May 13, 1969 R. HALM 3,444,435

ELECTROMAGNETIC IGNITION DEVICE, PARTICULARLY FOR LIGHTERS

Filed July 13, 1967

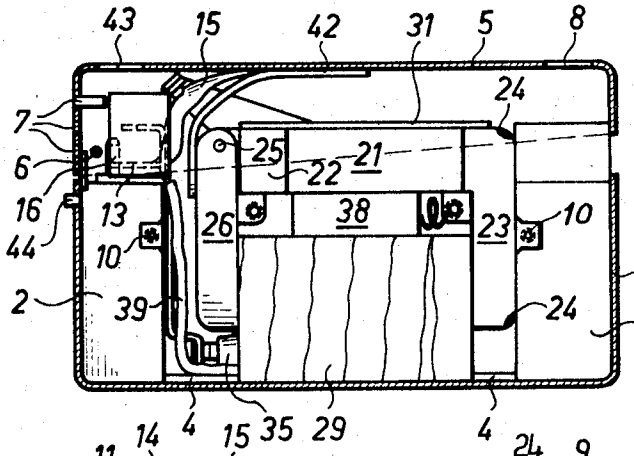

Fig. 1

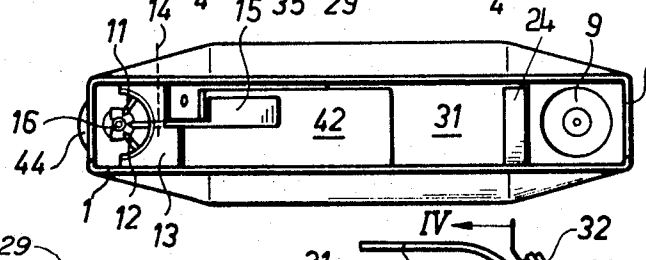

Fig. 2

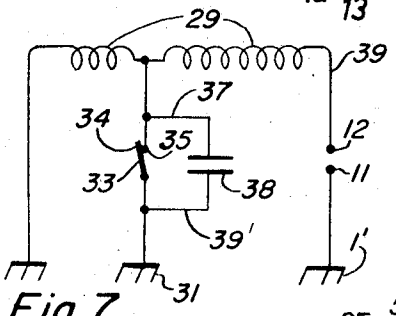

Fig. 7

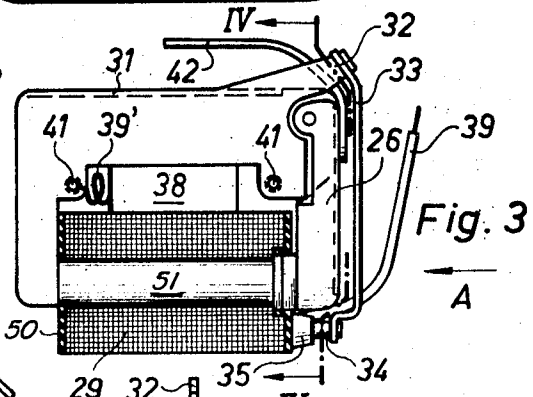

Fig. 3

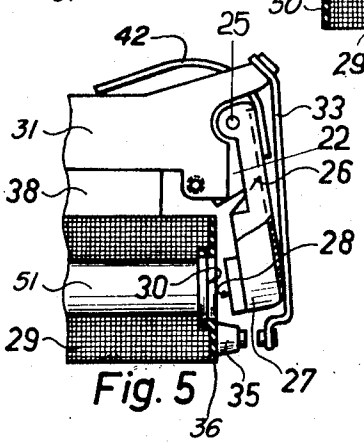

Fig. 5

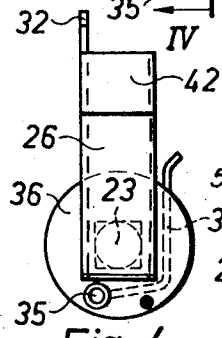

Fig. 4

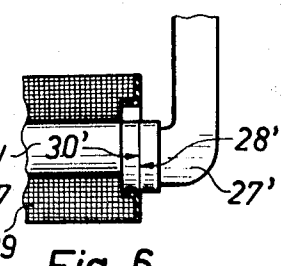

Fig. 6

Inventor

RICHARD HALM

Otto John Munz.

