(No Model.) 2 Sheets—Sheet 1.

W. E. AYRTON & T. MATHER.

INDUCTIVE MECHANISM FOR ELECTROSTATIC INSTRUMENTS.

No. 513,975. Patented Feb. 6, 1894.

FIG.1.

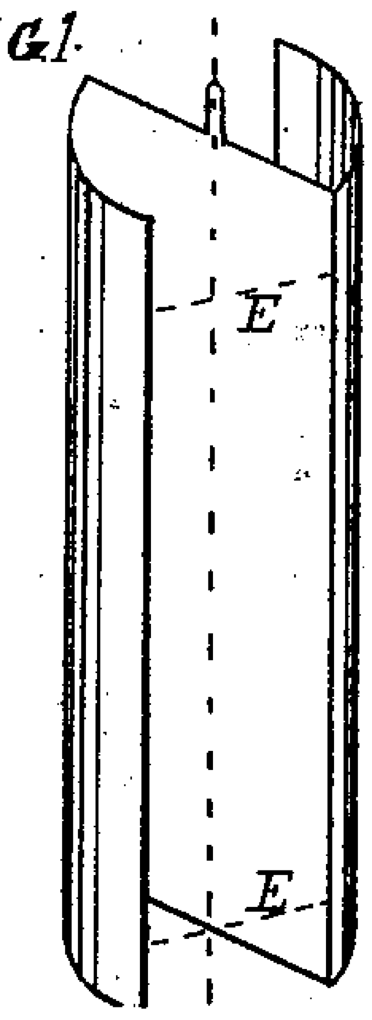


FIG.2

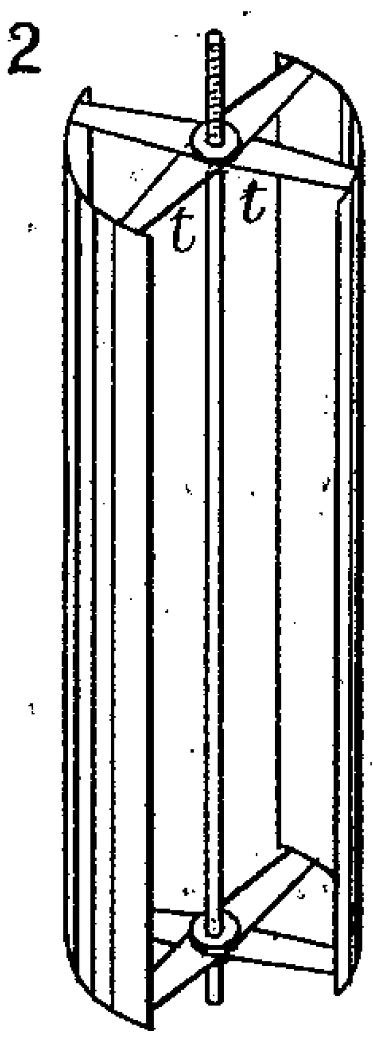


