(No Model.) 7 Sheets—Sheet 1.

S. Z. DE FERRANTI.

DYNAMO ELECTRIC MACHINE.

No. 409,349. Patented Aug. 20, 1889.

Fig. 3.

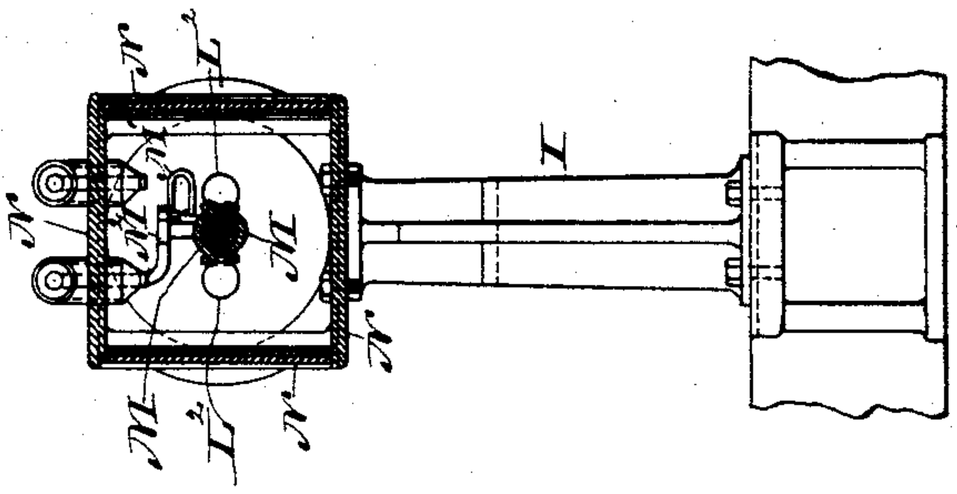
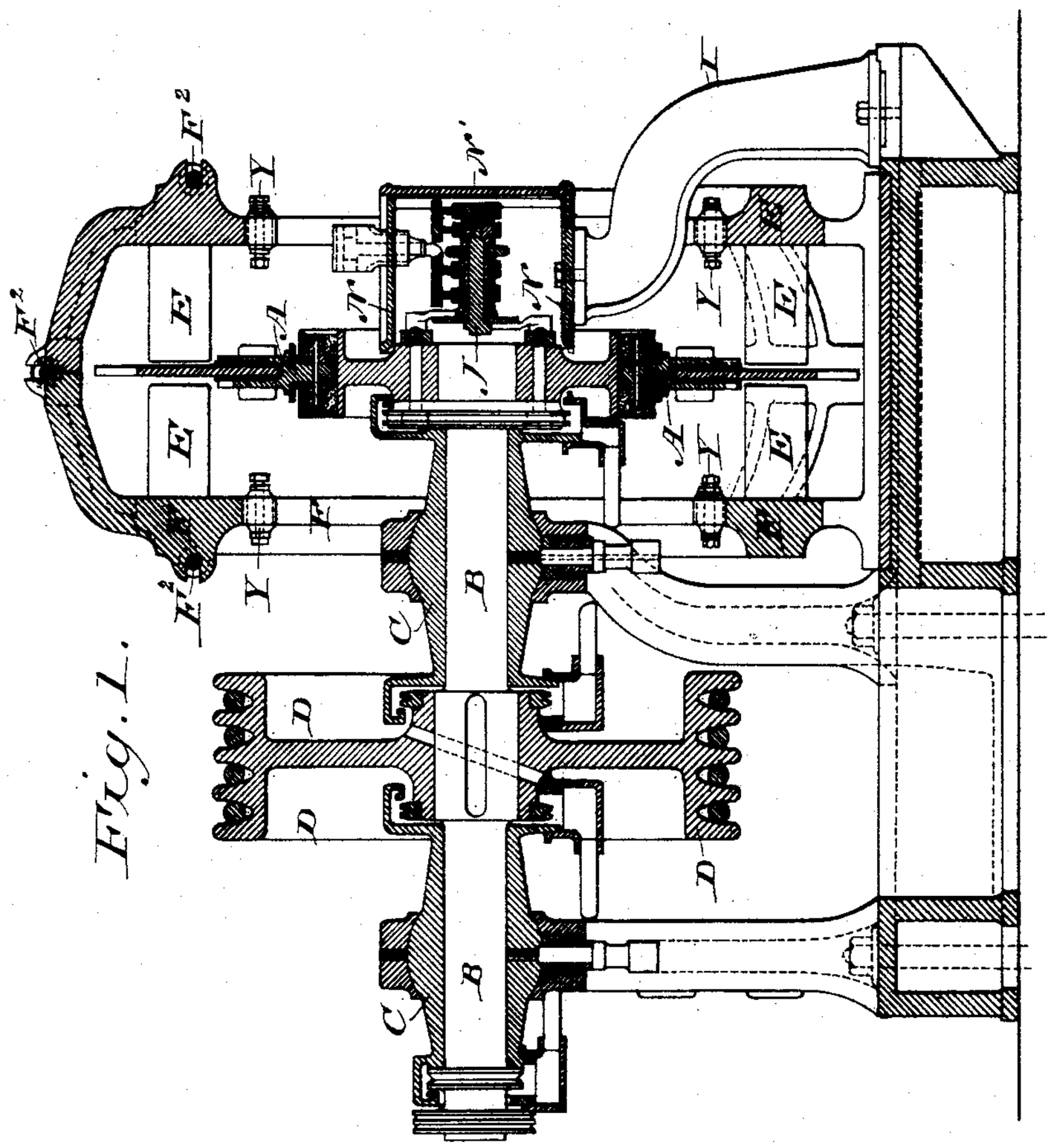


Fig. 1.



