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[54] MAGNETIC IGNITER

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[57] ABSTRACT

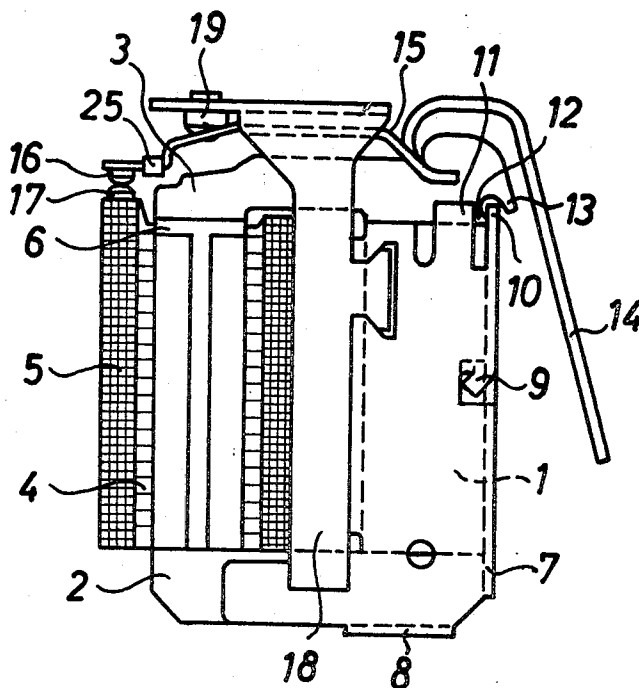
A magnetic igniter for a lighter, comprising a magnetic circuit including an induction coil, a permanent magnet, a body of magnetizable material and a movable armature, means for operating the armature, a pair of contacts movable relative to each other on operation of the armature to open and close the magnetic circuit, and spring means for reducing the contact pressure between said pair of contacts.

[56] References Cited

5 Claims, 5 Drawing Figures

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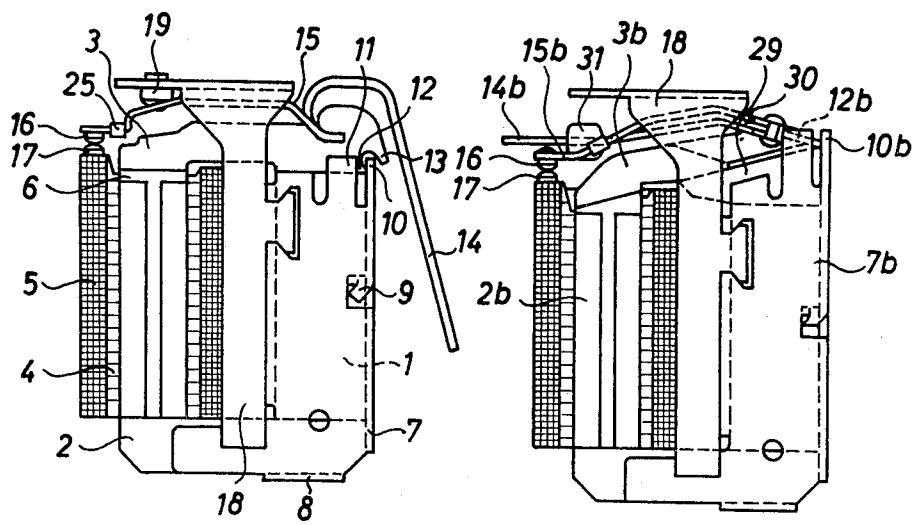


