

No. 671,662.

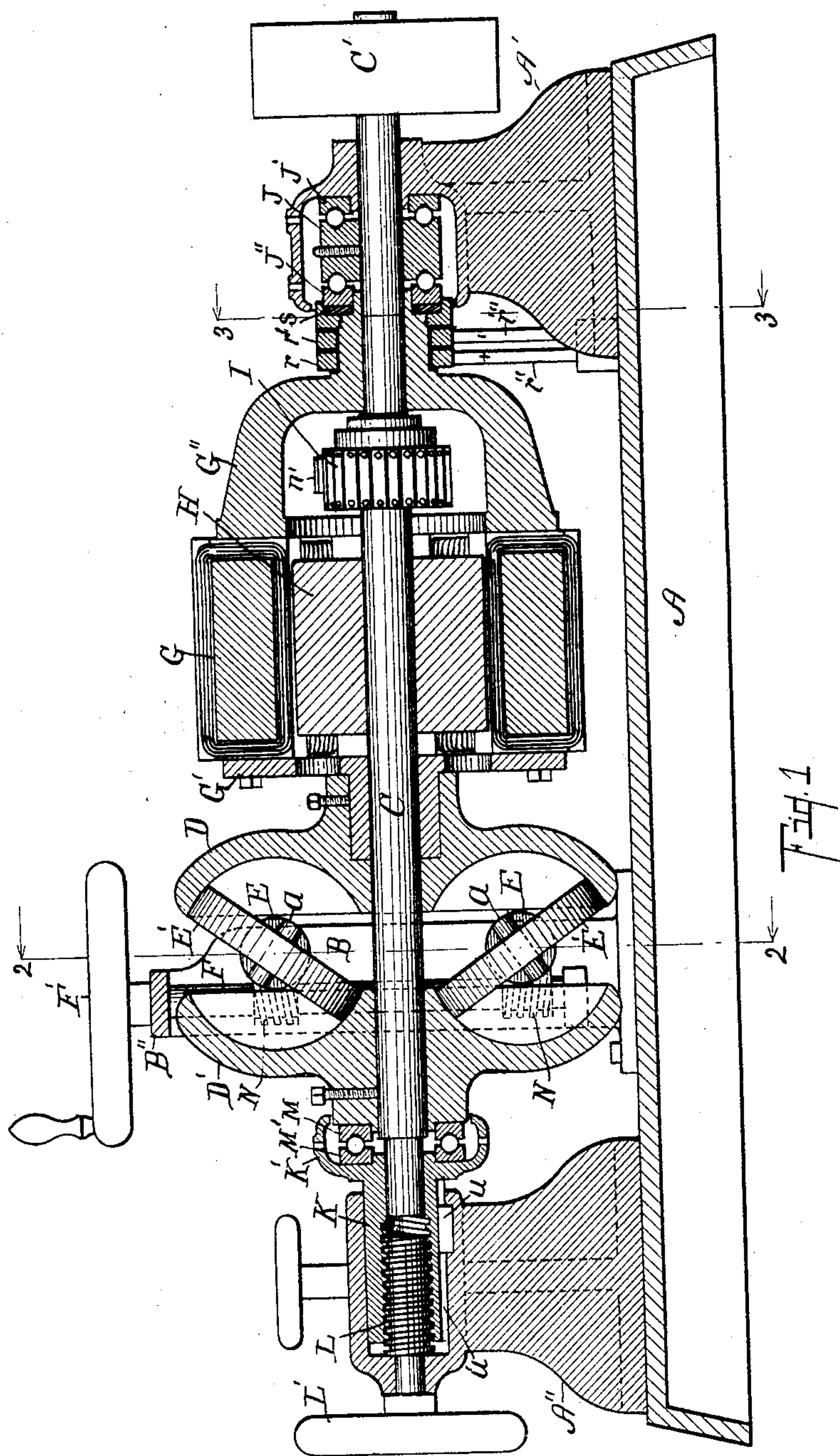
Patented Apr. 9, 1901.