Witnesses

A. C. Fennand.

E. C. Davidson.

Inventor

S. Z. de Ferranti

By Baldwin, Davidson & Wright

Attorneys

(No Model.)

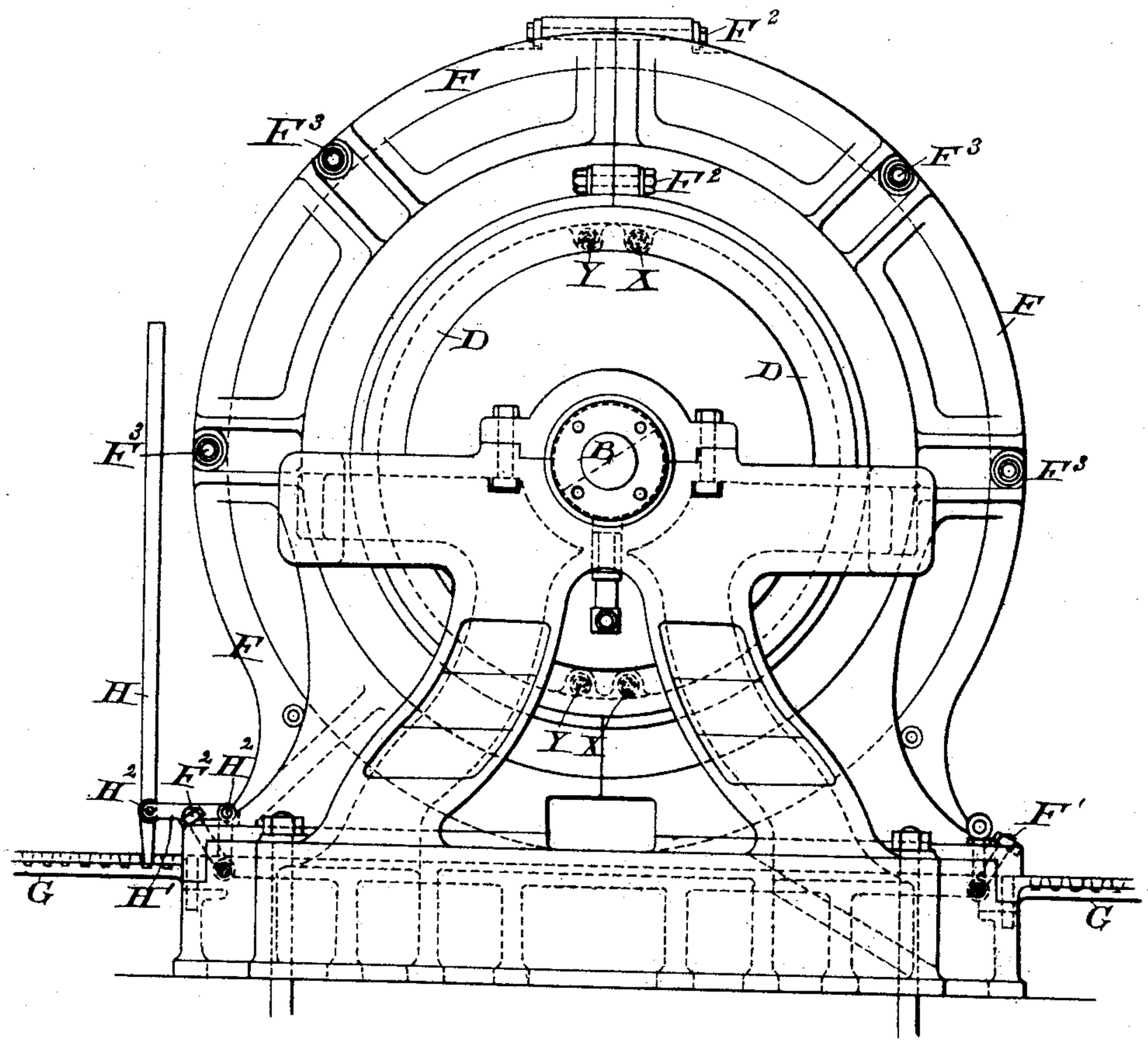
7 Sheets—Sheet 2.

S. Z. DE FERRANTI.

DYNAMO ELECTRIC MACHINE.

No. 409,349. Patented Aug. 20, 1889.

Fig. 2.



Witnesses

H. C. Newman.

C. C. Davidson

Inventor

S. Z. de Ferranti

by Baldwin, Davidson & Wright.

Attorneys

(No Model.)