Fig. 1

Fig. 4

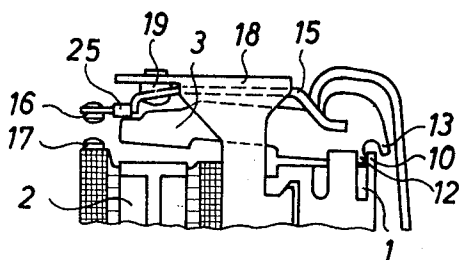


Fig. 2

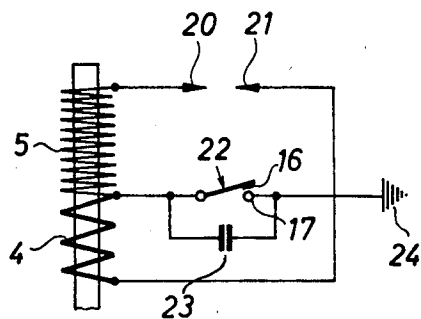


Fig. 5

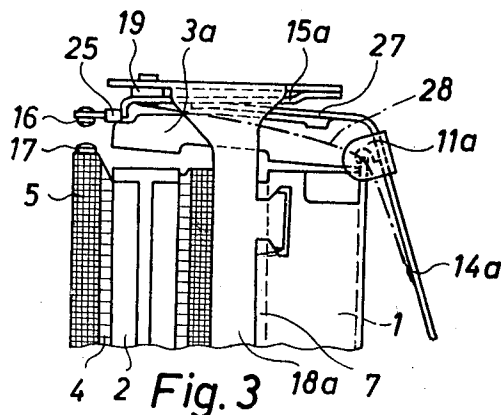


Fig. 3

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MAGNETIC IGNITER

The invention concerns a magnetic igniter, more particularly a make-and-break magnetic igniter for pocket lighters.

In a previously proposed magnetic igniter for pocket lighters the power for opening the contact spring is derived solely from the movement of a make-and-break armature. This is suitably decreased, the breaking speed and consequently the alteration of the magnetic flow per unit of time is decreased. The ignition efficiency left by the decrease of the alteration of flow is of greater disadvantage the smaller the design of the magnetic igniter. It is indeed possible to obtain a higher breaking speed and consequent higher ignition efficiency by use of a lower contact pressure. However, if low contact pressure is applied special material must be used to provide a satisfactory contact, such material being relatively soft and thus only allowing a limited number of ignitions.

The object of the invention is to provide a magnetic igniter of small construction yet having a high ignition efficiency and long life.

According to the invention there is provided a magnetic igniter for a lighter, a magnetic circuit including an induction coil, a permanent magnet, a body of magnetizable material and a movable armature, means for operating the armature, a pair of contacts movable relative to each other on operation of the armature to open and close the magnetic circuit, and spring means for reducing the contact pressure between said pair of contacts.

Thus the invention resides in the appreciation that the contact pressure between the contacts to close the magnetic circuit or when the magnetic circuit is closed, may be considerably greater than the contact pressure shortly before the operation of the armature to open the contacts.

The pre-tensioning of the contact spring is reduced at least in the area between the striking position of the armature and the contact part. Thus the armature only has to overcome the residual contact force, which may lie within the order of magnitude which makes it possible to keep the contacts closed. For this a considerably smaller force is necessary than to close the interrupter contact, i.e., for building a transmission position for the electric current which does not have such loss. In accordance with the invention the closure pressure may be selected to be relatively high, the use of a contact material resistant to wear, more particularly tungsten is possible, which has a long life. Due to the decrease of the contact pressure directly before the opening of the contact, the latter can be opened with only small loss in efficiency by breaking the make-and-break armature on lifting the movable contact part. The decrease in the ignition efficiency of the ignition system is less, the smaller the resistances against the armature on its track when breaking. As the efficiency of a magnetic igniter, although of the same design, decreases the smaller the embodiment thereof, in this case the prevention of losses for the production of a given ignition efficiency is of greater significance than in the larger magnetic igniters. A lessening of the noise of the armature striking on the part serving to lift the contact spring is a further advantage of the decrease of the power needed to open the contact by the armature.

