3 Sheets--Sheet 1.

WILLIAM H. RICHARDSON.

Improvement in Electro-Magnetic Motors.

No. 127,369. Patented May 28, 1872

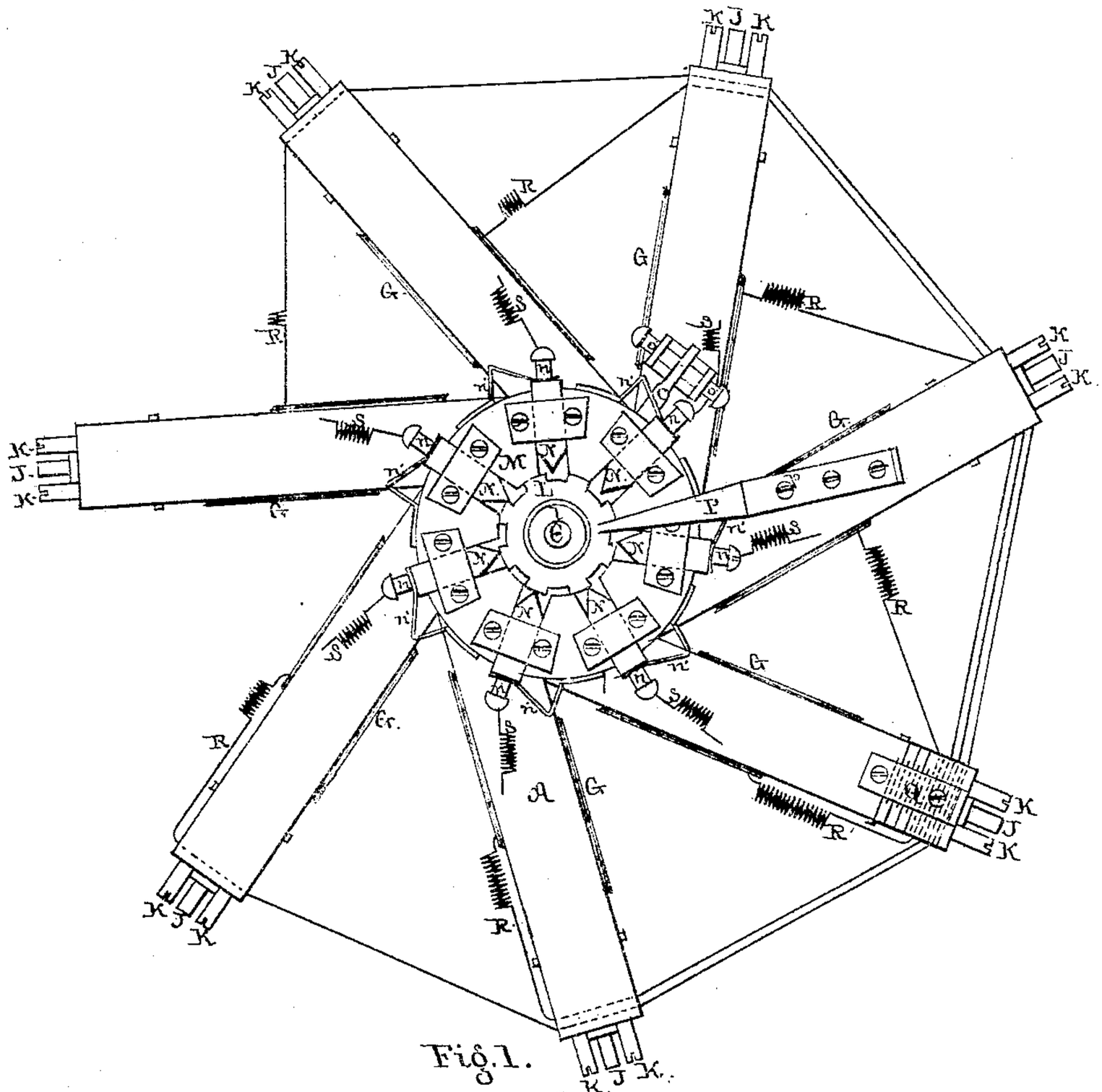

Fig. 1.

