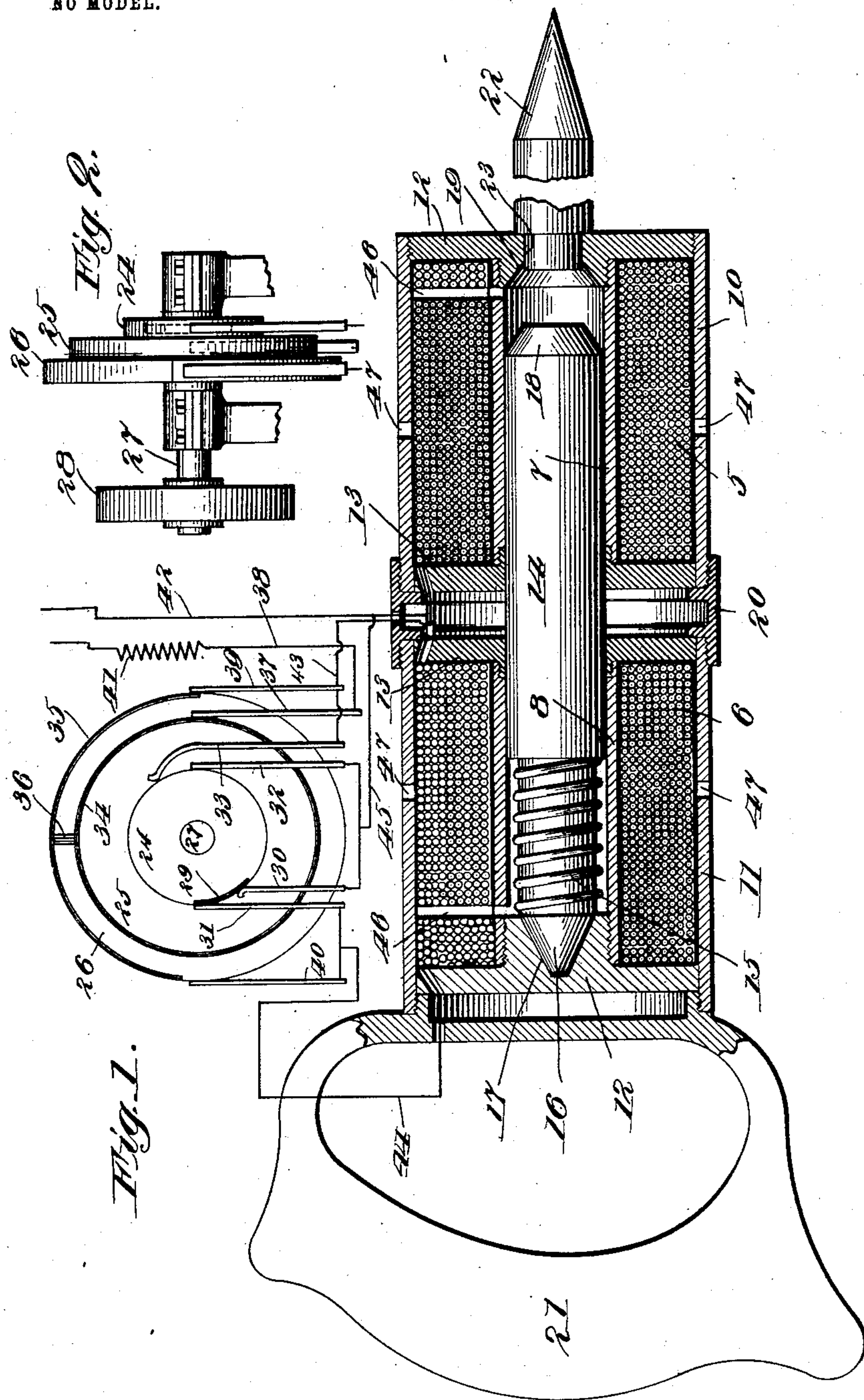


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ELECTROMAGNETIC RECIPROCATING TOOL.

APPLICATION FILED JUNE 8, 1901. RENEWED JULY 18, 1902.

NO MODEL.



Witnesses
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ELECTROMAGNETIC RECIPROCATING TOOL.

SPECIFICATION forming part of Letters Patent No. 720,596, dated February 17, 1903.

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To all whom it may concern:

Be it known that I, CLOYD MARSHALL, a citizen of the United States, residing at Lafayette, in the county of Tippecanoe and State of Indiana, have invented certain new and useful Improvements in Electromagnetic Reciprocating Tools, of which the following is a specification.

This application has relation to reciprocating tools, and particularly to an electromagnetic tool for hammering, chipping, riveting, and similar purposes.

One object of the invention is to provide a commutating device outside of the tool and operating to alternately energize the solenoids by which the tool is reciprocated and automatically and momentarily short-circuit each solenoid at the instant its circuit is broken to discharge the current in the solenoid due to self-induction.