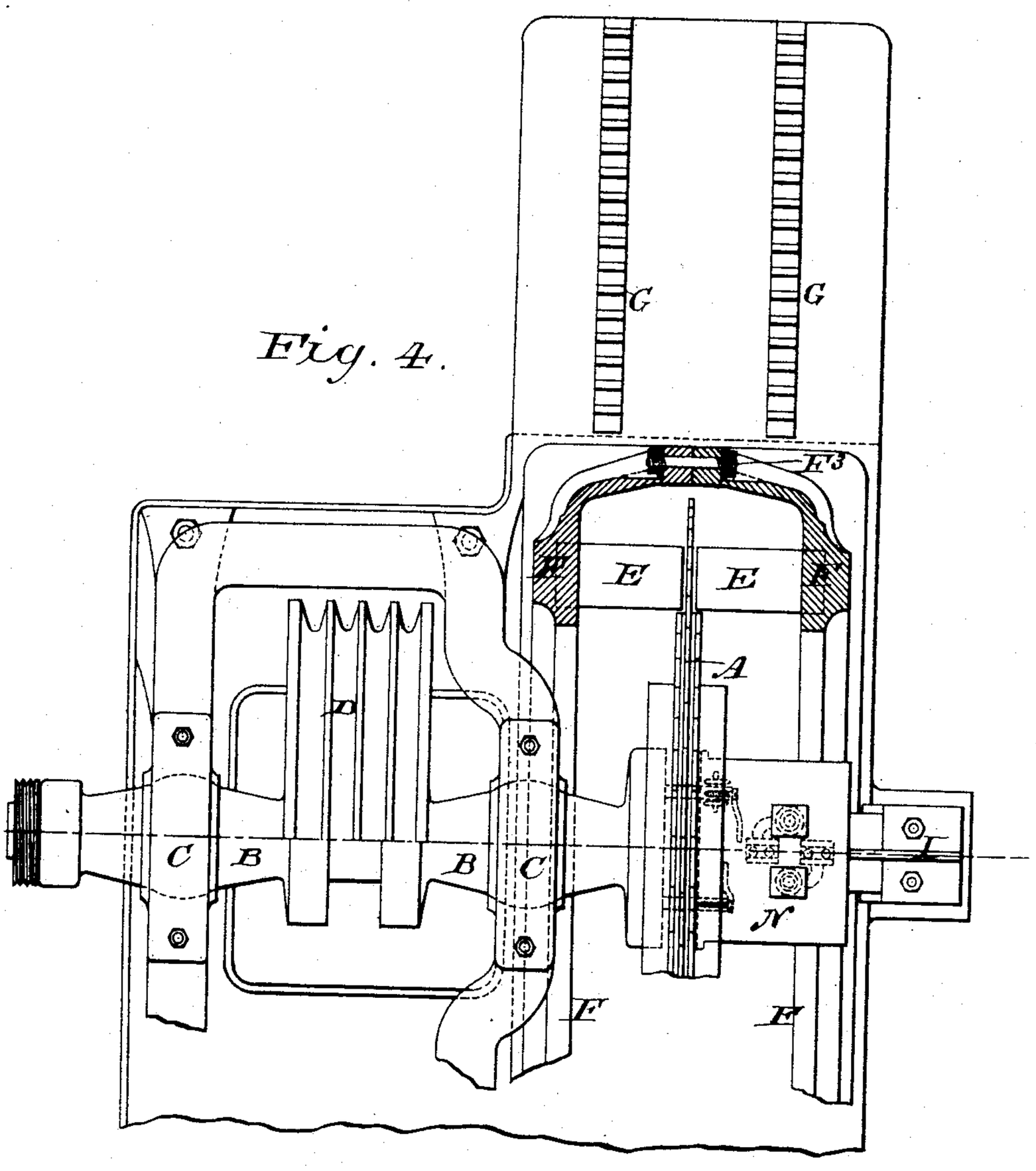
7 Sheets—Sheet 3.

S. Z. DE FERRANTI.

DYNAMO ELECTRIC MACHINE.

No. 409,349. Patented Aug. 20, 1889.

Fig. 4.



Witnesses

A. C. Neiman.

E. C. Davidson.

Inventor

S. Z. de Ferranti.

By Baldwin, Davidson & Wright

Attorneys

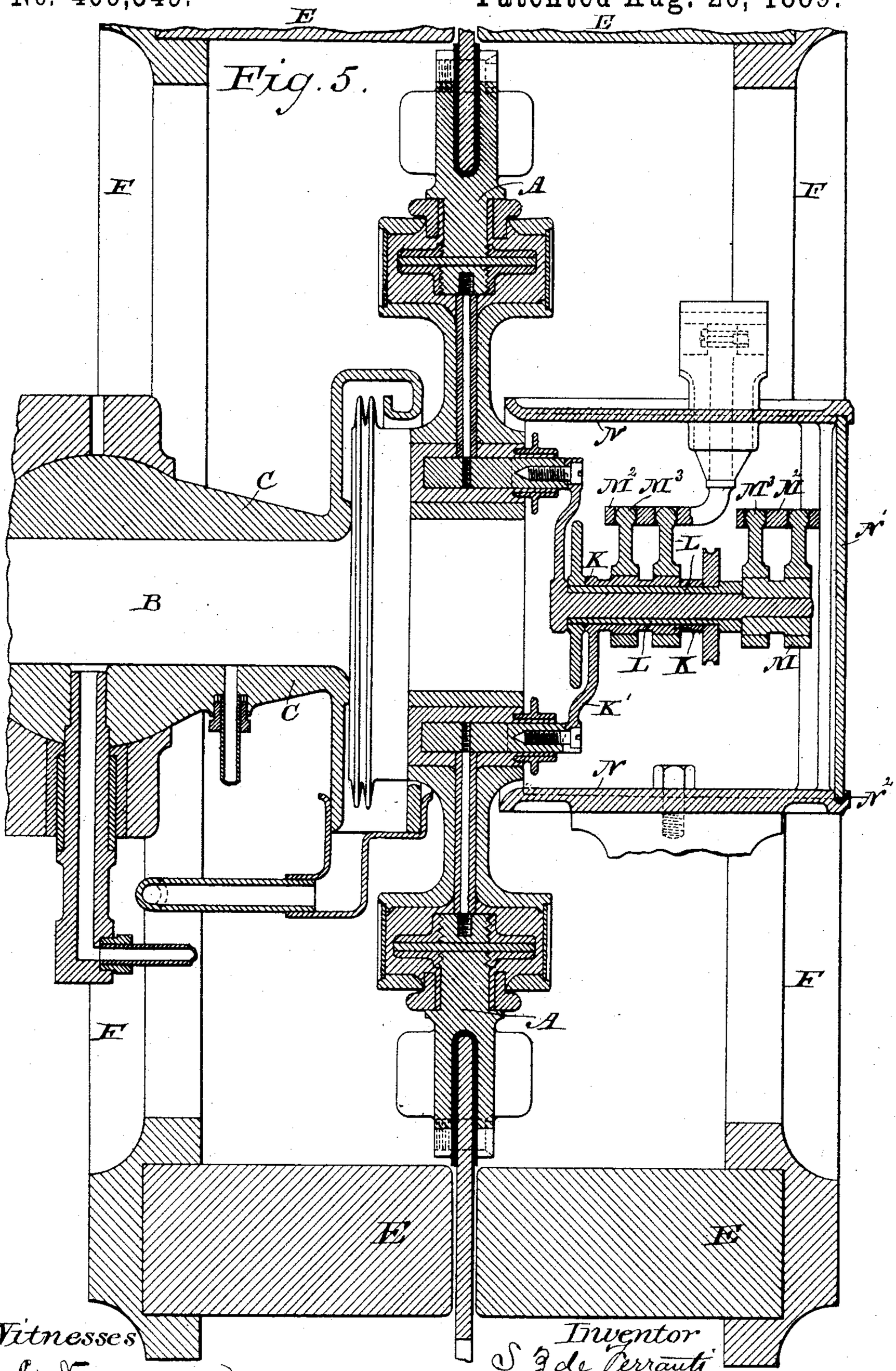
(No Model.) 7 Sheets—Sheet 4.

