

May 4, 1926.

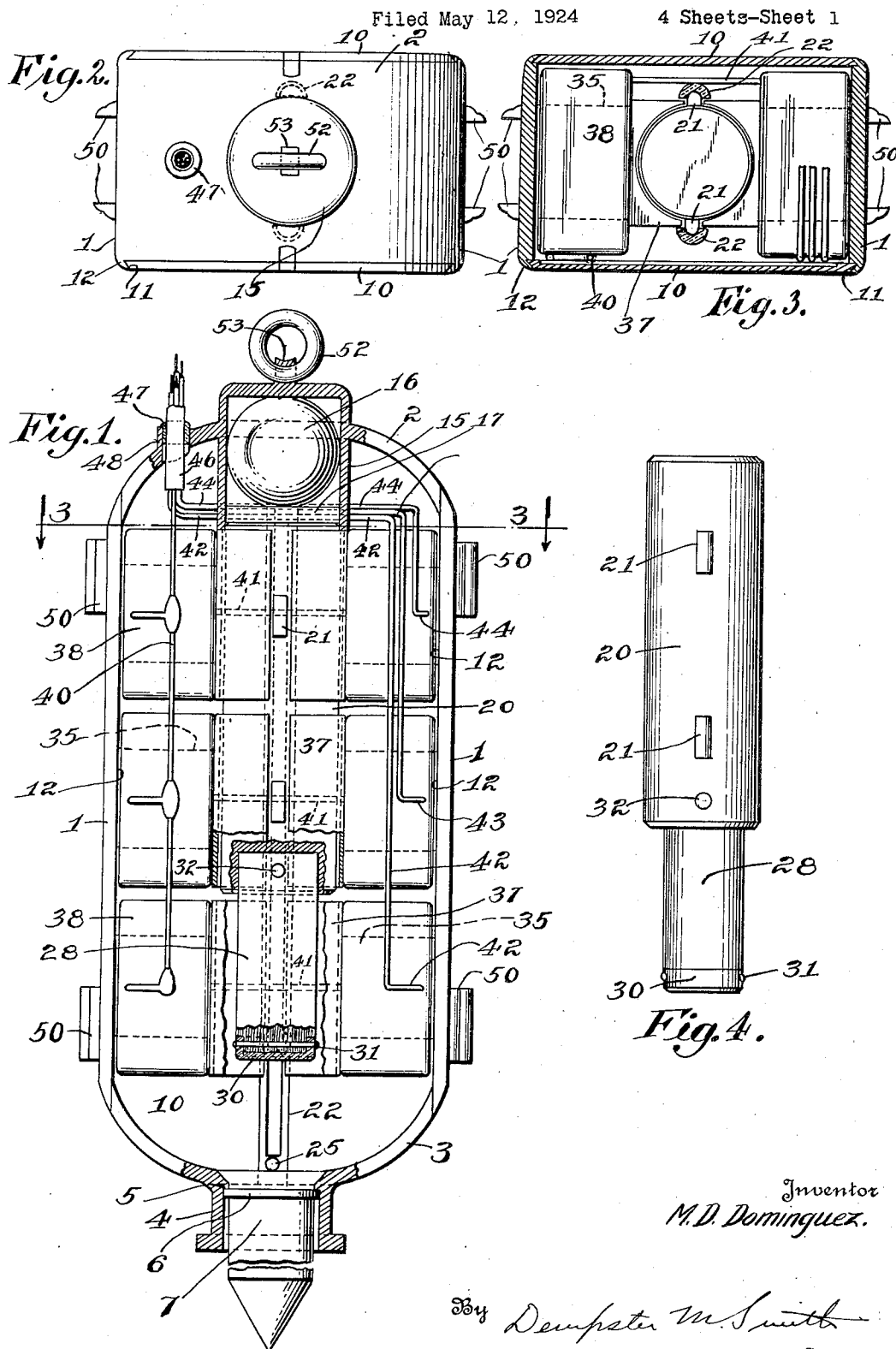
M. D. DOMINGUEZ

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ELECTRIC HAMMER

Filed May 12, 1924

4 Sheets-Sheet 1



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