

(No Model.)

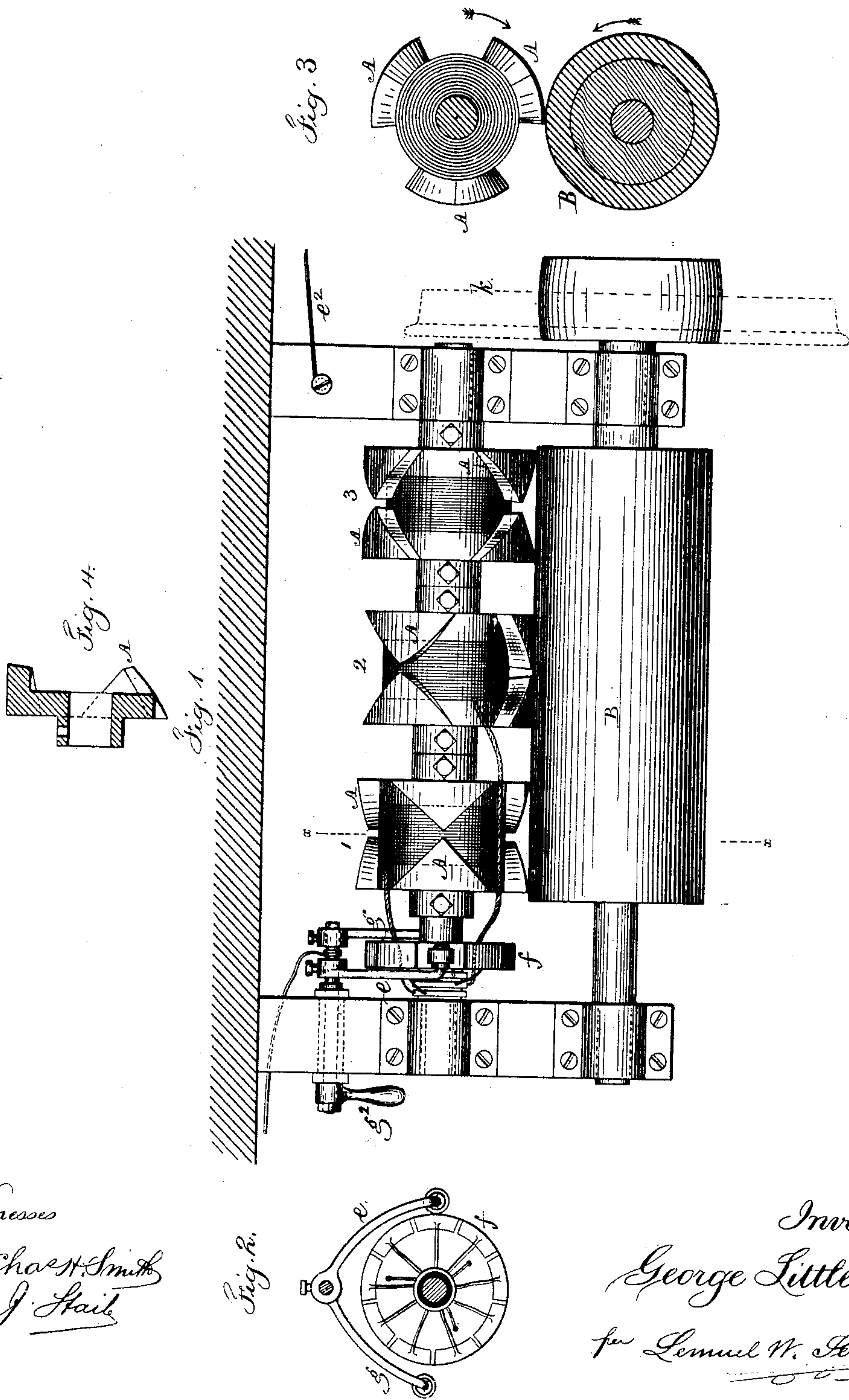
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G. LITTLE.

ELECTRO MAGNETIC MOTOR.

No. 259,404.

