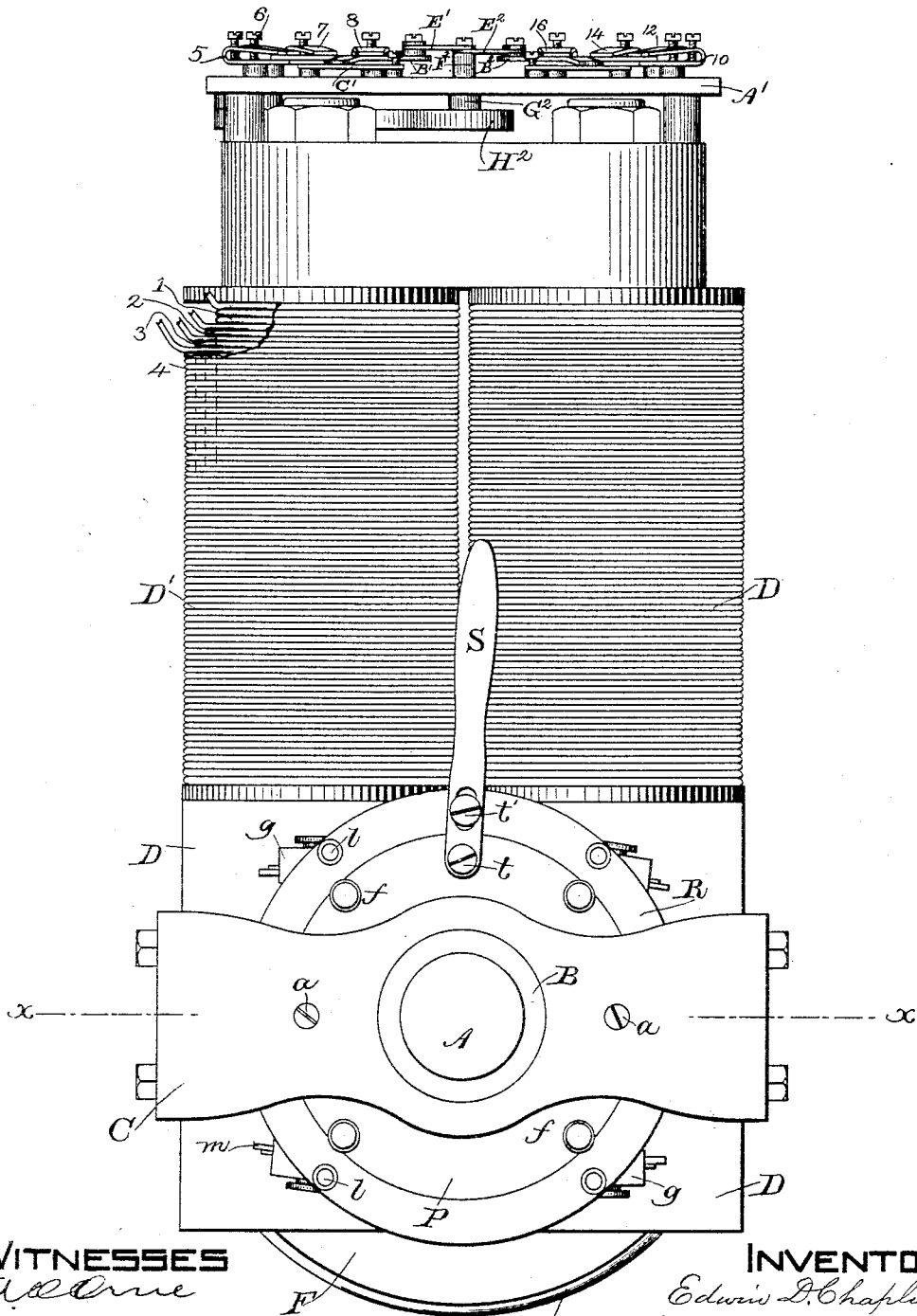


E. D. CHAPLIN.
ELECTRO MAGNETIC MOTOR.

No. 448,603.

Patented Mar. 17, 1891.

FIG. 1.



