United States Patent

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[54] **MECHANICAL PRIMER**
7 Claims, 2 Drawing Figs.

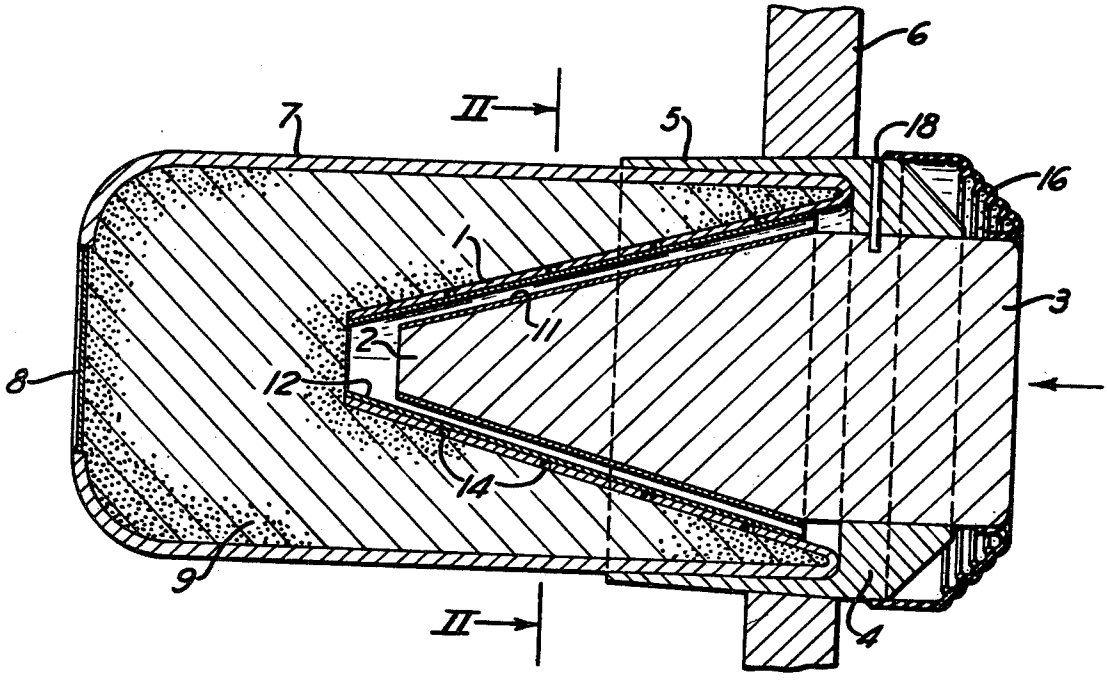
[52] **U.S. Cl.** **102/86.5,** 102/45
[51] **Int. Cl.** **F42b 19/10**
[50] **Field of Search** 102/86.5, 45, 70

[56] **References Cited**
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ABSTRACT: A rigid conical ram extends into an expandable perforated cone, but is spaced from it. The opposed surfaces of the cone and ram are coated with different components of pyrotechnic material that will ignite when brought together and subjected to compression and shear forces. The ram is supported for longitudinal movement so that it can be moved further into the cone in order to rub the pyrotechnic coatings together under pressure. The ignited material ignites other material around the cone.



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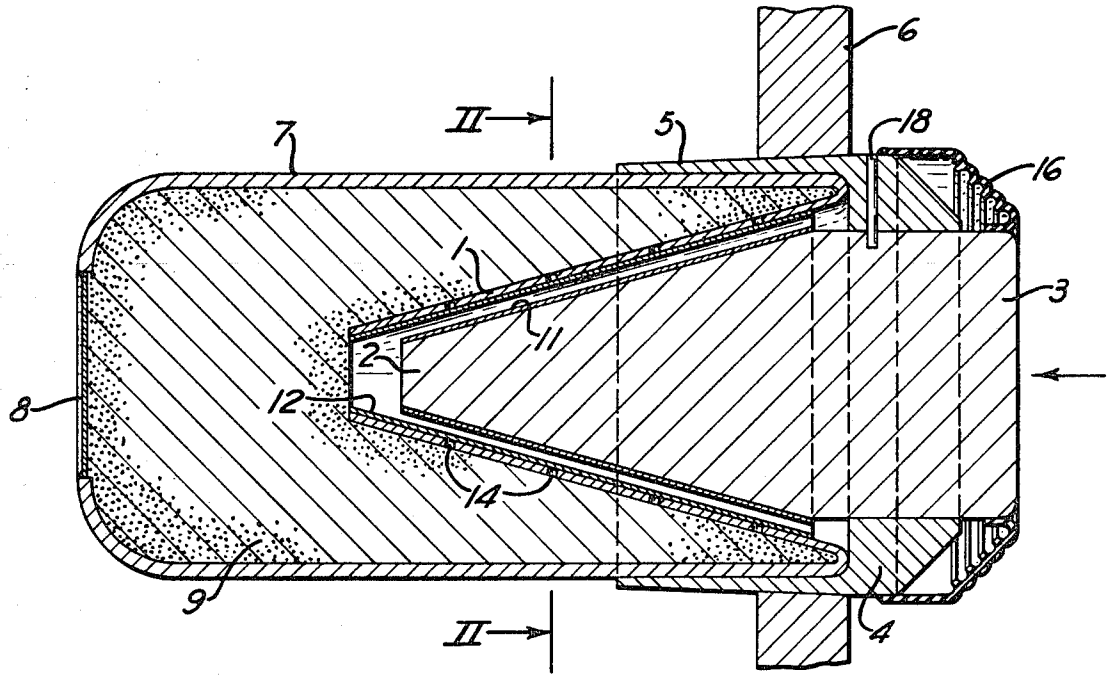


