4 Sheets--Sheet 1.

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Electro-Magnetic Engines.

No. 153,456. Patented July 28, 1874.

Fig. 2.

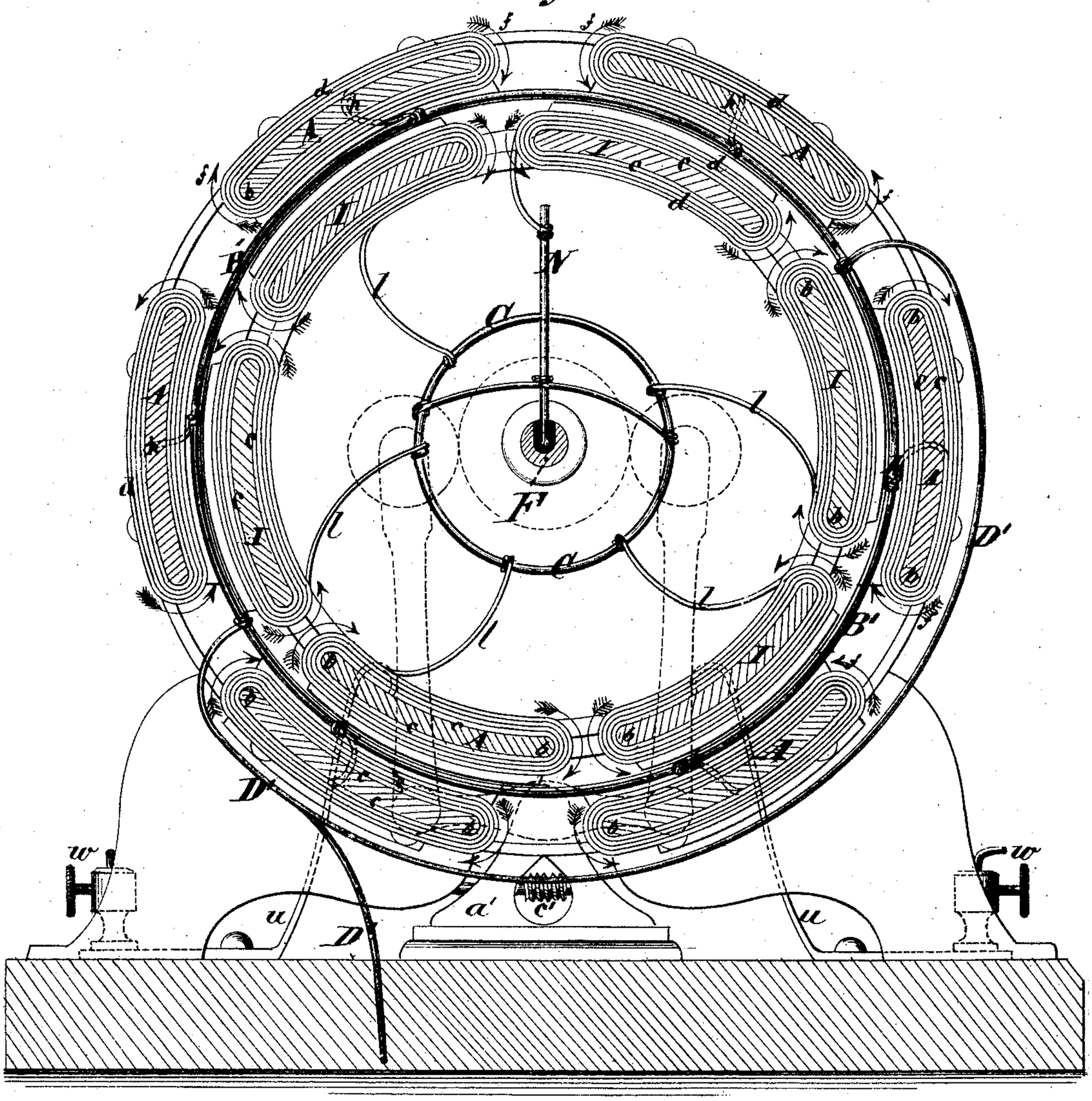
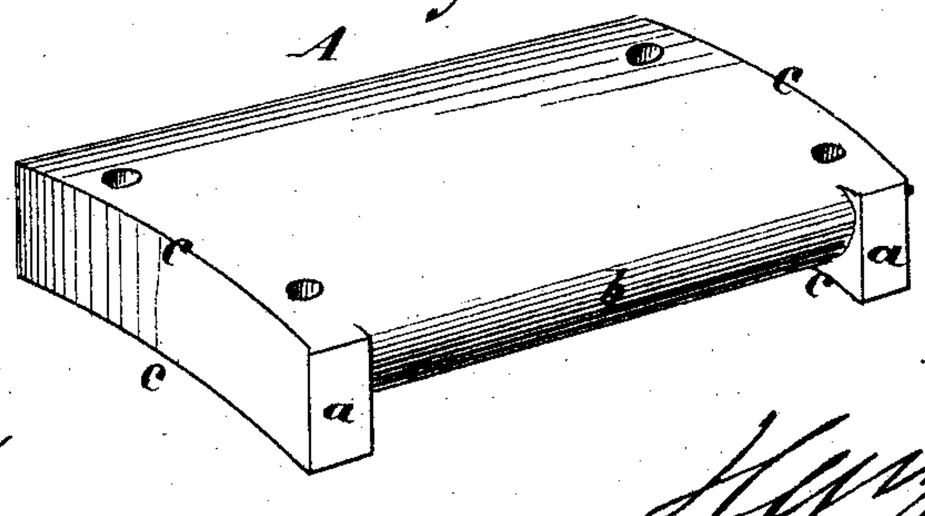