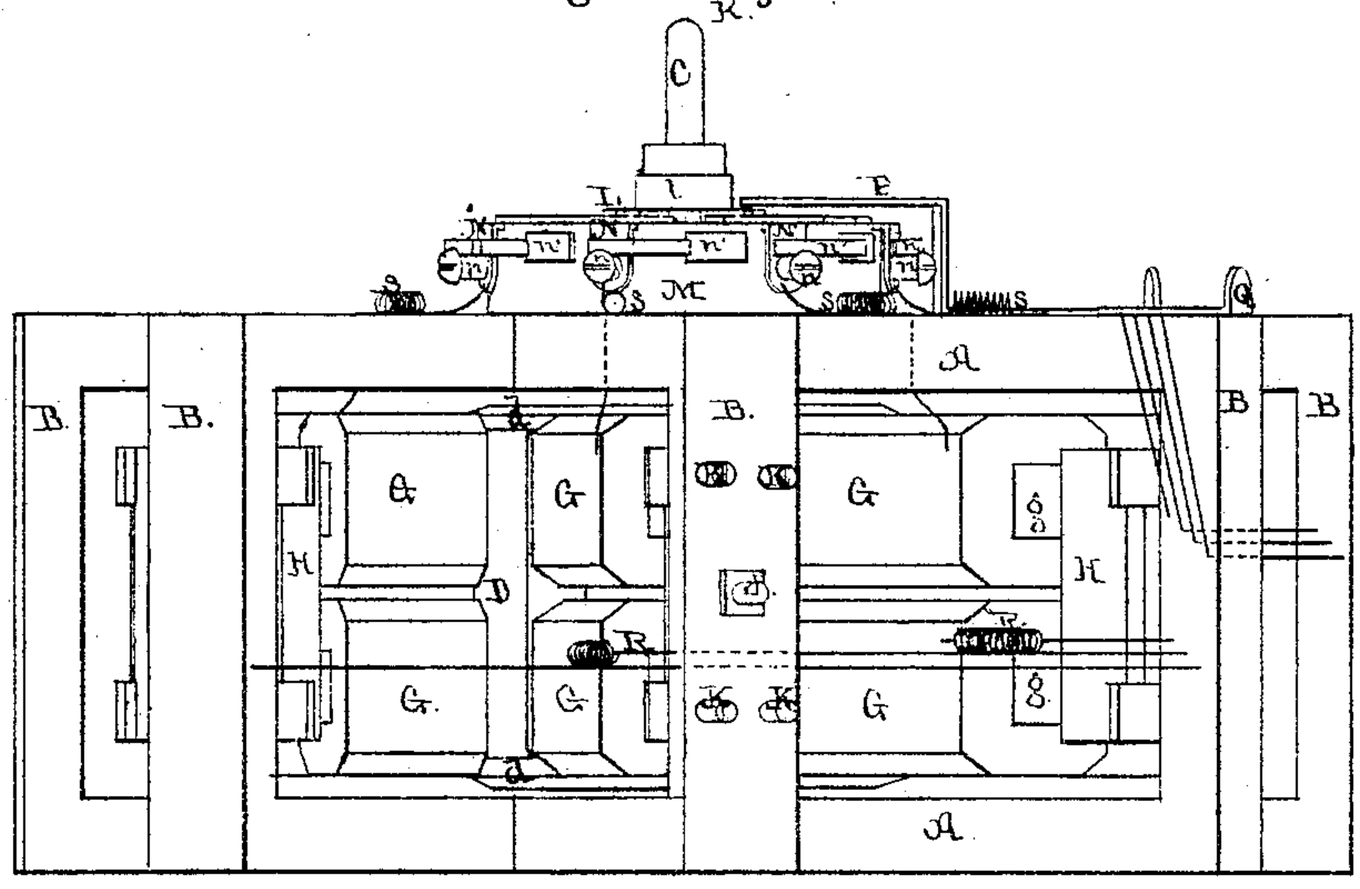

Fig. 2.

