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UNITED STATES PATENT OFFICE

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ELECTRICALLY OPERATED HAMMER

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10 Claims. (Cl. 172-126)

This invention relates to power operated hammers or like impact tools and particularly to a hammer or like tool operated electrically.

The general object of this invention is to provide a tool of this character wherein an impact element is reciprocated back and forth by means of two solenoids, the current being alternately directed through one or the other of the solenoids by means of a vibrator.

Another object is to provide manually operable means whereby the air gap at the contacts of the vibrator may be increased or decreased to thereby permit a light tapping of the tool or hard and high-speed blows at the will of the operator.

A further object is to provide the handle of the hammer with a trigger controlling the air gap at the contacts of the vibrator.

A still further object is to provide a structure of this character wherein the impact element is entirely free to reciprocate under the action of the magnetizing coils of the solenoids, this vibration of the impact element taking place within a tubular core, the vibrator which controls the alternate energization of the two solenoids being entirely independent of this tubular core.

Other objects will appear in the course of the following description.

Fig. 1 is a longitudinal medial section of an electric hammer, the handle of the hammer being shown partially in section.

Fig. 2 is an elevation of the hammer handle shown in Fig. 1.

Fig. 3 is a section on the line 3-3 of Fig. 2.

Fig. 4 is a section on the line 4-4 of Fig. 1.

Fig. 5 is a plan view of the vibrator and the supporting plate therefor, one of the lugs and the corresponding nuts being in section.

Fig. 6 is an end elevation of the structure shown in Fig. 5.

Fig. 7 is a diagrammatic view of the wiring.

Fig. 8 is a fragmentary diagrammatic view of the vibrator showing the use of condensers for preventing sparking.

Referring to these drawings, 19 designates generally a barrel having its rear end somewhat enlarged, as at 11, and interiorly screw threaded at 12. The barrel is formed with an intermediate open portion 13 at its middle and the barrel on each side of this intermediate portion 13 is formed with longitudinally extending slots 14. The intermediate portion 13, as shown in Figs. 1 and 4, is connected to the forward and rear portions of the barrel by means of the longitudinally extending webs 15. The forward end of the barrel is exteriorly screw threaded for the reception of a

tool guide in the form of a cap and designated generally 16. This tool guide has a marginal flange 17 which is interiorly screw threaded for engagement with the threads of the forward end of the barrel. A shank 18 of a tool extends through the center of this tool guide. The margins of the tool guide are notched at 19 for the application of a spanner wrench thereto. Engaging the internal threads 12 of the barrel is the externally threaded hub 20 of a handle designated generally 21. This handle will be described more specifically hereafter.

Disposed within the barrel and extending from the hub 20 of the handle to the tool guide 16 is a tubular or cylindrical core 22 which is formed with the annular flanges 23. This core is inserted within the barrel so that these flanges 23 define the intermediate chamber 13 of the barrel. Surrounding the end portions of the core forward and rearward of the flanges 23 are the magnet coils or solenoids 24 and 25. These are mounted upon the tubular end portions of the core, as shown most clearly in Fig. 1. Disposed between the rear end of the tubular core and the hub 20 of the handle is a plate 26 having a central forwardly projecting stop 27 which fits within the tubular core, the forward end of this stop being beveled. Disposed within the tubular core is the reciprocable impact element 28, the forward end of which is beveled and which, upon the energization of the solenoid 24, is drawn rearward against the stop 27, and upon the energization of the solenoid 25, is projected forward against the shank 18 of the tool.

Mounted upon the tubular core in the space 13 between the flanges 23 is a flat rectangular plate or base of insulating material 29 which supports the vibrator and the vibrator contacts. This flat support 29 is mounted upon the middle portion of the core by means of the U-shaped band 30, as shown best in Fig. 4. Mounted upon this plate or base 29 is a resilient vibrator 31 having attached to its free end the tungsten tips 32. This vibrator is provided with a weight 33 held in adjusted position upon the vibrator by the set screw 34. Disposed on each side of the free end of the vibrator are two contacts. One of these contacts 35 is adjustable toward or from the vibrator. To this end it has a threaded shank extending through a lug 36 and engaging a fixed nut 37. The shank of the contact may be rotated to adjust it, and when adjusted is held by the lock nut 38. The other contact 39 extends through a lug 40 mounted on a lever 41 pivoted at its lower end at 42 upon the base plate 29. The contact 39 is also

