United States Patent [19]

Schindler

[11] **3,760,313**

[45] **Sept. 18, 1973**

[54] **PERMANENT MAGNETIC FLUX CIRCUIT AND AN ACTUATING MEMBER FOR IGNITERS**

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[21] Appl. No.: **220,817**

[30] **Foreign Application Priority Data**

Feb. 28, 1971 Germany ..... P 21 42 294.6

[52] **U.S. Cl.** **335/229**, 310/36, 335/274, 317/81, 317/92, 431/255, 336/175

[51] **Int. Cl.** **H01f 7/08**

[58] **Field of Search** 317/79, 81, 92, 93, 317/132; 431/130, 254, 255, 256; 310/36; 336/178; 315/218; 335/229, 230, 274

[56] **References Cited**

UNITED STATES PATENTS

3,161,806	12/1964	Gordon, Jr.	317/132
3,543,203	11/1970	Alletru	335/229
3,559,131	1/1971	Schindler	335/229
3,424,950	1/1969	Halm	317/93
3,444,435	5/1969	Halm	317/81
3,449,636	6/1969	Wosylus	317/81
3,458,765	7/1969	Schindler	317/81
3,581,155	5/1971	Halm	317/81
3,584,247	6/1971	Pietzonka	310/36
3,610,793	10/1971	Steuernagel et al.	431/130
3,612,736	10/1971	Steuernagel et al.	431/130
3,602,622	8/1971	Cobarg	431/256

FOREIGN PATENTS OR APPLICATIONS

737,572	6/1966	Canada	335/229

Primary Examiner—Volodymyr Y. Mayewsky
Attorney—Ernest F. Marmorek

[57] **ABSTRACT**

An electromagnetic combination for igniters having a permanent magnetic flux circuit including a permanent magnet, an L-shaped soft iron core and an armature, said armature in the closed position closes the magnetic flux circuit and in the open position interrupts the magnetic flux circuit; and an energy storing operating member connected to the armature and extending from the magnet at an operating angle that is sufficiently large to move the armature from the closed position to the open position, when actuated.

10 Claims, 4 Drawing Figures

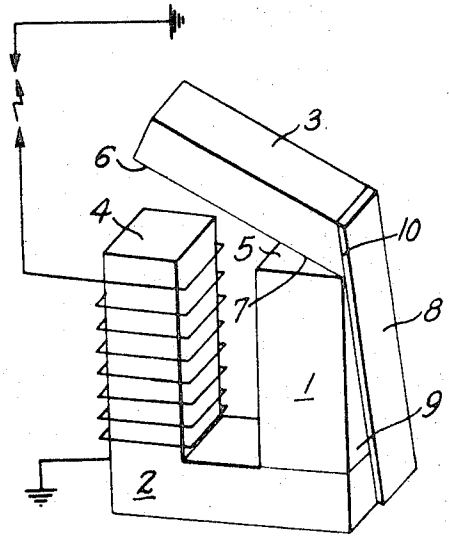


Fig. 1

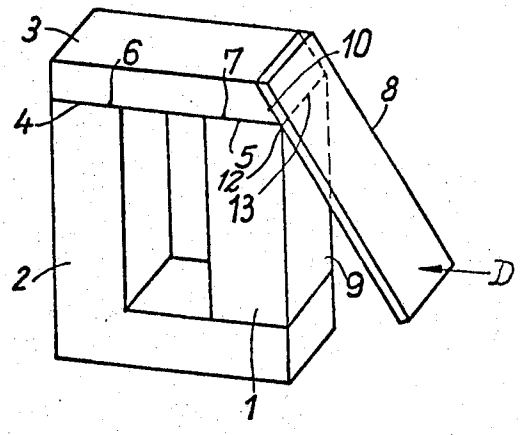


Fig. 2

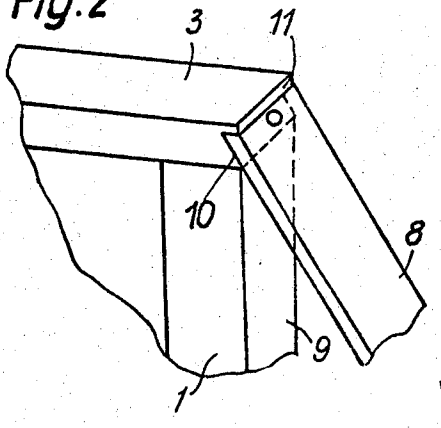
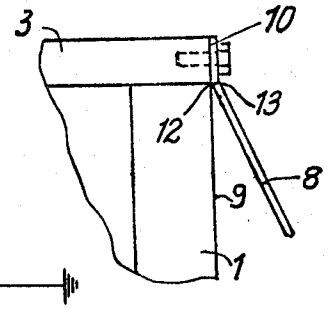


