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Gulbierz

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[54] **FLEXIBLE BLAST FRAGMENT BLANKET**

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[52] **U.S. Cl.** .... **161/36,** 89/36 R, 89/36 D, 161/39, 161/404

[51] **Int. Cl.** **B32b 3/10**

[58] **Field of Search** .... 161/404, 36, 37, 38, 39, 161/40, 42; 89/36 R, 36 D

[56] **References Cited**

UNITED STATES PATENTS

3,563,836	2/1971	Dunbar	161/38
3,376,185	4/1968	Shook	161/39
1,465,767	8/1923	Krause	161/404
1,495,489	5/1924	Krause	161/404
3,516,898	6/1970	Cook	161/36
3,684,631	8/1972	Dunbar	161/40

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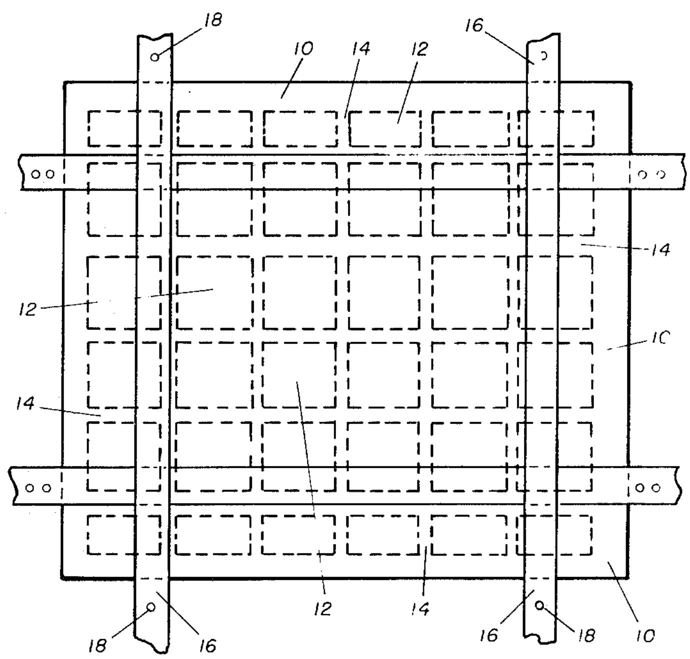
[57] **ABSTRACT**

A flexible blast fragment blanket comprising a plurality of layers of flexible blast-resistant material, and a multiplicity of blast-resistant plates embedded between said plurality of layers, said plates having greater blast resistant properties than the material of said plurality of layers, said plates having channels therebetween, said channels imparting a desired flexibility to the blanket.