S. Z. DE FERRANTI.

DYNAMO ELECTRIC MACHINE.

No. 409,349. Patented Aug. 20, 1889.

Fig. 5.



Witnesses
A. C. Newman,
E. C. Davidson

Inventor
S. Z. de Ferranti
By his Attorneys
Edwards, Davidson & Wright

(No Model.)

7 Sheets—Sheet 5.

S. Z. DE FERRANTI.

DYNAMO ELECTRIC MACHINE.

No. 409,349. Patented Aug. 20, 1889.

Fig. 6.

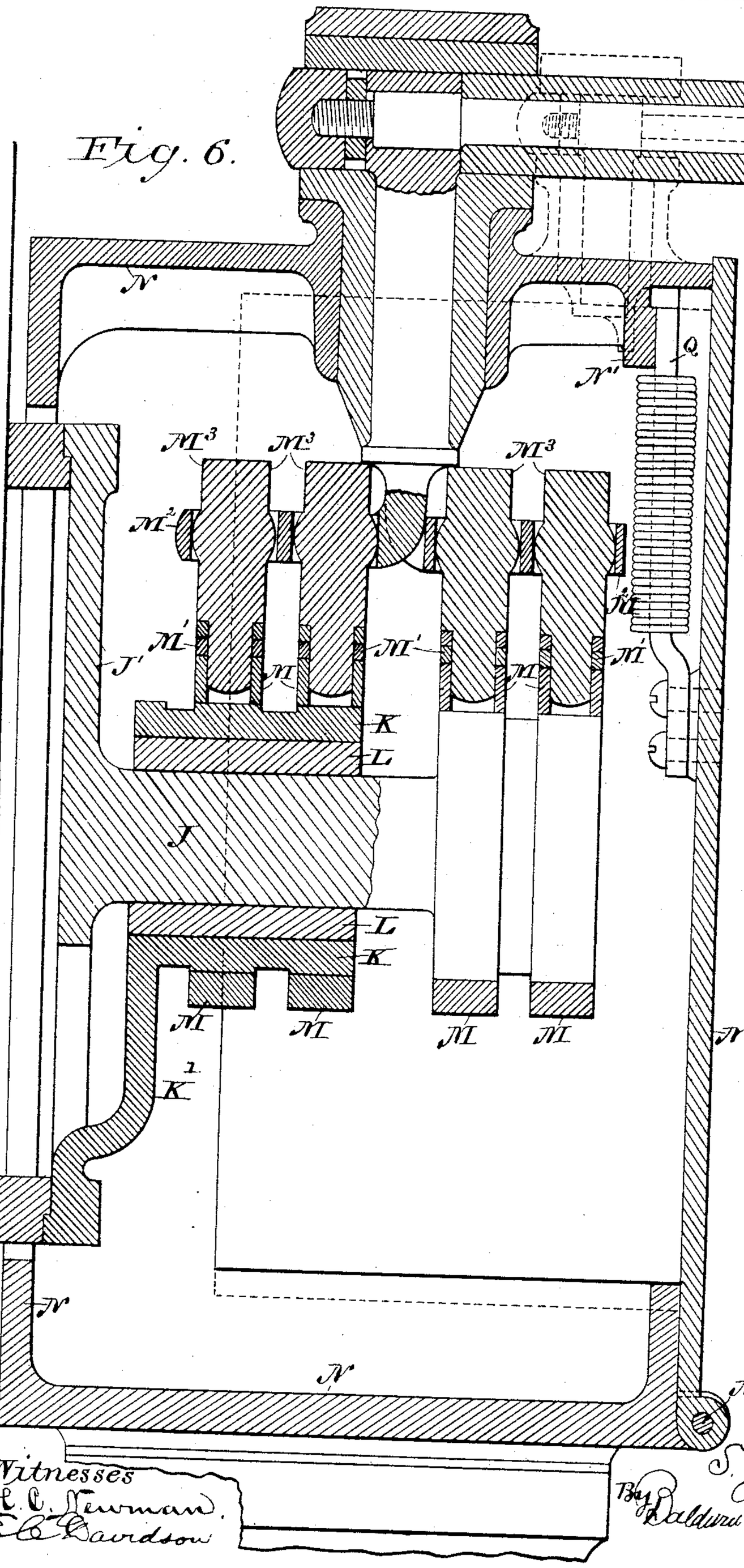
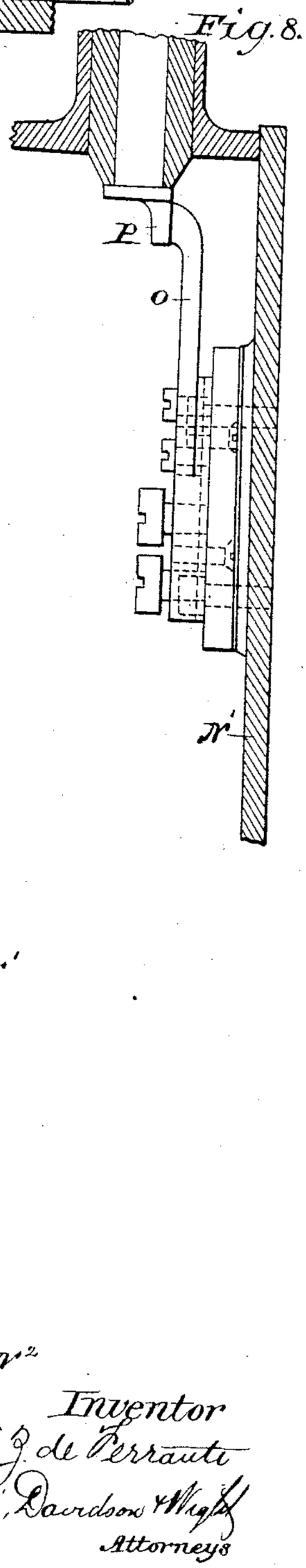