M. D. DOMINGUEZ

ELECTRIC HAMMER

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4 Sheets-Sheet 2

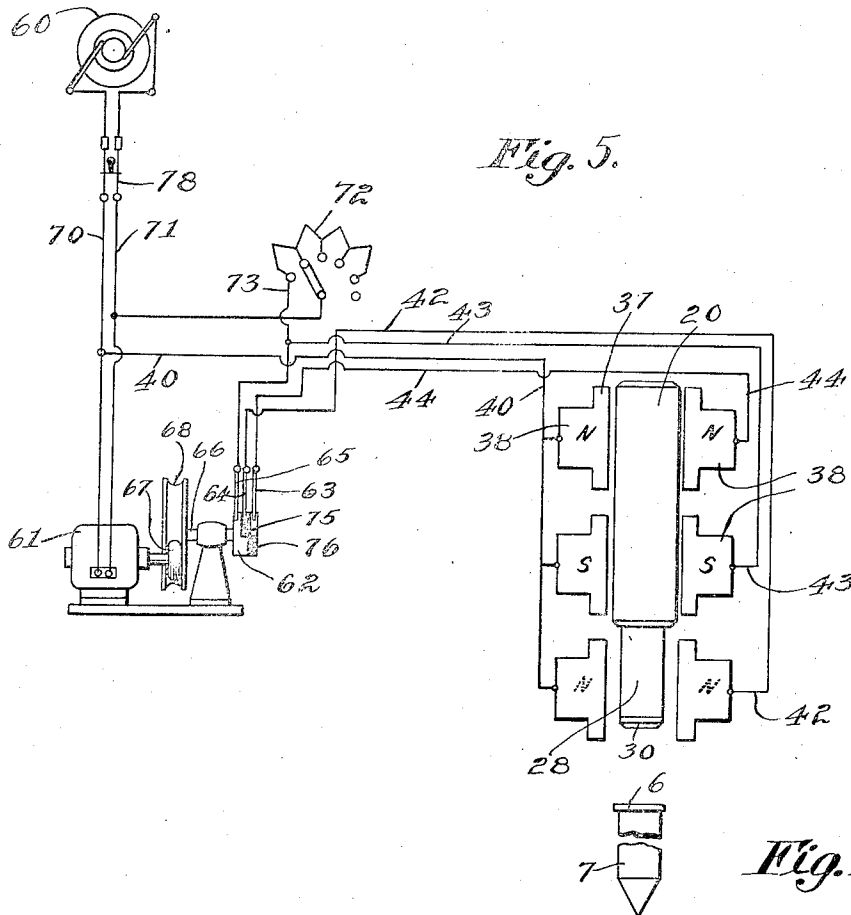
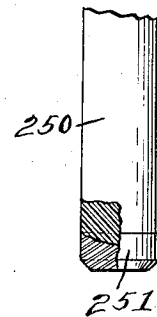


Fig. 14.