Fig. 1.



WITNESSES

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Fig. 3.

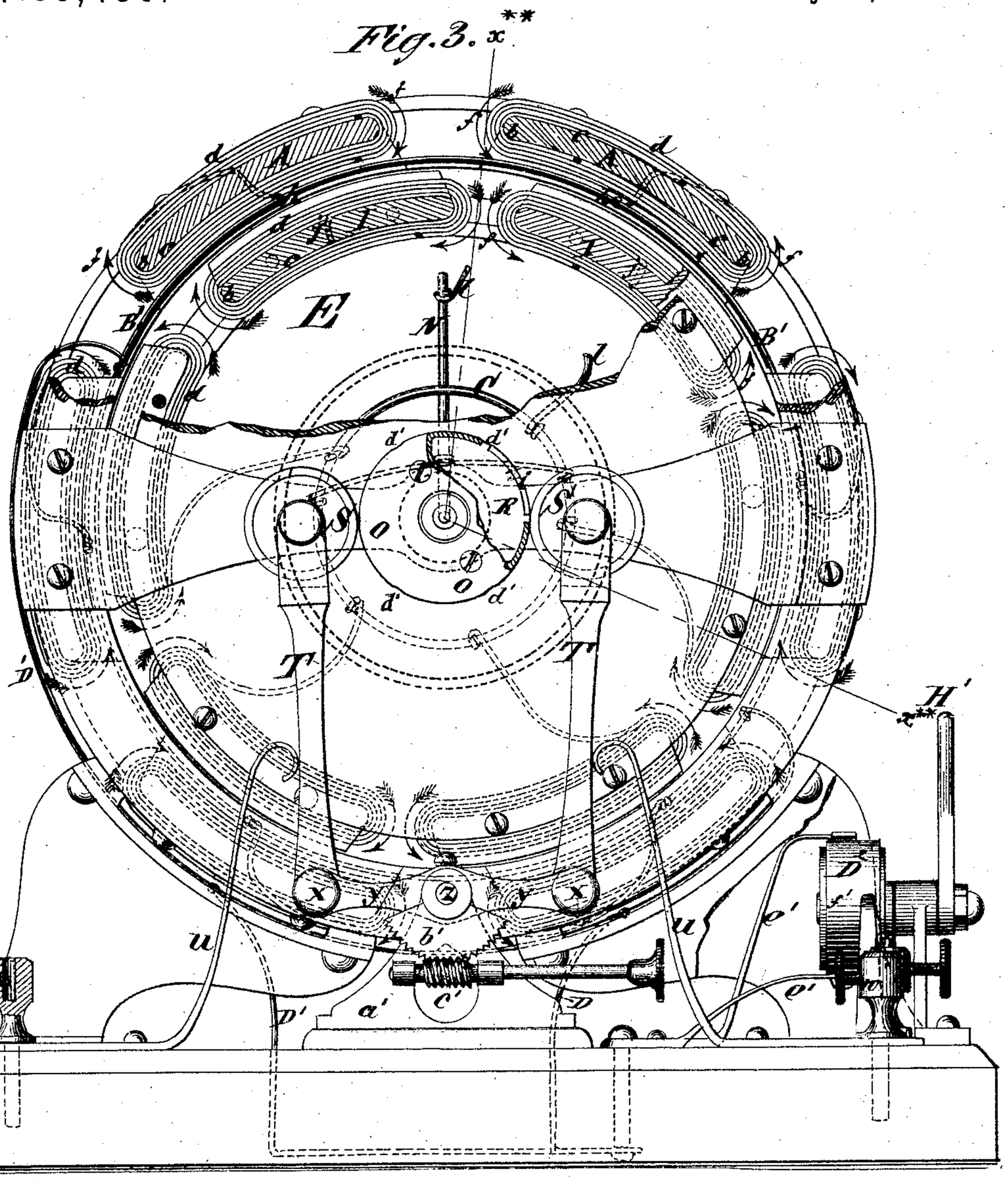
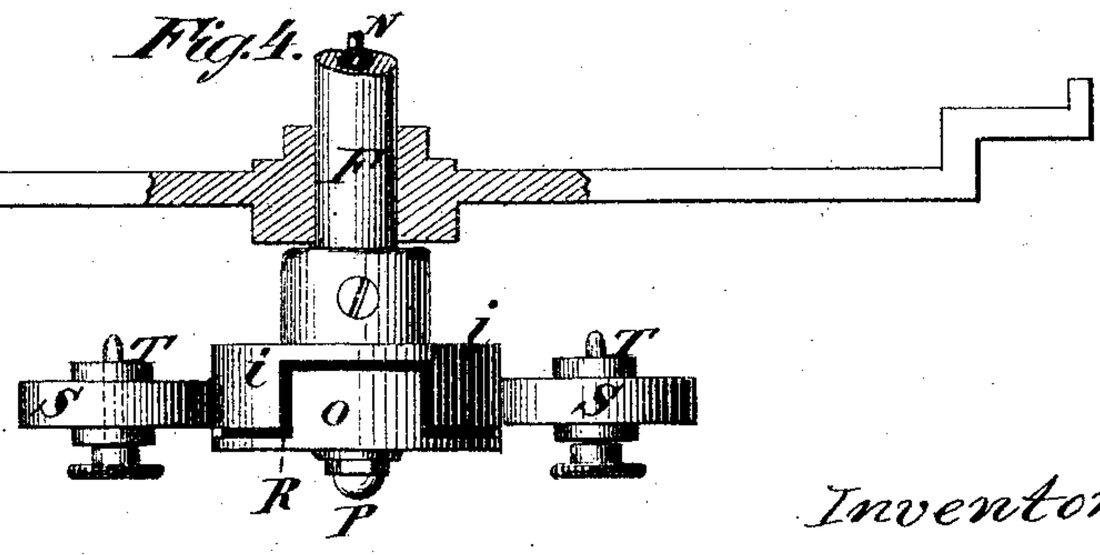


Fig. 4.



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4 Sheets--Sheet 3.

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Electro-Magnetic Engines.

No. 153,456. Patented July 28, 1874.

