

O. C. DURYEA & M. C. WHITE.
HAMMERING IMPLEMENT.

APPLICATION FILED APR. 9, 1910. RENEWED NOV. 4, 1912.

1,063,667.

Patented June 3, 1913.

3 SHEETS-SHEET 1.

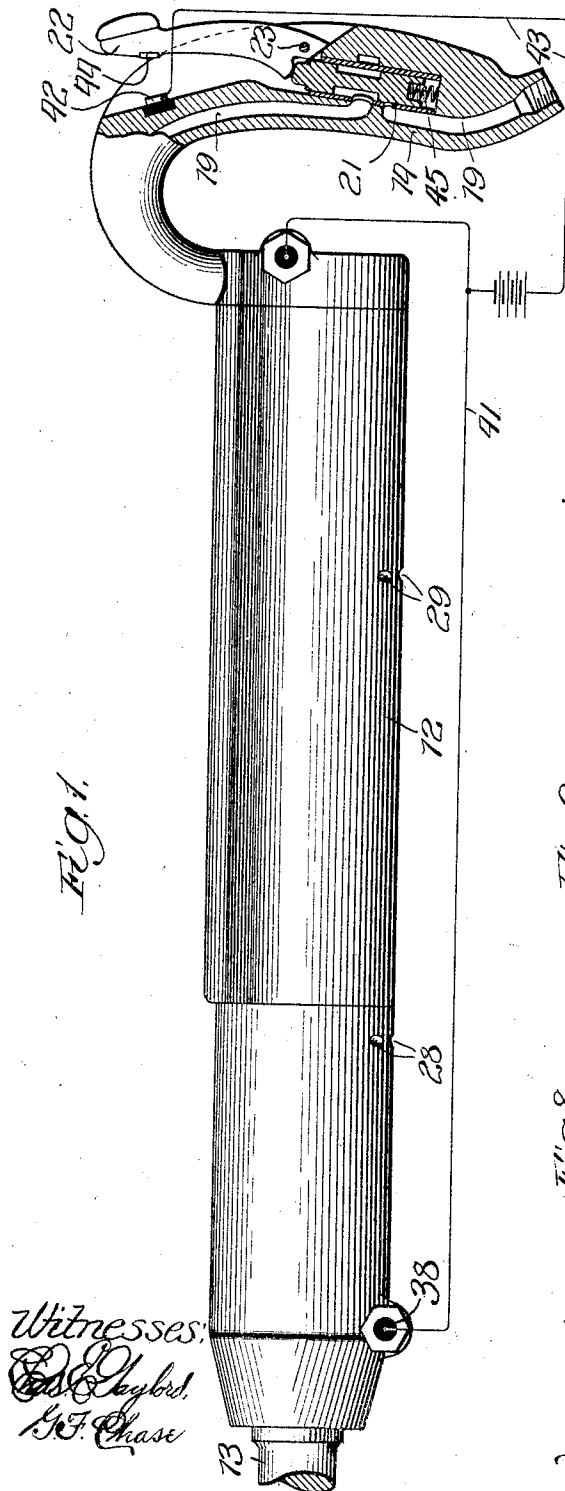


Fig. 1.

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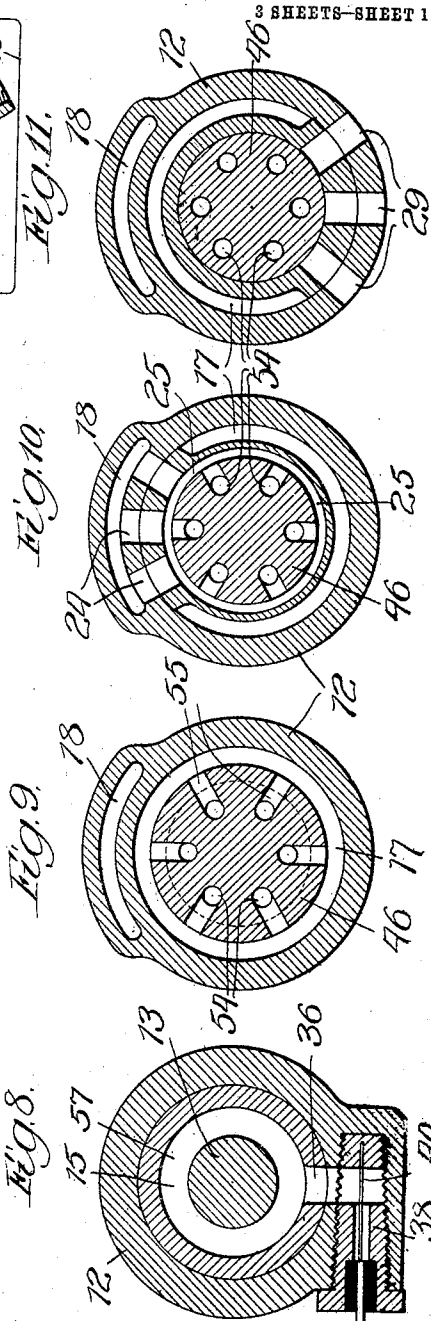