H. P. WHITE.
ELECTRIC MOTOR.

(Application filed Oct. 5, 1899.)

(No Model.)

2 Sheets—Sheet 1.



Witnesses:

Walter H. Carruthers.
Oliver A. Earl

Inventor,

Henry P. White
By *Fred L. Chappell*
Att'y.

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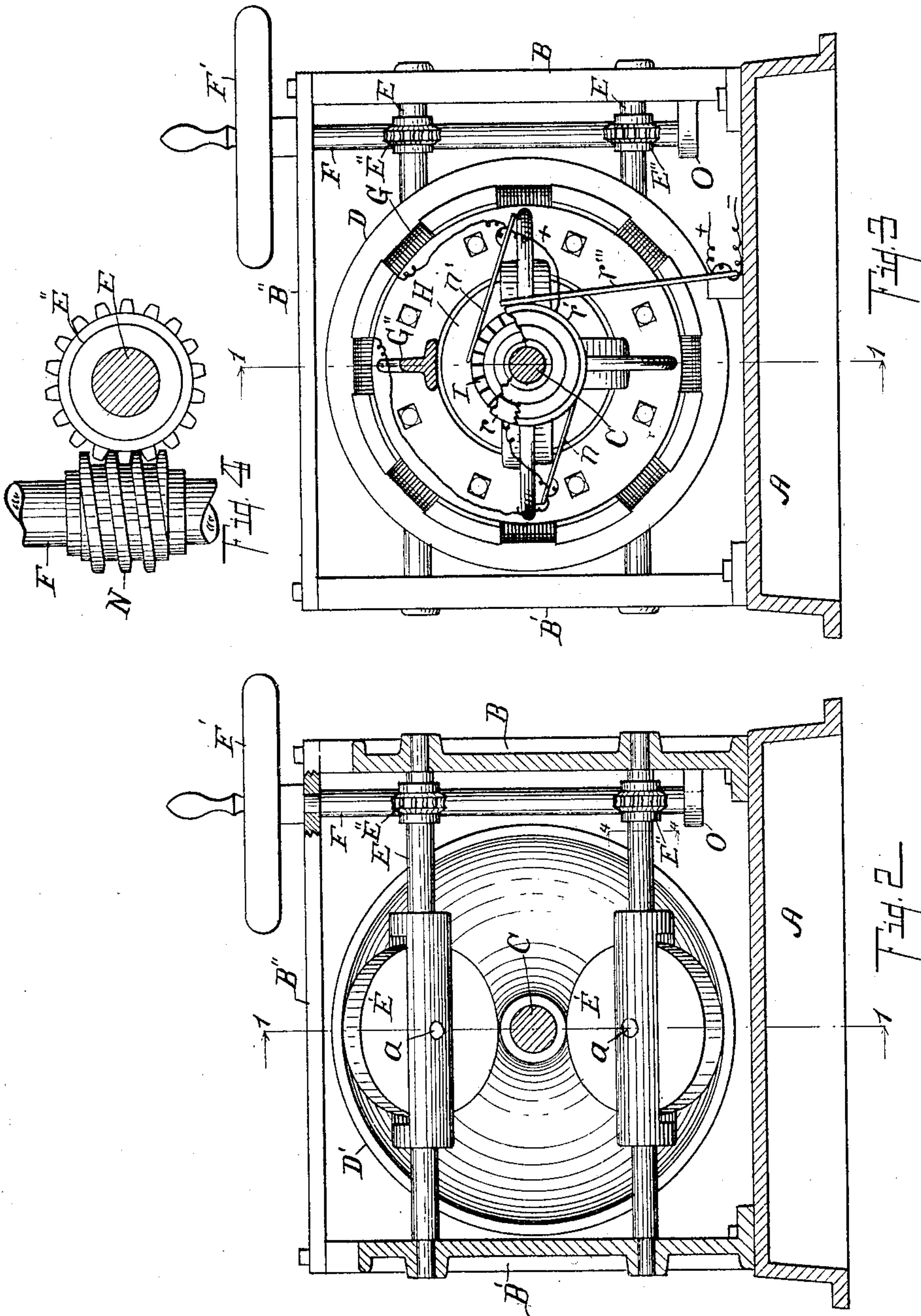
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Witnesses:

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UNITED STATES PATENT OFFICE.