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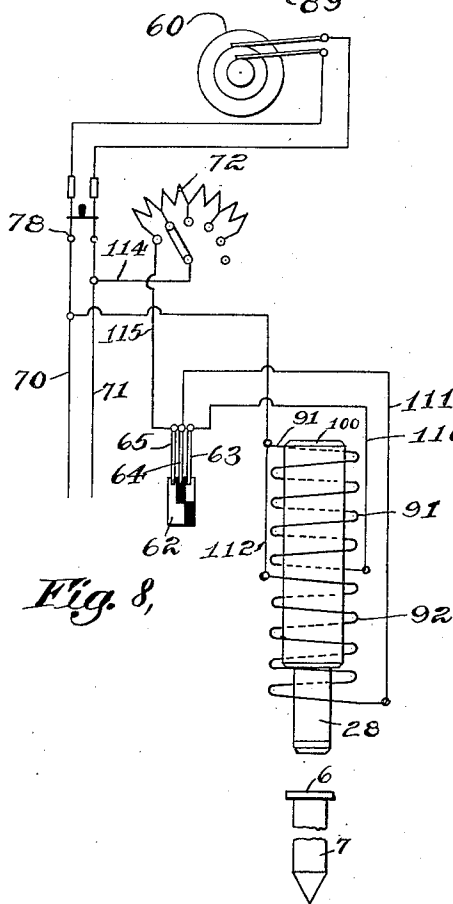
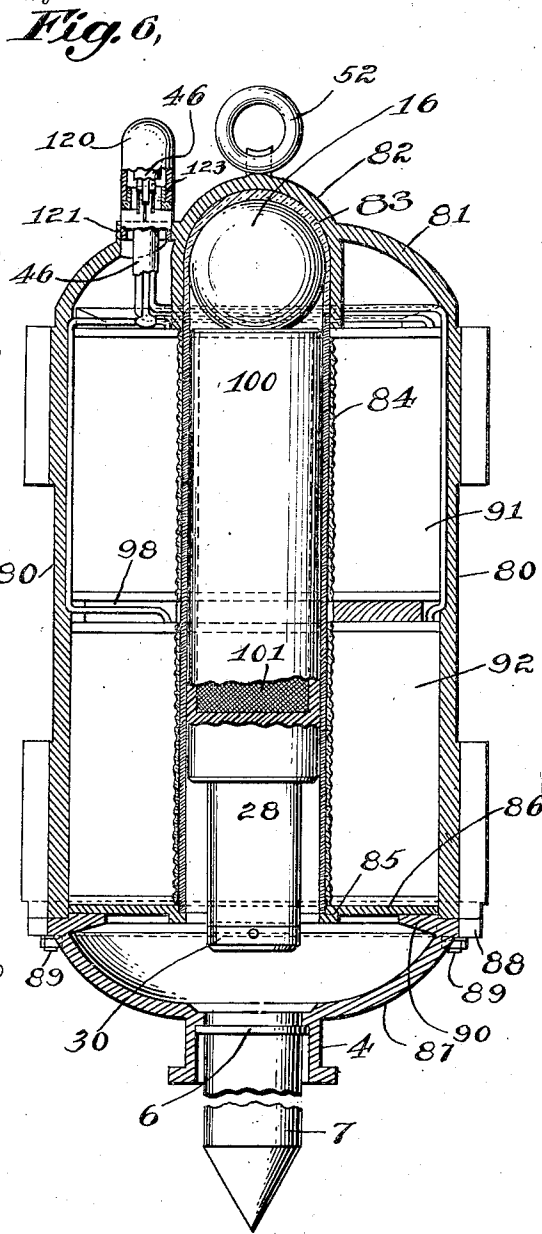
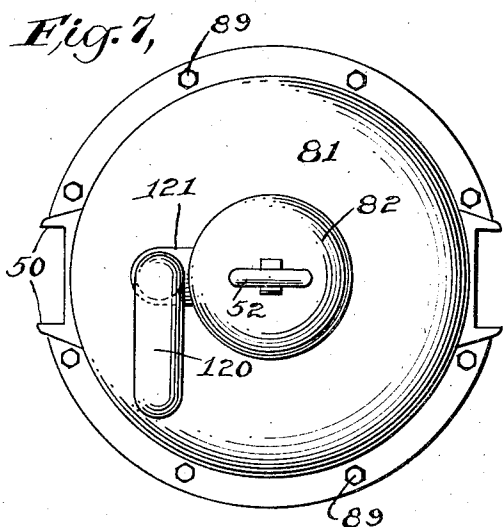
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ELECTRIC HAMMER

