(No Model.) 6 Sheets—Sheet 1.

E. WAGEMANN.

ELECTRIC REGULATOR.

No. 429,825. Patented June 10, 1890.

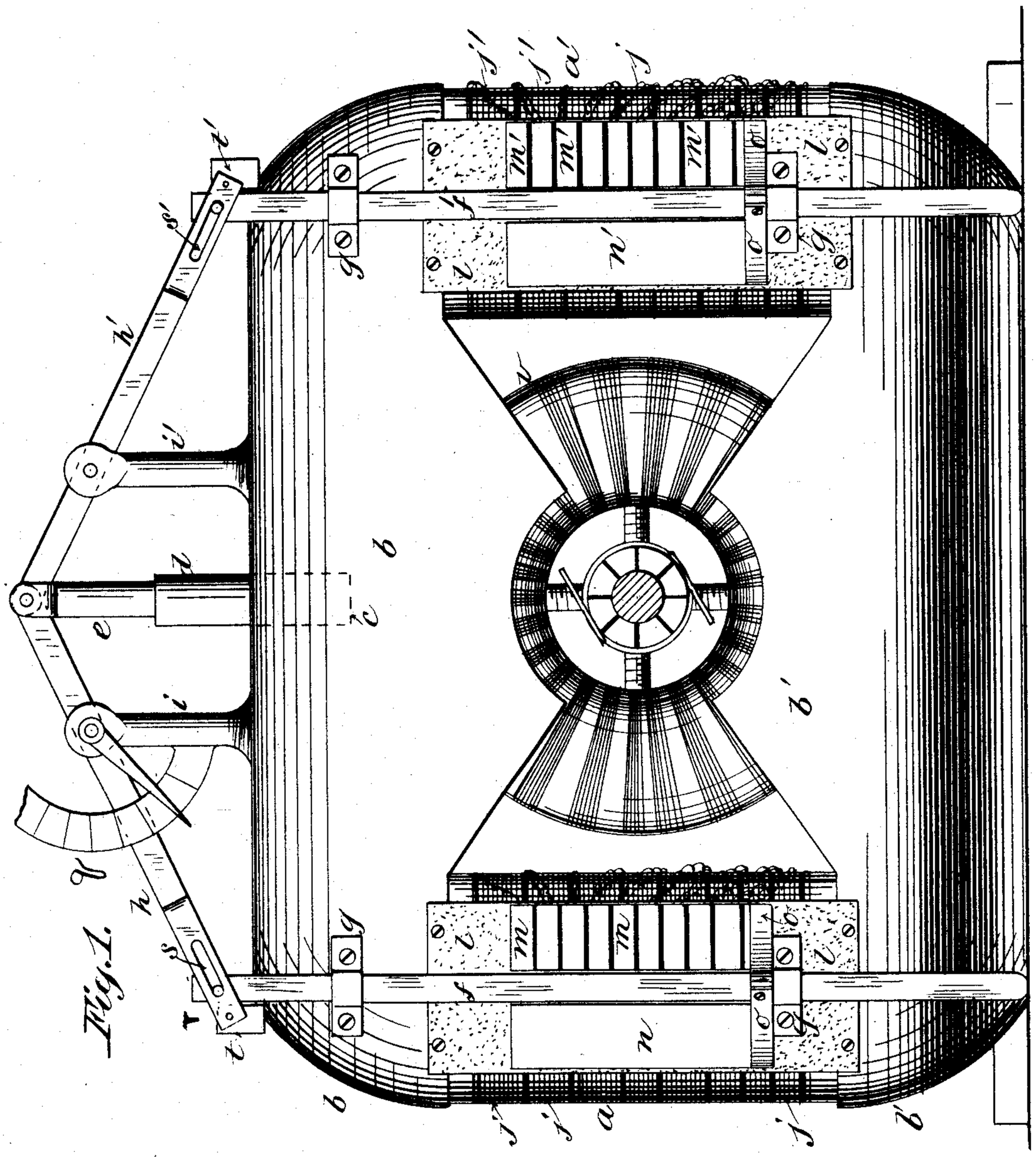


Fig. 1.

Witnesses:
D. W. Gardner
Nellie L. Pope.

Inventor:
Edmund Wagemann
By his Attorney,
Edward P. Thompson

(No Model.) 6 Sheets—Sheet 2.

E. WAGEMANN.

ELECTRIC REGULATOR.

No. 429,825. Patented June 10, 1890.

