

PATENT SPECIFICATION

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(54) AN IGNITION DEVICE FOR ELECTRICALLY IGNITED PROJECTILE FUSE

(71) We, WERKZEUGMASCHINEN-FABRIK OERLIKON-BÜHRLE AG, a company organised and existing under the laws of Switzerland, of Birchstrasse 155, CH-8050 Zurich, Switzerland, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

The present invention relates to an ignition device for an electrically ignited projectile fuse of the type comprising a housing in which there are arranged a permanent magnet component, an induction coil component and a soft iron core component, two of these components are movable or displaceable relative to one another, and elements or means of the device prevent unintentional movement or displacement of the movable component or components.

There is already known to the art an ignition device for current generator means of an electrical fuze of this type wherein the displaceable component or part, after firing or impact of the projectile, shears-off a safety element which elastically restrains or holds the displaceable component or part in such a manner that the elastic mounting or bearing arrangement is capable of resiliently absorbing shocks arising during transport of the projectile without destroying the safety element.

This state-of-the-art ignition device no longer fulfills the high demands presently placed upon such type device. In the presence of extreme shocks or blows the danger still exists that such type safety element will be sheared away.

Accordingly the present invention provides an ignition device for an electrically ignited projectile fuse comprising a housing member, a current generator having a permanent magnet component, an induction coil component and a soft iron core component arranged in said housing member, two of said components being fixed in said housing and the third

component being mounted to be relatively movable with respect to said two other components, a safety device comprising means for preventing unintentional movement of the movable component, said movement preventing means comprising rods structured for buckling, a member fixed to the housing member, each of the rods having opposed ends and secured at one end to the housing-fixed member and at their other end at the movable component and permitting displacement of the movable component only after overcoming the buckling resistance of the rods.

Reference is now made to the accompanying drawings, in which

Figure 1 is a fragmentary cross-sectional view of a fuze illustrated in its unarmed or safety position;

Figure 2 illustrates the fuze of Figure 1 after firing;

Figure 3 is a schematic front view, on an enlarged scale, of a portion of the arrangement of Figures 1 and 2 during firing of the projectile; and

Figure 4 is a cross-sectional view taken substantially along the line IV—IV of Figure 3.

Describing now the drawings, it is to be understood that for the sake of simplicity in illustration only enough of the details of the projectile fuze have been shown to enable those skilled in the art to readily understand the underlying concepts of the present invention which is directed to the ignition device thereof and which of course will be considered fully. Turning attention to Figure 1, there will be recognized a housing 10 in which there is arranged a sleeve 13 or equivalent structure housing a conventional electronic control device 11 and an energy storage means, typically for instance a capacitor 12. Sleeve 13 defines a housing-fixed part or component, e.g. is press fitted. In order to charge the capacitor 12 there is provided a current generator possessing a core 14 formed of soft iron which is secured by means of its flange 15 in any suitable

15 manner at the housing 10. The core 14
contains within a groove 16 an induction
coil component 17. Further, a substantially
ring-shaped permanent magnet component
18 and a soft iron ring component 19 are
displaceably arranged upon the core 14. The
permanent magnet 18 and the soft iron ring
19 secured thereto can be displaced or
moved out of a first position shown in
10 Figure 1 into a second position shown in
Figure 2. This displacement of the
permanent magnet 18 and the soft iron ring
19 is greater than the width of the groove 16
provided for the induction coil or winding
15 17. The induction coil 17 is electrically
connected in conventional manner with the
capacitor 12. In this electrical circuit
connection arrangement there can be
incorporated a rectifier which prevents
20 discharge of the charged capacitor 12
through the induction coil 17. Instead of the
rectifier or rectifier arrangement there
could be employed a switch which,
following charging of the capacitor 12,
25 renders possible interrupting the electrical
connection between the induction coil 17
and the capacitor 12.

Further there is provided a switch which
enables connecting the capacitor 12 with an
30 electrical detonator cap which can be
arranged in the space or compartment 20 in
order to initiate detonation of the
projectile. This switch either can be
activated upon impact of the projectile at
35 the target or by a timing relay which enables
self-destruction of the projectile after the
expiration of an adjustable period of time.
There is additionally provided a further
switch, for instance a centrifugal switch,
40 which turns-on the timing relay at the start
of rotation or spin of the projectile in order
that the projectile can be exploded
following the expiration of the set or
adjusted time. Finally, there is provided a
45 transport safety means or device which
ensures that the capacitor 12 cannot be
charged during transport of the projectile
due to an unintentional shock or blow
which may be unintentionally applied to the
50 projectile.

The foregoing structure is basically
conventional in this art and therefore
further details thereof as well as any further
showing of certain of the described
55 elements, apart from those illustrated,
have been omitted to preserve clarity
in illustration and to confine the disclosure
to the actual improvement aspects of this
development.