In a further development of the invention the spring means is a contact spring mounted on the armature. On breaking of the armature the power of contact is less the greater the path travelled by the armature. Due to continuous closing movement of the armature when the contact is already closed, a displacement takes place in the plane of the contact surfaces which exerts a self-cleaning action on the contact. Furthermore, a smaller operational power, which corresponds to the smaller contact power is necessary to operate the magnetic igniter, as the power of the contact spring stands in opposition to the power of attraction between the armature and the stationery magnetic pole piece in the magnetic circuit. When the magnetic circuit is closed the magnetic holding power serves to pre-tension the contact spring.

A decrease of the power of the contact spring in addition to its mounting on the armature or with a contact spring separated therefrom and fixedly mounted is obtained in an advantageous manner by mounting a resilient dog on the operating member so that the dog engages at least indirectly on the movable contact part. In this case on operation of the member for breaking the armature the power exerted on the contact by the contact spring is decreased so that the power to be used by the armature to open the contact is considerably less than the power which would otherwise have to be used and substantially corresponds to the closing power of the contact. Due to the resilient construction of the dog the latter also decreases the power to be applied by a fixedly mounted contact spring and with the armature open.

Specific embodiments of the invention will now be described by way of example with reference to the accompanying drawing, in which:

FIG. 1 shows a side elevation of a first embodiment of a magnetic igniter in partial section;

FIG. 2 is a side elevation of a portion of the first embodiment of FIG. 1 with some of the parts in a different position;

FIG. 3 is a portion corresponding to FIG. 2 of a second embodiment;

FIG. 4 is a side elevation of a third embodiment;

FIG. 5 is a circuit diagram;

Referring to FIG. 1 a rod shaped permanent magnet 1, a magnetic pole piece 2 angular in side elevation, the permanent magnet 1 and the magnetic pole piece 2 being arranged in the form of a U seen from the side and a make-and-break armature 3 closing the open end of the U form a substantially rectangular magnetic circuit. The magnetic pole piece 2 and the make-and-break armature 3 consist of individual, mutually magnetically insulated lamina. The contact surfaces between the permanent magnet 1, the magnetic pole piece 2 and the make-and-break armature 3 are polished. A low tension coil 4 is wound on one arm of the magnetic pole piece 2 over which a high tension coil 5 is mounted. The body of the magnetic pole piece 2 is substantially circular in cross-section laterally projecting lugs 6 being provided at the upper end of the pole piece 2 so that the said upper end is square or rectangular.

The permanent magnet 1 and the magnetic pole piece 2 are held together by a frame 7 made of non-magnetic material and which surrounds the permanent

magnet 1 on all sides without the ends of the frame 7 touching one another. The magnetic pole piece 2 is held in position by lugs 8 directed inwardly of the frame, which lugs may be welded together. At least one recess is provided in the permanent magnet 1 running above one of its edges. A prong 9 bent out of the frame 7 is engaged in the recess and abuts against a wall of the recess so as to urge the permanent magnet 1 towards the magnetic pole piece 2. The frame 7 extends laterally beyond the permanent magnet 1 in the form of lugs 10 and 11.

The magnetic pole piece 2 can have a recess corresponding to the permanent magnet 1 wherein the frame 7 engages in the vicinity of the lug 8. The described arrangement prevents displacement of the magnetic pole piece 2 at right angles to the axis of the permanent magnet 1.

The lugs 11 are disposed on each side of the make-and-break armature 3 and serve to hold it laterally. Instead of the lugs 11, lateral projections on the lug 10 could be bent round, which would likewise serve to secure the make-and-break armature 3 laterally. In that arrangement the lug 10 has a U-shaped cross-section in the area of its bent lateral projections.

The lug 10 together with the permanent magnet 1 forms a bearing surface for an edge 12 of the armature 3. The armature is provided with a nose 13 separated from the edge 12 by a recess of substantially semicircular cross-section. This arrangement co-operating with the lug 10 and prevents undesired displacement of the make-and-break armature 3 on the ends of the permanent magnet 1 and of the magnetic pole piece 2 in the direction of the coils 4 and 5. One end of an operating member comprising a spring 14 is engaged in a recess formed in the armature 3, the other end extending at an acute angle to the permanent magnet 1 and at a distance therefrom.