FIG.3

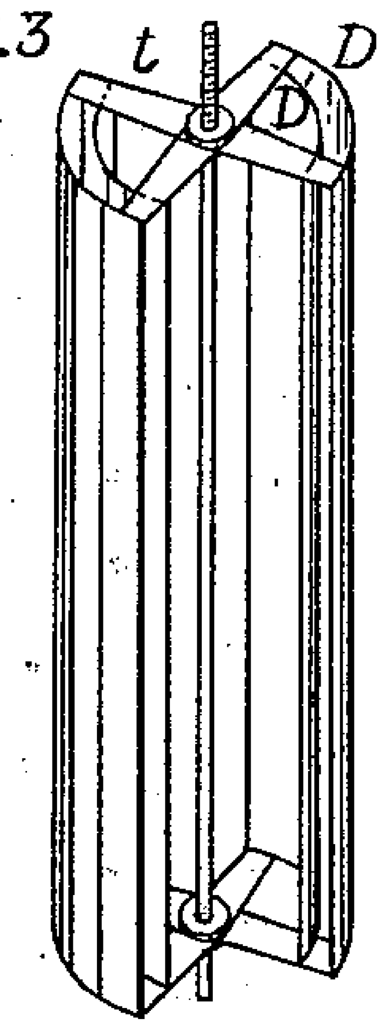


FIG.4

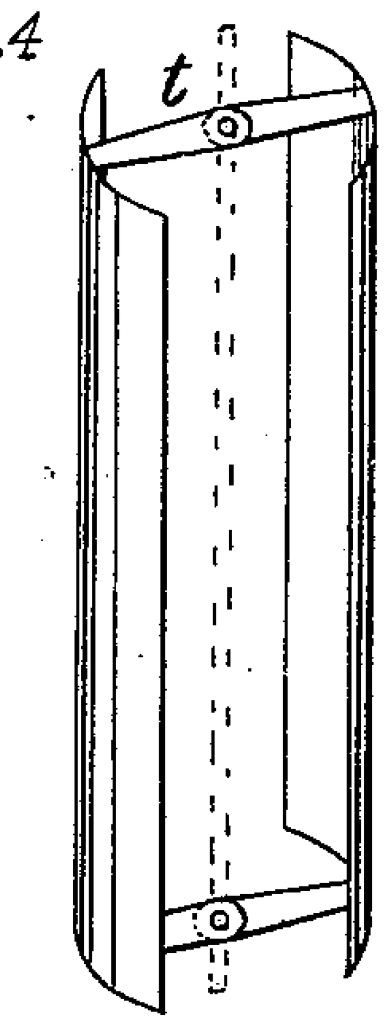


FIG.5

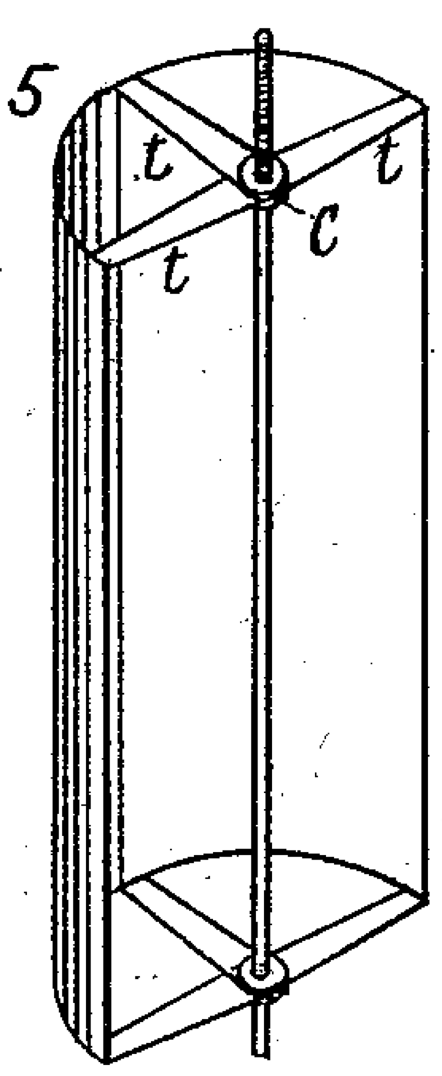


FIG.6

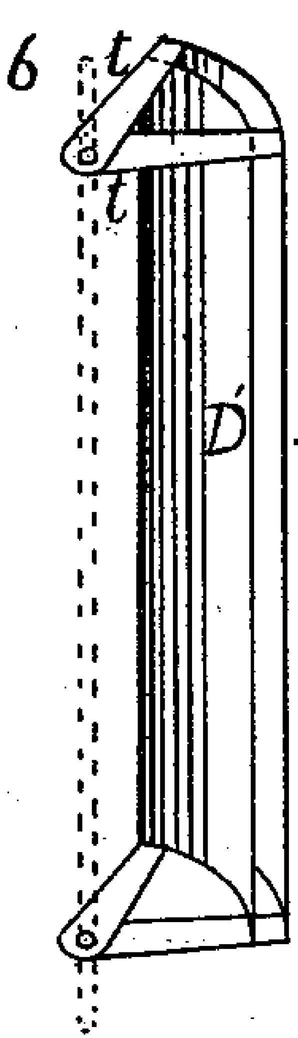
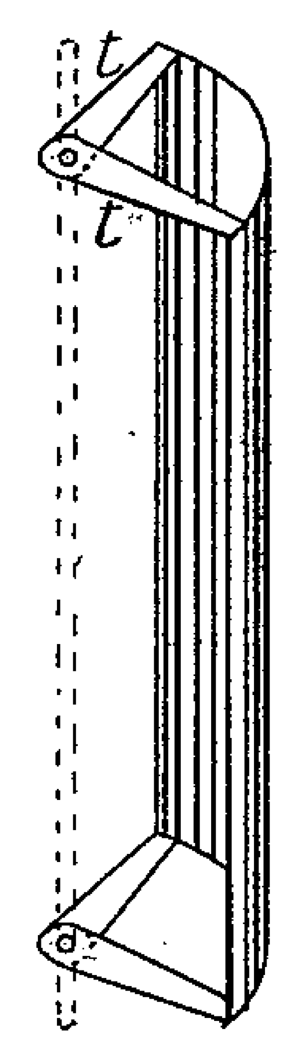


