(No Model.)

T. A. EDISON.

PYROMAGNETIC MOTOR.

No. 380,100. Patented Mar. 27, 1888.

Fig. 1.

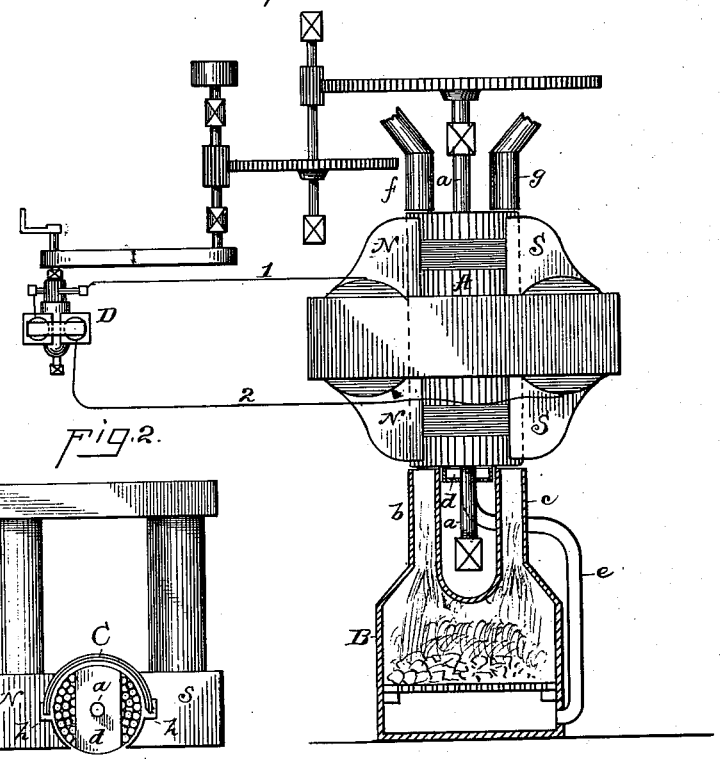


Fig. 2.

Fig. 3.

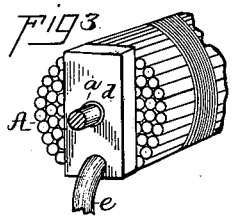


Fig. 4.

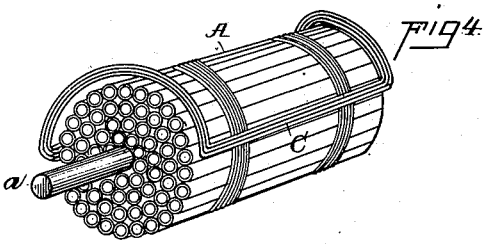
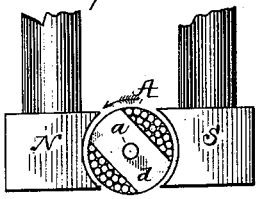


Fig. 5.



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UNITED STATES PATENT OFFICE.

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PYROMAGNETIC MOTOR.

SPECIFICATION forming part of Letters Patent No. 380,100, dated March 27, 1888.

Application filed June 13, 1887. Serial No. 241,098. (No model.)

To all whom it may concern:

Be it known that I, THOMAS A. EDISON, of Llewellyn Park, in the county of Essex and State of New Jersey, have invented a certain new and useful Engine or Prime Motor, (Case No. 720,) of which the following is a specification.

My invention relates to engines or prime motors, and is based upon the principle that the capacity of iron for magnetism diminishes as its temperature is raised, and that at a bright-red heat it becomes practically diamagnetic. Advantage is taken of this fact to construct an apparatus in which motion is produced by the combined action of heat and magnetism, and to this machine I have applied the term "thermo-magnetic engine." The heat is utilized to destroy the magnetic balance of iron parts moving in the field of one or more magnets, or to successively make magnetic parts diamagnetic as they reach centers of attraction. I am aware that it has been suggested that this principle might be utilized to produce motion; but no practical means capable of developing a useful amount of power has been proposed for that purpose, so far as I know.