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4 Sheets-Sheet 4

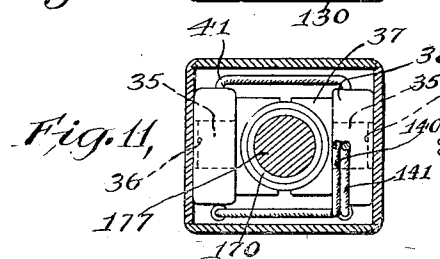
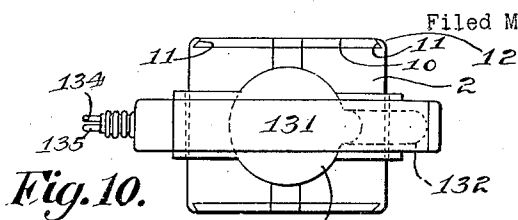
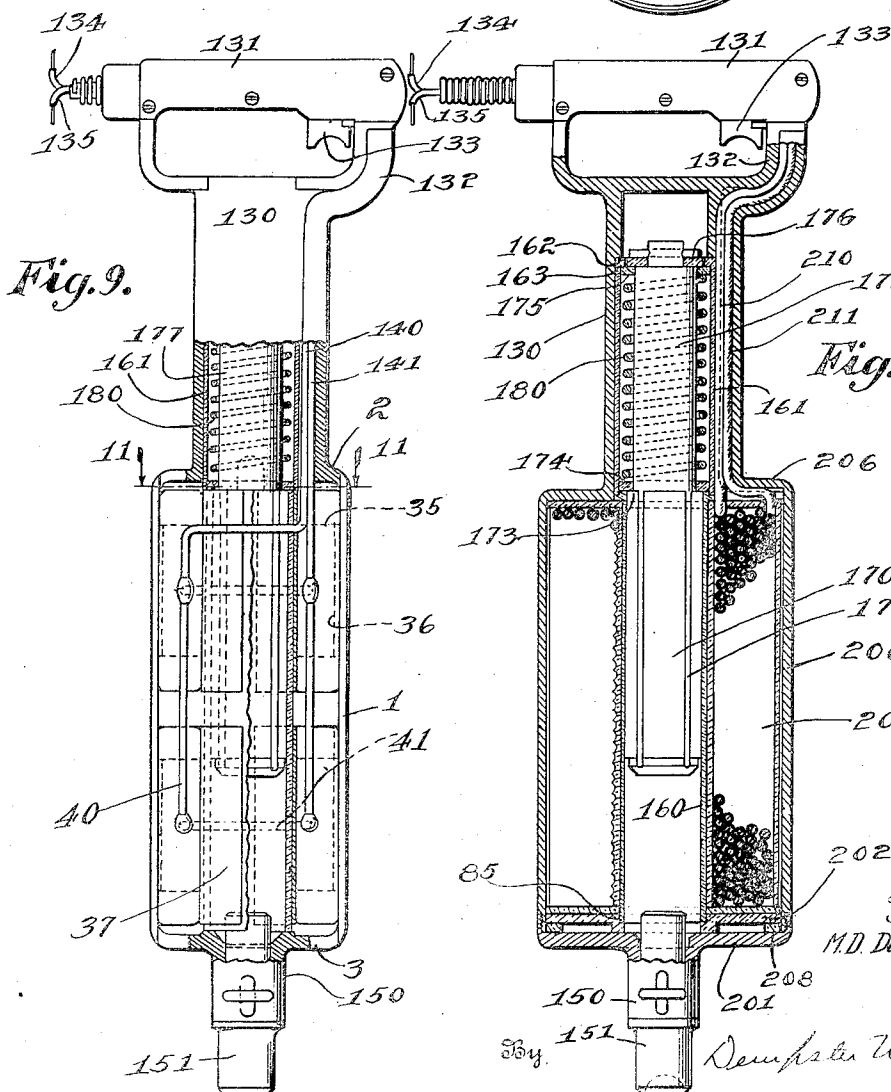
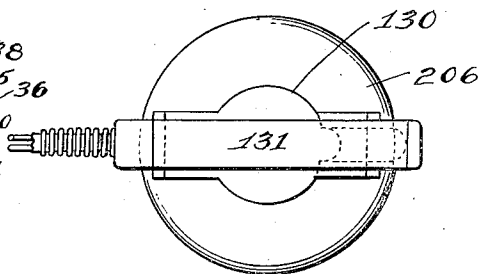


Fig. 13.



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UNITED STATES PATENT OFFICE.

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ELECTRIC HAMMER.

Application filed May 12, 1924. Serial No. 712,732.

To all whom it may concern:

Be it known that I, MANUEL D. DOMINGUEZ, a citizen of Spain, and resident of New Orleans, in the parish of Orleans and State of Louisiana, have invented certain new and useful Improvements in Electric Hammers, of which the following is a specification.

My invention relates to a class of implements or appliances which may be conveniently described as electric hammers, in which a heavy body is rapidly reciprocated by electrical means, and which are useful for hammering, riveting, chipping, caulking and analogous purposes.

The general object of the invention is to provide a tool or appliance of this class which is efficient, durable, easily controlled and is as simple in construction as the desired functions permit, and therefore can be manufactured at moderate cost.

The invention, in the preferred forms chosen for examples, is embodied in tools of types which are described, for convenience, as portable and nonportable, the principal distinction being that tools of the nonportable type, while they are, of course, capable of being transported and arranged for use in different locations, usually require, because of their weight, some supporting or guiding means other than the hands of the operator.

The present structures are similar in many respects to those disclosed in another application for United States Letters Patent, filed by me on April 26th, 1924, Serial No. 709,260, but in many other respects the present structures differ from those of said application, as sufficiently explained hereafter.

An important feature of the present invention is the provision of means external to the electric hammer proper for automatically controlling the hammer reciprocations.

The characteristics and advantages of the invention are further sufficiently explained in connection with the following detail description of the accompanying drawings, which show certain exemplifying embodiments of the invention. After considering these embodiments, skilled persons will un-

derstand that many variations may be made within the principles of the invention, and I contemplate the employment of any structures that are properly within the scope of the appended claims.

Fig. 1 is a view, partly in elevation, with one cover plate removed, and partly in section, of an electric hammer embodying the invention in one form.

Fig. 2 is a top plan of the same.

