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(54) SELF-DESTRUCTION TYPE DELAYED-ACTION FUSE FOR SPINNING PROJECTILES

(71) We, WERKZEUGMASCHINENFABRIK OERLIKON-BUHRLE 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 a new and improved construction of a self-destruction type nose fuse or delayed-action fuse for spinning projectiles which is of the type comprising an axially displaceable firing or ignition pin which can be brought to bear at an axially displaceable impact body against the force of a self-destruction spring by centrifugal bodies — which bear against a ramp —, as long as the projectile spin is above a boundary value determinative of the self-destruction, the impact body being located internally of a hollow space or compartment of the fuse housing and which hollow space is closed towards the front. The term impact body defines a body having a mass which enables it to strike and actuate a firing pin.

According to a known fuse of this type the impact body directly bears at the front wall of the hollow space or compartment and the firing pin in turn bears by means of its end surface at the impact body. This bearing action, upon impact of the projectile, insures for the consistent utilization of the further transmission of energy from the mass of the fuse tip to the mass of the firing pin according to the laws of elastic impact or percussion.

However, the heretofore known prior art arrangement is associated with the drawback that for certain fields of application it is much too response-sensitive, i.e. the response time is so short that the projectile detonates when its greatest portion is still

in front of the target. This is particularly disadvantageous when firing the projectile at aircraft.

Hence, it is an object of the present invention to provide an improved delayed-action fuse for spinning projectiles which is not associated with the aforementioned drawbacks and limitations of the prior art proposals.

The present invention provides a fuse, having a fuse housing, an axially displaceable firing pin arranged within said fuse housing, an axially displaceable impact body for actuating said firing pin, the impact body being located internally of the fuse housing, said fuse housing having two oppositely situated support surfaces, a bushing supported in the fuse housing between said two oppositely situated support surfaces of the fuse housing, said bushing having an outer wall and internally possessing a shoulder against which bears the impact body for the transmission of an impact impulse from the fuse housing to the impact body and thence to the firing pin, a hollow space provided between the fuse housing and the outer wall of the bushing, and the bushing being formed of a material of greater strength than the fuse housing. The invention also provides a self-destruction delayed-action fuse for spinning projectiles, comprising a fuse housing containing a forwardly closed hollow compartment, means defining a ramp, centrifugal bodies bearing against said ramp, an axially displaceable firing pin, a self destruction spring co-operating with said firing pin, an axially displaceable impact body for actuating said firing pin, the axially displaceable firing pin being brought to bear against the axially displaceable impact body against the force of the self-destruction spring by the centrifugal bodies bearing against said ramp as long as the spin of the projectile is

located above a boundary value determinative of self-destruction, the impact body being located internally of the hollow compartment of the fuse housing, said fuse housing having two oppositely situated support surfaces, a bushing clamped in the hollow compartment between said two oppositely situated support surfaces of the fuse housing, said bushing having an outer wall and internally possessing a shoulder against which bears an end face of the impact body for the positive transmission of the impact impulse from the fuse housing forming fuse tip means to the impact body and thence to the firing pin, a hollow space provided between the fuse housing and the outer wall of the bushing, and wherein the bushing is formed of a material of greater strength than the fuse housing.

At the fuse itself the factors which come into consideration is the material, the configuration and the mass of the fuse housing, impact body and firing pin. At the target there is also of significance the material and the thickness of the wall which is to be penetrated.

Now with the foregoing in mind the fuse of this development is manifested by the features that in the aforementioned hollow space there is clamped a bushing between two oppositely situated support surfaces of the fuse housing. Internally of the bushing there is provided a shoulder against which bears an end surface of the impact body for the positive transmission of the impact shocks or pulses from the fuse housing forming the fuse tip to the impact body. Further, a hollow space or compartment is provided between the fuse housing and the outer wall of the bushing, and the bushing is formed of a material of greater strength than that of the fuse housing.

The elastic shock upon impact of the fuse tip at the target therefore must be transmitted from the fuse tip via the bushing and via the impact body to the firing or ignition pin, with the result that there is obtained the desired time delay.

The invention will be better understood and objects other than those set forth above, will become apparent when consideration is given to the following detailed description thereof. Such description makes reference to the annexed drawings wherein:

Figure 1 is an axial partial sectional view through a fuse in the safety or unarmed position; and

Figure 2 illustrates the same fuse as portrayed in Figure 1 but this time in the armed position or state.

