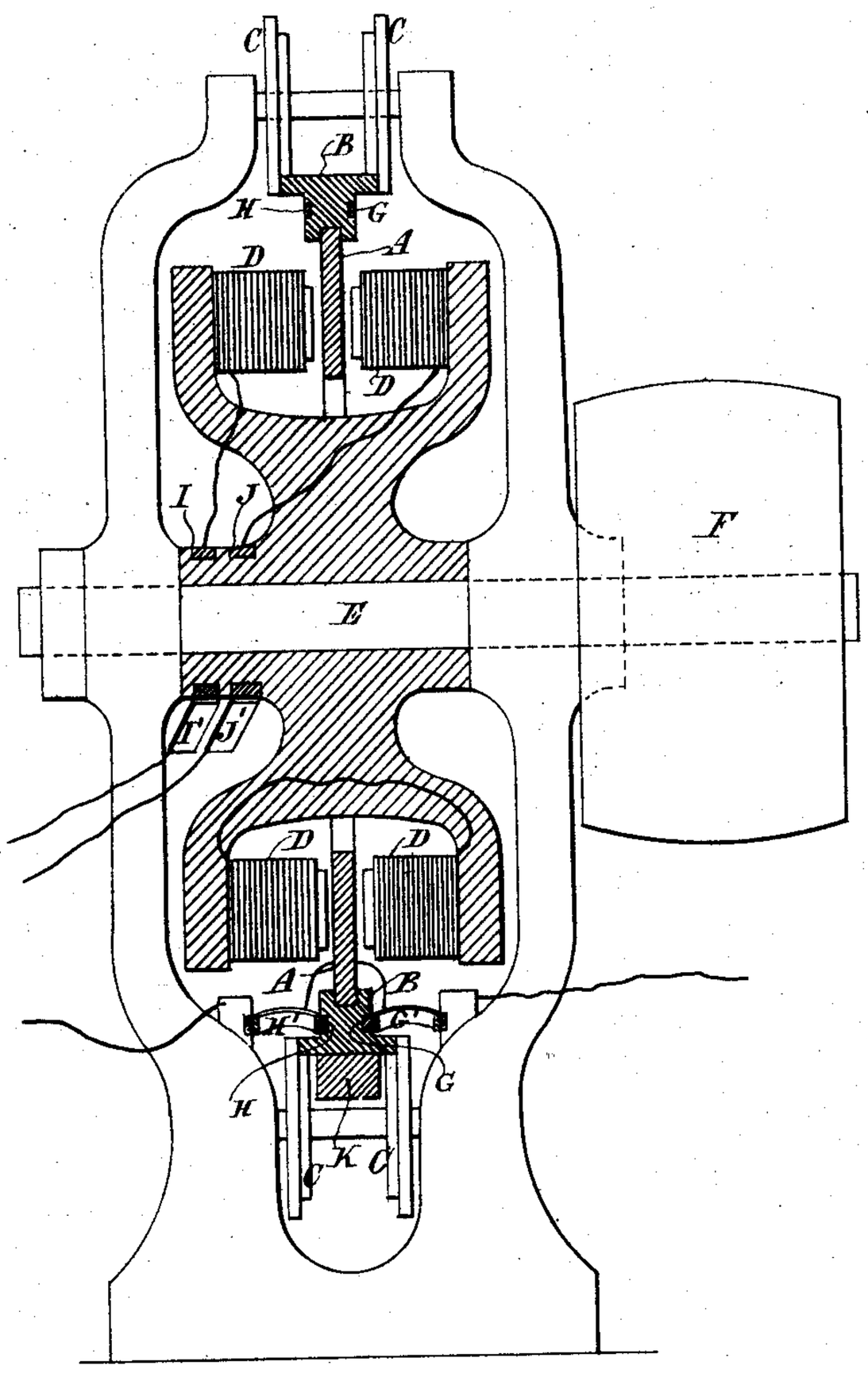
(No Model.) 2 Sheets—Sheet 1.

S. Z. DE FERRANTI.

ELECTROMOTOR ENGINE.

No. 422,755. Patented Mar. 4, 1890.

