(No Model.) 2 Sheets—Sheet 1.

J. F. CLEMENT.

IMPACT TOOL.

No. 522,511. Patented July 3, 1894.

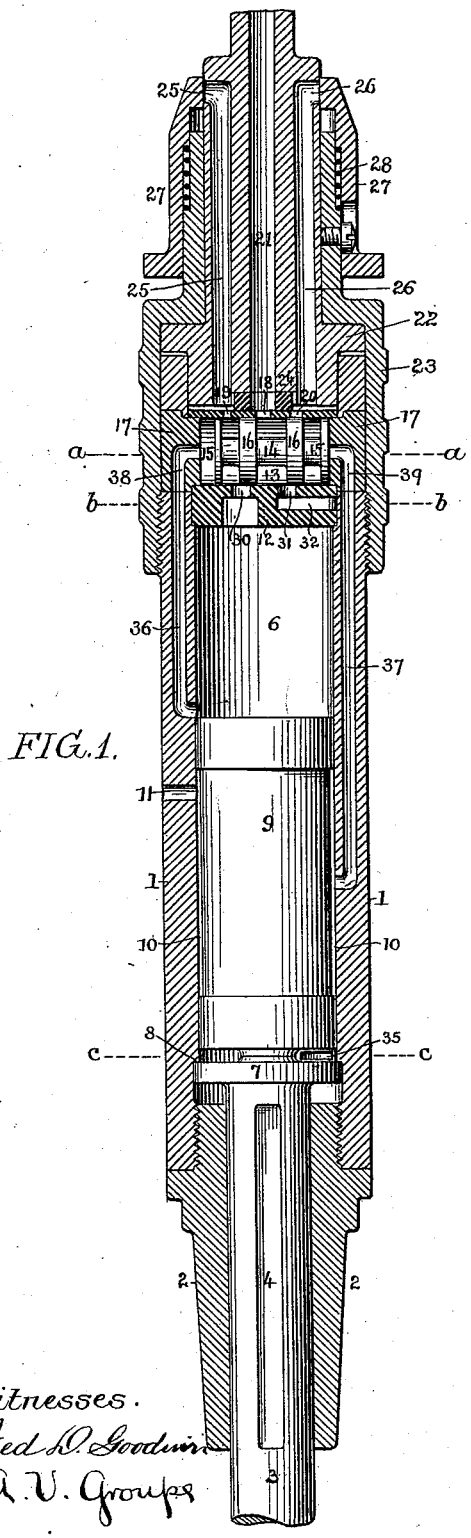

FIG. 1.

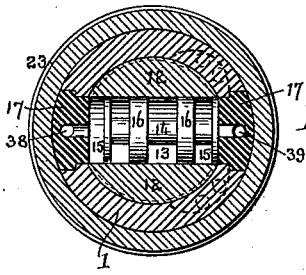

FIG. 3.

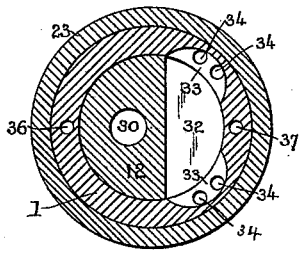

FIG. 4.

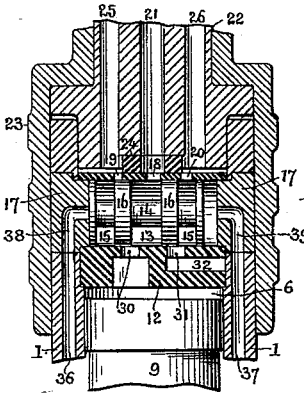

FIG. 2.

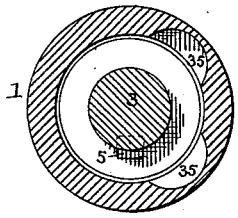

FIG. 5.

Witnesses.
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A. V. Groupe

Inventor:
John F. Clement
by his Attorneys
Howson & Howson

(No Model.) 2 Sheets—Sheet 2.

J. F. CLEMENT.

IMPACT TOOL.

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FIG. 6.

