

(No Model.)

3 Sheets—Sheet 1.

C. HOULGRAVE.
DEMAGNETIZING APPARATUS.

No. 535,060.

Patented Mar. 5, 1895.

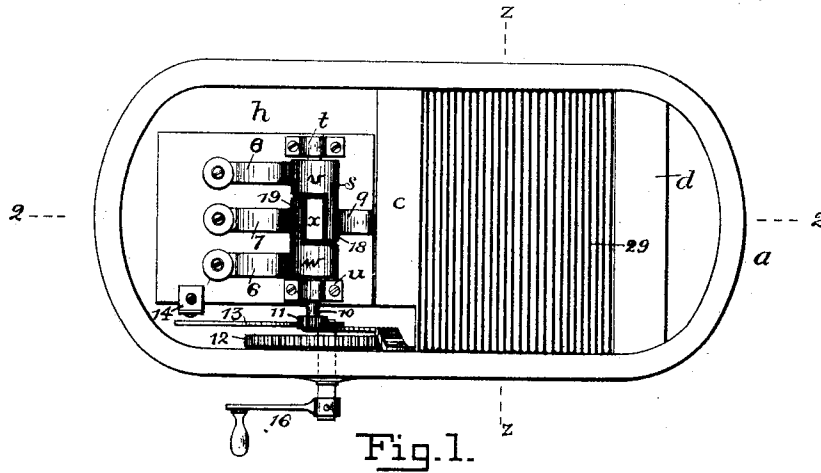


Fig. 1.

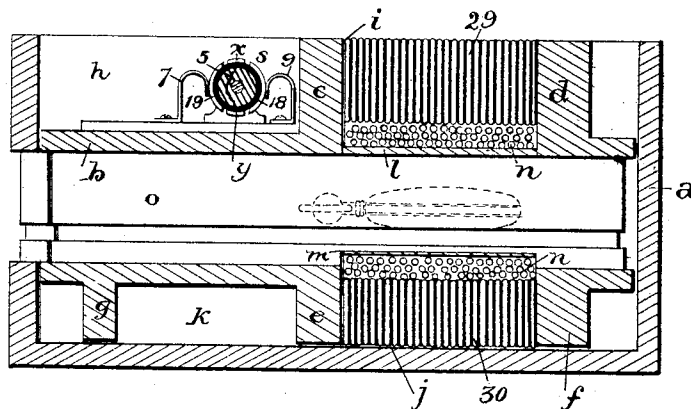


Fig. 2.

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ATTORNEY.

(No Model.)

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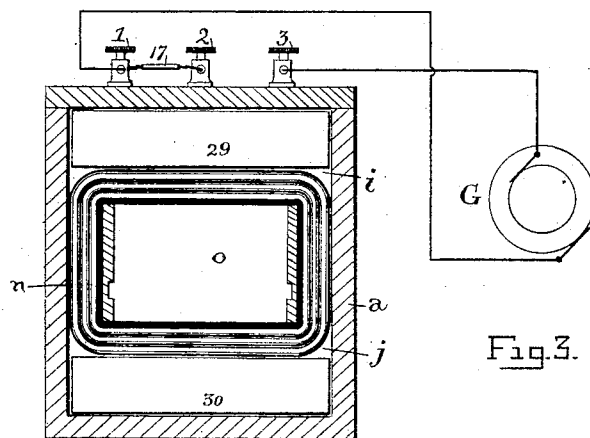


Fig. 3.

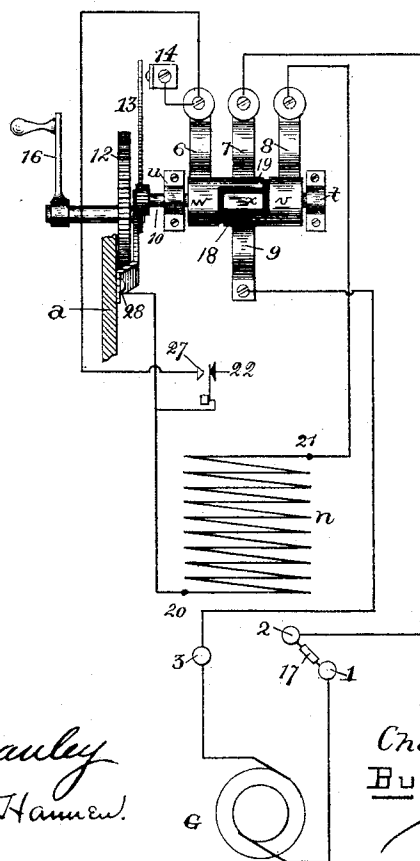


Fig. 4.

