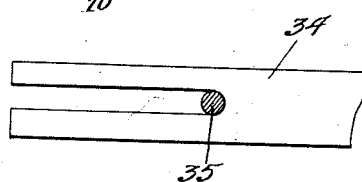
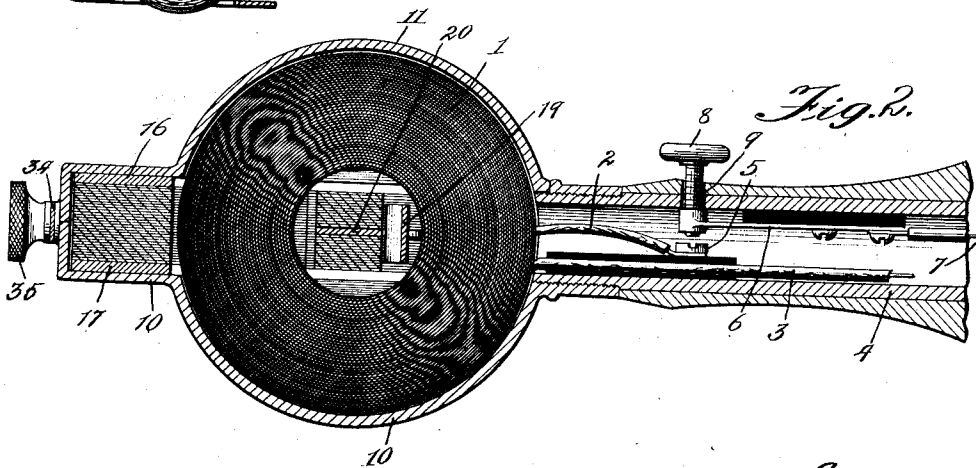
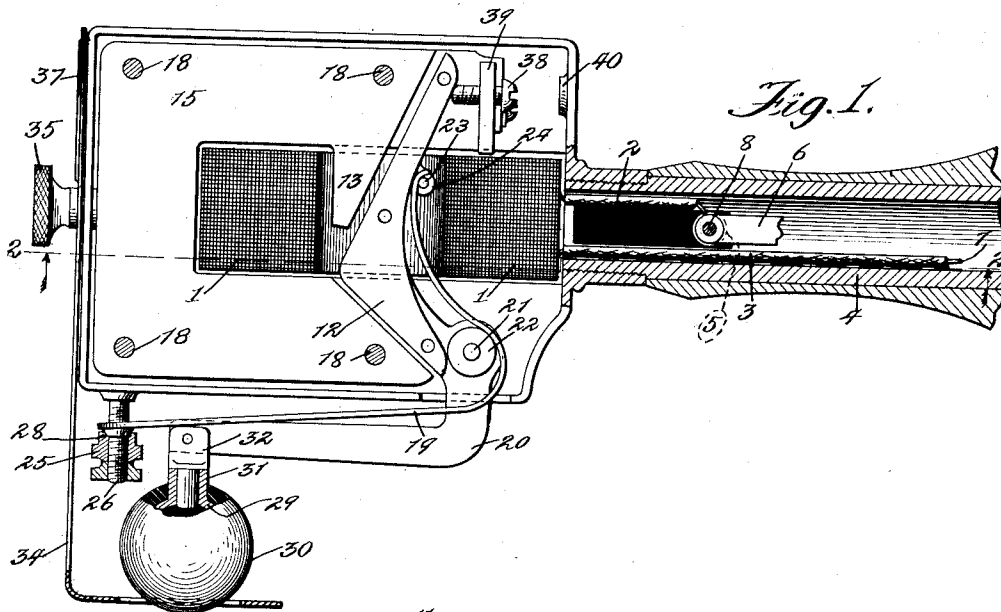


C. H. THORDARSON.
ELECTROMAGNETIC VIBRATOR.
APPLICATION FILED AUG. 4, 1905.

983,657.

Patented Feb. 7, 1911.

