J. L. DINSMOOR.

ELECTRICALLY OPERATED VIBRATOR.

APPLICATION FILED NOV. 14, 1912.

1,098,893. Patented June 2, 1914.

Fig. 1.

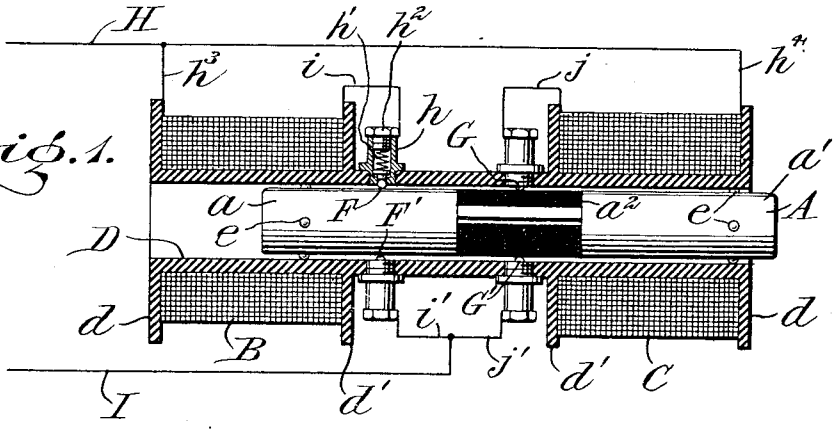


Fig. 2.

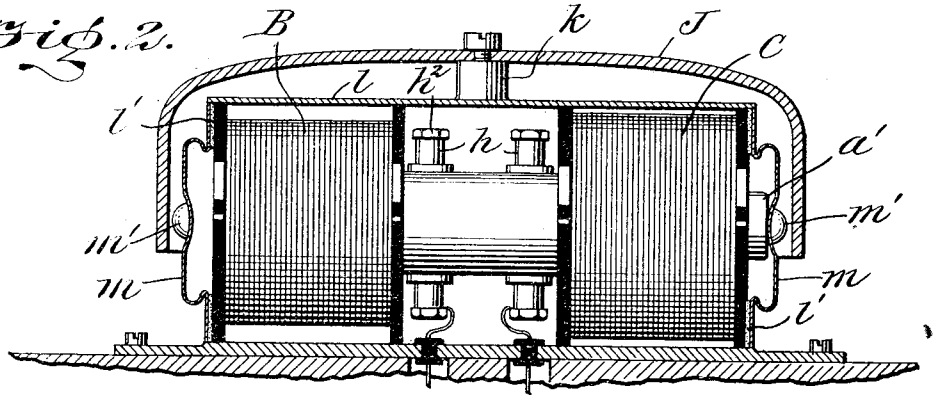
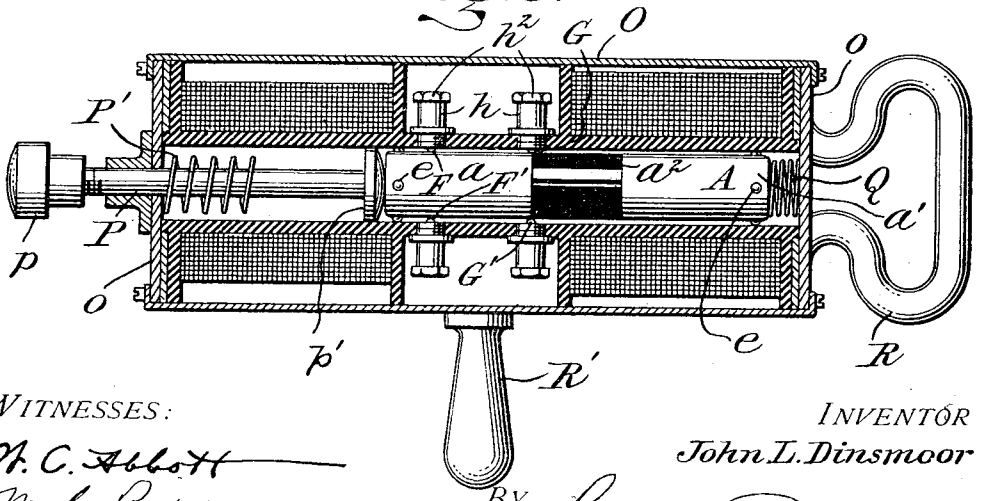


Fig. 3.