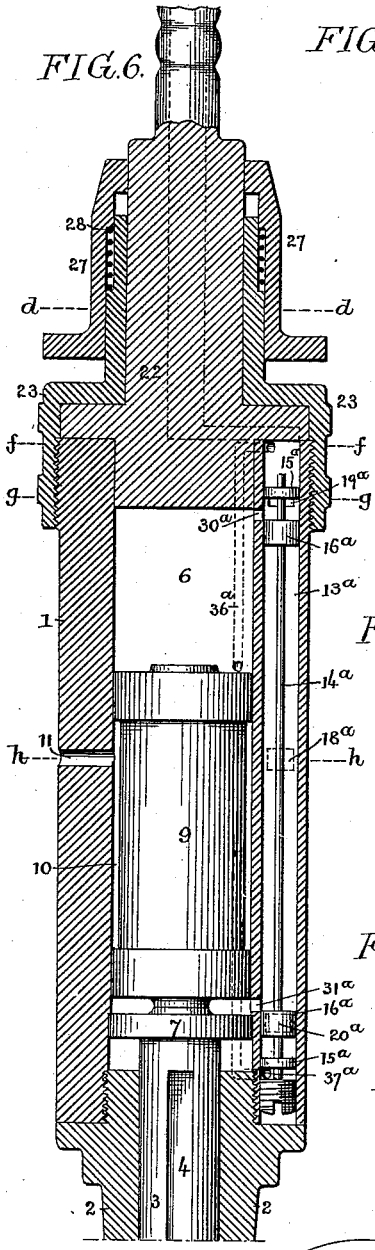


FIG. 8.

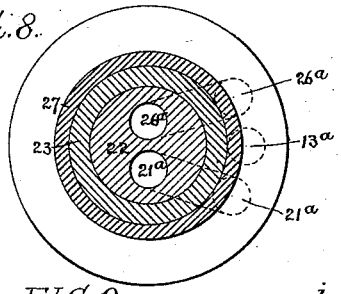


FIG. 9.

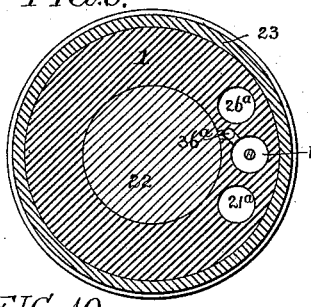


FIG. 10.

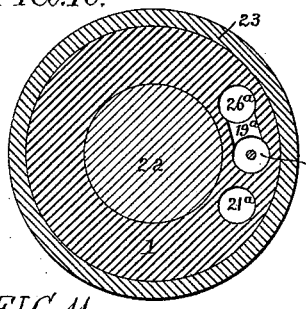


FIG. 11.

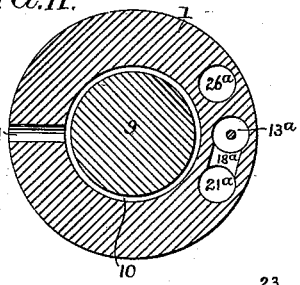


FIG. 7.

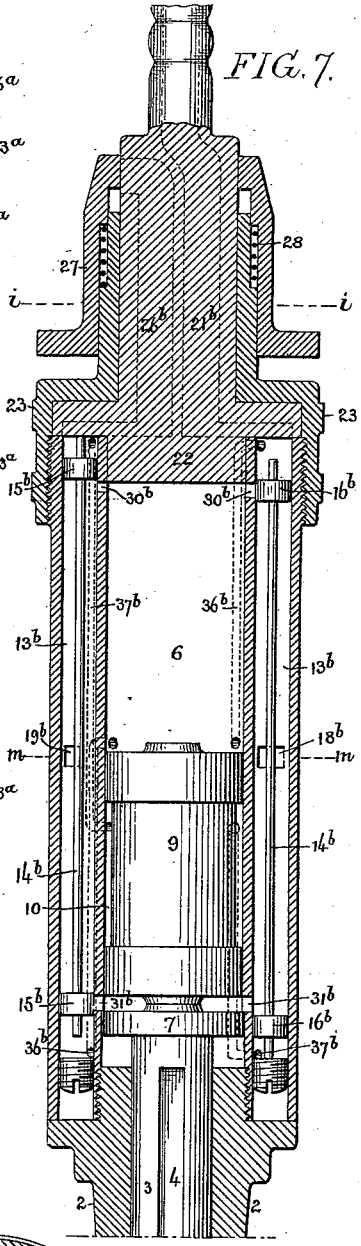


FIG. 12.