Fig. 8.



Witnesses
H. C. Newman.
E. C. Davidson

Inventor
S. Z. de Ferranti
By Baldwin, Davidson & Wright
Attorneys

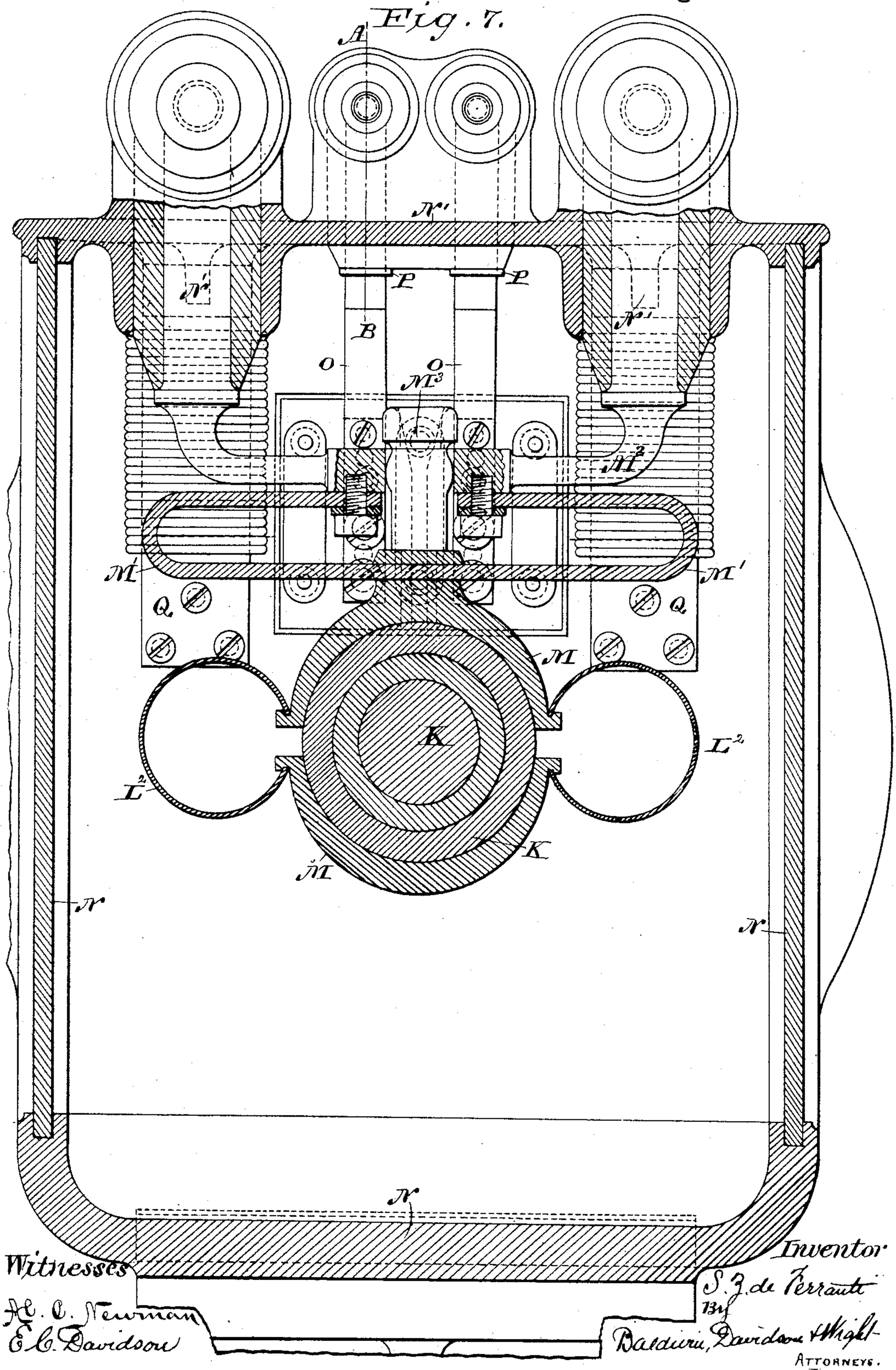
(No Model.) 7 Sheets—Sheet 6.