ATTORNEY

United States Patent Office 3,444,435 Patented May 13, 1969

3,444,435

ELECTROMAGNETIC IGNITION DEVICE, PARTICULARLY FOR LIGHTERS

Richard Halm, Schorndorfer Strasse 8/1, Baltmannsweiler, Germany

Continuation-in-part of application Ser. No. 397,969, Sept. 21, 1964. This application July 13, 1967, Ser. No. 653,229
Claims priority, application Germany, July 15, 1966, H 59,972
Int. Cl. F23q 3/01
U.S. Cl. 317—81 12 Claims

ABSTRACT OF THE DISCLOSURE

Electromagnetic ignition device with a permanent magnet in a magnet circuit, including a laminated U-shaped yoke provided with a low-tension winding and a high-tension winding, into one leg portion of which yoke a permanent magnet is inserted, the other leg portion carrying the high and low tension windings. An armature is movably arranged between the yoke leg portions. Pivoting of a lid downwards tensions a leaf-type spring finally to tear the armature from abutment with the yoke. Fuel is emitted from a storage reservoir through a valve actuated by the pivoting of the lid. Following emission of fuel, the armature, in tearing off the yoke, breaks open the low tension winding to cause a spark to jump a gap in the high tension winding to ignite the fuel.

CROSS REFERENCE TO RELATED APPLICATIONS

This application is entitled to the priority filing date of the corresponding German patent application No. H 59,972, filed July 15, 1966.

This is a continuation in-part to copending patent application S.N. 397,969, filed Sept. 21, 1964, and priority thereof is claimed for all subject matter common therewith.

Field of the invention

Broadly the present invention relates to a burner having an electric spark igniter. Specifically, the present invention relates to an electromagnetic ignition device with a permanent magnet in a magnetic circuit. The magnetic circuit has a laminated yoke and a movable armature. The yoke iss provided with a low-tension winding and a high-tension winding. The invention is concerned more particularly with a small lighter, especially a pocket lighter, comprising a fuel tank, a spark gap disposed over a burner nozzle and operatively connected with the high-tension winding, and an actuating member for the armature of the ignition device and the burner valve.

Description of the prior art

The operation of electric spark ignition devices of the prior art include a tearing of an armature away from a yoke, whereby at least one air gap formed between the armature and the yoke is abruptly increased. As a result of the change of the magnetic flux in the magnetic circuit thereby produced, a corresponding voltage pulse is induced in a coil to supply, in a lighter, the ignition spark for a gas-air mixture at a burner nozzle.

During the opening of each magnetic circuit, a leakage flux is produced which increases with the growing air gap and reduces the change of flux with the ultimate result that the induced voltage will not attain the value actually possible on the basis of the strength or power of the permanent magnet which, in turn, depends upon the volume and magnetic material of the latter.

Because of this leakage flux and because of the relatively small contact surfaces between the armature and the yoke, it has not been possible heretofore to reduce the dimensions of the ignition device to an extent such as would be required, on the one hand, for a small lighter, particularly a pocket lighter, if, on the other hand, an ignition spark of sufficient power were to be produced with absolute certainty.

SUMMARY OF THE INVENTION

It is, therefore, the object of the present invention to provide a small lighter while nevertheless being equipped with an electromagnetic ignition device by proposing improvements for such devices of the prior art.

For the purpose of obtaining this object, the present invention uses as its basis an electromagnetic ignition device with a magnetic circuit comprising a U-shaped yoke, one leg portion of which is provided wth a permanent magnet inserted therein and the other leg portion of which carries an induction winding, and an armature disposed between the leg portions of the yoke in a movable fashion.