WITNESSES

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Henry Hunt Lettency

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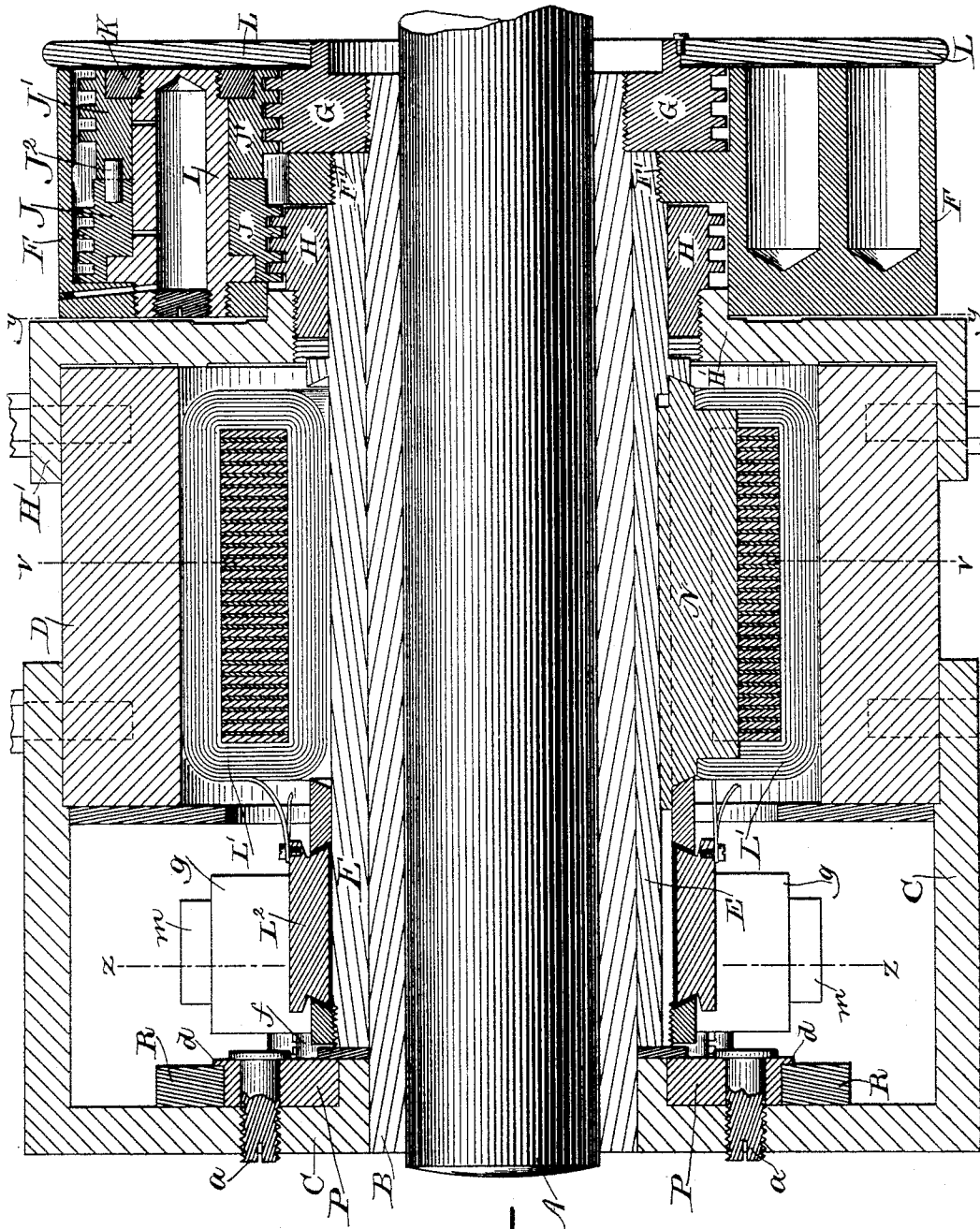
(No Model.)

6 Sheets—Sheet 2.

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FIG. 2

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FIG. 3.

