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H. L. DODSON ET AL

3,111,901

FRANGIBLE FIRING DEVICE

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Fig. 1.

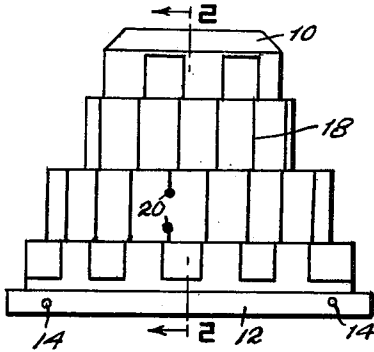


Fig. 2.

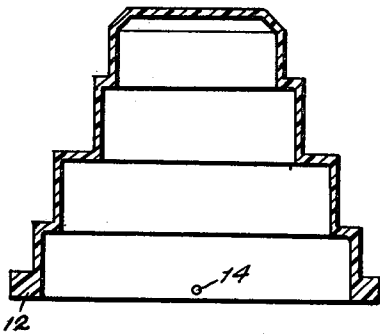


Fig. 3.

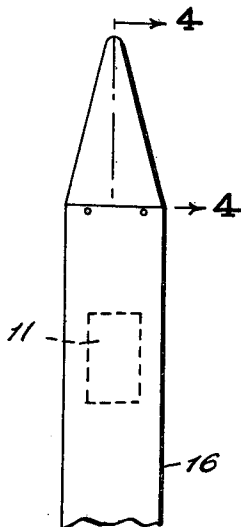


Fig. 4.

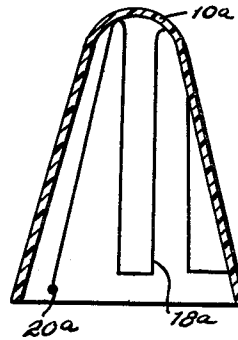


Fig. 5.

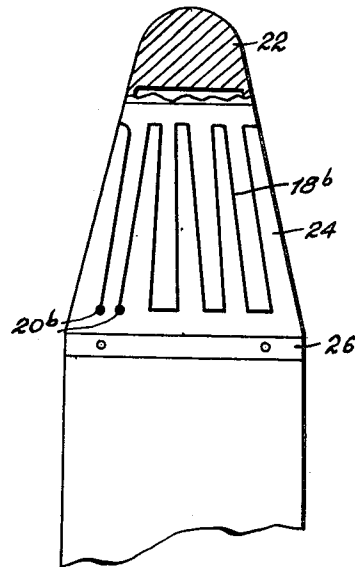
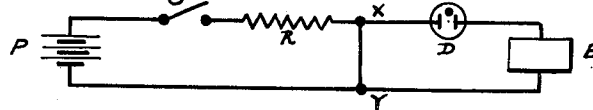


Fig. 6.



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FRANGIBLE FIRING DEVICE

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1 Claim. (Cl. 102—70.2)

This invention relates to a fuzing device for mounting on a missile and more particularly to an electrical means printed on a frangible body for detonating the missile warhead before warhead damage occurs as a result of impact.

The typical fuzing system generally employs a piezoelectric crystal in such a manner that when compressed, as by impact, an electrical impulse is generated which serves to detonate the warhead. With such devices as these, however, the necessary electrical impulse is generated only when the warhead impacts the target with sufficient force to compress the piezoelectric crystal surfaces. Accordingly, a glancing impact between crystal and target may be insufficient to generate the necessary detonating voltage. In the case of spike-type targets, it is absolutely essential that the crystal and target meet precisely head-on, otherwise there will be a complete failure to detonate. Additional deficiencies of employing piezoelectric crystals lie in their sensitivity to temperature changes and their ability to accumulate and retain electrical charges on their surfaces thereby adding to the drawbacks and inadequacies previously mentioned.

A surface fuzing system must supply the proper fuzing signal to the warhead before any warhead damage occurs as a result of impact. The ultimate surface fuzing system would be one that would fuze the missile at instant of impact with the target. However, practical aspects of this system must include safety factor allowances for handling, shock, vibration, temperature extremes, and the like.

It is an object of this invention, therefore, to overcome these objectional features of the prior art and provide a fuzing system which will detonate the warhead almost instantly upon impact.

A further object of this invention is to provide a missile nose cone of frangible material having a printed circuit thereon, which nose cone will shatter on impact interrupting said circuit and detonate the warhead.