adjustable through the lug 40. By shifting the lever 41, the air gap between contact 39 and the tip of the vibrator may be increased or decreased. The pivot of lever 41 is constituted by the binding screw 42. The lower end of the vibrator 31 is electrically connected to a binding screw 43 and the lug 36 is carried by a metallic bar 44 held to the base 29 by screws and electrically connected to the binding screw 45. As shown in Fig. 7, the vibrator tongue 31 is connected by the binding screw 43 to a negative lead 46. The coil of solenoid 24 is connected at one end by wire 47 to the contact 35 and at the other end by wire 48 to a positive lead 49. The inner end of coil 25 is electrically connected to the contact 39 by wire 50 and its other end is connected by a wire 51 to the positive lead 49. The solenoids, as shown in Fig. 7, are reversely wound. The lever 41 is connected by a link rod 52 to a trigger 53 pivoted at 54 to the handle 21. A spring 55 bears at one end against an abutment 56 and at the other against a cotter pin 57 passing through the rod 52. This spring urges the rod 52 and lever 41 rearward.

It will be seen from Fig. 3 that the handle 21 is hollow and constructed in two sections, one of these sections constituting a cover plate 58 detachably held upon the body of the handle. The trigger has its upper portion disposed within the handle while its lower portion is exposed through a slot 59. Thus the fingers of the operator extend across the face of the trigger. The rod 52 extends through a passage 60 in the upper portion of the handle. The wires 46 and 49 extend into the handle through a bushed opening 61. Extending forward from the forward end of passage 60 is a cable guard 62 which extends over the intermediate portion 13 of the barrel 10. A manually operable switch 63 is mounted on the handle to control the passage of current through the solenoids.

In the operation of this hammer, when current is turned on by the switch 63, the solenoids are energized reversely to each other so that the hammer or impact element 28 is forced alternately in opposite directions and in one direction striking against the shank of the tool and in the other direction striking against the stop 27. The vibrator acts to cause alternations in the direction of current through the solenoids so that the hammer or impact element 28 is reciprocated very rapidly in opposite directions. It will be noted that the vibrator is entirely independent of the core 22. The speed of vibration will be fixed by the mass of the vibrator and the air gap between the contacts. In order to vary the speed of vibration, the trigger 53 is operated to increase or decrease the air gap at the contacts. This will allow either a light tapping on the tool or hard high-speed blows at the will of the operator. This trigger 53 gives instant control of the tool at all times during operation. The plunger or impact element 28 is of case hardened tool steel as regards its ends.

It will be seen that we have provided an electrically operated tool which requires only a minimum of current for its operation. It may be operated directly from an electric welding machine, battery, generator or an electronic or oxide type rectifier, or any other source of current. The slots 14 formed in the barrel keep the coils cool and allow free circulation of air about the coils. The magnetic power produced by the coils is completely insulated by the fibre insulation 64.

It will be understood that in the operation of

this device, the weight 33 carried by the vibrator spring 31 is disposed within the fields of the magnetic coils 24 and 25 when either of these coils is energized. Thus when the coil 24 is energized, the weight 33 and spring 31 will be drawn toward the right in Fig. 5, but as soon as the tip on the spring engages contact 39, the circuit will be completed through the opposite magnetic coil 25 and the magnetic action will draw the weight to the left in Fig. 5. Here again, when the tip of vibrator 21 engages contact 35, the circuit will be completed through coil 24 and again the vibrator will be released and swing toward coil 24 and so on. Of course the instant that the vibrator tip leaves the contact 35 or 39, the current will be broken through the corresponding coil, but the inertia of the weight 33 will carry the vibrator over until it engages with the opposed contact.

While we have illustrated certain details of construction and arrangement of parts, it will be obvious that these might be varied in many ways without departing from the spirit of the invention as defined in the appended claims.

What is claimed is:

1. An implement of the character described, including a central tubular core, two solenoid coils disposed in longitudinally spaced relation around the core but insulated therefrom, a stop at the rear end of the core, a tool having its shank extending into the forward end of the core, an impact element reciprocable within the core by and upon the alternate energizing of the coils, means for automatically alternately energizing said coils, including a forward contact electrically connected with one side of the one of the coils nearest the rear end of the core and a rear contact spaced from the forward one and electrically connected to one side of the coil nearest the forward end of the core, a resilient vibrator disposed between the spaced contacts and including a magnetizable element disposed within the fields of said coils, means for connecting the coils and the vibrator with a source of potential, and manually controllable means for shifting one of the contacts nearer to or further from the vibrator to thus vary the gap between the contacts.