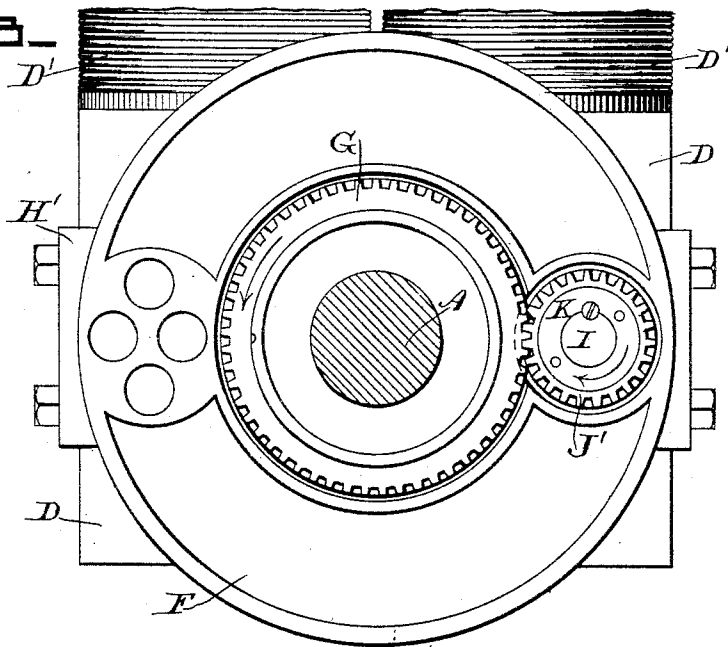
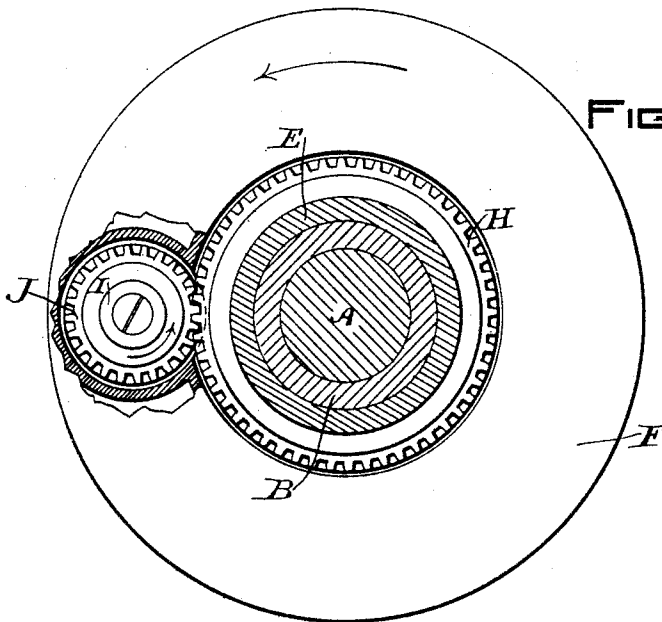


FIG. 4.



WITNESSES

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FIG. 5.