In carrying out my invention I employ an interstitial armature constructed of thin sheet-iron, so that it will be capable of rapid changes in temperature. This armature is one having interstices extending through it, and it may be made up of or provided with iron tubes extending longitudinally of the armature, the armature being mounted on a vertical shaft, so that the tubes will act as flues; or a corrugated iron sheet could be rolled up to form an equivalent construction, or the interstitial armature could be made in many other ways that would suggest themselves to skilled persons. Beneath the interstitial armature may be located a suitable furnace, with flues for the exit of the products of combustion extending to and covering at their ends opposite portions of the armature. The ends of the armature-tubes will move in close relation with the open ends of the furnace exit-flues, so that the products of combustion will be directed into the tubes as they successively come over the flues. The intermediate tubes are protected from the furnace, and since the power of the machine depends largely upon the rapidity with which the iron tubes can be heated and cooled these intermediate tubes may be covered by a stationary box connected by a flue with the furnace beneath its grate, so that the fresh air for supporting combustion will be drawn down through the tubes that are being cooled.

To increase the power of the machine, a fixed coil of wire for magnetizing or polarizing the armature may be wound in recesses formed in the pole-pieces of the field-magnet.

The field-magnet may be a permanent magnet; but for large machines I prefer to employ an electro-magnet, which may be charged by a battery or by a small dynamo run by the machine, and which can be turned by hand for starting the machine, unless, indeed, the residual magnetism is sufficient for that purpose.

In the accompanying drawings, forming a part hereof, Figure 1 is an elevation and partial section of an apparatus embodying my invention; Fig. 2, a plan view taken from the lower end of the armature, looking upwardly; Fig. 3, a perspective view of one end of the armature, showing also the cold-air box over the central tubes; Fig. 4, a perspective view of the armature with the relative position of the fixed magnetizing-coil shown, and Fig. 5 a view similar to Fig. 2 of a machine without the coil for magnetizing or polarizing the armature.

A is a cylindrical armature mounted upon a shaft, *a*, and composed of thin iron tubes suitably held to the shaft, or otherwise constructed as an interstitial body. These tubes may be nickel plates or thinly covered with enamel or otherwise protected to prevent oxidation. This armature is mounted between the poles N S of a magnet, which may be a permanent magnet, but is preferably an electro-magnet. The parts are suitably supported so that the armature has a vertical position, the tubes extending longitudinally thereof. Beneath the armature is a furnace, B, having two exit-flues, *b c*, extending upwardly and covering the open lower ends of a number of the armature-tubes on opposite sides of the armature. The open upper ends of these furnace exit-flues fit as closely as possible against

the ends of the armature-tubes while permitting the armature to turn. Between the flues *b c* the lower end of the armature is preferably covered with a cold-air box, *d*, which is stationary, and is connected by a pipe, *e*, with the furnace beneath the grate-bars. Above the armature are flues *f g*, forming continuations of the furnace exit-flues *b c* through the armature-tubes. The tubes between the flues *f g* at the upper end of the armature may be left uncovered.

When the cold-air box *d* is arranged to cover an oblique section of the tubes, as shown in Fig. 5, and the flues *b c* cover the spaces left uncovered by that box, the tubes will be heated on the diametrically-opposite sides of the armature that come opposite the lower corner of the pole N and the upper corner of the pole S. These heated portions of the armature being diamagnetic or less magnetic than the remaining portion of the armature, it will be seen that the armature will occupy an unbalanced position in the field, and consequently it will be turned in the direction of the arrow in Fig. 5. The unbalanced position of the armature is maintained by the fact that the heat is always applied to those portions of the armature at obliquely-opposite points in the magnetic field. Hence the rotation of the armature will be continuous, its rapidity of movement being largely dependent upon the rapidity with which the armature-tubes can be heated and cooled.