12 Claims, 1 Drawing Figure



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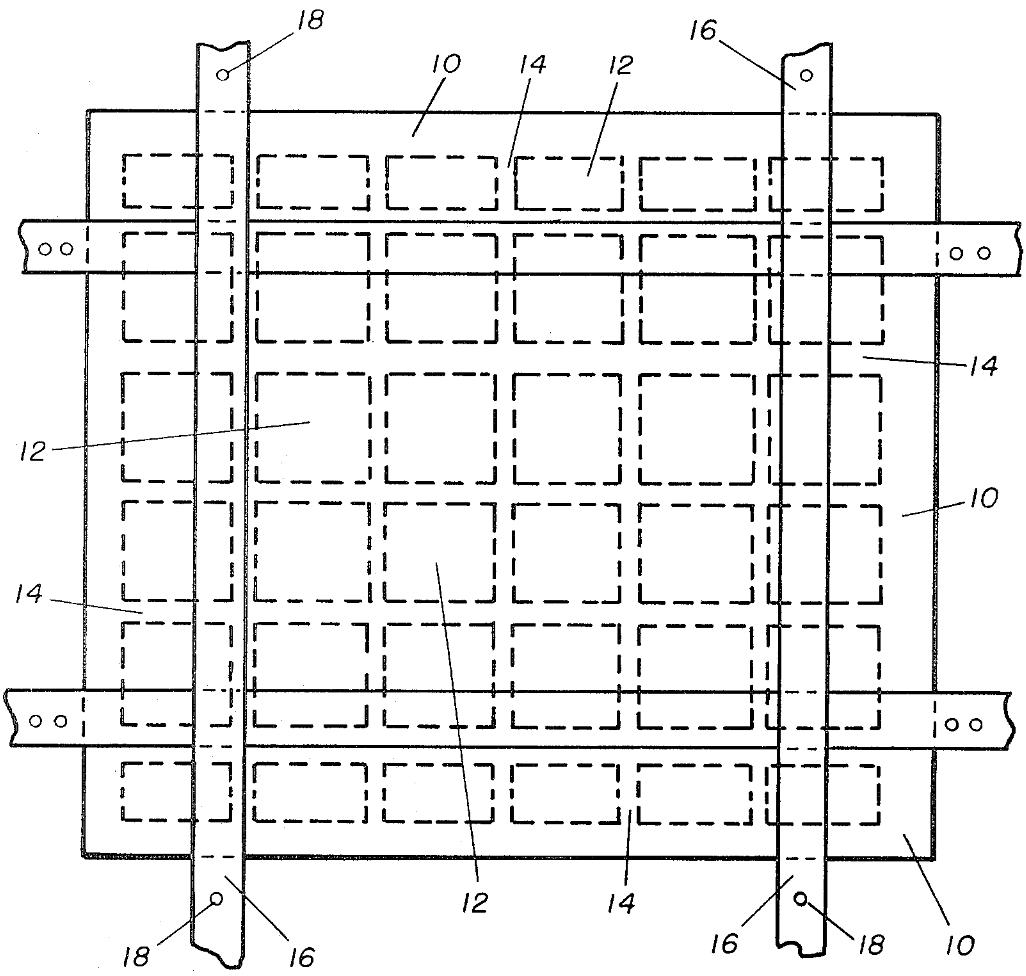

FLEXIBLE BLAST FRAGMENT BLANKET

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

BACKGROUND OF THE INVENTION

The present invention deals with nylon blankets used in the suppression of blast fragments emanating from explosive devices upon detonation. The problem in the designing of such blankets has been to both suppress the explosion and confine the fragments while retaining the flexibility required to drape the blanket around the item to be destroyed.

Another design consideration is that of weight. Within the constraints of the design criteria of weight and drapability, a blanket has long been needed that could confine fragments of both a higher mass and a higher velocity than is currently possible. The interest in the obtaining of such an improved blanket is simply, but significantly, that fewer casualties among ordnance disposal personnel would of necessity result.

The need for an item such as this lies mainly with the military. Its use comes to the fore when the destruction of a particular item without risk to personnel is desired. While destruction of such an item is easily achieved, the containment of said explosion gives rise to a safety problem. It is toward the solution of this problem that the instant invention is directed.

SUMMARY OF THE INVENTION

An object of the present invention is to provide a shielding means that will suppress blast fragments emanating from explosive devices.

Another object is to provide a blanket achieving the above Object, but yet having a flexibility enabling it to be easily draped around an item to be destroyed.

Yet another object is to provide a means of confinement of fragments of an explosion wherein said fragments possess a higher mass and a higher velocity than those fragments that can presently be confined.

A yet further object is to provide a shielding means which will reduce casualties among Ordnance Disposal Personnel.

The present invention comprises a flexible blast fragment blanket comprising a plurality of layers of flexible blast-resistant material, and a single layer of blast-resistant plates embedded between two of said plurality of layers, said plates having greater blast-resistant properties than the material of said plurality of layers, said plates being laterally spaced apart to provide channels therebetween, to impart a desired flexibility to the blanket.

BRIEF DESCRIPTION OF THE DRAWING

The drawing illustrates the present blast fragment blanket showing straps adhered thereto.