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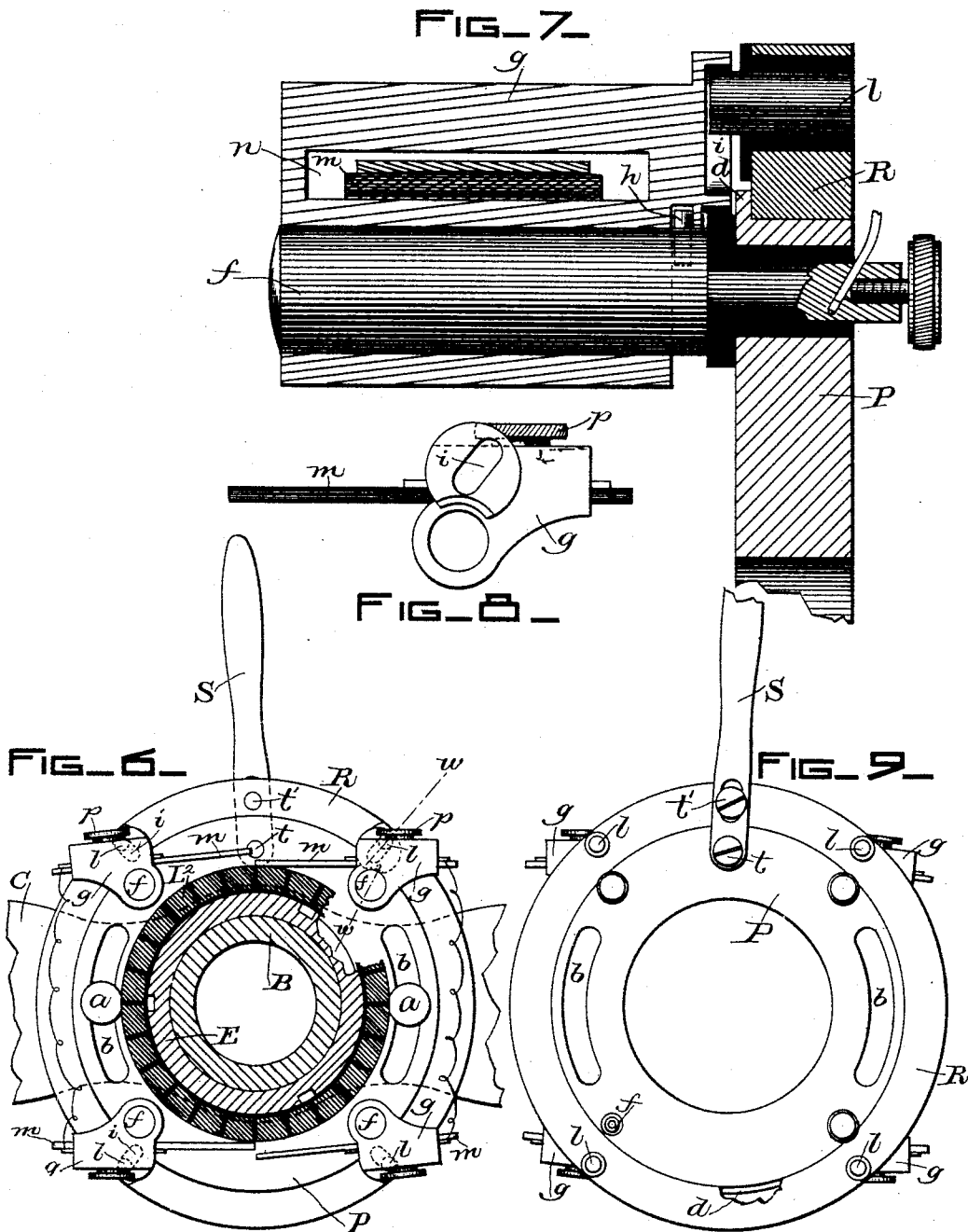
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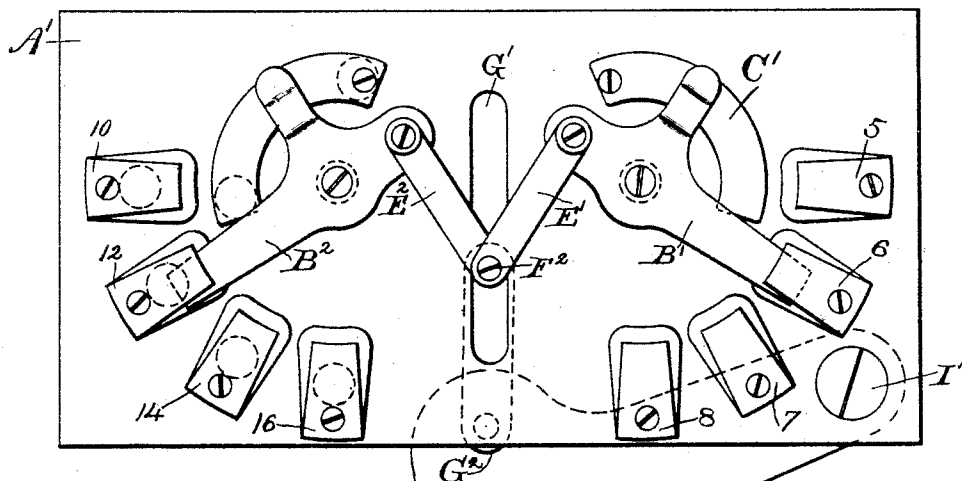
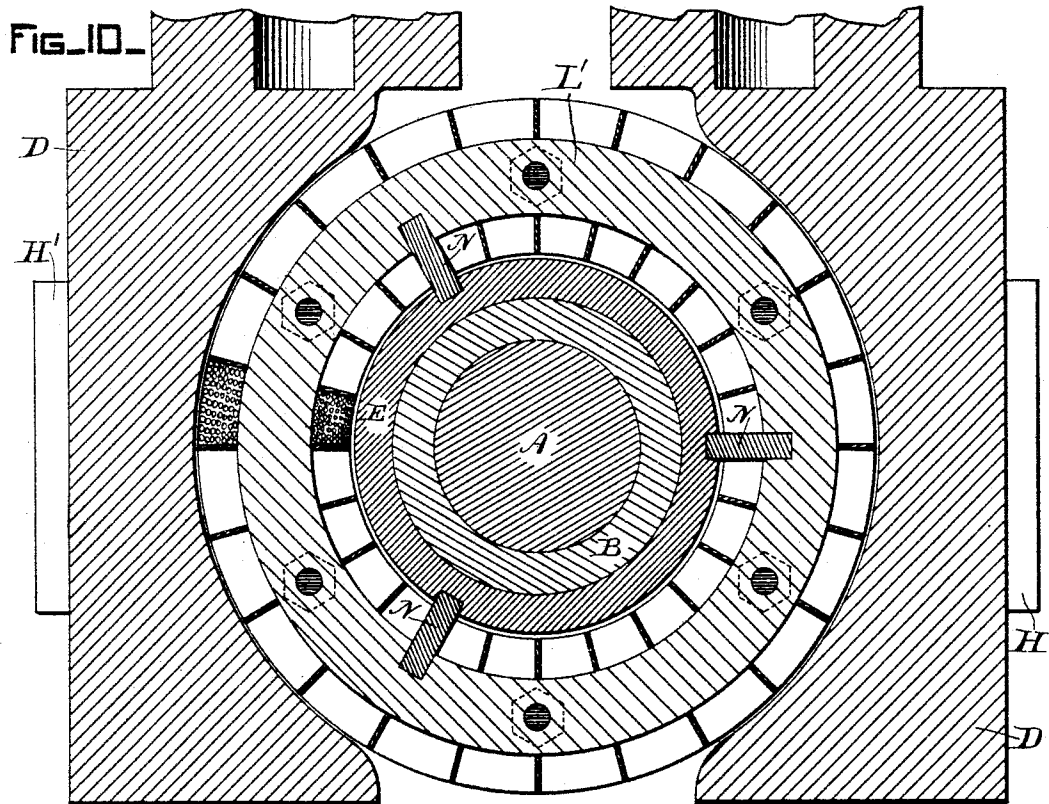
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WITNESSES

