

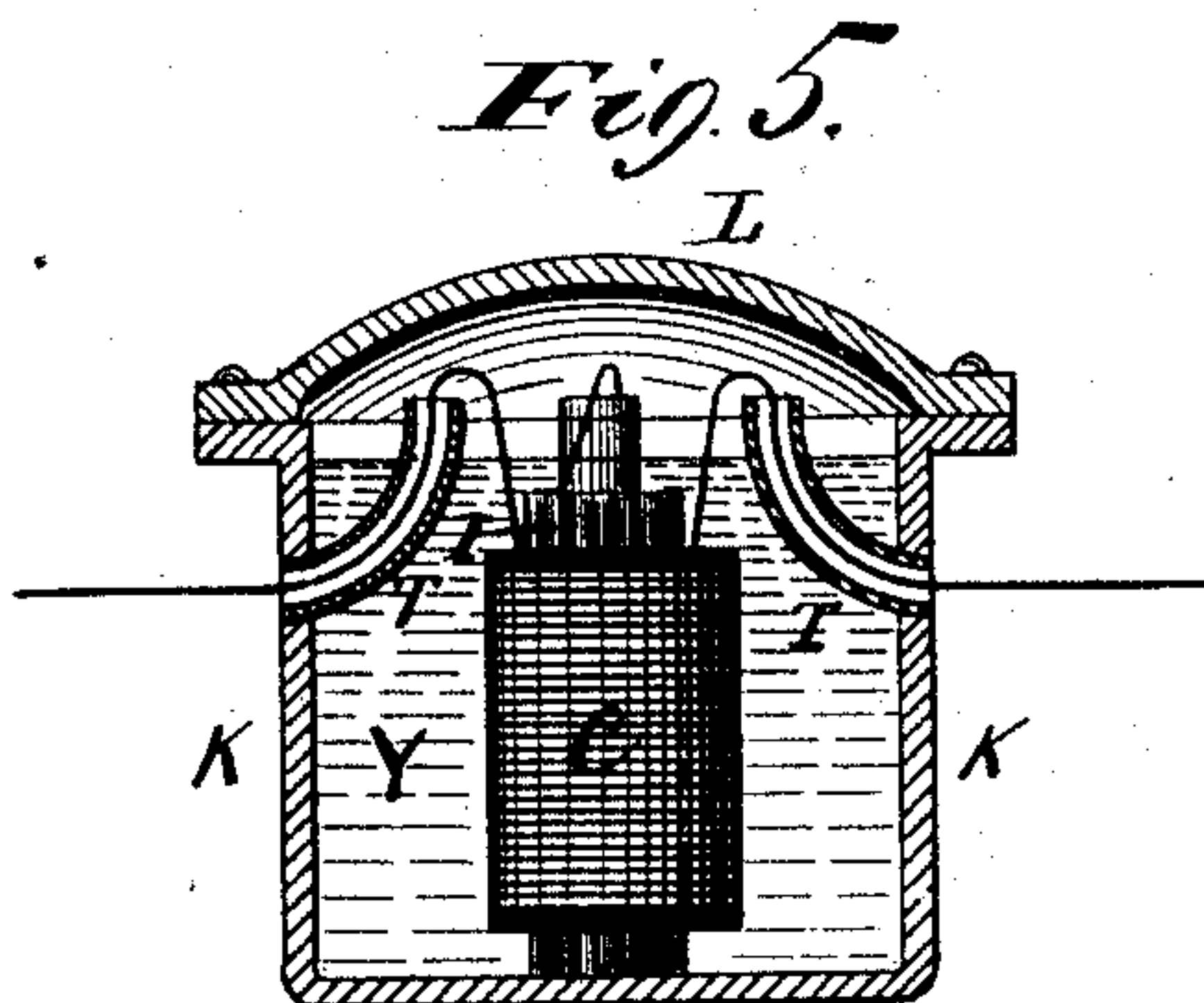