Fig. 1.



Witnesses.
M. J. Kelley.
C. M. Brooke.

Inventor.
S. Z. de Ferranti
by his attorneys
Baldwin, Davidson & Wright

N. PETERS, Photo-Lithographer, Washington, D. C.

(No Model.) 2 Sheets—Sheet 2.

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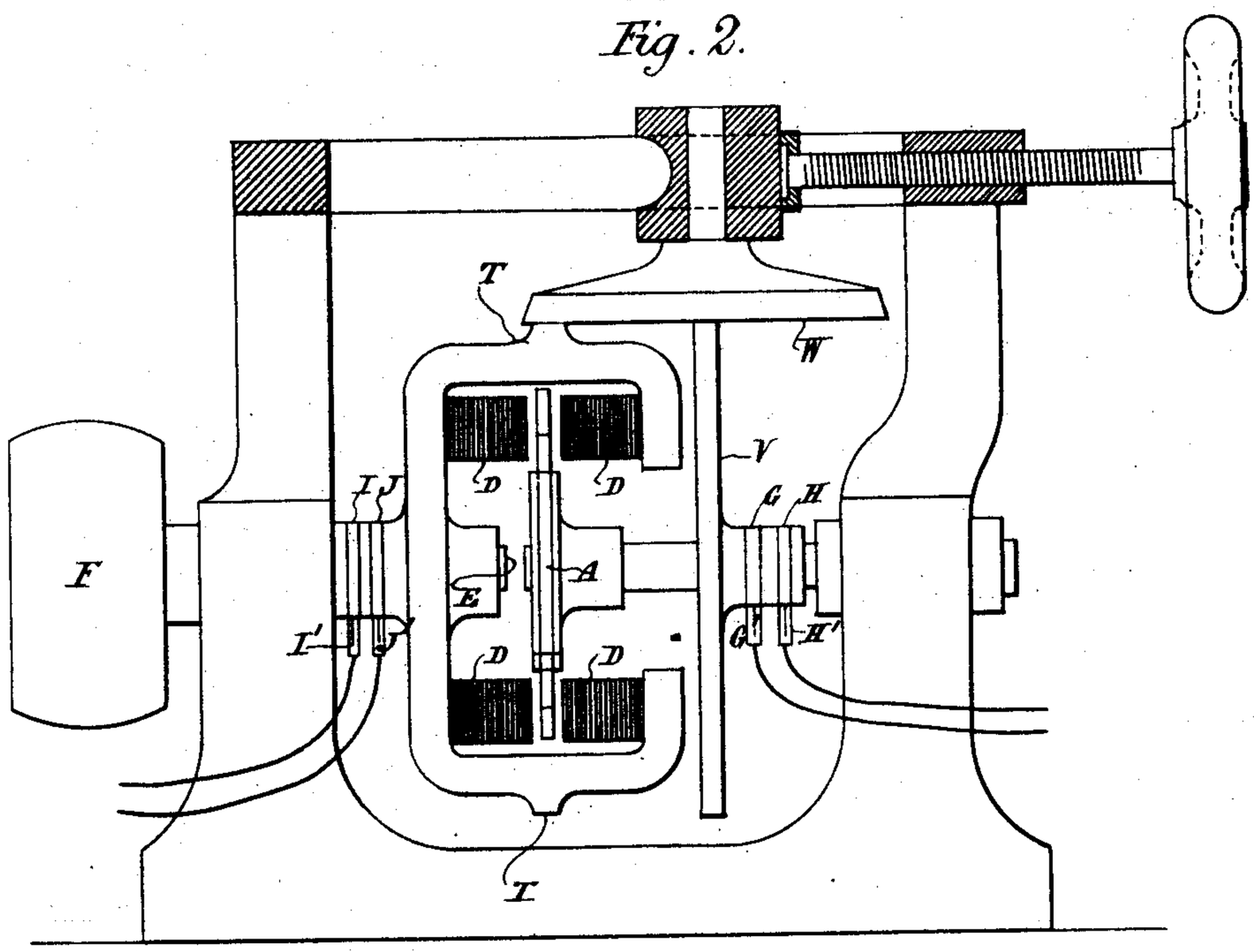
Fig. 2.



