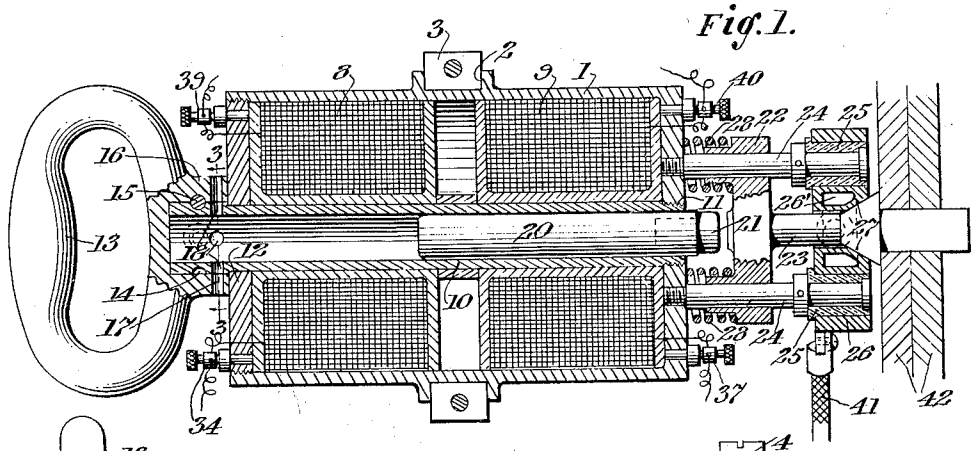
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S. LAKE

ELECTRIC HAMMER

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Fig. 1.



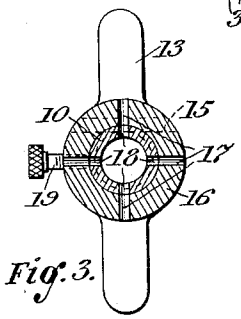




Fig. 3.

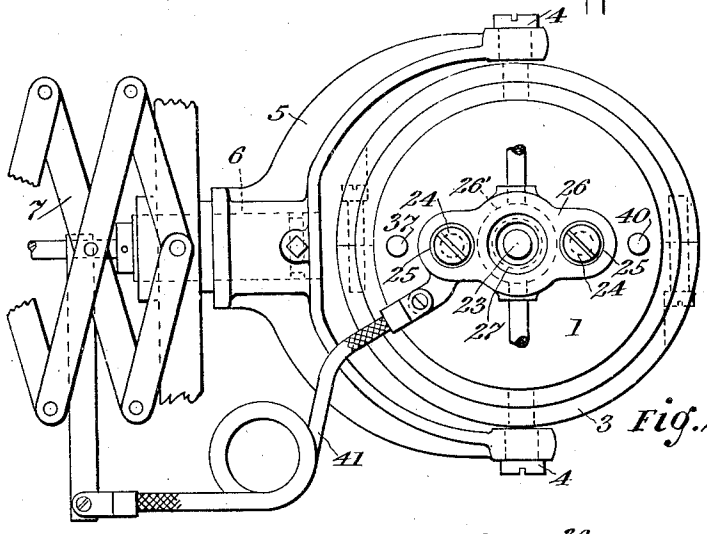



Fig. 2.

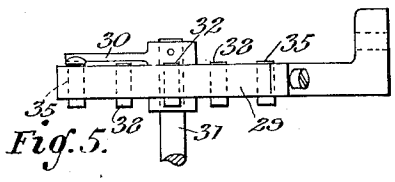



Fig. 5.

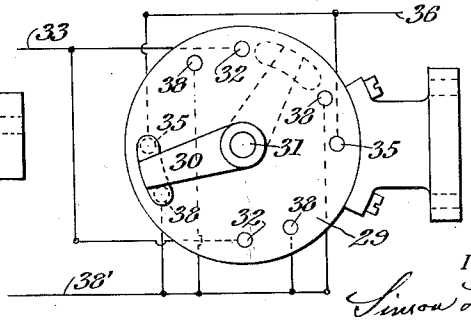



Fig. 4.

INVENTOR

Simon Lake

BY

ATTORNEY.