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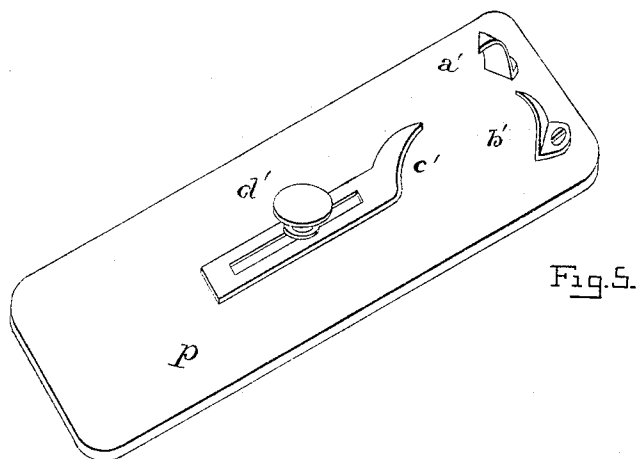


Fig. 5.

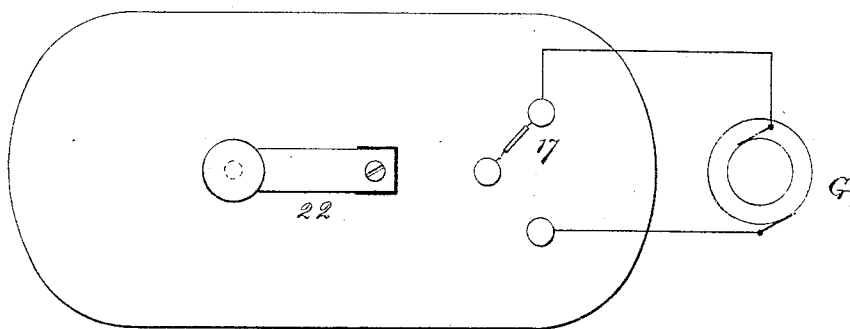


Fig. 6.

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CHARLES HOULGRAVE, OF BUFFALO, NEW YORK.

DEMAGNETIZING APPARATUS.

SPECIFICATION forming part of Letters Patent No. 535,060, dated March 5, 1895.

Application filed January 22, 1894. Serial No. 497,734. (No model.)

To all whom it may concern:

Be it known that I, CHARLES HOULGRAVE, a citizen of the United States, residing at Buffalo, in the county of Erie, State of New York, have invented certain new and useful Improvements in Demagnetizing Apparatus; 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.

My invention relates to electro-magnetic devices for effecting the magnetic status of objects in general; and more particularly to those devices for use in the magnetization or demagnetization of watches and similar articles; and it has for its object to provide a device of this nature which shall be cheap and simple of construction, accurate of operation, and which, moreover, may be operated equally well with either the continuous, pulsating or alternating current. It being the theory of magnetism, that a magnetic body is composed of an inconceivable number of magnetic molecules which normally dispose themselves so as to neutralize each other, in the well known manner, and when under the influence of the proper agent such molecules are caused to arrange themselves regularly and co-operatively, it is only necessary that some means be employed to disarrange such regularity of position of the molecules, in order to destroy the magnetic exhibition of the body formed by such molecules. It is upon this well known principle that my invention is based.

In the accompanying drawings forming a part of this specification:—Figure 1, is a plan view of the apparatus, the cover thereof, bearing the binding posts and switch, being removed. Fig. 2, is a longitudinal section of the apparatus, having the cover in place, on line 2—2 of Fig. 1. Fig. 3, is a section on line $z-z$ of Fig. 1. Fig. 4, is a diagrammatic representation of the circuits through the device. Fig. 5, is a perspective view of the slide for holding the article to be operated upon. Fig. 6, is a top plan view of the device showing its connection with a source of electricity.

Referring now to the drawings, a is a casing composed of wood or other cheap non-magnetic substance, and of such dimensions as to receive the mechanism of my apparatus,

which mechanism consists of a frame b of similar material, consisting of a hollow body, square in cross section, having upwardly and downwardly projecting ribs c , d , and e , f and g , respectively, forming recesses h , i , j and k , for purposes as will be presently explained.

The floors of the diametrically opposite recesses i and j I prefer to entirely remove and in place thereof to substitute a single layer l and m of paper, oil cloth, or similar magnetically permeable protection to receive the windings n of insulated wire to form an inducing solenoid. Exterior of this solenoid, which in the drawings is shown as being rectangular in cross-section, and within the recesses i and j , which for this purpose are formed rather deeper than the side recesses h and k , are arranged electro-magnet poles 29 and 30, formed of laminals of soft iron set on edge and lying at an angle to the bore of the solenoid.

Within the opening o of the frame b , is arranged to slide a plate p (Fig. 5), in suitable grooves in the interior walls of said opening. This plate p is provided with any desired number of stationary clips such as a' and b' and with an adjustable clip c' for holding the article to be operated upon in place. A thumb screw d' may be employed, as shown, for retaining the clip c' in place.