These and other objects will become more apparent when reference is had to the following detailed description and drawings in which:

FIGURE 1 illustrates an elevation of a stepped nose-cone having a printed circuit schematically shown thereon;

FIGURE 2 illustrates a cross-sectional view taken on line 2—2 of FIGURE 1;

FIGURE 3 shows a typical missile body having mounted thereon on frangible nose-cone having a printed circuit interiorly thereof and connected to a conventional warhead;

FIGURE 4 illustrates a cross-section of the nose-cone of FIGURE 3 taken on line 4—4 and showing the printed circuit on the interior thereof;

FIGURE 5 illustrates a nose-cone having a solid nose-cone shown in section, and a frangible portion with a printed circuit immediately to the rear of the solid section; and

FIGURE 6 schematically illustrates a typical fuzing and detonating circuit.

Referring now in more detail to the drawings and particularly to FIGURES 1 and 2 thereof, there is shown a stepped, resinous nose-cone section 10 of thermosetting plastic or other frangible, electrically non-conductive material, having a substantial ring portion 12 with a plurality of equally spaced mounting holes 14 for attaching to a conventional missile body 16, typically shown in FIG-

URE 3. Applied to the exterior of electrically non-conductive nose-cone section 10 by means well known in the art, is printed circuit 18. This printed circuit is applied in a pattern such that maximum coverage over the entire nose-cone section is obtained. The ends of printed circuit 18 terminate in connections 20 which extend through to the interior of nose-cone section 10 for connection to a warhead section 11 schematically shown in FIGURE 3.

In operation, the circuit 18 may be energized at or before missile launching. However, on impact with a target, the resinous nose-cone, because of its brittle character, will shatter, thereby interrupting the energized printed circuit causing the warhead to detonate. The circuit schematically illustrated in FIGURE 6 shows, by way of example, only a typical arrangement for accomplishing the detonation, wherein such circuit comprises a source of potential P, a switch S which is closed just prior to launching, a resistor R, a gas-filled diode D, and warhead E. Short-circuit x—y depicts what in actuality is printed circuit 18 whereby at launching and prior to impact only that portion of the circuit comprised of P, S, R, x, and y is energized. At impact, x—y becomes interrupted thereby allowing electrical flow from R to D and E resulting in the detonating of the warhead. The time which elapses between circuit rupture and detonation amounts to only a few milli-seconds; consequently the distance which the warhead continues to travel toward the target during this brief interval is insufficient to do any damage to the warhead portion. By proper design of the nose cone, shattering of this component can be predicted for high or low velocity impacts.

FIGURE 4 illustrates a modification of the preferred embodiment of this invention wherein the printed circuit portion 18a of the fuze circuitry is placed on the interior surface of a nose-cone portion 10a so as to adequately cover the entire expected target contact area of the nose-cone. Circuit connections 20a extend through the nose-cone body from the interior to the exterior surface for suitable connections thereto and to facilitate the required missile check-out procedure prior to launching.

FIGURE 5 is a further modification illustrating a nose-cone section having a solid tip portion 22 with a frangible section 24 immediately rearward thereof, the frangible portion having a printed circuit 18b on its surface terminating in connections 20b. As shown in FIGURE 5, the nose cone is connected to the missile body 24 by circumferential means 26. Any target impact forward of connection 26 will cause shattering of the nose-cone thus producing the switch opening necessary to generate a pulse to initiate a firing train.

Thus, it is now readily apparent that by fitting an electrical circuit on a frangible missile component of dielectric material, and locating this component so as to impact with a target with sufficient force to fracture the material and interrupt the printed circuit, a fuzing pulse can be generated to detonate the warhead almost instantly. By fabricating the frangible component from a resinous material, standard techniques of applying printed circuits can be readily utilized with ease and economy.

This invention is not limited to nose-cone applications, however, but may be employed on any portion of a missile body and the resinous material need not necessarily rupture completely, but just enough to interrupt the electrical continuity of the printed circuit on its surface.

Having particularly described our invention, it is obvious that many modifications and variations may be resorted to by those skilled in the art without departing from the scope of the appended claim.

We claim:

A surface fuzing device for a missile having a warhead and a detonating circuit for said warhead, said fuzing

device comprising a nose cone for attachment to the missile and having interior and exterior surfaces, said nose cone being fabricated entirely from a frangible, dielectric material, a conductive circuit printed on one surface of said case and covering a maximum area thereof, and a pair of terminals connected to said conductive circuit for electrical connection with the detonating circuit, said frangible nose interrupting said conductive circuit when said frangible nose is ruptured by an impact thereon to permit the detonating circuit to generate an electrical impulse and detonate the warhead.

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References Cited in the file of this patent

UNITED STATES PATENTS

1,543,895	Winkley	June 30, 1925
2,712,791	Bleakney et al.	July 12, 1955
2,835,107	Ward	May 20, 1958
2,887,056	Perret	May 19, 1959

FOREIGN PATENTS

783,850	Great Britain	Oct. 2, 1957
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