4 are transverse sections on the lines 3—3 and 4—4 respectively of Fig. 1; Fig. 5 is an enlarged transverse section on the line 5—5 of Fig. 2; Fig. 6 is a section on the line 6—6 of Fig. 5.

To the outer shell or main casing 10 is secured the head 11. Within the outer shell is an inner shell forming a gear casing 12. Between the shell 10 and head 11 and the gear casing 12 is formed a chamber 13 for an electric motor 14. The motor shaft projects through the wall of the gear casing 12 and in the gear casing is provided with a pinion 15 which engages a gear 16 on a shaft 16′. The latter shaft extends across the gear casing 12 and turns in bearings on opposite sides of the inner wall of the gear casing. On the shaft 16′ are two pinions 17, 17, which engage respectively with two gears 18, 18. The shafts of gears 18, 18, turn in separate bearings 19, 19, secured to the gear casing 12. The gears 18, 18 have crank pins 18′, 18′ on which are pivoted connecting rods 20, 20.

In front of the gear casing 12 and secured thereto is a shell 21, to the forward end of which is secured a shell 22, forming a hammer piston chamber, which is also secured to the contracted forward end of the main shell 10. Secured to the forward end of the main casing 10 is a tool guide or holder 23 having an axial orifice for the reception of the shank of the tool to be actuated.

The rods 20, 20, extend through the front wall of the gear-casing 12, through the shell 21 and at their front ends are secured to an air-compressing member or head 24 slidable within the shell 22 and forming the rear wall of the hammer piston chamber.

Adapted to reciprocate in the shell 22 is a hammer piston 25 having secured thereto a piston-rod 26 which extends rearward through the head 24 and a stuffing box 27 (see Fig. 6) formed therein into the shell 21. A spring 28 surrounds the piston rod 26 and is confined between the head 24 and piston 25, being secured to both members. The piston-rod 26 is contracted near its rear end to form a neck which is engaged by the ends of the clutch-levers 29 pivoted between their ends on brackets 30 (see Figs. 5 and 6) and normally pressed into engagement with the piston-rod by springs 31. The other ends of clutch-levers 29 are in line of travel with the collars 32 on the rods 20.

The front wall of the gear-casing 12 has a centrally located tubular projection 33 whose front head has an orifice, of somewhat less diameter than the interior of the tube, through which extends the shank of a buffer 34. A spring 35 surrounds the shank of the buffer and is confined between the head of the buffer and the forward end of the projection 33. The inner end of the shank of the buffer 34 has a cross-pin 36, which holds the buffer from slipping out.

The head 24 has a pair of orifices 37, 37, each of which is wider at its front end than its rear end, thereby forming an intermediate shoulder forming a valve-seat, against which rests a ball valve 38, which is held in position by means of a hollow nut 39 threaded within the wider end of the orifice 37 and a spring 40 confined between the nut

and the valve 38. The valve 38 thus acts as a check valve, permitting air to pass through the orifice 37 into the piston chamber 22 but not permitting air to pass in the opposite direction.

Integral with the head 11 of the tool is an L-shaped handle 41 having a thumb-lever 42 (see Fig. 2) pivoted within a recess in the tool and normally projecting out beyond the handle. The thumb-lever has a cam face which engages the end of a rod 43 extending through the one arm of the handle into the motor chamber. The rod 43 at its front end engages the rear end of a rod 44 of insulating material, sliding in a guide 45 projecting from the casing. The front end of rod 44 carries an electrical contact 47 adapted, when the rod 44 is moved forward to contact with a fixed electrical contact 48. A spring 49, coiled about the rod 44 between the guide 45 and a head at the rear of rod 44, tends to hold the rods 44 and 43 in their retracted positions and the contacts 47 and 48 separated. It will be understood that these contacts are so connected with the motor and with a source of current supply (said connections not being shown, as they form no part of my invention) that when they are brought together the current will be closed through the motor.