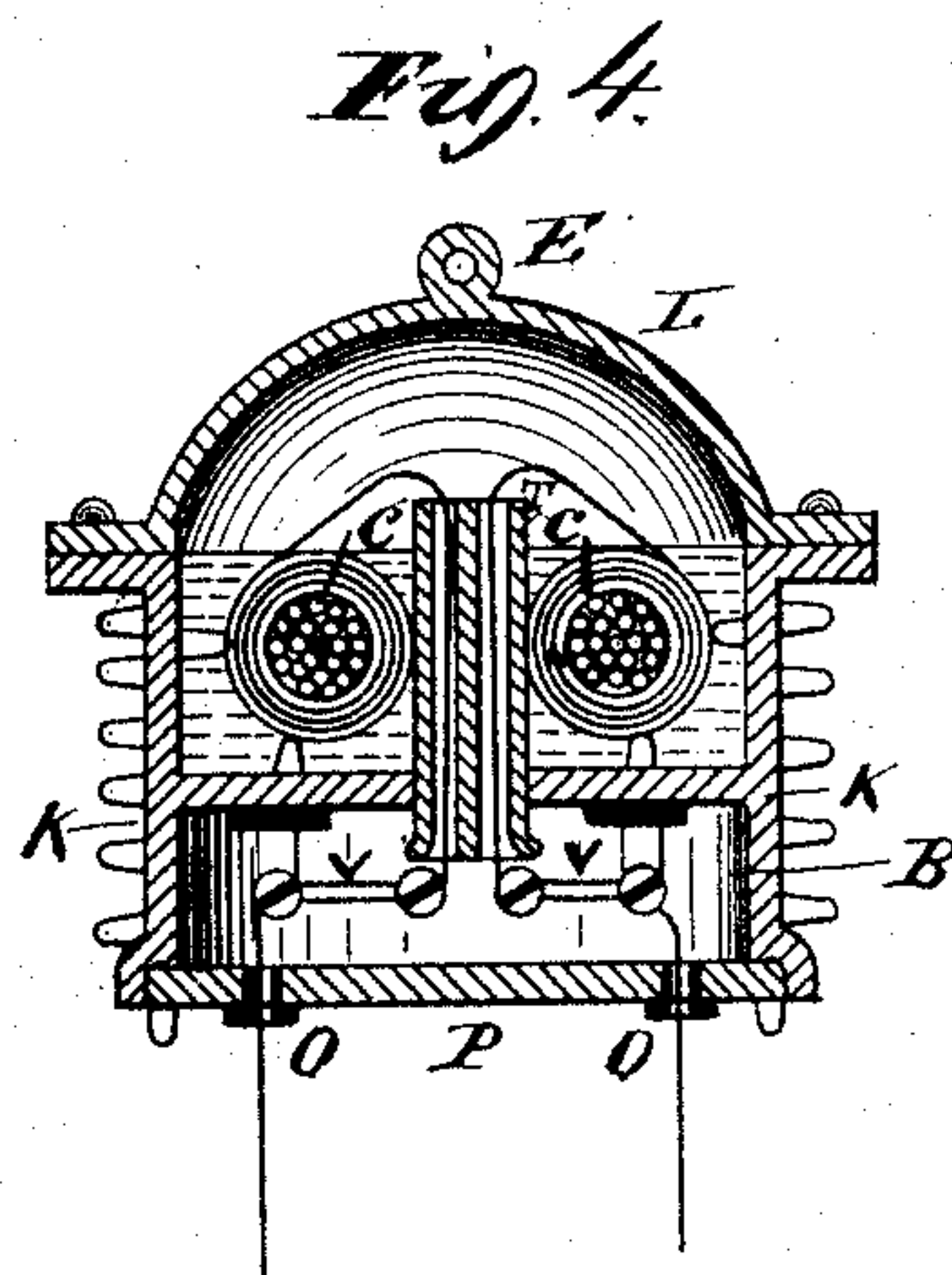
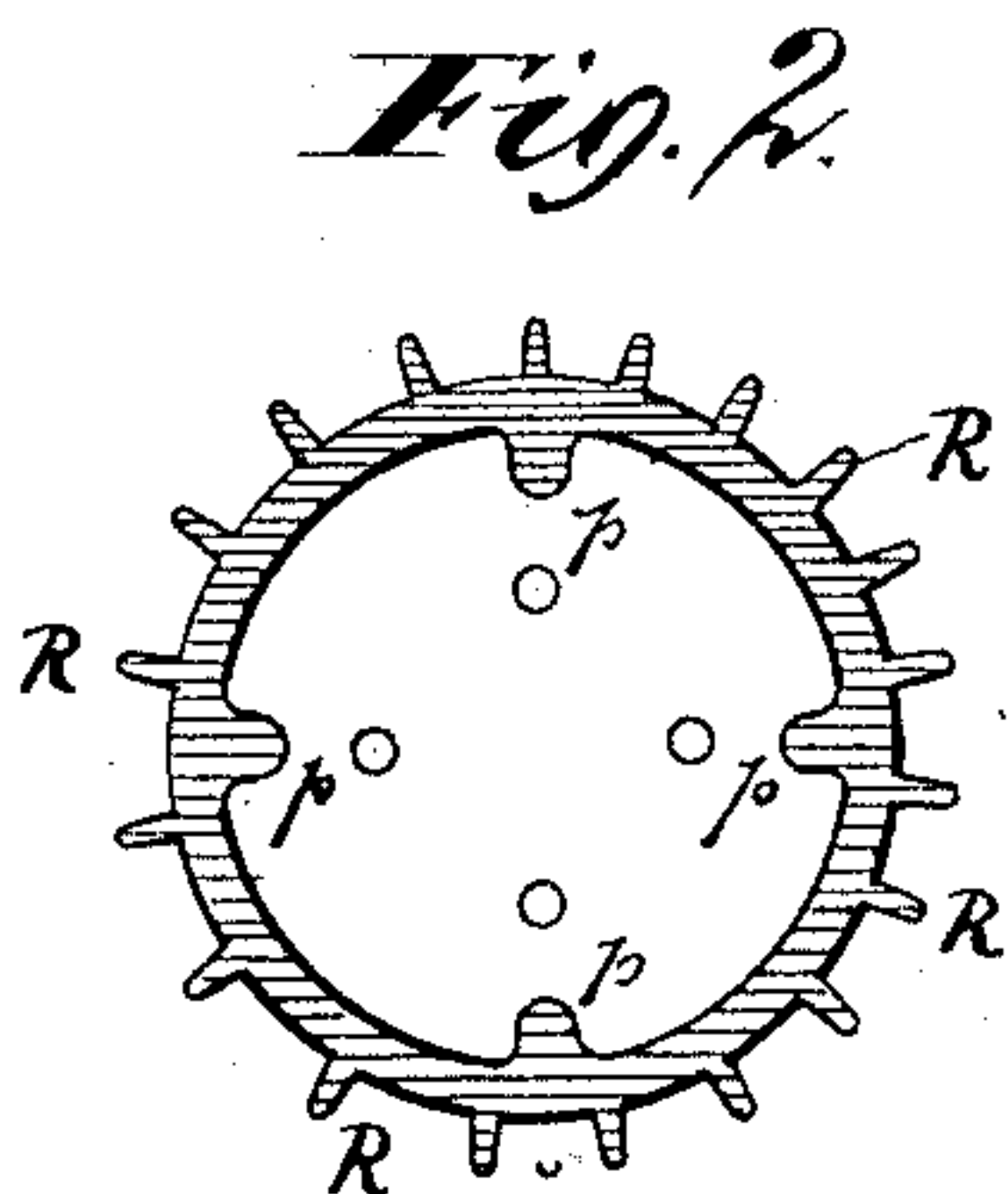