Fig. 8.

Fig. 9.

Fig. 10.

Fig. 11.

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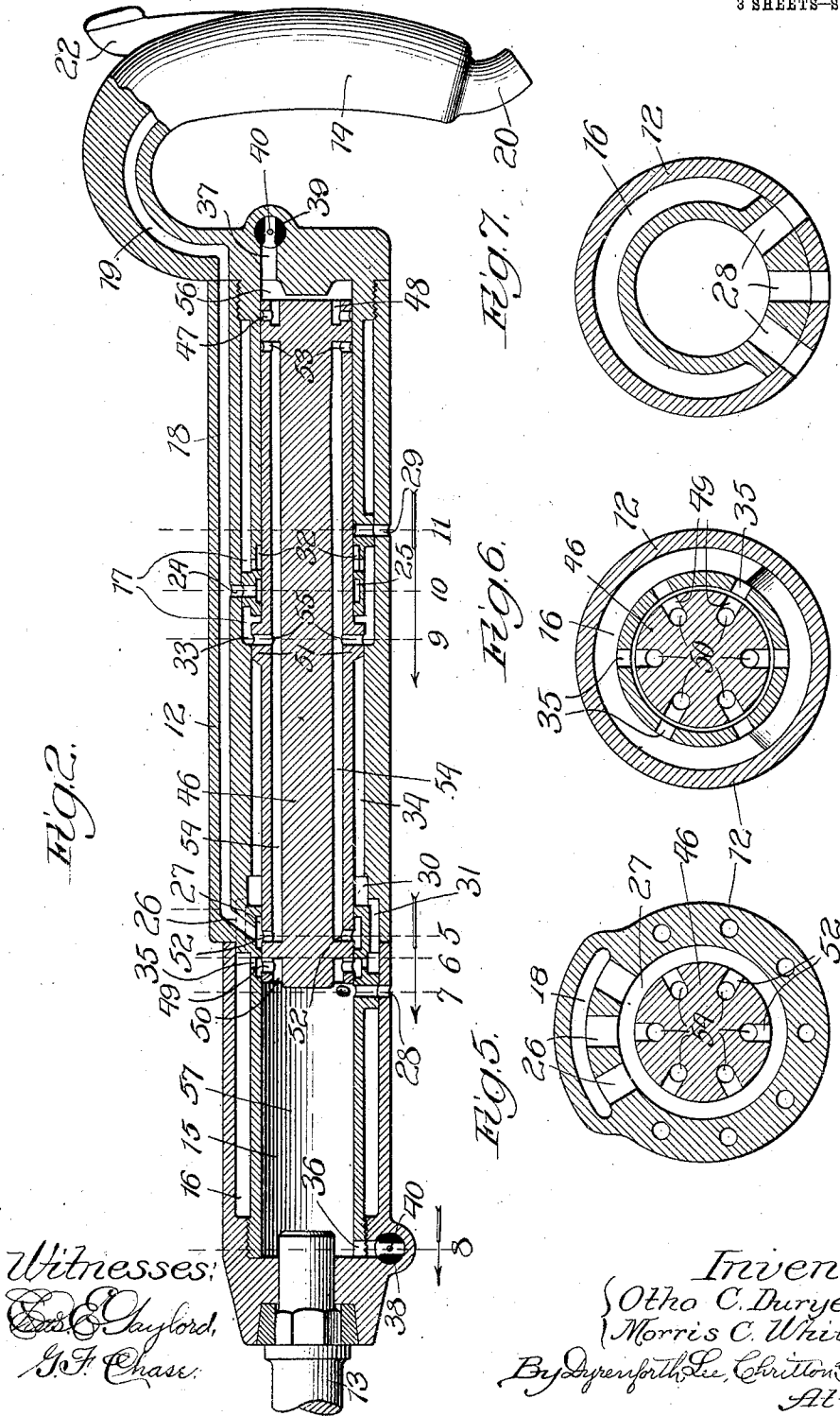
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3 SHEETS—SHEET 2.