3 SHEETS—SHEET 1.



Witnesses:

Ed. D. Perry
J. B. Weir

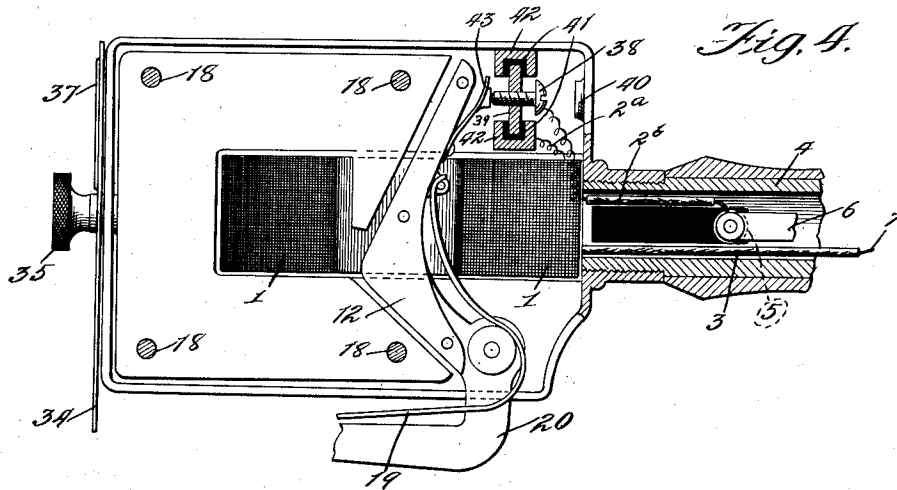
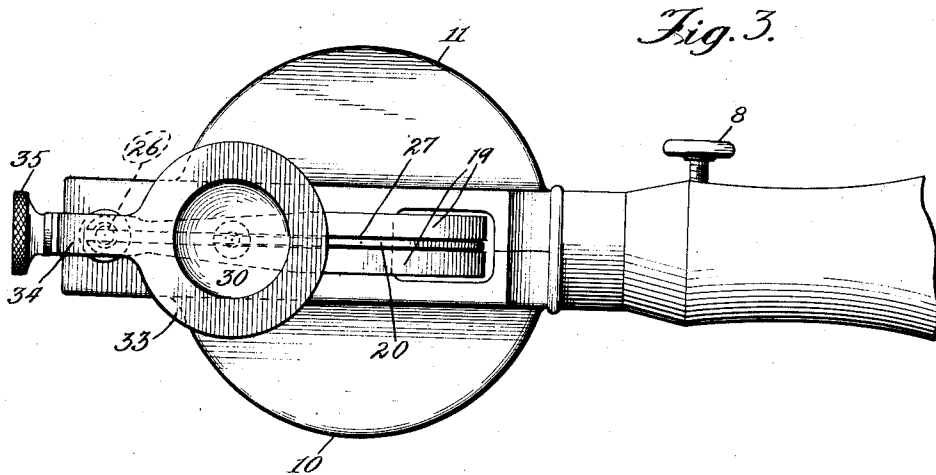
Inventor:

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3 SHEETS—SHEET 2.



Witnesses:
Bailey
W. E. Wain

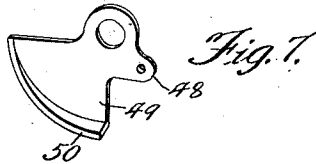
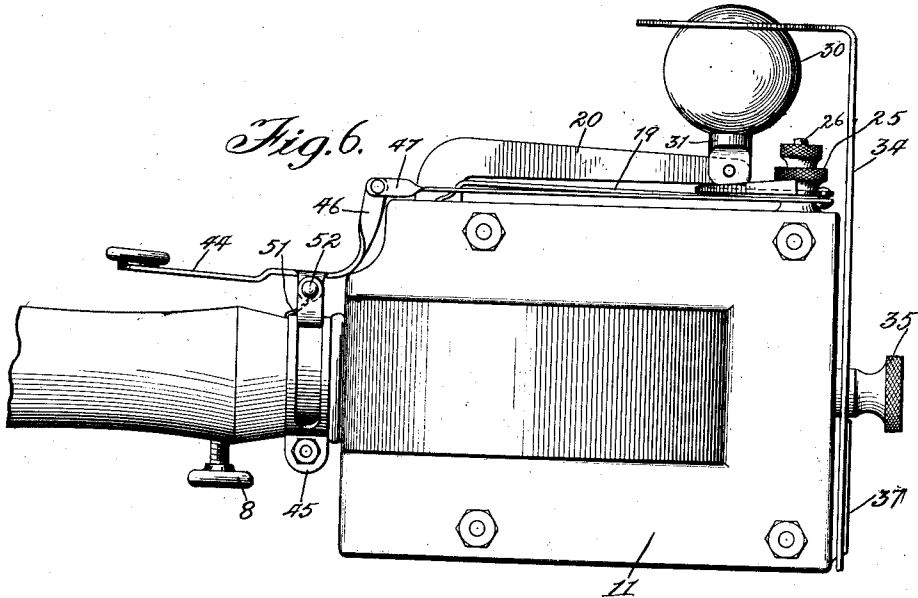
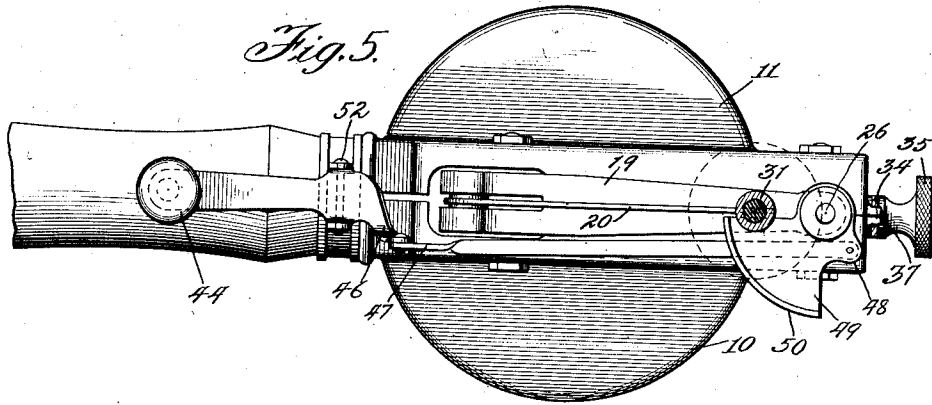
Inventor:
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3 SHEETS—SHEET 3.