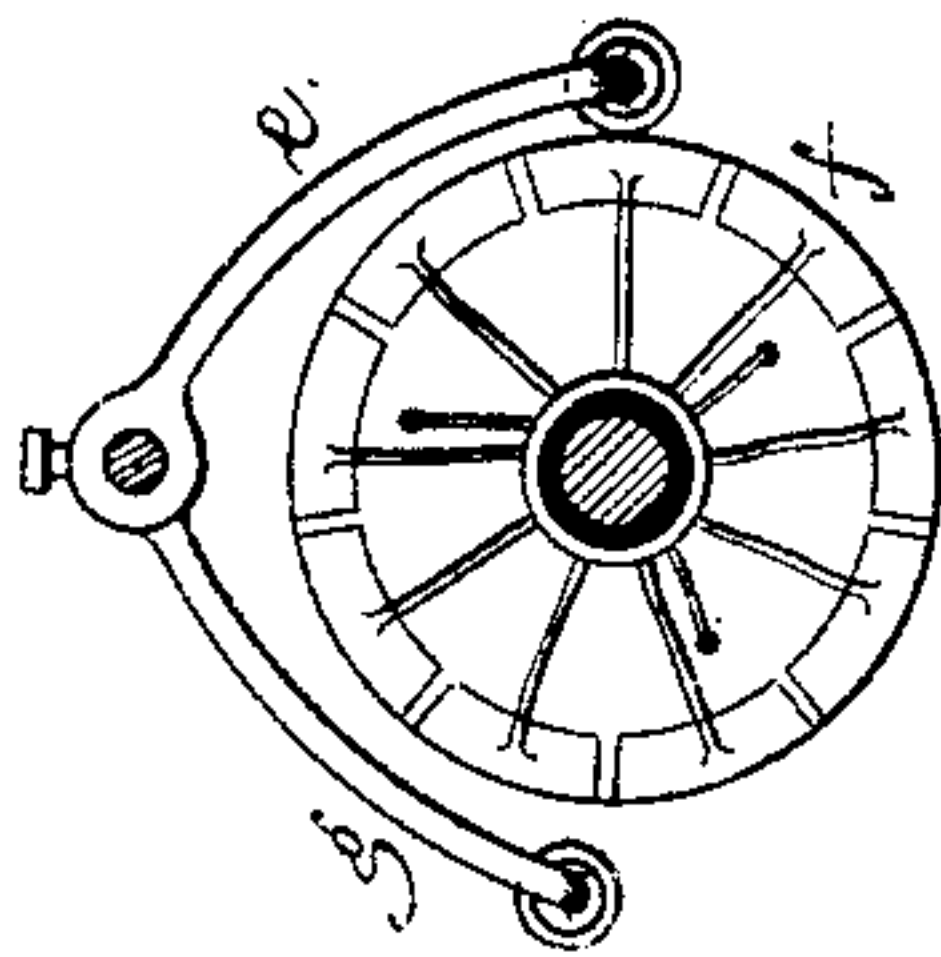
Patented June 13, 1882.



Witnesses

Chas H. Smith
J. Hail

Fig. 5.