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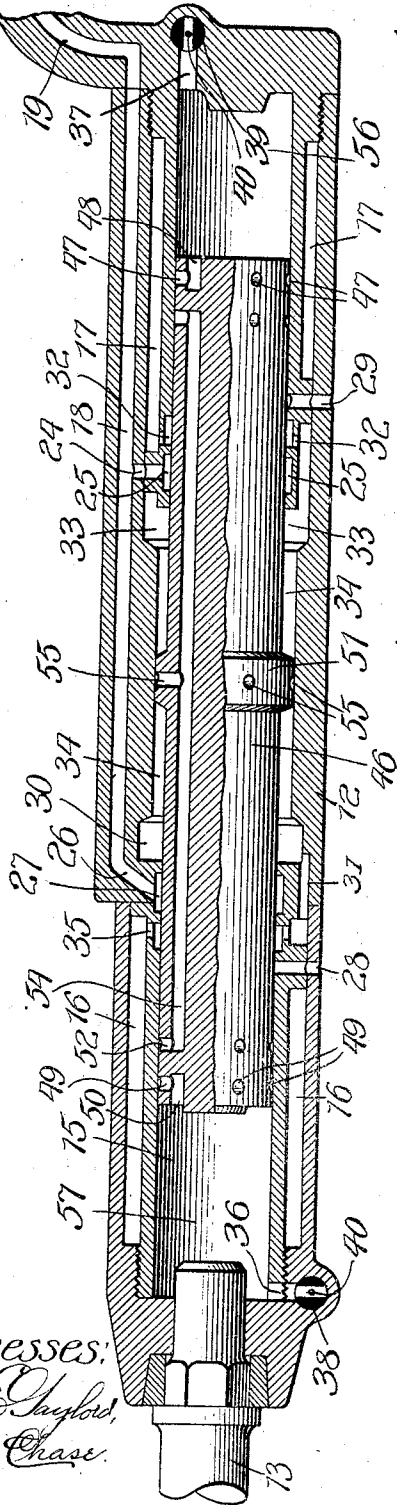
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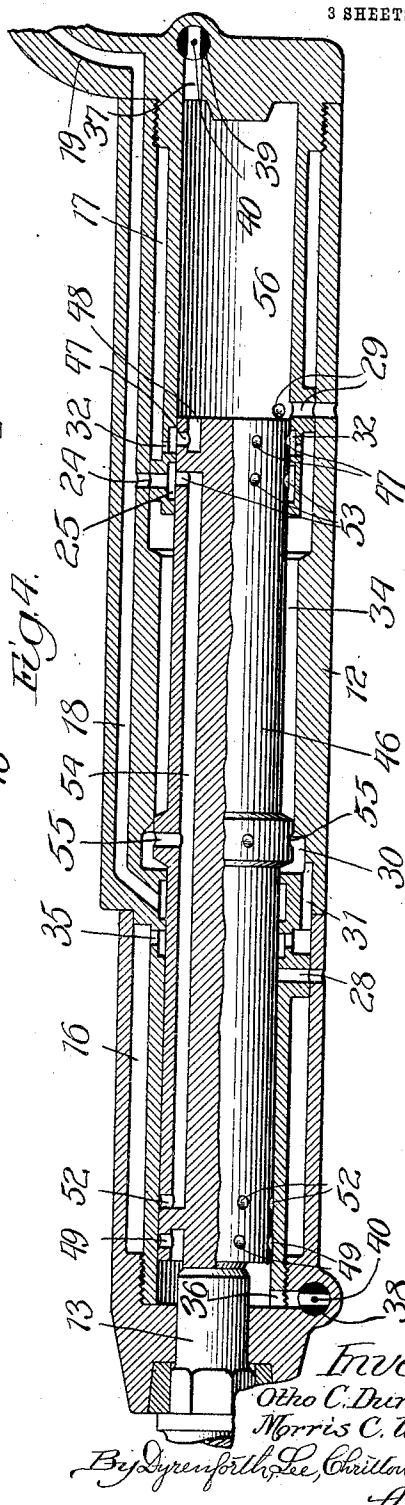
3 SHEETS-SHEET 3.