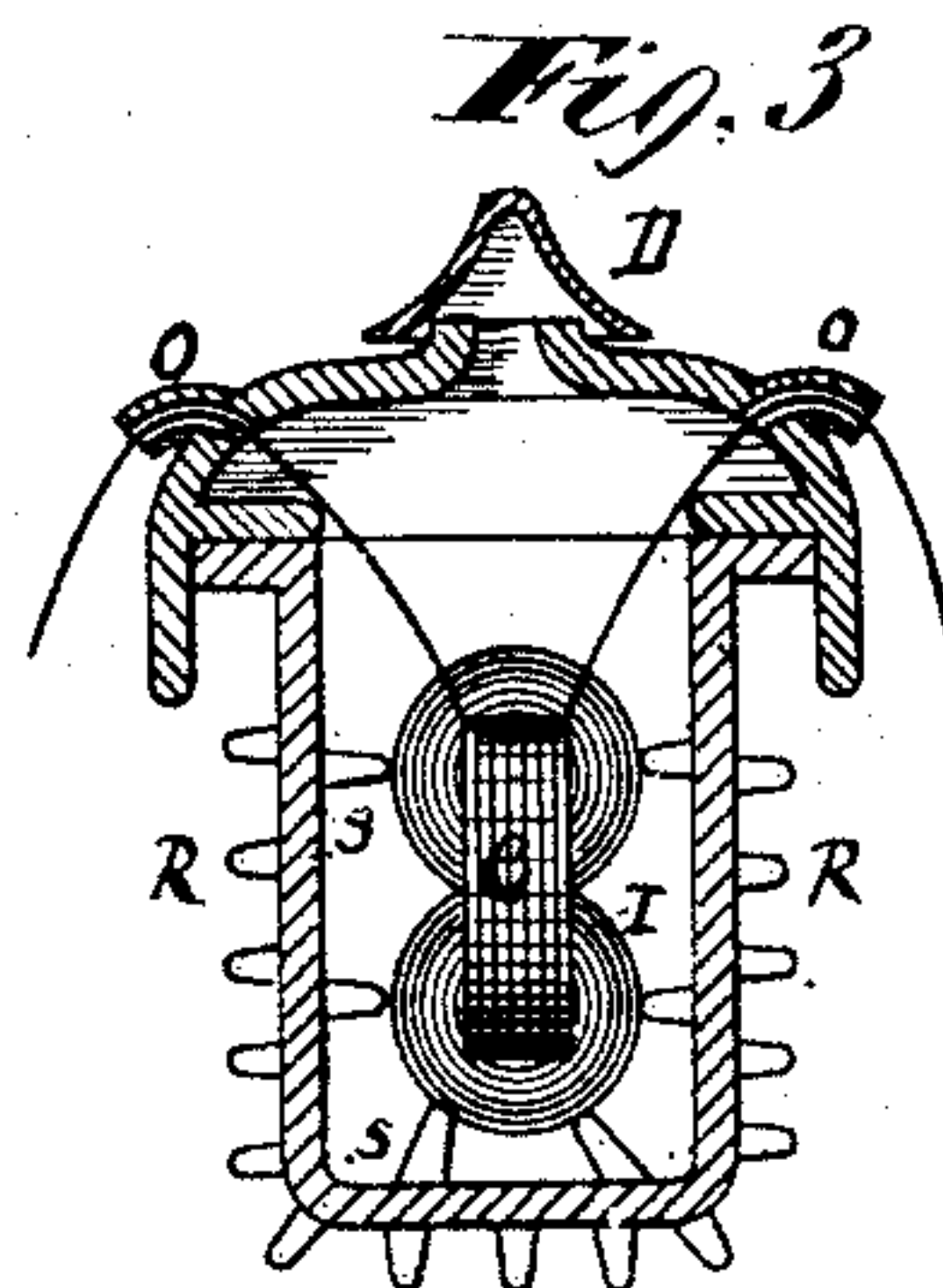
