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Bonvicini

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[54] **IGNITION SYTEM FOR INTERNAL-COMBUSTION-MICRO-ENGINES**

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[51] **Int. Cl.** **H02k 17/42**

[58] **Field of Search**..... 310/70 R, 70 A, 153, 168, 310/268; 315/206, 209 R, 218

[56] **References Cited**

UNITED STATES PATENTS

809,268	1/1906	LePontois	310/153 X
2,843,769	7/1958	McGrevy	310/70 A

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[57] **ABSTRACT**

An ignition system for internal-combustion micro-engines comprising an ignition magneto provided to energize a spark plug by means of an electric current fed through a contact breaker controlled by a cam and designed to become operative in conditions of maximum current, characterized by the fact that said magneto is so shaped and dimensioned as to be comprised within the engine clearance gauge, the inductor of said magneto being mounted into a housing defined between the blades of the engine fan which is fixed on the driving shaft, said inductor having its pole shoes set at a right angle to the rotation axis of the driving shaft, while the armature comprises a three leg core, where said legs are parallel to the said rotation axis and are simmetric with respect of a plane passing through said rotation axis, said armature core being constituted of a laminated iron structure, wherein the central leg which supports the primary and secondary winding, has a thickness smaller than that of the side legs which are identic, while the outer surfaces of said three legs are coplanar, the inductor being constituted of a two leg core, wherein the transverse centre plane passes through the axis or the fan rotor supporting said inductor, while the thickness of the inductor core legs is greater than that of the core legs of the armature so as to obtain towards the rotation axis of the ignition system a zone of electromagnetic leakage in order to produce a flattening of the peaks of the current curve.

4 Claims, 3 Drawing Figures

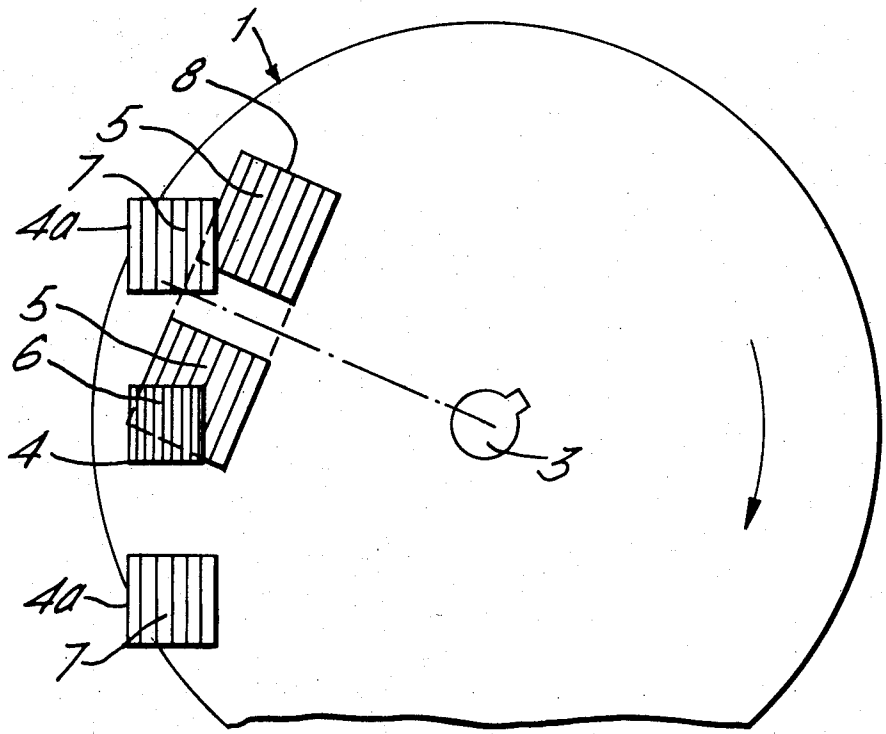


FIG. 1.

