



# UNITED STATES PATENT OFFICE

2,628,319

## ELECTRIC HAMMER

Alfred Vang, Carmel, Calif.

Substituted for abandoned application Serial No. 36,337, July 1, 1948. This application May 29, 1952, Serial No. 290,654

4 Claims. (Cl. 310—15)

1

This application is a substitute application for application Serial Number 36,337, filed July 1, 1948 which became abandoned.

This invention relates to an improved form of electric hammer of the general type wherein a core of magnetic material is arranged to oscillate between two alternately excited solenoidal coils.

Electric hammers of this general type are well-known in the art as well as power conversion devices for supplying electrical energy to the two coils in proper fashion.

The hammer of the present invention may be employed with any power conversion and control device.

One object of the present invention is to provide a hammer of the type identified, in which the magnetic structure associated with the stationary magnet coils is magnetically polarized.

Another object of this invention is to provide, in an electric hammer of the type specified, a moving core member which shall be of higher efficiency, both electrically and mechanically, than has hitherto been found possible.

A further object of the present invention is to provide an electric hammer in which a steady magnetic flux is superposed upon the flux produced cyclically in the stationary magnetic circuits of the magnet coils thereof.

Yet another object of this invention is to provide an electric hammer in which the time taken to magnetize the field coils is reduced by imparting to the iron associated with such coils a permanent magnetic flux, thereby reducing the amount of flux additionally required to move the core with a predetermined force.

A still further object of the present invention is to provide an electric hammer in which the moving parts are subjected to less stress, and are less liable to chatter when striking the work.

A yet further purpose of this invention is to provide an electric hammer in which vibration of the moving parts is reduced in degree, so that longer life and less mechanical wear can be obtained.

Other objects and advantages of the device of the present invention will be apparent to those skilled in the art from the following description, and from the drawings hereunto annexed.

In the drawings:

Figure 1 is a cross-sectional representation of an electrical hammer using the improved fixed magnetic structure of this invention.

Figure 2 is a longitudinal cross-sectional view of an improved form of moving core structure, according to this invention, and

2

Figure 3 is an end elevation of the core structure shown in Figure 2.

Referring now to Figure 1, an outside casing 10, of iron or the like encloses the magnets and the moving core 11. At the front end of the casing a structure 12 is provided for retaining therein a tool to receive the blows of the core and to convey the effects thereof to the work to be operated upon. The casing is provided with a nose portion 13, acting to retain element 12 in position. At the rear end, there is provided a barrel 14 and a seat 15, for holding a spring 16. For stopping the movement of the core in a rearward direction there is provided a core stop 17, held in a clamp ring 18 and supporting a stop seat 19. These elements do not form an essential part of the instant invention, and therefore may be formed in any other suitable manner, without in any way altering the operation of this invention.

Within the outer casing are held the magnet coils 20 and 21. These coils are fed with electrical energy, alternately, in any convenient fashion, by means not shown here. In accordance with this invention, there is mounted between the two coils a permanently magnetized ring 22 presenting a north pole upon one side, and a south pole upon the other side thereof. The direction of this polarity preferably accords with the temporary magnetic poles protruded when the coils are, in turn, energized by the main power supply. This ring magnet may be formed of any suitable material, such as, for example, one of the lately discovered magnetic alloys which provide very powerful fields of magnetic force. Alternately, it is possible to substitute for this ring an electromagnet of generally similar shape. However this substitution would also demand the provision of a source of continuous direct current for the excitation thereof, would cause a dissipation of energy, and a production of undesired heating effects, so that the use of a permanent magnet is preferred at this point.

The operation of a hammer as just described presents several advantages. The permanent magnetic flux, yielded by the ring magnet, will prevent the need of allowing the magnetic structure of the fixed electromagnet to become completely de-magnetized, thereby causing a saving of the electrical energy needed to actuate the core. Furthermore, when both main magnets are at any instant de-magnetized, the core will be under a force tending to move it towards the central position, even before the main magnet which is next to be energized has actually received a pulse of current. Therefore the core

3

has already overcome the inertia of a resting position, and is endowed with a certain amount of kinetic energy, additional to that which it receives from the main magnet excitation. This action may be considered somewhat analogous to the increased efficiency of the telephone receiver, employing a permanent magnet in addition to the varying flux due to the actual speech currents.

