(No Model.)

A. L. BOGART.

INDUCTION COIL.

No. 605,174. Patented June 7, 1898.

Fig. 1.

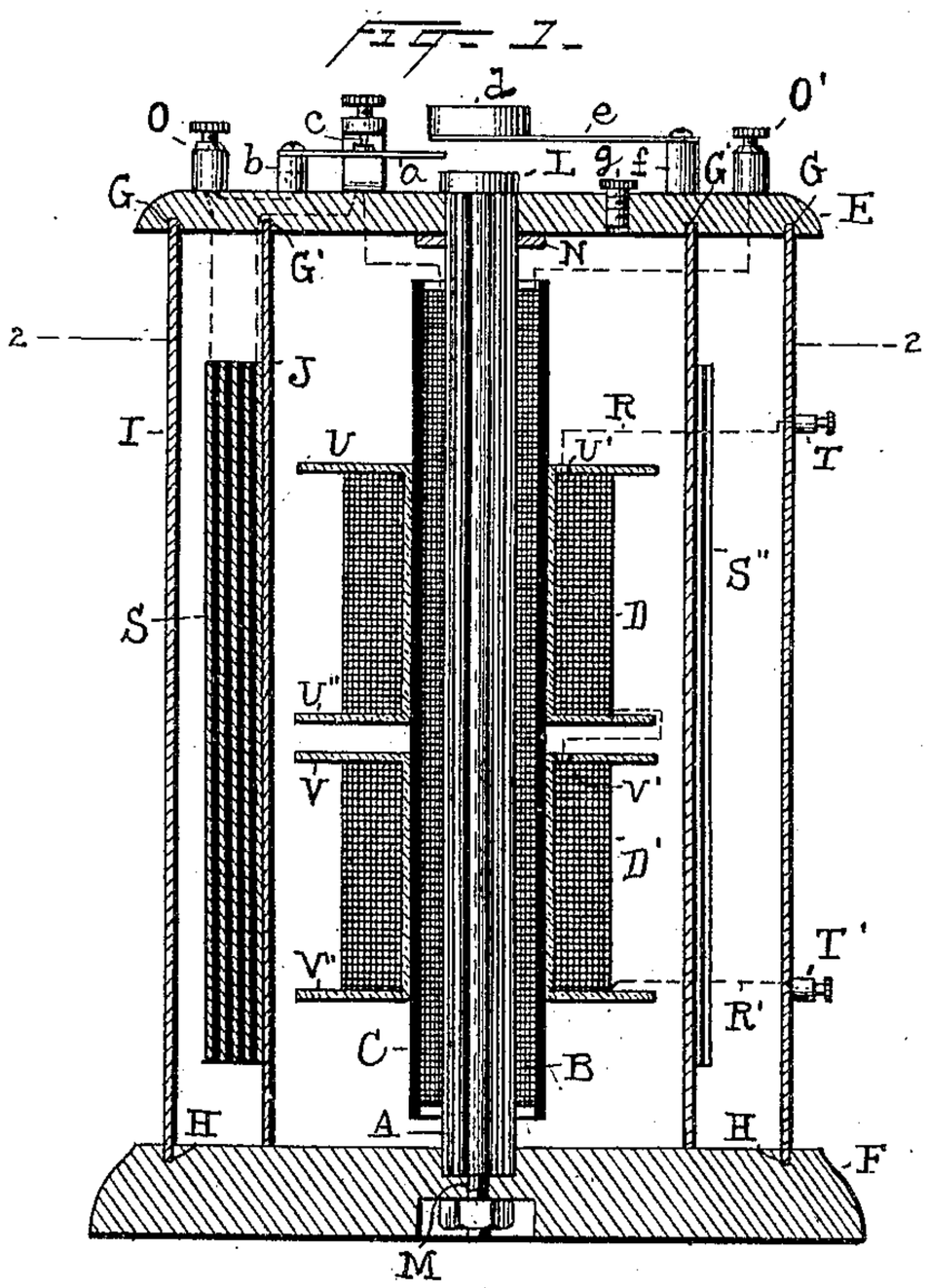
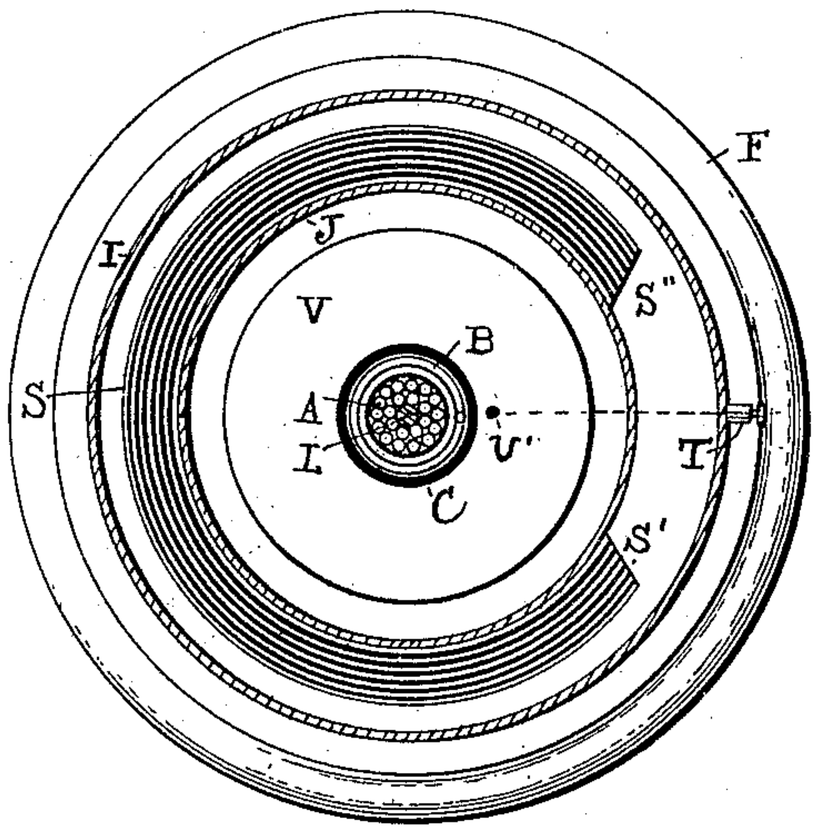


