No. 754,681. PATENTED MAR. 15, 1904.

E. K. MÜLLER.

ELECTROMAGNETIC DEVICE.

APPLICATION FILED SEPT. 20, 1902.

NO MODEL.

Fig. 2.

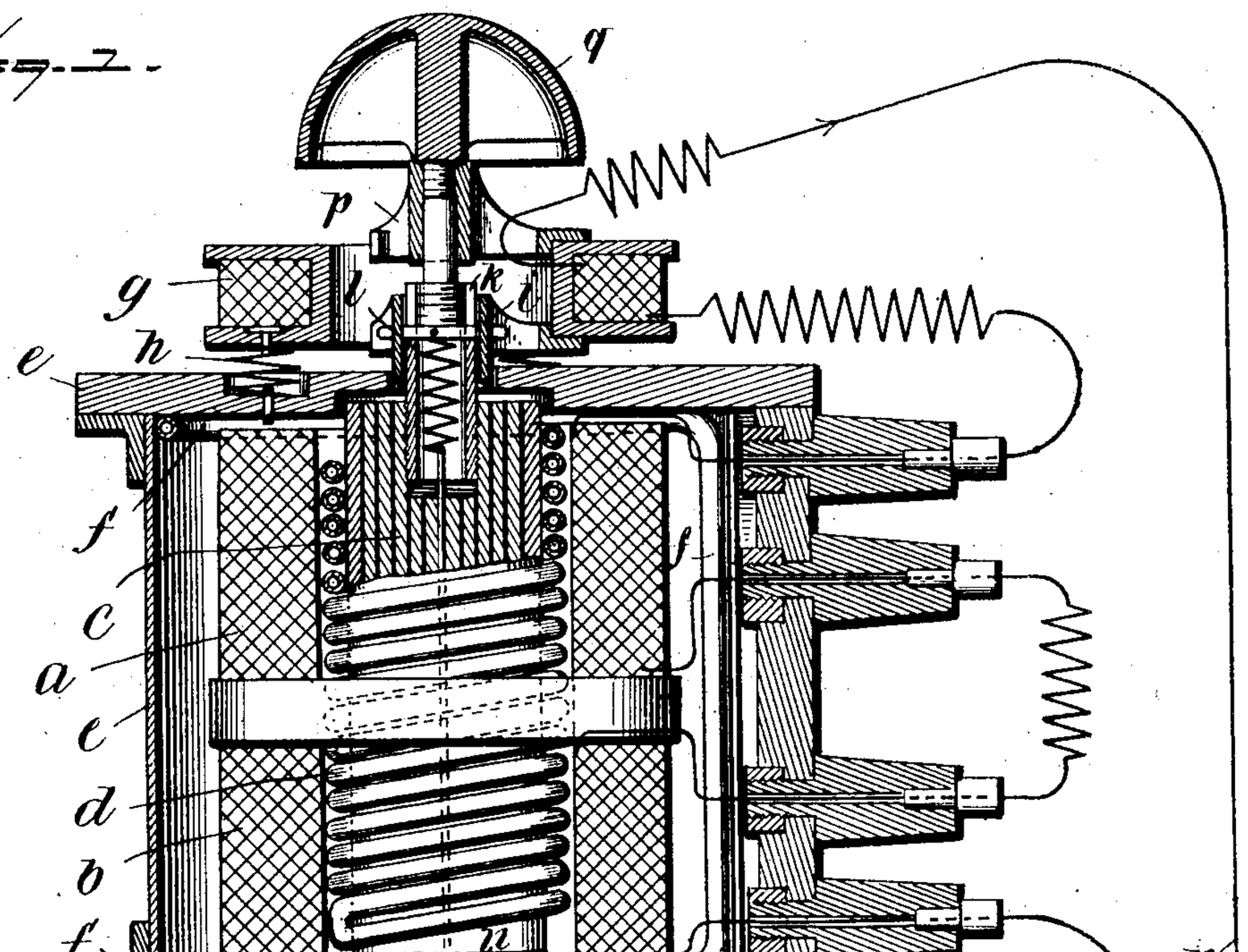
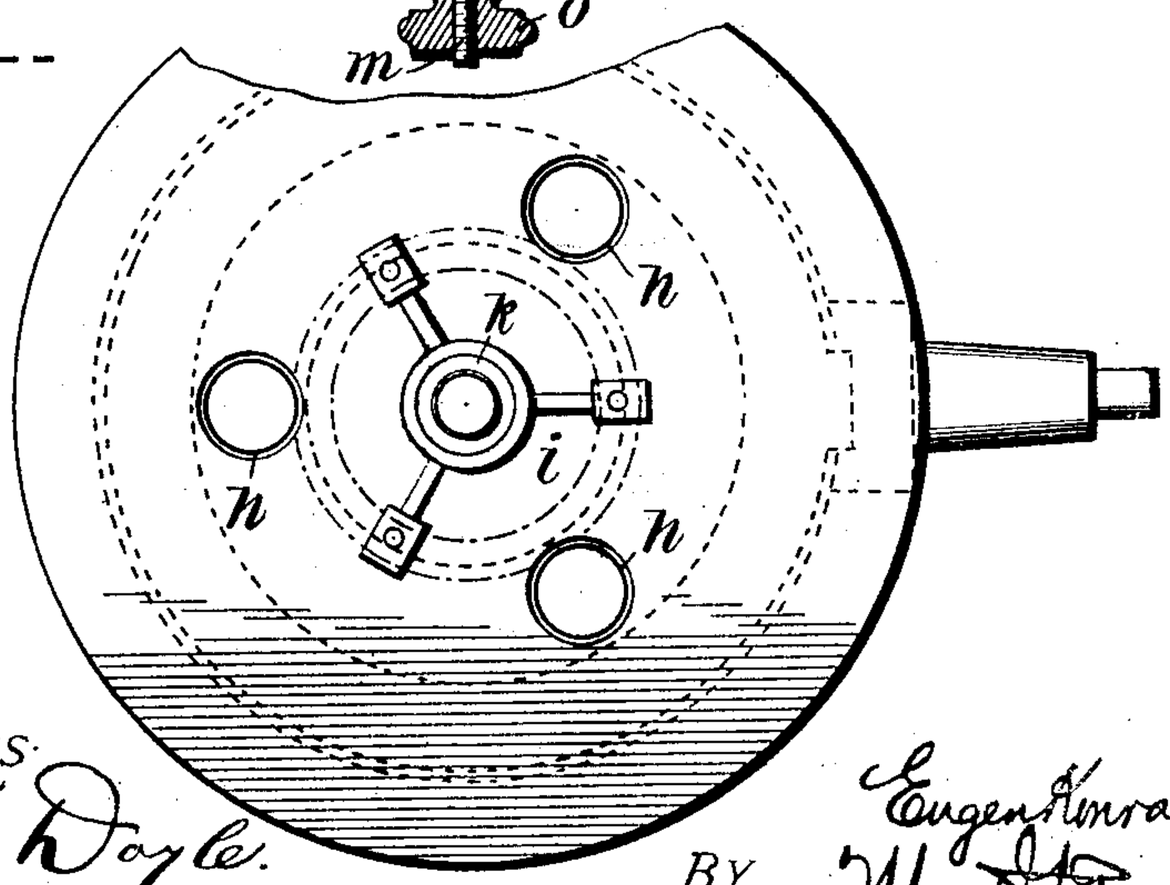