Fig. 3



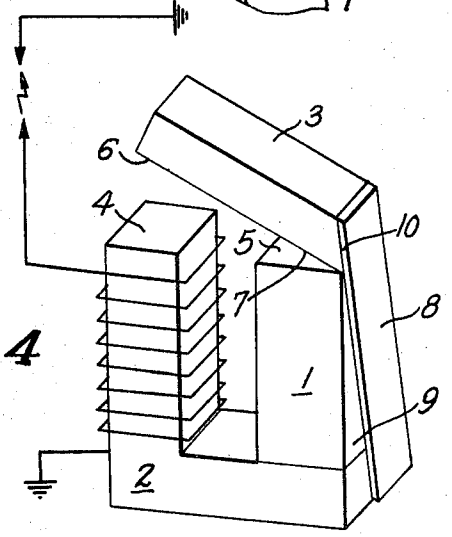


Fig. 4

PERMANENT MAGNETIC FLUX CIRCUIT AND AN ACTUATING MEMBER FOR IGNITERS

CROSS REFERENCE TO RELATED APPLICATIONS

Reference is had to my co-pending application entitled "Lighter with Metal Casing" filed by me on or about the filing date of the instant application and assigned to the assignee of record of the instant application, Ser. No. 222,940 filed on Feb. 2, 1972; and to my application entitled "Magnetic Igniter" filed by me on or about the filing date of the instant application and assigned to the assignee of record of the instant application, Ser. No. 222,954 filed on Feb. 2, 1972.

BACKGROUND OF THE INVENTION

The invention relates to magnetic igniters, and relates more particularly to magnetic igniters of the type that have a magnetic flux circuit including a magnet having two poles and an armature that is movable between a closed, circuit making position and, respectively, an open circuit breaking position at an angle to the closed position; and an energy storing operating member is provided for moving the armature from the closed position to the open position.

Magnetic igniters of the foregoing type are particularly useful for lighters, and desirable features for such magnetic igniters include reliability and safety of handling, and these features generally are found in such igniters previously described. For example, in French Patent No. 1,591,411, a magnetic igniter is disclosed which has a magnetic flux circuit and an operating member which either directly or indirectly is connected to the angularly movable armature; and on the external side of the magnet there is mounted a bearing element that includes a bearing pin about which a second bearing element is movable that is connected to the armature.

The magnetic igniters of the prior art are, however, deficient therein that the bearing structure for the armature that moves between two positions at an angle to each other is complex and costly. Furthermore, the magnetic igniters that have become known, due to the complexity of the bearing elements, require a size which makes the magnetic igniter unwieldy for use in connection with small size pocket lighters.

SUMMARY OF THE INVENTION

It is accordingly among the principal objects of the invention to provide a magnetic igniter that has a sufficiently small size for use in connection with small sized pocket lighters.

It is a further object of the invention to provide a magnetic igniter with a simple and inexpensive bearing means for guiding the armature between the closed and open positions at an angle to each other.

Further objects and advantages of the invention will be set forth in part in the following specification and in part will obvious therefrom without being specifically referred to, the same being realized and attained as pointed out in the claims hereof.

With the above and other objects of the invention in view, the invention consists in the novel construction, arrangement and combination of various devices, elements and parts, as set forth in the claims hereof, certain embodiments of the same being illustrated in the

accompanying drawings and described in the specification.

Broadly speaking, the instant invention provides for an arrangement in which the operating member and the armature are so disposed relative to each other that they form an operating angle with each other of more than 90°, sufficient for moving the armature from the closed position to the open position at an angle to the closed position, and the apex of the operating angle being supported on the edge of the magnet at right angle to the direction of elongation of the armature, which edge among all the edges of the magnet is disposed closest to the operating member.

For a better understanding of the construction and purpose of magnetic igniters for lighters, reference is had to the following U.S. Pats.:

Pat. to Schindler (applicant)
No. 3,458,765
Issued July 29, 1969
Pat. to Halm
No. 3,424,950
Issued Jan. 28, 1969
Pat. to Steuernagel et al.
No. 3,612,736
Issued Oct. 12, 1971
Pat. to Steuernagel, Solzer and Schindler (applicant)
No. 3,610,793
Issued Oct. 5, 1971.