Fig. 2.



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INDUCTION-COIL.

SPECIFICATION forming part of Letters Patent No. 605,174, dated June 7, 1898.

Application filed April 22, 1897. Serial No. 633,416. (No model.)

To all whom it may concern:

Be it known that I, ADRIAN LIVINGSTON BOGART, a citizen of the United States, residing at Jamaica, in the county of Queens and State of New York, have invented a certain new and useful Improvement in Induction-Coils, of which the following is a specification.

The object of my improvement is to simplify, cheapen, and increase the efficiency and durability of induction-coils of the type known as "Ruhmkorff" coils. Heretofore such coils have been made in one general form, which was to build up the coil or induction apparatus proper complete and then mount the same on an oblong hollow base, in which base was placed the condenser. This form of construction necessarily occupied considerable area or ground-space, which was objectionable, as the induction-coil usually constituted but one element of a set of apparatus which it was employed to energize, and as the coil should be close at hand for frequent adjustment it was usual to mount it upon the same table as the balance of the apparatus, and the latter occupied a disproportionately small space as compared to the space occupied by the induction-coil with its hollow base. As my coil is constructed this objection is obviated, the space occupied being very much less than in the old forms. Again, in the old forms of apparatus manufacturers were obliged to carry, in order to produce various sizes of coils for different lengths of spark, inclosing cases for each different size, whereas with my apparatus this is not necessary, as I am enabled to build up a wide range of sizes of coils without carrying on hand a large and expensive stock of parts of different sizes. Again, the conventional form of the Ruhmkorff coil was clumsy and inartistic in appearance, whereas the coil produced by me is artistic and well proportioned in appearance. Again, in the old forms of coils in the construction of the interrupter the armature carried one of the contact-points, which made it necessary to mount the armature upon a stiff spring, in order to secure contact between its point and the opposing point. Hence the interrupter was not, as a rule, self-starting, but had to be started by the finger, while if the spring of the armature were light enough to make it self-starting the contact between its point and the opposing point would not be a good one, and hence difficulties would arise. By my invention this objection is overcome.

In carrying out my invention I start with the primary idea of surrounding the induction-windings by the condenser instead of, as heretofore, locating the condenser in a hollow base beneath the windings. In following out this idea I wind the primary and secondary around the soft core in the usual way or in a way hereinafter described, which I prefer, and then surround these windings by a casing of insulating material, upon which I locate the condenser. In this way it will be observed that I economize space to a very considerable degree, because the condenser being wound around the induction-windings instead of flat a given capacity of condenser will occupy much less space.

In order that practically the same parts may answer for various sizes of coil, I provide a base and head which are to be secured by a bolt or bolts, preferably a single bolt passing through the soft-iron core, which as the bolt is lengthened or shortened will of course be nearer or farther away one from the other, thus enabling me to locate larger or smaller parts between the same. The inclosing shells, preferably being cylindrical, of course are simply cut the desired length for any size of apparatus.

Regarding the interrupter, I mount the armature upon a comparatively light spring and omit the usual contact-point carried by it. Adjacent to the armature and projecting in its path I locate a comparatively heavy spring carrying upon its back a contact-point, which is in contact with an adjusting-screw carrying the opposite contact-point. By this means it will be seen that I can adjust the strength of contact without interfering with the armature. Hence the light spring of the armature will be attracted when current flows, will strike the stiff spring, and thereby interrupt the current, the armature being self-starting.