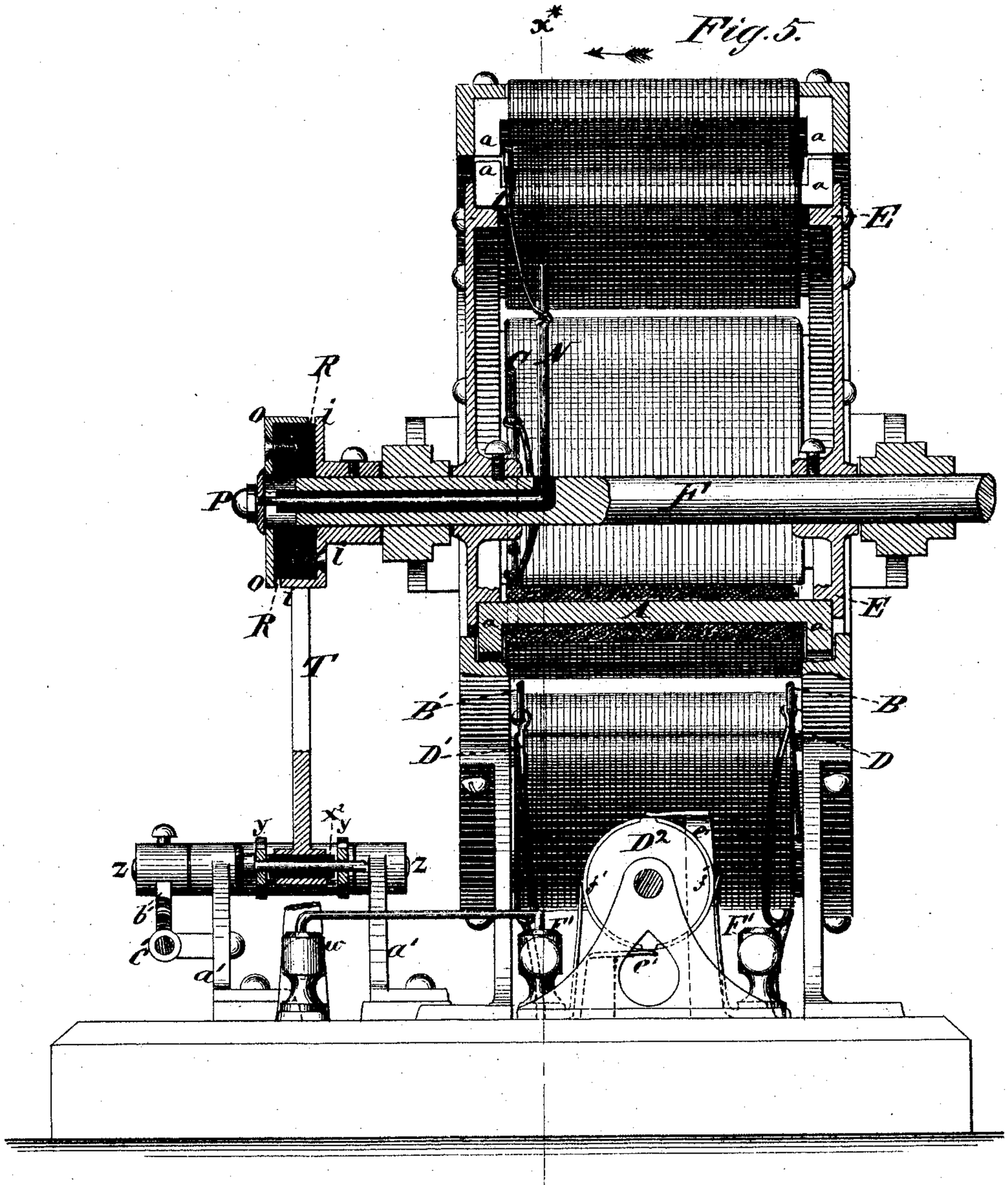


Fig. 6.

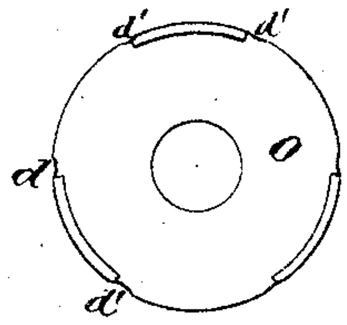


Fig. 8. x*

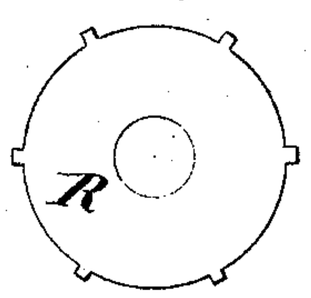
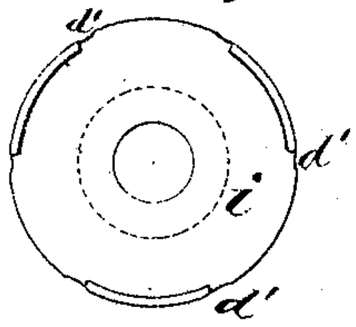


Fig. 7.



