Dec. 24, 1940. S. BERMAN 2,225,967

ELECTRIC HAMMER

Filed May 5, 1938 2 Sheets-Sheet 1

Fig. 1

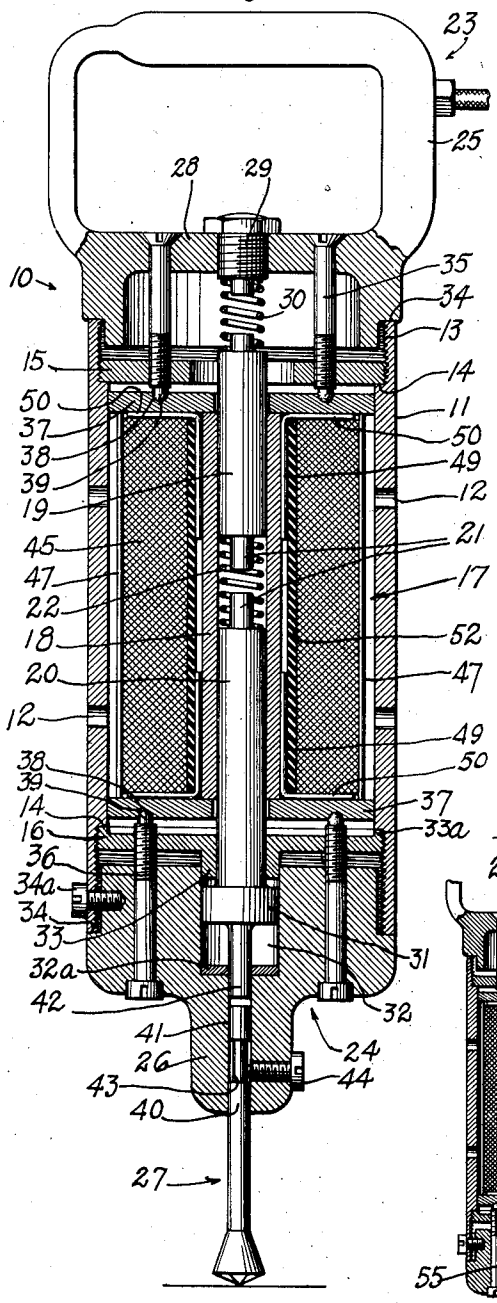


Fig. 2

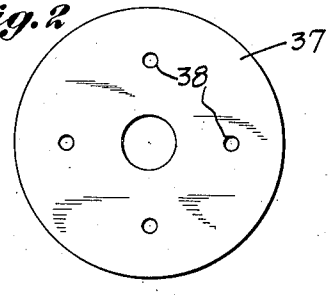


Fig. 3

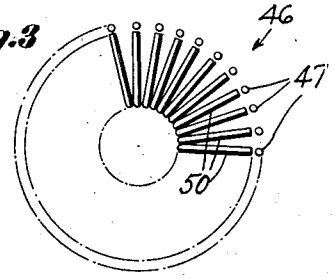


Fig. 4

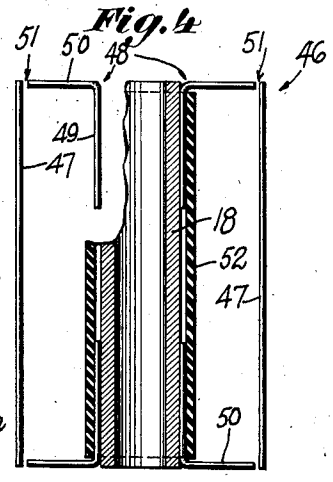
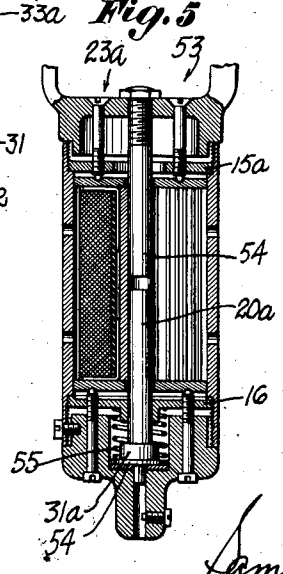