Reference is now made to Figures 2 and 3, which show the core as divided into two sections 30 and 31, each formed of magnetic material, such as iron. These two sections are mechanically joined together by an intermediate section 32, formed of any suitable non-magnetic material, affording sufficient mechanical strength and rigidity, such as copper, for example. The mechanical fastenings between these three parts may be by any suitable means, such as brazing, or by internal threading, or the like. In Figure 3 are clearly seen the laminations 33 which extend radially from the center portion of the core.

The form of core structure just described possesses many advantages over the conventional one-piece homogenous core of the prior art. The natural vibratory period of a single relatively large piece is broken up by the division thereof into two sections, having therebetween a material possessing an entirely different vibratory period. When the core strikes upon the tool, not only is there set up a much lower degree of vibration, thereby greatly lessening the tendency of the core to chatter against the tool, but also the mechanical shock occurring upon striking is greatly lessened. This latter advantage flows from the fact that the coupling section 32, tends to absorb a very considerable amount of the kinetic energy of the rearward section 30, of the core. The intermediate section should be formed of material which can absorb energy in this fashion without thereby being substantially deformed or distorted. This feature of the device of this invention also reduces wear upon the striking head of the core and upon the face of the tool with which it comes into violent contact at each blow, and substantially completely eliminates the chipping effects which often occur with cores of the type of the prior art.

The core just described presents yet further advantages. By the division of the magnetic mass into two sections, magnetically isolated from one another by the purely mechanical coupling of non-magnetic material, only one half of the core has to be saturated with magnetic flux, to secure movement in each direction. This greatly reduces energy consumption by the hammer.

Still an additional advantage of the core shown derives from the employment therein of laminations, as shown. Losses due to eddy current effects are reduced, and de-magnetization occurs in an easier and quicker fashion, due to the subdivision of the lines of magnetic force.

4

While there have been herein shown and described certain embodiments of my invention, it is to be understood that many variations thereof will be apparent to those skilled in the art. Therefore, what I claim and desire to secure by Letters Patent of the United States is defined and limited only by the scope of the hereunto appended claims.

I claim:

1. An electric hammer including two fixed solenoids, means for alternately exciting said solenoids, a ring magnet located between said solenoids and producing a permanent field of magnetic force, two cores of magnetic material slidable through said ring magnet and into each solenoid in turn, and a ring of non-magnetic material of a diameter not greater than said cores, and located therebetween, so as rigidly to mechanically couple them together into a single blow-delivering element, but at the same time dividing them into substantially independent magnetic units.

2. An electric hammer according to claim 1, in which said cores are provided with radially extending slits, whereby they are longitudinally laminated, and whereby electrical and mechanical efficiency in the hammer are increased.

3. In an electric hammer of the type employing a core oscillating between alternately excited magnet coils, a core formed in three sections, the two end sections being of magnetic material, and the central section being of non-magnetic material, and a ring magnet of substantially fixed polarity intermediate of the said coils and surrounding the central section when the core is about mid-way between the extreme positions of oscillation, whereby magnetic and mechanic efficiency are increased.

4. An electric hammer including two fixed solenoids, means for alternately exciting said solenoids, a magnet located between said solenoids and producing a permanent field of magnetic force, two cores of magnetic material slidable through said magnet and, in turn, into each solenoid, and a portion of non-magnetic material of a diameter not greater than said cores, and located therebetween, so as rigidly to mechanically couple them together into a single blow-delivering element, but at the same time dividing them into substantially independent magnetic units.

ALFRED VANG.

#### REFERENCES CITED

The following references are of record in the file of this patent:

#### UNITED STATES PATENTS

Number	Name	Date
458,872	Van Depoele	Sept. 1, 1891
519,662	Carpenter	May 8, 1894
1,120,414	Schoolfield	Dec. 8, 1914