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Electro-Magnetic Engines.

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Fig. 9.

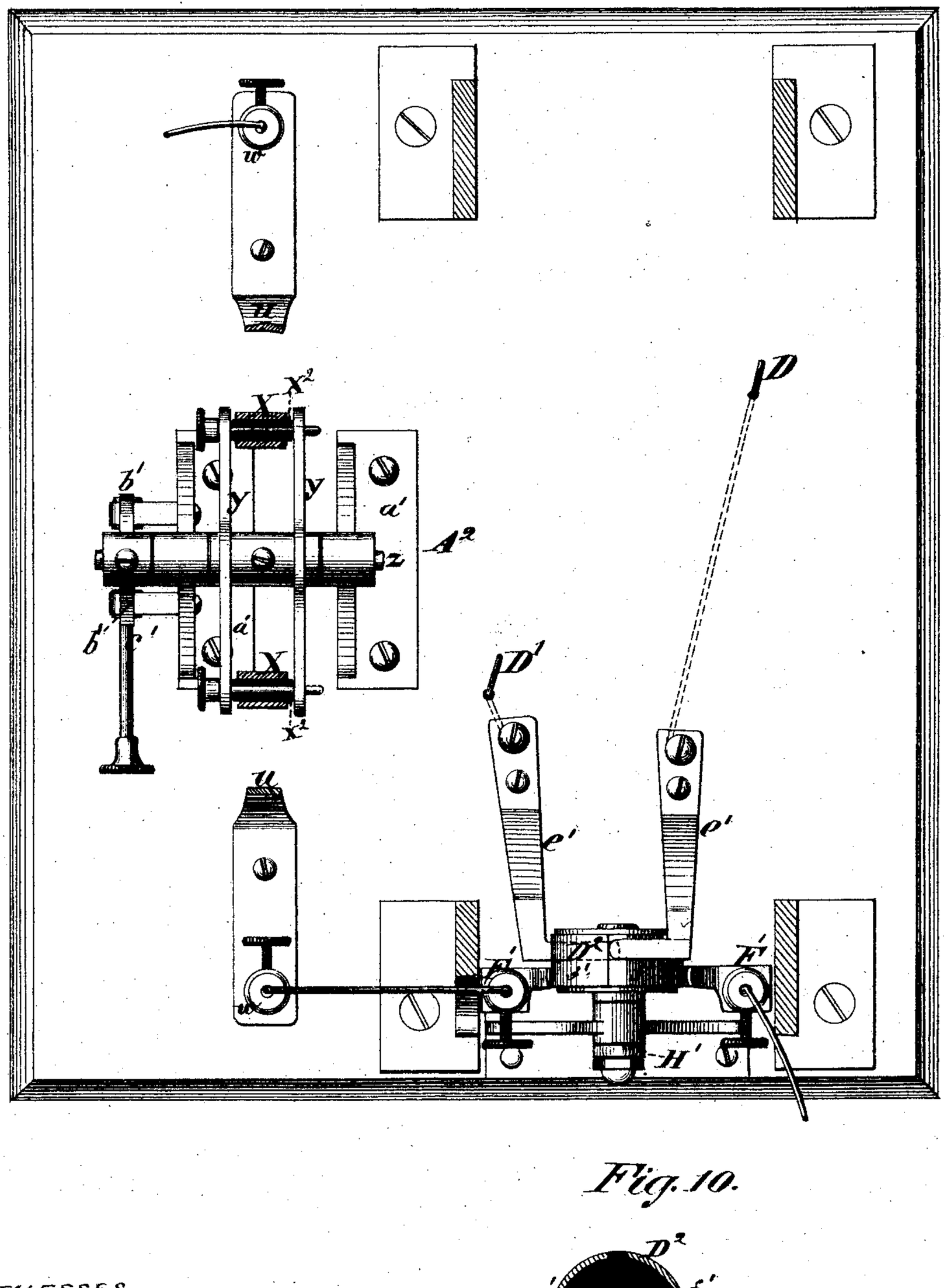
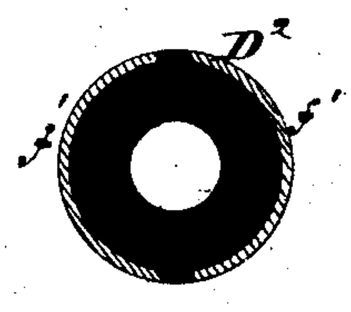