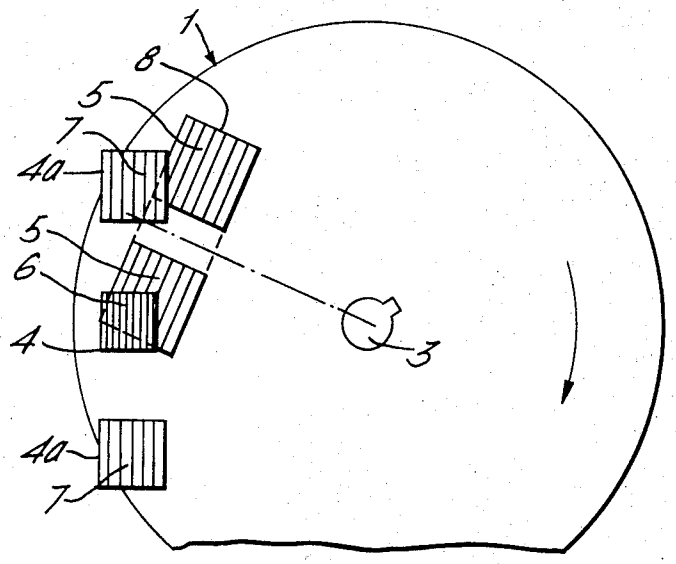


FIG. 3.

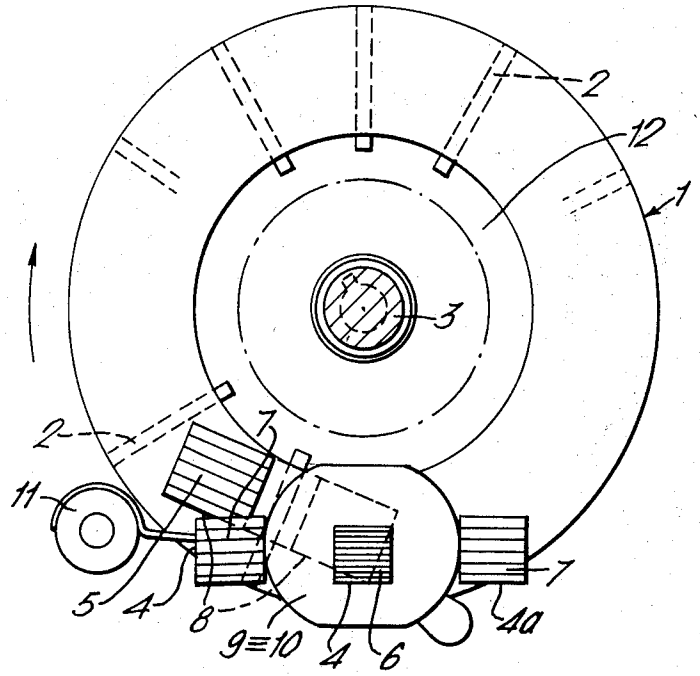
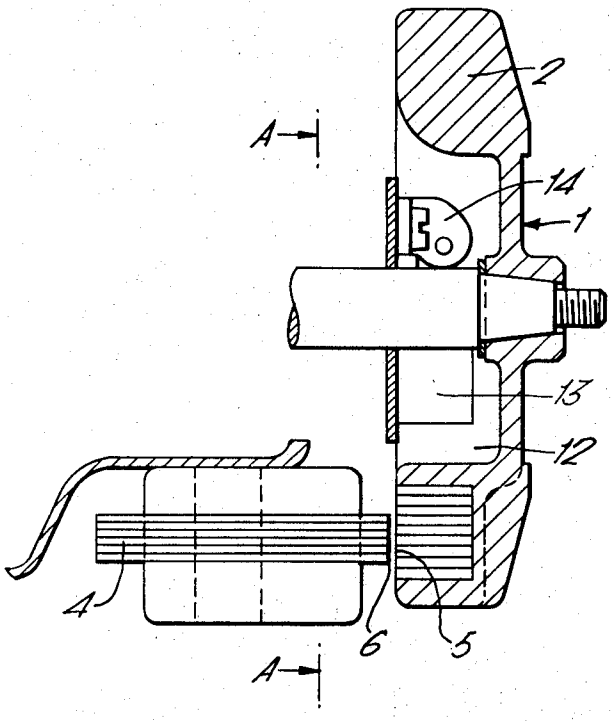


FIG. 2.