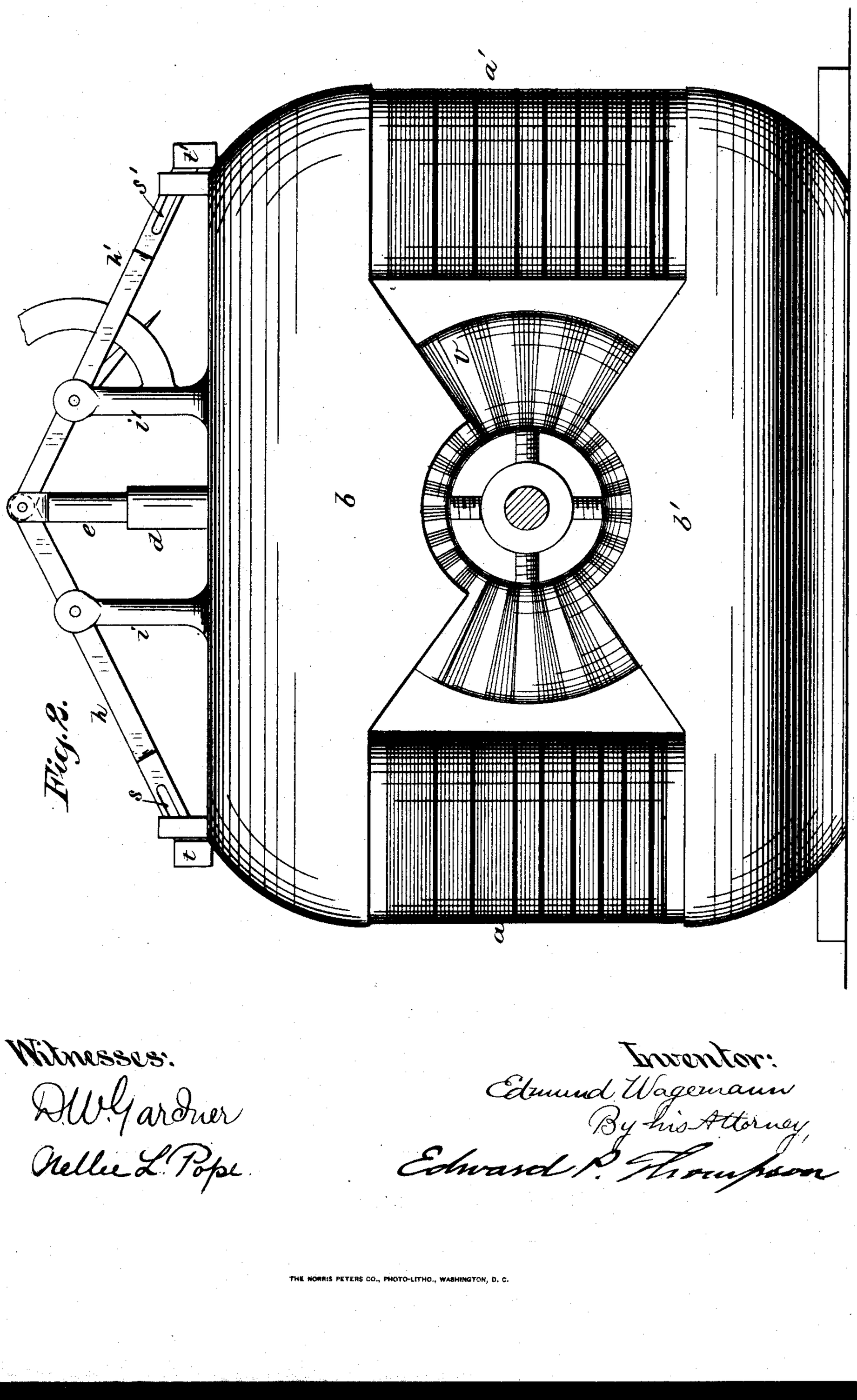


Fig. 2.

Witnesses:
D. W. Gardner
Nellie L. Pope.

Inventor:
Edmund Wagemann