One end of a contact spring 15 is also located in the same recess as the said one end of the spring 14. The contact spring 15 carries a contact member 16 at its other end and contact member 16 co-operates with a contact member 17 mounted on the coil 5. At least the contact surfaces of the contact members 16 and 17 consist of a non-corrodible metal such as tungsten which requires a contact pressure of from 350—400 p. and the contact spring 15 is suitably designed for that purpose.

The holder frame 7 is provided with recesses co-operable with a U-shaped stop frame 18. The stop frame carries a resilient stop member 19 adjacent the make-and-brake armature 3. The stop frame 18 is not necessary provided that the stop member can be mounted in its desired position on some other part, for example the wall.

As shown in FIG. 5 the coils 4 and 5 are connected in series, the other ends of the coils being connected to electrodes 21 and 20 respectively. A switch 22 is connected in parallel with the coil 4, a condenser 23 being connected in parallel with the switch. The electrode 21 is grounded. The contacts of the switch 22 are in fact the contact members 16 and 17 and are operable by the make-and-break armature 3. After release of the operating member 14, the make-and-break armature 3 returns to its initial position shown in FIG. 1 under the action of the magnetic forces in the magnetic system. FIG. 2 shows the device with the contacts 16, 17 open.

During the breaking movement of the make-and-break armature 3, the power with which the contact members 16 and 17 rest on one another decreases, as the make-and-break armature engages the contact spring 15. The contact member 16 and along with it the contact spring 15 is raised from the contact member 17 thereby the switch 22 opened, when the alteration of the magnetic flow is at its greatest (FIG. 2). Due to the arrangement of the contact spring on the make-and-break armature 3 the contact power decreases with increased pivoting of the make-and-break armature 3. The pressure on the contact members 16, 17 is so chosen that, when the magnet circuit is closed it is several times greater than shortly before the opening of the contact by the make-and-break armature. The design can be such that starting from a power of contact of about 400 p, the make-and-break armature 3 on the stop member 25 has to overcome a residual power of contact of, for example, about 50 p. Due to the use of a non-corrodible metal, for example, tungsten for the contact, a very high number of ignitions can be obtained with the make-and-break magnetic igniter. The power, with which the contact members 16 and 17 are held together when the make-and-break igniter is at rest (FIG. 1) works against the power which urges the make-and-break armature against the magnetic pole piece 2 and to a certain degree also onto the permanent magnet 1.

In the second embodiment, shown by way of example in FIG. 3, parts corresponding to those in the first embodiment bear the same reference numbers, altered parts have the letter *a* added. The contact spring 15*a* is, in this embodiment, not mounted on the make-and-break armature 3*a* but is secured to a projection, adjacent the bearing, of the stop frame 18*a*. The operating member 14*a* is secured on the armature 3*a*, the part 27 thereof being resilient. For the operation of the magnetic igniter, it is however an advantage, if the part of the operating member 14*a* accepting the operational power is also resilient, the part 27 can then by preference be made considerably softer. The contact spring 15*a* is so designed that it only exerts the contact pressure which is necessary to hold the contact parts 16 and 17 together when the contact is closed. The pressure required to close the contacts 16, 17 is transferred from the resilient part 27 of the operating member 14*a* to the contact spring 15*a* for which purpose the resilient contact part 27 is either connected securely to the contact spring 15*a* at least at right angles to its resting surface, or overlaps the said contact spring, preferably laterally so that a force acting in the closure direction of the contacts 16, 17 can be exerted by the resilient part 27 on the contact spring 15*a*.