FIG.7



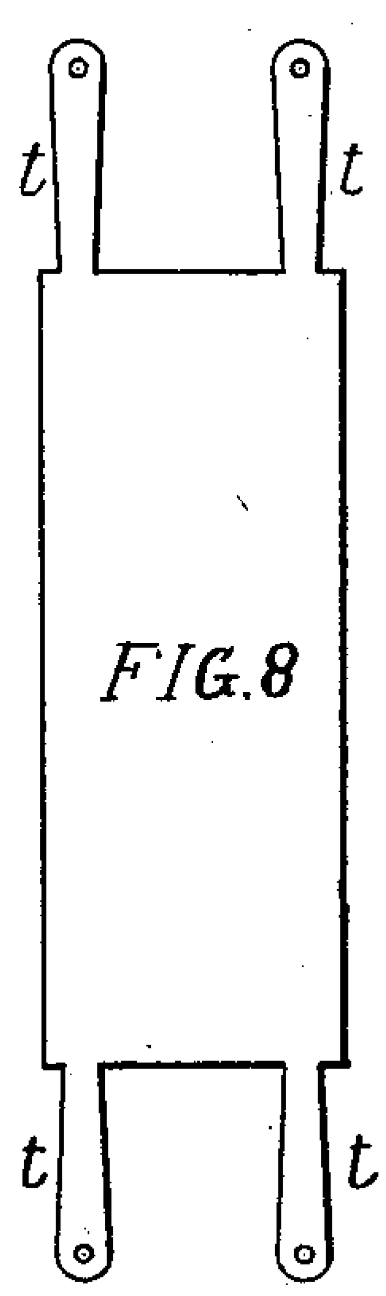


FIG.8

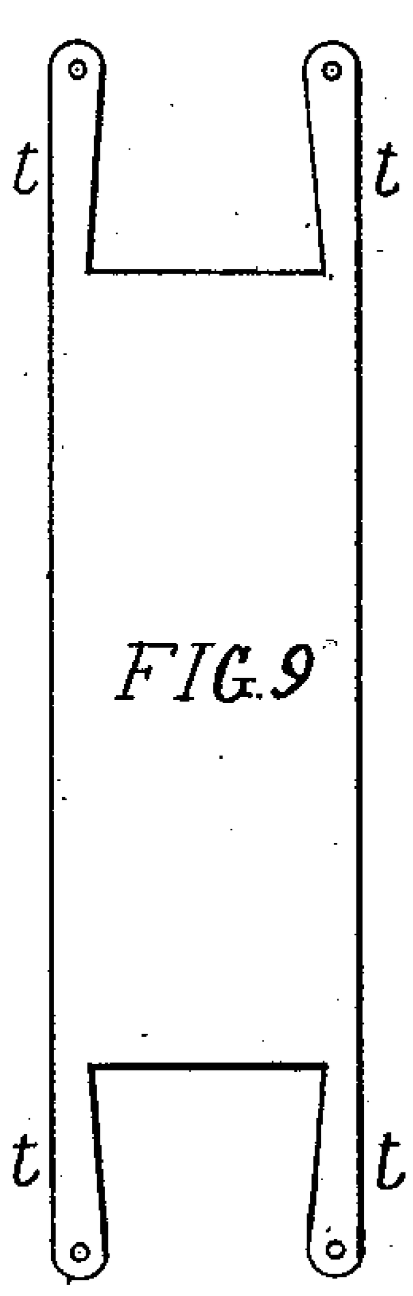


FIG.9

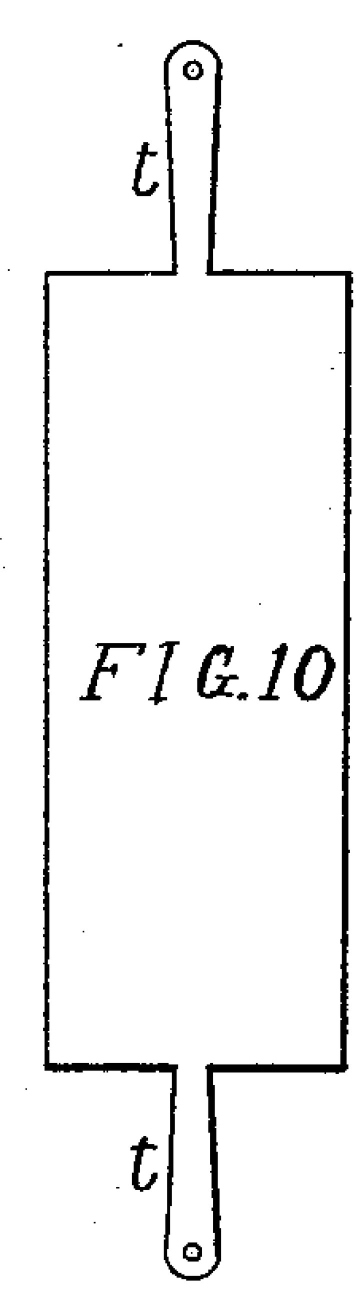


FIG.10

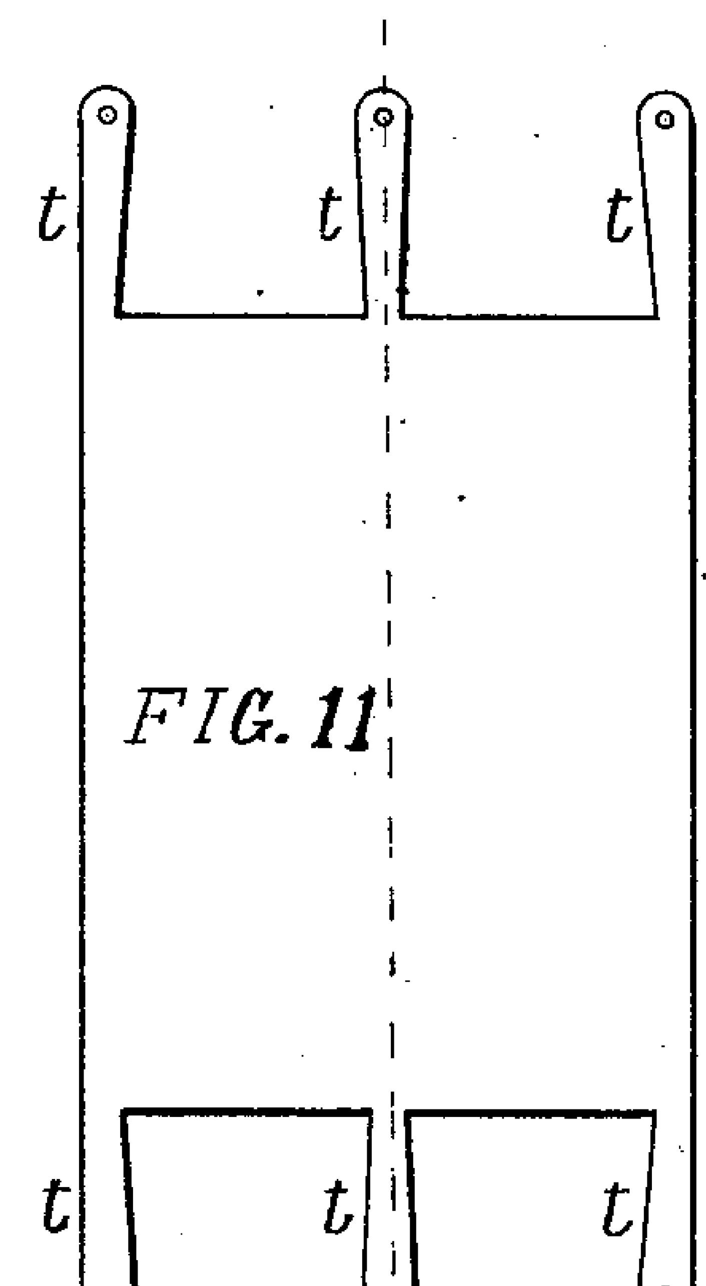


FIG.11

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(No Model.) 2 Sheets—Sheet 2.

W. E. AYRTON & T. MATHER.

INDUCTIVE MECHANISM FOR ELECTROSTATIC INSTRUMENTS.

No. 513,975. Patented Feb. 6, 1894.