DETAILED DESCRIPTION OF THE INVENTION

The drawing illustrates a flexible blanket which comprises a plurality of layers **10** of flexible, blast-resistant material. Embedded within said plurality of layers **10** of blast-resistant material is a multiplicity of plates **12,** also blast-resistant. These plates are set between the layers of the blanket and have greater blast-resistant properties than the material of the blanket's plurality of layers.

A variety of arrangements of the blast resistant material is possible. For example, blast-resistant plates **12** may be placed between every layer **10**; also, such plates may be placed between less than all the layers. Preferably, the blast-resistant plates **12** are all placed between two adjacent layers **10.** Furthermore, the physical design of the plates may vary considerably. The drawing illustrates plates configured as squares and rectangles. However, this particular shape is not critical. Different applications will dictate a different plate configuration.

The plates **12** are laterally spaced apart, as shown in the drawing, to provide channels **14** between the plates in order to impart to the blanket the desired properties of flexibility and drapability.

Adhered to the surface of the blanket, are various blast resistant straps **16** which may be required in certain applications in order to anchor the blanket over the object to be destroyed. The straps may be adhered to both the top and bottom surfaces of the blanket.

In addition, it should be noted that the length of the straps must be in excess of the longest peripheral cross section of the blanket. Furthermore, attachment means **18** may be placed at the end of each strap **16.**

The flexible, blast-resistant material of which the blanket layers are composed is preferably that of an organic textile material. Textile materials falling within this category would include nylon, dacron and cotton duck. Suitable types of nylon include NYLON 6, produced by Allied Chemical, NYLON 66, produced by Dupont, and NOMEX, sold commercially by the Dupont Corporation. Also, certain inorganic texile materials would be suitable.

The material of which said plates **12** are composed, must possess a tensile strength of between 10^4 and 10^6 pounds per square inch, and an elastic modulus of between 10^5 and 10^8 pounds per square inch. These properties may be obtained through a proper choice of blast resistant material. For example, suitable materials would include fiberglass, graphite, plastic, metal and ceramic. Within these very broad groups of materials, experimentation has disclosed that the utilization of said materials in fibrous form can often result in a more efficient material. When so used in fibrous form, reinforcement material is used for the interbonding of the fibers.

Various reinforcement materials have been considered. Of these, the following are presently viewed as suitable for the present application: epoxy, polyester-plastic, polyester resin, polyurethane, polypropylene, and nylon.

Where metals are utilized in fibrous form, the following metals have been found suitable: aluminum, steel, titanium, and mixtures and alloys thereof.

The construction of each particular plate **12** can be of considerable significance. A popular mode of construction is that of forming said plates from a plurality of sublayers, wherein the various sublayers are interbonded to each other. Within each sublayer, there may exist a fibrous structure wherein greater strength is imparted to the fiber network through an appropriate interweaving of said fibers.

In addition to the technique of interweaving, it has been found that great strength may be derived through adjoining adjacent sublayers that are placed so that the fiber axis of each particular sublayer is angularly displaced by 60° from the fiber axis of the adjacent sublayer.

As above noted, the entire multiplicity of blast resistant plates may be placed as a single layer between two adjacent layers of the blanket. In the actual construction of nylon blast-fragment blankets, it has been found efficacious to follow such a construction procedure. A refinement of this procedure involves the use of nine layers of nylon. After adhering the first three layers together, the above-described layer of laminated plates is then bonded to the third of said nylon layers. As aforestated, the particular shape of the embedded plates may vary; however, it is essential that whatever configuration is chosen does not in any way impair the flexibility or drapability of the blanket. The configuration displayed in the drawing represents one which has been found acceptable for the present application. It involves the simple use of squares and rectangles having channels therebetween, wherein the channels are sufficiently wide to allow whatever degree of drapability may be required.

After adhering the layer of plates to the third layer, the other six layers of nylon are glued thereto to complete into the total blanket structure. An adhesive suitable for such gluing is one known as rubber reclaimed adhesive and sold by the 3–M Company as Product No. 1300.

An additional embodiment of the present invention may be obtained through the adherence of a layer of hardened material to that side of each of blast resistant plate that is to face the blast. The material of said hardened layer may be chosen from a wide group of materials that would include ceramic, fiberglass, graphite, metals, and plastic.