In accordance with the present invention, the pole shoe surface areas of the yoke and of the armature are made larger than the cross-sectional surface areas of the yoke leg carrying the induction winding, and the armature is provided with a pole shoe which projects toward the pole shoe of this yoke leg.

An increase of the pole surface area of approximately 20% as compared to the cross section of the yoke results already in a marked reduction of the magnetic contact or transition resistance within the air gap, and this contact resistance obviously decreases in the same proportion as the two pole surfaces increase with respect to the yoke cross section, all conditions being otherwise identical. The contact or transition resistance is advantageously further reduced if the pole surfaces of the armature and of the yoke are accurately machined and perfectly matched with regard to each other.

The pole shoe of the armature projecting toward the yoke pole shoe prevents the generation of a detrimental stray flux toward the armature body which would counteract the desirable temporary change of flux, which should be as great as possible, at the time when the armature is torn away from the yoke.

In order to prevent that the dimensions of the system be increased by the pole shoe of the armature, a front plate of the induction winding facing the armature is advantageously provided with a recess into which the armature pole shoe fits when abutting with the pole shoe of the yoke.

A particular problem arises with respect to the combination of the sheets of the yoke and of the armature to constitute compact stacks of sheets. The customary provision of screws or rivets is not feasible here since it reduces the magnetic cross section and thus makes an increase of the cross sectional dimensions of the stack mandatory for a required value of magnetization, which increase counteracts the object of compactness to be obtained with the present invention. Furthermore, harmful short-circuit connections are produced as a result of the screw or rivet connection in which eddy currents are formed during changes of flux.

For this reason, it is a further characteristic of the present invention that, at points which are positioned at the outer circumference of the magnetic circuit, the sheets are connected with each other by means of a fusion connection, for example by welding or soldering. The provision of a fusion connection at the periphery of the magnetic circuit has the advantage that the magnetic flux is considerably smaller there and is less disadvantageously

influenced than it would be in the center of the cross section, for example.

A further problem arising when a small ignition device is to be constructed concerns the mechanically rigid connection of yoke parts with respect to one another and the movable positioning of the armature in a manner such that the strong power required for tearing off the armature and the impacts which arise in catching or intercepting the armature movement are absorbed without loosening the connection and without impairing the precise fitting of the armature onto the poles of the yoke and of the permanent magnet between the yoke parts.

In accordance with the present invention, the smallest possible structural form is obtained if, instead of a mounting on a pedestal or on a plate bar, the parts of the yoke are disposed at a supporting plate which is provided as an angle section and made from non-magnetic but suitably electrically-conductive material, the two leg portions of the angle section resting against two neighboring sides of the yoke.

An arm may advantageously be disposed on the supporting plate as an integral part thereof within the area of the armature to carry an elastic contact member of an interterrupter contact. Such an interrupter contact is customary in this construction and is actuated by the armature.

If, furthermore, a rigid counter contact of the interrupter contact, for operative engagement with the elastic contact member, is disposed directly and in an insulated manner at the front plate of the induction winding adjacent the armature, a further saving in space is realized as compared to an interrupter contact mounted at a separate insulating member.

Other objects and many of the attendant advantages of this invention will be readily appreciated as the same becomes better understood by reference to the following detailed description when considered in connection with the accompanying drawings in which like reference numerals designate like parts throughout the figures thereof.

An advantageous use of the available space, which use contributes essentially to reducing the structural bulk of the ignition device and therewith that of the lighter iself, is realized addiionally in that the conventional condenser which is connected in parallel to the interrupter contact is accommodated in the free space of the yoke present between the induction winding and the permanent magnet. This measure results in short conductor connections between the condenser and the rigid counter contact of the interrupter contact on the front plate, on the one hand, and the supporting plate as mass connection of the electrical circuit, on the other hand.

