(No Model.)

F. HASELWANDER.

COMPENSATING DEVICE FOR ENGINES.

No. 585,755. Patented July 6, 1897.

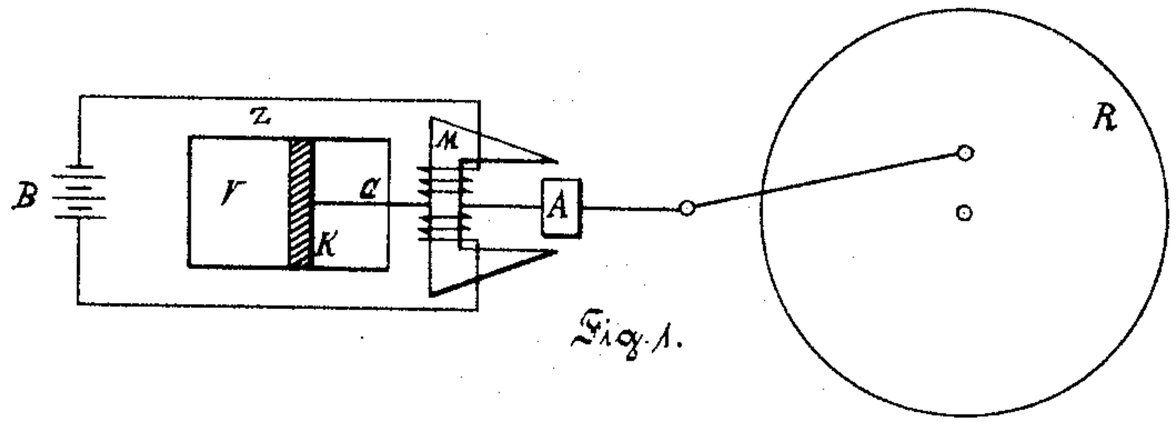

Fig. 1.

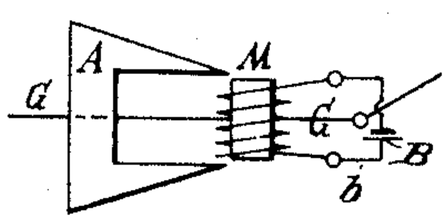

Fig. 2.

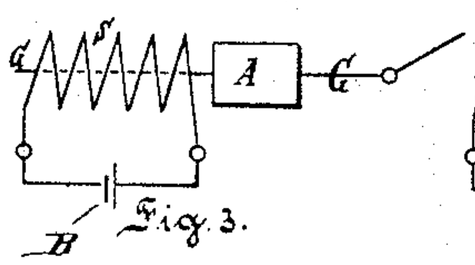

Fig. 3.

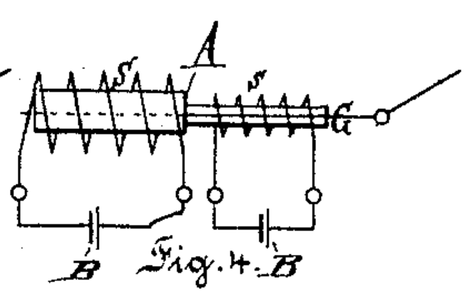

Fig. 4.

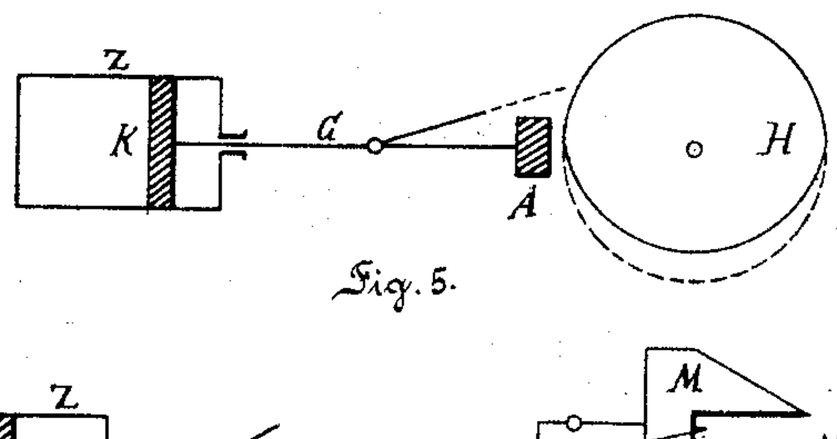

Fig. 5.

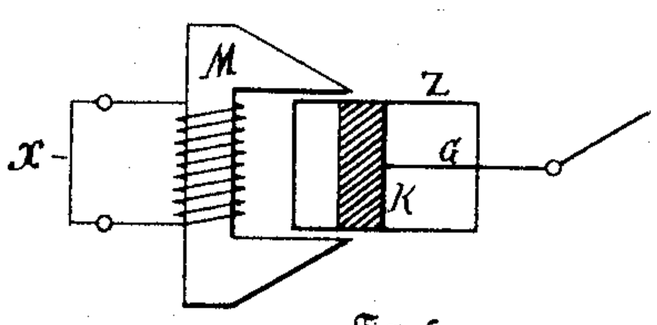

Fig. 6.