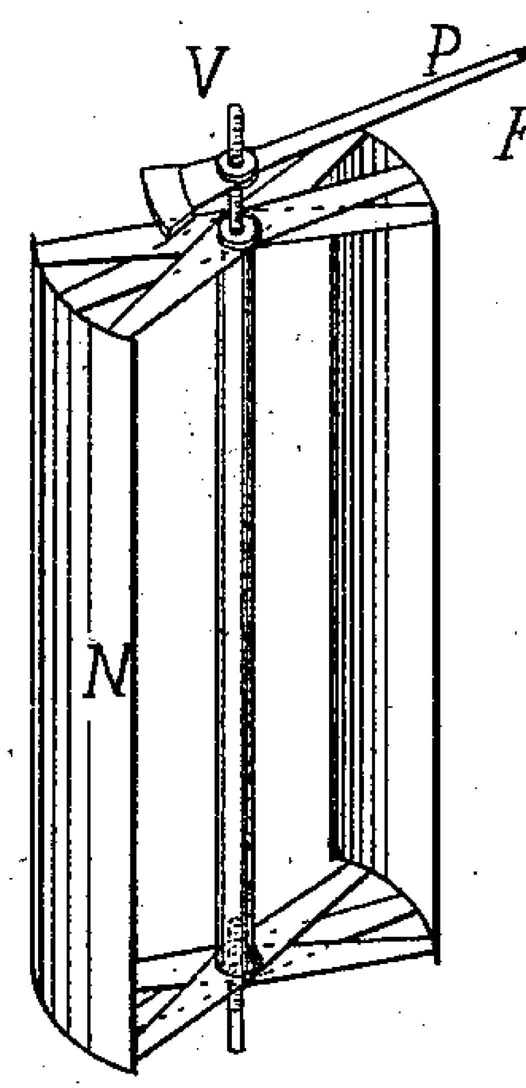

FIG. 12

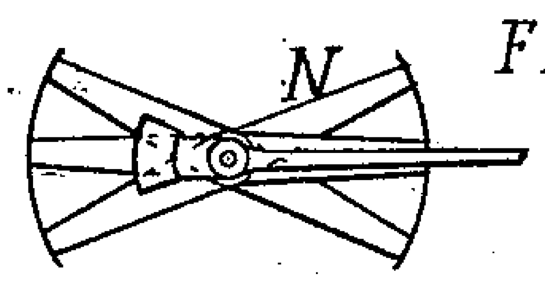

FIG. 13

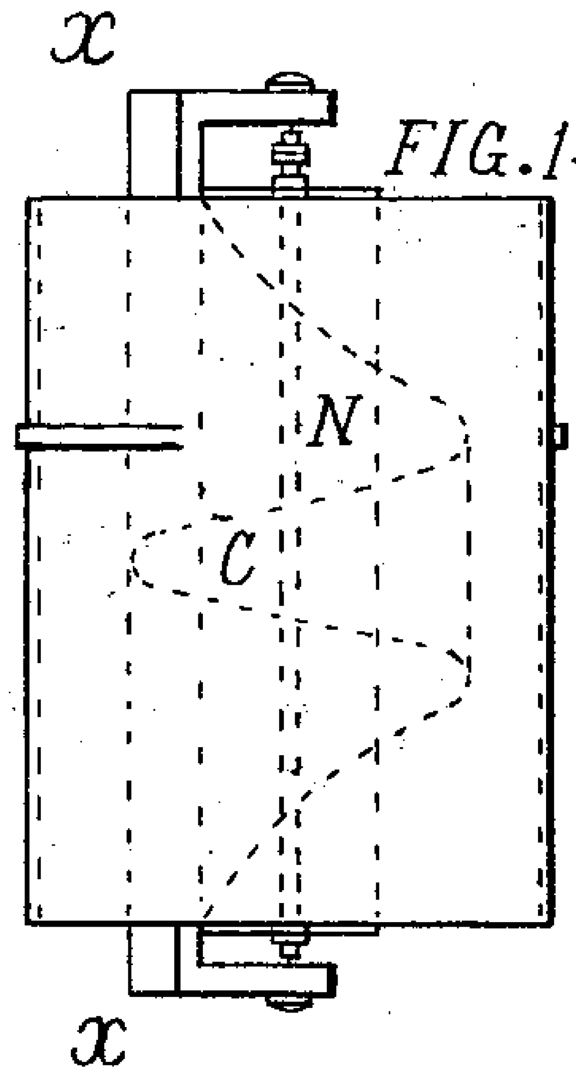

FIG. 14

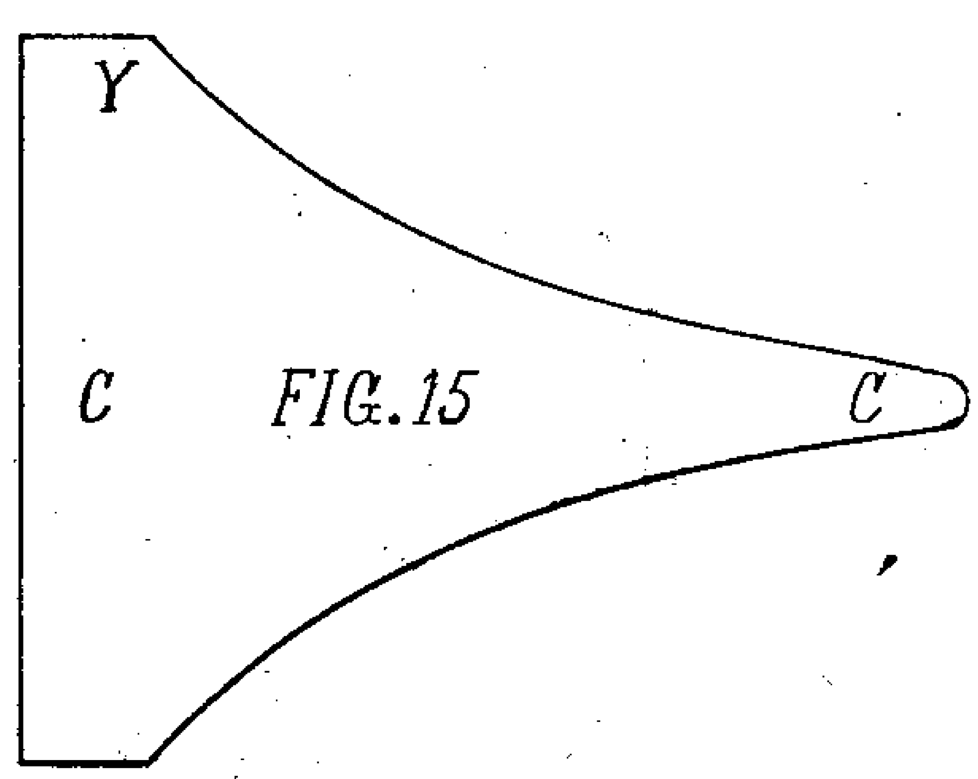

FIG. 15

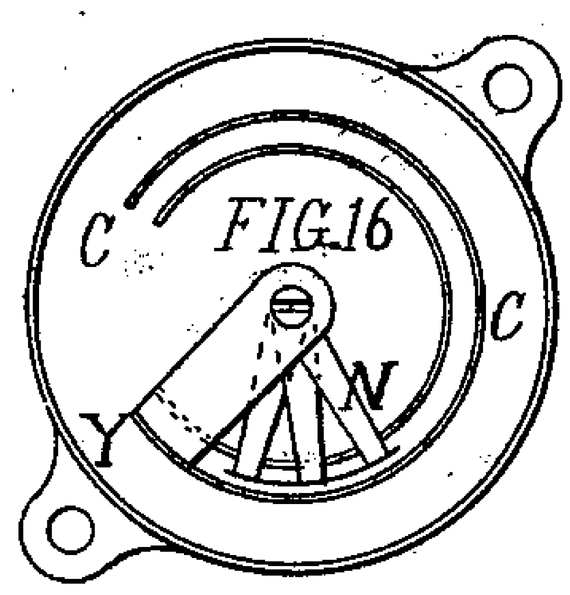

FIG. 16

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UNITED STATES PATENT OFFICE.

WILLIAM EDWARD AYRTON AND THOMAS MATHER, OF LONDON, ENGLAND.

INDUCTIVE MECHANISM FOR ELECTROSTATIC INSTRUMENTS.

SPECIFICATION forming part of Letters Patent No. 513,975, dated February 6, 1894.

Application filed May 1, 1893. Serial No. 472,822. (No model.) Patented in England July 29, 1890, No. 11,862.

To all whom it may concern:

Be it known that we, WILLIAM EDWARD AYRTON and THOMAS MATHER, both residing at London, England, have invented Improved Inductive Mechanism for Electrostatic Instruments, (which has been patented to us in Great Britain under No. 11,862, and dated July 29, 1890,) of which the following is a specification.