BRIEF DESCRIPTION OF THE DRAWING

A lighter as embodiment of the present invention is schematically illustrated in the accompanying drawing, wherein

FIGURE 1 is a lateral view of the lighter of the present invention sectioned to disclose its interior;

FIGURE 2 is a top plan view of the lighter of the present inpention with its lid removed;

FIGURE 3 is a rear view of elements indicated in FIGURE 1;

FIGURE 4 is a partial view in the direction of the arrow A in FIGURE 3 with a modified part;

FIGURE 5 is a view corresponding to FIGURE 3 with the armature shown open;

FIGURE 6 is a view corresponding to FIGURE 3 of a modification thereof;

FIGURE 7 is a circuit diagram applicable to the embodiments of the preceeding figures.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Accommodated at the two end faces of a two-piece housing **1, 1'** of non-magnetic material are two storage reservoirs **2** and **3** for fuel gas. These storage reservoirs are connected with each other by means of a connecting line **4**. The upper side of the housing is covered with a lid **5** of non-magnetic material which is pivotally positioned above the reservoir **2** by means of a cross pin **6** extending through the housing. The lid **5** has on the side thereof adjacent the cross pin **6** air passages **7** and thereabove a fire hole **43**, and has on the side thereof adjacent the reservoir **3** an opening **8** as access to a charging port **9** within the reservoir **3**. The housing shell **1** is intended to be secured by means of screws to the housing shell **1'** receiving the reservoirs **2, 3**, and these screws must be threaded in tapped holes **10** disposed at the reservoirs **2** and **3**. The housing may be covered at the outside thereof with a leather-like plastic or the like.

Disposed above the reservoir **2** is an insulating member **13** of ceramic material containing electrodes **11** and **12**. It is secured to the housing part **1'** by means of a screw **14**. Positioned on the screw **14** is at the same time an actuating lever **15** for a gas valve **16** provided as a burner. The lever is accommodated within a slot of the insulating member **13**. The electrodes **11, 12** are provided with platinum tips so as to effectively prevent the oxidation of the tips.

A permanent magnet **21** is inserted between two yoke members **22** and **23** which consist of mutually insulated layers of sheets and are held together at the outer side—referred to the magnetic circuit—by means of transverse soldered seams **24**. Through the yoke member **22** extends a pivot **25** as bearing for a rocking lever **26** which encloses, at the end thereof through which the pivot **25** extends, the yoke member **22** and which receives at the end thereof removed from the pivot **25** an armature **27**, which latter is best seen in FIGURE 5. The armature is constructed in the manner of the yoke members **22, 23** and has a pole shoe **28** projecting abruptly from its body. The leg portion **51** of the yoke **23** provided with induction winding **29** has a pole shoe **30** which corresponds to the pole shoe **28**. Pole shoes **28** and **30** have the same cross section. Both pole shoes are accurately machined and ground on their mutually abutting surfaces which are shown flush with respect to each other in the position illustrated in FIGURE 3 and separated in the position illustrated in FIGURE 5.

The pole shoe **30** has a square-shaped cross section which is larger in area than the cross section of the cylindrical leg portion **51**. The diameter of the cylindrical leg portion **51** may correspond approximately to the length of the side of the square of pole shoe **30**, as shown in FIGURE 4. Winding space is gained by virtue of the cylindrical configuration of the yoke leg portion. Additional space may be saved if only a thin insulating layer of paper is inserted between leg portion **51** and the winding **29**. The front plate **36** of the winding is disposed radially outwardly of the pole shoe **30** and is held at its socket-like part by means of a lateral blasting off or separation of material of the yoke leg portion **51**. The other front plate **50** is flat and is simply slid upon the leg portion **51** flush against the winding.

Secured to the end face of the rocking lever **26** is a leaf-type spring **42** which rests with the free end thereof from below against the inner side of the lid **5**.

The yoke members **22** and **23** are connected by means of soldering with a supporting plate **31** of a conducting but non-magnetic material. The supporting plate is angularly bent to rest against two adjacent surfaces of the yoke members; and is thereby reinforced (FIGURE 3). The permanent magnet **21** is pressed in between the oppositely directed leg portions of the two yoke members (FIGURE 1). The supporting plate **31** is secured to the housing shell **1'** by means of screws which engage in tapped holes **41** in the supporting plate, these holes being disposed in the dead space between the two yoke leg portions not utilized by the induction winding **29** (FIGURE 3).