The invention provides for various specific structures. In accordance with a preferred embodiment, the armature has a sloping end surface which is inclined relative to the elongated inner surface of the armature for the operating angle, and has an elongated outer surface which is substantially parallel to the inner surface and intercepts the sloping end surface and is shorter than the elongated inner surface, and the operating member is straight and is connected to the sloping surface and forms thus with the inner armature surface the aforesaid operating angle.

In accordance with another embodiment, the armature has an end surface that is flush with the side surface of one of the magnet poles, and the operating member is connected to that end surface but then is bent to form the operating angle.

In accordance with another embodiment, the armature has an end surface, a portion of which near the inner surface of the armature is inclined relative to that inner surface for the aforesaid operating angle, but the remainder of the end surface defines a shoulder that is operable to receive in abutment the end of the operating member.

The instant invention offers several advantages, among which are a minimum amount of bearing structure parts, because parts already existing in the magnetic igniter structure are used for bearing purposes; and the arrangement of supporting the apex of the operating angle that is formed between the inner surface of the armature and the interior surface of the operating member on the pole edge, thereby considerably reducing the overall volume of the magnetic igniter, which is particularly advantageous for use in connection with small sized pocket lighters.

While the instant magnetic igniter is particularly suited for use in connection with lighters and particularly pocket lighters, that is not the only use for the magnetic igniter of the instant invention. For example,

it may also be used as an igniter for other equipment that uses gaseous fuel.

The operating member may include an operating lever portion that may be formed as a leaf spring; furthermore, the aforesaid supporting edge may be a sharp edge. The aforesaid operating angle should be larger than 90°, and generally ranges from about 95° to 115°, and may optimally be 98°.

BRIEF DESCRIPTION OF THE DRAWINGS:

For a fuller understanding of the nature and object of the invention, reference should be had to the following detailed description, taken in connection with the accompanying drawings, in which:

FIG. 1 is a schematic perspective view showing a magnetic flux circuit of a magnetic igniter in accordance with an embodiment of the instant invention;

FIG. 2 is a fragmentary perspective view similar to FIG. 1, but embodying a modification;

FIG. 3 is a fragmentary plan view of a further modification; and

FIG. 4 is a schematic perspective view showing a conventional magnetic igniter including the magnetic flux circuit of FIG. 1 in its actuated position.

DESCRIPTION OF THE PREFERRED EMBODIMENTS:

In carrying the invention into effect in the embodiments which have been selected for illustration in the accompanying drawings and for description in this specification, and referring now particularly to FIG. 1, there is provided a permanent magnet 1 that has a soft iron core 2 and an armature 3. The magnet 1 and core 2 form a U-shaped structure with two poles, and the poles have upper surfaces 4 and 5 arranged in a plane, respectively.

The armature, in the closed position shown in FIGS. 1–3, extends throughout the entire width of the U-shape, and covers the upper pole surfaces 4 and 5 with corresponding surface portions 6 and 7 which form a part of the inner surface of the armature 3. An operating member 8 is provided that includes a portion that is connected either directly or indirectly, and hence with relation to the end surface 10 of the armature 3, and a lever portion that in all the views hereof extends in the closed armature position at an angle from the side surface 9 of the magnet 1. The interior surface of the lever portion of the operating member 8 forms an operating angle exceeding 90° with the inner surface of the elongated armature 3. This operating angle must be sufficiently large for moving, when actuated, the armature 3 from the illustrating closed position to an open position in which the armature is disposed at an angle to its closed position and breaks the magnetic flux circuit; in the closed position shown, the armature 3 makes the magnetic flux circuit.

As previously indicated, the operating angle can be from about 95° to 115°, and may have an optimal value of 98°.

The end surface 10 of the armature 3 is inclined relative to the elongated inner surface of the armature 3, and the operating member 8 projects from the entire magnet structure at an angle, in FIG. 1.

The armature 3 and the operating member 8, in all three views of the drawing are supported, and hence borne at the apex 12 of the said operating angle on the uppermost edge 13 of the magnet 1 which edge, among all the edges of the magnet poles 1, 2, is closest to the operating member 8. The edge 13 is disposed at right angles to the direction of elongation of the armature 3.

In the modification of FIG. 2, the end surface 10 of the armature slopes only for a portion, and for the remainder defines a shoulder 11 that is operable to receive in abutment the end of the operating member 8. The upper portion of the operating member 8 may be connected to an inclined part of the end portion 10 of the armature 3, for example by means of a screw or a rivet. The shoulder 11 will aid in resisting movement of the operating member 8 while it is being connected to the armature 3.