2. An implement of the character described, including a central tubular core, a barrel surrounding the core and spaced therefrom and having an intermediate open portion, the barrel on each side of the intermediate portion having air vents, two reversely wound solenoid coils disposed in longitudinally spaced relation around the core but insulated therefrom and disposed within the slotted portions of said barrel, a handle operatively connected to the barrel, a stop disposed at the inner end of the core and operatively abutted against the handle, a tool guide engaged with the barrel at its forward end and having an opening for the insertion of a tool shank, an impact element reciprocable within the core by and upon the alternate energizing of the coils, a pair of contacts mounted in the intermediate space between the two coils, the rearmost contact being electrically connected to the foremost coil and the foremost contact being electrically connected to the rearmost coil, a vibrator spring having its tip end disposed between the two contacts and carrying a magnetic weight disposed within the fields of the two coils, and means connecting the two coils and the vibrator spring in circuit with a source of potential.

3. An implement of the character described,

including a central tubular core, two reversely wound solenoid coils disposed in longitudinally spaced relation around the core but insulated therefrom, a handle operatively connected to said core, means disposed at the forward end of the core constituting a tool guide and having an opening for receiving the shank of a tool, an impact element reciprocable within the core by and upon the alternate energizing of the coils, two contacts disposed in the space between the coils and exterior to the core, the forward contact being electrically connected to the rear coil, the rear contact being electrically connected to the forward coil, a vibrator spring having its tip end disposed between the two contacts and having a magnetic weight disposed within the fields of both coils, and means for connecting the coils and the vibrator spring in circuit with a source of potential.

4. An implement of the character described, including a central tubular core having two spaced flanges adjacent its middle, a barrel surrounding the core and supported upon said flanges and having openings for the passage of air, a handle having screw threaded engagement with the barrel, a tool guide having screw threaded engagement with the forward end of the barrel and bearing against the forward end of the core and having a central tool-shank-receiving opening, an impact element reciprocable through the tubular core, a stop at the rear end of the tubular core against which the impact element strikes upon its rearward movement, two solenoid coils disposed around but insulated from the tubular core, one of said coils being disposed between the forward flange of the core and the tool guide, the other of said coils being disposed between the rear flange of the core and the handle, said coils being reversely wound, a support of insulating material disposed between the flanges on the core and exteriorly of the core, two contacts mounted on the support in longitudinal spaced relation, the forward contact being connected to the rear coil, the rear contact being connected to the forward coil, a leaf spring constituting a vibrator disposed with its tip end between the contacts, and means connecting the coils and the vibrator spring in circuit with the source of potential.

5. An implement of the character described, including a central tubular core having two spaced flanges adjacent its middle, a barrel surrounding the core and supported upon said flanges and having openings for the passage of air, a handle having screw threaded engagement with the barrel, a tool guide having screw threaded engagement with the forward end of the barrel and bearing against the forward end of the core and having a central tool-shank-receiving opening, an impact element reciprocable through the tubular core, a stop at the rear end of the tubular core against which the impact element strikes upon its rearward movement, two solenoid coils disposed around but insulated from the tubular core, one of said coils being disposed between the forward flange of the core and the tool guide, the other of said coils being disposed between the rear flange of the core and the handle, said coils being reversely wound, a support of insulating material disposed between the flanges on the core and exteriorly of the core, two contacts mounted on the support in longitudinal spaced relation, the forward contact being connected to the rear coil, the rear contact being connected to the forward coil, a leaf spring con-

stituting a vibrator disposed with its tip end between the contacts, a lever carrying the rear contact and pivoted for movement toward or from the opposed contact, and a trigger mounted upon the handle constructed and arranged when pressed to shift the rear contact toward or from the first-named contact.

