M. EGGER.

ELECTRO-MAGNETIC ENGINE.

No. 189,714. **Patented April 17, 1877.**

Fig. 1.

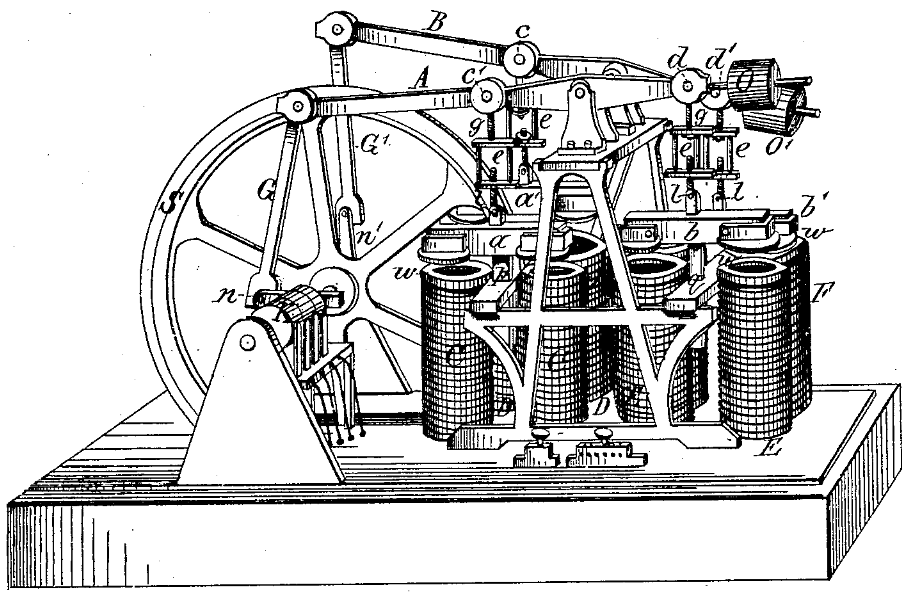


Fig. 3.

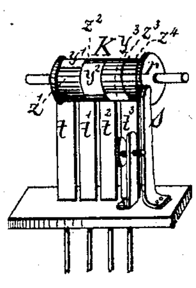


Fig. 2.

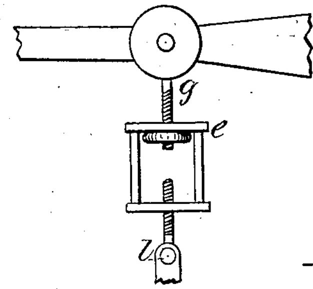
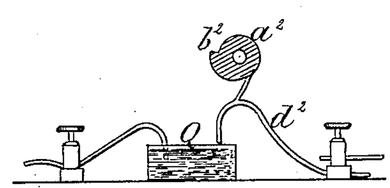


Fig. 4.



Witnesses.

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UNITED STATES PATENT OFFICE.

MARTIN EGGER, OF MARIASCHEIN, AUSTRIA.

IMPROVEMENT IN ELECTRO-MAGNETIC ENGINES.

Specification forming part of Letters Patent No. **189,714**, dated April 17, 1877; application filed December 28, 1876.

To all whom it may concern:

Be it known that I, MARTIN EGGER, of Mariaschein, in Bohemia, Empire of Austria, have invented a certain new and useful Improved Electro-Magnetic Engine, of which the following is a specification:

This invention relates to improvements in electro-magnetic engines, and consists partly in peculiar arrangements for making the armatures approach to or recede from the magnets, and partly in constructing the commutators in a peculiar manner, so that the electric circuit is at no time entirely broken.

In the accompanying drawings, Figure 1 shows the entire engine. Fig. 2 shows a part of the same, drawn to a larger scale, and Figs. 3 and 4 show two different forms of commutators.

In an electro-magnetic engine constructed according to this invention two oscillating beams, A and B, Fig. 1, are employed, from each of which two armatures, *a b* or *a′ b′*, are suspended, so that in all four armatures are suspended above four pairs of magnets, C D E F. The arrangement is such that the armatures are successively attracted, each by its own respective electro-magnet. The armatures are so suspended that during their reciprocating up-and-down motion they can swing on horizontal axes *c c′ d d′* attached to the beams A B. Below each of the said axes a small square frame, *e*, Fig. 2, is suspended so loosely as to allow of the end of the beam going a little farther down, after the armature rests on the magnet, but carrying up the armature along with it when the respective end of the beam goes upward. The frame *e* is provided with a set-screw, to enable the distance of the armature from the beam to be adjusted, which has to be done in such a manner that the armature will rest on the magnet when the respective end of the beam has nearly reached its lowest position. Each of the two beams is connected at one end with one of the two cranks *n n′* on a driving-shaft. As the oscillating center of each beam is situated between two armatures, these armatures balance each other, and the weight of the rod G or G′ connecting each beam end with the crank *n* or *n′* may be counterbalanced by a weight, O or O′, attached to the other end of the beam.

In order to insure the vertical movement of the armatures, each of them is provided at the bottom with a guide-piece, *p q*, sliding in a suitable guide arranged between the magnets.