Fig. 10.



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UNITED STATES PATENT OFFICE.

HENRY M. PAINE, OF NEWARK, N. J., ASSIGNOR, BY MESNE ASSIGNMENTS, TO THE AMERICAN ELECTRO-MOTOR COMPANY, OF NEW YORK CITY.

IMPROVEMENT IN ELECTRO-MAGNETIC ENGINES.

Specification forming part of Letters Patent No. **153,456**, dated July 28, 1874; application filed November 4, 1873.

To all whom it may concern:

Be it known that I, HENRY M. PAINE, of the city of Newark, in the county of Essex and State of New Jersey, have invented certain Improvements in Electro-Magnetic Engines, of which the following is a specification:

This invention consists, partly, in a peculiar construction of the magnets of broken annular sections, which, while reducing the electrical coils to their minimum as regards dynamical values, also present a figure peculiarly well adapted to their mechanical disposition in the construction of rotary motors, likewise conduce to the utilization of the electrical attraction and repulsion of the coils; and the invention furthermore includes a novel operation of a permutator, whereby the motion of the motor is controlled, its speed or power being varied by the simultaneous rise and fall or change in position of the current-wheels.

In the accompanying drawing, which forms part of this specification, Figure 1 represents a perspective view of one of the magnet-cores; Fig. 2, a vertical section of the motor in transverse relation with its axis, on the line x^* x^* in Fig. 5, looking in direction of the arrow. Fig. 3 is a partly-broken side view of the motor; Fig. 4, a plan view of the permutator. Fig. 5 is a partly-sectional edge view, the section being taken mainly as indicated by the irregular line x^* x^* in Fig. 3. Figs. 6, 7, and 8 are face views of details of the permutator. Fig. 9 is a sectional plan view of the motor in part, and Fig. 10 a transverse sectional view of the pole-changer.

Similar letters of reference indicate corresponding parts.

The fulcrum or fixed magnets A are parallelogrammic bars, whose breadth should be to their length as two to three. The poles *a a* of these bars are formed at right angles to their planes, as shown in perspective, Fig. 1, and the web *b* and poles made convex and concave, according to the radius of the circle of which they are to form a part, as shown at *c c*, Figs. 1, 2, and 3. The coils *d d* are wound on their respective cores in opposite directions as regards each other in their order of position, as indicated by the arrows *f f*, and all their ends are fastened to one common circle or ring, B. Said coils at the other end of the core terminate in a corresponding ring, B′, and battery connection is made with the rings B B′ by means of the conductors D D¹. This arrangement of details completes the fulcrum or stationary parts of the motor, and the arrangement of the moving parts of the same will now be explained.

A series of magnets, I I, precisely like, in all their details of coils, cores, and order of winding, those first described, and having a convex radius on their polar faces coinciding with the concave radius of the fulcrum-magnets, are securely bolted to flange-plates E, which flange-plates are secured to the driving-shaft F. One end of the coils on this series of magnets I I are electrically connected with their several cores at *j j*, Fig. 3, and the other ends, *l l*, Fig. 2, are attached to a ring, C, which in its turn is connected with an insulated rod, N, centered in the shaft F.