Witnesses:

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UNITED STATES PATENT OFFICE.

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ELECTROMAGNETIC VIBRATOR.

983,657.

Specification of Letters Patent.

Patented Feb. 7, 1911.

Application filed August 4, 1905. Serial No. 272,644.

To all whom it may concern:

Be it known that I, CHESTER H. THORDARSON, a citizen of the United States, residing at Chicago, in the county of Cook, and State of Illinois, have invented a new and useful Improvement in Electromagnetic Vibrators, of which the following is a specification.

My invention relates to electromagnetic vibrators, and more particularly to a form of vibrator especially adapted for imparting vibration to a surgical applicator.

The invention also relates to improvements in the applicator.

The primary object of the invention is to produce vibrations of sufficient force to perform work by the direct action of an alternating current upon an oscillatory armature or a magnetic mass.

Another object of the invention is to vibrate an applicator with sufficient force to perform its allotted work by the direct action of an alternating magnetic circuit upon an oscillatory armature or magnetic mass.

Another object of the invention is to have the construction such that the same machine may readily be converted also into a direct current machine.

The invention has for its further object to make an electromagnetic vibrator of compact and powerful form.

With a view to the attainment of these ends and the accomplishment of certain other objects which will hereinafter appear, the invention consists in certain features of novelty in the construction, combination and arrangement of parts, which will now be described with reference to the accompanying drawings and then more particularly pointed out in the claims.

In the drawings.—Figure 1 is a longitudinal plan section of an electromagnetic vibrator embodying this invention; Fig. 2 is a longitudinal vertical section thereof taken on the line 2—2, Fig. 1; Fig. 2^a is a detail view of a portion of the support of the plate for pressing the flesh around the point where the applicator is applied and showing the fastening screw in section. Fig. 3 is a bottom view; Fig. 4 is a view similar to Fig. 1, partially diagrammatic, showing modifications, whereby the machine may be used for a direct current; Fig. 5 is a bottom elevation of the machine, showing the same provided with a

means of regulating at will the length of the stroke of the armature; Fig. 6 is a side elevation of the same; and Fig. 7 is a perspective view of the regulating cam.

It will be understood that the alternating magnetic circuit induced in a pole-piece or core by the action of an alternating electric current passing contiguous to the same is ordinarily of such high frequency as to preclude its employment for purposes requiring any material degree of vibration, because of the inability of the magnetic attraction to overcome the inertia of the armature in the short duration of time between the occurrence of the negative and positive waves constituting a single period; but by a proper proportionment of the weight of the armature with respect to the frequency, the armature may be made to pulsate substantially in synchrony with the alternations of the current. In carrying out the invention, therefore, due regard is had for this principle, and the weight of the armature is varied only in inverse ratio to the square of the frequency while keeping the air gap between the opposed faces of the armature and core or field mass as small as possible, and the areas of these opposed faces as large as possible.