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Secretary

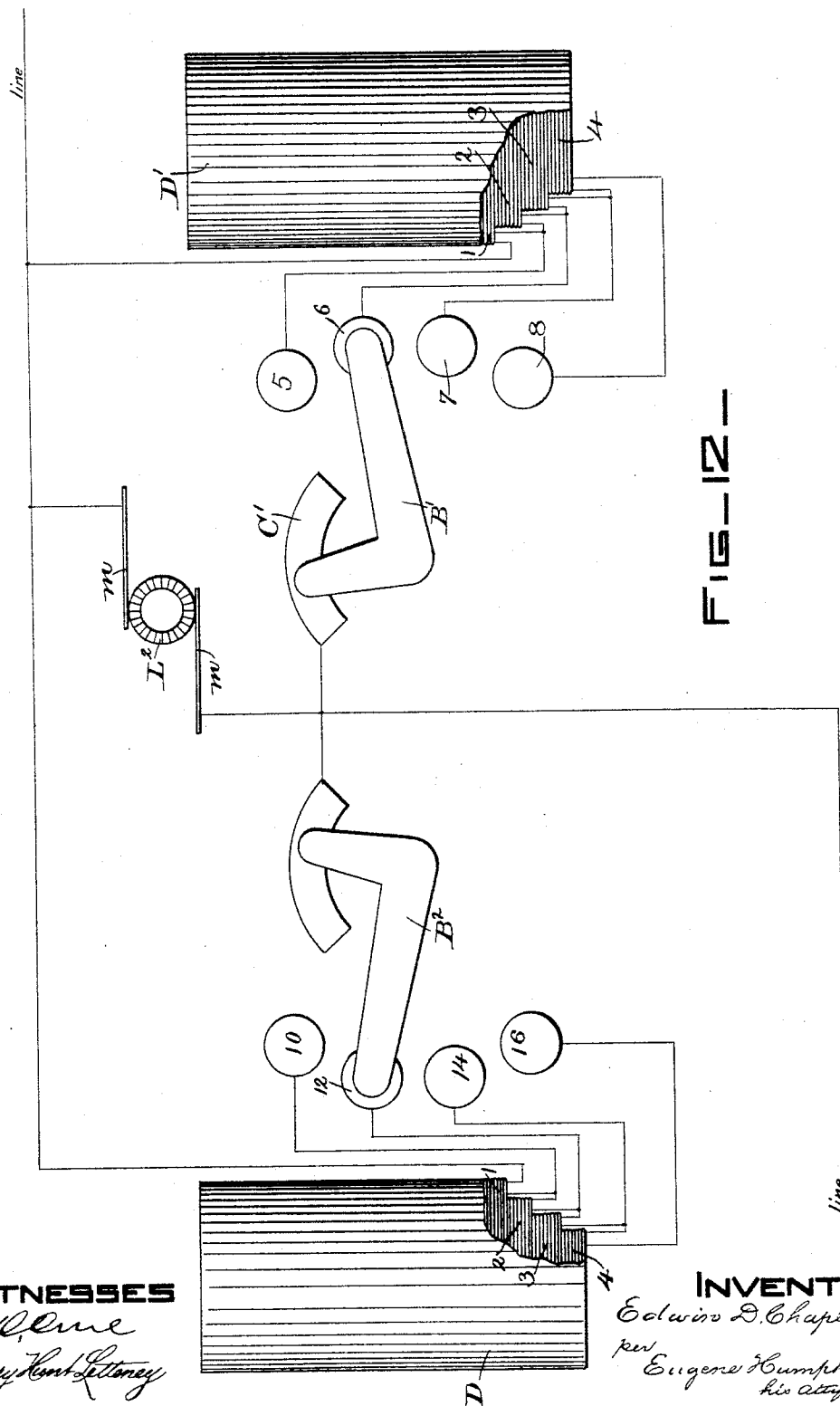
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UNITED STATES PATENT OFFICE.