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ELECTRICALLY-OPERATED VIBRATOR.

1,098,893. Specification of Letters Patent. Patented June 2, 1914.

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To all whom it may concern:

Be it known that I, JOHN L. DINSMOOR, a citizen of the United States, residing in the city of New York, borough of Brooklyn, county of Kings, and State of New York, have invented a certain new and useful Electrically-Operated Vibrator, of which the following is a specification.

This invention is an electrically operated vibrator adapted for a variety of useful purposes such as for bell and signal purposes, riveters and other instruments or devices to which it is desirable to impart a rapid reciprocating motion.

The objects of the invention are, first, to impart a rapid reciprocation to a plunger without producing a destructive spark; second, to house or incase the working parts in such manner as to effectually protect them from the action of the weather and even allow the device to be submerged in water without resulting in deterioration, and, third, to simplify the construction and effect economy in manufacture.

Broadly speaking, the invention embodies a plunger having an insulating member intermediate soft iron end portions, a plurality of coils within which the plunger is movable, and switch contacts so positioned with respect to the plunger that as the latter moves in one direction or the other the current is shunted first into one coil and cut out of the other in such manner that at no period will the circuit be broken and cause excessive sparking, and a rectilinear reciprocating movement will be imparted rapidly to said plunger.

In a practical embodiment of the invention, one of the coils is of less resistance or possessed of a stronger magnetic field than the other coil, for the purpose of precluding the two coils from exerting a balancing effect upon the plunger, thus resulting in the stronger coil having a greater pulling effect on said plunger than the weaker coil and preventing said plunger from coming to a dead stop between the coils.

When embodied in a bell or audible signal, a spring striker is positioned in the path of the plunger and in an operative relation to the weaker of the two coils, so that the impact of the plunger against the striker will result in a rebound of the plunger tending to give an initial impulse thereto.

The vibrator when used as a riveter or metal upsetter embodies a striking member separate from the plunger and positioned in the path thereof, said striking head being cushioned by a spring. At the other end of its stroke, the plunger contacts with a spring buffer, and thus the reciprocation of the plunger is cushioned in both directions and the two springs operate on the plunger to give a rebound thereto. All parts of the vibrator are incased so that they will not be injuriously affected by moisture or water.

Other features of the invention and the advantages thereof will appear from the following detailed description.

In the accompanying drawings, I have illustrated different practical embodiments of the invention, but the constructions shown therein are to be understood as illustrative, only, and not as defining the limits of the invention.

Figure 1 is a diagrammatic view of the electrically operated vibrator embodying this invention, certain parts being shown in longitudinal section. Fig. 2 is a longitudinal section, partly in elevation, of the vibrating mechanism embodied in an audible signal such as a bell. Fig. 3 is a longitudinal section, partly in elevation, illustrating the vibrating mechanism embodied in connection with parts to produce an electrically operated riveter.

A designates a plunger, herein shown as consisting of soft iron pieces a a' and an insulating piece a^2 positioned intermediate the soft iron pieces a a' and attached in any suitable way rigidly thereto, said parts a a' a^2 constituting a single unitary structure wherein the soft iron sections are spaced and electrically insulated from each other by the intermediate section a^2. The two soft iron pieces and the intermediate insulating section are in axial alinement, and the several parts are united mechanically in any desired way.

B C designate coils within which plunger A is reciprocable. Said coils are wound upon the end portions of a spool or sleeve D composed preferably of fiber or equivalent material, said spool extending lengthwise through the two coils. As shown, the sleeve is provided at its end portions with heads d, and with other heads d' intermediate the ends thereof, each coil being positioned between one end head d and an intermediate head d', and the two intermediate heads being spaced with respect to each other for the accommodation of the contacts. Means

are provided for insuring the free and easy movement of plunger A within the coils; as shown, the metal sections of the plunger are provided with roller or ball bearings e adapted for frictional contact with the walls of sleeve D. The roller or ball bearings support the weight of the plunger within the sleeve D and enable said plunger to travel easily within the coils.