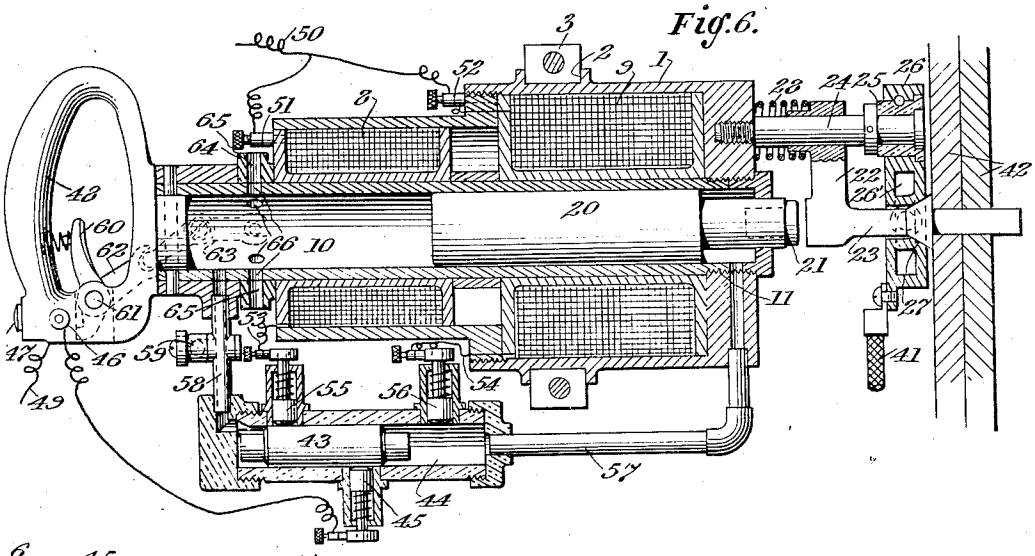
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Fig.6.



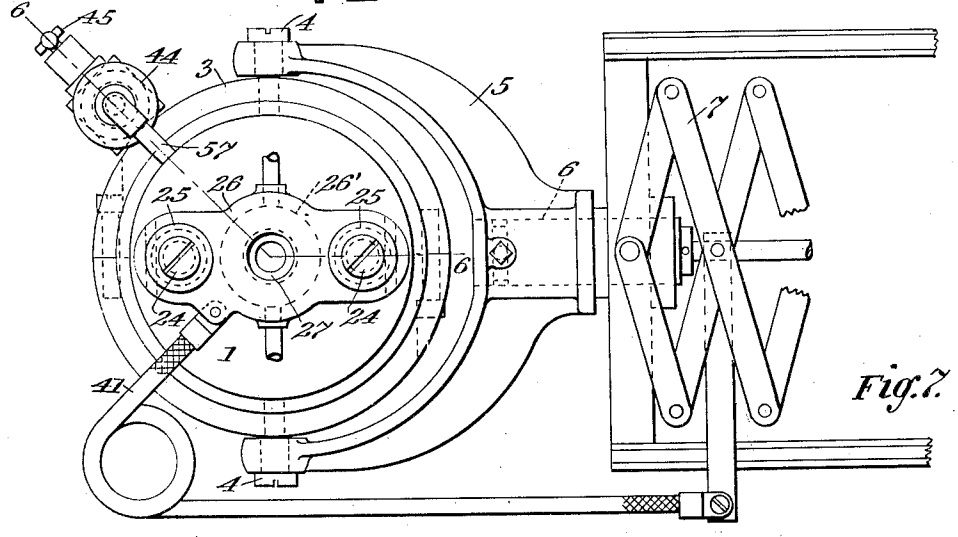




Fig.7.

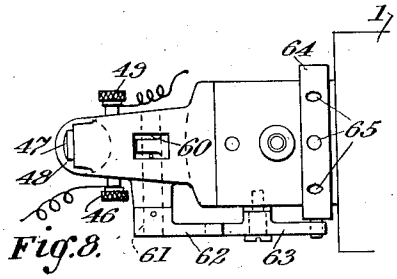



Fig.8.

INVENTOR
Simon Lake
BY
Wm. H. Finnell
ATTORNEY.

Patented Sept. 11, 1923. 1,467,677

# UNITED STATES PATENT OFFICE.

SIMON LAKE, OF MILFORD, CONNECTICUT.

## ELECTRIC HAMMER.

Application filed March 5, 1920. Serial No. 363,514.

*To all whom it may concern:*

Be it known that I, SIMON LAKE, a citizen of the United States, residing at Milford, in the county of New Haven and State of Connecticut, have invented a certain new and useful Improvement in Electric Hammers, of which the following is a full, clear, and exact description.

So far as I am aware, electric hammers are not, as now constructed, suitable or adapted for heavy work, such as riveting, cutting, drilling and the like, where blows of considerable force are required, and where the operation of the hammer must be continued during a somewhat extended period of time.

The principal reason, as I understand it, for the lack of electrically operated hammers for such work, is the fact that, in order to construct such a hammer, its parts and operating mechanism must be of such great weight as to negative its real usefulness. However, with the supporting device of my copending application, Serial No. 342,694, filed December 5, 1919, I am able to support tools of great weight in such manner as to make their manipulation practically as easy as if they were supported by hand, thus making practical the use of electric hammers of sufficient weight and power to perform the desired operations above mentioned.