Fig. 5.



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No. 754,681. Patented March 15, 1904.

UNITED STATES PATENT OFFICE.

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ELECTROMAGNETIC DEVICE.

SPECIFICATION forming part of Letters Patent No. 754,681, dated March 15, 1904.

Application filed September 20, 1902. Serial No. 124,177. (No model.)

To all whom it may concern:

Be it known that I, EUGEN KONRAD MÜLLER, a citizen of Switzerland, residing at Zurich, in the Republic of Switzerland, (whose post-office address is Splügenstrasse 2,) have invented certain new and useful Improvements in Electromagnetic Devices; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

This invention relates to a device for effecting vibratory movement having a magnetically-excited holder for the body to be moved arranged to oscillate in front of the one end of a wire coil, in which device the wire coil is excited by means of a pulsatory (continuous or alternating) current, for the purpose of directly oscillating the body through the variations of the excited undulatory magnetic field.

This device is adapted, among other uses, to the effecting of vibratory massage.

A form of the invention is illustrated by way of example in the accompanying drawings, in which—

Figure 1 is an axial section, and Fig. 2 an end elevation.

a and *b* are two windings arranged in series and composing a coil, in the interior of which is a core *c*, consisting of small thin plates of paramagnetic material (soft iron, nickel, cobalt, &c.) insulated from one another by means of sheets of paper and secured together. Between this core and the interior surface of the windings *a* and *b* a pipe *d* is arranged, which is suitably formed as a double spiral for a reason which will be explained hereinafter. The windings *a b* are arranged in a casing *e*, between the interior surface of which and the exterior of the windings *a* and *b* a refrigerating-pipe *f* is arranged, which is in the form of a continuous coil of pipe doubled upon itself and running in opposite directions.

To the one end of the casing *e* a wire coil *g* is attached by means of three spiral springs *h*. The wire coil *g* is furnished with a boss *i*, which is mounted so as to be axially displaceable on the free end of a tube *k*, firmly connected with the core *c*. The boss *i* is connected, by means of a pin which runs through two slots in the tube *k* situated diametrically opposite each other, with a spiral spring *l*, arranged in the interior of the tube *k*. This spring can be put under tension to a greater or less extent by means of a rod *n*, that runs lengthwise through the core *c* and one end of which is firmly connected with the spiral spring *l* and the other with an eyebolt *m*, which passes through an opening in the side of the casing *e* opposite to the coil *g* and receives the adjusting-nut *o*. The coil *g* is pulled more or less powerfully by the spring *l* toward the casing *e*, while the spiral springs *h* tend to force the coil *g* away from the end of the casing *e* against the action of the spring *l*. The coil *g* is furnished on its outer end with a support *p*, to which the body *q*, that effects the massage, is fixed.

The coils *a*, *b*, and *g* are arranged in series in the outer circuit of a source of current *r*, with which a pulsatory current can be produced, and the mounting or winding of these coils in relation to one another is so effected that the two windings *a* and *b* act mutually in exciting a magnetic field the lines of force of which run opposite to those of the magnetic field excited by the coil *g*. As the exciting current is a pulsating current, and consequently both of the excited opposing magnetic fields are pulsating; when both fields attain their maximum intensity the coil *g*, and with it the body *q*, that effects the massage, is repelled from the casing *e*, and when both fields have reached their minimum the coil *g*—that is to say, the body *q*—is pulled in by the spiral spring *l*. This successive repulsion and drawing in of the body *q* leads to a very effective vibratory massage of the part of the patient's body brought into contact therewith.

The coil-pipe *d*, arranged around the paramagnetic core *c*, and the pipe *f* serve for circulating cold water or cold air for the purpose of preventing any heating of the core in consequence of hysterisis resulting from the magnetic field produced being pulsating or

any heating of the windings of the wire coil owing to the current passing through them being possibly too intense. The coil-pipe *d*, as already mentioned, is formed of a single continuous pipe doubled upon itself, so that the currents induced in the two spirals neutralize each other. Not only are the eddy-currents neutralized by this disposition of the refrigerating-pipe, but the cooling effect is rendered more uniform.

Although not indispensably necessary for actuating the body that effects the massage, the paramagnetic core is of great service, as it prevents any dissipation of the magnetic lines of force.