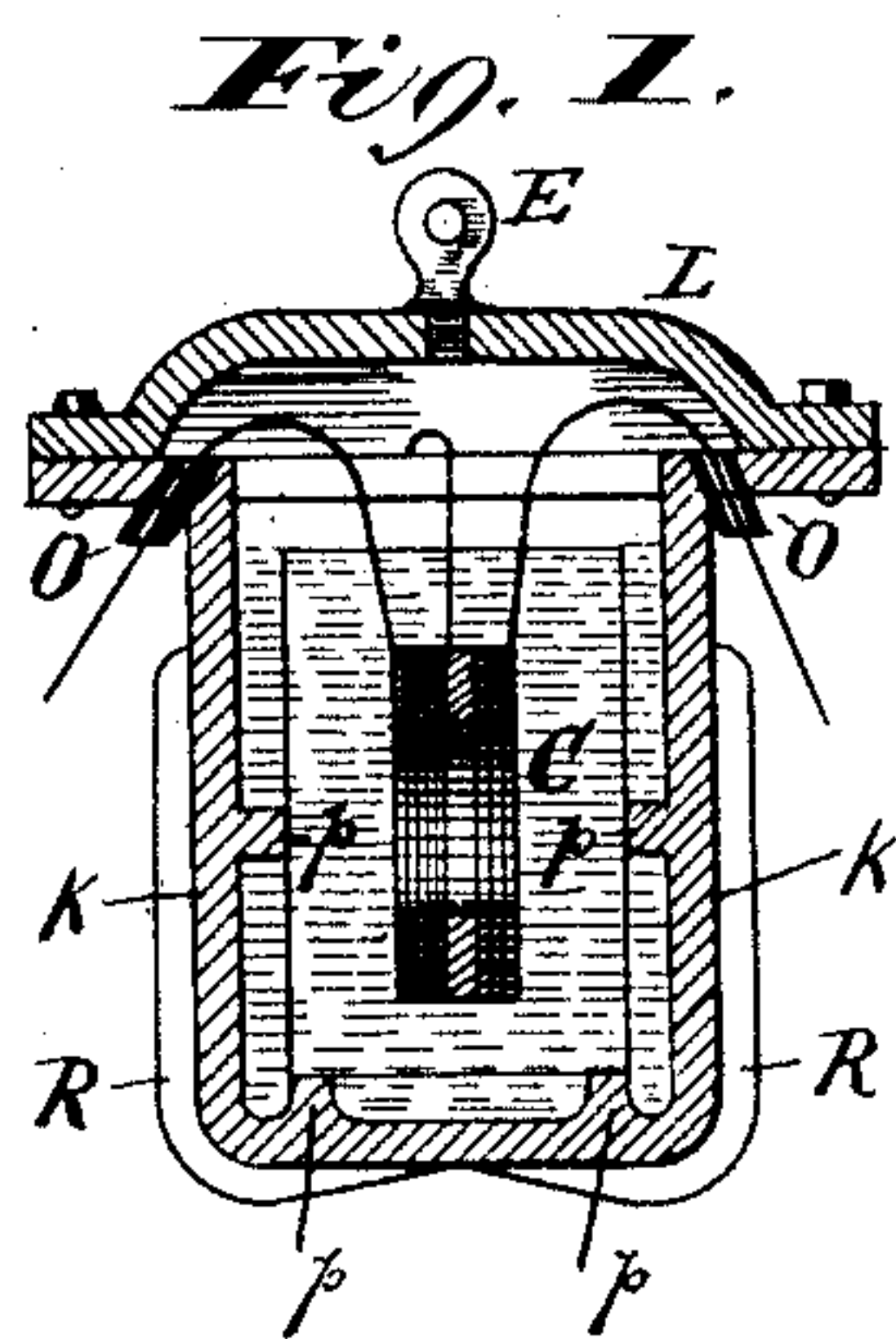
(No Model.)