Fig. 3 is a section at 3—3, Fig. 1.

Fig. 4 is a side elevation of the piston or hammer proper.

Fig. 5 is a diagrammatic view of essential parts of the mechanism of Fig. 1 and of suitable automatic controlling mechanism and circuits.

Fig. 6 is a vertical section of a modified form of the electric hammer.

Fig. 7 is a top plan of the same.

Fig. 8 is a diagrammatic view of essential parts of the hammer mechanism of Fig. 6, and of suitable automatic controlling mechanism and circuits.

Fig. 9 is a view partly in elevation, with one cover plate removed, and partly in vertical section, of another form or modification of the invention, being of the type conveniently identified as a portable hammer.

Fig. 10 is a top plan of the same.

Fig. 11 is a section at 11—11, Fig. 9.

Fig. 12 is a vertical section of still another modified form of the hammer.

Fig. 13 is a top plan of the same.

Fig. 14 is a fragmentary detail view of one form of piston or hammer proper.

Referring first to Figs. 1 to 4 inclusive, which show the invention embodied in the hammer mechanism of relatively heavy or nonportable type,

A main frame or housing is provided, which comprises fixed side plates 1, an upper end plate or member 2, and a bottom end plate or member 3 which terminates in a sleeve 4 having an internal shoulder 5. A plate 6 fits movably within sleeve 4 and the inward movement of the plate relative to the electric hammer mechanism is limited by engagement with a shoulder 5. Plate 6 may be arranged as a part of the hammer mechanism, or in some cases, it may be se-

cured to the top of the post 7 which represents an object being worked on, such as a post or pile; or otherwise the member 7 with its plate 6 might be considered as a tool or working element combined with the hammer mechanism.

The enclosure of the hammer is completed by movable or removable side cover plates 10, which are arranged in the present example, for longitudinal or sliding removal and for that purpose have beveled edges 11, cooperating with guideways or gibs 12, formed at the edges of plates 1.

A chamber or short cylinder 15 is formed in top plate 2. A resilient shock absorbing device in the form of a pneumatic ball 16 is located in the cylinder and below the ball and in contact with it, is a disc 17, usually of metal, having a reciprocating fit in the cylinder. Downward displacement of the disc may be prevented in any suitable way, for instance, by a shallow flange or by pins located near the end of the cylinder.

A piston or hammer proper 20, is arranged in line with the axis of cylinder 15 and sleeve 4 and is guided for reciprocating movement by ears or lugs 21, which have rounded or part-cylindrical ends fitting in channel guides 22. The upper ends of these guides are suitably secured to suitable lugs or fittings which may be formed on the periphery of cylinder 15. The lower ends of the guides fit in suitable sockets in bottom plate 3 and are prevented from downward displacement by pins 25. The hammer may in some cases be substantially in a single piece of iron or other suitable magnetic metal; but preferably, in some cases, as here shown, it comprises the main portion 20 having its lower end formed with a socket in which fits the upper end of a hammer extension 28, which may be non-magnetic metal or a suitable wood, sapota being a suitable wood for use in some cases. The lower end of the hammer extension is provided with a steel cap 30 secured by a pin 31. The extension or member 28 is secured in the socket of hammer 20 by a pin 32. The wooden extension interposed between the main hammer and the part being worked on, such as post 7 or the disc 6, very materially takes up the shock on the hammer without reducing materially the force of the blow.

Suitable electro-magnetic devices are arranged within the casing. In the present example there are three pairs of these devices, those of each pair being oppositely arranged and the pairs being distributed substantially throughout the length of the casing. Specifically, each electro-magnetic device consists of a core piece 35 secured to a seat 36 formed on one of the side walls or plates 1. Each core has a pole-piece 37, the inner face of which is made substan-

tially semi-cylindrical and arranged to fit with suitable clearance around substantially one-half the circumference of piston 20. A suitable solenoid 38 is wound or located around each pole-piece 35.

The solenoids may be connected in any suitable way. Specifically, in the present example, a common conductor 40 has branches connecting it to one end of each solenoid at one side of the casing. The other end of each solenoid is connected by a suitable cross conductor 41 to one end of the other solenoid of the same pair. From the other ends of all of the solenoids at the other side of the casing, suitable conductors 42, 43, and 44, which together with conductor 40 are suitably insulated, go to a point where all of the main conductors 40, 42, 43 and 44 pass through a sleeve or cable covering 46 of suitable insulating material. This sleeve or covering 46 in turn passes through a bushing 47 of suitable insulating material such as rubber or rubber composition, which is inserted in a sleeve in top plate 2.