Fig. 5



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Fig. 6

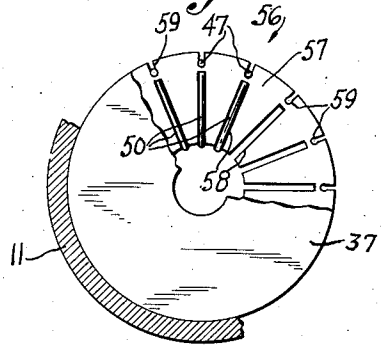


Fig. 7

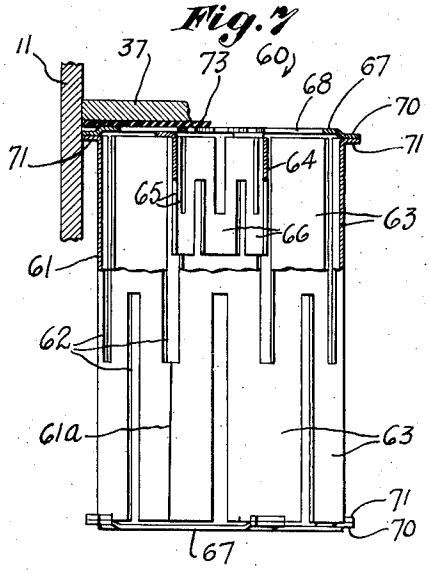


Fig. 9

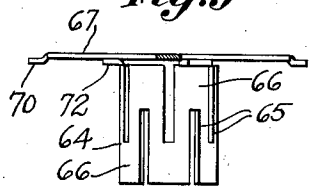
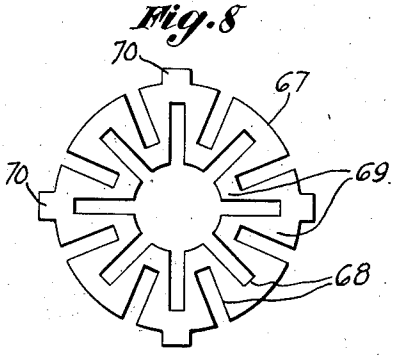


Fig. 8



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UNITED STATES PATENT OFFICE

2,225,967

ELECTRIC HAMMER

Samuel Berman, Bayonne, N. J., assignor to Standard Electric Hammer Co., Jersey City, N. J., a corporation of New Jersey

Application May 5, 1938, Serial No. 206,112

2 Claims. (Cl. 172—126)

This invention relates to electromagnetic devices such as electric hammers.

One object of the invention is to provide a device of the character described wherein a solenoid is provided with improved magnetic shielding means whereby the heavy and bulky plate laminae are eliminated, and the generation of heat avoided; and a supplemental object is to furnish an improved method for accomplishing this result.

Another object of the invention is the provision of an improved electric hammer having improved means to secure the end heads without the loosening action which has heretofore occurred due to the powerful vibration of the hammer.

Another object of the invention is to provide an electric hammer having improved means for securing the solenoid and/or the casing end heads, and to prevent undesired turning, lateral or other movement of the solenoid.

Another object of the invention is to construct an electric hammer having improved means to prevent the tool from accidentally dropping out, while permitting free power reciprocation of the tool without strain of said means.

A further object of the invention is the provision of a device of the nature set forth having few and simple parts, and which are inexpensive to manufacture and assemble, and the device being small, compact, light in weight, and durable, reliable and efficient in use.

Other objects and advantages of the invention will become apparent as the specification proceeds.

With the aforesaid objects in view, the invention consists in the novel combinations and arrangements of parts hereinafter described in their preferred embodiments, pointed out in the subjoined claims, and illustrated in the annexed drawings, wherein like parts are designated by the same reference characters throughout the several views.

In the drawings:

Figure 1 is a view in longitudinal section showing a device embodying the invention.

Fig. 2 is a view of an end plate.

Fig. 3 is a top plan view of the solenoid shielding means.

Fig. 4 is a schematic elevational view thereof with parts of the solenoid and plunger passage removed and with certain parts of the latter in section.

Fig. 5 is a sectional view on a reduced scale of a modified device embodying the invention, with a part of the solenoid and its shielding means in elevation.

Fig. 6 is a fragmentary plan view showing an improved means for mounting the wire elements.

Fig. 7 is a view in elevation showing a modified embodiment of the principle of the wire elements, with a part in section.

Fig. 8 is a top plan view of one part of the same.

Fig. 9 is a view in side elevation showing one section of the same.