The limbs of the magnets A A A A A A, Sheet 1, Fig. 2, and the magnets I I I I I I, Sheet 1, Fig. 2, having their radius generated from one common center, necessarily give the same curvature to the wire which is wound around them, and the coils may be continued until their several layers are on a level with the poles of the limbs, in which case there will be an annular electrical attraction and repulsion by the action of the coils on each other, as well as a magnetic attraction and repulsion of the poles—a result which cannot be maintained with magnets the limbs of which are plane, and the poles of which are curves.

The coil ends *j j*, through their attachment to the cores of the magnets, and their fastening to the flange-plate E on the shaft F, communicate with one section, *i*, of a permutating-wheel, Figs. 3, 4, 5.

The ends *l l* are, by means of their attachment to the ring C, made to communicate, through the insulated rod N, with another section, *o*, Figs. 4, 5, 6, of the permutating-wheel, by means of a binding-nut, P, Figs. 4 and 5, the space between the two metallic sections *i* and *o* of the permutator being maintained by a core, R, of some non-conducting substance, like hard rubber. It will be seen that by this combina-

tion one section of the permutator represents the aggregated ends of one pole of the magnet's coils, and the other section the aggregated ends of the opposite poles of the magnet's coil. The electrical currents are brought onto the permutator by means of the current-wheels S S, standards T T, and spring-binders *u u*, which connect with the screw-cups *w w*, as shown in Figs. 3 and 9. The standards T T are jointed at X X between two levers, Y Y, which levers have a shaft, Z, passing through their common center, and the whole combination is supported by pillar-blocks *a' a'*, as shown in Fig. 3, and in Fig. 9, at A^2. On the end of the shaft Z, Figs. 3 and 9, is a sector-plate, *b'*, which is operated by a screw, *c'*. The standards T T have an insulated bearing, x^2 x^2, Figs. 5 and 9, on their journals X X, and the spring-binders *u u* perform the double duty of securing good contact between the current-wheels S S and the permutator, and acting as conductors. The insulating section R between the sections *i o* of the permutator should be sufficiently depressed below the surface of the permutator's working face as to insure contact between the current-wheel and one section before it leaves the other section, as shown at *d' d'*, Figs. 3, 6, and 7. The conductors D D^1 are connected to a pole-changer, D^2, Figs. 3, 5, and 9, by means of the spring-connections *e' e'*. As this pole-changer is only used when it is desired to reverse the motion of the motor, it has only two break-pieces, *f' f'*, Fig. 10. The rotating magnets having been brought directly opposite the fulcrum-magnets, and the permutating-wheel sections made to intersect the magnet-sections by the levers Y Y being brought into a horizontal plane, one pole of the battery is entered at screw-cup F', Figs. 5 and 9, and, by means of the rings B B', the current is made to traverse the fulcrum-magnets, from which it passes, by means of the connection of the one ring, B or B', with its screw-cup F', to screw-cup *w*, Fig. 9, and, thence passing up the one standard T to the permutator, is transmitted by it to the movable magnets on the shaft around which it traverses, and, by one operation of the permutator, passes down on the other standard T, through binding-spring *u*, to the opposite pole of battery in the other screw-cup *w*.

The speed of the revolving magnets may be modified while in motion to any desirable extent by simply turning the screw *c'* to the right or left, as may be required, which action ships the current around the magnets I I I I I I, Sheet 1, Fig. 2, earlier or later, as regards their approach to the magnets A A A A A A, Sheet 1, Fig. 2, and the motion may be reversed by moving the handle H' of the pole-changer D^2 from right to left, or vice versa, as required.

The winding of the coils of the magnets or broken annular magnet-sections in opposite directions gives opposite polarity to the magnets, in the order of their positions relatively to each other—a condition of things which gives a simultaneous attraction and repulsion of both magnetic and electrical action.

I claim as my invention, and desire to secure by Letters Patent—

1. The magnets A I, constructed of broken annular sections having their coils wound in reverse directions, substantially as herein shown and described.

2. The combination of the permutator-wheel *o*, Sheet 2, Fig. 3, current-wheels S S, standards T T, and lever Y, actuated by the worm *c'* working in the sector *b'*, substantially in the manner and for the purpose as specified.

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Witnesses:
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J. E. CONDICT.