To assist in supporting or guiding the appliance in some cases or for certain classes of work, pairs of lugs 50 are provided near the upper and lower ends of side plates 1. These lugs are spaced apart to properly cooperate with suitable posts or guides which will direct the hammer toward or in contact with the work. To further assist in handling the hammer by means of a crane or hoist, for example, a ring 52 is provided engaging in an eye 53 formed at the outward end of cylinder 15.

While in some cases automatic controlling mechanism may be incorporated in or as a part of the hammer mechanism proper, and such arrangements are shown in my companion application above referred to, in some cases, and especially in appliances described as of the non-portable type, it is preferred to provide automatic controlling mechanism outside of or apart from the hammer mechanism proper. Figure 5 shows one suitable construction or arrangement of such external automatic controlling mechanism. The source of power may be an alternator, or a direct current generator 60. A motor 61 in circuit with the generator is arranged to drive contact mechanism comprising a distributor 62 and brushes 63, 64 and 65. The distributor is carried by a shaft 66 which may be driven directly by the motor, but since the electric motor will usually run at a higher speed than that desirable for the distributor, the motor is usually connected by a suitable reduction gearing such as the friction wheel 67 mounted on the motor shaft engaging a driving wheel 68 on shaft 66. One of the generator main wires 70 is connected to common wire 40 previously mentioned. The other

main wire 71 goes to the rheostat 72 or other suitable current or voltage regulator. From the rheostat a wire 73 is connected to one of the magnet return wires 43 and is also connected to brush 65. The other magnet return wires 42 and 44 are connected to brushes 64 and 63.

The main periphery or body of the distributor 62 may be of metal, the metal surface in engagement with brush 65 being continuous. The surface in contact with brush 64 is interrupted for one-half of its periphery by an insulated segment 75 and the surface in contact with brush 63 is interrupted by a similar insulated segment 76.

Rheostat 72 being properly adjusted, the main circuit is closed by switch 78. The center pair of solenoids 38 is thereupon energized and this pair remain energized constantly while the tool is in operation. With brush 63 on a conducting part of distributor 62, as shown, the circuit is closed to the upper pair of solenoids 38 to bring the hammer 20 to the upper position as also shown. As soon as the distributor 62 turns far enough to break the circuit of the upper pair of solenoids, the lower pair is energized by brush 64 coming in contact with a conducting part of the distributor, and at the same time the circuit of the upper pair of solenoids is broken in an obvious way. The strong magnetic field established between the magnet poles therefore causes the hammer to reciprocate powerfully and rapidly, the speed of the hammer being regulatable by the speed of motor 61 which may have any suitable speed control (not shown). The return strokes of the hammer are taken up resiliently by the shock absorbing ball 16 which may be of any suitable hollow construction, such as a spherical air bag of rubber covered with canvas or with a composite canvas and rubber structure similar to a pneumatic tire casing. The re-expansion of the ball at about the time the magnet circuit is reversed, materially assists in speeding the hammer on its active stroke.

Figures 6 and 7 show a modification in which the hammer mechanism is assembled in a cylindrical casing 80 having a head 81. Centrally located in the head is a chamber or shock absorbing cylinder 82, and a suspension ring 52 is provided, as in the previous example. The shock absorbing chamber has a liner 83 and a tubular hammer guide 84 extends downward from the end of the liner and has its lower end located in a recess 85 in a plate 86, which fits within the lower end of the casing. The casing end is closed by a cap 87 having an outer flange 88 by which it is secured to the casing by screws or bolts 89. The cap also has an inwardly projecting flange 90 engaging plate 85 and holding it in position.

The hammer guide tube 84 may be of insulating material or may be of a suitable metal such as brass, and in that case it will usually be interrupted circumferentially or slotted longitudinally to avoid interfering with the magnetic flux or to avoid producing any substantial lag effect in the magnetic action.

The electro-magnetic devices in this instance consist of two solenoids 91 and 92 wound on any suitable spools or otherwise arranged or supported. In the present particular example, the upper end of the spool of magnet 91 rests against the lower end of the shock absorber housing 82. A spacer 98 is placed between the two magnet spools and the lower end of the spool of magnet 92 rests against plate 86, so that the magnets are properly and tightly held in position by plate 86 when cap or cover 87 is secured in the manner previously explained.