Witnesses.

William H. Lee

Sanford R. Hackett

William H. Richardson.

3 Sheets--Sheet 2.

WILLIAM H. RICHARDSON.

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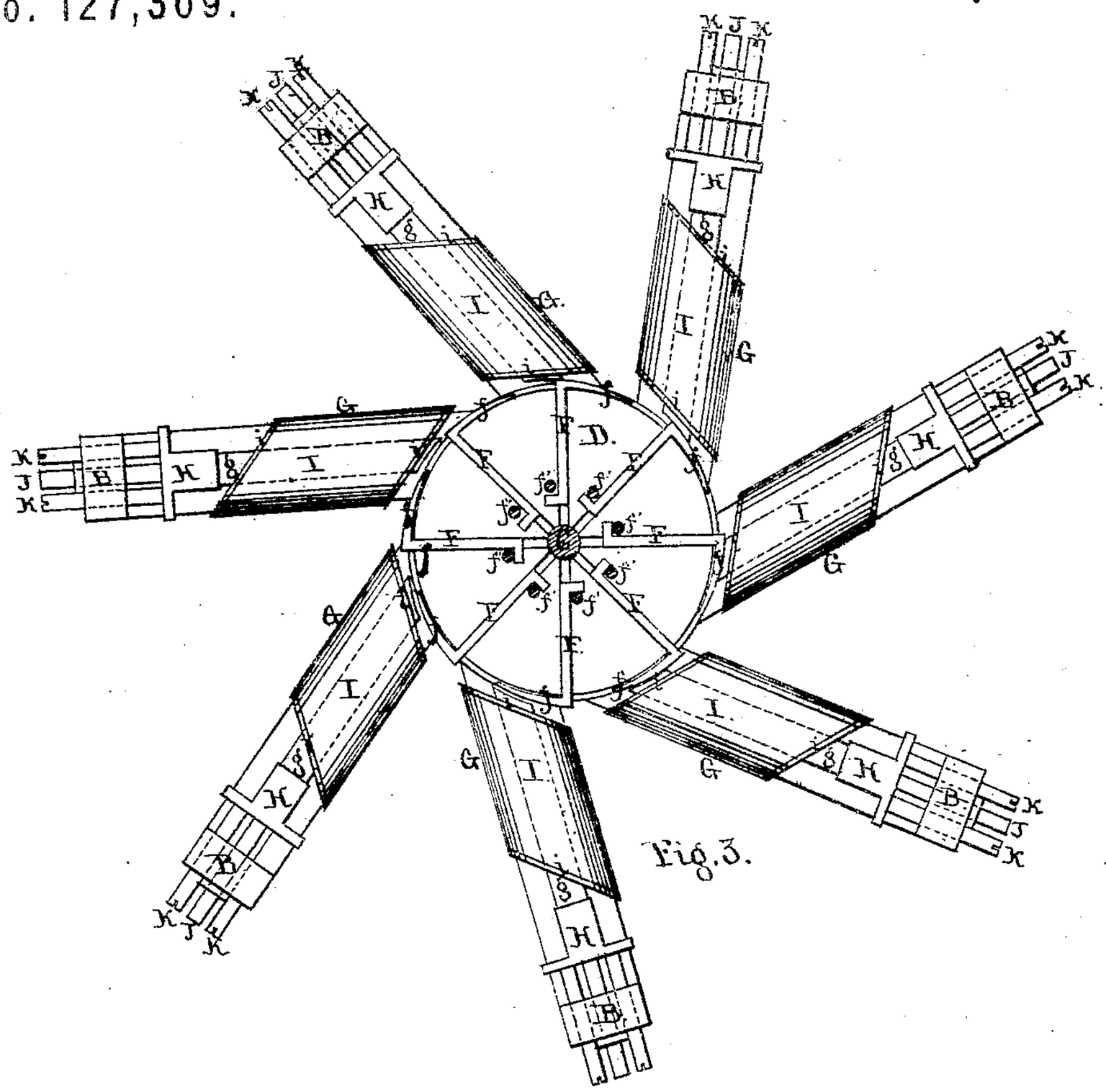

Fig. 3.