EDWIN D. CHAPLIN, OF HOLLISTON, ASSIGNOR TO EUGENE HUMPHREY,
TRUSTEE, OF BOSTON, MASSACHUSETTS.

ELECTRO-MAGNETIC MOTOR.

SPECIFICATION forming part of Letters Patent No. 448,603, dated March 17, 1891.

Application filed August 21, 1889. Serial No. 321,459. (No model.)

To all whom it may concern:

Be it known that I, EDWIN D. CHAPLIN, of Holliston, in the county of Middlesex and State of Massachusetts, have invented a new and useful Improvement in Electro-Magnetic Motors, which will, in connection with the accompanying drawings, be hereinafter fully described, and specifically defined in the appended claims.

10 In the accompanying drawings, Figure 1 is an end elevation of an electro-magnetic motor embodying my invention as viewed from the left of Fig. 2. Fig. 2 is a horizontal section taken as on line *x x*, Fig. 1. Fig. 3 is a partial end elevation as viewed from the right of Fig. 2. Fig. 4 is a sectional elevation taken as on line *y y*, Fig. 2, and as viewed from the left of said section-line, omitting such portion of the angular plate which extends across the machine and supports the gearing as intervenes between said line and the gearing. Fig. 5 is a plan showing the form of the teeth in the gearing. Fig. 6 is a vertical section through the commutator, taken as on line *z z*, Fig. 2, and as viewed from the right of said line. Fig. 7 is an enlarged detail section taken as on the irregular line *w w*, Fig. 6, as seen from the right of said line. Fig. 8 is an enlarged detail showing one of the brushes and its holder in side elevation. Fig. 9 is an elevation of the shipper by which the motor is started and stopped and reversed, and is a view the reverse of that shown in Fig. 6. Fig. 10 is a vertical section taken as on line *v v*, Fig. 2. Fig. 11 is a plan of the field-magnet switch by which the power exerted is regulated. Fig. 12 is an illustrative diagram showing the circuit as arranged to be affected by the switch.

40 My invention as illustrated in the accompanying drawings is especially adapted for use upon individual machines in a shop, furnishing directly thereto the requisite motive power without the intervention of the usual driving-shafts, counter-shafts, pulleys, and belting; but it may be attached to a line of shafting for driving machinery in the usual manner; and its chief novelty consists in an electric-motor mechanism having its armature constructed and arranged to revolve about the axis of a central shaft and comprising

ing a system of differential gearing arranged to revolve about the same axis, and to serve as the means whereby motion is transmitted from the revolving armature to said central shaft or to other operative devices revolving about the same, as and for the purposes hereinafter more fully described.

Other novel features will also be hereinafter fully described, and specifically pointed out in the appended claims.

Referring to Fig. 2 of the drawings, A represents a section of a shaft upon which the operative part of my motor is placed to revolve freely upon the shaft or to be keyed thereto and revolve with it, as may be required for the purposes to which the motor is applied. In the one case the revolving face-plate of the motor would serve as the driver, in the other the central shaft would serve as the operative connection. A hollow spindle or bushing B, in which shaft A is fitted, has its bearing at one end in the hub of an angular plate C, which embraces one end of the machine and is bolted to the field-magnet D, as shown, while the main body of bushing B is supported in a concentric sleeve E, fitted thereon, as shown.

To one end of sleeve E is attached a revolving carrier F, screwed thereon at F', while the opposite end of the sleeve abuts against a washer between it and the hub of plate C, as shown.

Upon the end of the hollow spindle B is screwed a gear G, through which the spindle is revolved when the motor is in operation. Encircling sleeve E is a concentric fixed gear H, the hub of which is threaded into the hub of an angular plate H', which extends across the machine and is bolted to the field-magnet, as shown, and also supports that end of sleeve E, together with the parts within the same.

In the overhanging rim of the revolving carrier F is threaded a hollow stud I. Upon this stud are mounted two pinions J and J', secured thereon by a nut K. The teeth of pinion J engage the teeth of the stationary gear H, around which it revolves with the carrier, while the teeth of J' engage the teeth of gear G during the revolutions of the carrier around the same. The pinion J is made

to drive pinion J' by means of a suitable interlocking device, uniting them in their revolutions about their stud I as they are united by pin J^2 . Diametrically opposite these pinions the rim of the carrier is counterbalanced, as shown, and a centrally-recessed face-plate L is secured to the carrier, with which connection may be made when required in practical operations. The system of gearing and the movable devices above described are set in motion by electro-magnetic force applied thereto through other and stationary parts of the machine or motor properly connected therewith.