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UNITED STATES PATENT OFFICE.

SEBASTIAN ZIANI DE FERRANTI, OF HAMPSTEAD, COUNTY OF MIDDLESEX, ENGLAND.

ELECTROMOTOR-ENGINE.

SPECIFICATION forming part of Letters Patent No. 422,755, dated March 4, 1890.

Application filed April 8, 1889. Serial No. 306,416. (No model.) Patented in England September 13, 1887, No. 12,418; in France August 2, 1888, No. 192,192, and in Belgium August 3, 1888, No. 82,780.

To all whom it may concern:

Be it known that I, SEBASTIAN ZIANI DE FERRANTI, electrician, a subject of the Queen of Great Britain, residing at 120 Fellows Road, Hampstead, in the county of Middlesex, England, have invented certain new and useful Improvements in Electromotor-Engines, (for which I have received Letters Patent in Great Britain, No. 12,418, dated September 13, 1887; in France, No. 192,192, dated August 2, 1888, and in Belgium, No. 82,780, dated August 3, 1888,) of which the following is a specification.

The object of my invention is to provide means whereby alternating electric currents can advantageously be employed for driving electromotor-engines.

It is known that a dynamo-engine capable when driven of producing an alternating current will, if an alternating current is supplied to it, run synchronously with the alternations of the current—that is, each part of its armature will pass from in front of one magnet-pole to in front of the next magnet-pole of opposite polarity coincidently with the alternations in the current. Practically such engines cannot, however, be used as motor-engines without means being provided for readily revolving the armature of the motor-engine at a speed to coincide with the alternations in the current, because they do not develop power until this movement synchronizes with the reversals of the current. I make the armature and field-magnets both capable of revolving on concentric axes, so that one may be revolved without doing work, and then when it is revolving synchronously with the current be gradually arrested by a brake, while the other, which is on the driving-axis of the machine, starts gradually into movement, the relative movement between the two being always maintained the same by the current.

Figure 1 is an elevation, partly in section, of one form of apparatus constructed as above described. Fig. 2 is an elevation, partly in section, of another form of similar apparatus.

A is the armature, formed in the same way as the armature of any dynamo-engine which is capable, when driven, of producing an alternating current. The armature shown in the drawings is an armature formed in the manner described in a former patent to me, dated November 13, 1883, No. 288,316. The armature is carried within a ring B, which rests between pairs of flanged rollers C at intervals apart around its circumference, so that it can revolve freely.

D are two circles of electro-magnets on the two opposite sides of the armature, with their poles ranged alternately north and south, as described in my former patent. These are carried by the axle E, which is concentric with the ring B. On the axle is a band-wheel F, by which, when the axle is driven, motion can be given to an endless band and the band used for driving other machinery.

K is a brake-block, which can be pressed against the ring B to stop it from rotating. The ring B carries two insulated conducting-rings G H. One of these rings is coupled to one end of the conductor of the armature and the other ring to the opposite end of the conductor. Against the ring G is pressed a rubber G′, and against the ring H is pressed a rubber H′. The rubbers are coupled to the main conductors and convey an alternating current to the conductor of the armature. The axle E also carries two insulated contact-rings I J, to which a continuous current is conveyed by brushes I′ J′, which bear upon them. The current passes from one ring through the coils of all the field-magnets D to the other ring.

When the field-magnets are excited by continuous current fed to them by the brushes I′ J′, the alternating current is supplied to the armature-conductor by the brushes G′ H′ and the armature is revolved by hand. The armature can quickly be revolved at the required speed, as it is very light, and when revolving at the speed at which the current will drive it it will be kept revolving by the current at this speed, the magnets and the axle which carries them remaining practically at rest; but if the brake-block K be gradually pressed against the ring B the armature will be gradually stopped and the magnets and axle will commence to revolve and will gain in speed as the armature loses until, when the armature is absolutely stopped, the axle will be driven at the speed which the current will drive it at, and power can be taken from the axle by an endless belt, as described, or other-

wise. I prefer that the circuit through the field-magnets should be derived from a secondary battery, and this battery may be charged by means of a dynamo driven by the motor from time to time when it is at work; or the battery may be charged from the main circuit by the aid of a commutator and suitable appliances to adjust the intensity of the current.