A spring shown in chain-dotted line may be provided instead of the part 27, which either, as shown rest with its ends freely on the operating member 14*a* and on the contact spring 15*a*, producing the pressure to close the contacts, respectively, and is supported or mounted therebetween (substantially at its middle), or whose middle is free and whose ends support themselves on projections on the operating member 14*a* and on the contact spring 15*a* respectively.

The lugs 11 of the first embodiment are here replaced by a U-shaped stirrup 11*a* mounted on the operating member 14*a* which forms a bearing for the operating member 14*a*.

The third embodiment shown in FIG. 4 by way of example has a make-and-break armature 3b which is considerably shorter than those in the previous embodiments, which requires special design of the permanent magnetic or the additional provision of a magnetic pole piece 29 which is securely connected to the permanent magnet. Contact surfaces of the make-and-break armature 3b, in this embodiment also lie in a plane inclined to the axis of the magnetic pole piece 2b carrying the coils. The make-and-break armature 3b is mounted in a substantially U-shaped bearing stirrup 30, which has a bearing edge 12b positioned adjacent a lug 10b of the carrier frame 7b, the lateral lugs being provided as in the first described embodiment for retaining the make-and-break armature 3b in its correct position. A contact spring 15b and an operating member are secured to the bearing stirrup 30. In this embodiment the operating member carries a dog 31, which co-operates with the contact spring 15b in such a manner that on operation of the operating member 14b for the breaking of the make-and-break armature 3b the pressure on the two contacts 16 and 17 is diminished to the smallest possible value before the make-and-break armature 3b breaks the contacts.

When the operating member is designed as shown in the embodiment shown in FIG. 4 and use is made of a dog corresponding to the dog 31, the contact spring 15 may be disposed at some other position than on the make-and-break armature 3, for example on an arm of the holding frame 7.

The dog 31 consisting of resilient material, is conveniently, so designed that from it an arm engages resiliently below the contact spring 15b, the arm being integral with the dog 31 or inserted therein. The dog 31 built of resilient material can serve at the same time as the stop-buffer. The dog may also be designed as a leaf spring folded in zig-zags, one of whose ends is attached to the operating member 14b and the other to the contact spring 15b.

It has been found that high contact power is only necessary to close the contact, but to maintain the contact a much smaller power is sufficient, so that the decrease of the contact power shortly before the breaking of the make-and-break armature does not cause any increase of the transitional resistance between the members of the contact.

The embodiments shown on the drawing by way of

example only are larger than in reality, about in the scale 2 : 1.

What is claimed is:

1. A magnetic spark igniter for lighters of the type having at least one permanent magnet, a body of magnetizable material, and an electric circuit including at least one induction coil, comprising:
 - an armature rotatable from a first position in which a closed magnetic circuit is formed by said permanent magnet, said body of magnetizable material and said one induction coil to a second position where an open magnetic circuit is formed;
 - a fixed electrically grounded contact;
 - a contact moved from a first position in contact with said fixed contact to a second position separated from said fixed contact by movement of said armature;
 - a spark gap having an electrode connected directly to one of said contacts and another electrode connected by means of at least one said induction coil to the other contact;
 - means for moving said armature to separate said fixed contact and said movable contact so as to generate a spark across said spark gap;
 - a resilient element carrying said movable contact; and
 - means for reducing the contact pressure between said fixed contact and said movable contact prior to movement therebetween.
2. A magnetic spark igniter as in claim 1, further comprising a frame member and wherein said resilient element for reducing the contact pressure is a spring mounted to said frame member and actuated by said means for moving said armature.
3. A magnetic spark igniter as in claim 1, wherein said armature is pivotable about a point remote from said fixed and said movable contact, said resilient element is a spring being secured to said armature adjacent said point.
4. A magnetic spark igniter as in claim 3, wherein said resilient element is resiliently connected with said means for moving said armature.
5. A magnetic spark igniter as in claim 1, wherein said resilient element provides only sufficient pressure on said fixed and movable contacts to keep said contacts closed, and further comprising a means for closing said contacts.

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