S. Z. DE FERRANTI.

DYNAMO ELECTRIC MACHINE.

No. 409,349. Patented Aug. 20, 1889.

Fig. 7.



Witnesses
H. C. Newman
E. C. Davidson

Inventor
S. Z. de Ferranti
By
Baldwin, Davidson & Wright
Attorneys.

(No Model.) 7 Sheets—Sheet 7.

S. Z. DE FERRANTI.

DYNAMO ELECTRIC MACHINE.

No. 409,349. Patented Aug. 20, 1889.

Fig. 9.

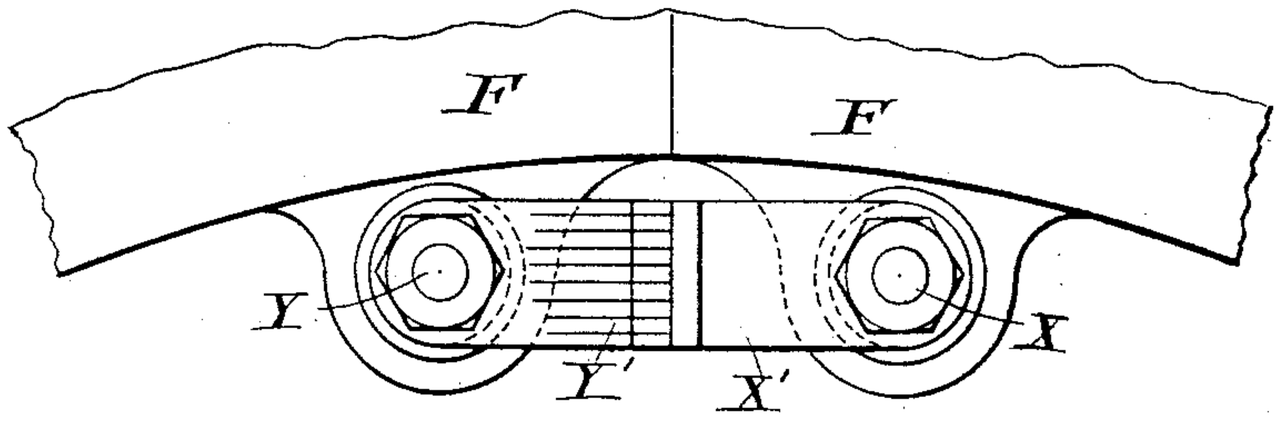
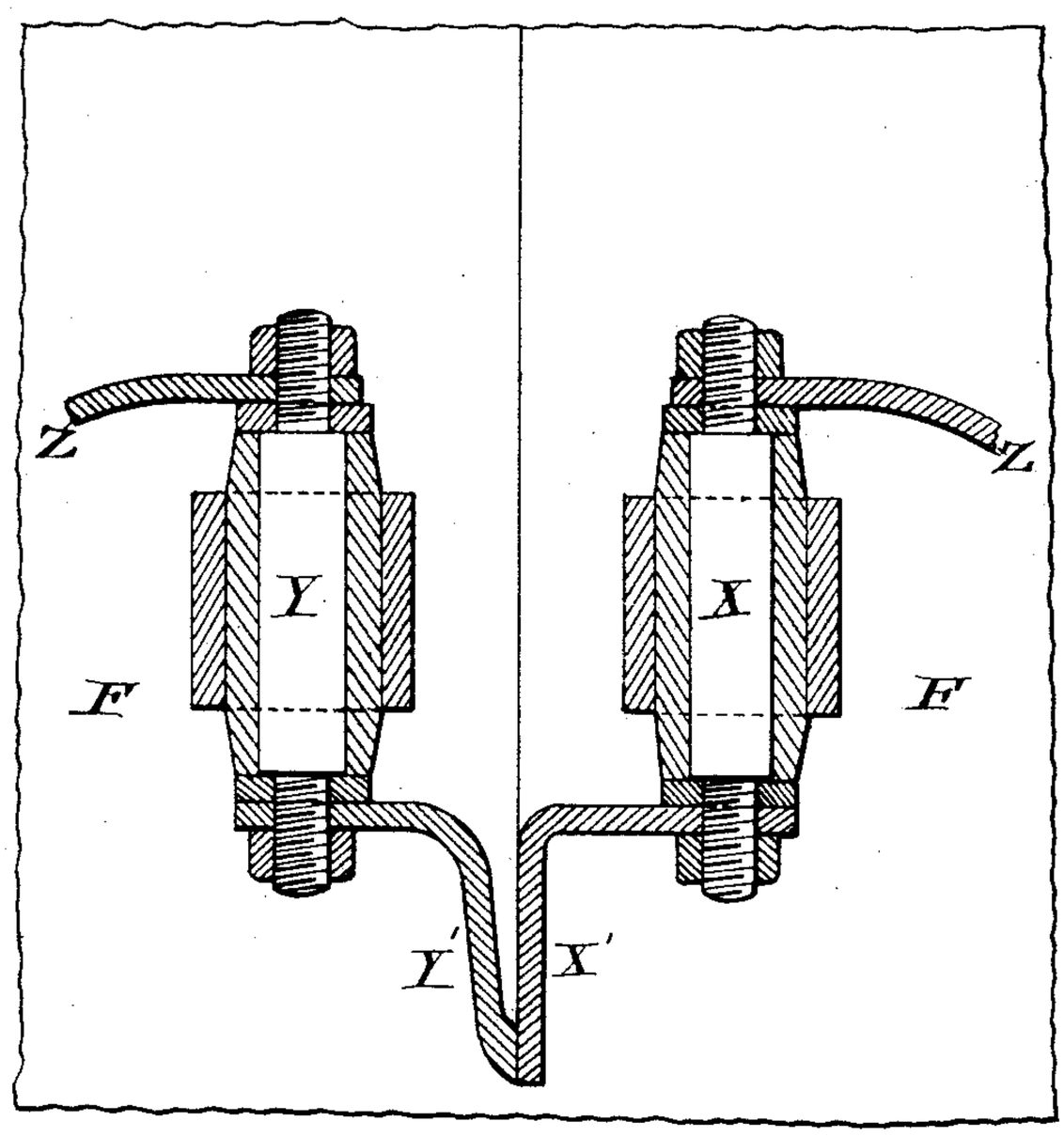


Fig. 10.