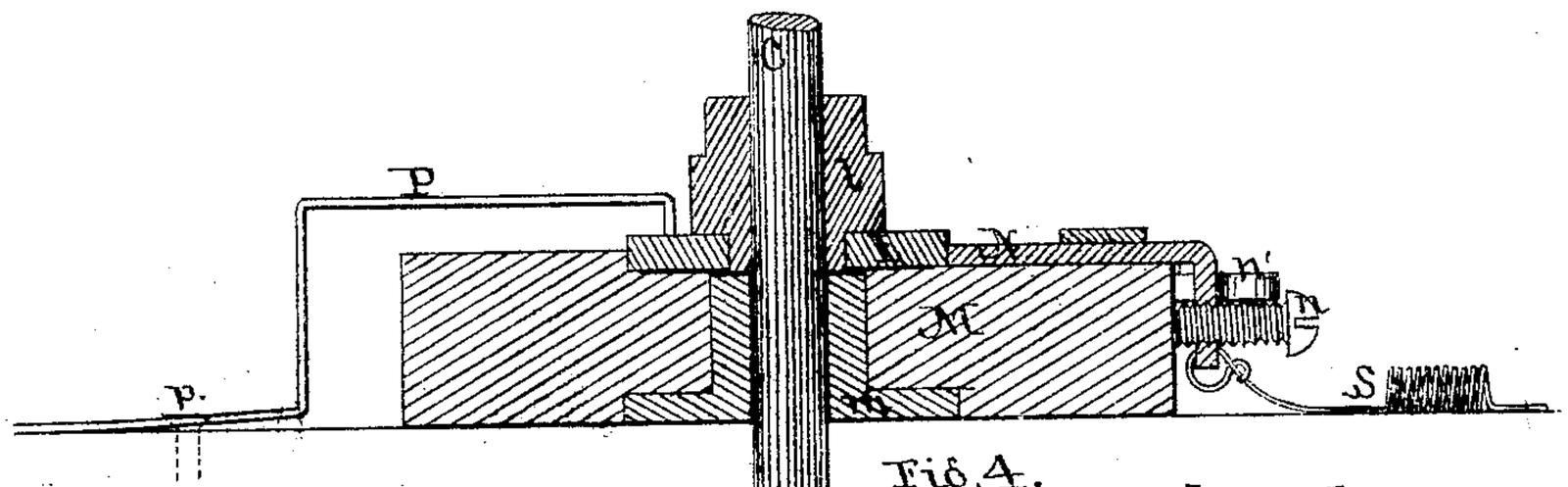

Fig. 4.

Witnesses.

William H. Lorn

Sanford R. Hackie

Inventor.

William H. Richardson

3 Sheets--Sheet 3.

WILLIAM H. RICHARDSON.