HENRY P. WHITE, OF KALAMAZOO, MICHIGAN, ASSIGNOR OF THREE-
FOURTHS TO CHARLES D. FULLER, OF SAME PLACE.

ELECTRIC MOTOR.

SPECIFICATION forming part of Letters Patent No. 671,662, dated April 9, 1901.

Application filed October 5, 1899. Serial No. 732,738. (No model.)

To all whom it may concern:

Be it known that I, HENRY P. WHITE, a citizen of the United States, residing at the city of Kalamazoo, in the county of Kalamazoo and State of Michigan, have invented certain
5 new and useful Improvements in Electric Motors, of which the following is a specification.

This invention relates to improvements in electric motors.

10 The objects of this invention are, first, to provide an electric motor in which it is possible to control the speed without waste of energy; second, to provide an improved means of utilizing a differential movement in electric motors; third, to simplify and improve
15 the construction of motors in which both the field-magnet and armature are rotary; fourth, to provide an improved connecting-gearing between a rotary field-magnet and a rotary armature to facilitate the coaction of the same, and, fifth, to provide an improved
20 connecting-gearing between a rotary field-magnet and a rotary armature to facilitate the coaction of the same in securing variable speeds.

Further objects will definitely appear in the detailed description to follow.

I accomplish these objects of my invention by the devices and means and mechanism described in this specification.
30

The invention is clearly defined and pointed out in the claims.

A structure fully embodying the features of my invention is illustrated in the accompanying drawings, forming a part of this specification, in which—
35

Figure 1 is a vertical detail longitudinal sectional view taken on a line corresponding to lines 1 1 of Figs. 2 and 3, certain portions
40 being shown in full lines. Fig. 2 is a transverse vertical detail view, partially in section, on line corresponding to line 2 2 of Fig. 1. Fig. 3 is also a transverse detail view, partially in section, on line 3 3 of Fig. 1. Fig.
45 4 is an enlarged detail view of the worm-gear connection for shifting the friction-gears to vary the speed.

In the drawings the sectional views are taken looking in the direction of the little
50 arrows at the ends of the section-lines, and

similar letters of reference refer to similar parts throughout the several views.

Referring to the lettered parts of the drawings, A is the base, supporting the remaining parts of the machine, which is preferably
55 made hollow and of cast metal. On this are supported pillow blocks or brackets A' A". Suitable bearings are provided for the shaft C of the machine.

On the shaft C is supported the armature
60 H, with the commutator I, which are fixed thereto so that they may revolve therewith. The field-magnet G is supported by suitable spiders G' G'', which have suitable hubs on the shaft, so that it revolves freely thereon.
65 At the outer end of the shaft is provided a ball-bearing for the various parts, made up of a central block J, which is fixed on the shaft C, and an outer block J', supported by brackets, there being ball-races between the two,
70 and a collar J'' is supported on the outer end of the spider G'', and a cushion of leather or suitable material is between the collar J'' and the hub of spider G''. On the hub to the spider G'' are supported commutator-rings
75 r', against which rest brushes r'' r''', respectively. The electrical connection for operating the machine is to the brushes r'' r''', and wires connect the rings r r' to the brushes
80 n n', respectively, and other wires are connected to the field-magnet from these same branches to excite the same. The winding of the field-magnet and the armature is entirely immaterial, so that they coact as in a motor of the
85 usual construction.

On the hub of the spider G' is supported a friction-wheel D, having a concave annular face corresponding in cross-section to a portion of an arc of a circle.