By his Attorney,
Edward P. Thompson

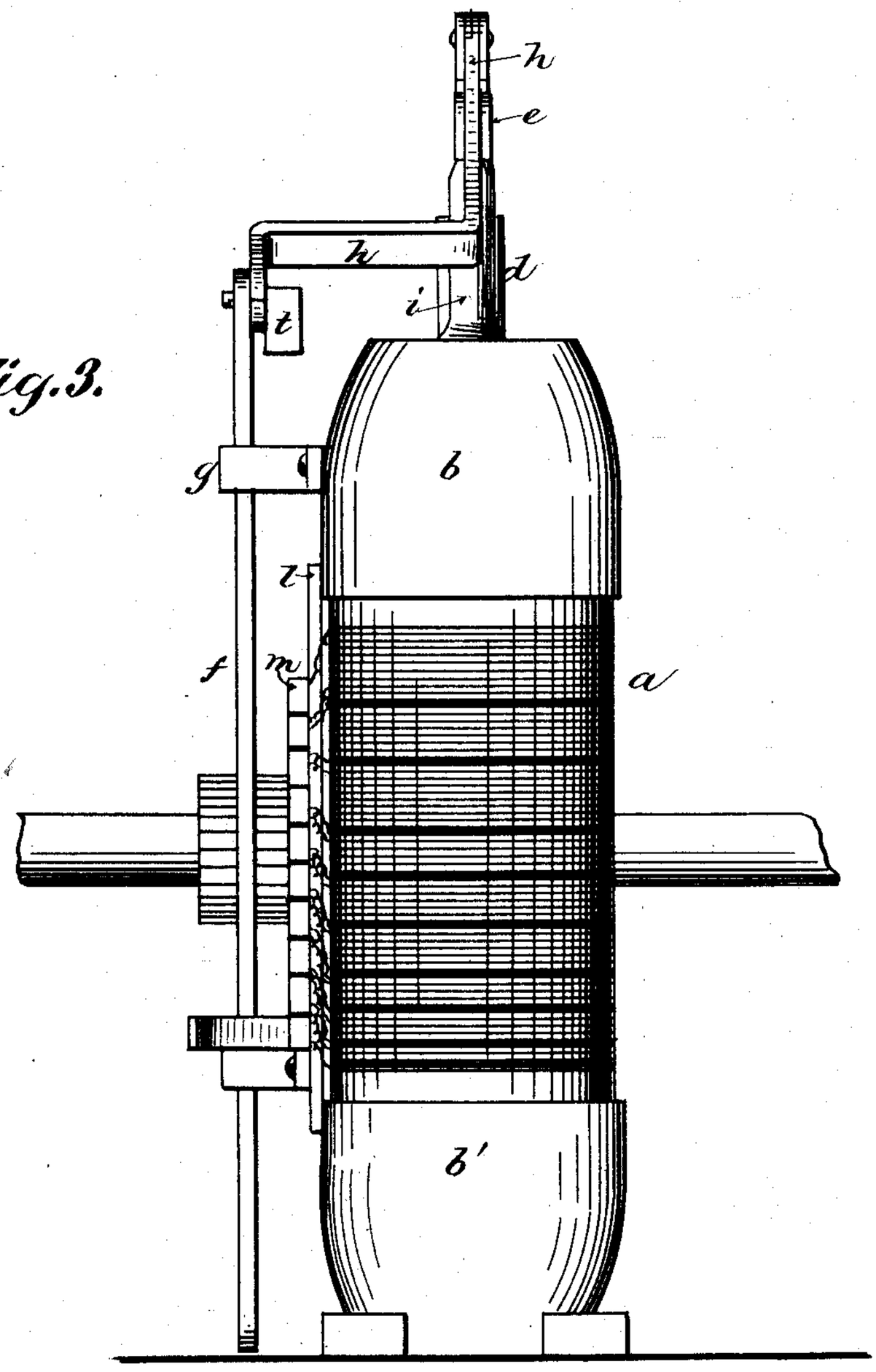
(No Model.) 6 Sheets—Sheet 3.

