

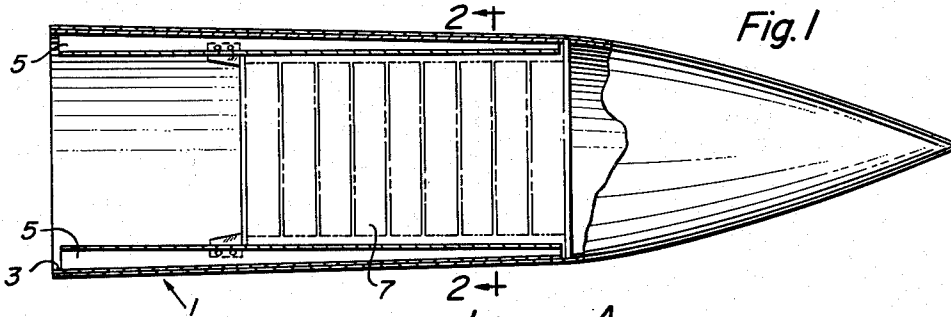
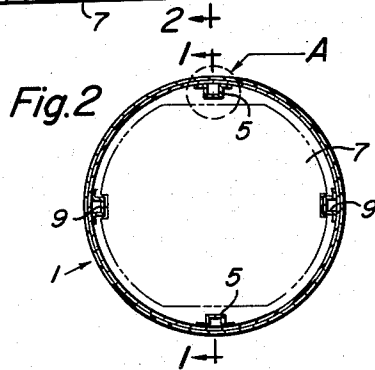
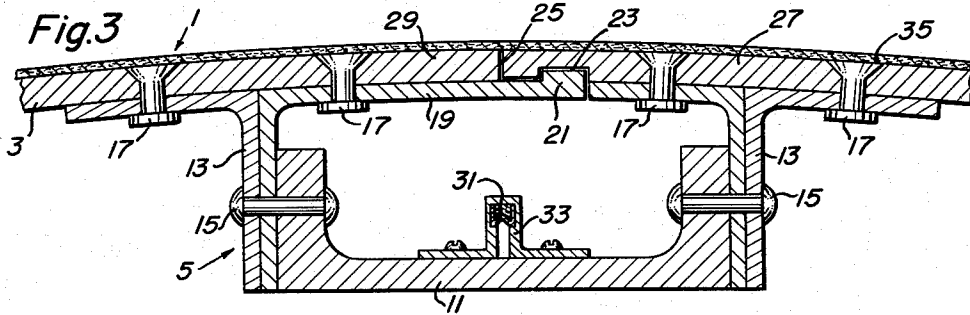
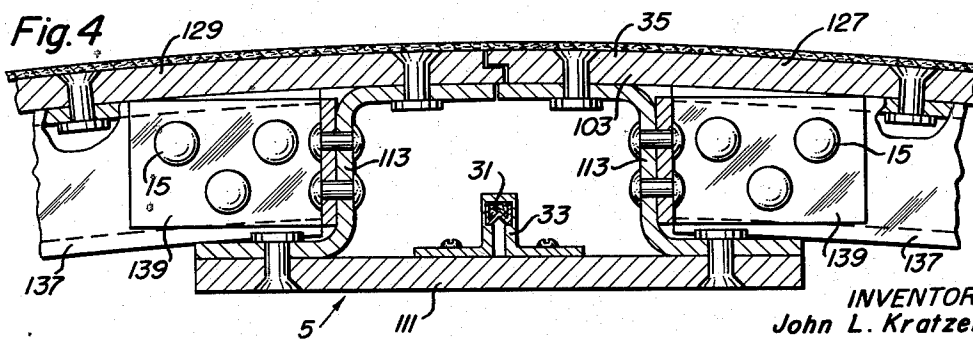
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2,996,985

EXPLOSIVE WARHEAD SKIN SEPARATION DEVICE

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2,996,985

EXPLOSIVE WARHEAD SKIN SEPARATION DEVICE

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5 Claims. (Cl. 102-7.2)

(Granted under Title 35, U.S. Code (1952), sec. 266)

The invention herein described may be manufactured used by or for the Government of the United States of America for governmental purposes without the payment to me of any royalty thereon.

This invention relates to an arrangement for separating the skin of a missile warhead to release the payload.

It makes use of a linear explosive shaped charge which is disposed in such a manner as to prevent its being heated unduly during the relatively short interval (say 20 seconds) between the reentry of the missile into the atmosphere and the release of the payload. It is also designed to make efficient use of both the main or cutting blast and the back blast of the linear shaped charge.