Describing now the drawings, according to the showing of fuse portrayed in Figure 1 a substantially truncated conical-shaped

fuse housing 1 formed of light metal, for instance, avional (aluminum-copper-magnesium alloy), possesses a central bore which is subdivided into four portions or sections possessing different diameters. The forwardmost bore portion 4 is a blind-hole bore and possesses the smallest diameter. Thereafter there follow both of the bore sections or portions 3a and 3b, the transition of which is formed by a conical surface 5. A closure body 6 with a forwardly protruding cylindrical projection 7 is threaded into the rearmost bore portion 2 which possesses the largest diameter. A substantially disc-shaped rotor 8 is rotatably mounted in a not particularly referenced groove or recess of the projection 7. The rotor 8 has a continuous bore 9 into which there is inserted a detonator cap 10. The axis of the bore 9 together with the rearwardly directed fuse axis encloses an acute angle. A sleeve 11 arranged in the bore 2 has an intermediate bottom or floor 12 which extends essentially perpendicular to the axis of the fuse. The sleeve 11 bears through the agency of the intermediate floor 12 upon the projection or attachment 7. Connected with the front portion of the sleeve 11 is a ring or ring member 13 formed of steel, a conical-shaped bore 14 of which opens towards the front. A bushing 15 formed of a light metal alloy, for instance Perunal, is centered with very little play in the bore sections or portions 3a, 3b. The material of which the bushing is formed has a greater strength than the material of which the fuse housing 1 is formed. The rear portion or region 16 of the bushing 15 possesses a smaller wall thickness than the front portion 40. A conical shoulder 15a of the bushing 15 is spaced from the bore portion or conical surface 5. The bushing 15 bears against the ring or ring member 13 and its front end surface 15b bears against a bore shoulder 17 of the housing 1, this bore shoulder 17 being directed essentially perpendicular to the lengthwise axis of the fuse. A stepped portion or shoulder 18 which is likewise disposed transversely with respect to the fuse axis separates two bore sections 19 and 20 of the bushing 15 from one another. The rear portion or section 16 and the front portion or section 40 of the bushing 15 possess a smaller external diameter than the intermediate section or portion 41.

A cylindrical impact body 21 formed of steel is equipped with a flange 22. The impact body 21 extends with play through the bushing 15 and is centered and movably mounted in the bore portion or section 4 and by means of the flange 22 in the bore section or portion 19 of the bushing 15. The impact body 21, the end surface 21a of which possesses a spacing from the

base 4a of the bore portion or section 4, is loaded by the forwardly effective force of a self-destruction type spring 23 and bears under the action thereof by means of the flange 22 at the stepped portion 18 of the bushing 15. A firing pin 24 possesses at its front end a sleeve 25 which is stepped in diameter. A shoulder of the sleeve 25 which is directed perpendicular to the fuse axis has been designated by reference character 26. The sleeve 25 is guided in bores 13a and 12a of the ring 13 and the intermediate floor or bottom 12, respectively. The components of a self-destruction mechanism are arranged in conventional manner. In radial bores 27 of the sleeve 25 there are located substantially spherical or ball-shaped centrifugal bodies 28, at the outside of which there is oppositely situated the conical surface or bore 14 of the ring or ring member 13. A likewise conventional safety or securing device for the sleeve 25 with the firing pin 24 consists of a slotted ring or ring member 29 provided with radial grooves and formed of light metal, a thin spiral band 30 wound thereon and a securing or safety band 31 enclosing the same. The sleeve 25 bears under the pressure of the spring 23 with its shoulder 26 at the ring 29. The ring-shaped end surface 32 of the sleeve 25 possesses a small spacing from the impact body 21.

Having now had the benefit of the above description of the fuse construction of this development its mode of operation will be now described and is as follows:

Upon passage of the projectile or the like through the firing barrel, after firing the same from a suitable weapon, the projectile which carries the fuse is placed into rotation or spin, the securing or safety band 31 opening under the action of the centrifugal force and bearing against the inner wall of the sleeve 11. The spiral band 30 and the ring 29, which are pressed against the intermediate floor or bottom 12 by virtue of the action of the inertia forces which engage thereat as well as at the sleeve 25 and the impact body 21 remain in the transport position according to Figure 1.

After departure of the projectile out of the firing barrel of the weapon the rotor 8 rotates until the axis of the detonator cap 10 essentially coincides with the fuse axis. Furthermore, the spiral band 30 and the ring 29 open under the action of the centrifugal force. The centrifugal bodies 28 move outwardly in the bores 27 of the sleeve 25 and upwardly at the surface 14 of the ring 13, which surface 14 acts in the manner of a ramp. Consequently, the sleeve 25 is pulled forwardly until its end surface 32 comes to bear at the impact

body 21 (Figure 2). The sleeve 25 is held in this position as long as the spin of the projectile is above a boundary value which is decisive for the self-destruction.