2 Sheets—Sheet 1.

E. THOMSON.  
CASING FOR INDUCTION COILS.

No. 428,648.

Patented May 27, 1890.



WITNESSES:  
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*Wm. A. Cape*

INVENTOR  
*Elihu Thomson.*  
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*Townsend & MacArthur*  
ATTORNEYS

(No Model.)

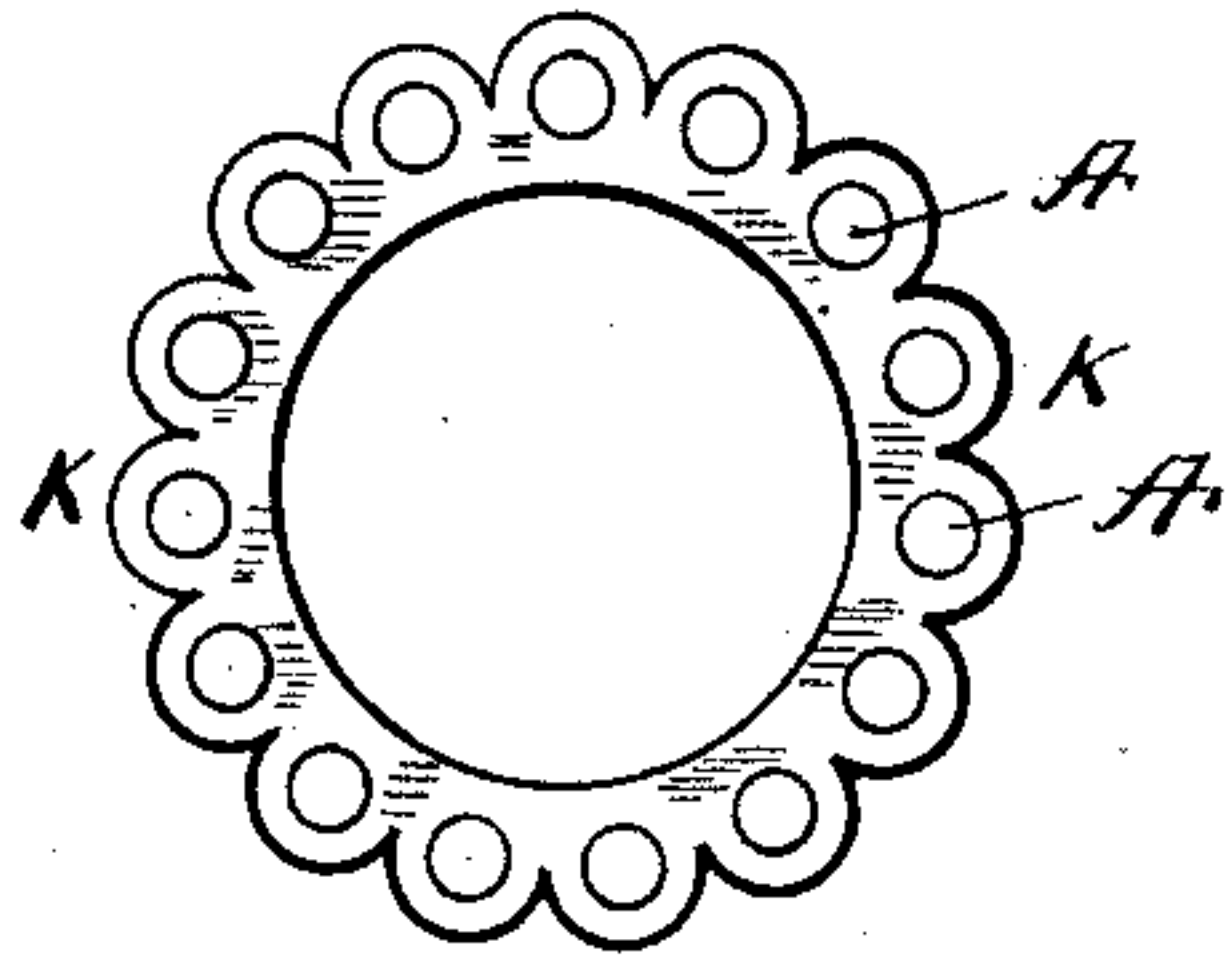
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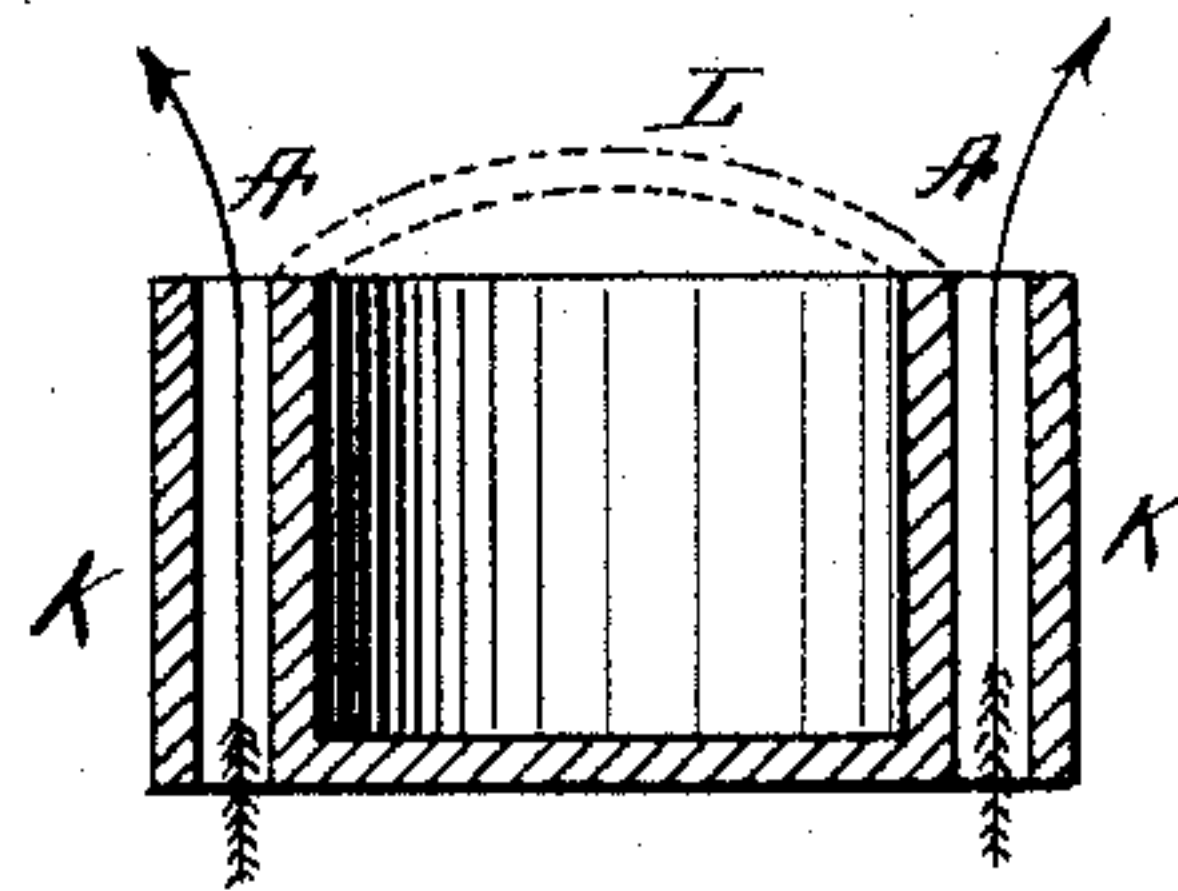
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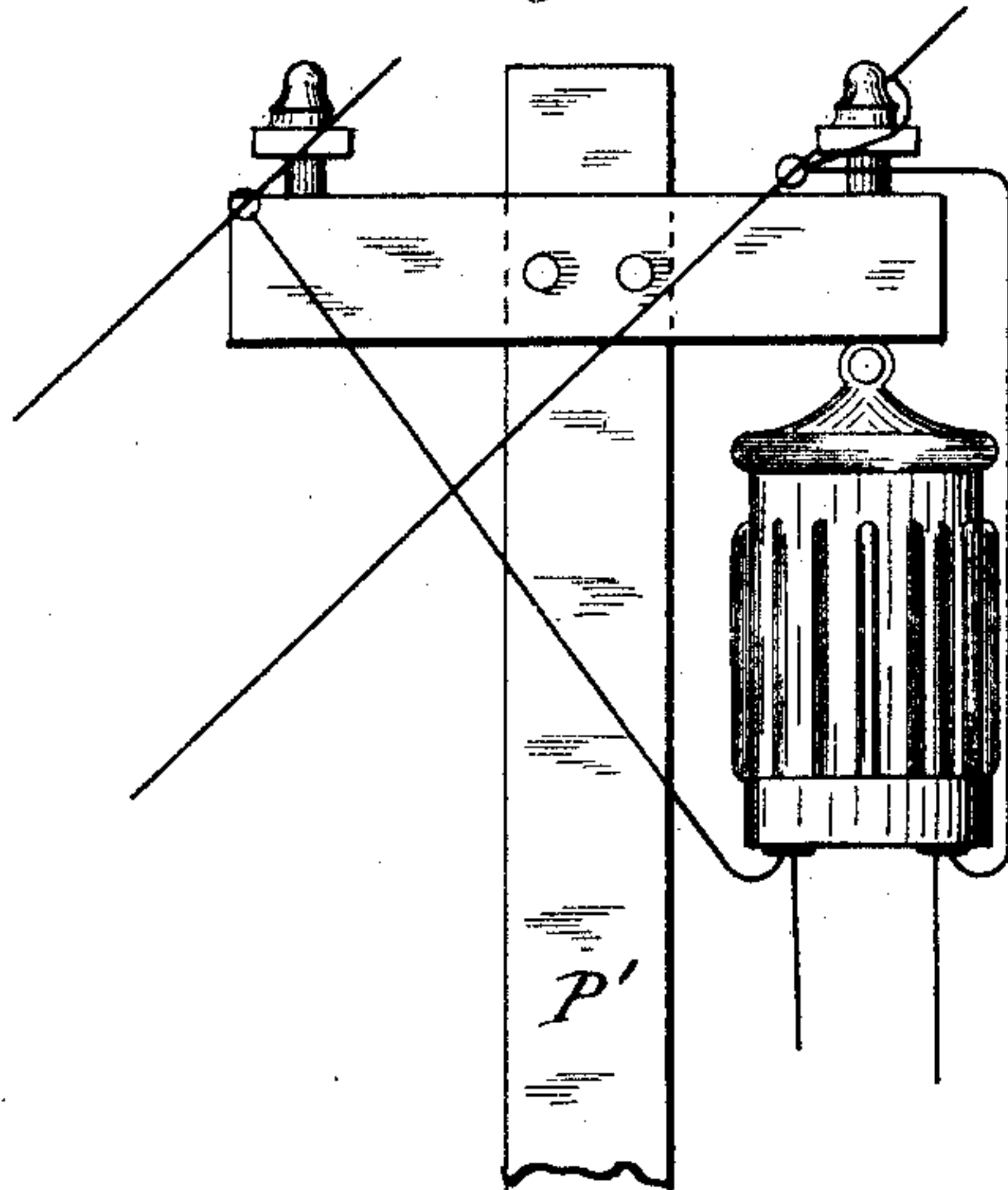
*Fig. 6.*