The advantages of the invention as here outlined are best realized when all of its features and instrumentalities are combined in one and the same structure, but, useful devices may be produced embodying less than the whole.

It will be obvious to those skilled in the art to which the invention appertains, that the same may be incorporated in several different constructions. The accompanying drawing, therefore, is submitted merely as showing the preferred exemplification of the invention.

This invention represents an improvement over my U. S. Patent No. 1,837,197, issued December 22nd, 1931, for Electromagnetic hammers.

Referring in detail to the drawings, 10 denotes a device embodying the invention. The same may include an open ended tubular casing 11 having vent holes 12. The end portions of said casing are counterbored and threaded at 13 up to the annular shoulder 14. Engaged with the threads 13 are the end plates 15 which are disposed within the casing and may be considered to be a part thereof.

Disposed within the casing between the plates 15, 16 is a solenoid means 17 hereinafter more particularly described. Within the solenoid is a suitable metallic tubular member 18 that affords a passage for a plurality of reciprocable plungers 19, 20. The latter have their inner ends undercut as at 21 to form stop portions that are adapted to abut each other on retraction of the plungers. Extending around the stop portions and acting between the plungers 19, 20 is an expandible coil spring 22. The outer end portions of the plungers project through suitable central holes in the plates 15, 16.

Associated with the casing are the end heads 23, 24, the former having a handle 25 and the latter a nozzle 26 for engaging any suitable tool 27. Formed on the head 23 is a disc portion or wall 28 which may be considered an end wall of the casing, and may have an adjustable central screw means 29 alined with the plunger 19. The

latter and the screw means may mount therebetween an expandible coil spring 30.

Formed on the companion plunger 21 is a cylindrical head 31 which lies in snug fitting relation in a compartment 32 on the head 24. The plate 16 may have an annular lip 33 tightly fitted in the upper end of said compartment and constituting a stop for the head 31 to cause a "kick back" for rapid projection of the power plunger 20. It will be noted that the operation of the stop head 31 and of the plungers and their springs 22 and 30 is in principle the same as described in my patent above mentioned. A cushioning gasket 32a of soft metal, leather or the like may be provided in the chamber 32 for the head 31.

Heretofore the end heads have been directly threadedly connected to the casing 11, but this arrangement has caused excessive strain on the threads and consequent loosening of the heads due to the powerful vibration of the hammer. According to the present invention, the plates 15, 16 are directly threaded to the tubular casing and seat snug against the shoulders 14 thereof. The heads 23, 24 merely have abutment with the ends of the casing 11, as at 34, and are free of the threads 13. To secure the heads to said casing, the screws 35, 36 are utilized, the former passing through the wall 26 and being threaded into the plate 15, while the latter pass through the heavy shock absorbing head 34 and are threaded into the plate 16.

Difficulty had been heretofore encountered in that the solenoid tended to turn and move laterally, axially or both. According to this invention, the screws 35, 36 pass through their respective plates 15, 16 and clampingly or otherwise engage the end rings or non magnetic walls 37 of the solenoid means 17. Preferably the members 37 are formed with recesses 38 and the screws 35, 36 have undercut end portions 39 that snugly fit in said recesses to prevent turning and lateral movement of the solenoid means and to endwise securely support the same at a plurality of points. If desired, the parts 39 of the screws may have wedging engagement in the recesses for a yielding or adjustable end engagement.

Thus it is perceived that the same means which is utilized to secure the end heads 23, 24 to the casing in an improved manner also reliably fixes the solenoid means in position.

Desirably a small clearance space may be provided between the plates 15, 16 and the solenoid end walls 15 as shown. If necessary, the plate 16 may have an annular lip 33a to seat on its shoulder 14. A set screw 34a may lock the head 24 to the casing to prevent turning of the head and straining of the screws 36.

A difficulty had been encountered in that the tool frequently fell from the hammer when lifted from the work. According to the present invention, the shank 40 of the tool 27 is received in a guide passage 41 of the nozzle 26, which also receives a projecting impact portion 42 of the power plunger 20, but the shank 40 is formed with a longitudinal, preferably annular groove 43 in which there may engage a removable set screw 44. The length of the recess 43 is preferably such as to afford ample clearance for reciprocation without impact on the set screw, whereby excessive strain on the latter is avoided.

