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RIGID EXPLOSIVE CARTRIDGES

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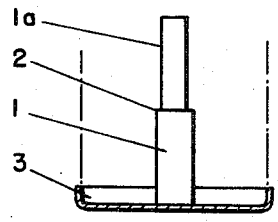


FIG. 1

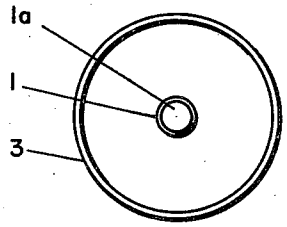


FIG. 2

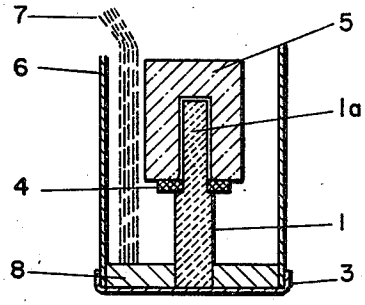


FIG. 3

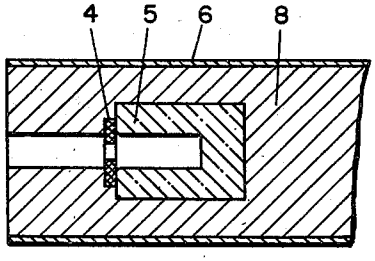


FIG. 4

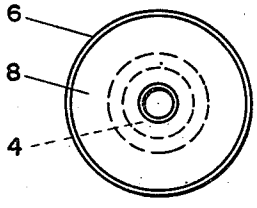


FIG. 5

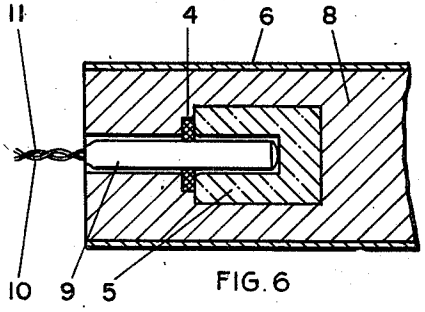


FIG. 6

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RIGID EXPLOSIVE CARTRIDGES

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6 Claims. (Cl. 102—24)

The present invention relates to an improvement in an explosive cartridge of the kind comprising a rigid detonating explosive cast around a portion of the surface of a rigid explosive pellet booster, that is to say an intermediate explosive element whose detonation can be effected by a smaller detonating impulse than that of the explosive in which it is thus embedded and serves to effect the detonation of the latter explosive, the pellet booster being shaped to provide a housing for an initiating explosive element insertable into it from the exterior of the cartridge, which will usually be a commercial detonator.

Explosive assemblies of this kind have been used for military demolition purposes, and on account of their excellent propagation of detonation would be desirable for commercial blasting in boreholes, especially at considerable depths as for instance in seismic prospecting. A borehole blasting charge may consist of a single cartridge, but sometimes it is necessary to employ a file of such explosive cartridges end to end and frequently the explosive cartridge or column of cartridges is provided with a rigid exterior casing along its length.

Whenever a pellet booster is used it is necessary to insert the initiating element, which will usually be a detonator, into the housing in the pellet booster shaped to accommodate it and for borehole cartridges this will require to be done before the cartridge, or one of the cartridges in the file, is introduced into the borehole. It may be required that the pellet booster should face downwards, or alternatively upwards. In either case the rigidity of the explosive pellet booster renders it a matter of some uncertainty whether the initiating element in this case normally an electric detonator, will remain in effective initiating position in its housing within the pellet booster while the cartridge is being lowered into the borehole and thereafter until the shot is fired, either owing to the tensions on the leading wires tending to pull the electric detonator out of its housing when obstructions are met, or owing to their failing to provide adequate support to retain the detonator in its housing if the latter is facing downwards.

It is the object of the invention to provide an explosive cartridge of the kind described having gripping means within itself adapted to engage the initiating element to be inserted from the exterior of one end of the cartridge into the housing in its pellet booster, and thus more securely retain the initiating element in initiating position than has hitherto been possible.