Fig. 3.



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Fig. 4.



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UNITED STATES PATENT OFFICE.

OTHO C. DURYEA AND MORRIS C. WHITE, OF CHICAGO, ILLINOIS.

HAMMERING IMPLEMENT.

1,063,667.

Specification of Letters Patent.

Patented June 3, 1913.

Application filed April 9, 1910, Serial No. 554,341. Renewed November 4, 1912. Serial No. 729,469.

To all whom it may concern:

Be it known that we, OTHO C. DURYEA and MORRIS C. WHITE, citizens of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented a new and useful Improvement in Hammering Implements, of which the following is a specification.

Our invention relates to improvements in hammering implements of the class in which a piston is actuated by fluid pressure to reciprocate against a riveting, or other work-performing, tool.

Our object is to provide an implement of the above class of simple and improved construction, which may be actuated by the pressure of compressed fluid alone, or by the same pressure supplemented by that produced by combustion of fluid.

In carrying out our invention, we prefer to provide the implement in the form of a valveless tool equipped with electric igniters and actuated by explosive fluid fed thereto under pressure.

In the accompanying drawings—Figure 1 is a side elevation of our improved tool partly in section and with the electric-current conductor-wires illustrated in a conventional way; Fig. 2, a longitudinal section showing the piston in its retracted position; Fig. 3, a broken and enlarged longitudinal section showing the piston in an intermediate position; Fig. 4, a view the same as Fig. 3, but showing the piston in advanced position impacting against a riveting, or other, tool; and Figs. 5, 6, 7, 8, 9, 10 and 11, enlarged sections taken on lines 5 to 11 inclusive in Fig. 2, and viewed as indicated by the arrows.

The casing 12 is fitted at one end with a tool 13, which may be a riveting tool, a chisel, or the like, and provided at its opposite end with a handle 14. The casing is formed of suitable sections or divisions screwed together and forming a central piston-chamber 15, annular expansion chambers 16 and 17 in the positions shown, and an inlet-passage 18 of segmental form. The passage 18 communicates at one end with a

supply-passage 19 extending longitudinally through the handle and adapted for connection at its outer end, 20, with a flexible hose leading thereto from a fluid-pressure supplier (not shown). Interposed in the passage 19 is a slide-valve 21 controlled by a thumb-lever 22 to open and close the passage 19, the lever being pivoted at 23. The passage 18 communicates through ports 24 with an annular enlargement 25, of the chamber 15, in the chamber-wall; and it also communicates through ports 26 with an annular enlargement 27 of the chamber 15. Extending through the casing in the relative positions shown are the exhaust-ports 28 and 29. In the wall of the chamber 15 is the annular enlargement 30 communicating through ports 31 with the chamber 16. Also, in the wall of the chamber 15 are ports 32 and 33 communicating with the chamber 17. Between the ports 30 and 33, the wall of the chamber 15 is somewhat enlarged to present the annular chambered portion 34. Extending through the wall of the chamber 15, in the position shown, are ports 35 communicating with the chamber 16. In the opposite ends of the chamber 15 and communicating therewith through ports 36 and 37, respectively, are electric igniter-plugs 38 and 39, each containing a suitably insulated resistance wire or element, 40 connected at one end with an electric conductor-wire 41, and grounded at the opposite end in the casing 12. On the handle 14, in the position shown, is a suitably insulated electric contact 42 from which the other wire 43 of the electric circuit extends. On the thumb-lever 22 is a contact 44 adapted to engage the contact 42, when the lever is pushed forward against the resistance of a spring 45, to open the valve 21.

46 is a piston provided near opposite ends, respectively, with radial ports 47 communicating with end-ports 48 and radial ports 49 communicating with end-ports 50. At the center of the piston 46 is an annular enlargement 51 fitting and sliding in the enlarged part 34 of the chamber 15, while the piston at opposite sides of the enlargement

51 fits and slides in the annular walls of the opposite end-portions of the chamber 15, as shown. In the piston, toward its opposite ends, in the positions shown, are radial ports 52 and 53 communicating with longitudinally-extending passages 54; and extending through the enlargement, or piston-head, 51 are ports 55 also communicating with the passages 54.