F F′ designate one set of contacts, and G G′ another set of contacts, the two sets of contacts being positioned for electrical engagement with sections a a' of the plunger, respectively. Any suitable form of electrical contact may be employed, but as shown, each contact consists of a metal roller or ball which is seated in one end of a bushing h attached to sleeve D. The contact is pressed into frictional engagement with the plunger by a spring h' seated at its outer end against a head or plug h^2 which is screwed adjustably into the bushing, thereby exerting tension upon the contact. The plug is movable in the bushing for effecting a variation in the tension of the spring, but the main purpose of the spring is to act upon the contact for securing good electrical engagement thereof with the metal part of the plunger.

Current is supplied to the coils by a feed wire H having branch connections h^3 h^4 with coils B C. From coil B extends a branch connection i to contact F, and in a similar way a branch conductor j connects one end of coil C to contact G. The other contacts F′ G′ of the two sets are connected by branch conductors i' j' with a common return wire I.

With the plunger A toward the right, as shown in Fig. 1, contacts G G′ of one set are in engagement with insulated section a^2 of the plunger, whereas contacts F F′ are in electrical engagement with metal section a of said plunger. Accordingly, current flows from conductor H through coil B and thence through conductor i to contact F, across the metal section a of the plunger into contact F′ and by return connection i'' through return wire I to the source of supply. Coil B is thus energized and the magnetic field established thereby acts on section a of the plunger to move the latter toward the left in Fig. 1. During this movement the plunger travels across contacts F F′ and G G′, and as it completes its movement toward the left contacts F F′ are in engagement with insulated section a^2 of the plunger, whereas contacts G G′ make electrical connection with the metal section a' of the plunger just prior to the engagement of contacts F F′ with insulated section a^2, whereby the current is diverted from coil B into coil C for the purpose of energizing the latter, the current flowing in the following path: from conductor H through branch h^4, into coil C, thence through branch connection j to contact G, thence through metal section a' of the plunger through contact G′, and thence through return connection j' by return wire I to the source of supply. The magnetic field of coil C attracts section a' of the plunger to quickly move said plunger from left to right, said plunger thus moving in an opposite direction so as to shift the position of sections a a' a^2 relative to contacts G G′ and F F′. As the plunger moves from left to right contacts G G′ are in electrical engagement with section a', whereas contacts F F′ are in frictional engagement with insulated plunger section a^2 until just before the plunger reaches the limit of its stroke toward the right, at which time contacts F F′ are in electrical engagement with plunger section a prior to the frictional engagement of contacts G G′ with insulated plunger section a^2, thus diverting the current from coil C and sending it through coil B.

From the foregoing description it is apparent that the current is switched from one coil to the other coil, and vice versa, by the reciprocating movement of the plunger, and the operation of switching the current alternately energizes the coils for the purpose of attracting said plunger in first one direction and then the other, the switching of the current from one coil to the other being effected in such manner that the circuit is not broken, whereby reciprocating movement is imparted to the plunger without producing a destructive electric spark. To secure the foregoing results it is important that the contacts of the respective sets should be spaced apart a distance less than the length of insulated section a^2 of the plunger, or in other words, insulated section a^2 of the plunger is not as long as the distance between the two sets of contacts F F′ and G G′, as result of which the contacts of one set are adapted to engage with one metal part of the plunger just prior to the engagement of the contacts of the other set with the insulated part of the plunger when said plunger is moving in one direction, thereby diverting the current from one coil into the other coil without interrupting the electric circuit or producing a destructive spark at the contacts. In this connection attention is directed to the fact that the circuit is completed through the contacts of one set and through a metal section of the plunger, the current flowing from the feed conductor through one coil, thence to one contact of a set, thence through a metal part of the plunger into the other contact of the same set, and back to the source of supply through the return connection.

It is preferred to employ coils of different magnetic intensity, and to this end coil C is of somewhat greater strength or capacity than coil B. This result may be secured

in various ways as by making coil C larger than coil B. Should the plunger have a tendency to stop intermediate the coils or come to a dead center, the flow of current through coil C will attract section a' of the plunger so as to move said plunger toward the right, but when current is switched out of coil C and into coil B then the plunger is attracted to move to the left. The plunger is reciprocated rapidly by switching the current from one coil into the other due to the movement of the plunger itself, and this rapid reciprocation of the plunger may be utilized in various ways for operating suitable mechanism, examples of which are shown in Figs. 2 and 3, respectively.