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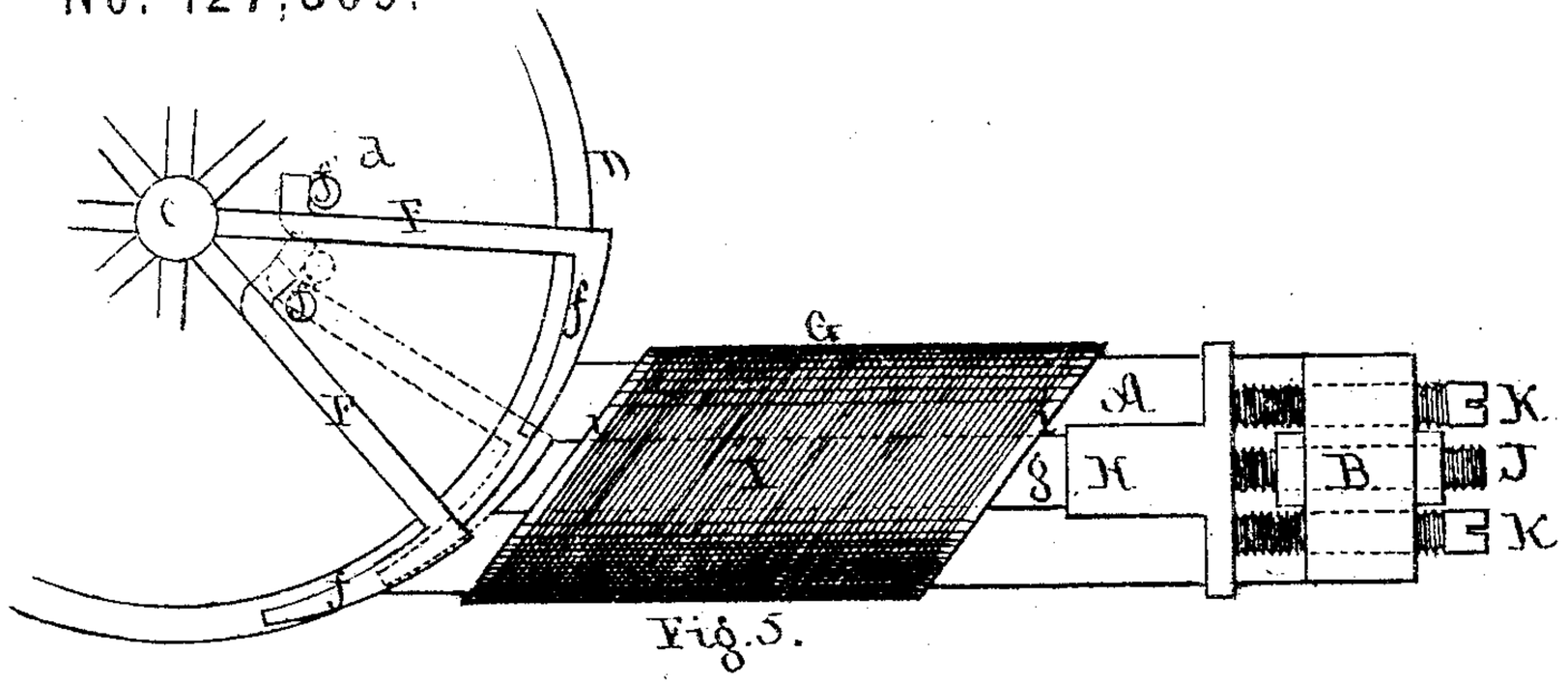

Fig. 5.

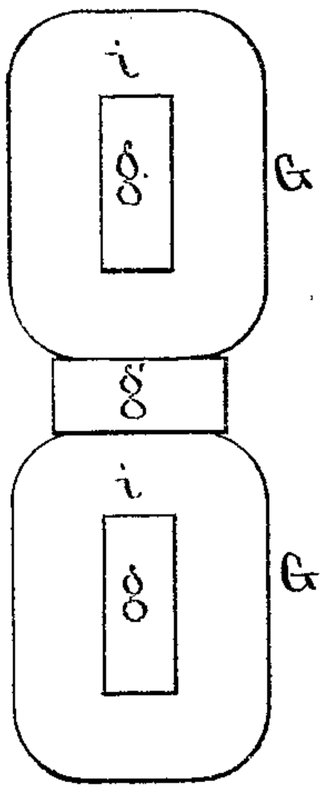

Fig. 6.