By reference to Fig. 2 it will be noticed that the motor casing rests in a shallow concavity in the upper wall of the gear casing and by reference to Figs. 1 and 3 it will be noticed that a partition 50 divides the motor chamber into two parts. Air entering the intake ports 51 in the head 11 will be compelled to pass from one part of the motor chamber to the other part through the field and armature of the motor for the purpose of cooling it. Thence the air will pass through a channel 52 formed between the main shell and the gear casing into the annular space around the shell 21. Thence the air passes through large openings 53 formed in the shell 21 into the interior of the shell and thence through the valved orifices 37, 37, as hereinafter described.

The operation of the machine is as follows: The operator takes hold of the handle 41 and depresses the thumb-lever 42, thereby moving the rods 43 and 44 into position to close the circuit through the motor 14 by means of contacts 47 and 48. The motor, through the gears 14, 15, 17 and 18, reciprocates the rods 20, 20 and head 24. In the forward stroke of the head 24, the air is compressed in the piston chamber 22 between the head 24 and the hammer piston 25. This air is thus confined within a closed chamber whose volume diminishes as the head 24 moves forward. The air cannot escape through the valved orifices 37, 37, as these are closed by the ball valves 38, 38. On the other hand, the hammer-piston 25 cannot move forward, being locked against such movement by the clutch-levers 29. When the air in the piston chamber 22 has been compressed to a determinate extent, the collars 32 on the rods 20 engage the clutch-levers 29 and move them into position to release the piston rod 26 and hammer-piston 25. Thereupon, and with great suddenness and force, the air confined in the piston chamber expands and propels the hammer-piston 25 against the tool shank, causing it to deliver a blow precisely as in the case of a pneumatic hammer. As the hammer piston nears or reaches the end of its stroke, the air in the piston chamber exhausts, through the by-pass port 54 into the space in front of the piston and thence through the orifice in the tool-holder 23 to the atmosphere. In the return movement of the rods 20, 20 and head 24, the collars 32, 32, are retracted from the clutch-levers 29, leaving the latter free to again move into operative position. This they do as soon as the piston 25 and piston rod 26, under the action of spring 28, resume their original position. The extent of rearward movement of the piston and piston rod is yieldingly limited by the buffer 34. The air exhausted through the by-pass ports 54 is replaced by air admitted through the valved orifices 37, 37.

This completes one cycle of operation. Continued rotation of the motor will thus cause the hammer piston to deliver a blow upon the tool once at every given number of revolutions of the motor.

It is obvious that the specific construction of the machine may be varied from without departing from my invention as hereinafter claimed.

Having now fully described my invention, what I claim and desire to protect by Letters Patent is:

1. In a power-actuated hand-tool, the combination with an electric motor, of an air-compressing member and connections between the motor and said member whereby the same is reciprocated, a hammer-piston adapted to be actuated by the air compressed by said member in its forward movement, means to lock the hammer piston from forward movement until the air compressing member has compressed the air to a predetermined extent in its forward movement, means operating in the forward movement of the air-compressing member to release said locking means, and a spring connecting the air compressing member and the hammer piston and by which the latter is returned to its normal position when the air-compressing member is retracted.

2. In a power actuated tool, the combination with the main casing of a piston chamber within the main casing, a hammer piston and an air-compressing head reciprocable within the piston chamber, a rod se-

cured to said piston and extending through said head, a spring connecting said head and piston tending to maintain them at a certain distance apart, an electric motor within the main casing, gears within the main casing and connected with the motor, a connecting rod between the gears and said head, means normally engaging the piston rod and adapted to lock the hammer-piston from forward movement until the air-compressing member has moved forward and compressed the air to a predetermined extent, and means operating in the forward movement of the connecting rod and head to release said locking means and allow the previously compressed air to actuate the hammer-piston.