In Fig. 2 the vibrator is employed for actuating an audible alarm, the latter being shown in the form of a bell J supported on a post k and so fashioned as to substantially incase the mechanism of the vibrator. The coils are inclosed within an exterior casing 1 having heads or face plates 1', and on these face plates are provided metal diaphragms which are positioned in the path of the plunger at the respective ends thereof, said diaphragms serving to close the respective ends of the vibrator in a liquid tight manner. The diaphragms act, also, as bellstrikers for the reason that they are positioned for contact with the overhanging edge portion of bell J. The strikers m may be provided with impact pieces m' composed of hard material for striking against the edge portion of the bell, but in the action of the vibrator the flexible diaphragms m impart a rebound to the plunger when the latter strikes against said diaphragms, whereby the strikers impart the initial return impulse to the plunger.

When the vibrator is embodied as a part of an electric riveter, shown in Fig. 3, the working parts are incased within a housing O, the ends of which are closed by heads o. In the head at one end of the casing is an aperture in which is fitted a slidable stem P, one end of which protrudes beyond the casing so as to carry a striking head p. The end of the stem within the casing is provided with a collar p', and around the stem is positioned a coiled spring or buffer P', one end of which is seated on head o, the other end of said spring being in the path of collar p' at the inner end of the stem, whereby the spring P' acts to cushion the movement of the plunger in one direction and the recoil of the spring acts on head p' to press the stem inwardly so as to normally retain the stem and striking head in operative relation to the plunger and in the path thereof. The other end of the plunger is adapted to strike against a spring Q positioned in the path of said plunger and seated against a head o at the end of the casing. The riveter is provided with two handles R R', the former being loop-shaped and attached firmly to one end of the casing, whereas the other handle R' is secured firmly to the casing intermediate its ends.

The electrical connections in the signal device of Fig. 2 and in the riveter of Fig. 3 are the same as heretofore described in connection with Fig. 1, and the plunger is given a rapid reciprocating movement by switching the current alternately into the coils. The movement of the plunger toward the left in Fig. 3 imparts a blow to the striking head p for upsetting the metal of a rivet or other device, and after the blow is delivered spring P' returns the striking head to its normal position and imparts the initial impulse to the plunger for moving it backwardly. On the return stroke of the plunger spring Q absorbs the shock due to the impact of the plunger against it and effects the rebound of said plunger to start it on its movement toward the striking head.

It is apparent that a rapid reciprocating movement in a rectilinear path is imparted to the plunger without breaking the circuit and resulting in a spark, the mechanism employed being efficient and wholly automatic. All the working parts of the vibrator may be housed or incased to protect them from the accession of moisture, and, in fact, the vibrator is well adapted for use under conditions where the signal of Fig. 2 will either be exposed to the weather at all times or submerged in water.

Having thus fully described the invention, what I claim as new and desire to secure by Letters Patent is:—

1. An electrically operated vibrator embodying a plurality of coils, a plunger reciprocable therein, and means controllable by the movement of the plunger for switching current through said coils alternately whereby movement is imparted to the plunger, said plunger being normally in a closed circuit with said coils and operating as a conductor in completing said electric circuit.

2. A vibrator embodying a plurality of coaxial coils, a plunger movable within the magnetic fields of said coils, said plunger embodying magnetizable sections and a section of insulating material positioned intermediate said magnetizable sections, all of said sections being rigidly connected and contacts connected in series with the coils and positioned for engagement directly with the magnetizable and insulating sections of said plunger whereby the movement of the plunger switches the current alternately from one coil to the other, and vice versa.

3. A vibrator embodying a plunger composed of soft iron sections and an intermediate section of insulating material, a plurality of coils within which the plunger is

reciprocable, contacts positioned for engagement with the insulating and soft iron sections of said plunger, the length of said insulating plunger section being slightly less than the distance between the respective contacts, and electric connections whereby current is adapted to flow through one coil and one soft iron section of the plunger alternately with the other coil and soft iron plunger section.