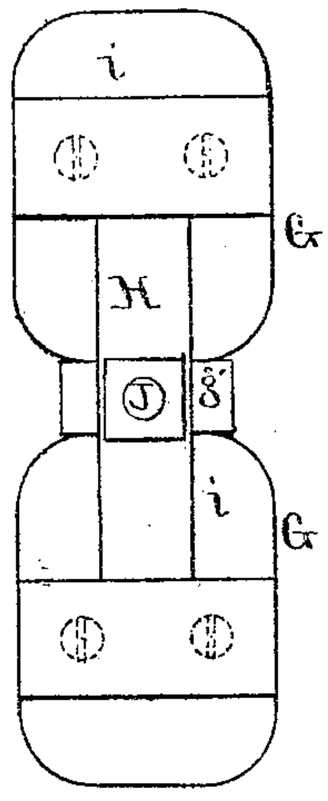

Fig. 7.

Witnesses.

William H. Lorr

Sanford R Haskell

Inventor.

William H Richardson

127,369

UNITED STATES PATENT OFFICE.

WILLIAM H. RICHARDSON, OF ALBANY, NEW YORK, ASSIGNOR OF ONE-HALF OF HIS RIGHT TO HENRY C. HASKELL, OF SAME PLACE.

IMPROVEMENT IN ELECTRO-MAGNETIC MOTORS.

Specification forming part of Letters Patent No. 127,369, dated May 28, 1872.

To whom it may concern:

Be it known that I, WILLIAM H. RICHARDSON, of the city and county of Albany and State of New York, have invented certain Improvements on Electro-Magnetic Motors, of which the following is a full and exact description, reference being had to the accompanying drawing making a part of this specification, in which—

Figure 1 is a plan view; Fig. 2, a side elevation; Fig. 3, a plan view, with the top work removed to show the arrangement of magnets and armatures; Fig. 4, an enlarged section of the circuit-wheel, circuit-point holder, and circuit-points; Fig. 5, an enlarged detached view of one of the electro-magnets, showing the position of one of the armatures at the time of closing and opening the circuit; Fig. 6, an enlarged detached front elevation of one of the electro-magnets; and Fig. 7, a rear elevation of the same.

The nature of my invention consists, first, of a new and peculiar arrangement of electro-magnets around a revolving wheel containing a series of armatures of novel construction; second, of an improved construction of the electro-magnets; and, third, of the construction of the circuit-wheel, circuit-point holder, and circuit-points, and the manner of insulating them.

The frame-work consists of a top and bottom piece, A A, having seven (more or less) arms arranged tangentially around a circle, held together by the uprights B B. This frame-work I make preferably of brass in order that it may not act as a magnetic conductor. Between each pair of arms of the frame-work I attach an electro-magnet, so that its center line will be coincident with the central line of the arm. C is the shaft to which the revolving wheel D and the circuit-wheel L are attached. The revolving wheel D has two circular heads, *d d*, in which radial grooves are made to receive eight (or more or less) sliding armatures, F F. These armatures are made of soft iron, and have their outer ends *f f* turned back in a scroll form, as shown in the drawing, for a distance of about one-thirteenth of the circumference of the circular head. By means of this scroll-formed (or an angular) end the attraction of the electro-magnet is continued until the longest point of the armature is brought to coincide with the front edge of the core of the electro-magnet, thereby greatly increasing the time the armature is kept under the attracting influence of the electro-magnet as compared with the common forms of armatures and magnets heretofore used in revolving wheels. The inner ends of the armatures are bent to form a stop to strike against the rods *f' f'* to prevent the armatures from sliding out of the heads *d d* beyond the point required to admit of their longest points joining the cores of the electro-magnets when the circuit is broken. G G are the electro-magnets, whose cores *g g* are made of rectangular bars of soft iron. These cores have their front ends made to conform to the ends *f f* of the armatures, and are secured to the cross-bars H H, also made of soft-iron bars. The helices I I consist of insulated wire wound between the heads *i i*, set at an angle with the cores *g g* to correspond as nearly as possible to the form of the front end of the cores. By so doing a great increase of the length of the wire is produced and a corresponding increase of the power of the electro-magnet is effected. In Figs. 6 and 7 the electro-magnets are shown with two cores, *g g*, and an intermediate bar of soft iron, *g'*, the object of the latter being to form a third point of attraction in the magnets, but which, of necessity, must be of a lower grade of power than the cores. In constructing these electro-magnets these intermediate bars may be dispensed with; but preferably I construct them as shown. The electro-magnets are secured to the frame-work by means of the bolts J J, and are adjusted in position by the set-bolts K K. All of these bolts, where they pass through the frame-work, should be insulated therefrom by means of wooden, hard-rubber, or other non-conducting bushings. The circuit-wheel L is made of brass or any of the finer metals. It is secured to the shaft C, and is insulated from it by the hub *l*, made of wood or other non-conducting material. The periphery of the wheel is cut into projections, the number of which corresponds with the number of armatures in the revolving wheel D. The length of these projections should bear the same ratio to the diameter of the circuit-wheel L that the ends *f f* of the armatures bear to the revolving wheel D. The corners of these projections should be slightly rounded to admit of a more perfect adjustment of the open-