10 The handle 14, as before stated, is connected at 20 to the end of a flexible hose which forms a conduit leading thereto from a compressed air-supplier. Interposed in the conduit is a suitable carbureter, or gas-mixer, which it is not thought necessary to illustrate, and which mingles gasoline vapor or gas with the compressed air to produce an explosive mixture.

Assuming the piston 46 to be in the position shown in Fig. 2, the operation will be as follows: By pressing the thumb-lever 22 inward, the valve 21 is slid to cause the compressed explosive mixture to enter through the passage 19 to the passage 18. At the same time, the contacts 42 and 44 are closed to cause electric current to pass through the resistance wires 40 of the igniters 38 and 39. The compressed fluid in the passage 18 passes through the ports 26 to the annular space 27 and thence through the ports 32, passages 54 and ports 55 to the annular chamber 17. The compressed fluid entering the chamber 17 exerts expansive force against the piston-head 51, thereby moving the piston in the direction to the left in the figures. On leaving the position shown in Fig. 2, all the ports of the piston are blanked, as illustrated in Fig. 3, and the pressure in the chamber 17 forces the piston along to the position shown in Fig. 4, wherein it strikes the end of the tool 13. As the piston nears this latter position, the ports 47 register with the annular chamber or enlargement shown at the inner ends of the ports 32, thus permitting the still somewhat compressed explosive mixture to escape from the chamber 17 and annular space, or chamber, 34 through the ports 47 and 48 into the part 56 of the chamber 15. At the same time, the ports 55 register with the annular enlargement, or chamber, 30, and the ports 53 register with the annular chamber, or enlargement, 25. This causes the compressed explosive mixture to enter from the passage 18 through the ports 24, 53, passages 54 and ports 55 to the annular chamber 30, and thence through the ports 31 to the annular chamber 16. The pressure thus accumulated in the chamber 16 is exerted through the ports 31 and in the annular space 30 against the piston-head 51, with the result of forcing it in the direction to the right in the figures, past the position indicated in Fig. 3 again to that illustrated in

Fig. 2. In this movement, the exhaust-ports 29 are first closed and then the mixture confined in the part 56 of the chamber is compressed; while, when the piston-ports 49 come into register with the annular space at the inner ends of the ports 35, the explosive mixture still under compression in the chamber 16 expands through the ports 35, 49 and 50 into the part 57 of the chamber 15. It will be noted that when the piston reaches one end of its traverse indicated in Fig. 2, the exhaust-ports 28 are uncovered, and when it reaches the end of its traverse in the opposite direction, as shown in Fig. 4, the exhaust-ports 29 are uncovered.

In practice, when the contents 42 and 44 are closed as described, and the electric current thus caused to pass through the resistance wires 40, the latter will soon become heated sufficiently to ignite the explosive mixture when the latter is sufficiently compressed. This heating of the resistance wires requires, say, a second or more of time, during which the reciprocation of the piston, and consequent impacts against the tool 13, will be effected by the pressure of the compressed mixture alone, during each of which operations, it will be understood, fluid pressure is exerted first against one face of the piston-head 51 to move it, say, to the right in the figures, and, at the same time, compress the mixture in the chamber 16 against the igniter at 39; while in the opposite travel of the piston the mixture in the chamber-portion 57 is compressed against the igniter at 38. Consequently, when the wires 40 have become sufficiently hot, the mixture compressed in the final movement of the piston will explode and drive the piston in the opposite direction with comparatively great force. It will be understood, therefore, that in each instance explosive mixture, entering under pressure, exerts said pressure against the piston and is then caused to escape into the end of the cylinder to be again compressed and exploded. As the piston reaches the position indicated in Fig. 2, the exhaust-ports 28 are uncovered to permit the products of combustion to escape from the chamber-portion 57 at the same time that explosive fluid is entering through the ports 50 to scavenge said chamber-portion and fill it with a fresh charge to be compressed. When the piston approaches the position shown in Fig. 4, the exhaust-ports 29 are uncovered and fresh mixture enters through the ports 48 to the chamber-portion 56 to scavenge the same and fill it with a fresh charge.

In each operation, the initial reciprocations of the piston, or hammer, 46 will be effected as stated by the pressure of the incoming fluid alone, producing impacts against the tool 13 of comparatively light

force. This is quickly succeeded by impacts produced by the same pressure supplemented by that of the explosions. This mode of operation is particularly desirable in riveting, whereby heated rivets are first upset by comparatively light impacts and then expanded in the rivet holes under the force of heavier blows.