Another object of the invention is to inclose the plunger entirely within the shell or casing of the tool and provide openings in the casing communicating with the plunger-chamber to permit the circulation of air around the solenoids and to and from the plunger-chamber.

With these and other objects in view the invention consists in the novel construction and arrangement of parts hereinafter described, and illustrated in the accompanying drawings, in which—

Figure 1 is a longitudinal sectional view of the tool, showing the plunger ready to deliver a blow upon the tool. Fig. 2 is a side view of the commutator device.

Referring to the drawings, in which like numerals of reference denote corresponding parts in both the figures, 5 and 6 designate the two axially-alined solenoids, which consist of coils of insulated wire wound on non-magnetic sleeves 7 and 8. Each of the solenoids is inclosed within a shield of magnetic material consisting of the cylinders 10 11 and the outer heads 12 and the inner heads 13, the heads being arranged at the ends of the solenoids and within the cylinders.

The plunger 14, which is preferably made of soft wrought iron or steel, is arranged to

travel within the sleeves 10 11, and its inner end is reduced to receive a spring 15 and provided with a pointed or cone-shaped end 16 to enter a corresponding socket 17 in the head. The outer end 18 of the plunger is reduced to fit a similar socket 19 in the head 12.

The two shielded solenoids are separated from each other mechanically and electrically by a non-magnetic connection consisting of a cylinder 20.

A handle 21 is provided at one end of the tool. At the other end the drill or chisel or hammer or other tool 22 is arranged in an opening 23 in the head 12 to receive a blow direct from the plunger. The solenoids are alternately energized by the operation of the commutating device, so that the retracting-solenoid 6 will carry the plunger back to its retracted position and compress the spring 15, as shown in Fig. 1, whereupon the circuit to solenoid 6 is broken and the working solenoid 5 is energized to carry the plunger forward to deliver the blow, this operation of the working solenoid being preferably assisted by the spring 15. The commutating device consists of the disks 24 25 26, mounted on a shaft 27, carrying a belt-wheel 28 and operated in any desired manner. The disks are made of insulating material, and disk 24 is provided on its periphery with a short metal strip 29, with which the brushes 30 31 and 32 33 are arranged to make alternate contact. The disk 25 is provided on its periphery with a continuous metal contact-strip 34, and the disk 26 is provided with a metal contact-strip 35, which extends halfway around its periphery and is connected with the contact 34 on disk 25 by the block 36. The brush 37 is connected with the main wire 38 and is constantly in engagement with the strip 34 on the disk 25, and the brushes 39 40, connected, respectively, with the solenoids 5 and 6, are in alternate engagement with the contact-strip 35 on disk 26. A resistance 41 is provided in one of the main wires. It will thus be observed that one of the main wires is connected with the brush 37 and always in engagement with the constant contact 34, which is in alternate cir-

cuit with the solenoids through the medium
 of the contacts 35 36 and the brushes 39 40.
 The other main wire 42 is connected in cir-
 cuit with each of the solenoids, and the so-
 lenoid 5 is connected by a wire 43 with the
 brushes 39 33, and the solenoid 6 is connect-
 ed by wire 44 with the brushes 40 31. The
 brushes 32 30 are connected by wire 45 with
 the main wire 42. The drawings show the
 workingsolenoid 5 energized, the spring com-
 pressed, and the plunger in retracted position
 and just starting forward to deliver a blow,
 the retracting-solenoid 6 being deenergized
 by reason of the movement of the contact 35
 out of engagement with the brush 40 and into
 engagement with the brush 39 to energize
 the working solenoid. The retracting-solenoid
 is also short-circuited at this time by the
 engagement of the brushes 30 31 with the
 contact 29. When the disks have revolved
 a half-turn, the contact 35 will pass from en-
 gagement with the brush 39 to break the cir-
 cuit to the working solenoid 5 and into en-
 gagement with the brush 40 to close the re-
 tracting-solenoid circuit, the contact-strip 29
 being then in engagement with the brushes
 32 33 to momentarily short-circuit the work-
 ing solenoid at the instant the contact-strip
 35 passes from engagement with the brush 39.
 The plunger is wholly inclosed within a
 chamber formed by the sleeves 7 8, the outer
 heads 12, and the cylinder 20. To permit the
 admission of air to said chamber and its es-
 cape therefrom during the reciprocation of
 the plunger, I provide passages 46, extend-
 ing through the sleeves 7 and 8 and the solen-
 oids and openings 47 in the cylinders 10 11.
 Besides allowing air to escape from one end
 of the plunger-chamber and enter the other
 end thereof as the plunger reciprocates I
 thereby provide a constant circulation of air
 around the solenoids and within the shields
 thereof during the operation of the plunger,
 which to a very large extent reduces the heat
 generated in the solenoids, and thereby pro-
 motes the efficiency of the tool. The open-
 ings 47 may be arranged in any desired posi-
 tion and any number employed; but the pas-
 sages 46 are located approximately at the end
 of the stroke of the plunger in each direction,
 so that the air which is compressed at one end
 may wholly escape and be circulated around
 the adjacent solenoid while air is being drawn
 in through the openings in the shield of the
 other solenoid and around said solenoid and
 into the plunger-chamber to prevent the for-
 mation of a vacuum, this operation being re-
 versed on the return of the plunger and re-
 peated during each movement thereof.
 I have shown in the drawings a plunger re-
 ciprocated by means of two alined solenoids
 and a spring 15 for assisting the working so-
 lenoid in projecting the plunger to deliver the
 blow as being the preferred form of construc-
 tion; but it will be understood that the spring
 may be omitted or it may be otherwise ar-
 ranged and also that other changes in the