One object of this invention is, therefore, to produce an electric hammer suitable for heavy work, such as riveting, metal-cutting, stone-chiselling, rock-drilling and the like though it will be obvious from the following description, that its design is capable of embodiment in hammers for lighter work.

Another object is to provide a hammer in which the length and force of the stroke of the power-exerting element may be controlled as may also its rapidity of movement, the return stroke of the element being cushioned as will hereinafter appear.

A still further object is to combine with such a hammer, when it is to be used for rivet-setting, a heating element, whereby the rivets may be heated either previous to or during the hammering operation, or both, and whereby, if desired, they may be shaped to form a head of neat, symmetrical appearance.

The invention consists in an electric hammer provided with a pair of solenoid magnets adapted to be alternately energized to cause a plunger or power-exerting element to be moved backward and forward in a cylinder within these magnets, the stroke of this element being regulated and controlled by a valve which regulates the cushioning effect of air trapped in the cylinder; and it consists further in other cooperating parts and devices, all as I will proceed now to explain and finally claim.

In the accompanying drawings illustrating the invention, in the several figures of which like parts are similarly designated, Figure 1 is a sectional elevational view showing a hammer of one form of the invention in the act of heading a rivet. Fig. 2 is an end view of same looking toward the right-hand end of Fig. 1. Fig. 3 is a section taken in the plane of line 3—3, Fig. 1. Fig. 4 is a semi-diagrammatic view of a distributor for controlling the flow of electric current to the magnets of the hammer. Fig. 5 is an edge view of the distributor. Fig. 6 is a section taken in the plane of line 6—6, Fig. 7, and showing a modified form of the invention. Fig. 7 is a view of the right-hand end of Fig. 6. Fig. 8 is a partial side view of this form showing the controlling devices.

In the form of the invention shown in Figs. 1 to 5, the hammer comprises a casing 1 provided with an annular groove 2 adapted to receive a gimbal ring 3 carried on pintles 4 in a yoke 5 which has a swivelling connection 6 with a supporting arm 7 of the type shown in my copending application above mentioned. As hereinbefore stated, by means of this support the hammer, regardless of its weight, may be easily and freely manipulated.

Mounted within the casing 1 is a pair of solenoid magnets 8 and 9 through the centers of which extends a tube 10 rigidly secured to the casing 1 at one end by suitable means such as screwthreads 11 and its other end extending through the head 12 of the casing and fitted with a handle or grip 13 capable of circumferential adjustment on the tube but held against longitudinal movement thereon by means of a groove 14 and pin 15. The shank 16 of the handle is provided with ports 17 registering with openings 18 in the tube and the circumferential adjustment of the handle with relation to the tube whereby the opening and closing of the ports 17 is effected is maintained by means of a set-screw 19.

Mounted within and in sliding engage-

ment with the tube 10 is the solenoid core or plunger 20 made of suitable magnetic metal and provided with a hard steel tip 21 adapted to strike against an anvil-piece 22 provided with a shank 23 and working on rods or studs 24 attached to the casing 1. These studs are provided at their outer ends with insulating bushings 25 on which is mounted a heating element 26 preferably water-cooled as by chamber 26′ and having a cavity 27 of the shape which it is desired to impart to the finished rivet head. The shank 23 extends into the cavity and the anvil-piece 22 is normally pressed towards the element 26 by springs 28.

Of course, the use of the heating element 26 may be dispensed with, if desired and the hammer used in the ordinary manner.

Referring to Figs. 4 and 5, the distributor comprises a suitably supported disc 29 of insulating material provided with contact pieces arranged in pairs and adapted to be bridged at regular intervals by a rotating member 30 mounted upon a shaft 31 driven by suitable means, not shown. One contact 32 of each alternate pair of contact pieces is connected to a lead 33 which runs to a terminal 34 of the magnet 8, and one contact 35 of each of the pairs of contacts between is connected to a lead 36 which runs to a terminal 37 of the magnet 9. The other contacts 38 of all the pairs are connected to a lead 38′ which runs to one pole of a source of electrical energy, the other pole of same being connected with the terminals 39 and 40 of the magnets 8 and 9 respectively.

It will thus be seen that, in operation, as the rotating member 30 bridges successive pairs of contacts the magnets 8 and 9 will be alternately energized and the core or plunger 20 will be driven back and forth in the tube 10 expending the force of its forward drive upon the anvil-piece 22 through which it is communicated to the rivet or other object operated upon, the length of stroke of the plunger and consequently the force of its blow being regulated by the air cushion formed in the rear end of the tube and controlled by the extent to which the ports 17 are opened by manipulation of the handle 13.