Our invention relates to electrical measuring instruments, whose indications depend on electrostatic attraction or repulsion or both, and consists of an improved manner of making and fitting together the movable system, or needle of such an instrument, to insure good electrical continuity between these parts, or between them and any portion of the fixed inductor system of the instrument; and further in making the movable and fixed inductor parts of such an instrument of certain definite forms and shape so as to embrace the needle peripheries on several sides and of certain definite relative positions to one another, to obtain great sensibility, or an exceptional sensibility at certain parts of its scale of indication. It has been hitherto customary to construct the skeleton aluminium needle of a cylinder electrometer, out of several pieces, riveted or cemented together, but such methods do not always insure good electrical contact between the parts so attached, and thus a serious error is introduced, when the instrument is employed with alternating potential differences. To avoid this defect, we make the entire body of the needle out of one piece of metal, bent, molded, or otherwise adapted, to the required shape.

Figures 1, 2, 3, 4, 5, 6, and 7 show in perspective various modified forms of skeleton needles for an electrometer and Figs. 8, 9, 10 and 11 represent the flat sheets of metal from which such skeleton needle bodies with attachments to the central spindle are made in one piece without joints. Figs. 12 and 13 are a perspective elevation and plan of a double skeleton needle fixed to spindle ready to be mounted in an electrometer. Figs. 14 and 16 are an elevation and plan of the movable and fixed systems of an electrometer made according to our invention, and Fig. 15 is a development in the flat of the fixed inductor plate, showing special modification of shape to obtain special calibration.