6. An implement of the character described, including a central tubular core having two spaced flanges adjacent its middle, a barrel surrounding the core and supported upon said flanges and having openings for the passage of air, a handle having screw threaded engagement with the barrel, a tool guide having screw threaded engagement with the forward end of the barrel and bearing against the forward end of the core and having a central tool-shank-receiving opening, an impact element reciprocable through the tubular core, a stop at the rear end of the tubular core against which the impact element strikes upon its rearward movement, two solenoid coils disposed around but insulated from the tubular core, one of said coils being disposed between the forward flange of the core and the tool guide, the other of said coils being disposed between the rear flange of the core and the handle, said coils being reversely wound, a support of insulating material disposed between the flanges on the core and exteriorly of the core, two contacts mounted on the support in longitudinal spaced relation, the forward contact being connected to the rear coil, the rear contact being connected to the forward coil, a leaf spring constituting a vibrator disposed with its tip end between the contacts, a lever carrying the rear contact and pivoted for movement toward or from the opposed contact, a trigger mounted upon the handle constructed and arranged, when pressed, to shift the rear contact toward or from the first-named contact, the handle being hollow, the conductors connecting the coils and vibrator with a source of current passing through said handle, the trigger being pivoted upon said hollow handle, and a switch carried by the handle whereby to control the supply of current to the coils and vibrator.

7. A percussion tool, comprising two coaxially disposed spaced solenoid coils arranged in fore and aft relation in the tool, an impact receiving body at and within the forward end of the forward coil remote from the other coil, a magnetically attractable percussion body arranged for movement along said axis under the magnetic influence of the coils when the same are alternately energized, switching means for effecting the alternate energization of the coils, comprising a forward terminal electrically connected with one side of the aft coil and a rear terminal electrically connected with one side of the fore coil, a current conductor mounted for free vibratory movement between said terminals and adapted to electrically contact the same, the said conductor being adapted for connection with one side of a source of electric potential and being arranged between the coils in position to be acted upon by the magnetic fields of the coils as the same are alternately energized, and the other side of said source being electrically connected to the other sides of the coils.

8. A percussion tool, comprising two coaxially disposed spaced solenoid coils arranged in fore and aft relation in the tool, an impact receiving body at and within the forward end of the forward coil remote from the other coil, a magnetically attractable percussion body arranged for move-

ment along said axis under the magnetic influence of the coils when the same are alternately energized, switching means for effecting the alternate energization of the coils, comprising a forward terminal electrically connected with one side of the aft coil and a rear terminal electrically connected with one side of the fore coil, a current conductor mounted for free vibratory movement between said terminals and adapted to electrically contact the same, the said conductor being adapted for connection with one side of a source of electric potential and being arranged between the coils in position to be acted upon by the magnetic fields of the coils as the same are alternately energized, the other side of said source being electrically connected to the other sides of the coils, and means for changing the gap between the terminals to vary the period of contact of said conductor therewith.

9. An implement of the character described, including a central tubular core, two solenoid coils disposed in longitudinally spaced relation around the core but insulated therefrom, a stop at one end of the tubular core, a tool having its shank extending into the other end of the core, an impact element reciprocably within the core by and upon the alternate energizing of the coils, two terminals carried by the implement for connection with the two sides of a source of electric potential, means electrically connecting corresponding ends of said coils to one of said terminals, and means for automatically alternately energizing said coils, comprising two spaced contacts each of which is electrically connected to the other end of a coil, a vibrator disposed between the spaced contacts for alternate electrical connection therewith and carrying a magnetically attractable element thereon disposed within the fields of the two coils, means electrically connecting the vibrator with the other one of said terminals, the said contacts and coils being arranged relative to the said vibrator so that upon engagement of the vibrator with either terminal

the magnetic field of the coil connected therewith will attract said magnetic element to draw the vibrator into contact with the other terminal, and said magnetically attractable element being adjustable on the vibrator to vary the period thereof.

10. An implement of the character described, including a central tubular core, two solenoid coils disposed in longitudinally spaced relation around the core but insulated therefrom, a stop at one end of the tubular core, a handle coupled with the core at the said end thereof, a tool having its shank extending into the other end of the core, an impact element reciprocably within the core by and upon the alternate energizing of the coils, two terminals carried by the implement for connection with the two sides of a source of electric potential, means electrically connecting corresponding ends of said coils to one of said terminals, and means for automatically alternately energizing said coils, comprising two spaced contacts each of which is electrically connected to the other end of a coil, a vibrator disposed between the spaced contacts for alternate electrical connection therewith and carrying a magnetically attractable element thereon disposed within the fields of the two coils, means electrically connecting the vibrator with the other end of said terminals, the said contacts and coils being arranged relative to the said vibrator so that upon engagement of the vibrator with either terminal the magnetic field of the coil connected therewith will attract said magnetic element to draw the vibrator into contact with the other terminal, said magnetically attractable element being adjustable on the vibrator to vary the period thereof, and manually controllable means operable from the handle for varying the speed of alternate energizing of the coils while the impact element is being reciprocated in the core.

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