Frequently it has been found that dust would settle in the path of the power plungers of electric hammers and seriously interfere with their operation. According to the present invention, the parts 16, 24, 31 and 42 interfit so snugly that practically no dust can enter. In other words, the power plunger forms a plug-like closure, whereas heretofore hammers of this type generally afforded central passages through which dust could readily enter the plunger passages.

The solenoid means 17 will now be described. The same includes any suitable winding 45 and is preferably operative by both D. C. and A. C. currents. When the solenoid is worked by A. C. current, considerable heat is generated, the dissipation of which cannot be effectively accomplished by ventilation, and has heretofore presented a problem. In commercial electromagnetic hammers, it is customary to use plate laminae surrounding the solenoid, but these greatly add to the weight and bulk of the hammer and constitute a drawback in a portable device. For instance, such laminations increase the diameter of the hammer by approximately one-third. The present invention aims to overcome this difficulty and, in a certain sense, may be considered to be of general application in the electrical art and as involving a new method for electromagnetic shielding.

Briefly described, the solenoid 17 includes shielding means 46 which consists of wire-like elements arranged about the solenoid or along a surface portion thereof in a laminated-like manner. These wire-like elements are set together as closely as possible and are insulated from each other by shellac, Bakelite or other suitable insulation. In cross section, said elements may be of any suitable shape or size, for instance, as small as $\frac{1}{32}$ inch and as large as $\frac{1}{8}$ inch in diameter. The wire shape is desirable because it is very inexpensive to produce, but it tends to limit the diameter to the smaller sizes.

To concentrate the electromagnetic force at a point where it will be most effective, namely, at the central inner region of the solenoid adjacent to the inner ends of one or both of the plungers 19, 20, the shielding means extends along the solenoid passage except at the said central region. In such a case, it is desirable to interrupt the wire-like elements at points outside of said passage. The sleeve 18 is of course nonmagnetic so as to permit normal operation of the plungers by the induction coil. But the plates 37 are desirably of magnetic material to afford a substantial field for magnetic flux. This field at each plate 37 should have an area equal to its thickness multiplied by the circumference of the plunger hole in the plate. The magnetic shielding elements 47, 48 hereinafter described may be insulated from the plates 37 as by enamel coating.

Specifically, the shielding means 46 may include the straight elements 47 secured parallel to the solenoid axis along the outer surface of the winding 45, and may also include the L-shape wire elements 48 at the opposite ends of the solenoid. The elements 48 have their longer arms 49 lying along the solenoid passage, and their shorter arms 50 lying radially along the ends of the solenoid winding. The elements 47 and 48 are interrupted at 51, being insulated from each other at this point. If desired, the elements 47, 48 may lie in like radial planes, but this is unnecessary. As shown in the drawing, the arms 49 lie between the metallic guide sleeve 18 and the insulator sleeve or core 52 of the solenoid.

In operation, the shielding means 46 eliminates magnetic eddy currents, and other losses, and hence prevents overheating. Also the magnetic

force is concentrated at the gap between the ends of the arms 49, and additional shielding is obtained in this manner. These features have been thoroughly tested on an electric hammer that was subjected to a long period of actual industrial use.

In Fig. 5 is shown a modified device 53 embodying the invention, and which is generally like the device 10, except as otherwise stated. Principally, it is noted that one plunger 54 is fixed, being threadedly connected to the plate 15a or the head 23a or both, as shown, to thus provide a rigid core acting as a "kick back" abutment for the power plunger 20a. The head 31a of the latter may have an annular shoulder 54, an expansion coil spring 55 acting between the latter and the plate 16 to project the power plunger after retraction thereof by the solenoid. By locating the spring outside of the solenoid, a large spring of ample power and life may be used.

In operation, the solenoid retracts the plunger 20a so that it strikes the fixed core 54 causing a reaction which sends the power plunger forward to supplement the action of the spring 55.