The compression of the fluid in the end-
 10 portions of the chamber 13 operates to properly cushion the piston at the end of each of its strokes, and, in practice, the explosive mixture and its pressure should be so regulated as to produce the best results. The
 15 ports, passages and chamber-enlargements are, in practice, so proportioned that in each reciprocation of the piston the necessary supply and exhaust of the fluid takes place to cause the tool to work with maximum efficiency; and by means of our improvement
 20 the tool may be satisfactorily operated by fluid under comparatively low compression instead of the high compression employed in the case of purely pneumatic tools. This
 25 saving in the cost of installation of the compressors and cost of their operation greatly outweighs the slight cost of the gas and electric energy necessary for the operation of our improved tool.

30 While we prefer to construct our improvements throughout as shown and described, they may be variously modified without departing from the spirit of our invention, as defined by the claims.

35 Though we have shown and described our hammering implement with an explosion chamber at each end of the piston, by which is meant the opposite sides of the piston-head 51, the explosions for retracting the
 40 piston, and the construction providing for such explosions, may be dispensed with and the retraction of the piston be produced in every instance simply by fluid pressure.

What we claim as new, and desire to secure by Letters Patent, is—

1. In a hammering implement, a tool-carrying casing, a piston therein, means for reciprocating the piston by fluid under pressure, including an expansion chamber in
 50 which the fluid operates against the piston from one direction, an explosion chamber in the casing into which said fluid is exhausted from the expansion chamber and compressed by the piston, and means for causing an
 55 explosion in said last mentioned chamber while the fluid is under compression.

2. In a hammering implement, a tool-carrying casing, a piston therein, means for reciprocating the piston by an explosive
 60 fluid under pressure, including an expansion chamber in which the fluid operates against the piston from one direction, an explosion chamber in the casing into which said fluid is exhausted, from the expansion chamber,

and compressed by the piston, and means for
 65 igniting, in said explosion chamber, the fluid thus compressed.

3. In a hammering implement, a tool-carrying casing, a piston therein, means for reciprocating the piston by an explosive
 70 fluid under pressure, including expansion chambers in which the fluid operates against the piston from opposite directions, explosion chambers in the casing into which said
 75 fluid is exhausted, from the expansion chambers, and compressed by the piston, and means for igniting, in said explosion chambers, the fluid thus compressed.

4. In a hammering implement, a tool-carrying casing provided with an inlet-pas-
 80 sage for explosive fluid under pressure, an expansion chamber and an explosion chamber, ports in the casing for communication between the passage and expansion chamber, and between said chambers, an explosion-
 85 chamber exhaust-port, a piston in the casing movable under force of said fluid to open and close said ports and thereby open and close communication first between the said
 90 passage and expansion chamber and then between said chambers and open and close the exhaust, the piston operating to compress the fluid in the explosion chamber, and
 95 means for igniting, in said explosion chamber, the fluid thus compressed.

5. In a hammering implement, a tool-carrying casing provided with an inlet-pas-
 sage for explosive fluid under pressure, ex-
 100 pansion chambers and explosion chambers, ports in the casing for communication between the passage and expansion chambers and between the expansion and explosion chambers, explosion-chamber exhaust-ports,
 105 a piston in the casing movable under force of said fluid in the expansion chambers to open and close said ports and thereby open and close communication between the said passage and expansion chambers alternately and between said expansion chambers and explosion chambers alternately, and
 110 open and close the said exhausts, the piston operating to compress the fluid entering from the expansion chambers into the explosion chambers, and means for igniting, in said explosion chambers, the fluid thus com-
 115 pressed.

6. In a hammering implement, a tool-carrying casing provided with an inlet-pas-
 sage for explosive fluid under pressure, a
 120 valve for said passage, an operating lever for said valve, an expansion chamber and an explosion-chamber in the casing with
 ports for communication between the pas-
 sage and expansion chamber and between
 125 said chambers, an explosion-chamber exhaust-port, a piston in the casing movable under force of said fluid to open and close said ports, and thereby open and close com-

munication first between the said passage and expansion chamber and then between said chambers, and open and close the exhaust, the piston operating to compress the fluid in the explosion-chamber, and means
5 for igniting the fluid thus compressed, comprising a resistance element in the explosion-chamber, a normally-open electric cir-

cuit communicating with the resistance element, and a circuit-closing contact on the lever.

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