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[54] **EXPLOSIVE CHARGE ASSEMBLY AND ITS USE IN SEISMIC PROSPECTING**

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[30] **Foreign Application Priority Data**

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[52] **U.S. Cl.**.....**102/23,** 102/24, 89/1 A, 181/0.5 XC

[51] **Int. Cl.**.....**F42d 1/02,** F42d 3/06

[58] **Field of Search**.....102/22, 23, 24, 27; 181/0.5 XC; 89/1 A

[56] **References Cited**

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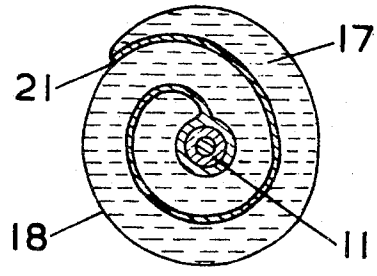
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[57] **ABSTRACT**

A method of assembling blasting explosive charges on an initiating line of detonating cord which method is especially advantageous in seismic prospecting involves sticking the charges on the detonating cord by means of a layer of adhesive. The invention also includes the blasting assembly comprising the detonating cord and adhering charges, a blasting charge having a layer of adhesive for attaching the charge to detonating cord and a method of seismic prospecting using the blasting assembly on or under the ground surface and substantially parallel thereto.

7 Claims, 5 Drawing Figures



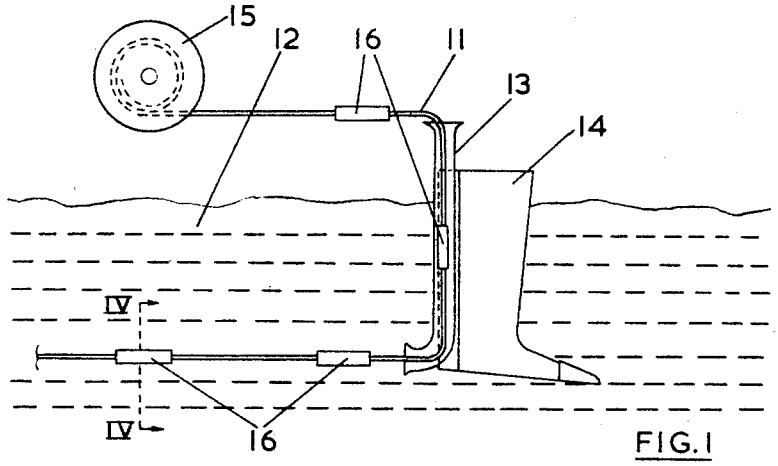


FIG. 1

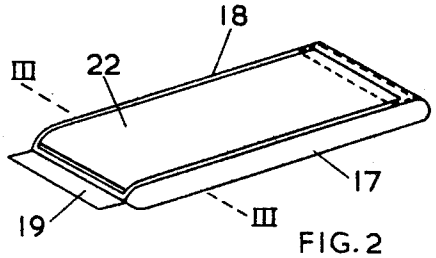


FIG. 2

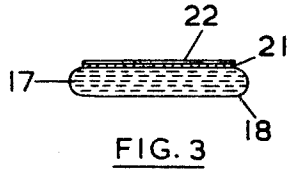


FIG. 3

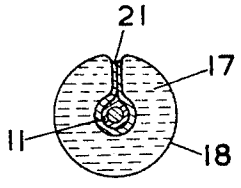


FIG. 4

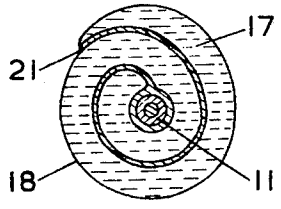


FIG. 5

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EXPLOSIVE CHARGE ASSEMBLY AND ITS USE IN SEISMIC PROSPECTING

This invention relates to a method of assembling blasting explosive charges on an initiating line of detonating cord, to the assembly produced thereby, to a method of seismic prospecting using the said assembly and to an explosive charge for use in the assembly.

In numerous blasting operations it is convenient to employ individual explosive charges located at positions where explosive energy is required and connected to an initiating line of detonating cord. The charges are usually attached by tying them to the cord or, alternatively, cord is threaded through the charge. These methods were adequate for operations such as quarrying where speed of charge placements was relatively unimportant but they are unsuitable for certain recently developed applications of explosives where it is necessary to attach explosive charges to detonating cord at high speed. One important development where individual charges attached at intervals to detonating cord is advantageous in land seismic prospecting. In a recently developed method of seismic prospecting, detonating cord is placed under stemming parallel to the surface of a prospect area and detonated to produce the seismic signal. The burying of such an explosive charge by feeding it through a tubular conduit attached to a plough member has been described in United Kingdom Pat. specifications Nos. 1,151,882 and 1,151,883. The seismic signal from a charge of elongated explosive can be much improved if, instead of using detonating cord only, auxiliary charges of explosive are connected to the cord at intervals. With such an assembly it is often possible to employ the explosive laid on the surface of the ground without stemming. Attempts have been made to tie charges to the detonating cord with adhesive tape wrapped round the charges and the cord but this method is too slow to enable the charges to be attached as the detonating cord is fed from a supply reel into position for detonation. The assembly of charges could not be fed easily through a tube in order to bury it because each auxiliary charge was necessarily positioned on one side of the detonating cord and the unsymmetrical assembly tended to block the tube entry.