The electro-magnetic devices through which the described mechanism is set in motion are not wholly new, but consist of the usual field-magnet, constructed of the proper size and form to adapt it to the purpose and requirements of the machine to which it is to be applied, and a common Gramme armature L' , revolving in the field of the magnet D , and the usual commutator L^2 and connecting-brushes m , the armature L' being secured to the sleeve E by keys N , as shown in Fig. 10.

In the operation of the motor the electro-magnetic force is exerted through armature L' upon sleeve E to rotate the sleeve and therewith the carrier F , the power of such force and the consequent velocity of the armature and carrier being controlled and regulated by the means and in the manner hereinafter described.

In the described system of differential gearing, through which motion is transmitted from the armature to the spindle or bushing B and its connections, varied in relative velocity to the requirements of the work to be performed, if the diameters of gears G and H were equal and the diameters of pinions J and J' were also equal then by the revolution of the carrier, with its pinions, about gears G and H no movement would be imparted to gear G and its connections, but it would remain as stationary as the fixed gear H . If, however, the gearing be constructed, as illustrated, with gear H having fifty-four teeth, pinion J twenty-four, pinion J' twenty-three, and gear G fifty-five—a difference between the gears and pinions, respectively, of one tooth—it will result in practical operation in a ratio of about seventeen revolutions of the carrier F to one revolution of gear G . Thus it will be readily understood that this simple, compact, convenient and effective system of gearing as embodied and constituting a part of my electric-motor mechanism affords wide scope for variation between the number of revolutions of the actuating-armature and the number of revolutions of the operative shaft to which the motor may be attached through its hollow central spindle with comparatively slight changes and variations in the relative diameters of the gears and pinions. For instance, if pinion J' were varied, two teeth from pinion J and gear G two teeth from pinion H , giving J' twenty-two teeth and gear G fifty-

six, then the resulting ratio of revolutions would be about nine of the carrier F to one of the gear G , the speed of gear G being relatively increased, and other proportions may be had by varying both pinions and gears relatively to each other, the sum of the diameters of H and J being always equal to the sum of the diameters of J' and G . Thus the speed of the central operative shaft relatively to the number of revolutions of the armature and carrier may be either increased or decreased.

In the described gearing, as illustrated in the drawings, V -shaped spiral teeth, as shown in Fig. 5, are employed and considered preferable.

To start, stop, and reverse the motor, I employ a device which I call a "shipper," constructed, arranged, and operated as I will now describe. To the rear face of plate C (see Figs. 1, 6, 7, and 9) is adjustably secured a circular plate P by means of screws a passed through curved slots b and threaded into said plate C . Plate P is arranged concentrically with sleeve E , and around its periphery is formed a shoulder d , (see enlarged Fig. 7,) against which an outer ring R bears, which is mounted upon the plate and is free to turn thereon to a limited extent. In plate P in insulated bearings the four brush-holder studs f are secured. Upon these studs are mounted four brush-holders g , which are secured linearly upon the studs by pins h , one of which is shown in Fig. 7, in an interior slot in the holder, which it engages when the holder is turned on the stud into working position. Other slots i in the holders receive the projecting ends of studs l , which are held in insulated bearings in ring R . The metallic brushes m are secured in slots n in holders g by screws p . A shipper handle or lever S is pivoted at t to the fixed plate P , and is also connected by a screw-stud t' through a slot in the handle with the movable plate R . The brushes m bear upon the commutator L^2 in pairs, two diametrically-opposite brushes constituting an operative pair, and a brush in each pair is connected with a brush in the opposite pair and the two with the line, the two brushes thus connected being those opposite each other in a vertical line, as shown in Fig. 6. By turning the free end of shipper-lever S to the left, as viewed in Fig. 6, and thus moving ring R therewith, the brush-holders g are rocked upon their studs f by means of the studs l acting in the slots i , so as to throw one pair of brushes out of contact with the commutator and the other pair in, and by reversing the movement of lever S and carrying it to the opposite extreme the pair of brushes in contact with the commutator will be thrown out and the pair out of contact will be thrown in, and thus by manipulating the lever S the electric current may be changed from passing through one pair of brushes to passing through the other, and consequently the direction of the current in and the rota-

tion of the armature will be changed accordingly, so as to revolve with its attachments forward or backward, as may be desired, and when the lever S is turned to a position midway of its extremes of movement then all the brushes are thrown out of contact with the commutator, the circuit is thereby broken, and the motor stopped, and from this position it may be started again in either direction forward or backward, accordingly as the shipper is moved to the right or left, as stated.