Inventor

George Little

per Lemuel W. Perrell
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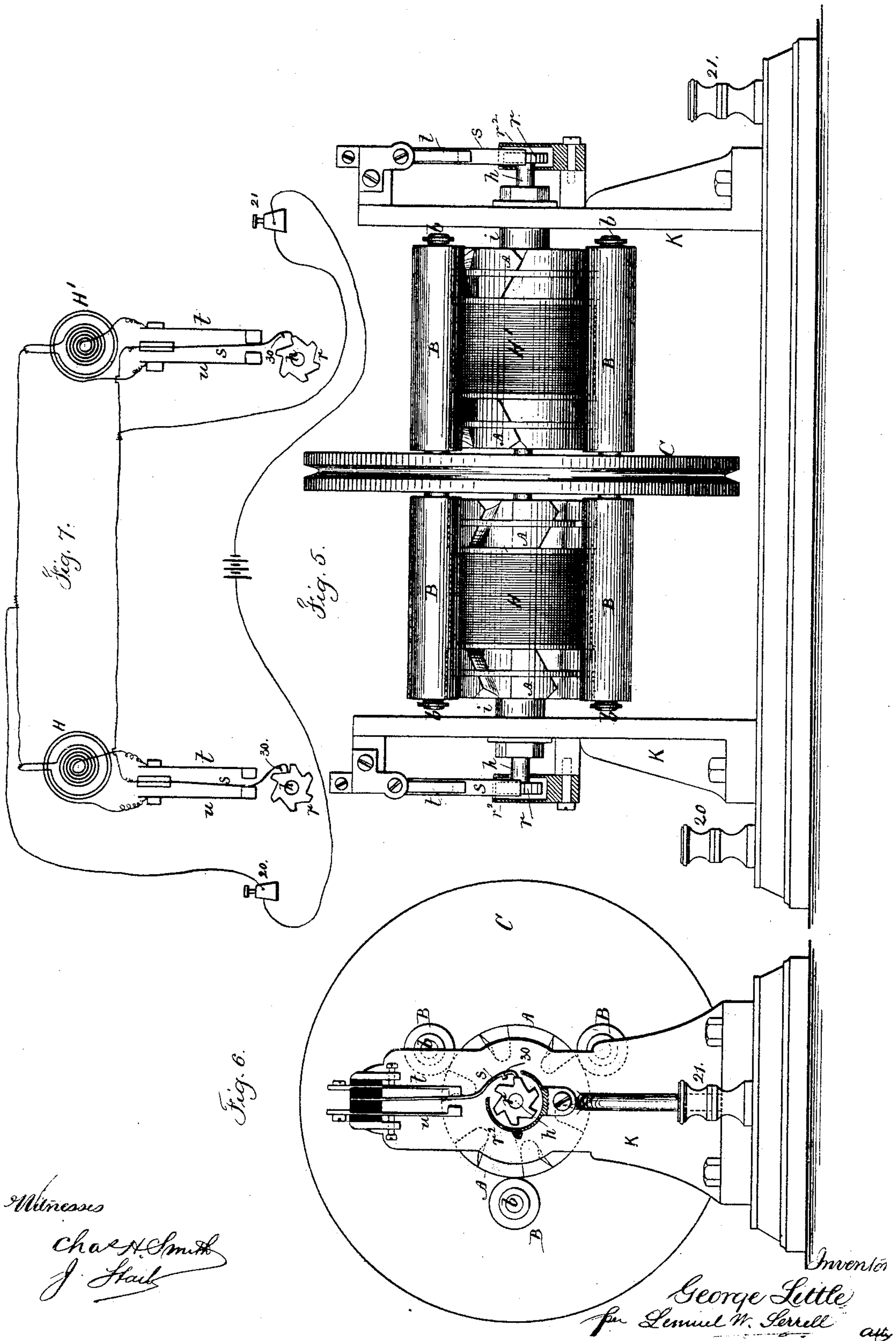
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UNITED STATES PATENT OFFICE.

GEORGE LITTLE, OF PASSAIC, NEW JERSEY.

ELECTRO-MAGNETIC MOTOR.

SPECIFICATION forming part of Letters Patent No. 259,404, dated June 13, 1882.

Application filed March 1, 1882. (No model.)

To all whom it may concern:

Be it known that I, GEORGE LITTLE, of Passaic, in the county of Passaic and State of New Jersey, have invented an Improvement in
5 Electro-Magnetic Motors, of which the following is a specification.

It is well known that magnetic attraction is the most efficient where the armature is in close contact with the magnet-poles, and that the
10 force of the magnetism is very much weakened by interrupting the actual contact of the metallic surfaces.

In magnetic engines as ordinarily constructed the actual contact of a free moving
15 armature with the poles would defeat the objects for which the machine was constructed by causing the armature to adhere.

In my improvement I avail of a rolling motion given to the armature, whereby the metallic surfaces of the poles are brought into actual contact for obtaining the maximum magnetic force, and the magnetism is neutralized or partially or entirely reversed as the rolling
20 armature passes the place of greatest magnetic action, so as to prevent any sticking of the armature to the pole, and to avail of the passive state of the poles as the armature rolls off them.

In the drawings, Figure 1 is an elevation of
30 a revolving magnet with rotating armature-rollers. Fig. 2 is a separate view of the circuit-changer. Fig. 3 is a section of the magnet and armature. Fig. 4 is a detached section of one of the magnet-heads. Fig. 5 is a
35 side elevation of a magnetic engine in which the magnets are stationary and the armatures roll around them and the continuous non-magnetic bearing rings or guides. Fig. 6 is an end view of the circuit-changers adapted to
40 the machine shown in Fig. 5, and Fig. 7 is a diagram of the circuit-connections.