Upon impact of the projectile at the target and penetration therethrough, for instance the sheet metal, plating or otherwise forming the outer skin or covering of an aircraft, the sleeve 25 has imparted thereto by means of the impact body 21 and by virtue of the elastic shock a rearwardly directed impulse. This impulse together with the rearwardly directed force of the self-destruction spring 21 brings about that the forwardly directed component of the force transmitted from the centrifugal bodies 28 to the sleeve 25 is overcome and such together with the firing or ignition pin 24 is propelled against the detonator cap 10. Consequently, there is initiated the detonation of the explosive charge of the projectile and which charge has not been particularly illustrated in the drawings since the same is quite conventional and well known to those skilled in the art. As tests have shown the bushing 15 acts in the sense that the shock or percussion at the sleeve 25, after impact of the projectile at the target, is exerted with a time-delay in such a manner that the projectile first detonates when it has penetrated for the most part through the target sheet metal or the like i.e. the body of the target. While not wishing to be bound to any particular theory, it is assumed that due to the bushing 15 the propagation of a shock wave is retarded or delayed since the elastic shock, upon impact of the fuse tip 50, at the target, must be transmitted from the fuse tip via the bushing 15 and via the impact body 21 to the firing pin 24, so that there is obtained the desired enlargement of the response time.

The magnitude of the response delay of the fuse can be influenced within certain limits due to the mass of the impact body 21 and the bushing 15, and furthermore by means of the material from which there is formed these components. Furthermore, the shape or configuration of the bushing 15 plays a certain role.

As mentioned the rear portion 16 of the bushing has a smaller wall thickness than the front portion 40, as the same is apparent from the showing of the drawings. This is particularly of significance when the projectile impacts against the armor plates of tanks and the danger exists that the fuse housing, already prior to detonation, becomes deformed so markedly that the firing pin jams and no longer is capable or penetrating the fuse capsule. The rear end of the bushing then forms a so-called crumple or crease-zone preventing deformation of the supporting ring located

therebehind, since by virtue of such deformation of the ring the firing pin could become jammed at the region of the sleeve.

- 5 While there is shown and described present preferred embodiments of the invention, it is to be distinctly understood that the invention is not limited thereto, but may be otherwise variously embodied
10 and practiced within the scope of the following claims.

WHAT WE CLAIM IS:—

1. A self-destruction delayed-action fuse for spinning projectiles, comprising a fuse
15 housing containing a forwardly closed hollow compartment, means defining a ramp, centrifugal bodies bearing against said ramp, an axially displaceable firing pin, a self-destruction spring co-operating with
20 said firing pin, an axially displaceable impact body for actuating said firing pin, the axially displaceable firing pin being brought to bear against the axially displaceable impact body against the force of
25 the self-destruction spring by the centrifugal bodies bearing against said ramp as long as the spin of the projectile is located above a boundary value determinative of self-destruction, the impact
30 body being located internally of the hollow compartment of the fuse housing, said fuse housing having two oppositely situated support surfaces, a bushing clamped in the hollow compartment between said two op-
35 positely situated support surfaces of the fuse housing, said bushing having an outer wall and internally possessing a shoulder against which bears an end face of the impact body for the positive transmission of
40 the impact impulse from the fuse housing forming fuse tip means to the impact body and thence to the firing pin. a hollow

space provided between the fuse housing and the outer wall of the bushing, and wherein the bushing is formed of a
45 material of greater strength than the fuse housing.

2. The self-destruction delayed-action fuse as defined in Claim 1. having a sleeve co-operating with said firing pin, the bush-
50 ing having a rear portion and a front portion, the rear portion of the bushing possessing a smaller wall thickness than the front portion in order to form a crumple zone preventing clamping of the firing pin
55 at the region of the sleeve.

3. A fuse having a fuse housing, an axially displaceable firing pin arranged within said fuse housing, an axially displaceable impact body for actuating said
60 firing pin, the impact body being located internally of the fuse housing, said fuse housing having two oppositely situated support surfaces, a bushing supported in the fuse housing between said two op-
65 positely situated support surfaces of the fuse housing, said bushing having an outer wall and internally possessing a shoulder against which bears the impact body for the transmission of an impact impulse
70 from the fuse housing to the impact body and thence to the firing pin, a hollow space provided between the fuse housing and the outer wall of the bushing, and the bushing being formed of a material of
75 greater strength than the fuse housing.

4. A self-destruction delay-action fuse for spinning projectiles substantially as described and illustrated herein with refer-
80 ence to the accompanying drawings.

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