Accommodated in this space is furthermore a condenser **38** in a space-saving manner.

An arm 32 integral with the supporting plate 31 carries a breaker spring 33 having a contact 34 at the free end thereof. This contact 34 is shown in FIGURE 3 in operative engagement with a counter contact 35 disposed in an insulated manner on the front plate 36 of the coil. This counter contact is connected by way of a line 37 with one terminal of the condenser 38 whose other terminal is connected with the supporting plate 31 by way of a line 39'.

The interrupter switch comprising contacts 34 and 35 and the condenser 38 are connected in parallel with respect to the low-tension winding of the induction winding 29. The housing shells 1 and 1' and the supporting plate 31 form the "chassis" as it were of the electrical circuit. A line 39 extends from the high-tension winding of the induction winding to the electrode 12, while the electrode 11 is connected with the housing 1'.

In the embodiment according to FIGURE 6, the armature 27' is angularly bent with respect to pole shoe 28' having a cross section enlarged relative to that of leg portion 51. To pole shoe 28' corresponds an enlarged pole shoe 30' which is arranged offset on one side to the leg portion 51 of yoke member 23. The stray or leakage flux is reduced also by virtue of this construction.

For purposes of operating the lighter, the lid 5 is pivoted about the cross pin 6 in the direction toward the reservoir 3 by means of pressure exerted at the end containing the access opening 8 whereby the spring 42 is tightened and ultimately tears the armature 27 secured within the rocking lever 26 away from the yoke leg portion 23. At the same time, the actuating lever 15 is pressed down by the lid 5 and opens the gas valve 16 so that an ignitable gas mixture is present when during the tearing-off movement the lever 26 lifts the contact 34 disposed on the end of breaker spring 33 off the counter contact 35 so that as a result an ignition spark will jump between the electrodes 11 and 12. The flame will emerge from the fire hole 43 in the lid 5.

When the lid 5 is released, the armature 27 will return into the position illustrated in FIGURES 1 and 3 due to the magnetic attraction between the pole shoes. The spring 42 presses the cover or lid upwardly again and is relaxed, the actuating lever 15 is released and the gas valve 16 closes automatically by means of a valve spring installed as is known in connection with gas lighters, whereafter a new tearing-off process may be initiated.

The pocket lighter described herein is approximately 65 mm. long, has a height of 40 mm. and a width of approximately 10 mm. at the end faces and of approximately 18 mm. within the area of the coil 29. The distance between the two storage reservoirs 2, 3 is approximately 44 mm. The pocket lighter has been shown in the drawing enlarged about 1.5 times.

The small-construction ignition device proposed by the present invention is, however, by no means restricted to pocket lighters in the use thereof but may be used advantageously also in any case where electromagnetic devices operable without battery or without power supply are needed for generating a strong high-tension impulse, for example for igniting oil or gas burners, mines, and the like.

It should be understood, of course, that the fore-going disclosure relates to only preferred embodiments of the invention and that it is intended to cover all changes and modifications of the examples of the invention herein chosen for the purposes of the disclosure, which do not constitute departures from the spirit and scope of the invention set forth in the appended claims.

I claim:

1. An electric spark igniter for small lighters and similar devices, comprising a magnetic circuit means to conduct a magnetic flux; said magnetic circuit means including a permanent magnet (21) and, in series, a leg portion (51), a pole shoe (30), a pole shoe (28), and an armature (27); pole shoes (28) and (30) connected respectively to the armature (27) and the leg portion (51), the pole shoe (28) projecting from the armature (27); means to actuate said armature (27) to move said pole shoe (28) into and out of abutment with said pole shoe (30) and to effect a change in the magnetic flux conducted in the magnetic circuit means; and electrical circuit means to utilize said change in magnetic flux to create a spark, the electrical circuit means including a winding (29) wound on said leg portion (51), and electrode means (11, 12) connected to said winding (29) to provide a spark gap, one end of the winding (29) lying substantially coplanar with the abutment between pole shoes (28) and (30); leg portion (51), pole shoes (28) and (30) in abutment, and winding (29) being coaxial, the armature (27) extending substantially perpendicularly to their axis; the cross sections of the pole shoes (28) and (30) being greater than the cross section of leg portion (51), and a housing for assembling the elements of the electric spark-igniter.