Witnesses

H. C. Newman.

E. C. Davidson.

Inventor

S. Z. de Ferranti

By Baldwin, Davidson & Wright

Attorneys

UNITED STATES PATENT OFFICE.

SEBASTIAN ZIANI DE FERRANTI, OF HAMPSTEAD, COUNTY OF MIDDLESEX, ENGLAND.

DYNAMO-ELECTRIC MACHINE.

SPECIFICATION forming part of Letters Patent No. 409,349, dated August 20, 1889.

Application filed January 14, 1889. Serial No. 296,325. (No model.) Patented in England January 15, 1887, No. 702.

To all whom it may concern:

Be it known that I, SEBASTIAN ZIANI DE FERRANTI, electrician, a subject of the Queen of Great Britain, residing at 120 Fellowes Road, Hampstead, in the county of Middlesex, England, have invented certain new and useful Improvements in Dynamo-Electrical Machines, (for which I have received Letters Patent in Great Britain, No. 702, dated January 15, 1887,) of which the following is a specification.

The object of my invention is to construct a dynamo-electrical machine in such manner that the revolving armature and fixed field-magnets can be quickly got at for cleaning or repairs and to secure safety in working when obtaining high-tension currents. The revolving armature I mount on the end of an axle, which has a driving-pulley fixed upon it, by which it can be driven. This pulley is placed between the bearings in which the axle is carried. The fixed magnets, which are on either side of the machine, I carry by two ring-frames, which are independent one of the other and of the standards which carry the bearings for the armature-axle, but are all coupled together when the machine is being worked, and I make the frames capable of being drawn away from the armature, so that the armature and magnets can be quickly and readily got at for cleaning. The base-plate or bed of the machine I make with extensions, along which the frames are supported when slid away from their working position. The frames may either be slid away from the armature in a direction parallel with the armature-axle, or they may each be divided vertically into two equal parts, which can be drawn away from one another in a direction at right angles to the axle. To facilitate any one or other of these sections being drawn outward to give access to the armature or magnets, I connect a vertical lever by a link to each section and form the lower end as a tooth, which can be made to engage with any one or other of the teeth of a rack formed in the bed of the machine; or, for larger machines, an endless chain or screws or hydraulic cylinders might be used for moving the sections toward or away from one another. To convey exciting-current to the magnet-coils on each part of the frame that carries them, I use spring contact-pieces secured to the sections of the frame when current has to be conveyed from one to the other. The springs press one against the other when the sections are brought together in working position, so that the mere act of bringing the sections together also completes the necessary electrical connections. The collector I place outside the armature and form it of two insulated metallic rings or sets of rings concentric with the armature-axis, each ring having an insulated conductor passing from it to the conductor of the armature, and the conductor to one ring passing through the other ring. For conveying current from the collector-rings I use rubbers, each composed of a pair of metallic blocks held against opposite sides of a ring by springs, which tend to press the two blocks toward one another. One block I also press against one side of the ring by a spring, which may also serve for conveying away current. To insure safety in working, I inclose the collector in a box, locked magnetically by the exciting-current, and so arrange the connections that the exciting-current cannot be completed until the lid of the box is closed. I also similarly cause all switches and fuses used in connection with the dynamo to be similarly inclosed and locked in before the exciting-current can be completed, so that no accident can occur from incautious handling of the parts while the machine is running.

My improvements are shown in the drawings hereunto annexed.

Figure 1 is a vertical section of a dynamo-electrical machine formed in the above manner, with the armature at the end of its axle and with fixed magnets situated on each side of it. Fig. 2 is an elevation of one end of the same. Fig. 3 is an end elevation of the collector, which is at the opposite end of the machine. Fig. 4 is a part plan view. Fig. 5 is a longitudinal section on a larger scale of part of the machine, showing clearly the collector and box containing it. Fig. 6 is a longitudinal section of the collector on a still larger scale, showing the means used for locking the containing-box. Fig. 7 is a cross-

section of the same, and Fig. 8 a section through the line A B, Fig. 7. Fig. 9 is a side view, and Fig. 10 a horizontal section, of the electrical connections between one division of a magnet-frame and the other for coupling the coils of the magnets on the two divisions of the frame in series.

A is the revolving armature. It is shown to be formed in the manner described in an application for patent lodged by me, bearing even date herewith; but other constructions of revolving armature may be used in place of it.

B is the armature-axis, mounted in two bearings C, carried by standards which form part of the fixed framing of the machine.

D is the driving-wheel, fixed upon the axle between the two bearings.

E are the fixed field-magnets on either side of the armature. They are carried by two ring-frames F, each of which is divided vertically into two equal parts. Each part of each ring is at the bottom secured by bolts F′ to the bed-plate of the machine, and the two halves of each ring are bolted together by other bolts F^2. The rings are also so formed that they meet together outside the magnets, and are there bolted, the one to the other, by bolts F^3. The several bolts are shown to pass into slots in the parts which they are to hold together, so that when the screw-nuts which screw onto them have been slackened by a partial turn the bolts and nuts can be at once removed, so that the parts can with great rapidity be detached one from the other, which in practical working is a matter of very great importance.