The explosive cartridge according to the invention comprises a rigid pellet booster having an internal cylindrical channel extending into it from one end surface, a washer of rubbery material having a perforation co-axial with that of said cylindrical channel but of smaller cross-section in contact with said end surface, and a rigid mass of a main charge explosive cast around the combination of the pellet booster and washer, said main charge having an internal cylindrical channel co-axial with and leading into the internal cylindrical channel

of the pellet booster by way of the said perforation and of a diameter greater than the diameter of the said perforation, so that a cylindrical initiating element that is an easy sliding fit in said channels requires to be pushed past an engaging inwardly protruding flange of the rubbery material of said washer before it can be inserted into the inner channel in the pellet booster, and once inserted therein encounters resistance to its retraction.

The explosive material of which the pellet booster is composed must be such that the initiator housing will retain its shape while the main charge explosive is being cast around the booster and therefore the main explosive composition must be capable of remaining liquid at a temperature not substantially exceeding the fusion temperature of the pellet booster explosive. Trinitrotoluene and mixtures of trinitrotoluene with cyclonite or pentaerythritol tetranitrate may be employed as the main charge explosive, and the pellet booster may be formed by compression of cyclonite, pentaerythritoltetranitrate or tetryl, or their mixtures with trinitrotoluene advantageously modified by containing a small amount of waterproofing binder. The cylindrical channel in the booster may be formed in the usual manner during the pressing of the pellet, and advantageously it is formed with a slightly enlarged mouth, which provides a certain space for the accommodation of rubbery material displaced forwardly when the initiating element is pushed against the protruding flange of this material, thereby magnifying the resistance to its retraction. This rubbery material may consist of a soft rubber, neoprene or other suitable rubber substitute.

A method for the production of the improved explosive cartridge according to the invention comprises providing a tubular container with a removable base, standing on said base an externally shouldered upright cylindrical mandrel the lower portion of which substantially corresponds in diameter to the diameter of the cylindrical channel in the pellet booster and the upper portion of which is of smaller diameter than said channel, positioning the pellet booster around the narrower portion of the mandrel and on a washer of rubbery material closely fitting the narrower portion of the mandrel and resting on the shouldered portion of the mandrel, pouring the molten main charge explosive into the container around the exposed surfaces of said mandrel, washer and pellet until the liquid explosive has embedded the so-supported pellet booster and filled the container to the height corresponding to the desired length of the cartridge, solidifying the molten charge, and removing the base and mandrel.

The invention will be more clearly understood by reference to the diagrammatic drawings accompanying the specification, whereof Fig. 1 is a section and Fig. 2 a plan view showing the shouldered mandrel resting on the detachable base, Fig. 3 shows in section the liquid main charge explosive being poured into the container with the removeable base on which stands the mandrel, and showing the inverted pellet booster resting on the washer of rubbery material positioned on the shoulder of the mandrel. Fig. 4 is a sectional view of the end portion of the resulting explosive cartridge and Fig. 5 is a plan view of the cartridge as seen from the exterior. Fig. 6 is a sectional view of a portion of the cartridge showing an electric detonator fully inserted into its housing.

In Fig. 1, **1** is the lower part and **1***a* is the reduced upper part of a mandrel shouldered as shown at **2**, and **3** is a shallow metal cup. As is best seen in Fig. 3 the tube of cardboard or like material **6** is inserted so as to fit snugly into the shallow cup **3** and an annular washer of rubbery or rubberlike material **4** whose cylindrical perforation is of slightly smaller diameter than the upper portion **1***a* of the mandrel is forced over so as to rest on the shoulder **2**, and the pellet booster **5** is inverted