form and construction and arrangement of
 parts may be made without departing from
 the spirit or sacrificing the advantages of the
 invention.

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

1. The combination with a plunger and a
 pair of solenoids for reciprocating the same,
 of an external rotary commutating device
 comprising a series of disks of different di-
 ameters and means for operating the same to
 alternately energize the solenoids and mo-
 mentarily short-circuit each solenoid at the
 time its circuit is broken.

2. The combination with a plunger and a
 pair of solenoids for reciprocating the same,
 of an external rotary commutating device
 comprising a series of disks of different di-
 ameters, and means for operating said device
 to alternately energize the solenoids and mo-
 mentarily short-circuit each solenoid at the
 time its circuit is broken, and a spring bear-
 ing upon the plunger to assist one of said so-
 lenoids in moving the plunger, substantially
 as described.

3. The combination with a plunger and a
 pair of solenoids for reciprocating the same,
 of an external rotary commutating device
 connected in circuits with the solenoids, said
 device comprising a series of revolving disks
 of different diameters, and contact devices
 arranged to alternately energize the solenoids
 and momentarily short-circuit each solenoid
 at the time its circuit is broken.

4. The combination with a plunger and a
 pair of solenoids for reciprocating the same,
 of a commutating device connected in circuits
 with the solenoids, said device comprising a
 series of revolving disks, one disk having a
 contact-strip on half of its periphery, another
 disk having a contact-strip entirely around
 its periphery and connected with said pre-
 ceding contact-strip, a short contact-strip on
 another disk, and brushes arranged in the
 circuits to engage said contact-strips as the
 disks revolve to alternately energize the so-
 lenoids and momentarily short-circuit each
 solenoid at the time its circuit is broken.

5. The combination with a plunger and a
 pair of solenoids for reciprocating the same,
 of a commutating device connected in circuits
 with the solenoids and comprising three re-
 volving disks, brushes in the circuits engag-
 ing said disks, and contact devices on the
 disks, one of said devices having a constant
 contact with a main-line brush during the
 whole revolution of the disk, the contact de-
 vice on another disk being connected with
 said constant contact and having engagement
 alternately throughout its revolution with
 brushes in the circuit with the two solenoids
 to alternately energize said solenoids, and an-
 other disk having a short contact device ar-
 ranged to engage brushes in circuit with each
 solenoid at the time said solenoids are deen-
 ergized to short-circuit the solenoids.

6. The combination with a pair of alined solenoids and a plunger arranged to be reciprocated by and through the same, of an independent cylinder surrounding each solenoid, a non-magnetic connection for said cylinders, inner heads for the cylinders at the opposite ends of the solenoids and outer heads adjacent to the outer ends of the solenoids, one of said outer heads being provided with an opening to receive a tool at one end of the plunger-chamber and the other head closing the other end of the plunger-chamber, substantially as described.

7. The combination with a pair of alined solenoids and a plunger arranged to be reciprocated by and through the same, and having a conical end, of a cylinder surrounding each solenoid, a non-magnetic connection between the cylinders, inner heads for the cylinders arranged adjacent to the opposing ends of the solenoids, a cylinder-head at the outer end of one solenoid provided with an opening to receive a tool, and a cylinder-head at the outer end of the other solenoid provided with a conical shaped socket to receive the conical end of the plunger and thereby reduce the air-gap, substantially as described.

8. The combination with a solenoid, of a plunger and means for operating the same through the solenoid, said solenoid being provided with a transverse air-passage leading to the plunger-chamber, substantially as and for the purpose described.

9. The combination with a pair of alined solenoids provided with a centrally-located closed plunger-chamber, of a plunger arranged to be reciprocated in said chamber by the solenoids, and air-passages at the ends of said chamber extending transversely through the solenoids, substantially as and for the purpose described.

10. The combination with a pair of alined solenoids provided with a centrally-located plunger-chamber, of a plunger arranged to be reciprocated in said chamber by the solenoids, air-passages at the ends of said chamber extending through the solenoids, and shields inclosing the solenoids and provided with air-openings arranged out of alinement with said air-passages, substantially as described.

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Witnesses:

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