60 It is in fact the transport safety device or
means which constitutes the actual
invention of this disclosure and therefore
the same will be now described in detail.

65 According to the showing of Figures 3
and 4 blindhole bores 21 or equivalent

structure are preferably uniformly arranged
about the periphery of both the soft iron
ring component 19 and also the housing-
fixed sleeve 13. Extending into oppositely
situated blindhole bores 21 are the
70 respective ends of rods or bars 22 or
equivalent structure, these rods 22 being
arranged essentially parallel to the fuze axis
in a circle which is essentially concentric to
such fuze axis. These rods 22 safeguard
75 against a premature displacement of the
permanent magnet component 18 and the
soft iron ring component 19 and delay such
displacement after firing the projectile.

Suitable for use as the rods 22 are, for
80 instance, small tubes 22a each of which are
slotted in their lengthwise direction, for
instance as indicated by reference character
30 for the tube designated in Figure 3 by
reference character 22b, and therefore can
85 resiliently bear at the wall of each
associated blindhole bores 21. Instead of using
small tubes or tubular members there can
be employed small rods or bars 22
possessing an optional cross-sectional
90 configuration, so that the bending or
buckling resistance of such rods 22 can be
freely selected. Apart from the ability to
freely select the cross-sectional shape of
these elements it is also possible to freely
95 select the wall thickness of such rods 22.
Another optional selection which is possible
relates to the number of rods 22.

The mode of operation of the described
electrical fuze is as follows:

100 During transport of the projectile the
rods 22 or equivalent structure prevent
unintentional movement or displacement of
the permanent magnet component 18 and
the soft iron ring component 19.

105 Upon firing of the projectile the
acceleration thereof is incapable of
displacing or moving the permanent magnet
component 18 and the soft iron ring
component 19 for such length of time as the
110 projectile guide band is not yet located
along the course or extent of the weapon
barrel and which guide band, as is known in
this art, imparts the spin or rotation to the
projectile. Only the inertia force acting at
115 the permanent magnet component 18 with
the soft iron ring component 19, due to the
spin acceleration, is able to rotate such
relative to the housing 10 and the therein
secured sleeve 13. Due to this rotation the
120 rods 22 buckle or bend. The start of this
operation has been illustrated in Figure 3.
As soon as the axes of two oppositely
situated blindhole bores 21 no longer
coincide then the axial inertia force acting
125 upon the permanent magnet component 18
and the soft iron ring component 19 is
capable of buckling or bending the rods 22,
resulting in the component or parts 18 and
19 assuming the position shown in Figure 2. 130

Displacement of the permanent magnet component 18 and the soft iron ring component 19 is thus first initiated after the spin acceleration and the axial acceleration of the projectile have reached a value which is dependent upon the resistance to deformation or buckling of the rods 22, i.e. under the action of large inertia forces, so that the change of the magnetic flux as a function of time becomes larger than would be the case if there were not provided any rods 22. Hence, with less windings of the coil it is possible to advantageously induce a predetermined voltage.

In Figure 3 the rods have been shown, for purposes of simplicity in the illustration, at the same spacing, although this is not completely correct. In Figure 2 there has been neglected the thickness of the flatly pressed rods 22 which only amounts to a few hundredths of a millimeter.

WHAT WE CLAIM IS:—

1. An ignition device for an electrically ignited projectile fuse comprising a housing member, a current generator having a permanent magnet component, an induction coil component and a soft iron core component arranged in said housing member, two of said components being fixed in said housing and the third component being mounted to be relatively movable with respect to said two other components, a safety device comprising means for preventing unintentional

movement of the movable component, said movement preventing means comprising rods structured for buckling, a member fixed to the housing member, each of the rods having opposed ends and secured at one end to the housing-fixed member and at their other end at the movable component and permitting displacement of the movable component only after overcoming the buckling resistance of the rods.

2. An ignition device for an electrically ignited projectile fuse as defined in claim 1, wherein the rods each comprise a tubular-like member incorporating means imparting resilient properties to each said rod, the housing-fixed member having bore means for receiving the rods and the movable component having bore means for receiving said rods, each rod resiliently protruding at one end into said bore means and at its other end resiliently protruding into said bore means of the movable component.

3. An ignition device for an electrically ignited projectile fuse as defined in claim 2, wherein said resilient property-imparting means comprises slotted tubes defining the tubular like means.

4. A device substantially as herein described with reference to and as shown in the accompanying drawings.

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PATENTS ACT 1949

SPECIFICATION NO 1497893

Amendment is made in accordance with the Decision of the Principal Examiner acting for the
Controller-General, dated the 4th day of September 1978 under Section 9 in the following manner:

Reference has been directed in pursuance of Section 9 subsection (1) of the Patents Act
1949 to Patent No. 1499858

2 PATENT OFFICE
October 1978

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