Several hammers of this type may be operated from a single distributor by means of suitable electrical connections therewith, the control of the blows of each being effected by manipulation of its handle to open and close the ports 17.

If it is desired to heat the rivet, current may be supplied to the heater by a cable 41 connected with one pole of a source of electricity, the other pole being connected with the plates 42 to be joined by the rivet, and the current passing through the rivet will heat it.

In the modified form of the invention, shown in Figs. 6 to 8, the main working parts are substantially the same as those just described, but instead of controlling the energizing of the magnets by means of a distributor, I so fashion the tube 10 that air will be trapped therein at both ends and this air is utilized to operate a switch member 43 adapted to be moved back and forth in a cylinder 44 reversely of the motion of the plunger 20.

This switch member 43 always engages a contact member 45 connected with one terminal 46 of a push-button switch 47 mounted in the handle 48; the other terminal 49 of this switch being connected with one pole of a source of electrical energy, the other pole of which is connected with a lead 50 branched to one terminal 51, 52 of each of the magnets 8 and 9 respectively. The other terminals 53, 54 of these magnets are attached to contact pieces 55, 56 respectively with which the switch member 43 alternately makes and breaks contact as it moves back and forth in its cylinder.

Air is conducted from the forward end of tube 10 to the forward end of cylinder 44 by a pipe 57 and from the rear end of the tube to the rear end of the cylinder by a pipe 58 supplied with a check-valve 59 through which air may enter this pipe to prevent the formation of a vacuum behind the member 43.

As in the other form of the invention previously described, the length of stroke and consequent force of blow of the plunger 20 in this modified form are controlled by regulating the air cushion in the rear end of tube 10, but, in this form, the handle 48 is rigidly secured to the tube 10 and is provided with a trigger 60 which through shaft 61, toggle 62 and lever 63 operates a revoluble collar 64 having ports 65 which register with and control the openings 66 in tube 10. It may be desirable to provide a magnet of greater force at the forward end of the hammer than at the rear in order that the plunger may be advanced with greater force than it is retracted, and in Fig. 6 I have shown such arrangement.

It is to be understood that I do not consider my invention as limited to the particular details of construction and arrangement of parts shown, as various modifications and changes may be made without departing from the spirit of the invention or the scope of the following claims.

What I claim is:—

1. In an electric hammer, a casing, a pair of magnets arranged therein in axial alignment, a plunger core arranged axially of said magnets, means for alternately energizing said magnets to move said core backward and forward, means for forming an air cushion behind said core, and means operable to control said cushioning means.

2. In an electric hammer, a casing, solenoid magnets mounted therein, a tube arranged axially of said magnets, means for alternately energizing said magnets, a plunger in said tube adapted to be attracted by said magnets as they are energized, means for forming an air cushion behind said plunger comprising a closure for one end of said tube, and means operable to control the volume of said air cushion.

3. In an electric hammer, a pair of magnets, a tube arranged axially thereof, a plunger slidably mounted in said tube, means for alternately energizing said magnets to alternately attract said plunger and move it backward and forward in said tube, and means for cushioning the backward stroke of said plunger in said tube including means for regulating the volume of air trapped in said tube, said regulating means comprising openings in said tube and a ported member cooperating with said openings and adapted to determine the extent of communication between the interior of the tube and the atmosphere.

4. In an electric hammer, a casing, a pair of electro-magnets arranged therein, a tube arranged axially of said magnets, a plunger core mounted in said tube for reciprocation therein under the influence of said magnets and adapted to compress air at each end of said tube alternately during reciprocation, and means for alternately energizing said magnets comprising a cylinder provided with a reciprocable switch member and a plurality of contacts adapted to be engaged by said switch member, said switch member being reciprocated in said cylinder by the air compressed by said core to alternately make and break the circuits through said electromagnets by engagement with said contacts in timed relation to the reciprocation of said core.

5. In an electric hammer, a casing, pair of electro-magnets arranged therein, a tube arranged axially of said magnets, a plunger core mounted in said tube for reciprocation therein under the influence of said magnets and adapted to compress air at each end of said tube alternately during reciprocation, and means for alternately energizing said magnets comprising a cylinder containing a reciprocable switch member, an electrical contact member in constant contact with said switch member and connected with a source of electrical energy, a pair of contacts electrically connected with the pair of magnets respectively and adapted upon reciprocation of said switch member to alternately energize each of said magnets, and means for conducting the compressed air from the ends of said tube to the ends of said cylinder to reciprocate said switch member reversely of the reciprocation of said core.

In testimony whereof I have hereunto set my hand this 4th day of March, A. D. 1920.

SIMON LAKE.

Witnesses:
GERTRUDE M. LYNCH,
R. M. KEYS.