It should be noted that the various adherings of layers, plates, and straps required to practice the present invention, can be achieved through the use of a technique known as spot-bonding. This technique involves the simple dabbing of spots or circles of glue at various points suitably separated from each other on the surfaces to be bonded together.

A desirable thickness of the blast-resistant plates is about one-half inch. Various experiments have produced acceptable results with the use of a polyester-plastic reinforced fiberglass having a tensile strength of about 10^4 pounds per square inch. The use of such an armor-like material for blast-resistant plates has not been limited to this particular field. Rather, it has also been the object of investigation in the general field of personnel armor.

Among the various types of laminates suitable for use in the plate material are: E-glass or Electrical-type fiberglass, LM-glass or low modulus fiberglass, and lead oxide-type fiberglass. This type of "lead" fiberglass may provide greater protection in as much as its modulus density ratio is much lower than that of E-glass, and hence the speed of sound or pressure waves therein is much slower. Such a characteristic increases the protection which a blanket composed thereof would afford.

It is thus seen from the above that the Objects set forth in the Summary of the Invention are among those made apparent from and efficiently attained by the blast fragment blanket of the preceding description.

I wish it to be understood that I do not desire to be limited to the exact detail of construction shown and described for obvious modification will occur to persons skilled in the art.

Having described my invention, what I claim as new, useful and non-obvious, and accordingly, by this instrument, secure by Letters Patent of the United States is:

1. A flexible blast fragment blanket adapted to be draped around an explosive device to be destroyed for confining fragments therein, comprising:

a plurality of layers of flexible blast-resistant textile material,

a single layer comprising a multiplicity of blast-resistant plates embedded between two adjacent layers and having greater blast-resistant properties than the material of said layers, the material of said plates possessing a tensile strength of between 10^4 and 10^6 psi and an elastic modulus of between 10^5 and 10^8 psi, said plates being laterally spaced apart to provide channels therebetween to impart a desired flexibility to said blanket, and

a plurality of blast-resistant straps, having attachment means at the ends thereof, adhered to the surface of said blanket, for securing said blanket around said explosive device.

2. The blanket as recited in claim 1 in which the flexible blast-resistant material of said plurality of layers comprises an inorganic textile material.

3. The blanket as recited in claim 1 in which the flexible blast resistant material of said plurality of layers comprises an organic textile material.

4. The blanket as recited in claim 3 in which the material of said plurality of layers is selected from the group of organic texile materials consisting of nylon, dacron and cotton duck.

5. The blanket as recited in claim 3 in which the the material of said multiplicity of blast resistant plates is selected from the group consisting of fiberglass, graphite, plastic, metal and ceramic.

6. The blanket as recited in claim 5 in which the materials of the second-named group are utilized in a fibrous form with a reinforcement material used for the interbonding of the individual fibers to each other.

7. The blanket as recited in claim 6 in which said reinforcement material is selected from the group consisting of epoxy, polyester-plastic, polyester resin, polyurethane, polypropelene and nylon.

8. The blanket as recited in claim 6 in which the material for the fibers of the material forming said plates is a metal selected from the group consisting of aluminum, steel, titanium, and mixtures and alloys thereof.

9. The blanket as recited in claim 6 in which each plate of said multiplicity of plates comprises interbonded sublayers of fibers.

10. The blanket as recited in claim 9 in which each of said plates is assembled with each adjoining sublayer having its fiber axis angularly displaced by 60° from the fiber axis of each adjoining sublayer.

11. The blanket as recited in claim 6 in which the material of each of said plates consists essentially of polyester-plastic reinforced fiberglass having a tensile strength of about 10^4 psi and wherein the thickness of each plate is about one-half inch.

12. The blanket as recited in claim 1 in which each of said plates has a layer of hardened material, selected from the group consisting of ceramic, fiberglass, graphite, metal and plastic, adhered to the side of each of said plates that is to face the blast.

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