Secured to the shaft C and facing opposite
90 to wheel D is a similar friction gear-wheel D', symmetrical therewith. Friction-wheels E' E' are carried on pivots a in rock-shafts E and serve as a gear connecting the one to the other. On the rock-shafts E are provided
95 hubs E'', bearing worm-gears, which are actuated from worms N on shaft F, the worms on these shafts being oppositely threaded to shift the friction-wheels E' from or toward each
100 other within the hollow faces of the gear-

wheels D D', so that they exactly coact together. The shaft F is controlled by a hand-wheel F'. The ends of the rock-shafts E are supported in suitable brackets B B' on the
5 base A, the brackets being connected by a cross-piece B'' at the top to give them stability and strength.

The outer end of the hub of the friction-wheel D' is provided with a collar M, having
10 ball-races, and a sleeve K is provided having a suitable casing K', which surrounds the ball-race and contains collar M', also containing a ball-race corresponding to that on the collar M. A screw L is provided which engages the
15 screw-thread within the sleeve K and is actuated by a hand-wheel L' at the outer end to put pressure on the same to force the various ball-bearings snugly together, and so compensate for any wear. The sleeve K is provided
20 with a suitable key-seat u' , and u is supported on the bracket A'' to engage the same and guide it into position.

In operation with the parts arranged as I have indicated the armature will revolve in
25 one direction and the field-magnet in the opposite direction. The relative speed of the armature and the field-magnet is regulated by the friction-gearing which I have shown, and it will be observed that as the motion of the
30 field-magnet is lessened or approaches the stationary the greater will be the speed of the armature, though it will then run with less torque, and vice versa, so that by increasing the speed of the field-magnet the speed
35 of the armature will be lessened, but its power increased, and this is accomplished in this particular instance by the changeable-speed gear shown, which I believe is especially adapted to the purpose. I wish to say, how-
40 ever, that other means might be employed for connecting the revoluble field-magnet and armature together so that they will coact as I have here indicated.

I believe that I have shown the best embodiment of my invention, but desire to state
45 that it can be greatly varied. The style of motor employed can be varied indefinitely so long as both the field-magnet and the armature revolve, it being easily possible to use
50 any type or style of either alternating or direct current electric motor in this connection and control its efficiency by the means I have adopted. I do not deem it necessary to illustrate these various types of motors in this connection, as it is impossible to claim each one
55 specifically in this patent, and I do not show the different gearings by which the revolving field-magnet and the revolving armature may be connected. I show the structure which I
60 believe from my experience to be the best. I desire in this connection to be understood as embracing these different constructions within my broadest claim, and I also submit herewith a specific claim to the construction I
65 have shown. I desire to state in this connection that the power for my improved motor can be utilized by the pulley C' on the end of

the shaft C, or the entire motor can be mounted directly in a lathe and connected directly to
70 the lathe-spindle, or it can be connected directly without any gearing for use in drill-presses or other similar tools. It could also be connected directly to the axle of a street-car. In fact, the motor can be utilized di-
75 rectly on any shaft where it is desired to apply power without resorting to a main-shaft and counter-shaft construction, thus providing a new and valuable means for doing away with back gearing, cone-pulleys, and inter-
80 mediate shafts, where a variable speed is necessary.

Having thus described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. In an electric motor, the combination of
85 the base A; brackets A'; shaft C supported by said brackets; an armature H and commutator-sections I supported on said shaft; a revoluble field-magnet G supported by
90 suitable spiders G' G'' having suitable hubs supported on the shaft C by suitable journal-bearings; commutator-rings r, r' supported on the hub of spider G'' with brushes $r'' r'''$
95 delivering current thereto; brushes n, n' carried by the spider G'' and resting on the segment I of the commutator; connections from the rings r, r' to the brushes and to the coils of the field-magnet; friction gear-wheel D
100 supported on hub of spider G' having an annular concave face, the cross-section of which corresponds to the arc of a circle; an opposite friction-wheel D' symmetrical thereto
105 and fixed on the axle C; ball-bearings between the various parts; a sleeve K; a screw L within said sleeve with hand-wheel L' for adjusting the various parts together upon the
110 ball-bearings; friction-wheels E' E'' supported on pivots on transverse rock-shafts E; and worm-gears for actuating the rock-shafts to rock them to and from each other so that
115 there is a changeable-speed-gear coupling between the friction-wheels D, D' whereby the connection can be varied, all coacting substantially as described for the purpose specified.