In the form of the invention illustrated the windings *a*, *b*, and *g* are so mounted in relation to one another, or wound, that the electromagnetic action on the support or holder for the body that effects the massage is repellent, while the drawing in of such a body is effected by a spring. The arrangement could, however, be reversed—that is to say, the electromagnetic action on the support might be attractive and the repulsion be effected by a spring. For this purpose it is only necessary to insert the coil *g* in the circuit of the source of current *r* in such a manner that the magnetic field produced thereby is of the same nature as that which is excited through the windings *a* and *b*.

Owing to the current that runs through the coils, by which the magnetic fields are excited, being a pulsating current, pulsating magnetic fields are obtained without a current-interrupter, through the variations of which fields the body that effects the massage is oscillated and with a much greater frequency of vibration than if, as hitherto, it were oscillated by mechanical gearing or by the armature of a coil combined with a current-interrupter. Moreover, it is possible to vary this rate of vibration easily and to a large extent by altering the frequency of the exciting-current.

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

1. In a device of the character described, a coil, a second coil movably mounted relative to the first coil, yielding means connecting the supports of the two coils, and a member mounted on the second coil, the two coils adapted to be connected with a source of alternating electric current and so wound that their magnetic fluxes will be opposed.

2. In a device of the character described, a coil, a core, a second coil movably mounted relative to the first coil, yielding means connecting the supports of the two coils, and a member mounted on the second coil, the two coils adapted to be connected with a source of alternating electric current and so wound that their magnetic fluxes will be opposed.

3. In an electromagnetic device, the combination, with a coil, of a refrigerating-pipe arranged to cool the same and doubled upon itself whereby eddy-currents are neutralized.

4. In an electromagnetic device, the combination, with a coil, and a core, of a refrigerating-pipe arranged to cool the core and coil and doubled upon itself whereby eddy-currents are neutralized.

5. In an electromagnetic device, the combination with a coil, and a core within the coil, of a pipe disposed between the core and coil and consisting of a continuous hollow tube doubled upon itself and adapted for the circulation of a refrigerating medium.

6. In an electromagnetic device, the combination, with a coil, and a core within the coil, of a pipe disposed between the core and coil and adapted for the circulation of a refrigerating medium, said pipe consisting of a continuous hollow tube doubled upon itself and arranged about the core in such manner that the respective coils of the tube alternate thus preventing self-induction and equalizing the cooling effect.

7. In a device of the character described, a coil composed of two windings arranged in series, a core composed of insulated sections, a refrigerating-spiral disposed between the core and windings and consisting of a continuous pipe doubled upon itself, a second coil arranged upon and axially displaceable relative to the first coil, springs connecting the supports of the two coils, and a member carried by the second coil, the two coils adapted to be connected with a source of alternating electric current and so wound that the magnetic fluxes of their respective windings will be opposed.

8. In a device of the character described, a coil composed of a plurality of windings arranged in series, a laminated core common to the windings, a refrigerating-spiral enveloping the core and arranged between the core and windings and consisting of a continuous pipe doubled upon itself in such manner as to neutralize eddy-currents, a similar spiral surrounding the windings of the coil, a second coil mounted upon and axially displaceable relative to the first coil, springs connecting the supports of the two coils, means for adjusting the tension of the springs, a member carried by the second coil, the two coils adapted to be connected with a source of alternating current and so wound that the lines of force of their respective magnetic fields are opposed.

9. In a device of the character described, a coil composed of a plurality of windings arranged in series, a laminated core composed of insulated plates, a hollow spiral disposed about the core between the same and the windings and consisting of a continuous pipe

doubled upon itself, a similar spiral surrounding the windings of the coil, a second coil mounted upon and axially displaceable relative to the first coil, a member carried by the second coil, the two coils adapted to be connected with a source of alternating electric current and so wound that the lines of force of their magnetic fields will be opposed whereby the movable coil will be intermittently repelled, and adjustable yielding means for returning said second coil.

In testimony whereof I affix my signature in presence of two witnesses.

EUGEN KONRAD MÜLLER.

Witnesses:
ADOLF FETERER,
CONRAD GUTKNECHT.