The skeleton needle, as shown in Fig. 1, is made by molding a rectangular sheet of metal in a **Z** form, the peripheries being thus in actual metallic continuity with one another, and with the spindle, which may be formed from the same sheet or be brazed thereto. If desired, stays, E may be used to support the peripheries to render them rigid.

Figs. 2 and 4 show needles, made respectively from pieces of sheet metal of the shapes shown in Figs. 8 and 10. A complete needle, resembling Fig. 2, is shown in Figs. 12 and 13.

Fig. 3 shows a double needle with duplicate peripheries D, D′ made from four sheets as shown in Fig. 9, two of the said sheets having lugs or arms *t t* of shorter length than those of the two external peripheries.

Fig. 5 is a single needle, with half cylindrical periphery, with three arms of attachment *t t t* to the center spindle C, as bent up from a sheet of the form shown in Fig. 11.

Figs. 6 and 7 show a single needle, with two duplicate peripheries and a single periphery respectively, made from sheets of the shape shown at Figs. 8 or 9, the length of the lugs or arms being shortened for the inner duplicate periphery.

In Figs. 12 and 13, double light needle peripheries N are shown, attached to a spindle of extra weight, and preferably of large specific gravity to give stability to the needle when suspended, while at the same time its moment of inertia about its axis is as small as possible, in order that the time of oscillation should not be unduly long.

By reason of the construction of the needles with skeleton peripheries as herein above described we can arrange the attracting or inductive fixed surfaces C. C. both upon the inside and outside of the needle peripheries N as shown in Fig. 16. The said fixed surfaces C C are attached by their widest edges Y to a fixed bracket *x* of the instrument. A pointer P Fig. 12 is attached to the axis V to give the usual indication on a dial of the movement of the needle.

As the nature of the calibration curve of an electrostatic instrument depends on the character of the controlling force, and on the rate at which the electric capacity or induction of the system varies as the needle turns, we have found it advantageous to vary the shapes or area of the fixed inductive faces C C; and as one example of such variation of shape, we show in Fig. 15 a development in the flat of one of the fixed inductive surfaces C, which is of wide dimensions at one point of the travel of the needle and is caused to taper nearly to a point at the farther end of the travel of the needle.

It is obvious that we may employ various modifications in the shapes of the fixed inductive surfaces C, to produce various desired effects as to the calibration of the instrument. A similar modification in the calibration of the instrument may be effected by causing the fixed inductive surfaces C C to approximate at places nearer to the needle peripheries than at others; or a combination of various proximities of the fixed surfaces to those of the needle, and a variation of shapes of the fixed surfaces or needle peripheries may be used for this purpose.

Having now described our invention, what we claim, and desire to secure by Letters Patent, is—

1. In combination in an electrostatic measuring instrument, a skeleton needle of light periphery, and curved fixed sheet inductors embracing both faces of skeleton needle peripheries, and adjacent thereto.

2. In combination in an electrostatic measuring instrument, a suspended skeleton needle of light periphery with heavy spindle, to prevent instability of needle with minimum increase of time of oscillation, and curved sheet inductors concentric with and adjacent to the peripheries of needle.

3. In combination in an electrostatic measuring instrument a skeleton needle with light peripheries connected to spindle by arms formed without joint, out of stamped sheet peripheries; and curved sheet inductors concentric with and adjacent to, said peripheries.

4. In combination in an electrostatic measuring instrument, a skeleton needle of light periphery, and curved sheet inductors, adjacent to faces of said periphery, the said inductors being modified as to their surface area by part excision to effect a special calibration for the instrument.

In testimony whereof we have signed our names to this specification in the presence of two subscribing witnesses.

WILLIAM EDWARD AYRTON.
THOMAS MATHER.

Witnesses:
RICHARD A. HOFFMANN,
CHARLES H. CARTER.