Cap 87 has an extension 4 to receive a suitable tool, or to enclose a plate or washer 6 for co-operation with a part to be worked on, such as the post 7, substantially as in the previous example. The casing is also provided with spaced ears or lugs 50 to co-operate with upright or guide posts or rails, as in the previous example.

The hammer in this embodiment of the invention includes an upper portion 100 of iron or other suitable ferrous metal and preferably, is made hollow and filled with lead or mercury 101, to increase the effective weight of the hammer. The complete hammer structure also includes a lower portion or extension 28 which may be of wood, provided with a metal end cap 30, as in the previous example.

Suitable automatic controlling mechanism is sufficiently shown, diagrammatically, in Fig. 8. This includes an alternator or generator 60, switch 78, main wires 70 and 71, rheostat 72 and a distributor 62, as in the previous example. A suitably insulated wire 110 leads from the lower terminal of the upper solenoid 91 to contact brush 63. A wire 111 leads from the lower terminal of solenoid 92 to contact brush 64. A common wire 112 leads from the upper terminals of both solenoids to main wire 70. A conductor 114 leads from the other main wire 71 to the rheostat, and the wire 115 leads from the rheostat to contact brush 65. The distributor is, of course, constantly driven when switch 78 is closed by a motor and suitable gearing, as shown in Fig. 5, and the solenoids 91 and 92 are in this way alternately energized in an obvious way to produce the desired reciprocating movement of the hammer.

The shock absorbing arrangement may be similar to that shown in Figs. 1, 2 and 3; otherwise, as particularly shown in Fig. 6, the shock absorbing ball 16, which may be

similar to that described in connection with Figs. 1, 2 and 3, may be retained in place by the partly spherical formation of the liner 83, so that a washer or plate similar to 17 of Fig. 1, may be dispensed with.

The wiring within the hammer proper may be arranged substantially as in Fig. 1, otherwise, the various internal conductors or their common sheath or insulator 46 may pass into an inverted C shaped housing or tube 120, one end of which is secured in a socket 121 formed in housing head 81. The outer downwardly turned end of the conductor tube 120 is provided with a bushing 123 through which the cable or sheath carrying the conductors passes with a tight fit. In this way a substantially weather-proof enclosure or outlet for the wiring is provided. Moisture striking the tubular housing 120 will run off at the inverted free end without any opportunity to enter the tube or the main case of the hammer mechanism.

Figs. 9, 10 and 11 show another modification designed principally as a portable or hand tool in distinction from the heavier or relatively non-portable devices, previously explained.

The main frame or body of the appliance is constructed substantially in accordance with Fig. 1, and similar parts are correspondingly numbered and require no detail explanation. A substantially tubular extension 130, which may be aluminum or brass, projects upward from the main housing head or top plate 2 and a handle 131 is secured to this extension. The extension 130 is welded or otherwise secured to plate 2, and has a lateral extension or tubular chamber 132 to enclose internal conductors. Within the handle is provided suitable hand controlling mechanism for making and breaking the main circuit. This mechanism includes a trigger 133. External main wires 134 and 135 enter one end of the handle and are guided and supported therein, and all of the handle and switch mechanism are in fact substantially as disclosed in my above mentioned companion application to which reference should be made for an understanding of these details.

The electro-magnetic devices are constructed and arranged substantially as explained in connection with Fig. 1 and similar parts bear similar numbers, the principal variation being that in this example there are only two pairs of the electro-magnets, the arrangement of which is clearly understood in Fig. 9 without detail explanation. The solenoids are wired and connected in an obvious way to internal main wires 140 and 141, which pass up through the tubular conduit to switch mechanism in handle 131.

The lower end or bottom plate 3 of the main housing is provided with a tubular extension 150 in which a suitable tool or work-

ing implement 151 is arranged and detachably secured with its inward end accessible to the lower end of the hammer, substantially as shown and described in my above mentioned companion application.