An object of this invention is to provide an improved method of attaching explosive charges to detonating cord, thereby to improve the aforementioned seismic prospecting method. A further object is the provision of an explosive charge which may be readily attached in detonation initiating relationship to detonating cord.

In accordance with the invention a method of assembling one or more explosive charges on an initiating line of detonating cord comprises sticking a charge on the detonating cord by means of a layer of adhesive material.

The preferred method comprises applying a layer of adhesive material to the external surface of a portion of a flexible container containing a deformable explosive composition, and wrapping that portion of the container around one or more lines of detonating fusecord.

Preferably the width of the adhesive layer is greater than the cord circumference and in this case the part of the adhesive layer in excess of that in contact with the cord is stuck to itself or overlaps and is stuck to a further portion of the charge. Thus the edges of the adhesive coated portion of the explosive charge may be brought into either abutting or overlapping contact. The blasting charge and the layer of adhesive may be sufficiently wide to permit the charge to be wound around the detonating cord more than once. Conveniently the charge around the detonating cord is deformed to approximately circular cross-section.

From another aspect the invention consists in a blasting assembly comprising one or more explosive charges fastened to one or more lines of detonating cord by the aforementioned method.

The invention also includes a method of seismic prospecting which comprises laying the blasting assembly of the invention in a continuous manner, on or under the surface of a prospect area and substantially parallel thereto, and detonating the detonating cord and adherent charges to generate the seismic signal. In this method the adherent charge may advantageously be assembled on the detonating cord as the assembly is being laid in position.

This method of seismic prospecting is applicable both in land and marine prospecting. For land use, however, it is preferred to bury the blasting assembly by passing it down through a conduit attached to a plough member which penetrates the upper ground layer of a prospect area and forms a temporary opening therein to receive the blasting assembly.

From a still further aspect the invention consists in an explosive charge having a layer of adhesive material applied to a portion of its external surface, said adhesive layer being capable of sticking the explosive charge to detonating cord. A preferred charge comprises a deformable explosive composition contained in a flexible container having a layer of adhesive applied to a portion of the external surface of the container. The adhesive may be any kind of adhesive which will adhere to the surface of the detonating cord and the flexible container but a pressure-sensitive adhesive is preferred. The adhesive layer may conveniently be applied to the container in the form of a tape which, if desired, may comprise a reinforcing fabric or tissue coated on both sides with adhesive composition. The adhesive layer on the container is preferably protected by a readily strippable covering, for example silicone-treated paper or fabric, which is removed from the adhesive just before the charge is attached to the detonating cord. In this form the adhesive layer may conveniently be applied as a transfer tape comprising a double-sided adhesive layer or tape stuck to a releasable backing of, for example, silicone-treated paper.

The preferred charge is an elongated charge which is of such flexibility and dimensions that when wrapped longitudinally around a line of detonating cord, it may be formed to an approximately circular cross-section.

The flexible container may be fabricated from any flexible wrapping material. Paper, metal foil or synthetic plastics material are most convenient. The container may advantageously be of a gussetted construction where it is desired to form a flat charge to facilitate wrapping it wround detonating cord with the minimum amount of deformation. Usually, however, with easily deformable explosive compositions and containers having a high degree of flexibility, tubular

containers of circular cross-section are most convenient. An especially convenient container is one made from a sealed length of tubular synthetic plastics film, the film of the kind known as 'lay-flat' tubing being preferred. The synthetic plastics material may conveniently be polyethylene, polypropylene or polyvinyl chloride.

A wide variety of explosive compositions may be used in the explosive charge and assembly of the invention. For example, gelatinous or plastic explosives based on gelled nitroglycerine, or powdered explosive comprising an oxygen-supplying salt sensitized by nitroglycerine, trinitrotoluene, pentaerythritol tetranitrate (PETN) or cyclotrimethylene-trinitramine (CTMTN) are suitable. Obviously the explosive must be sufficiently sensitive to be capable of being initiated by the detonating cord with which it is to be used.

The detonating cord of the blasting assembly is conveniently one having a core of PETN encased in textile wrappings and an outer sheath of thermoplastics material, for example 'Cordtex' (Registered Trade Mark) detonating fuse-cord.