In order to avoid the liability of sparking between sections existing in former appara-

tus when the secondary coil is constructed in sections, as is necessary to secure a spark of over an inch in length, I wind each section of my secondary coil upon a separate spool of insulating material and then slip the spools over the primary coil and connect them up in the usual way. In this way there is no liability of sparking between adjacent layers of the different sections or from the top layer of one section to the top layer of the next.

Figure 1 of the accompanying drawings presents a sectional elevation of an induction-coil constructed in accordance with my invention, and Fig. 2 a sectional plan of the same along the dotted line $x\ y$ of Fig. 1.

A represents the core of soft-iron rods or wires, about which is wound the pimary coil B. The primary coil is inclosed by an insulating-tube C, of glass, rubber, or other suitable material. About this latter is wound the secondary coil or coils D D'. So far the construction is or may be the usual one.

E and F are respectively a top and base of wood, hard rubber, or other material, but which I prefer to make of a hard wood, like mahogany, disk-like in shape, so that it can be readily and cheaply turned on a lathe. Both E and F are provided with corresponding grooves G G' H.

I J are two cylinders of any insulating material, but which for purposes of economy I prefer to make of paper or pasteboard.

In making a coil according to my invention I prefer to inclose among the wrought-iron wires constituting the core A a wrought-iron bolt L, having at its lower end a screw-thread M. A collar N holds the wrought-iron wires and bolt firmly together. The core A passes through an opening in the top E, where it may be secured either by the head of the bolt L and the collar N or by the collar being screwed fast to the under side of the top A. On the core A the various parts constituting the primary and secondary coils B and D are now built up with their proper insulations. The electrical connections are now made between the primary coil B and the interrupter, as usual, terminating at two binding-posts, as O O'. The coil and top are now inverted and the cylinder J placed in position, fitting into the groove G' in the top. The terminal wires R R' of the secondary coil D D' are brought through small openings in the wall of the cylinder J, after which, if it is desirable, the entire inner space between the coil and the inside of the cylinder J may be filled up with melted paraffin or other similar insulating material. This cylinder J may be used simply as a mold within which the melted paraffin is poured and may be removed after the paraffin has solidified. The condenser S S' S'', consisting of alternate sheets of paper and tin-foil, is now wrapped about the cylinder J or the solid paraffin, it having been so proportioned that the ends S' S'' will be out of striking distance of the spark when passing through the wires R R'. The condenser may be secured in position by means of bands of rubber or tape. The condenser being now connected, as usual, to the interrupter, the outside cylinder I is placed in position, the wires R R' connected to the binding-posts T T', and the base F put in place and secured by means of the nut run on the screw-thread M. An opening supplied with a plug g may be provided in the cover, through which the melted paraffin may be poured to fill up the space between the coil and cylinder J after the coil is finished instead of prior thereto, as described above. Where it is desired to use paraffin-oil as an insulator instead of solid paraffin, this same plug can be utilized both for filling and emptying; but in this case apertures should be made in the walls of the cylinder J about the bottom. In this manner of construction the same size of top and base will answer for a great variety of sizes of coils, the cylinders I and J, of cheap material, being cut of varying lengths, as required. The exterior of the cylinder I may be ornamented by covering with velvet or otherwise.

While I prefer to make the top, base, and cylinder-casing round for purpose of cheapness, any of these parts may be either square or polygonal in cross-section.

Any form of interrupter may be employed; but I prefer a special construction for the following reasons: The usual form employed for this purpose consists of an armature located over the end of the core supported by a flat spring secured rigidly to a post. Between the armature and the post is located a piece of platinum on the side of the flat spring opposite to the core. A set-screw with a platinum point is rigidly secured to a second fixed post above the spring, so that normally the platinum point of the screw will bear against the platinum contact on the spring, these two pieces of platinum serving as circuit-makers. The objection to this arrangement is that whenever it is necessary to vary the contact between the electrodes (which is performed by screwing up or down the upper platinum contact) the tension of the spring is varied, and further than this the relative distance between armature and core likewise altered. As a result, when a very firm contact is insured between the electrodes the armature is brought too near to the core to admit of sufficient swing to allow of the amount of break between the electrodes to obtain the maximum spark effect with the current employed. Again, in the coils it is frequently desirable that they should be self-starting—that is, that continuous vibration should be set up as soon as the circuit is closed at the operating button or key without having to assist the armature with the finger at the start. This cannot be readily achieved if the spring is a stiff one, while, on the other hand, if the spring is not stiff a sure contact is not made and the effect of oxidation is done away with. To overcome these difficulties, I make the contact-