In the modification of FIG. 3, the armature 3 has an end surface 10 that is flush with the side surface 9 of the pole of the magnet 1. The operating member 10 is bent, and its lever portion extends from the aforesaid edge 13 for an angle, to form between its interior surface and the inner surface of the aperture 3 of the aforesaid operating angle.

Also in the embodiment of FIG. 3, the operating member 8 may be connected to the armature 3 by means of screw as shown, or by means of a rivet.

Furthermore, in all of the embodiments of the instant invention herein disclosed, the operating member 8, either in addition to the attachment by screw or rivet, or without attachment by screw or rivet, may be soldered or brazed to the end surface 10 of the armature 3.

The armature 3 is lifted off its closed position (FIG. 4) shown due to a force D (FIG. 1) exerted in the direction shown in FIG. 1 by an arrow, and during the application of the force D, the edge 13 of the magnet pole acts in conjunction with the apex 12 of the operating member 8 and the armature 3 as a knife-edge bearing.

OPERATION

The operation will be evident from what has been said in the foregoing. When the force D is applied in the direction of the arrow of FIG. 1, against the operating member 8, the armature 3 will be lifted angularly off its closed position into the open position (FIG. 4) thereby interrupting the magnetic flux and causing a magnetic ignition current to flow. This current flow is described in my U.S. Pat. No. 3,458,765 mentioned hereinbefore.

The lifting of the armature 3 of the poles 1 and 2 takes place while overcoming the magnetic force exerted by the poles 1 and 2 against the armature.

I wish it to be understood that I do not desire to be limited to the exact details of construction shown and described, for obvious modifications will occur to a person skilled in the art.

Having thus described the invention, what I claim as new and desire to be secured by Letters Patent is as follows:

1. In an electromagnetic ignitor,
a combination comprising,
a permanent magnetic flux circuit including a permanent magnet, an L-shaped soft iron core and an armature:
said magnet and said core forming a U-shaped magnetic structure with two poles having upper surfaces arranged in a plane:
the upper pole surface of the magnet forming with an adjacent outer side surface of said magnet an angle of substantially 90° thus defining a tilting edge;

the armature extending throughout the entire width of the U-shaped structure and covering the upper pole surfaces with corresponding surface portions which form a part of the inner surface of the armature;

said armature being mounted tiltably about said edge between a magnetic flux closing position in which it bridges said upper pole surfaces and, respectively, a magnetic flux opening position in which it is inclined relative to said plane; and

a resilient, energy storing, operating member being attached to the end surface of said armature in the region of tilting;

said operating member having a lever portion forming with said armature an apex abutting against said edge;

said lever portion and said inner armature surface forming an operating angle ranging from about 95° to about 115° in the magnetic flux closing position of the armature, whereby upon actuation of said lever portion overcoming the magnetic attraction force exerted against the armature by the U-shaped magnetic structure in the flux closing position, the armature will be tilted about said edge from the flux closing position toward the flux opening position.

2. In an electromagnetic igniter, as claimed in claim **1**, said armature having a sloping end surface inclined relative to said elongated inner surface for said operating angle, and having an elongated outer surface substantially parallel to said inner surface and intersecting said end surface and being shorter than said elongated surface, said operating member being substantially straight throughout and connected to said sloping end surface, whereby said operating member will form with said inner armature surface said operating angle.

3. In an electromagnetic igniter, as claimed in claim **1**, said armature having an end surface substantially flush with outer side surface of said magnet, said operating member being connected to said end surface, said lever portion extending from said apex relative to said inner surface at said operating angle.

4. In an electromagnetic igniter, as claimed in claim **1**, said armature having an end surface a portion of which near said inner surface being inclined relative to said inner surface for said operating angle, the remaining of said end surface defining a shoulder operable to receive in abutment the end of said operating member.

5. In an electromagnetic igniter, as claimed in claim **2**, said operating member being formed as a leaf spring.

6. In an electromagnetic igniter, as claimed in claim **2**, said operating member being cemented to said armature.

7. In an electromagnetic ignite, as claimed in claim **3**, said operating member being connected to said armature by means of a screw.

8. In an electromagnetic igniter, as claimed in claim **2**, said operating member being soldered to said end surface of said armature.

9. In an electromagnetic igniter, as claimed in claim **2**, said operating member being brazed to said end surface of said armature.

10. A magnetic igniter, as claimed in claim **2**, said operating angle being 98°.

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