In the drawing FIGURE 1 is a longitudinal section of a missile warhead embodying my invention, taken in the line 1-1, FIG. 2.

FIGURE 2 is a cross section on the line 2-2, FIG. 1.

FIGURE 3 is an enlarged view of the portion A of FIG. 2 of my invention applied to a warhead of semi-monocoque construction.

FIGURE 4 is a view corresponding to FIGURE 3, but showing the invention applied to a warhead of skin-frame construction.

The invention will be first described in connection with the embodiment shown in FIGURES 1, 2 and 3.

The warhead to which this invention relates is designed to release a payload at an elevated point within the earth's atmosphere. After the missile has reached a great height, there is, as is well known, upon reentering the atmosphere, a period of rapid frictional heating. This invention employs a linear shaped explosive charge which is positioned so as to split the shell of the warhead. The specific disposition of the shaped charge, which is the subject of this invention, protects the explosive from excessive heat during the critical period following reentry to the atmosphere. If the explosive becomes too hot it may melt, thereby altering its explosive characteristics.

Referring to FIGURES 1 and 2 the warhead is formed of an elongated shell 1 of generally circular cross section. In the modification shown by FIGURES 1, 2 and 3 the shell is of semi-monocoque construction. It includes a stressed skin 3 formed of sheet material. Two hollow longerons 5, spaced 180° apart extend longitudinally of the shell and form the supporting means for the shaped explosive charge. A payload 7 is disposed within the shell. The nature of the payload forms no part of the invention, but it may consist of bomblets carried in containers which are supported on longitudinal rails 9.

The longerons are shown in detail in FIGURE 3. Each includes a web 11 which is spaced inwardly from the skin 3 and flanges 13 which join the web to the skin. In the specific design shown in these figures each flange is formed of two angles which are secured by rivets 15, and 17 to web 11 and skin 3 respectively. One of the angles 19 is elongated as shown and terminates in a key connection 21 which engages a seat 23 formed in skin 3. The skin 3 is divided longitudinally at 25, between the flanges 13 of each longeron 5. The key and seat 21, 23 serve to transmit skin hoop tension loads between the skin sections 27 and 29. A linear shaped charge 31 is supported within each longeron by a bracket 33 which is formed of a thermal insulating material, for ex-

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ample a phenolformaldehyde resin. This insulating bracket is mounted on web 11 and surrounds the shaped charge 31 except on the side toward web 11. The shaped charge 31 has a linear concave side facing web 11 and the bracket 33 is proportioned to provide the proper standoff between the web and the shaped charge, in order that the shaped charge will, on explosion, most efficiently cut the web 11.

The linear shaped charge as such is not my invention, and the design of the charge and determination of its standoff are made in accordance with well known principles. Reference is particularly made to United States Patent 2,667,836, granted February 2, 1954 to Joseph H. Church and Gregory J. Kessenich, as well as the literature cited therein. Reference is also made to United States Patent 2,543,057, granted February 27, 1951 to L. F. Porter, which shows a type of linear shaped charge which is well adapted to my purpose, provided the insulation of the patent is made of a material which will withstand temperatures of the order of 200 to 300° F.

I have found that by proper selection of the shaped charge and use of the proper stand-off the cutting jet from the explosion can be dissipated just before it penetrates completely through the web 11, so that the payload 7 is not damaged. I find that this condition is most easily attained by initial selection of a given shaped charge followed by experimental variation of the stand-off.

The explosive 31 is provided with a suitable detonator and fuze which are initiated to explode at the proper time. When the explosion occurs the cutting blast will sever web 11 and at the same time the back blast will force the walls of the longeron and the skin sections 27, 29 apart, thereby releasing the payload 7. The essence of my invention resides in the specific disposition of the explosive charge 31. The charge could conceivably be placed directly adjacent the skin 3 and positioned so as to cut the skin. However, upon reentry to the atmosphere the skin heats very rapidly. If the explosive were adjacent the skin it would be melted. By my arrangement the charge is sufficiently removed from the skin, that the transfer of heat to the explosive is materially slowed down. Since the critical period between reentry and explosion of the charge is relatively short, of the order of 20 seconds, this separation adequately protects the charge from being melted. The fact that bracket 33 is of thermal insulating material greatly assists in the protection of the explosive charge from heat. The disposition of the explosive charge in the manner shown has still another advantage. The back blast of a shaped charge is of a bursting character. This bursting force, directed outwardly, assists in separating the skin sections and efficiently releasing the payload.