4. In a vibrator, the combination of a plurality of coils, a plunger having magnetizable sections, and an interposed insulating section, all of said sections being rigidly connected, and make and break contacts coöperating with the respective magnetizable sections of the plunger for switching current into and out of said coils alternately, one or the other of the magnetizable sections of said plunger being at all times in a closed circuit with one or the other of said coils whereby said plunger operates as a conductor in normally closing said electric circuit.

5. A vibrator embodying a plurality of coils the magnetic fields of which are of unbalanced intensity, switch contacts in circuit with said coils, and a plunger composed of iron sections and an interposed insulating section, all of said sections being rigidly connected, said plunger being reciprocable within the magnetic fields of said coils and movable relative to said switch contacts to serve the function of a moving switch member in controlling the flow of current through said coils, the iron sections of said plunger acting as conductors in normally closing the electric circuits through said contacts and coils.

6. A vibrator embodying a plurality of coils wound to produce magnetic fields of unbalanced intensity, a plunger composed of magnetizable and insulating materials rigidly connected to each other, said plunger being reciprocable within said magnetic fields, and means operating in conjunction with the magnetizable materials of the plunger for diverting the flow of current through the coils alternately so as to establish the magnetic fields of alternately unbalanced intensity.

7. In a vibrator, the combination of a plurality of coils, a plunger embodying magnetizable sections and a section of insulating material between said magnetizable sections, and relatively stationary means coöperating with said plunger, said relatively stationary means being controllable by the movement of the plunger for switching an electric current into and out of said coils, whereby reciprocating motion is imparted to said plunger.

8. A vibrator embodying a plurality of coils the magnetic fields of which are of unbalanced strength, and a solenoid plunger reciprocable within said magnetic fields, said plunger being operable as a switch member in normally closing the electric circuit through the coils and in controlling the flow of current through said coils the unbalanced magnetic fields of which preclude the dead centering of said plunger under the influence of said coils.

9. A vibrator embodying a plurality of coils the magnetic fields of which are of unbalanced intensity, a reciprocable plunger composed of magnetizable and insulating sections, all of which are rigidly connected, said plunger being operable within said magnetic fields, and means contacting with the magnetizable plunger sections whereby said plunger serves the purpose of a current carrying switch in shunting current through said coils.

10. In a vibrator, the combination of a plurality of coaxially positioned coils, a plurality of switch contacts in circuit with said coils, and a plunger embodying insulating material and magnetizable sections separated by said insulating material, said plunger being movable relative to the switch contacts for one magnetizable section thereof to engage with one contact prior to the disengagement of the other magnetizable section from the other contact so that the movement of said plunger switches an electric current into and out of said coils alternately.

11. In a vibrator, the combination of a plunger embodying soft iron sections and an interposed insulating section, a plurality of coils, and switch contacts in circuit with said coils, said switch contacts being spaced apart for a distance less than the length of the insulating plunger section, said plunger coöperating with the switch contacts and performing the function of a moving switch member in controlling the flow of current through said coils.

12. In a vibrator, the combination of a plurality of coils, and a plunger movable in the magnetic fields of said coils and operating to normally close an electric circuit through one or the other of said coils, said plunger being adapted by its reciprocating movement to impart motion to a mechanical translating device.

13. In a vibrator, the combination of a plurality of coils, and a plunger movable in the magnetic fields of the coils and electrically connected with said coils to maintain at all times a closed electric circuit through one or the other of said coils, said plunger operating as a movable switch member in diverting current alternately from one coil into the other without interrupting the main circuit.

14. In a vibrator, the combination of a plurality of coils, and a plunger movable in the magnetic fields of the coils and elec-

trically connected with said coils to maintain at all times a closed electric circuit through one or the other of said coils, said plunger operating as a movable switch member in diverting current alternately from one coil into the other without interrupting the main circuit, and incasing means for said coil and plunger, said incasing means including a flexible member positioned in the path of said plunger and adapted to be mechanically operated thereby.

15. In a vibrator, the combination of a coil, a plunger composed of insulated magnetizable sections and movable in the field of said coil, and current switching devices in circuit with the coil and in electrical contact with one or the other of the magnetizable sections of said plunger for normally closing the electric circuit through said plunger and the coil.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

JOHN L. DINSMOOR.

Witnesses:
H. I. BERNHARD,
M. C. RODRIGUEZ.

Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents, Washington, D. C."