IGNITION SYTEM FOR INTERNAL-COMBUSTION-MICRO-ENGINES

The present invention relates to the ignition system for internal-combustion engines of small sizes and aims to reduce the weight and the space occupied by the ignition magneto by using, as supporting means, some of the engine members which are designed to perform other functions.

Another object of the invention is to provide means adapted to compensate for the disadvantages due to the reduction of the diameter of the rotating unit, either with respect of the mutual correlation between the inductor and the armature pertinent to said ignition system, or of the contact breaker operation.

It is known that the power which is necessary for the ignition of the air-full mixture is substantially independent of the engine piston displacement, since the produced spark substantially only serves to prime or start the combustion which then continues spontaneously. Commonly the sizes of the ignition unit remain unvaried, even if the engine dimensions decrease and as a result thereof the ignition unit of the micro-engines tends to occupy more space than that of the main unit, i.e., that of the same engine. This unbalance between said dimensions is lightly attenuated on account of the fact that in the explosion engines of small or very small dimension, the compression torque is modest so that also when manual strat devices are used, as for instance, a starting string, the driving shaft attains instantaneous considerable speeds, that enabling within predetermined certain limits to construct magnetos smaller that the normal ones, owing to the fact that the induced voltages increase with the speed at which varies the magnetic flux interlinked with the winding. However the dimensions of the ignition unit remain, always considerable and negatively affect the possibility of constructing light microengines which occupy little space, as are required for particular intended purposes, as, for instance, for the production of portable mechanized tools.

For such a purpose this invention serves to eliminate the supporting members for the ignition unit, which is also so shaped and dimensioned as to be comprised within the clearance gauge of the engine.

Other features and advantages will be better understood from the following description of an embodiment of the invention which has to be taken in consideration together with the accompanying drawings, in which:

FIG. **1** is a diagrammatic view of the stationary and movable operating magnetic and electric devices of the ignition system, the engine fan rotor being partially broken away;

FIG. **2** is a diagrammatic section taken on the transverse centre plane of the armature passing through the axis of the driving shaft and said figure only showing the devices of the induction system and of the fan rotor which is used for supporting the rotating component of said system; and

FIG. **3** is the diagrammatic section taken along the line A—A of FIG. **2**.

At **1** is marked the fan rotor provided with a plurality of radial blades **2** and which is mounted on the driving shaft **3**. The ignition system comprises an armature having a core formed of three legs **4, 4***a*, which extend parallelely to the axis of the driving shaft **3** and which are so positioned and dimensioned as to do not project