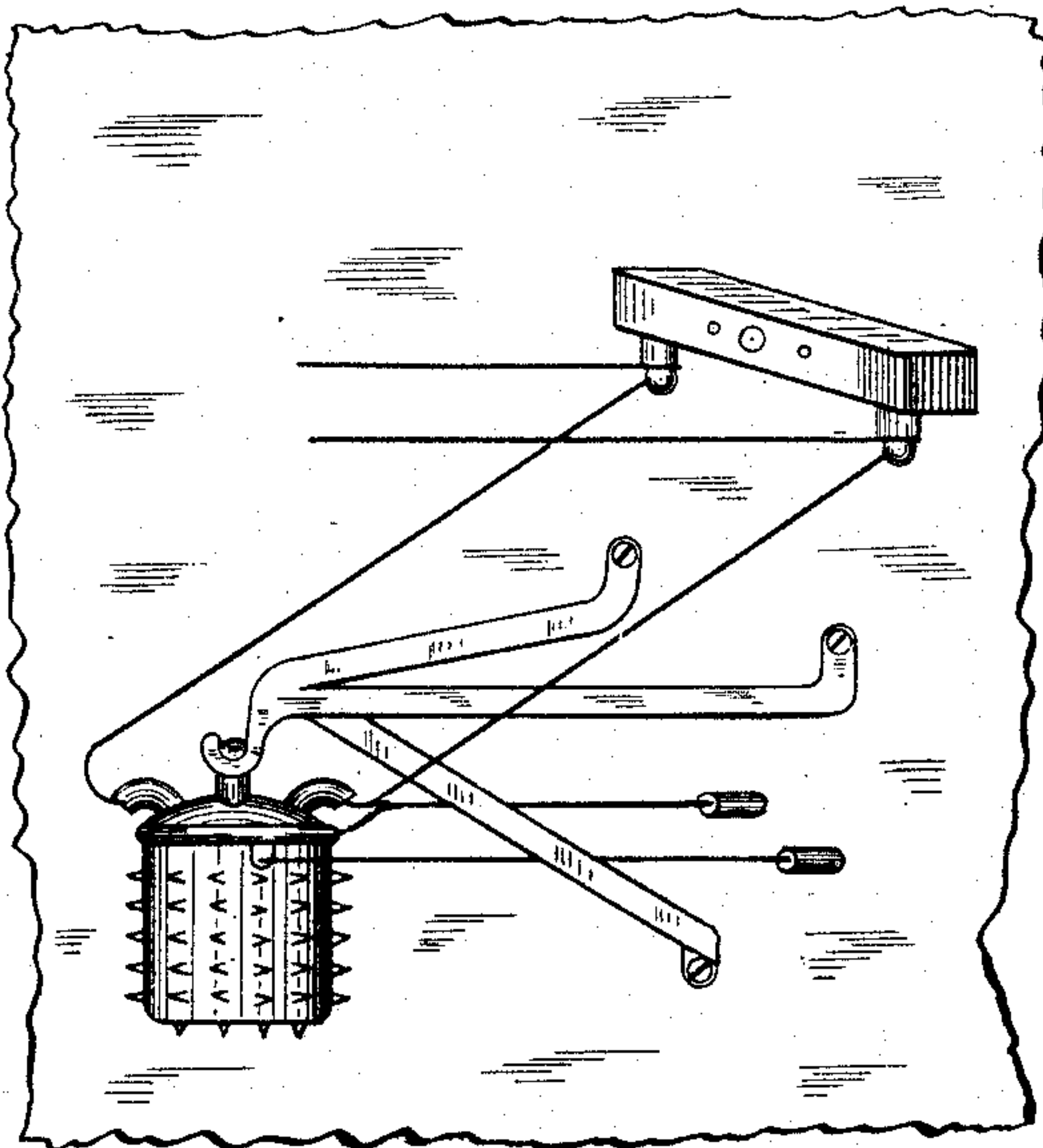
*Fig. 7.*



*Fig. 8.*



*Fig. 9.*



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# UNITED STATES PATENT OFFICE.

ELIHU THOMSON, OF LYNN, MASSACHUSETTS, ASSIGNOR TO THE THOMSON-HOUSTON ELECTRIC COMPANY, OF CONNECTICUT.

## CASING FOR INDUCTION-COILS.

SPECIFICATION forming part of Letters Patent No. 428,648, dated May 27, 1890.

Application filed May 9, 1887. Serial No. 237,517. (No model.)

*To all whom it may concern:*

Be it known that I, ELIHU THOMSON, a citizen of the United States, and a resident of Lynn, in the county of Essex and State of Massachusetts, have invented a certain new and useful Casing for Induction-Coils, &c., of which the following is a specification.

The object of my invention is to provide a means whereby electro-magnetic coils—such as induction-coils, reactive coils, &c.—may be protected from exposure to the weather and from injury from external sources, and whereby at the same time the escape of heat from the coil to the external air may be facilitated without ventilating the casing of the coil and without rendering the insulation liable to materialization.

My invention is designed especially for application to electro-magnetic coils consisting of either induction-coils or of simple reactive coils when placed in an alternating-current circuit or in a rapidly-pulsating or otherwise variable current circuit where the coils are liable to become heated from the rapid changes of magnetic and electrical conditions.

Briefly, my invention consists in the combination, with an electro-magnetic coil, of a closed casing made of some material which is a good conductor of heat and is of sufficient size to provide a space within it between its inner walls and the coil, within which space is contained a fluid—such as air or oil—that by convection shall transmit the heat of the coil to the casing, from which latter it is dissipated in the surrounding air.

My invention consists, also, in certain novel means for insulating the coils, as will be hereinafter more particularly described.

The casing itself may be provided with external projections or studs or ribs, whereby the surface exposed to air is greatly increased. The interior surface of the casing may also be studded or ribbed, but in such way as not to seriously interfere with the convective currents of fluid.

The convective fluid for small coils may be air only; but I much prefer to use oil, preferably a mineral oil of a non-volatile character, which is also an excellent insulator. Oils of the paraffine series are suitable, especially those of high boiling-point. Paraffine-wax may itself be used as the filling, as on

slight heating it melts and becomes fluid, acting thereafter as an oil. A mixture of paraffine-wax and mineral oil is good, for when cold it is buttery or semi-solid and when warmed it becomes perfectly fluid and convective, while during the warming much heat is rendered latent by the melting of the solid paraffine present.

The immersion of the induction-coil in such an oil gives great advantages in keeping out all moisture, in avoiding the necessity for other insulation on the copper wire of the coil than the cotton or other porous covering, which becomes permeated by the oil, and in transferring heat by convection from the body of the induction-coil to the external iron casing, by which latter it is, on account of the large surface exposed to the air, dissipated. Besides these advantages the casing may be so covered or sealed that it can be exposed to the weather without risking the insulation of the coils. Ventilated coil-casings in foggy or very rainy weather so exposed may easily become leaky and cause, through access of moisture to them along with the entering air, a loss of insulation of the inclosed coil.