E. WAGEMANN.

ELECTRIC REGULATOR.

No. 429,825. Patented June 10, 1890.

Fig. 3.



Witnesses.
D. W. Gardner
Nellie L. Pope.

Inventor:
Edmund Wagemann
By his Attorney
Edward P. Thompson.

(No Model.) 6 Sheets—Sheet 4.

E. WAGEMANN.

ELECTRIC REGULATOR.

No. 429,825. Patented June 10, 1890.

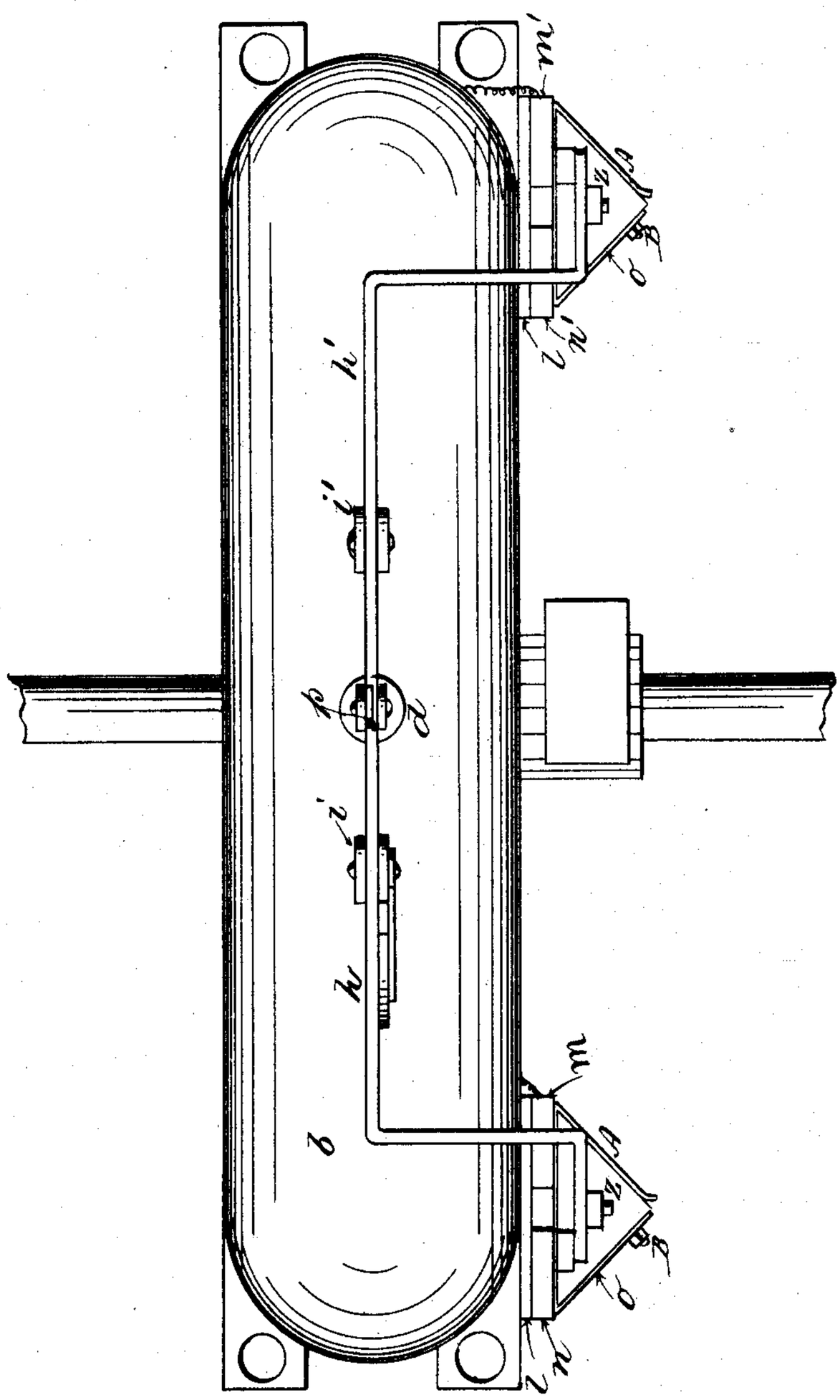


Fig. 4.

Witnesses:
D. W. Gardner
Nellie L. Pope.

Inventor:
Edmund Wagemann
By his Attorney,
Edward P. Thompson

(No Model.) 6 Sheets—Sheet 5.

E. WAGEMANN.

ELECTRIC REGULATOR.

No. 429,825. Patented June 10, 1890.

Fig. 5.

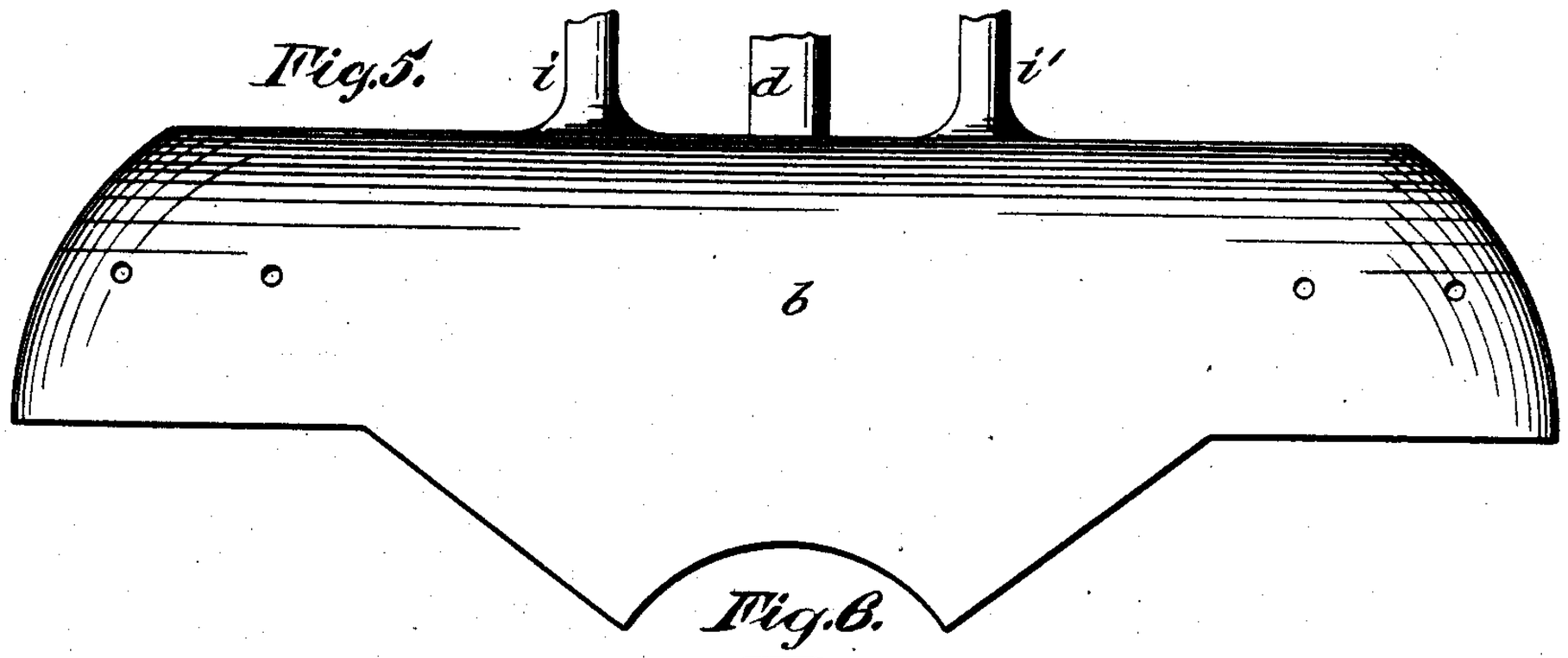


Fig. 6.