Using the method of the invention explosive charges may be attached rapidly to detonating cord and the method speeds up blasting operations where interconnected blasting charges are required. In addition to seismic prospecting, operations where the method is especially useful include the excavation of ground for tree planting, the assembly of charges for rock presplitting in quarry blasting and tunnelling, for multipoint priming of relatively insensitive explosive compositions, for example AN/FO compositions, and in general demolition operations using an array of charges.

In order further to illustrate the invention a preferred method of putting the invention into practice will be described, by way of example only, with reference to the accompanying drawings wherein:

FIG. 1 shows schematically a line of detonating cord with adherent explosive charges assembled therein being buried in a method of seismic prospecting;

FIG. 2 shows a prospective view of an explosive charge before attachment to detonating cord;

FIG. 3 is a cross-section on the line III—III of the charge of FIG. 2;

FIG. 4 is a cross-section on an enlarged scale on the line IV—IV of one configuration of explosive charge attached to detonating cord as in FIG. 1;

FIG. 5 is a cross-section of an alternative configuration of the explosive charge attached to detonating cord as in FIG. 1.

Referring to FIG. 1, a detonating fuse-cord **11** is buried in an upper ground layer **12** of a prospect site by passing it through a tube **13** attached to a towed plough member **14** which penetrates the ground and forms a temporary opening therein to receive the cord. The supply of cord **11** is stored on a reel **15** and during its traverse from the reel **15** to the tube **13** explosive charges **16** are wrapped around it and stuck to it at intervals.

The explosive charges **16** are shown in FIGS. **2** and **3** and comprise a deformable explosive **17** in a container **18** fabricated from lay-flat polythene tubular film sealed at one end **19**. The opposite end of the container is folded back and sealed by sticking down with a length of adhesive tape which extends along the container **18**. The tape is a double-sided pressure-sensitive transfer tape, manufactured by the Minnesota Mining and Manufacturing Company as "Scotch" (Registered Trade Mark) tape type **464** (reinforced) or type **465** (not reinforced) comprising an adhesive layer **21** and a releasable silicone-treated paper covering **22**.

The explosive charges are assembled on the detonating cord **11** by removing the releasable covering **22** immediately before use and wrapping the charge **16** around the cord **11** with the adhesive layer **21** on the inside. The charge is either wrapped once around the detonating cord **11** and the adhesive layer **21** is stuck to the cord **11** and to itself to give the cross-sectional configuration shown in FIG. **4** or it is wound around the cord more than once to give the cross-sectional configuration shown in FIG. **5** wherein the adhesive layer **21** is stuck to the cord **11** and to the outside of the container **18**.

Explosive charges of a convenient size, for example 4 oz. to 16 oz. charges of nitroglycerine gelatinous explosive 'Polar Ammon Gelignite' in 2 inch 'lay-flat' polythene tubing (4 inch circumference) × 6 **4** 18 inches long may be wrapped longitudinally at a rate of about 16 per minute around a line of detonating fuse as it is being ploughed into the ground. When the explosive assembly is detonated to generate a seismic signal for a seismic prospecting operation the seismic record obtained is markedly superior to that obtained using the detonating cord alone without the adherent explosive charges.

What we claim is:

1. A method of rapidly assembling a series of explosive charges on an initiating line of detonating cord moving longitudinally of itself in relation to an assembly point, which method comprises sticking the individual explosive charges at intervals on the detonating cord at said assembly point by means of a layer of adhesive material applied between the charges and the detonating cord.

2. A method as claimed in claim **1** wherein the individual explosive charges comprise a deformable explosive composition, contained in a flexible container and each charge is stuck to the cord by applying a layer of adhesive material to an external surface portion of the container and wrapping that portion of the container around the line of detonating cord.

3. A method as claimed in claim **2** wherein the width of the layer of adhesive material is greater than the circumference of the detonating cord and the part of the adhesive layer in excess of that contacting the cord is stuck to itself.

4. A method as claimed in claim **2** wherein the width of the layer of adhesive material is greater than the circumference of the detonating cord and the part of the adhesive layer in excess of that contacting the cord overlaps the portion of the charge surrounding the cord and is stuck thereto.

5. A method of seismic prospecting comprising assembling a series of explosive charges on an initiating line of detonating cord by the method of claim **1**, laying the resulting assembly on or under the surface of a prospect area and substantially parallel to said surface, and detonating the detonating cord and adherent charges.

6. A method as in claim 5 wherein the adherent charges are assembled on the detonating cord as the assembly is being laid in position.

7. A method as in claim 5 including burying the assembly by passing it down through a conduit attached to a plough member which penetrates the upper ground layer of the prospect area and forms a temporary opening therein to receive the assembly.

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