In Fig. 2, the position of a watch undergoing treatment, is indicated in dotted lines.

In the recess h of the frame b is arranged a pole changing device or alternator consisting of a cylinder s of insulating material suitably journaled in bearings t and u and having externally arranged plates v and w each consisting of an encircling band or base portion having a finger 18 and 19 respectively, made integral therewith and extending longitudinally of the cylinder s . The said plates are arranged in such positions as that their fingers will assume diametrically opposite positions on the cylinder s , said fingers being of such narrowness as to permit the insertion therebetween of plates x and y , in electrical relation to each other, such relation being secured through the medium of suitable resistance connections 5, as shown in Fig. 2 of the drawings. Suitable brushes of brass or other material, are arranged to bear against the plates of the alternator, the

brushes 6 and 8 bearing against the continuous portions of plates *v* and *w*, respectively. The brushes 7 and 9 are arranged centrally of the alternator and bear against the fingers 5 of the plates *v* and *w* and against plates *x* and *y*, in accordance with the position of the alternator. The shaft 10 of the alternator is provided at one end with a pinion 11 arranged in its bearings to accomplish such engagement. Secured also to the interior of the casing is a spring switch 13 passing across the center of gear wheel 12 whereby, when the said gear is brought into engagement with the pinion 11, said switch may be caused to make contact with point 14, which is in connection with brush 8.

Thus my invention may be operated under four distinct conditions which I shall now describe, setting forth the connections in each instance, reference being had to Fig. 4 of the drawings.

I find that my device is especially adapted for the magnetization of needles employed in the manufacture of compasses and other articles. To secure this result with the continuous current, the article or articles to be treated is secured to the plate 15 in the manner described, or by other suitable means, which slide is then pushed into the inclosure of the solenoid until the article or articles thereon are brought into the portion of the field of greatest intensity of the magnet *n*. The gear wheel 12 is then revolved slowly, by means of the crank 16, and is pressed inwardly in order to mesh with the pinion 11 and to make connection of the switch 13 with its point 14. It will thus be seen that by use of the pole changer or alternator, an alternating current is passed through the magnet *n*, said current having long time phases by virtue of the slow revolution of the gear wheel and consequently the alternator, which, according to the well known principles will effectually magnetize any magnetizable substance under its influence.

With the employment of the continuous current, the alternator being in the position shown, the circuits are as follows:—generator 50 G, binding post 1, fuse wire 17, binding post 2, brush 7, finger 19, base of *w*, brush 6, point 14, switch 13, point 28, point 20, winding of magnet *n*, point 21, brush 8, plate *v*, finger 18, brush 9, post 3, to generator G. When one 55 quarter of a revolution is made, the circuit is generator G, post 1, fuse 17, post 2, brush 7, plate *y*, plate *x*, brush 9, post 3, to generator. A second quarter revolution being made, the electro magnet is again brought into circuit, 60 inversely however, as will be readily seen by the circuit as follows:—generator G, post 1, fuse 17, post 2, brush 7, plate finger 18, plate *v*, point 21, winding of magnet *n*, point 20, point 28, spring switch 13, point 14, brush 6, 65 base of plate *w*, finger 19, brush 9, post 3 and generator G. A third similar partial revolution again short circuits, and a final quarter

revolution brings the alternator into its original position. The object of thus successively cutting into circuit the magnet and shunting 70 through resistance, is to give opportunity for the escape of all residual magnetism from the electro-magnet and at the same time maintain an approximate load on the generator, thus insuring its even running and a consequent 75 similitude of phases, through the apparatus.

To demagnetize a watch, the same rules are observed as in the process of magnetization, with the exception of the speed of revolution of the alternator which must be greatly increased, resulting in rapid alternations of the polarity of the electro-magnet, the slide and watch being slowly withdrawn.

In magnetizing, the polarity is changed so slowly that similar changes may readily take 85 place in the article operated upon and when it is finally withdrawn from the influence of the apparatus, its magnetic molecules are approximately all in similar positions. However when such changes of polarity are made in 90 rapid succession, the watch or similar object being of non-laminal construction, becomes heated, when hysteresis sets in (gradually however, certain portions being more readily affected than others,) with the result of annihilation of the homogeneous molecular arrangement and the consequent destroying of 95 the magnetic exhibition of the article.

In the employment of an alternating current, the pole-changer or alternator, is of 100 course not necessary and at such time the circuit through the magnet is completed through the medium of a switch 22, connections being as follows:—generator G, point 1, fuse 17, post 2, brush 7, finger 18, base of plate 105 *w*, brush 8, switch point 27, switch 22, point 20, electro-magnet *n*, point 21, brush 6, plate *v*, finger 19, brush 9, point 3, and generator G. It is of course necessary that the brushes 7 and 9 be in contact with fingers 18 and 19, 110 otherwise a superfluous resistance would be in circuit.