The casing which I use is of course closed or made tight, or is suitably constructed to prevent escape of fluid or access of water. When the coil is placed in it, the whole is heated to the boiling-point of water, or a little above, to drive out all moisture from the casing and inclosed coil and cause the oil to thoroughly permeate all spaces.

My invention may be adapted to use with all forms of electro-magnetic coils, and may be indefinitely modified in form and minor details.

In the accompanying drawings, Figure 1 is a vertical section of an apparatus embodying my invention. Fig. 2 is a horizontal cross-section of the same. Figs. 3, 4, and 5 are vertical sections of modified forms of the invention. Fig. 6 is a horizontal section, and Fig. 7 a vertical section, of a modified form of inclosing-casing.

Figs. 8 and 9 illustrate ways of suspending the apparatus when it comprises an induction-coil the primary of which is connected to a main feeding-line, while its secondary is connected to a local line.



Referring to Fig. 1, C indicates a form of induction-coil composed of iron plates and copper coils, as indicated, said coils being primary and secondary coils.

5 K indicates an outer closed casing of cast-iron or other material that is a good conductor of heat, and L the lid for said casing, which lid may be provided with an eye or hook E, for suspending the whole apparatus  
10 or to assist in handling the lids. The casing is made large enough to leave a free space, as indicated, between the induction-coil and the interior of the casing.

I preferably provide interior projections *p*  
15 *p* for the casing, which serve to steady and support the induction-coil, and which project into the space containing the oil or other fluid. Projecting external ribs R R may be also provided for increasing the external sur-  
20 face of the casing exposed to the air, the oil, or other fluid. The projections R R are not necessary; but they are more useful with the large sizes of coils, or where the external surface of the casing is small in proportion to  
25 its capacity.

Suitably-insulated holes O are provided for the wires leading to and from the coil C. These holes lead downwardly, as indicated in Fig. 1 and in the other figures, in order that  
30 when the apparatus is in its upright and normal position there may be no opportunity for the entrance of water or other foreign substance.

Fig. 3 shows a similar arrangement with  
35 exterior studs R R R and interior studs *s s* and with another form of induction-coil C I inclosed. The lid overhangs the casing, and the wire-openings O O are spouts in the lid turned downward to prevent entrance of wa-  
40 ter. The lid can have an opening at the top, with a cover D lightly capping the same, for the purpose of allowing free expansion and contraction of contained fluid and air during warming and cooling.

45 Fig. 4 is a section of a casing differing from Fig. 1 in that the entering wires pass up through the center and through vertical tubes T, reaching above the oil in the vessel. This is done to prevent leak of oil. The  
50 coil C C is shown as of the closed-ring type. Below the oil-chamber in K is an open space or chamber B, protected from weather by an extension from casing K downward, and in which space switches or fusible plugs or light-  
55 ning-arresters, as may be desired, may be established and rendered accessible by removal of a portion of or the whole of the bottom plate P, ordinarily screwed to the casing K.

60 V V represent fusible plugs in circuit between the wires leading in at the openings O O and the wires leading to the coil C up the central tube T.

Fig. 5 shows plain cylindrical coils C and  
65 iron-wire core I as the induction-coil immersed in a body of oil Y. The lid L is closed securely, and the casing K K is large

and without projections either interior or exterior. The curved tubes T, opening above the oil-surface and from the exterior sur-  
70 face of K, permit the wires to pass in and upward before turning down to the coil C. The wires are of course heavily insulated with a good covering, which is not injured by the oil. In the case of Fig. 5 the parts  
75 will be more bulky for the same work, but will serve the purpose of the invention. Instead of projections on K, lateral air-passages, as A A, &c., Figs. 6 and 7, may be provided for upward circulation of air to keep  
80 the temperature down, and various similar modifications may be employed. The casing and induction-coil inclosed therein may be placed wherever convenient, as suspended from the cross-arm of a pole P', Fig. 8, or  
85 hung upon a bracket on the side of a building, as indicated in Fig. 9, suitable wiring and connection being of course provided.

What I claim as my invention is—

1. The combination, with an electro-mag-  
90 netic coil, of a casing formed of a metal that is a good conductor of heat, containing oil in a free intermediate space adapted to allow convective currents in the oil for conveying the heat of the coil to the casing, as and for  
95 the purpose described.

2. The combination, with the electro-mag-  
netic coil, of the closed iron or equivalent casing separated from the same by a free fluid-containing space and having internal  
100 projections, as and for the purpose described.

3. The combination, with the electro-mag-  
netic coil, of the closed casing separated from the same by a fluid-containing space and  
105 having external projections or their equivalent, as described, to facilitate the dissipation of heat.

4. The combination, with the electro-mag-  
netic coil and the liquid-containing box or  
110 receptacle for the same, of passages for the electric conductors, extending downwardly, as described, and starting from a point above the level of the liquid, as and for the purpose set forth.

5. The combination, with the electro-mag-  
netic coil, of a closed casing having a down-  
wardly-depending flange forming a chamber B and safety-fuses mounted in said chamber,  
120 as and for the purpose described.

6. The combination, with an induction-  
coil, of an inclosing case, chamber, box, or receptacle formed of metal, so as to be a good  
125 conductor of heat, and containing oil, in which the induction-coil is immersed for protection, insulation, and withdrawal of heat.

Signed at Lynn, in the county of Essex and State of Massachusetts, this 4th day of May, A. D. 1887.

ELIHU THOMSON.

Witnesses:

J. W. GIBBONEY,  
M. L. THOMSON.