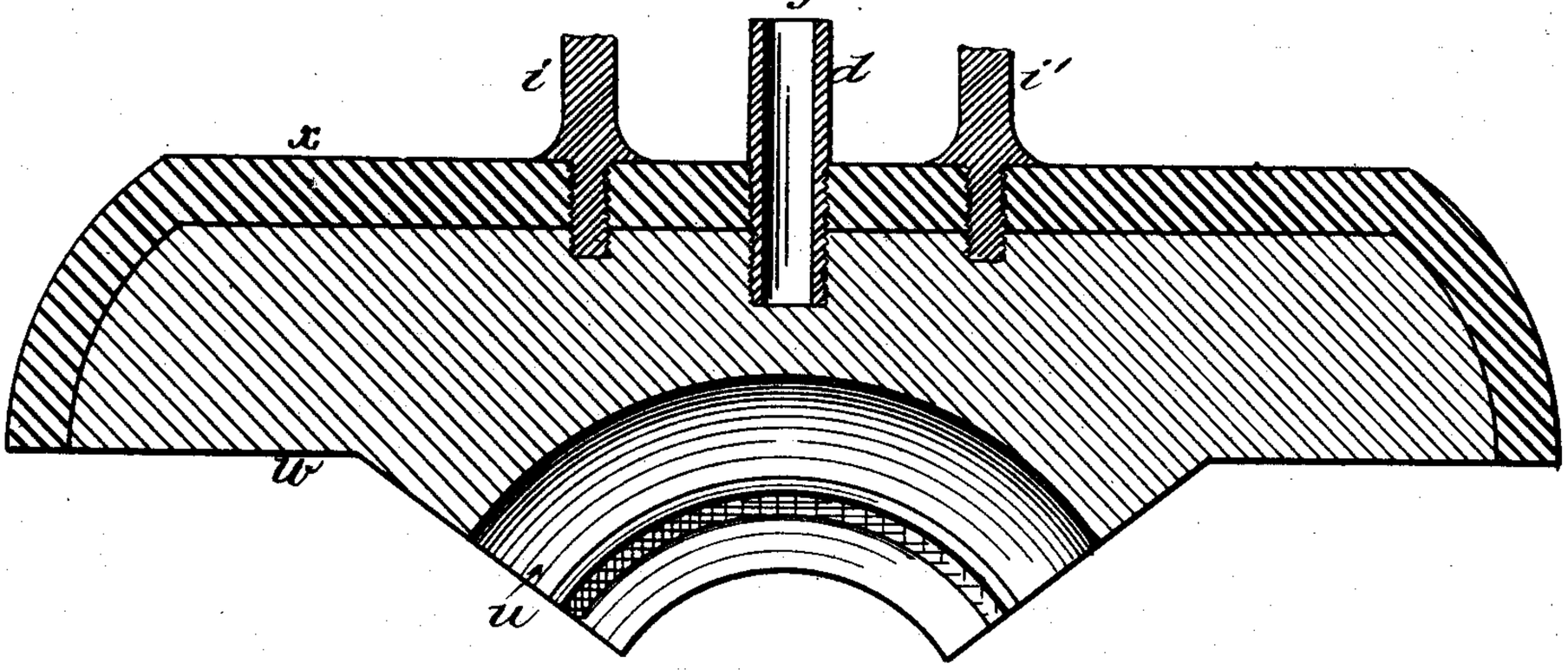
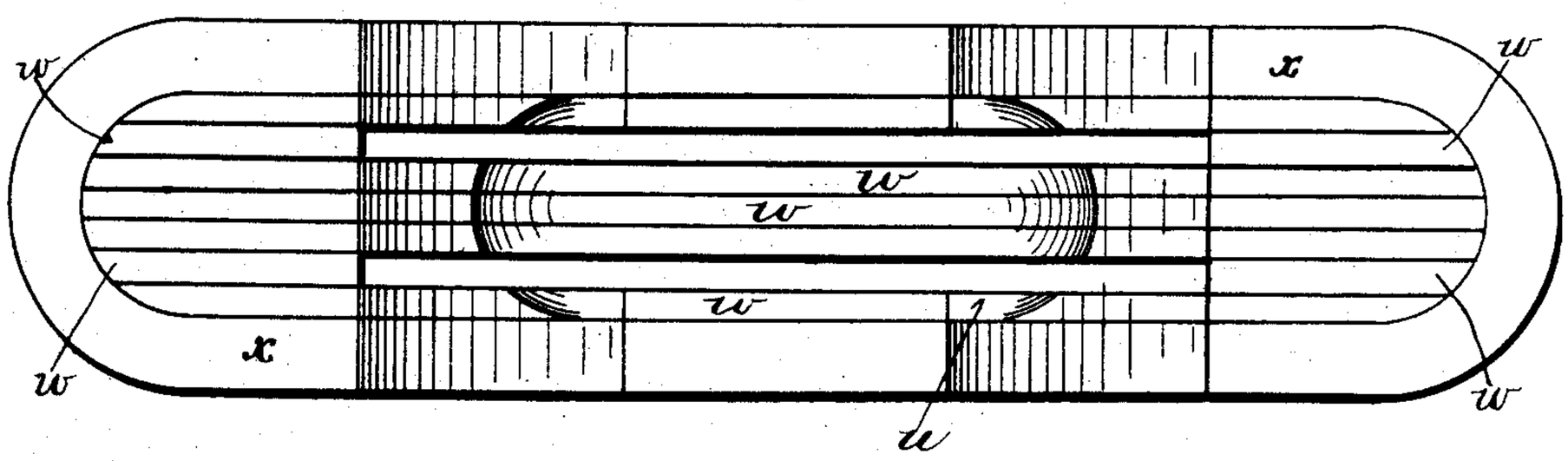


Fig. 7.