spring quite stout, but disconnect the armature from it entirely, supporting it on a light spring. By reference to Fig. 1, *d* is the armature supported by the post *f* and light spring *e*. From the post *b* extends the stiff spring *a* with its platinum contact, against which firmly bears the platinum-tipped adjusting-screw *c*. The left-hand lower side of the armature *d* overhangs the right-hand end of the stiff spring *a*. The armature *d* may be set at any required distance away from the end of the core L, but in its descent when attracted by the core will strike the projecting end of the stiff spring *a*, causing a separation of the electrodes at *c*. The electrical connections are made as indicated by the dotted lines. By this arrangement as firm a contact as may be desired can be effected between the contact-points without in any manner affecting or altering the tension of the spring *e*, carrying the armature. The armature-spring *e* may be made extremely light, so that in the first place the armature *d* can be located at a comparatively considerable distance away from the core L and still be sensitive and put in motion immediately by the attraction of the core when the latter is energized, and, secondly, gathering momentum as it descends into the stronger field to strike a sharp quick hammer-blow on the contact-spring *a*, insuring the rapid break between the electrodes required to obtain the best results.

In the construction of the secondary coil of such instruments it is customary and necessary for purposes of insulation to divide the same into two or more sections in coils intended to give more than a one-inch spark. These sections are built up one at a time, thus: A layer of the fine secondary wire is formed. About this is wrapped a layer of paper, about which latter comes the second layer of wire as a continuation of the first. In this manner is built up successively all of the windings going to make up the first section. The second section is then made in a similar manner to the first, but at a certain distance away from it. Now in order to prevent the spark from jumping across from the ends of the different layers of one section to those of the adjacent one or from any part of the top layer of one section to that of the next it is usual to either fill the entire space between the different sections, as well as about the same, with some insulating material like paraffin, which may be melted and poured into place, where it hardens, or else, in addition thereto, insulating disks or washers are placed between each of the sections. These latter have but a limited value for the reason that there is always left an uninsulated space between the inside of the washer and the insulating-tube covering the core and primary coil upon which the sections are wound. As obviating these defects I prefer to use the following method of winding the secondary sections: I employ for each section a complete and hollow spool, which may be cheaply blown or molded from glass, porcelain, hard rubber, or other insulator. I find that glass is the most economical and serves every purpose. In Fig. 1 U U″ V V″ represent two of these spools in section. The internal diameter is of such size as to permit of their passing over the insulating-tube C, which envelops the primary coil B and core A. Each of these spools at one end is provided with holes U′ V′ through the head. A spool is "chucked" in a lathe. One end of the secondary wire being passed through the hole, say U, and secured outside, the wire is then wound upon the spool either entire in the quantity required to make a section or each layer is insulated from the succeeding one by means of a layer of paper or other material. The last end of the wire will terminate at U′. After the proper number of sections have been thus wound, each on its own insulating-spool, they are slipped onto the primary over its insulating-tube C and the outside end of one section, as U′, connected to the inside end of the next, V′.

I claim—

1. In a Ruhmkorff induction-coil, the combination with the primary and secondary coils, of a condenser arranged in the same plane therewith and partially inclosing the same, substantially as set forth.

2. In an induction-coil, the combination of a primary and secondary, with a condenser and an interrupter comprising an armature mounted upon a relatively light spring, a second and heavier spring carrying a movable contact-point and arranged in the path of movement of the first spring, and a fixed contact-point normally making contact with said movable contact-point, substantially as set forth.

3. In an induction-coil, the combination with a base and head, of a bolt securing the same and surrounded by the primary and secondary, a casing of insulating material inclosing the said primary and secondary, and a condenser located upon said casing, substantially as set forth.

4. In an induction-coil, the combination with the primary coil, of a secondary coil in sections, each section comprising an insulating-spool with its conductor wound thereon, several sections being properly connected, and a condenser partially inclosing said primary and secondary coils, substantially as set forth.

5. In an induction-coil, the combination with the primary and secondary, of a casing inclosing the same, a condenser adjacent to said casing, and an outer casing surrounding the whole, with a base and top inclosing the ends of said casing, to which said casings are secured, substantially as set forth.

6. In an induction-coil, the combination with the working parts of a head and base, a bolt or bolts connecting the same, a condenser partly inclosing the coils and a casing inclosing the condenser and coils and held in place

by the head and base, substantially as set forth.

7. An interrupter for induction-coils, comprising an armature mounted upon a relatively light spring, a second and heavier spring carrying a movable contact-point and arranged in the path of movement of the first spring, and a fixed contact-point normally making contact with said movable contact-point, substantially as set forth.

This specification signed and witnessed this 16th day of March, 1897.

A. LIVINGSTON BOGART.

Witnesses:

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