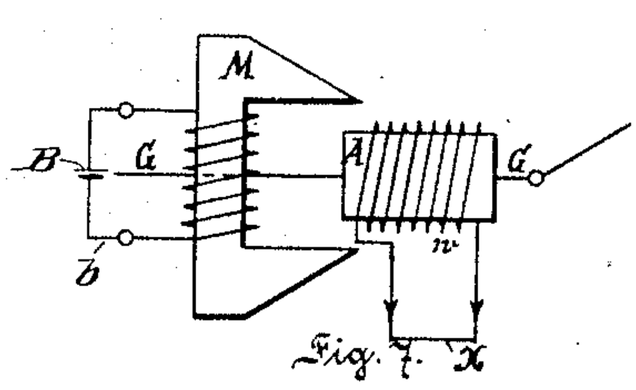

Fig. 7.

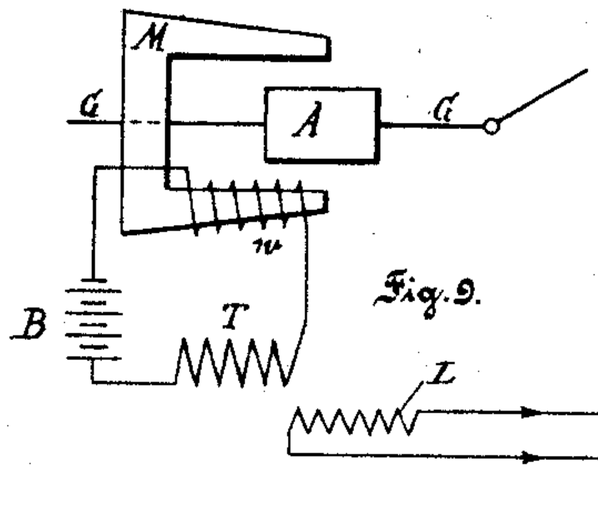

Fig. 9.

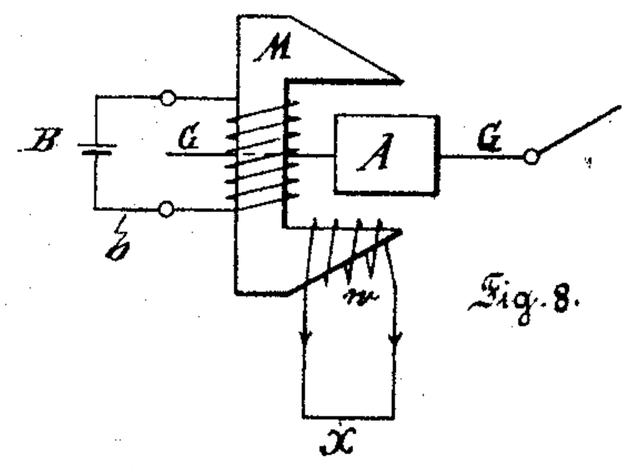

Fig. 8.

Witnesses:
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UNITED STATES PATENT OFFICE.

FRITZ HASELWANDER, OF FRANKFORT-ON-THE-MAIN, GERMANY, ASSIGNOR TO ADOLF KOLBE, OF SAME PLACE.

COMPENSATING DEVICE FOR ENGINES.

SPECIFICATION forming part of Letters Patent No. 585,755, dated July 6, 1897.

Application filed March 8, 1895. Serial No. 541,053. (No model.) Patented in England November 17, 1894, No. 22,249.

To all whom it may concern:

Be it known that I, FRITZ HASELWANDER, a subject of the Emperor of Germany, residing at Frankfort-on-the-Main, Germany, have invented certain new and useful Improvements in Compensating Devices for Engines, (for which A. Kolbe, my assignee herein, has obtained Letters Patent in Great Britain, No. 22,249, dated November 17, 1894,) of which the following is a specification.

My invention relates to devices for compensating for the internal work in fluid-pressure engines, such as gas-engines and the like, in which there is a compression of the working fluid at the end of the stroke, and has for its object to provide magnetic means for compensating for the increase in the amount of work to be done at the end of the stroke in compressing gas or other working fluids in gas or hot-air engines or the like.

To this end my invention consists in the construction hereinafter set forth and claimed.

My invention will be understood from the accompanying drawings, in which—

Figure 1 is a diagrammatic view of an engine with my invention applied thereto. Figs. 2, 3, 4, 5, 6, and 7 are modifications thereof, and Figs. 8 and 9 present modifications thereof in which the compensating devices serve for producing an alternating current.