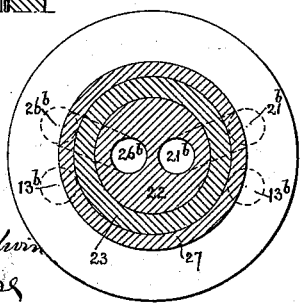
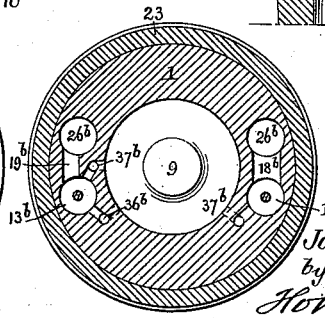


FIG. 13.



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Inventor:
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UNITED STATES PATENT OFFICE.

JOHN F. CLEMENT, OF PHILADELPHIA, PENNSYLVANIA.

IMPACT-TOOL.

SPECIFICATION forming part of Letters Patent No. 522,511, dated July 3, 1894.

Application filed November 14, 1891. Serial No. 411,912. (No model.)

To all whom it may concern:

Be it known that I, JOHN F. CLEMENT, a citizen of the United States, and a resident of Philadelphia, Pennsylvania, have invented certain Improvements in Impact-Tools, of which the following is a specification.

The object of my invention is to provide a simple and effective form of automatic impact tool, such as is employed for plugging teeth, drilling rock, chipping stone and metal, &c., my invention comprising certain constructions and combinations of parts fully set forth and specifically claimed hereinafter.

In the accompanying drawings:—Figure 1, is a longitudinal section of an impact tool of the preferred form, constructed in accordance with my invention. Fig. 2, is a longitudinal section of part of the same showing a certain valve in a different position from that represented in Fig. 1. Fig. 3, is a sectional plan view on the line *a a* Fig. 1. Fig. 4, is a sectional plan view on the line *b b*, Fig. 1. Fig. 5, is a sectional plan view on the line *c c*, Fig. 1. Figs. 6 and 7, are longitudinal sections of two other forms of tool, also embodying my invention. Fig. 8, is a sectional plan view on the line *d d*, Fig. 6. Fig. 9, is a sectional plan view on the line *f f*, Fig. 6. Fig. 10, is a sectional plan view on the line *g g*, Fig. 6. Fig. 11, is a sectional plan view on the line *h h*, Fig. 6. Fig. 12, is a sectional plan view on the line *i i*, Fig. 7, and Fig. 13, is a sectional plan view on the line *m m*, Fig. 7.

I will first describe the preferred form of tool illustrated in Figs. 1 to 5.

1 represents the tubular casing or cylinder of the tool, which is closed at one end by a head 2, and in the latter is guided the shank or stem 3 of the tool which is to be operated, which tool may be either a dental mallet, a rock-drill, a stone or metal chipping chisel, or other tool to which it is desired to impart a series of blows in rapid succession. If it is desired to prevent rotation of the stem 3 the latter may have a groove 4 for the reception of a suitable spline 5 in the head 2 as shown by dotted lines in Fig. 5.

Within the chamber or bore 6 of the cylinder 1, the stem 3 is expanded to form a head 7 which plays within a slight enlargement of the bore at the bottom of the cylinder so that its upward movement is restricted by a shoulder 8 formed by said enlargement of the bore.

Within the chamber 6 of the cylinder is free to slide a plunger or ram 9, the opposite end portions of which fit so snugly to the bore of the cylinder as to prevent leakage, or at least rapid leakage, of air past the plunger, but the central portion of the plunger is reduced in diameter to a slight extent so as to form an internal chamber 10 which is always in communication with an exhaust passage 11 formed in the cylinder as shown in Fig. 1, this passage either extending directly through the cylinder, as shown, or being carried to any convenient point of discharge.

To the upper end of the cylinder 1 is snugly fitted a valve box 12 which is bored transversely to form a valve chamber 13 in which is free to slide what I term a "double duplex" valve comprising a central stem 14, opposite end disks 15 and two intermediate disks 16, these various disks being so arranged that there is a space between the disks 16 as well as a space between each disk 16 and the corresponding end disk 15. The opposite ends of the valve chamber 13 are preferably closed by means of plugs 17 which fit into suitable openings formed in the cylinder 1 for their reception as shown in Fig. 3.

In the top of the valve box is formed a central induction port 18 and on each side of the same an eduction port, one of said eduction ports being represented at 19 and the other at 20, in Figs. 1 and 2, the induction port communicating with a supply passage 21 in a cap 22, which is secured to the upper end of the cylinder 1 by means of a nut 23, a packing ring 24 surrounding the induction opening 18.