The hammer and its guiding and shock absorbing mechanism are substantially as shown in Fig. 12. These parts include the hammer guide tube proper 160, the upper end of which interfits with a tubular extension 161 extending up into the housing extension 130, where it abuts against a shoulder 162 therein. Tubular extension 161 is provided with a shallow inwardly directed flange 163. The hammer 170 is of generally cylindrical form and is provided with longitudinal channels or else with spaced ribs 172 to engage guide sleeve 160 with a sliding fit. This arrangement provides for free transfer of air past the hammer in its reciprocating movement. At its upper end the hammer is formed with a shoulder 173 engaging the inwardly projecting portion of a ring or washer 174 located in the lower end of the tubular extension 161. A similar ring or washer 175 is located in the upper end of the tubular extension. Its upward movement is limited by flange 163 previously mentioned. This ring 175 also co-operates with a washer 176 secured on the upper end of hammer extension or stem 177, which projects upward from the hammer proper with a sliding fit through washer 174. Around stem 177 is located helical spring 180, the ends of which are in engagement with rings 174 and 175. When the hammer is pulled downward by electro-magnetic force, washer 176 connected to the upper end of stem 177 pulls ring 175 downward, compressing spring 180 against washer 174. When the magnet circuit is reversed or broken, the hammer is returned toward upward position in an obvious way by the combined magnetic and spring action, or if, as in the case of Fig. 12, the magnets are not arranged to return the hammer, it is returned entirely by the spring force. As the hammer reaches the end of its upward travel shoulder 173 strikes ring 174 at practically the same instant that ring 175 engages flange 163, and then the spring is compressed somewhat in the opposite direction to check the return movement of the hammer, and the re-expansion of the spring will aid in speeding the hammer on its next working stroke in an obvious way.

The devices of Figs. 9 and 12 are intended for co-operation with an external automatic controlling mechanism, as well illustrated in Figs. 5 and 8, or in lieu thereof any known or suitable type of thermo-flasher may be employed to control the intermittent energizing of the magnet or magnets or to reverse the magnet circuits in ways that will be obvious to skilled persons, in view of pre-

ceding explanations. Such external automatic controlling mechanism is, of course, brought into action whenever the main circuit is closed by the movement of trigger 5 133 as fully explained in the above identified companion application.

The structure of Figs. 12 and 13 is substantially similar to that of Fig. 9, except for the following particulars: The main 10 casing 200 is cylindrical with an open lower end which is closed by a screw cap 201 in which the tool extension 150 is formed. Within the lower end of the casing is located a plate 202 which is in engagement with 15 the lower end of the single solenoid 204, or a spool in which the solenoid may be wound. The upper end of the solenoid or its spool is in engagement with top plate 206 of the casing. A ring or gasket 208 of rubber or 20 other suitable compressible material is located between plate 202 and cover plate or cap 201 to yieldingly retain the parts in position and exclude moisture in an obvious way.

The conductors 210 and 211 lead from the 25 switch mechanism in handle 131 to the two ends of the solenoid winding. Hammer guide tube 160 has its lower end located in the socket 85 in plate 202 substantially as shown and described in connection with Figure 6. 30

Fig. 14 shows a modified form of hammer in which the hammer body 250 is of suitable magnetic metal such as soft iron, and the cap or tip 251 may be of other metal, such as 35 hard steel, better adapted to stand the wear and tear of impact with a tool or other object. The cap 251 may be welded or otherwise secured to the end of the body 250.

What I claim is:

40 1. In electric hammer mechanism, a hammer comprising a substantially cylindrical body of ferrous metal, a resilient wood extension therefrom, and a metal cap at the striking end of said extension.

45 2. In electric hammering mechanism, a hammer comprising a hollow substantially

cylindrical body of ferrous metal and a loading of heavier metal within the body.

3. In electric hammering mechanism, a hammer comprising a hollow substantially 50 cylindrical body of ferrous metal, a loading of heavier metal within the body, the body also having an extension of resilient material, and a relatively hard cap on the striking end of said extension. 55

4. In electric hammering mechanism, a hammer comprising a hollow, substantially cylindrical body of ferrous metal and a loading of heavier metal within the body, the 60 body also having a wood extension, and a metal cap on the striking end of said extension.

5. Electric hammering mechanism comprising a casing, electro-magnetic means therein, conductors running from said 65 means, a hammer arranged for reciprocation and actuation by said electro-magnetic means, and a protecting conduit of substantially inverted U form secured at one end of the casing, and having its other end free 70 therefrom, said conductors passing through the protecting conduit and emerging at the free end thereof.

6. Electric hammering mechanism comprising a casing, electro-magnetic means 75 therein, conductors running from said means, a hammer arranged for reciprocation and actuation by said electro-magnetic means, and a protecting conduit of substantially inverted U form secured at one end of 80 the casing, and having its other end free therefrom, said conductors passing through the protecting conduit and emerging at the free end thereof, and a bushing of yieldable insulating material in the free end of said 85 protecting conduit to tightly secure the conductors.

Signed at New Orleans, in the parish of Orleans and State of Louisiana, this 30th day of April A. D. 1924.

MANUEL D. DOMINGUEZ.