1 is a coil or helix, which has its terminals 2, 3 connected in any suitable way to an alternating circuit. In this exemplification of the invention, the terminal 3 passes through a hollow handle 4, and the terminal 2 is connected to a suitable contact 5, located within the handle adjacent to a spring contact 6, which is connected with a conductor 7, completing the circuit with the main line. In one end of the spring contact 6, which remains normally out of connection with the contact 5, is screwed a push-button 8 passing loosely through an aperture 9 in the side of the handle, so that pressure upon the button 8 will close the circuit from 2 to 7, and which will remain closed as long as such pressure is continued, or, if desired, the circuit may be permanently closed any required length of time by screwing the button down against the contact 5.

The handle 4 is rigidly secured to one of the members 10, 11 of a two-part casing, which is formed to embrace the coil 1, and thus not only inclose and protect it but also affording it the requisite support. The coil

1 is preferably square or rectangular in cross-section, as shown in Fig. 1, and is of annular form in axial section as shown in Fig. 2, thus leaving a central opening or passage, in which is arranged an armature 12 and a portion 13 of a core or magnetic mass 15, which, together with the armature, completes a magnetic circuit through and around the coil, the coil being composed of insulated wire and fitting with a reasonably close fit within the core or magnetic mass 15. The core 15 constitutes what might be called the field of the device, and is preferably laminated or composed of a multiplicity of thin sheets of iron or magnetic metal clamped between two brass or non-magnetic plates 16, 17, by means of rivets or other suitable devices 18, passing through both of the brass plates and also through the lower half 10 of the casing, whereby the core is rigidly secured in the casing, allowing the upper half of the casing to be removed, if desired, without danger of the parts becoming displaced. The plates or sheets constituting the core 15 are preferably rectangular in plan view so as to form the rectangular opening for the coil 1, and one of the legs thereof is provided with the inwardly projecting portion 13, whose outer edge is formed at an oblique angle to the axis of the core, as clearly shown in Fig. 1, whereby an extended area of the pole-piece or field is presented to the armature 12, while the opposite leg is similarly beveled but at a greater angle, thus increasing the area of this pole-piece also. The armature 12 is also composed of laminæ or thin sheets of magnetic metal, as shown in Fig. 2, riveted or otherwise secured together, and the side thereof which is presented toward the core 15 is formed in planes parallel with the planes of the opposed ends or faces of the pole-pieces so that the armature may be arranged very close to the core and the faces thereof which are presented to the core may be of the maximum size or area, while the air space between said faces and the core will be reduced to the minimum, thus completing as far as possible the magnetic circuit around and through the coil induced in the core and armature by the current traversing the conductor of the coil and magnetizing the armature as well as the core.

The apparatus being connected to an alternating current circuit, it will be understood that the current passing in one direction or one wave of the current will attract the armature 12, and before the opposite wave occurs the armature will be retracted by a suitable spring 19, connected thereto in any appropriate manner. In the exemplification of the invention shown in the drawings the armature 12 is secured to an arm 20, which is pivoted at 21 in the lower half of the casing and against a hub 22 through which

the pivot 21 passes bears a portion of the spring 19, which has its inner end engaged under a pin 23 secured to the back of the armature 12 by a pair of lugs 24, while the outer end of the spring is attached to the side of the casing by any suitable means such as an adjustable nut 25 on a screw-threaded pin 26 secured at the side of the casing. For convenience in assembling the parts and adjusting the tension of the spring, the spring is preferably composed at its outer end of two separate tongues, which may be produced by forming a longitudinal slot 27 in this end of the spring, and the extremities of these tongues are formed with bosses 28, over the pair of which engages the cupped inner end of the nut 25, thereby holding the bifurcations of the spring together while leaving them free to be readily disengaged from the nut 25 in the event it should be desired to straighten them out more to increase their tension. This bifurcated form of spring also provides for passing the arm 19 through the outer end thereof, and thus at once enabling the arm to be arranged close to the side of the casing while holding the spring in place.