For very high velocity missiles where frictional heating is particularly great it is desirable to provide an outer coating 35 formed of a material which has an endothermic phase change temperature, either a melting point or a sublimation point, in the range of the order of 300 F. to 2000° F. and substantially below the melting point of the skin 3. This coating may be composed of a layer of fiber glass or other ceramic, fiber-glass-reinforced plastic, or an alloy selected for its low melting point combined with as high a heat of melting or sublimation as can be obtained. The melting or sublimation of this outer layer, the process now termed "ablation," will serve to retard the heating of the skin 3.

In FIGURE 4 I have shown my invention applied to a warhead of skin-frame construction. Of this embodiment the skin 103 does not itself carry the load but is secured to a frame made up of longerons, including the hollow longerons 5, and rings 137 which are of Z or channel cross section. The rings are formed of arcuate

sections which abut the flanges 113 of hollow longerons 5 and which are secured thereto by angle members or structural clips 139. The shaped charge 31 is mounted on web 11 by brackets 33, the relationship and the structure being the same as in the embodiment previously described. In this embodiment the skin sections 127 and 129 are not keyed together since the hoop tension stresses are transmitted through rings 137, 139 and web 111 of the hollow longeron. A low melting outer layer 35 may be provided on the exterior of the skin as in the preceding embodiment.

The mode of operation and the advantages of this modification so far as my invention is concerned, are the same as in that previously described.

While I have described two embodiments in detail it will be apparent that various changes may be made. It is also apparent that my invention does not depend on the other details of the warhead, such as the fuze system. I therefore desire my invention to be limited solely by the scope of the appended claims.

I claim:

1. A missile warhead comprising an outer skin defining an elongated shell of generally circular cross section, at least one hollow longeron within said skin, said longeron comprising a substantially continuous web spaced inwardly from and substantially parallel to said skin and substantially continuous spaced flanges joined to said web and said skin, said skin being divided on a line extending along said longeron between said flanges, a linear shaped charge mounted within and extending longitudinally of said longeron and having a concave surface facing said web, and a bracket of thermal insulating material mounted on said web and supporting said linear shaped charge in spaced relationship to said web and said skin.

2. A missile warhead as defined in claim 1 and comprising two longerons as therein defined spaced substantially 180° from each other, said skin being divided along each said longeron.

3. A missile warhead as defined in claim 1 and further comprising a layer of solid on the outside of said skin having an endothermic phase change temperature in the range of the order of 300° F. to 2000° F., and substantially below the melting point of said skin.

4. A missile warhead of semi-monocoque construction comprising an outer stressed skin defining an elongated shell of generally circular cross section, two hollow lon-

gerons spaced substantially 180° apart within said skin, each of said longerons comprising a substantially continuous web spaced inwardly from and substantially parallel to said skin and substantially continuous spaced flanges joined to said web and to said skin, and said skin comprising two 180° sections meeting between the flanges of said longerons, each of said longerons further comprising a key member between said flanges rigidly connected to one of said flanges and to one of said skin sections and interlocking with the other of said skin sections in such a manner as to transmit skin hoop tension between said sections, a linear shaped charge mounted within and extending longitudinally of each of said longerons and having a concave surface facing said web, and a bracket of thermal insulating material mounted on said web and supporting said linear shaped charge in spaced relation to said web and said skin.

5. A missile warhead of skin-frame construction comprising an outer skin and an inner frame, said frame comprising longerons and rings, two of said longerons being spaced 180° apart and being hollow, each of said hollow longerons comprising a substantially continuous web spaced inwardly from and substantially parallel to said skin and substantially continuous spaced flanges joined to said web and to said skin, and rings comprising arcuate members having ends abutting and joined to said hollow longerons, said skin being joined to said rings and being divided along a line between the flanges of each of said hollow longerons, a linear shaped charge mounted within and extending longitudinally of each of said hollow longerons and having a concave surface facing said web, and a bracket of thermal insulating material mounted on said web and supporting said linear shaped charge in spaced relation to said web and said skin.

References Cited in the file of this patent

UNITED STATES PATENTS

2,543,057	Porter	Feb. 27, 1951
2,809,583	Ortynsky et al.	Oct. 15, 1957
2,835,107	Ward	May 20, 1958
2,908,455	Hoadley	Oct. 13, 1959

OTHER REFERENCES

"Astronautics," vol. 2, No. 5, December 1957, pp. 42 and 43.