ing and closing of the circuits. The circuit-point holder M is made of hard rubber or any non-conducting material, with a metallic bushing, *m*, secured in its center, in which the shaft C revolves freely. Its upper face is cut into radial grooves to receive the circuit-points N N, whose number equals that of the electro-magnets. Each of these circuit-points has a set-screw, *n*, by means of which its contact with the circuit-wheel L is adjusted. Springs *n' n'* are also attached to each to hold it firmly in contact with the circuit-wheel L during the time its corresponding electro-magnet is attracting the armatures. Attached to the circuit-point holder is an arm, O, held by the adjusting-screws *o' o'* attached to the frame, by means of which the circuit-points may be correctly adjusted to the rotation of the circuit-wheel; or, when desirable to do so, by removing it far enough around to allow the circuit-points to engage on the opposite sides of the projections of the circuit-wheel, the motion of the revolving wheel D may be reversed. P is a spring, the pressure of which is regulated by the screw *p*, and the point of which rests upon the circuit-wheel L. It is insulated from the frame by interposing wood or some other non-conducting material between them. To the opposite end of the spring P is attached one of the wires connecting the motor to the battery. Q is a consolidating-plate, to which the wires R R connecting with the electro-magnets are held in contact. It is insulated from the frame in the same manner as the spring P. The wires R R are formed into spiral coils, as shown, so as to make the connections to the electro-magnets of equal lengths for the purpose of equalizing the power of the electro-magnets. To the end of the consolidating-plate Q the other battery-wire is attached for the purpose of completing the circuit. S S are wires connecting each circuit-point to its electro-magnet.

The battery being connected by its wires to the spring P and consolidating-plate Q, so as to form a circuit for the electric current, the electro-magnets, as their circuit-points are brought into contact with the circuit-wheel L, become magnetized and attract toward them the armatures F F that are nearest, thereby giving motion to the revolving wheel D. When the longest point of the armature reaches the nearest edge of the core of the electro-magnet the circuit to that magnet is broken by its circuit-point passing off from the projection of the circuit-wheel L by the rotation of the wheel. Each armature, after the circuit is broken, in passing the cores of the magnets, moves freely in toward the center of the revolving wheel D, so as to clear the longest point of the core, as shown by the dotted lines in Fig. 5, after which the attraction of the next magnet or its own centrifugal force will throw it into its proper position again. By having an uneven number of electro-magnets and an even number of armatures, or vice versa, the relation of the one to the other is constantly varying, and a more powerful attraction is maintained during the entire revolution of the wheel D than can be obtained by using an equal number of each.