The eduction ports 19 and 20 communicate respectively with exhaust passages 25 and 26 formed in the cap 22, these exhaust passages discharging laterally at their upper ends and the area of the discharge being regulated by means of a sliding valve 27 which surrounds the reduced upper portion of the nut 23 and is free to move vertically thereon, a spiral spring 28, interposed between an external shoulder on the nut and an internal shoulder in the valve 27 serving to raise said valve so as to completely close and prevent the es-

cape of air from the passages 25 and 26, the freedom of discharge depending upon the extent to which the valve 27 is depressed.

In the bottom of the valve box are two ports 30 and 31 which serve as combined induction and eduction ports as described hereinafter, the port 30 communicating directly with the upper end of the chamber 6 of the cylinder and the port 31 communicating with a transverse chamber 32 in the valve box, which chamber is in communication with chambers 33 at the upper ends of vertical passages 34 formed in the cylinder 1, as shown in Fig. 4, these passages extending to the lower end of the cylinder and communicating with the lower end of the chamber 6 therein through chambers 35 as shown in Figs. 1 and 5. In the cylinder 1 are also formed passages 36 and 37 diametrically opposite each other, the passage 37 being somewhat longer than the passage 36 and both passages at their lower ends being carried into the chamber 6 of the cylinder, while the upper end of the passage 36 communicates with one end of the valve chamber 13 through a right angled passage 38 in one of the plugs 17, the upper end of the passage 37 communicating with the opposite end of the valve chamber through a like right angled passage 39 in the opposite plug 17.

The inlet passage 21 being supposed to be in communication with the supply of air or other fluid under pressure, and the valve 27 being supposed to be depressed so as to open the upper ends of the exhaust passages 25 and 26, the operation of the tool will be as follows: Supposing that the parts are in the position shown in Fig. 1, air under pressure passes through the induction port 18 into the valve chamber between the disks 16, 16, of the valve and passes through the port 31 and chambers 32 and 33 into the passages 34 in the cylinder 1, and is thereby directed to the lower end of the chamber 6 beneath the plunger 9 which is thus caused to rise, the air above the same escaping through the port 30, through the valve chamber between the disk 16 and the left hand end disk 15, and through the eduction port 19 and the exhaust passage 25. Under these circumstances the port 31 acts as an induction port, the port 30 is an eduction port, and the chambers and passages 32, 33, 34 and 35 are induction chambers and passages.

When the plunger has almost reached the limit of its upward movement it uncovers the lower end of the passage 37 and permits air to flow through the same and through the passage 39 into the right hand end of the valve chamber 13, so that the air, acting upon the right hand end disk 15 of the valve, shifts said valve to the position shown in Fig. 2, the air from the left hand end of the valve chamber escaping through the passage 36 into the chamber 10 around the plunger which by the rise of said plunger has been brought into communication with the lower end of the passage 36. From the chamber 10 the air escapes through the passage 11. By the shifting of the valve to the position shown in Fig. 2, the eduction port 19, which was formerly open, is now closed by the left hand disk 16 and the port 30, which was formerly the eduction port, is now brought into communication with the induction port 18 and thus becomes an induction port and permits air to enter the upper end of the chamber 6 above the plunger so as to force the latter downward, and, by the same movement of the valve, the eduction port 20, which was formerly closed by the right hand disk 16, is now opened and brought into communication with the port 31, communication between the latter and the induction port 18 being cut off by said right hand disk 16 of the valve. The port 31 thus becomes an eduction port and the chambers and passages 32, 33, 34 and 35 become eduction chambers and passages and permit the escape of air from the lower end of the chamber 6 below the plunger. When the plunger has almost reached the limit of its downward movement, however, it uncovers the passage 36 and permits air to pass through the same and through the passage 38 to the left hand end of the valve chamber so as to again shift the valve to the position shown in Fig. 1, the air from the right hand of the valve chamber escaping through the passages 39 and 37, the lower end of the latter being now in communication with the annular chamber 10 around the plunger as shown in Fig. 1, and these operations are repeated indefinitely so long as the supply of air to the passage 21 is maintained and a discharge from the exhaust passages 25 and 26 is permitted. The force of the blow delivered upon the stem 3 by the plunger 9 depends upon the adjustment of the valve 27, for the more the escape of air from the passages 25 and 26 is restricted, the less will be the force of the blow. It will be evident that this result might be effected by simply limiting the escape from the passage 26 which communicates with the lower end of the cylinder, the making of the valve 27 in annular form so as to obstruct both passages 25 and 26 being simply a matter of convenience.