The end of the arm 20 carries an applicator, which may be of any suitable form, or the arm may be put to any other work which it is desired that the machine shall perform. In this example of the invention the applicator consists of a light, hollow ball 29, which may be composed of aluminum or any other suitable material possessing the requisite strength, and which is preferably covered on the outside with rubber 30, or any other suitable elastic material, the ball 29 being formed with a neck 31 secured by a shank 32 to the arm 20. In some instances when the apparatus is used for vibrating a surgical applicator of this same general description, it is desirable to press the flesh at the part to be treated around the point where the applicator is applied, and to that end there is employed a ring or flat annular plate 33, through which a portion of the ball protrudes, as indicated in Figs. 1 and 3, and which plate is capable of being passed over the skin where the treatment is to be applied. This plate is made adjustable and secured to the frame or casing of the apparatus by an arm 34 and a set-screw 35, which passes through a slot 36, and binds the arm against the end of the casing, the end of the casing having a rib 37, which also engages in the slot 36 to hold the arm 34 against rotary movement on the screw 35.

Ordinarily the tension of the spring 19 may be adjusted to suit the power of the magnets by means of the adjusting nut 25, and the stroke of the applicator to suit the requirements of the particular patient may be regulated as desired by an adjusting screw 38, secured in any suitable nut 39 and ar-

ranged to impinge the back of the armature 12, and which screw is accessible through a suitable opening 40 in the casing.

In the form of the invention shown in Fig. 4 the construction and operation are the same except that the device is modified for use with a direct current and which involves the addition of the circuit interrupter. This is constituted in part by the same screw 38 which adjusts the stroke of the armature and the support 39 in which the screw is secured, except that the support 39 is electrically disconnected from the casing by suitable insulations 41 interposed between the edges of the support and suitable standards 42. One terminal of the coil 1 is connected to the wire or conductor 3, as before described, while the other is grounded on the casing, this other terminal in this form being indicated at 2^a. It remains now for the screw 38 to be connected to the contact 5, which may be accomplished by conductor 2^b, to complete the circuit through the coil via the armature and screw 38 when the armature springs back to its retracted position. If desired, the back of the armature may be provided with a spring contact 43 for the sake of better electrical connection. The device as shown in Fig. 4 is in readiness to be operated by the direct current, but should it be desired to operate it by means of an alternating current it is obvious that it is only necessary to change the conductor 2^a to the contact 5, or the conductor 2^b from the screw 38 to the terminal 2^a.

In Figs. 5 to 7, inclusive, is shown an attachment for the device, whereby the length of stroke of the armature 20 may be governed at the will of the operator by more or less pressure exerted upon the button or lever 44 arranged in a position convenient to the thumb or finger of the same hand of the operator which holds the apparatus. This lever 44 is supported on the handle by means of a collar 45 and has its end turned up as shown at 46 to constitute a bell-crank lever, which is connected to one end of a rod or link 47, and the other end is pivoted to the crank arm 48 formed on a plate 49 pivoted on the screw 26 and held in place thereon by the nut 25. On one edge of this plate, which edge is substantially concentric with the center 26, is arranged a wedge or cam 50, which is adapted when the plate 49 is rotated to project under the arm 20, and limit the degree of oscillation of the arm 20, ac-

cording to the extent to which the button 44 is depressed. The construction and arrangement may be such that the cam 50 will be wedged under the arm 20 by pressure upon the button 44, and the reverse movement may be produced by any suitable spring 51 coiled on the pivot 52 of the bell-crank lever 46.

Having thus described my invention, what I claim as new therein, and desire to secure by Letters Patent, is:

1. In a device for the purpose described, the combination with a vibratory armature and an electromagnet therefor, of an arm connected to the armature, an applicator on said arm, a bifurcated spring having one end acting upon the armature and straddling said arm, and means for holding and adjusting the other end of said spring.

2. In a device for the purpose described, the combination of an applicator, an electromagnetic vibrator for said applicator, an electric circuit, for supplying said vibrator with current, comprising a self-opening switch, means for closing said switch at will, and means for locking said switch in its closed position.

3. In a device for the purpose described the combination of an electromagnet, an armature therefor, an applicator attached to said armature and adapted to be vibrated by the same, a rotary member having a tapering flange or cam arranged to limit the degree of vibration of said applicator, a handle for supporting the device, and means for controlling the position of said rotary member at will from the handle.

4. In a device for the purpose set forth, the combination of an armature pivotally supported intermediate its ends, an electro-responsive device for intermittently moving the armature about its pivot in one direction, resilient means for moving the armature in the opposite direction, and means continuously under the control of the operator for varying the tension of said resilient means for regulating the degree of movement of the armature.

In witness whereof, I have hereunto set my hand this 31st day of July 1905, in the presence of the subscribing witnesses.

CHESTER H. THORDARSON.

Witnesses:

E. C. SEMPLE,
FRANK T. BROWN.