In constructing this motor the electro-magnets may be placed within the revolving wheel D and the armatures outside of them in the framing; or the armatures in the revolving wheel may be made stationary and the electro-magnets arranged to slide or swing so as to allow the armatures to pass them; but preferably I construct and arrange them as described. It may also be constructed with an even number of magnets and an uneven number of armatures; or the number of magnets and armatures may be varied so long as the inequality of the number of each is observed. In it I also embrace the construction of the revolving wheel D, divided into a series of spaces in the direction of its length, each space being provided with a series of armatures. To accomplish this a corresponding series of electro-magnets will be required. By this means the power of the motor may be greatly increased and the reversal of the motion of the revolving wheel easily accomplished.

By insulating the circuit-wheel L and circuit-point holder M from the shaft C, and the spring P and consolidating-plate Q from the frame, the primary current is prevented from entering into the motor, except at such points as are requisite for its perfect operation, thereby preventing the waste of power of the battery by the neutralizing of the electro-magnets by reason of their counteraction. The electro-magnets are insulated from the effects of the secondary current by means of the non-conducting bushings around the bolts J J and K K.

By changing the cores of the electro-magnets from the usual round form to a rectangular one the power exerted by its edge in attracting the armatures toward it is very greatly increased, and by its increase of circumference around an equal area the length of wire in its helix is greatly augmented, producing a corresponding increase in the power of the electro-magnet. Instead of a rectangular core one of an elliptical form, or of a rectangular form with its corners rounded, may be used; but, as these do not present so powerful an attracting-edge as the rectangular core, I use this form from preference.

What I claim as my invention is—

1. The revolving wheel D, carrying a series of sliding armatures, constructed substantially as herein described, and for the purposes set forth.

2. The armatures F F, having their outer ends *f f* made in the form of a scroll or bevel, as and for the purpose herein specified.

3. The combination of the sliding armatures F F and stops *f' f'*, substantially as and for the purpose described.

4. The electro-magnets G G, having the front end of their cores *g g* formed to correspond to the scroll form or bevel of the armatures, for the purpose of increasing their attractability.

5. The electro-magnets G G, constructed

with heads *i i* arranged diagonally across their cores *g g*, and their helices I I wound to correspond thereto, as and for the purposes herein described.

6. In combination with the electro-magnets G G, the intermediate bar *g'*, constructed and arranged as and for the purposes herein specified.

7. The combination of the electro-magnets G G with the bolts J J and K K, arranged as and for the purposes herein set forth.

8. In combination with the electro-magnets G G and the bolts J J and K K, the non-conducting bushings, arranged as and for the purposes described.

9. The combination of the non-conducting circuit-point holder M, constructed as herein described, with the circuit-points N N, as and for the purposes herein set forth.

10. The combination of the circuit-points N N, constructed as herein described, with the adjusting-screws *n n* and springs *n' n'*, or their equivalents, as and for the purposes herein specified.

11. The combination of the circuit-wheel L with the circuit-points N N, adjusting-screws *n n*, and springs *n' n'*, constructed and arranged to operate substantially as and for the purposes herein described.

12. The combination of the circuit-point holder M, arm O, and adjusting-screws *o' o'*, as and for the purposes set forth.

13. The combination of the circuit-wheel L with the spring P, constructed and arranged to operate substantially as and for the purposes specified.

14. The combination of the electro-magnets G G with the connecting-wires R R, constructed with coils or their equivalents, for the purpose of equalizing their lengths and action, as herein described.

15. The combination of the revolving wheel D and sliding armatures F F with the electro-magnets G G, arranged tangentially around the circumference of the wheel, as and for the purposes specified.

16. The combination of the revolving wheel D, armatures F F, and electro-magnets G G with the circuit-wheel L, circuit-point holder M, and circuit-points N N, when constructed and arranged to operate as herein described.

WILLIAM H. RICHARDSON.

Witnesses:
WILLIAM H. LOW,
SANFORD R. HASKELL.