To regulate the speed of the motor, I employ the devices which are shown in Figs. 1 and 11 and in the illustrative plan drawing Fig. 12, and which I will now describe.

Mounted upon the top of the field-magnet D, the coils D', of which are wound in layers 1 2 3 4, as shown in Fig. 1, and also as illustrated in Fig. 12, is a horizontal table A'. (Shown in elevation in Fig. 1 and in plan in Fig. 11, said plan or top view being represented as seen from a standpoint in the rear of Fig. 1.) The ends of the wires from the insulated coils 1 2 3 4 of the field-magnet are respectively connected with the insulated bent metallic plates 5 6 7 8, mounted upon table A'. A lever B', pivoted to table A' and having an arm which moves in contact with an insulated curved support C', is arranged to turn on its pivotal connection with table A' and bear with its longer arm successively upon the plates 5 6 7 8, the opposite end of the lever being pivoted to a link E', which link is also pivotally connected by a screw-stud F', which travels in a slot G' in the table, with a link G' on the under side of the table, as shown in broken lines in Fig. 11. This link G' is also loosely connected with a lever H', which is pivoted to the table at I'. By turning lever H' upon its pivot I' it moves lever B' about its pivot through the connecting-links just described, thereby shifting the contact of the long arm of lever B' from one of the series of four plates upon the table to another in either direction, accordingly as the lever H' is turned. A like series of plates marked 10 12 14 16 and a lever B' are in the same manner attached to and operated upon the opposite end of table A' and connected with the coils D' of the field-magnet, which are arranged immediately under that part of the table, and said lever B' is connected by a link E' with stud F' and through link G' with lever H', whereby both levers B' and B' are simultaneously operated to place their long arms in contact with corresponding plates in the two sets of four, arranged on the table as shown and described. The effect of such changes of position of the levers B' and B' through the manipulation of lever H' is such that when the lever B' is thereby moved from contact with plate 5 into contact with plate 6 and lever B' is by the same means and simultaneously moved from contact with plate 10 into contact with plate 12 the two coils of the field-magnet, which are respectively attached to plates 6 and 12, and which prior to such

movement were, together with the coils, attached to plates 7 and 14 and 8 and 16, switched out of the circuit, will by such movements be switched into the circuit. A like change from plates 6 to 8 and 12 to 16 will switch into the circuit all the coils connected with both series of plates, and thus produce the greatest increase of the magnetic force of the field and consequently decrease the speed of the motor to its minimum, while by a reverse movement of said lever H' said coils may be by pairs or all at once switched out of the circuit again, and thus accordingly decrease the magnetic force of the field, and thereby increase the speed of the motor and decrease its power.

The illustrative diagram, Fig. 12, is designed to more clearly show my arrangement of the circuit and the division of the electric force between the coils D and D' and the commutator L', as varied and regulated by the devices just described in accordance with a well-known law of electrical action.

I claim as my invention—

1. In an electric-motor mechanism, the combination, with a central operative shaft, of a motor having its armature constructed and arranged to revolve around the central shaft, a non-revolving gear H, fixed central to the axis of said shaft, and a system of speed-varying gearing arranged to revolve in connection with and in part around gear H, and through which gearing the actuating-armature imparts rotary motion to the central shaft, substantially as and for the purposes specified.

2. In an electric-motor mechanism, the combination, with a central operative shaft, of a motor having its armature secured to a sleeve E, arranged to revolve about the axis of said shaft, a carrier F, also secured to said sleeve and carrying pinions J and J', a fixed gear H, central to the axis of said shaft and engaging with pinion J, and a gear G, arranged to engage with pinion J' and to revolve upon or with the central shaft, all as and for the purposes specified.

3. In an electro-magnetic motor, and in combination with the circuit thereof, the described speed-regulating device, comprising table A', the double series of plates 5 6 7 8 and 10 12 14 16, mounted thereon and severally connected with the respective coils of the field-magnet, the levers B' and B', pivotally mounted upon the table and arranged to respectively make contact through their long arms successively with said plates, and the actuating-lever H', pivoted to the table and connected with levers B' and B' by links E', E', and G', united on a stud F', guided in a slot G', so that by the manipulation of lever H' the long arms of levers B' and B' are simultaneously moved from plate to plate, as and for the purposes specified.

EDWIN D. CHAPLIN.

Witnesses:

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