Witnesses:

D. W. Gardner

Nellie L. Pope.

Inventor:

Edmund Wagemann

By his Attorney

Edward P. Thompson

(No Model.) 6 Sheets—Sheet 6.

E. WAGEMANN.

ELECTRIC REGULATOR.

No. 429,825. Patented June 10, 1890.

Fig. 8

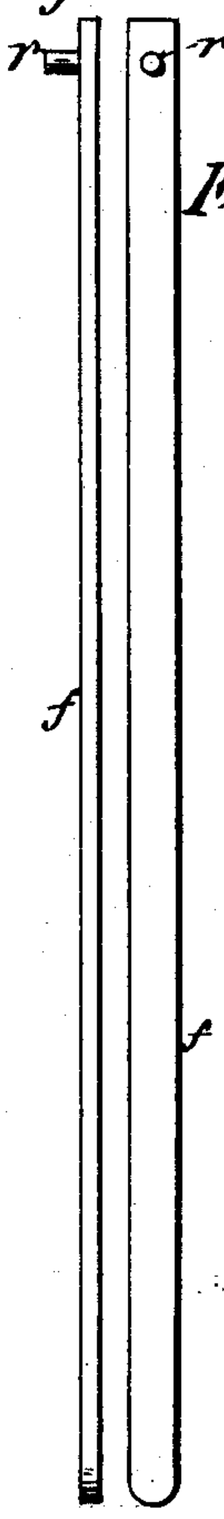


Fig. 9

Fig. 10.

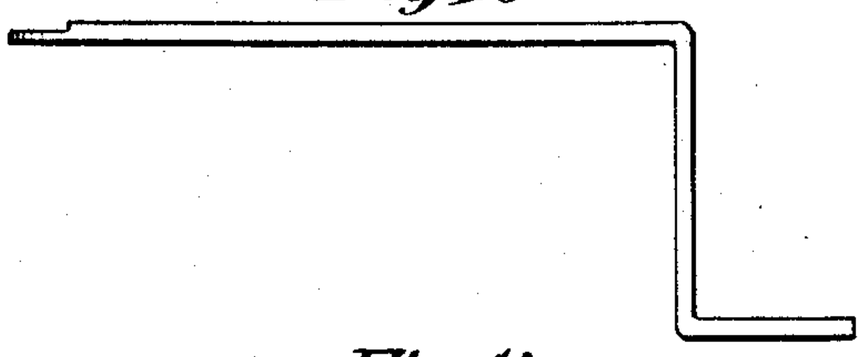


Fig. 11.

Fig. 12

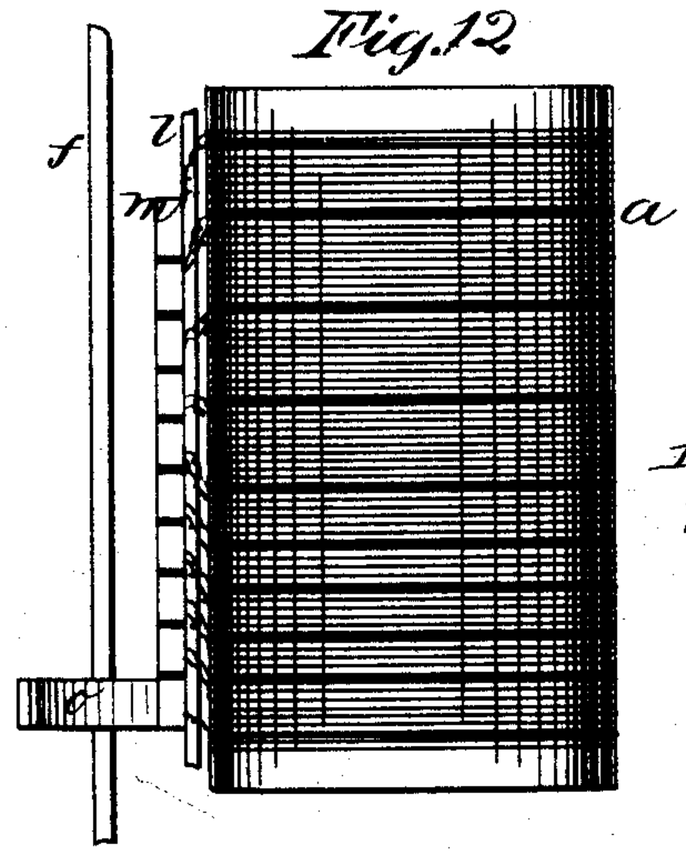
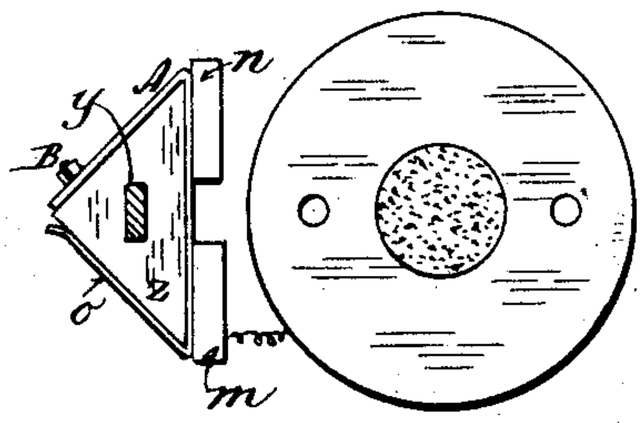


Fig. 13.