Sometimes in dynamos in which both the armatures and the magnets are capable of rotating I employ variable gear connecting the two together, and so arranged that either may be allowed to rotate while the other is at rest, or that both may rotate at any desired relative speeds. The machine shown by the diagram view, Fig. 2, is so constructed.

The machine is similar to the one just described; but the armature is on an axis in a line with the axis which carries the magnets. The parts which are similar to those shown in Fig. 1 are marked with the same letters of reference. The frame which carries the magnets has a raised rim T around it, and the axis of the armature has fixed upon it a disk-wheel V, of the same diameter as this rim.

W is a second disk-wheel, the face of which bears against the circumference both of the rim T and the disk-wheel V on the axis of the armature. The axis of the second disk-wheel W is carried in a bearing which can be traversed in a line parallel with the armature-axis, as indicated.

To start the machine, the second disk-wheel W is shifted until its center rests upon the rim T around the magnet-frame and its right-hand side upon the disk V on the armature-axis. The armature can then be revolved and kept revolving by the current while the magnet-frame remains at rest. The bearing carrying the disk-wheel W can then be shifted gradually to the right hand, and as this is done the magnet-frame will commence to revolve while the speed of the armature decreases until, when the parts are brought into the position shown by the drawings, the armature is brought to rest and the magnet-frame is alone revolved, and power can be taken from its axle by a band-wheel and endless band or otherwise.

The above is a convenient way of gearing together the armature and magnet by variable gear; but other forms of variable gear may be used for the purpose.

So far as I am aware, I am the first to organize field-coils excited by a continuous current and capable of being rotated freely around an axis, in combination with an armature revolving independently and concentrically therewith, in synchronism with an actuating alternating current, which drives the rotating field-coils synchronously, coincidently with the gradual stopping of the armature, after it has been brought up to synchronizing speed, while the field-coils were stationary, by the gradual transference of rotation from the armature to the field-coils.

Having thus fully described the organization and operation of my improved alternating-current electromotor, what I claim therein as new and as of my own invention is—

1. The combination, substantially as hereinbefore set forth, of wires supplied with an alternating current, an armature turning freely around its axis and adapted to be driven synchronously with the alternations of its actuating-current, field-magnets adapted to turn freely on their axis and energized by a continuous current, and a brake adapted to check the speed of the armature after it has risen to the synchronizing-point, and thereby to rotate the field-magnets co-ordinately by the action of the alternating current.

2. The combination, substantially as hereinbefore set forth, of the motor-frame, the field-coils rotating on an axis therein, the commutator and brushes for supplying them with a continuous current, the armature capable of revolving independently and concentrically therewith its peripheral circuit-connections with a source supplying alternating currents, and peripheral brake mechanism, whereby, after the armature has been brought up to synchronism with the alternations of its actuating-current, the field-coils may be brought up to the same synchronism by the gradual transfer of motion from the armature to them, as described.

3. The combination, substantially as hereinbefore set forth, of an armature and field-coils rotating concentrically but independently on concentric axes, a driving-pulley on each axis, and an interposed speed-transferring pulley movable parallel with said axes and tangentially to the driving-pulleys, so as to leave one free to rotate, while the other is stationary.

4. The compound motor hereinbefore described, consisting of the combination of the rotating armature, its circuit-connections with a source supplying alternating currents, the field-coils rotating on an independent concentric axis on opposite sides of the armature, their circuit-connections with a source supplying continuous currents, and speed-transferring and shifting gearing interposed between the armature and coils and adapted to drive the field-coils synchronously with the alternations of the current after the armature has been raised to synchronizing speed by the gradual transfer of that speed thereto.

5. The method herein described of raising an armature to synchronizing speed by an alternating current, and then transferring that speed to the field-coils by the gradual stoppage of the rotation of the armature.

SEBASTIAN ZIANI DE FERRANTI.

Witnesses:
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