In magnetizing with alternating current, the watch is inserted, as hereinbefore explained, connections are made with a generator 115 of alternating currents, the alternator is arranged in the correct position and the switch key 22 is held down for a short while only (about ten seconds) in order that hysteresis may not arise. Conversely, in demagnetizing, the switch should be held down a 120 sufficiently long time to insure hysteresis.

The interposition of resistance between the plates *x* and *y* on the alternator having a value equal to that of the electro-magnet, 125 insures a constant load on the generator and thus prevents both blowing of the fuse hereinbefore mentioned and condensive action of the magnet.

Having now described my invention and its 135 method of operation, what I claim is—

1. A device of the class described comprising an electro-magnet, means whereby the polarity of said magnet may be reversed, a

switch for cutting the reversing means into or out of circuit, and means for short circuiting from the source of electricity through said electro-magnet.

5 2. A device of the class described comprising a solenoid whose inclosure is free from all paramagnetic substance, pole pieces arranged entirely without the solenoid, means for reversing the polarities of said pole pieces,
10 means normally disengaged from the reversing means for operating it, and a switch operated by the engagement of the reversing means with its operating means to cut the reversing means into circuit during its operation.

15 3. A device of the class described, comprising a solenoid, pole pieces therefor formed of paramagnetic laminals arranged at an angle to the bore of the solenoid, means for bringing the article to be treated within the inclosure of the solenoid, and means for reversing the polarities of the pole pieces.

20 4. A device of the class described, comprising a solenoid, pole pieces therefor formed of paramagnetic laminals arranged at an angle to the bore of the solenoid, means for bringing the article to be treated within the inclosure of the solenoid, and means for reversing the polarities of the pole pieces irrespective
30 of the nature of the inducing current.

5. In a device of the class described, the combination with a solenoid provided with externally arranged pole pieces, of a commutator having connections with said solenoid,
35 a source of electricity in circuit with said solenoid and means for cutting said solenoid successively into and out of circuit with the source of electricity and for short circuiting said source through an equivalent resistance at such times as the solenoid is cut from circuit therewith.

6. In a device of the class described, the combination with a source of electricity, of an electro-magnet in circuit therewith, a commutator also in circuit with said source of electricity, an artificial resistance in circuit with certain segments of the commutator, and means for operating the commutator to reverse the polarity of the electro-magnet and
50 to short circuit the current from the source of electricity through the artificial resistance at times intermediate of the said reversals of polarity of the electro-magnet.

7. A device of the class described comprising a solenoid whose inclosure is free from all paramagnetic substance, pole pieces arranged entirely without the solenoid, means whereby the polarities of said pole pieces may be reversed, a switch for cutting the reversing
60 means into or out of circuit and means for short-circuiting from the source of electricity through the said solenoid.

8. The combination with a source of elec-

tricity and an electro-magnet arranged to be brought into circuit therewith, of a commutator comprising an insulating body having segments arranged thereon and provided with connections whereby it may be caused to reverse the polarity of said magnet, said commutator having also segments in electrical
70 communication through an artificial resistance within the body of the commutator, and means independent of the source of electricity for operating the commutator to reverse the flow of current through the electro-magnet and to short circuit said current through the artificial resistance intermediate of said reversals.

9. An electro-magnet comprising a solenoid having externally arranged laminated pole
80 pieces, the laminals of said poles extending longitudinally of the windings of the solenoid.

10. An electro-magnet comprising a solenoid and externally arranged laminated pole pieces, the laminals of said pole pieces lying
85 at an angle to the bore of the solenoid.

11. An electro-magnet comprising a solenoid having paramagnetic portions arranged externally thereof, said paramagnetic portions being formed of laminals, slab-shaped,
90 set on edge and extending longitudinally of the solenoid windings.

12. An electro-magnet comprising a solenoid having paramagnetic portions arranged externally thereof, said paramagnetic portions consisting of two poles arranged diametrically opposite each other and formed of laminals set on edge and arranged longitudinally of the solenoid windings, whereby an intense magnetic field may be formed within the solenoid.
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13. A device of the class described comprising an electro-magnet consisting of a solenoid having externally arranged pole pieces, a slide adapted to enter said solenoid and having clips to receive and retain the article to be operated upon, and means for reversing the polarities of the pole pieces irrespective of the nature of the inducing current.
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14. A device of the class described comprising a frame adapted to receive a solenoid winding, said frame having portions cut away to normally expose portions of the interior of the solenoid, protective coverings for the said exposed portions, paramagnetic portions arranged externally of the solenoid and adjacent the said exposed portions, and means for reversing the polarities of the resultant fields irrespective of the nature of the inducing current.
110 115 120

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

CHARLES HOULGRAVE.

Witnesses:

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CHARLES F. KILHAFFER.