PLASTIC BONDED EXPLOSIVES ROCKET WARHEAD

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The invention described herein may be manufactured and used by or for the Government of the United States of America for governmental purposes without the payment of any royalties thereon or therefor. This invention relates to improvements in warheads, and more specifically to the provision of minor caliber rocket warheads in which the permissible load of high explosive is of relatively much greater weight than hitherto possible. It has been common, in the past, to form warheads by filling heavy steel warhead cases with explosives (usually by cast-loading techniques), the cases remaining integral parts of the missiles of which they form a part. Such warhead cases, in the example of minor caliber rocket warheads, often weigh between two and three times more than the explosive charges carried therein. For example, in the conventional prior art constructions the steel warhead case of a 2.00-inch rocket weighs more than twice the weight of the explosive it carries and in a 2.75-inch rocket the warhead case weighs more than three times the weight of explosive. Distinct advantages in performance relative to blast damage potential may be realized by decreasing the amount of steel as much as possible thereby making it possible to carry greater weights of explosives without impairing performance of the rocket vehicle. The ultimate advantage in this direction, of course, would be attainable in the provision of means entirely eliminating the necessity for a metallic casing or other heavy metallic parts.

It is, therefore, an object of this invention to provide warhead structures in which the permissible pay load of high explosive materials is a higher percentage of the warhead weight than was previously possible. It is another object of this invention to provide such new structural shapes and forms of explosive materials as to obviate the need for metallic casings therefor when used as warheads. It is still another object of this invention to provide more simply manufactured and more economical warhead structures by obviating the need for providing and machining the metal case commonly used in the prior art.

A still further object of this invention is to provide a warhead in which plastic bonded explosive is of such form as to provide means for simple direct connection to the missile body and to a nose fuze, without recourse to metal parts for effecting such connections.

Still another object of this invention is the provision of a warhead formed of plastic bonded explosives and of such strength that strong metallic casings or supports are not essential to the structure although thin protective skin members may be used if desired. Other objects and many of the attendant advantages of this invention will be readily appreciated as the same become better understood by reference to the following detailed description when considered in connection with the accompanying drawings wherein:

FIG. 1 is a vertical sectional view of a warhead constructed in accordance with the invention; and

FIGS. 2 and 3 are similar sectional views of two other modified structures illustrating the principles of the invention and possible variations thereof.

As will become obvious from the ensuing detailed description, the instant invention is concerned primarily with warhead structural features which make possible the exclusion of the use of metallic parts to a very large degree. In the broadest sense, therefore, the explosive materials used need only be capable of being cast or molded into shape in order to practice the invention.

One type of such material has become known as plastic bonded explosive. Plastic bonded explosives (PBX) as used in this disclosure, is a generic term. It could comprise any solid explosive combined with any plastic binder. To mention a few examples, PBX could be a combination of RDX and styrene-modified polyester; PETN and epon-type plastic binder, HMX and acrylate-type plastic binder, etc. Thus, materials in this category may be described, in general, as each comprising particles of a particular explosive compound or mixture of explosive compounds bonded together by particular plastics and in which the resulting compositions, when pressed into structural shapes in molds, have considerable rigidity and strength. A typical group of such materials are formed by mixtures of explosive material such as RDX, which is cyclo trimethylene triaminurane with conventional plastics, as for example, polystyrene plastized with dicyclophthlate. In the formation of plastic bonded explosives from such materials, the resulting compositions contain explosive material in the order of 90 percent by weight and plastic materials (including plasticizer) in the order of 10 percent by weight. Typical examples are as follows:

(1) 90% RDX
9% polystyrene
1% dicyclophthlate

(2) 70% RDX
20% atomized aluminum
8.5% polystyrene
1.5% dicyclophthlate

Such compositions may be formed by any of the well known prior art methods. As an example of one method, a lacquer may be formed by mixing the desired amount of plastic (polystyrene) and plasticizer (dicyclophthlate) in a suitable solvent (such as toluene) to form a viscous lacquer. The lacquer is placed in a mixer and the required quantity of explosive is added. During mixing, the material in the mixer is treated by heat and vacuum to distill off the solvent and the resulting composition is in the form of non-cohesive lumps of material. The material thus formed may be formed into shapes by known molding techniques, as by pressing into a mold (preferably of the split type) having a cavity of the intended shape. The material is pressed at pressures exceeding 10,000 pounds per square inch and after such pressing operation is extruded and is allowed to cure. Attention is directed to the drawing, in all of the figures thereof, in which the reference numeral 12 represents a block of explosive material in the form of a warhead. Warhead 12 may be formed by the casting or molding of known explosive materials in known manners, specific examples of some of the usable materials and the techniques of manufacture and molding thereof being given in the above.

Referring now to FIG. 1, warhead 12 is provided with a frontal cavity 13 with a molded thread course 14 into which a fuze (not shown in FIG. 1) can be screwed directly. It is also provided with an externally threaded boss 16 which is adapted to be screwed directly into a complementary cavity of a rocket motor 17. Thus, the molded block of explosive material, without metal parts
of any kinds serves as a structural connecting piece with the fuze and the rocket motor connected directly thereto to complete a rocket assembly in which, as discussed above, the permissible pay load of explosive material is much greater than hitherto possible.

FIG. 2 illustrates an alternate mode of construction in which a light metal insert 18, having screw threads 14a thereon is fitted in a frontal cavity 13 which is itself not threaded. Such a construction does away with the difficulties involved in molding threads on the warhead body. The fuze 15 may then be screwed into the insert 18, as shown. The metal base head closure 19 is attached to the aft end, as by cementing. A light-metal, ogival, truncated cone 20 may, if desired, be attached to the warhead body 12, by any means, as for example, by cementing, to facilitate target penetration.

FIG. 3 is identical with FIG. 2 but illustrates a further variation of the principle of this invention in that it discloses a very light metal or plastic case 21 extending the full length of the explosive block and overlapping the flange of the closure 19. This case 21 is extremely thin and of light material, as for example, a mere skin 3/16" to 1/2" thick of aluminum or magnesium or a coating of tough, fire-resistant plastic material. Such a skin protects the surface of block 12 from damage and adds only a small amount of inert weight and is not to be interpreted as a reversion to the heavy metallic warhead casings of the prior art since the light casing contemplated in this invention serve no particular function of structural support at the expense of explosive pay load as is true of the prior art casings.

It should be obvious from the foregoing that the instant invention provides new and useful improvements in warhead structures, resulting in increasing the load of explosive material which may be carried by a given missile, in simplifying the fabrication of warheads, and in the savings in cost of warheads resulting from said simplification.

Obviously, many modifications and variations of this invention are possible in the light of the above teachings. It is therefore to be understood that the invention is not intended to be limited to the specific modifications herein illustrated and discussed, its scope being defined by the appended claims.

What is claimed is:
1. A warhead for high-speed missiles, said warhead comprising a unitary block of high-strength explosive material capable of withstanding flight and impact without appreciable deformation and of serving as the sole structural element connecting and supporting forward and aft elements of a missile without reinforcement, said block having a base member attached to the rearward end thereof, said base member having means for effecting attachment to a missile body, said block having also a frontal cavity, a metal insert secured into said frontal cavity, said insert having means to effect connection with fuze means.

2. A warhead according to claim 1 having also a light-metal, ogival, truncated, cone-shaped member, attached to the external surface of the forward end of the said block to facilitate penetration of a target, said cone-shaped member being supported solely by said block and having no structural connection with said forward and aft missile elements.

3. A warhead according to claim 1 having an external casing in the form of a thin skin of protective material extending substantially the full length of the block, but terminating slightly aft of the forward end of said block whereby the block rather than the external casing serves to connect the forward and aft missile elements and maintain them in proper structural alignment during flight and impact.

4. A warhead according to claim 3 in which said casing is of light-weight metallic material.

5. A warhead according to claim 3 in which said casing is of a tough fire-resistant plastic material.

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