G G are toothed racks fixed to the bed-plate.

H is a hand-lever, which, by a link H′ and pins H^2, can be coupled to any one or other of the sections of the magnet-frames F. The lower end of the lever can be inserted between the teeth of the racks and the section of the frame to which the lever is coupled be moved in either direction desired by working the lever.

The way in which I convey exciting-current to the coils of the magnets in the two sections of each frame is seen best in Figs. 2, 9, and 10. The two vertical divisions of each magnet-frame are provided with terminals X Y for the conductor used for conveying current through the magnet-coils. The pin X is carried by one section of the frame and the pin Y by the other section. Each pin has connected to it the conductor Z from the magnet-coils. One pin has also connected to it a contact-plate X′ and the other a spring metallic brush Y′ When the two sections of the frame are brought together, the coils of the magnets on one section will be coupled in series with the coils of the other section. Current can be led to and from the entire series by two terminals situated at any suitable position on either of the divisions of the frame.

I is a standard rising up from the bed-plate in front of the armature and carrying the collector. The collector is formed of a conductor J (see Figs. 6 and 7) passing through a tubular conductor K and insulated from it by insulating material L. The conductors are coupled to the terminals of the armature by metal strips J′ and K′.

M M are rubbers held by springs against circular bosses fixed or formed around the two conductors. The upper blocks are, as shown, pressed downward by springs M′ onto the top of the rings and the lower blocks are held up to the bottom of the rings by bronze springs L^2. The springs M′ are secured to arms M^2, which extend from the terminals from which current is led away—one from one terminal, the other from the other. The rubbers M have also pins M^3 extending upward from them, which pass into holes formed in the arms, and the rubbers are by these pins prevented from revolving with the conductors of the collector. The collector is inclosed in an iron box N, which is provided at the front with a door N′, that turns downward on a hinge-joint at N^2.

O O are two bronze strips carried by the door and insulated from it. These when the door is closed come against insulated conductors P.

Q are the two pole-pieces of an electro-magnet. The ends of these pole-pieces come against downward projections N′ from the top of the iron box when the lid is closed. One end of the insulated coils of the magnet is coupled to one of the bronze strips O and the other end of the coils to the other strip.

The insulated conductors P are arranged to form part of the circuit for supplying a continuous exciting-current to the coils of the field-magnets of the dynamo—that is, to complete the circuit of the exciting-current the current has to pass from one terminal to the other. This it can only do when the door is closed and the bronze strips O come against them. The circuit is then completed through the coils of the magnet Q, and the magnet holds the door closed, and it cannot again be opened until the exciting-current ceases to pass. Similarly, a box which has to be closed to complete the exciting-circuit, and which when closed is locked magnetically by the action of the exciting-current, may be used for inclosing any switches or fuses used in connection with the dynamo.

Having now particularly described and ascertained the nature of my said invention and in what manner the same is to be performed, I declare that what I claim is—

1. In a dynamo-electric machine, the combination of the sliding frame-sections moving at right angles to the armature-axis and carrying the field-magnets, and the extended foundation plate or bed upon which the frame-sections slide, substantially as set forth.

2. A dynamo-electrical machine in which the armature is at the end of an axle which

has a driving-pulley fixed upon it, situated between two bearings in which the axle is supported, in combination with a collector carried concentrically with the armature by arms projecting from the armature, and rubbers or brushes bearing on the collector, substantially as set forth.

3. In a dynamo-electrical machine, the combination of a revolving armature and a circle of field-magnets on either side of it, each carried by a frame divided vertically into two sections which can be slid away from one another other along the bed or foundation plate of the machine in a direction at right angles to the armature-axis.

4. In a dynamo-electrical machine, the combination of a revolving armature, a circle of field-magnets on either side of it, each carried by a frame divided vertically into two sections which can be slid away from one another along the bed or foundation plate of the machine at right angles to the armature-shaft, toothed racks on the foundation plate or bed, and a lever linked to the sections to engage with the racks and slide the sections along the bed.

5. In a dynamo-electrical machine, the combination of a revolving armature, a circle of field-magnets on either side of it, each carried by a frame divided vertically into two sections which can be slid away from one another, and spring contact-pieces on the sections, which, when the sections are brought together, complete an electrical circuit through the exciting-coils of all the magnets.

6. In a dynamo-electrical machine, a collector composed of a revolving ring from which current is to be led away, and a pair of rubbers, one pressed by a spring against the ring and both attached together by springs which draw them one toward the other and make them to bear against opposite sides of the ring.

7. In a dynamo-electrical machine, a collector composed of two rings or sets of rings side by side, but separated from one another, a conductor passing to each ring or set of rings, one conductor passing centrally through the other with a space between them, and arms extending from each conductor and secured to the side of the armature.

8. The combination, with the armature, of the concentric collector-conductors insulated from each other and connected with and carried by the armature by means of arms J′ K′, substantially as set forth.

9. In a dynamo-electric machine for producing currents of high tension, the combination, with the collector or like parts, (such, for instance, as switches or fuses,) of an inclosing box or casing and circuit connections and contacts controlled by the closing of the box to complete the field-magnet circuit, whereby said circuit is only completed when the box is closed.

10. In a dynamo-electric machine for producing currents of high tension, the combination, with the collector or like parts, (such, for instance, as switches or fuses,) of an inclosing box or casing, circuit-connections controlled by the closing of the box to complete the field-magnet circuit, and electro-magnetic locking devices which lock the box when it is closed and the circuit thereby completed.

SEBASTIAN ZIANI DE FERRANTI.

Witnesses:
HERBERT E. DALE,
ARTHUR R. SKERTEN,
Both of 17 Gracechurch Street, London, E. C.