beyond the clearance gauge of the engine. A three leg core **4, 4***a* has been provided so as to obtain a complete reversal of the magnetic flux. Since parasitic currents in said core are produced, which are due to the high speed changes of the interlinked currents, this core is realized by magnetic iron sheets having low losses. Therefore it will be necessary to provide a flat laminated iron structure, where the pole pieces **6, 7** of the legs **4, 4***a* of the core are aligned on a plane substantially perpendicular to the centre plane of the armature passing through the axis of the shaft **3,** while the pole pieces of the two leg core **8** of the inductor which according to the present invention is housed within recesses defined by three adjacent rotor blades **2** which travel along a circular path (FIG. **1**) which is of a small radius on account of the very small sizes of the engine which negatively affects the correct mutual facing of the pole shoes **6, 7** of the armature and those **5** of the inductor. In order to overcome said inconvenience which becomes more important as the rotor diameter of the rotor **1** decreases, according to this invention provision has been made to position a core **4, 4***a* of the armature in such a manner that the outer surfaces of the three legs **4, 4***a* are co-planar. The side legs **4***a* are formed by a greater number of iron sheets as compared to that of the iron sheets of the central leg **4** so that the side legs **4***a* can extend nearer to the path of the rotating pole pieces **5.** Therefore the side legs **4***a* have a thickness greater than that of the central leg **4** in order to compensate for the greater distance of the legs **4***a* from the axis of the shaft **3** as compared with that of the arm **4** and which is due to the provided aligned arrangement of all the outer surfaces of the legs **4, 4***a*. Also the pole shoes of the inductor **8** are formed by a number of iron sheets greater than that of the iron sheets forming the central leg **4** of the armature, while their thickness increases toward the rotation axis. At **9** and **10** are marked the primary and secondary windings of the armature and at **11** the condenser inserted in the ignition circuit. The rotor body **1** forms also a chamber **12** opened towards the driving shaft **3** and in which is mounted the conventional contact breaker **13** and which is controlled by a cam **14,** which, as the shaft **3** rotates, causes the closing and opening at predetermined time intervals of the contacts of the breaker **13.** The other devices of the ignition system have not been illustrated since they are of conventional type. It is evident that is will be always necessary to perform an adjustment of the ignition system in order to obtain a correct angular positioning between the stationary armature and the breaker **13** which is termed magnetic angle or inner phasing. This adjustment is made critical by the fact that, as well known, the electric degrees which are concerned with the said mutual position are smaller than the mechanic degrees, since the pole pitch of the development of the circular path of the inductor is a small fraction of the circular path length of the said pole shoes, which is smaller as the engine size is reduced. The criticity of this adjustment is limited according to the present invention by realizing a curve of the induced current having flattened peaks and that is attained by arranging the parts in such a manner that the stationary pole shoes **6, 7** of the armature and the movable pole shoes **5** of the inductor **8** cross each other according to an inclined disposition, thus producing also a considerable flux leakage due to the advancing of the pole pieces **5** towards the axis of the shaft **3.**

On account of the fact that the braker **13** must open in conditions of maximum current it will be apparent that such a flattening of the peaks allows to have at disposal a wider field amplitude of the break point.

I claim:

1. In an ignition system for internal-combustion micro-engines comprising an ignition magneto provided to energize a spark plug by means of an electric current fed through a contact breaker controlled by a cam and designed to become operative in conditions of maximum current, wherein said engine includes a rotatable cooling fan spaced from said engine and mounted on a drive shaft, the improvement comprising a magneto shaped and dimensioned to be comprised within the engine clearance gauge, said magneto including an inductor mounted between the blades of the engine fan, said inductor including pole shoes set at a right angle to the rotational axis of the driving shaft, an armature spaced from said inductor comprising a three leg core, where said legs are parallel to the said rotational axis, the central leg supports the primary and secondary winding of said armature, and has a thickness smaller than that of the side legs, the inductor being formed of a two leg core, the thickness of the inductor core legs being greater than that of the core legs of the armature, whereby a zone of electromagnetic leakage is obtained to yield a flattening of the peaks of the current curve.

2. The magneto ignition system of claim **1** wherein said inductor pole pieces are positioned on a chord of said fan rotor being substantially equidistant from said fan rotor axis, said armature pole pieces having faces which confront said inductor pole piece faces such that upon rotation of said fan only a portion of the surfaces of said armature side leg pole pieces are traversed by said inductor pole piece confronting faces.

3. The magneto ignition system of claim **1** wherein said fan rotor further includes ignition contact breaker means in electrical communication with said armature primary windings.

4. The magneto ignition system of claim **1** wherein the inductor and armature pole pieces have faces which are substantially rectangular in shape.

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