2. In an electric motor the combination of
120 a suitable shaft with bearings for its support; an armature and commutator fixed on said shaft; a revoluble field-magnet supported by suitable journal-bearings on the
125 said shaft; commutator-rings carried by the field-magnet; brushes delivering current thereto; a friction gear-wheel having an annular concave surface, the cross-section of which corresponds to an arc of a circle con-
130 nected to the revoluble field-magnet and adapted to rotate around the shaft; an oppositely-situated symmetrical friction-wheel fixed on the said shaft; intermediate adjustable friction-wheels between the said
135 concave friction-wheels for varying the connection and relative speed, all coacting substantially as described for the purpose specified.

3. In an electric motor, the combination of a suitable shaft with bearings for its support; an armature fixed on said shaft; a revoluble field-magnet supported by suitable journal-bearings on the said shaft; a friction gear-wheel having an annular concave surface, the cross-section of which corresponds to an arc of a circle connected to the revoluble field-magnet and adapted to rotate around the shaft; an oppositely-situated symmetrical friction-wheel fixed on the said shaft; intermediate adjustable friction-wheels between the said concave friction-wheels for varying the connection and relative speed, all coacting substantially as described for the purpose specified.

4. In an electric motor, the combination of a suitable shaft with bearings for its support; an armature fixed on said shaft; a revoluble field-magnet supported by suitable journal-bearings upon the said shaft; a gearing carried by said armature; a gearing carried by said field-magnet; and an intermediate changeable-speed gear connecting the same in such manner that the gear connection varies in relation to the gear-centers of the gears of said field-magnet and armature whereby the full power of the motor is delivered to the shaft without substantial loss, for the purpose specified.

5. In an electric motor, the combination of a revoluble armature; a revoluble field-magnet; gearings connected to each of the same; and an intermediate independently-supported changeable-speed gear constructed in such manner that the gear connection varies in relation to the gear-centers of the gears of said field-magnet and armature whereby the full power of the motor is delivered to the shaft without substantial loss, for the purpose specified.

6. In an electric motor, the combination of a revoluble armature; a revoluble field-magnet; friction gear-wheels connected with each, having their faces opposite; and the opposite faces bearing oppositely-situated annular concave rings; friction-gears supported between the same on opposite sides thereof, on suitable transverse rock-shafts to transfer the motion from one to the other; worm-gears on said rock-shafts; and a suitable shaft with

worm for actuating the gears to turn the friction-wheels to and from each other to vary the delivered speed of the motor without waste of power.

7. In an electric motor the combination of an armature, a field-magnet, a gearing carried by said armature, a gearing carried by said field-magnet and an intermediate gear connecting the same in such manner that the gear connection may vary in relation to the centers of the gears of said field-magnet and armature.

8. In an electric motor the combination of an armature, a field-magnet, a gearing carried by said armature, a gearing carried by said field-magnet and an intermediate independently-supported gear connecting the same in such manner that the gear connection may vary in relation to the centers of the gears of said field-magnet and armature.

9. The combination of a motor comprising a rotative armature and rotative field which turn in opposite directions, shafts connected with and driven by said armature and field, friction-disks connected respectively with said armature and field, an oscillatory disk which has opposite peripheral contact with the opposing surfaces of said disks and oscillates on an axis transverse to its axis of rotation, and means giving oscillatory motion to said oscillatory disk.

10. The combination of a motor comprising a rotative armature and rotative field which turn in opposite directions, shafts connected with and driven by said armature and field, friction-disks connected with shafts and rotating about a common axis, a plurality of oscillatory disks which have opposite peripheral engagement with the opposing faces of said disks and rotate on axes transverse to their axes of rotation, and means for simultaneously oscillating said several oscillatory disks about their transverse axes.

In witness whereof I have hereunto set my hand and seal in the presence of two witnesses.

HENRY P. WHITE. [L. S.]

Witnesses:

NETTIE F. CARRUTHERS,
OTIS A. EARL.