In Fig. 6 is shown an improved means 56 for mounting the wire elements 47, 48 to expedite the assembling thereof, and said means 56 may be regarded as incorporated in the device 10. Thus a ring plate 57 may be used consisting of a metal or other material which is non-magnetic, that is, unaffected by a magnetic field. This plate 57 may have a series of radial slots 58 which may be open ended, if desired, at the inner periphery of the plate. Disposed beyond the closed ends of the slots 58 and in radial alinement therewith are openings or holes 59 which may be in the nature of open ended slots, of slightly keyhole form, shown somewhat exaggerated in the drawings. It will now be perceived that the slots 58 snugly receive along the plane thereof the arms 50 of the wire elements 48, and the ends of the wire elements 47 may be engaged in the openings 59 as by being pressed or sprung thereinto laterally or axially. The plates 37 will serve to maintain the members 47, 48 and 57 in assembly relation, with the members 57, top and bottom, serving to hold the wire elements in place. If necessary, the plates 57 may be pinched at the open ends of the slots 58 to securely grip the wire elements 47. If desired, a suitable shelf hardening adhesive coating of shellac or the like may additionally interconnect the parts 47, 48 and 57 to facilitate assembling. The means 56 will securely hold the wire elements against dislodgement by vibration.

By making the plate 57 relatively thick, that is, thicker than the wire element 48, the latter and the wire elements 47 can be maintained out of contact with the plates 37 to maintain a desired magnetic field. The sides of the openings 59 may taper very slightly toward the ends of the wire elements 47 to facilitate desired endwise spacing relative to the plates 37.

In Figs. 7 to 9 is shown a structure 60 illustrating a modified form of the wire elements 47, 48 to facilitate assembling of the device 10. The same in general illustrates a sheet metal structure providing a substantial equivalent of the wire elements 47, 48. Thus the wire elements 47 are replaced by a shell 61 having offset slots 62 providing oppositely projecting staggered tongues or strips 63. Centrally disposed in the shell 61 are a plurality of alined shells 64 which replace the arms 49. The shells 64, like those shown at 61, have offset slots 65 affording oppositely projecting staggering tongues 66. In place of the arms 50, a pair of ring plates 67 are provided having radial offset inner and outer slots 68 affording oppositely extending tongues 69. By using relatively thin sheet metal, preferably less than 1/16 of an inch in thickness, the cross sectional area of the different tongues may be quite small. The elements 61, 64 and 67 may be interconnected in any suitable manner, by screws, rivets or by welding. For example, the plates 67 may have outward extending tongues 70 arranged to mate with laterally bent tongues 71 of the shell 60 at the free edges of the latter, and these parts 70, 71 being spot welded together. To afford a magnetic spacing between the elements 61, 67, the tongues 70 may be bent from the plane of the plates 67 toward the element 61. Likewise the elements 64 may have marginal tongues 72 outwardly but also axially bent to contact the elements 67 for spot welding thereto. It will be appreciated that the shells 61, 64 may be struck in the form of plane sheets, and then bent into the cylindrical form as indicated by the split at 61a. Further, it will be perceived that the plates 67, like the arms 50, may be coated at their opposite faces with a suitable material or filler 73, such as shellac, to afford a magnetic spacing from the plates 37 and between the elements 61, 67, especially as the plates 67 are subject to the pressure of the plates 37. If preferred, the coil 45 may itself afford a support for the plates 67 to prevent the same from being pressed into contact with the shell 61. The projections at 70, 71 may form a spacing means with the casing 11, or other spacing means may be used.

Preferably the plates 57 and 67 consist of magnetic material and are of sufficient thickness to afford an ample field for magnetic flux as described for the plates 37. In that event, the wire elements 48 may be insulated therefrom, as by enamel coating, if desired, although such insulation may be dispensed with.

It will be understood that the structures of Figs. 6 to 8 may also be used with the device of Fig. 5 as well as with that of Fig. 1.

If preferred, the plates such as 37, 57 and 67 may consist of laminae; and, further, the wire portions 49 may be replaced by a coaxial series of wire rings or laminae. But the preferred constructions are those herein shown.

I claim:

1. A device including an electric hammer comprising an open ended casing, a solenoid therein for actuating a power plunger, end plates in the casing removably connected thereto, end heads removably engaged to said plates and having abutment with the ends of the cylinder, and means connecting said heads to said plates including screw elements having inward projecting ends, and the solenoid having means having recesses receiving the projecting screw ends so as to secure the solenoid in position.

2. A device including an electric hammer, comprising a solenoid for actuating a power plunger and magnetic shielding means therefor, comprising a plurality of spaced wire-like elements along the outside of the solenoid, a plurality of spaced angle shaped wire-like elements each having an arm extending along the bore of the solenoid and a second arm extending generally radially along an end of the solenoid, and securing means for said elements comprising end plates of non-magnetic material having openings to receive and engage the end portions of said elements.

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