2. An electric spark igniter according to claim 1, further comprising a front plate (36) of the induction winding mounted on said leg portion (51) and facing the armature and provided with a recess, said pole shoe (28) mating with said recess when in abutment with pole shoe (30).

3. An electric spark igniter according to claim 1, wherein said magnetic circuit means includes a U-shaped yoke, one leg portion of which is provided with said permanent magnet (21), the other leg portion of which is said leg portion (51), the igniter further comprising a condenser (38) positioned between the said two leg portions.

4. An electric spark igniter according to claim 1, said winding (29) provided with high tension and low tension windings, said electrode means (11, 12) connected to said high tension winding; said means to actuate and to effect a change comprising a lid (5), means to mount the lid (5) pivotally, means to mount the armature (27) pivotally, a spring means (42) acting between the lid (5) and the armature (27) to tear pole shoe (28) from pole shoe (30) upon achievement of a minimum spring force created by pivoting of the lid (5), an interrupter switch in said low tension winding, means to mount said switch in the path of motion of said armature, whereby the switch is broken by impingement of said armature moving said pole (28) out of abutment with the pole shoe (30); the igniter further comprising a means operable by movement of said lid (5) to supply a flow of ignitable fuel before the breaking of the interrupter switch of the low tension winding, and means to mix oxygen with said fuel flow; said electrical circuit means including a spark gap located in said high tension winding and in the flow of fuel following its oxygenation, sparking occurring upon the breaking of the switch of the low tension winding.

5. An electric spark igniter as claimed in claim 1 comprising a housing means (1, 1') to mount the magnetic circuit means, the means to actuate and to effect a change, and the electrical circuit means as a unit.

6. An electric spark igniter according to claim 1, the parts of said magnetic circuit means being mounted on a supporting plate (31) of a non-magnetic material, said plate having the shape of an angle section, the two leg portions of the angle section resting against two adjacent sides of the magnetic circuit means.

7. An electric spark igniter according to claim 6, the parts of said magnetic circuit outside of said permanent magnet (21) being formed of layers of sheets, the sheets being connected at the outer periphery of the said magnetic circuit with each other.

8. An electric spark igniter according to claim 7, the sheets being connected together by fusion connections (24), the supporting plate (31) being fusion connected to the magnetic circuit means.

9. An electric spark igniter as claimed in claim 6, said supporting means (31) to mount the magnetic circuit

means, the means to actuate and to effect a change, and the electrical circuit means as a unit.

10. An electric spark igniter according to claim **6**, further comprising an arm (**32**) within the area of the armature (**27**), said arm carrying an elastic contact member (**33, 34**) of an interrupter switch, said arm mounted to said supporting plate (**31**) as an integral part thereof.

11. An electric spark igniter according to claim **10**, further comprising: a front plate (**36**) mounted on the armature-facing end of the induction winding, a stationary counter contact (**35**) mounted insulatedly on the armature-facing end of the inducting winding (**29**) for operative engagement with said elastic contact member (**33, 34**).

12. An electric spark igniter as claimed in claim **10**, further comprising: a front plate (**36**) arranged on the armature-facing side of the winding (**29**) and mounted on the leg portion (**51**).

References Cited

UNITED STATES PATENTS

2,427,719	9/1947	Exner	335—80 X
2,536,468	1/1951	Russell	317—92
3,246,207	4/1966	Remy	317—81

FOREIGN PATENTS

734,080	5/1966	Canada.
964,409	1/1950	France.
965,121	6/1957	Germany.

VOLODYMYR Y. MAYEWSKY, *Primary Examiner.*

U.S. Cl. X.R.

310—70; 315—218; 317—95, 96; 336—105; 431—255, 256