The magnet is composed of two heads upon a metal tube, with a helix wound in between the heads, and each head is divided up into
45 pole-faces that are either a single or a double V shape. In Fig. 1 the magnet-heads A A are provided with double-V-shaped poles, and in Fig. 5 the pole-faces are single-V-shaped, as shown. For locomotive-motors the V-shape

faces are preferably dispensed with and square
50 pole-faces employed.

The armature or armatures are cylindrical and adapted to roll around the circular magnet-heads A A, or else the armatures stand in one position and the electro-magnet and armatures revolve in contact with each other. The
55 armature B is shown in Fig. 1 as a cylinder on a shaft in stationary bearings, and in Figs. 5 and 6 there are three revolving armatures B upon arbors b, that extend out laterally
60 from the central wheel, C, from which a belt or gear extends to the machine or device to be rotated.

The pole-faces of the magnet-heads are to be of the proper size and number with reference
65 to the armature cylinder or cylinders, and the helix of such magnet is preferably to be charged just before the armature in its rolling movement comes into contact with such pole-faces, and the current through the inside con-
70 volutions of the helix is to be stopped and then reversed through the outside convolutions as and just before the armature rolls across the center of the pole-face. This will prevent any
75 back pull or reaction of the magnet on the armature, and the reversing of the polarity will neutralize the magnetism of the electro-magnet poles, producing a momentary passive
80 state that delivers the armature from the one pole-face and permits it to continue its movement toward the other pole-face, where the magnetic attraction is acting to promote a rapid movement of the armature as it rolls into
85 contact with the magnet-poles.

The magnets are to be charged by the ac-
85 tion of a circuit-closing device that admits the electric current to the helix, and the time of making and breaking circuit is to be such that the current will pulsate as many times in each
90 revolution of the electro-magnet or the armature around the electro-magnet as there are pairs of pole-faces. In Figs. 1 and 2 each magnet-head is represented with three pole-faces, and hence there will be three pulsations in each magnet every revolution. The mag-
95 net-poles are placed so as to operate progressively, so that as the pole-faces of the magnet 1 are ceasing to act the pole-faces of the mag-

net 2 are coming into action. Then the pole-faces of the magnet 3 come into action, and as these go out of action the pole-faces of the magnet 1 again come into action.

5 In Fig. 2 there is shown a circuit-closing wheel with nine insulated plates, *f*. The current passes from the arm *e* to one plate and to the magnet 1, and returns by the frame and the battery or generator wire *e*². From the
10 second plate *f* the current passes to the second magnet, and so on. It is to be understood that these magnets, acting in succession, exert a powerful force to roll the armature around in contact with the pole-faces, and the
15 power is constant and uniform, or nearly so, in consequence of the progressive action of the magnets.

The magnets and armature-roller will revolve in the direction shown in Fig. 3; but if
20 the arm *g* is brought into contact with the circuit-closing wheel, instead of the arm *e*, the parts will revolve in the reverse direction, in consequence of the order in which the electro-magnets are energized being reversed, the
25 magnet 3 being first magnetized, then 2, then 1, and so on, instead of the reverse, as aforesaid. The arms *e* and *g* are upon a shaft that can be turned by a handle, *g*², to bring into action either the arm *e* or the arm *g*.

30 A wheel is shown by dotted lines at *k*, Fig. 1, to indicate that this motor may be applied to the propulson of cars by electricity; or a belt or gearing may be used to convey the power to any machine that is to be operated.
35 In some cases it will be preferable to work this motor in a shunt-circuit, especially when operated as a stationary engine.

The machine shown in Figs. 5 and 6 is operated the same as before described; but the mag-
40 nets are held stationary upon tubular shafts *i*, supported by the frames *K*, and the shaft *h* revolves within such tubular shafts, and it carries the belt or gear wheel *C* and the studs *b* of the armature-rollers *B*, as aforesaid, and at the ends
45 of the shaft *h* there are the circuit-closing wheels *r*, that operate a contact-spring, *s*, that is between two spring contact-blocks, *t* and *u*. Cases *r*² (shown sectionally in Figs. 5 and 6) should partially surround the wheels *r* to contain lubricating material. Each wheel *r* has as many
50 teeth as there are pairs of pole-faces to each magnet, and the wheels are placed upon the shaft in such a manner that the energizing-currents are admitted to the helices *H H'* at the
55 proper time, which is preferably just before the rolling armatures reach the pole-faces. Six pairs of pole-faces are shown in each magnet, and hence the wheels *r* have six projections.