over the top of the mandrel so as to rest on the annular washer 4, the length of the axial channel and the thickness of the disc being such that the top end of the mandrel fails to reach the closed end of the channel. 7 is a stream of molten main charge explosive being poured into the resulting container and as shown in the diagrammatic drawing has already filled itself up into a thickness 8 at the bottom of the container. The pouring is carried out in stages and the explosive allowed to solidify in order to prevent flotation of the booster. The channel in the pellet booster is of the same diameter as the lower portion 1 of the mandrel. In Fig. 4 the numerals 4, 5, 6, and 8 and in Fig. 5 the numerals 4, 6, 8, have the same significance as in Fig. 3, and it will be seen that the diameter of the central perforation in the annular washer is now somewhat smaller than the upper portion of the mandrel over which it was forced, having regained more or less its original form.

In Fig. 6 the figures 4, 5, 6 and 8 have the same significance as in Fig. 4. 9 is an electric detonator having insulated leading wires 10 and 11. It will be seen that the insertion of the electric detonator 9 through the annulus of rubbery material 4 and beyond it as far as it can go into the axial channel of the pellet booster 5 has compressed that portion of the annulus of rubbery material shown as projecting into the channel leading from the end of the explosive cartridge to the pellet booster, with the result that the annulus of rubberlike material grips the electric detonator tightly and opposes any attempt to retract it.

I claim:

1. An explosive cartridge comprising a rigid pellet booster having an internal cylindrical channel extending into it from one end surface, a washer of rubbery material having a perforation co-axial with that of said cylindrical channel but of smaller diameter in contact with said end surface, and a rigid mass of a main charge explosive cast around the combination of the pellet booster and washer, said main charge having an internal cylindrical channel co-axial with and leading into the internal cylindrical channel of the pellet booster by way of the said perforation and of a diameter greater than the diameter of the said perforation.

2. A method for the production of the improved explosive cartridge as claimed in claim 1 which comprises providing a tubular container with a removable base, standing on said base an externally shouldered upright cylindrical mandrel the lower portion of which substantially corresponds in diameter to the diameter of the cylindrical channel in the pellet booster and the upper portion of which is of smaller diameter than said channel, positioning the pellet booster around the narrower portion of the mandrel and on a washer of rubbery material closely fitting the narrower portion of the mandrel and resting on the shouldered portion of the mandrel, pouring the molten main charge explosive into the container around the exposed surfaces of said mandrel, washer and pellet until the liquid explosive has embedded the so-supported pellet booster and filled the container to the height corresponding to the desired length of the cartridge, solidifying the molten charge, and removing the base and mandrel.

3. An explosive cartridge as claimed in claim 1 wherein the mouth of the cylindrical channel extending into said rigid pellet booster from one end surface thereof is slightly larger than the diameter of the channel in the main charge leading thereto.

4. An explosive cartridge as claimed in claim 1 wherein the diameter of the internal cylindrical channel of said main charge is substantially equal to the diameter of the internal cylindrical channel of said rigid pellet booster.

5. A method for the production of the improved explosive cartridge as claimed in claim 1 which comprises providing a tubular container with a removable base, standing on said base an externally shouldered upright cylindrical mandrel, the lower portion of which is of a diameter greater than its upper portion, positioning the internally channeled pellet booster around the upper portion of the mandrel and on a washer of rubbery material closely fitting the upper portion of the mandrel and resting on the shouldered portion of the mandrel, pouring the molten main charge explosive into the container around the exposed surfaces of said mandrel, washer and pellet, until the liquid explosive has imbedded the supported pellet booster and filled the container to the height corresponding to the desired length of the cartridge, solidifying the molten charge and removing the base and mandrel.

6. An explosive cartridge comprising a rigid secondary explosive having an internal cylindrical channel extending into it from one end surface, a washer of rubbery material having a perforation coaxial with that of said cylindrical channel but of smaller diameter in contact with said end surface, and a rigid mass of a main charge explosive around the combination of rigid secondary explosive and washer, said main charge having an internal cylindrical channel coaxial with and leading into the internal cylindrical channel of the rigid secondary explosive by way of the said perforation and of a diameter greater than the diameter of the said perforation.

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