3. In a power actuated tool, the combination with the main casing of a piston chamber within the main casing, a hammer piston and an air compressing head reciprocable within the piston chamber and adapted in its forward movement to actuate the hammer piston by compressing the air behind it, an orifice in said head and a valve in said orifice adapted to permit the air to flow into but not from the piston chamber, an electric motor and gearing actuated thereby in the main casing, driving connections between the gearing and said head, and means to retract the hammer piston in the rearward movement of the air compressing head.

4. In a power actuated tool, the combination with the main casing of a piston chamber within the main casing, a hammer piston and an air compressing head reciprocable within the piston chamber, an orifice in said head and a valve in said orifice adapted to permit the air to flow into but not from the piston chamber, an electric motor and gearing actuated thereby in the main casing, driving connections between the gearing and said head, means to lock the hammer-piston from forward movement until the air compressing member has moved forward and compressed the air to a predetermined extent, means to thereafter release the hammer piston, means to return the hammer piston to its normal position when the air compressing member is retracted, and means permitting the air compressed back of the hammer piston to escape.

5. In a power-actuated tool, the combination with a main casing, of an electric motor therein, gearing therein connected with the motor, an inner shell, an air-compressing head and a hammer-piston reciprocable within the shell, a connecting rod connected with the gearing and extending forward through the gear casing and connected with said head, a rod secured to the piston and extending through said head, a spring actuated clutch adapted to normally lock said rod, a collar on the connecting rod adapted in its forward movement to engage said clutch and release the piston rod, and means to return the hammer piston in the rearward movement of the head.

6. In a power-actuated tool, the combination with a main casing, of a motor chamber at the rear of the main casing, an electric motor therein, a gear casing in the main casing extending in front of the motor chamber, gearing in the gear casing connected wtih the motor, an inner shell in the front part of the main casing, a hammer piston and an air-compressing head reciprocable within the shell, driving connections between said gearing and head, a valve orifice in said head to permit pressure fluid to enter the space between the head and hammer piston, means permitting the air compressed between the two last named members in the forward movement of the head to escape, means to return the hammer piston in the rearward movement of the head, an intake port for the admission of air into the motor chamber, and a channel between the gear casing and the main casing communicating at its rear end with the motor chamber and at its front end with the space between the main casing and the air-compressing head.

7. In a power actuated tool, the combination with the main casing, of gearing and a gear casing inclosing the same, an electric motor connected with the gearing and placed in the chamber formed between the gear casing and the main casing, an intake port in the main casing communicating with the motor chamber, an air channel from the motor chamber between the main casing and gear casing, a connecting rod connected with said gearing and extending through the gear casing, a shell in front of the gear casing through which said connecting rod also extends, said shell having its wall cut away, a second shell in front of the last named shell, a head reciprocable within the second shell and secured to said rod, a hammer piston within the second shell and in front of said head, a piston rod secured to the piston and extending through said head, a spring surrounding said piston rod and connecting said head and piston, a spring-actuated clutch member fixed relatively to said head and piston and normally engaging said piston rod and locking it from forward movement, a collar on said connecting rod adapted to engage and actuate said clutch member to move the latter into inoperative position, an orifice in said head, a valve acting to permit air to pass forwardly but not rearwardly through said orifice, and a by-pass in the second shell permitting compressed air to escape from behind the piston hammer when the latter moves forward.

8. In a power-actuated hand-tool, the combination with an electric motor, of an air-compressing member and connections between the motor and said member whereby the same is reciprocated, an orifice in the

air compressing member, a check valve preventing the escape of air rearward through the orifice in said member, a hammer piston adapted to be actuated by the air compressed by said member in its forward movement, means permitting the air between said member and hammer piston to exhaust, thereby allowing air to pass through said orifice in the return movement of said member, and means to return the hammer piston to its normal position when said member is retracted.

In testimony of which invention, I have hereunto set my hand, at Philadelphia, on this 28th day of March, 1912.

ALBERT M. IRVINE.

Witnesses:
M. M. HAMILTON,
E. E. WALL.