The spring contact-blocks *t u* are insulated;
60 so also are the springs *s*; but the springs *s* may, if desirable, be connected to the metal frame.

The helices of the electro-magnets are wound in the usual manner, except that a connection is made from or about the middle part of each
65 helix to the negative binding-post 20, and the current comes from the positive binding-post

21 to the springs *s*, and the extreme ends of the helices *H H'* are connected to the respective springs *t u*, the outside convolutions of each helix constituting the neutralizing portion of
70 the helix.

The actions are alike in both electro-magnets. I will only describe the operations of one.

When the wheel *r* is in the position shown in
75 Fig. 6 the current passes by *s* to *t*, and thence through part of the helix to the loop-connection and to the binding-post 20; thence to the battery or generator. This energizes the electro-magnets, and their pole-faces attract the
80 revolving armatures. As soon as the rolling surfaces of the armatures in contact with the pole-faces nearly arrive at the middle of the pole-faces the turning of the wheel *r* causes the spring *s* to fly off the point of the tooth and
85 instantly close contact between *s* and *u*. This sends a current through the other portion of the helix in the opposite direction to the first-named current, as illustrated in the diagram Fig. 5, and hence the previous magnetism is neutral-
90 ized instantly, and the armature-rollers, instead of being detained and the rotary motion checked, are caused to pass freely off the pole-faces and pass into the magnetic field of the next pair of pole-faces. This reverse current
95 must be but momentary to neutralize the residual magnetism of the pole-faces. Otherwise, if prolonged, it would remagnetize the cores or pole-faces and attract the armature-roller. I therefore provide a projection at 30, on the
100 spring *s*, against which the next tooth of *r* acts and breaks circuit with *u*; but the teeth of *r* are so shaped that the circuit is not again closed with *t* until the rolling armatures have nearly
105 arrived at the edge of the next pole-faces.

It is to be understood that the pole-faces of one magnet are intermediate to those of the next, so that one is at its maximum intensity while the armature of the other is passing from
110 one pole-face to the other.

The tubular shafts *i*, being within the respective helices, are in the most intense portion of the magnetic field, and the magnet-heads and their pole-faces have their magnetism intensified by being formed with or connected to such
115 tubular shafts forming the cores. The V shape of the pole-faces lessens the abrupt separation of the armature and pole-faces, and should there be any residual magnetism in the pole-faces the effect will be lessened as the arma-
120 tures roll toward the narrowest parts of the pole-faces.

In order to develop a given power, motors constructed as herein described require much less weight in electro-magnets, and they are
125 operated with very much greater economy in current than has heretofore been accomplished with electro-magnetic engines.

The arrangement herein described of helices and reverse circuit-connections may be em-
130 ployed in electric motors having cores and armatures of the ordinary character, the current

being diverted through a portion of the helix in a reverse direction to neutralize the residual magnetism, as before set forth.

Rings of brass or similar non-magnetic metal introduced into peripheral grooves in the pole-faces support the rolling armatures as they pass from one pole-face to the next.

I claim as my invention—

1. The combination, with the magnet having heads and pole-faces, of a revolving armature the surface of which rolls in contact with the pole-faces and circuit-changing connections, substantially as specified, whereby reverse currents are employed to neutralize residual magnetism, substantially as specified.

2. In an electro-magnet having circular ends, the V-shaped segmental pole-faces of such circular ends, in combination with the revolving cylindrical armatures, substantially as set forth.

3. In combination with the electro-magnets having circular ends and segmental pole-faces,

the springs *s t u*, and wheel *v*, and circuit-connections, substantially as set forth.

4. In an electro-magnetic engine, the helix having circuit-connections to its ends and to an intermediate loop, in combination with circuit-closing springs and connections, substantially as set forth, whereby the residual magnetism is neutralized by a current passed in reverse direction through part of the helix, substantially as set forth.

5. The combination, with the rolling armature and the magnet-heads with pole-faces, of the rings of brass or other non-magnetic metal surrounding the magnet-heads, substantially as specified.

Signed by me this 23d day of February, A. D. 1882.

GEO. LITTLE.

Witnesses:

GEO. T. PINCKNEY,
CHAS. H. SMITH.