The motion of the engine takes place as follows: First, one of the four pairs of magnets—C, for instance—attracts one of the four armatures, *a*, and thus causes one of the two beams, A, to move downward with one end, and thus pushes downward one of the two cranks, *n*, which was situated to the left, and therefore rotates the crank-shaft through ninety degrees, arrangement being made so that each electro-magnet exerts its power while the crank on which it indirectly acts is situated between the dead-points. As the two cranks are arranged at an angle of ninety degrees to each other, the second crank *n′* will now be situated to the left horizontally, and therefore between the dead-points. Then a second pair of magnets, D, attracts the armature *a′* suspended at the reverse end of the second beam B′, which, through its connecting-rod G′, turns the second crank *n′* through another ninety degrees. The first crank *n* will now be situated horizontally to the right, and the third pair of electro-magnets E, attracting the third armature *b* suspended at the other end of the first beam A, this end goes downward, thus causing the other end to rise and draw up the first crank *n* through ninety degrees. The second crank *n′* will now be situated horizontally to the right, and when the fourth armature C′ is now attracted by the fourth pair of magnets F, the other end of the second beam D, and therefore the second crank *n′* connected to it, will be drawn up through ninety degrees. The first crank *n* will now be situated horizontally to the left, and the whole proceedings will be repeated, as above explained.

In this way the alternate attraction of the four armatures will cause an uninterrupted rotation of the crank-shaft, on which a fly-wheel, S, may be arranged.

The commutator may also be arranged on the crank-shaft. It may be constructed of contact-springs, gliding over a surface alternately conducting and non-conducting, as seen in Fig. 3, or an arrangement may be used by which contact devices may be alternately dipped into mercury, serving as a conductor, as shown in Fig. 4. In the first case the commutator is constructed as follows: On a cylinder, K, of non-conducting material, such as bone, wood, or vulcanite, four metallic plates, three of which, y^1 y^2 y^3, are visible in Fig. 3, are arranged in a row, but alternately around the circumference of the cylinder, so that each occupies rather more than ninety degrees of the circumference. These metal plates are in metallic contact with each other as well as with a metal disk, *r*, fixed to one end of the cylinder, and a contact-spring, *s*, rests on the said metal disk, and is connected with the positive pole of the circuit. Four contact-springs, *t t′ t″ t‴*, rest on the circumference of the cylinder, and are each connected with one end of the wire of one of the four pairs of magnets, the other ends of the said wires being connected with the negative pole of the circuit. The entire arrangement is made so that each contact-spring alternately touches a metal plate on the cylinder, and is therefore brought into the circuit, and remains in contact until the next contact-spring is brought into the circuit, and for a moment later, so that the entire circuit is never entirely broken at any moment, but is merely passed over from one electro-magnet to the other. The non-conducting parts of the cylinder are marked with the letters z' z'' z''' z^{iv}.

When mercury is to be used as a conducting material, the commutator may be constructed as follows: Instead of the above-mentioned cylinder, a set of four cams, b^2, Fig. 4, of non-conducting material, may be employed, which are so arranged that alternately one of the four contact-springs, d^2, is dipped, by the pressure of its respective cam, into a vessel, Q, containing mercury, and with which the positive pole of the circuit is always in connection. In this case, also, the arrangement is such that each contact-spring, and therefore the magnet connected with it, does not come out of the circuit until another magnet has been brought into the circuit by its respective contact-spring.

In order to receive any shock that might be occasioned by the armatures dropping on the pole ends of the magnets, rings *w w* of india-rubber or leather may be arranged thereon.

Without departing from the substance of this invention, the electro-magnets may be provided with hollow iron cylinders, placed over the coils.

It is evident that, instead of two oscillating beams, with four armatures and magnets, three beams, with six armatures and magnets, or four beams, with eight armatures and magnets, may be employed. When using three oscillating beams the cranks may be arranged at an angle of sixty degrees to each other, or with four beams at an angle of forty-five degrees.

I claim—

1. In an electro-magnetic engine, an oscillating beam or beams, having a connecting-rod on one extremity, and a pair of armatures suspended therefrom at equal distances from its center of oscillation, and a counterbalancing weight on the other extremity to counterbalance the connecting-rod, while the armatures counterbalance each other, in combination with a pair of electro-magnets or a series of magnets, arranged in pairs, substantially as described.

2. In an electro-magnetic engine the arrangement of india-rubber or leather rings *w w*, at the pole ends of the magnets.

3. In combination with the oscillating beams and the armatures of the frames *e*, to adjust the armatures vertically on said beams, and relatively to their respective electro-magnets, all constructed and operating substantially as described, for the purpose specified.

4. In combination with the oscillating beams, the armatures and their respective electro-magnets of the frames *e*, loosely suspended from said beams in such manner as to permit the downward motion of the oscillating beams after the armatures are in contact with their respective magnets, substantially as described, for the purpose set forth.

5. The armatures *a a′ b b′*, in combination with the guide-pieces *p q*, and the slotted transverse pieces of the frame, substantially as described, for the purpose specified.

6. A commutator, consisting essentially of a non-conducting cylinder having a series of conducting-surfaces alternately arranged upon its periphery, and in metallic contact with each other, a series of contact-springs, *t t′ t″ t‴*, the metal disk *r* and spring *s*, or their equivalent, to close the circuit from the battery to one magnet, after having opened said circuit to the other magnet, substantially as described, for the purpose specified.

In witness that I claim the foregoing I have hereunto set my hand this 15th day of November, 1876.

MARTIN EGGER.

Witnesses:

SALOMON SCHÜLLER,
RUDOLF STEINER.