It is advisable in all cases to make the eduction port 19 of less area than the eduction port 20 so that the escape of air through the upper end of the cylinder will be somewhat restricted and a cushioning effect thus produced to prevent contact of the upper end of the ram or plunger with the valve box 12.

It will be observed, on reference to Figs. 1 and 2, that the disks 16 of the valve do not completely uncover the ports 30 and 31 of the valve box in either position of adjustment of the valve, but the said disks overhang the ports to a considerable extent. I find that by this means the rapid flow of air past the overhanging edges of the valve disks has a tendency to prevent any accidental displacement of the valve such as would close the

ports, which displacement might otherwise be caused by back pressure, or by the jarring of the cylinder, or by gravity if the tool were used in an inclined or horizontal position instead of in a vertical position.

The principal difference between the tool shown in Fig. 1, and those shown in Figs. 6 and 7, is in the location of the valves and passages. In both of the modified forms of tool the valves are located in valve chambers formed in the casing of the cylinder. In the tool shown in Figs. 6 to 11 the valve chamber 13^a is flanked respectively by inlet and exhaust passages 21^a and 26^a, the latter taking the place of the two exhaust passages 25 and 26 of the tool shown in Fig. 1 and communicating with the valve chamber 13^a near each end through eduction ports 19^a and 20^a, while the inlet passage 21^a communicates with the center of the valve chamber through an induction port 18^a. Both of the chambers 21^a and 26^a communicate with like chambers in the cap 22, and the valve chamber communicates with the interior of the cylinder through combined induction and eduction ports 30^a and 31^a, the passages 36^a and 37^a being substantially the same as the passages 36 and 37 of Fig. 1.

In the tool shown in Figs. 7, 12 and 13 there are two valve chambers 13^b, one on each side of the instrument, each chamber containing a single duplex valve, that of one chamber having disks 16^b and that of the other chamber having disks 15^b. Flanking one of the valve chambers is an induction passage 21^b and flanking the other valve chamber is an escape passage 26^b as shown in Fig. 13, each of these passages communicating with its valve chamber near the center of the same. In this case instead of having two ports 30 and 31 which act alternately as induction and eduction ports, there are independent induction and eduction ports 30^b at the top of the cylinder and like independent induction and eduction ports 31^b at the bottom of the cylinder, and there are duplicate passages 36^b and 37^b, one set for each valve chamber, those of the eduction valve chamber being crossed so as to insure the proper movement of the valve.

In all cases the admission of air to and its discharge from the cylinder are controlled by what I call a "double duplex" valve, this valve in the case of the tool shown in Figs. 1 and 6, consisting of four disks upon one stem and in the case of the tool shown in Fig. 7 consisting of two independent valve stems, each having two disks.

Having thus described my invention, I claim and desire to secure by Letters Patent—

1. The combination of the cylinder, its plunger, the inlet and discharge passages for the motive fluid, induction and eduction passages for directing the motive fluid to and permitting its discharge from the opposite ends of the cylinder, an induction port, two eduction ports, that for controlling the discharge from the top of the cylinder being of less area than that for controlling the discharge from the bottom of the cylinder, and a valve controlling said ports, substantially as specified.

2. The combination of the cylinder, and its plunger, inlet and discharge passages for the motive fluid, induction and eduction passages for directing said motive fluid to and permitting its discharge from the opposite ends of the cylinder, induction and eduction ports communicating with the inlet and discharge passages, combined induction and eduction ports communicating with the cylinder, and a valve for controlling the flow of fluid through said ports, said valve overhanging the induction and eduction ports of the cylinder when the same are open, substantially as specified.

3. The combination of the cylinder and its plunger, inlet and discharge passages for the motive fluid, induction and eduction passages for directing said motive fluid to and permitting its discharge from the opposite ends of the cylinder, induction and eduction ports, a valve controlling the flow through said ports, and a valve box contained within one end of the cylinder and having a transverse valve chamber and plugs for closing the ends of said valve chamber, substantially as specified.

4. The combination of the cylinder having in the walls thereof passages for conveying motive fluid from one end of the cylinder to the other, the plunger, an inlet passage, and two discharge passages for the motive fluid, a valve box having induction and eduction ports communicating respectively with said inlet and discharge passages, and two combined induction-eduction ports, one communicating directly with the chamber within the cylinder, and the other communicating with a transverse passage which leads to the passages in the walls of the cylinder and a double duplex valve controlling said ports, substantially as specified.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

JOHN F. CLEMENT.

Witnesses:
EUGENE ELTERICH,
HARRY SMITH.