In Fig. 1, K represents a piston in a cylinder Z, in which the internal work of compression is performed. This piston may be connected in any well-known manner by a driving-gear with the fly-wheel R.

A description and representation of the manner of burning the fuel, the regulating mechanism, &c., will not be given here, as the compensating device may be used with all kinds of machines. Therefore no distinction is to be made between so-called "isothermal and adiabatic compression and expansion."

An iron armature A is in direct mechanical connection with the piston-rod G. This armature swings in the magnetic field of the magnet M, energized from a battery B over the circuit *b*, secured to some fixed part of the engine in such a manner that when the compression-pressure in the cylinder increases the magnetic attraction between M and A is likewise increased—that is to say, the curve or magnetic attraction is made to coincide with the curve of the cylinder compression. It can thus be easily seen that in this manner the internal work of compression may be compensated for at the moment of its origin and during its entire continuance.

In Fig. 2, M and A are exchanged—that is to say, the magnet is carried upon the piston-rod G and energized by the battery B by the circuit *b'* and the armature is stationary. In Fig. 3 the armature A, carried upon the piston-rod G, is shown as working in a solenoid S and energized by a battery B. In Fig. 4 the piston-rod G, carrying the armature A, passes through two alined solenoids S *s*, energized by batteries B B. In the construction shown in Fig. 5 the fly-wheel is the magnet. This fly-wheel may consist of one or more disks H, mounted on the shaft. With the movements of the piston K the iron armature A of the prolonged piston-rod G approaches or moves away from the magnetic fly-wheel H, so that by suitably shaping the circumference of H its action on the armature A will be regulated to compensate for the internal work of compression. The armature is oscillated to and from the rotating magnetic fly-wheel H, thereby changing the intensity of the field of force due to the magnetic condition of the fly-wheel, so that by suitably shaping the fly-wheel—for instance, as shown—its action on the armature A will be regulated to compensate for the internal work of compression of the motive fluid in the cylinder.

In Fig. 6 I have shown an arrangement wherein the compensating device is formed in part by a moving part of the engine. In this figure G is the piston-rod, which carries a combined armature and piston K, which works in a non-magnetic cylinder Z. The poles of the magnet M, energized by battery B by the circuit *b*, embrace the cylinder and extend so far alongside the same as to form a magnetic field in the path of the oscillation of the combined armature and piston K.

In Fig. 7, G represents an oscillating piston-rod, A an armature carried thereby, and M the magnet energized from the battery B by the circuit *b*. I provide the armature A with

a winding *w*, forming part of an external circuit *x*. Then as the armature A oscillates in the magnetic field of M and the circuit of *w* is closed through the external circuit *x* currents will be produced in *w* by the vibrations of the armature A, carrying the coil *w* in the said magnetic field, and the currents will be conducted from *w* into the external circuit *x*. Another arrangement for this purpose is shown in Fig. 8, wherein G represents the piston-rod, A the armature, and M the magnet energized by battery B by circuit *b*. The winding *w* is on a pole of the magnet M and is connected to an external circuit *x*. In this modification of my invention the iron armature A oscillates between the poles M, and varying the number and direction of the lines of force thereof produces a current in the winding *w*, which current is conducted into the external circuit *x*.

In Fig. 9, G indicates the piston-rod, A the armature, and M the magnet. Upon a pole of the magnet M a coil *w* is placed, which coil *w* energizes the magnet, being supplied with a current from battery B in circuit therewith. In the circuit of the coil *w* and battery B is the primary coil of a transformer, of which L is the secondary coil. This secondary coil L is connected to an external circuit *x*. Oscillations of the armature A in the field M will produce alternating currents in *w*, which will appear by induction in the secondary coil L of the transformer and will be conducted to the external circuit. Currents produced in this manner may be used for various purposes when desired—for instance, for exploding the gas for driving the engine in case a gas-engine is used, the said current being produced at just the proper instant to be effective in exploding the gas.

Insead of a single compensating device several may be used in the same structure.

What I claim, and desire to secure by Letters Patent, is—

1. The combination of a fluid-pressure engine wherein there is compression of the working fluid, a two-part magnetic device one part of which is affixed to a moving part of such engine, the said magnetic parts being arranged to act upon one another to compensate for the increase in the amount of work to be done at the end of a stroke in compressing the working fluid, substantially as described.

2. The combination of a fluid-pressure engine wherein compression of the working fluid is had, a two-part magnetic device one of whose parts is affixed to a moving part of such engine, the said magnetic parts being arranged to act upon one another to compensate for the internal work due to the compression at the instant of such compression, and a winding upon one of the magnetic parts connected to a circuit, whereby during such compensation an electric current is produced, substantially as described.

FRITZ HASELWANDER.

Witnesses:
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