To increase the power of the engine, I employ a fixed coil of wire, C, which is located in recesses *h* in the pole-pieces N S. The coil C may be connected in series with the coils of the field-magnet. Its function is to magnetize or polarize the armature. Its tendency is to produce poles in the armature at right angles to the poles of the field-magnet and to cause a repulsion as well as an attraction between the field-magnet and the armature, or, at least, to reduce the retarding attraction between each pole of the field-magnet and that portion of the armature which is moving away from it. When the coil C is employed, the sides of the armature directly opposite the centers of the poles N S will be heated instead of the obliquely-opposite portions, as in Fig. 5.

The wire-winding of the field-magnet, as well as the wire of the coil C, will be covered by an insulation capable of withstanding heat. I preferably use a very few turns of large-size copper wire both in the field-winding and in the fixed coil, and energize the same by a current of a sufficiently large quantity to give the desired magnetizing effects. With the large wire insulating-washers of some infusible material—such as porcelain—may be used to separate the wires.

A small dynamo, D, may be employed to supply the current for energizing the field and fixed coil through the circuit 1 2. This dynamo will be operated by the engine through a speed-increasing gearing, as shown, and it may have a hand-crank for giving the field-magnet energy in starting the engine.

A machine driven by the engine will be connected with the armature by speed-increasing gearing unless the machine is one having a low rate of speed.

The form of apparatus shown in the drawings is given as a simple illustration of an embodiment of the invention.

It will be understood that many modifications and changes can be made in the form, construction, and arrangement of the parts of the engine without departing from the spirit of my invention.

What I claim is—

1. A prime motor having, in combination, an interstitial magnetic body, a magnetic field in which said body is located, and means for heating said body to produce an unbalanced magnetic condition of the same, substantially as set forth.

2. A prime motor having, in combination, an interstitial magnetic body, a magnetic field in which said body is located, means for heating said body to produce an unbalanced magnetic condition of the same, and means for cooling the other parts of said body, substantially as set forth.

3. A prime motor having, in combination, a revolving interstitial magnetic body, a magnetic field in which said body is located, and means for heating said body to produce an unbalanced magnetic condition of the same, substantially as set forth.

4. A prime motor having, in combination, a revolving interstitial magnetic body, a magnetic field in which said body is located, and means for heating opposite parts of said revolving magnetic body to produce an unbalanced condition of the same, substantially as set forth.

5. A prime motor having, in combination, a revolving interstitial magnetic body, a magnetic field in which said body is located, means for heating opposite parts of said revolving magnetic body to produce an unbalanced condition of the same, and means for cooling the intermediate parts of said body, substantially as set forth.

6. A prime motor having, in combination, a magnetic interstitial body, a magnetic field in which said body is located, and means for passing a heating medium through the interstices of such body to produce an unbalanced condition of the body, substantially as set forth.

7. A prime motor having, in combination, a magnetic interstitial body, a magnetic field in which said body is located, and a furnace with exit-flues communicating with a part of the interstices of said body, substantially as set forth.

8. A prime motor having, in combination, a magnetic interstitial body, a magnetic field in which said body is located, a furnace with exit-flues communicating with a part of the inter-

stices of said body, and a fresh-air supply for said furnace, drawing fresh air through other interstices, substantially as set forth.

9. A prime motor having, in combination, a magnetic body, a magnetic field in which said body is located, means for heating said body to produce an unbalanced condition thereof, and a coil for magnetizing or polarizing said body, substantially as set forth.

10. A prime motor having, in combination, a revolving magnetic body, a magnetic field in which said body is located, means for heating said body to produce an unbalanced condition thereof, and a fixed coil for magnetizing or polarizing said body, substantially as set forth.

11. A prime motor having, in combination, a magnetic body, a magnetic field produced by an electro-magnet, means for heating said body to produce an unbalanced condition thereof, and a dynamo-electric machine driven by the movement of said magnetic body and supplying current for energizing said field-magnet, substantially as set forth.

This specification signed and witnessed this 24th day of May, 1887.

THOS. A. EDISON.

Witnesses:
WILLIAM PELZER,
E. C. ROWLAND.