Witnesses:

D. W. Gardner

Nellie L. Pope.

Inventor:

Edmund Wagemann

By his Attorney,

Edward P. Thompson

UNITED STATES PATENT OFFICE.

EDMUND WAGEMANN, OF LITTLE ROCK, ARKANSAS, ASSIGNOR OF SIX-SEVENTHS TO JOHN D. ADAMS, DEAN ADAMS, OSCAR DAVIS, JOHN W. DAVIS, HORACE G. ALLIS, AND JOHN B. JONES, ALL OF SAME PLACE.

ELECTRIC REGULATOR.

SPECIFICATION forming part of Letters Patent No. 429,825, dated June 10, 1890.

Application filed September 11, 1889. Serial No. 323,640. (No model.)

To all whom it may concern:

Be it known that I, EDMUND WAGEMANN, a subject of the Emperor of Germany, and a resident of Little Rock, county of Pulaski, and State of Arkansas, have invented certain new and useful Improvements in Electric Regulators, of which the following is a specification.

My present invention relates to the mechanical construction of a regulator for a dynamo.

The object of the invention is to provide a compact machine embodying a self-regulating regulator and which shall result in practically perfect regulation.

As the invention does not involve any new principle in electrical science, but relates to the mechanical construction, the latter may best be set forth by reference to the accompanying drawings.

Figure 1 is a front elevation of the complete machine equipped with the regulator. The armature of the dynamo is also shown, and may be of any suitable type of the ring-armature class. Fig. 2 is a rear view of Fig. 1, showing a portion of the regulating apparatus. Fig. 3 is an end elevation of the machine, showing a portion of the regulator, the view being at right angles to Figs. 1 or 2. Fig. 4 is a plan view of the machine, showing a portion of the regulator. Figs. 5, 6, and 7 show, respectively, the front elevation, a longitudinal and a plan view of the upper pole-piece of the field-magnet, showing a portion of the supports of a portion of the regulator. Figs. 8 and 9 are front and side views of the rod of the regulator for operating the device for cutting out the sub-coils of the field-magnets. Figs. 10 and 11 are similar views to Figs. 8 and 9 of the connecting-rod in the regulator. Figs. 12 and 13 are side and plan views of the field-magnet and some of the details of the regulator.

The complete device embodying my invention consists of the combination of two field-magnet coils *a* and *a'*, two field-magnet poles *b* and *b'*, connecting the ends of the cores of the coils, and more particularly described in the sequel, the upper pole-piece being provided with a cavity in the upper part about half-way between the two coils and the cavity being lettered *c;* a tube *d*, located in said cavity and fitting therein snugly and also fastened therein, and extending above the surface of the iron of the said field-magnet pole; a plunger fitting loosely in said tube and characterized by the letter *e;* rods *f* and *f'*, movable in bearings *g*, which are attached to the upper and lower field-magnet pole-pieces by means of suitable screws; connecting-rods *h* and *h'*, joining by means of pivot-joints the plunger *e* to the rods *f* and *f';* posts *i* and *i'* upon the upper pole-piece and serving as fulcrums for the connecting-rods *h* and *h';* sub-coils *j* and *j'*, forming the coils *a* and *a'*, respectively; plates *l* of insulation joining the upper and lower pole-pieces and affixed thereto by suitable screws; contact-plates or coil-terminals *m* and *m'*, mounted upon said plates of insulation and connected to the terminals of the sub-coils, so that were the uppermost and the lowest plates *m* and *m'* joined to the poles of a generator a current would pass through the sub-coils in series; a contact-strip *n* and *n'* on the insulating-plates *l* and equal in length to that of all the plates *m* or *m'* taken together, and a double contact-arm *o* on the rod *f* and a contact-arm *o'* on the rod *f'*, the arms *o* and *o'* being hereinafter more particularly described. The pole-pieces are of course of iron, while the plunger *e* is of the same material. The posts *i* and *i'*, as well as the rods *h*, *h'*, *f*, and *f'*, are preferably of a non-magnetic material, such as brass. The tube *d* should be of iron. The rods *h* and *h'* have each one end pivoted in a slot *p* in the upper end of the plunger, so that as the plunger rises or falls the rods *h* and *h'* are turned about their pivot or fulcrum supports on the posts *i* and *i'*. The tube *d* and the posts *i* and *i'* are secured to the pole-piece by screwing the same therein, as indicated in Fig. 6.

Upon the post *i* is a circular scale *q*, and upon the rod *h*, at the fulcrum thereof, is an index-hand adapted to turn with the said rod, so that the scale and hand together serve as

an indicator, for purposes hereinafter described in the statement of operation of the machine.

The joints at the ends of the rods *h* and *h'*, at those ends opposite where they are attached to the plunger *e*, consist of a pin *r*, mounted upon the end of the rod *f* and working or fitting in a slot *s* in the rod *h*, and of a like joint in respect to the connection between the rods *f'* and *h'*. The rods *h* and *h'* have weights *t t'* upon the outer ends, so as to counterbalance the weight of the plunger. It may be stated, also, that the rods *h* and *h'* have bends in them, first in one direction and then in the other, as plainly seen in Fig. 10. The slot is in the bend. It should be noticed that the posts *i* and *i'* are nearer the plunger than the rods *f* and *f'*, so that a small movement of the plunger will produce an increased motion of the rods *f* and *f'*. It should be noticed that the armature is partially surrounded by the field-magnets, in consequence of the field-magnet poles being provided with hollow recesses *u*, containing portions of the armature *v*.

In addition to the above it should be considered that the tube *d* enters approximately the strongest part of the magnetic field just above the highest part of the armature and in the geometrical center approximately of the pole-piece. This center is substantially the magnetic center or point of maximum magnetic influence during the operation of the machine.

In order to obtain an efficient pole-piece, so that the regulator will be the most serviceable, I provide plates of iron *w*, and surround them by a cast-iron shell *x*, except on that side facing the armature.

The construction of the rod *f* and its mechanical connections with the regulator are the same as the rod *f'*, so that the former connections may be described as follows: Through the lower end of the said rod *f* passes a cross-piece *y*, which carries a triangular support *z*, carrying a spring-plate fastened at one corner of the triangle by the bolt B, wound around the said triangle and left loose at the other end. This spring forms a meritorious or sure contact with the plates *n* and *m*. This portion—namely, the spring A, triangle *z*, and rod or cross-piece *y*—is clearly shown in Figs. 12 and 13, but not very clearly in Fig. 1, where the whole combination is represented or indicated as to position by the letter *o*.

It is thought unnecessary to describe here the electric circuits of the machine further than they have been mentioned, for the reason that they are similar to those in well-known forms of dynamos, it only being necessary to observe that the field-magnets have multiple or sub coils, and that they are normally connected in series with one another. Consider the left-hand portion of Fig 1, which is a duplicate of the right-hand side, and the operation may be intelligently described as follows: As the rod *f* rises, the coils are gradually cut out of circuit, and become idle coils. If the rod *f* descends, the coils—that is, the sub-coils or multiple coils—are successively introduced into series with one another. This operation is effected directly by the spring A, moving continually in contact with the plate *n* and successively in contact with the plates *m*. The plate *n* forms one terminal of the field-magnet *a*, while the top plate of the plates *m* forms the other terminal of the said field-magnet. It is well-known that the current established by a dynamo varies and that it needs some kind of regulation. For instance, the speed of rotation may increase suddenly or gradually, or it may diminish. The greater speed will cause an increase of current without a means of regulation, while a decrease of speed will, under like circumstances, cause less current to be generated. In my generator this regulation is effected in a simple manner. In Fig. 1 the rods *f* and *f'* are in their lowest position. Say that the current increases from any cause whatever, and it is desired that it should be automatically brought back to its original strength, then will the magnetic field be increased, or, rather, it is simultaneously increased or tends to be increased, while at the same time the plunger is more strongly attracted, and consequently is pulled downward, and thereby causes the rods *f* and *f'* to rise and cut out some of the coils of the field-magnets *a* and *a'*. When the current again decreases below the normal, then will the rods *f* and *f'* descend and the sub-coils will be introduced into circuit, as before. By predetermined setting of the hand on the rod *h* it may be made to indicate the amount of current being generated.

The weights *t* and *t'* serve to balance the plunger, so that very small variations are the cause of moving the plunger considerably.

I claim as my invention—

1. In an electric regulator, the combination of the field-magnets of a dynamo having subdivided coils, insulating-plates connecting the opposite pole-pieces, contact-plates mounted upon said insulating pieces and connected to the terminals of the multiple coils, one of the end plates forming one terminal of the field-magnet, an additional contact-plate insulated from the other plates mounted upon said insulating-plate and forming the other terminal of the said field-magnet, bearings *g*, attached to the pole-pieces of the field-magnets, rods fitting loosely in said bearings and carrying spring-contacts which are in contact with one of the first-named plates and with the second or additional plate, a plunger of iron located in a cavity of the field-magnet pole over the armature of the dynamo, and rods *h* and *h'*, connecting the first-named rods and supported upon proper fulcrums.

2. In a regulator for a dynamo, the combination of a field-magnet pole provided with a cavity at that point nearest the armature of the dynamo, a core or plunger of iron fitting loosely in said cavity, sub-coils of the

field-magnets, cut-out contacts for the sub-coils attached to movable rods, and connecting-rods *h* and *h'*, pivoted both to the first-named rods and to the said plunger.

3. An electric regulator for a dynamo, consisting of the combination of sub-coils for the field-magnets, a series of insulated plates to which the terminals of the sub-coils are electrically attached, a contact-plate, an electrical conductor or contact *o*, joining one of the series of plates with the said contact-plate, an insulating-plate supporting the said contact-plates heretofore mentioned and secured to the two pole-pieces of the field-magnets, and means for moving said contact *o* so as to cut in or out of circuit one or more of the sub-coils, said means consisting of an iron movable plunger located in a hole in one of the field-magnet poles, said plunger being connected by levers to the said contact *o*.

In testimony that I claim the foregoing as my invention I have signed my name, in presence of two witnesses, this 22d day of August, 1889.

EDMUND WAGEMANN.

Witnesses:

E. G. DUVALL, Jr.,

EDWARD P. THOMPSON.