Fig. 1

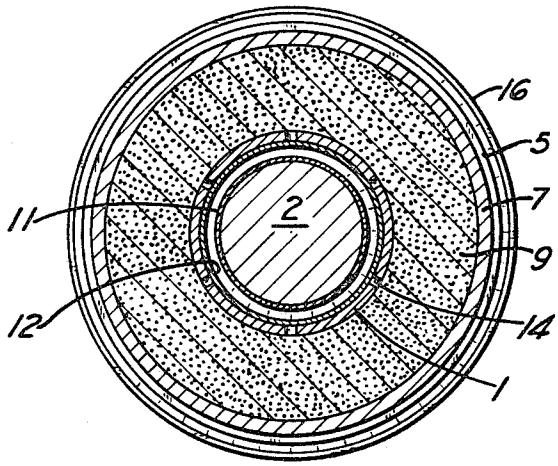


Fig. 2

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MECHANICAL PRIMER

It is among the objects of this invention to provide a primer which can be ignited by a combination of compression and shear forces in the optimum proportion, which is simple in construction and operation, and which requires only a small amount of energy to activate it.

The preferred embodiment of the invention is illustrated in the accompanying drawings, in which:

FIG. 1 is a longitudinal view through the primer; and

FIG. 2 is a cross section taken on line II–II of FIG. 1.

Referring to the drawings, a hollow cone **1**, open at both ends, has a wall that is thin enough to permit the cone to be expanded slightly by a modest amount of internal pressure. A suitable material for the cone is metal, but other deformable materials could be used. The internal pressure is applied by means of a rigid ram that has a conical portion **2** extending into the cone but normally spaced from it. The ram is tapered at substantially the same angle as the inside of the cone, i.e., within about 2° and has the same shape in cross section as the cone. The word "cone" is used herein to cover not only elements that are circular in cross section, but also those that may be polygonal in cross section. The outer end portion **3** of the ram is straight and is supported for longitudinal movement. The support preferably is an encircling bushing **4**, from which a sleeve **5** extends lengthwise around the cone. This sleeve may be mounted in an opening in a support **6** for the primer. The large end of the cone can be supported in the inner end of the sleeve in any suitable manner, but preferably it is joined to one end of a case **7** that is rigidly mounted in the sleeve. The case extends out of the sleeve and beyond the small end of the cone and has an opening in its outer end closed by a sealing disc **8**. The case is filled with an ignitable material or "first fire" mixture **9** suitable to the application involving the primer.

The opposed surfaces of the ram and cone; that is, the outside of the conical ram and the inside of the surrounding cone, are covered with spaced pyrotechnic coatings **11** and **12** that ignite when subjected to compression and shear forces. When one coating is rubbed against the other inside the cone, the compression of the pyrotechnic material insures close molecular contact between its components and ensures their burning after ignition. The shear forces provide the small activation energy that is required to start the reaction. The ram and cone carry separate components of the pyrotechnic material, which normally are separated to prevent unintentional firing. Thus, the oxidizer can be on the ram, for example, and the fuel on the cone.

A typical workable pyrotechnic material could be as follows:

		Percent
1.	Oxidizer coating:	
	Potassium chlorate	86
	Sulfur	5
	Potassium dichromate	1
	Zinc oxide	3
	Binder	5
	Total	100
2.	Fuel coating:	
	Phosphorous (red)	50
	Antimony trisulfide	45
	Binder	5
	Total	100

When the ram is driven into the cone, it expands the cone slightly and thereby rubs the pyrotechnic components together and simultaneously places them in contact with each other under pressure. The stretching of the cone also causes it to deform to the exact shape of the conical ram so that a large surface area for the pyrotechnic reaction to take place is provided. As soon as ignition occurs, the surrounding first fire mixture **9** is ignited through perforations **14** in the cone. The burning material in the case in turn ignites whatever element the primer is associated with. The first fire mixture may be composed, for example, of 10 percent amorphous boron and 90 percent barium chromate.

To hold the ram away from the cone until the primer is to act, the outer end **3** of the ram may be secured to an encircling flexible bellows **16**, the outer edge of which is secured to the outside of bushing **4**. Although the bellows normally spaces the ram from the cone, it can flex to permit them to move together when desired. Thus, the ram can be driver into the cone by application of pressure to its outer end or, if the primer is mounted in a moving object which is suddenly accelerated toward the right in Fig. **1**, inertia can cause the ram and cone to come together with sufficient force to ignite the primer. The firing energy required, or the adaptability to different pyrotechnics can be determined by the taper of the cone. Thus, the firing energy can be reduced to a minumum by the selection of the proper angle for the ram and cone. The bellows also serves to seal the primer.

To prevent accidental firing of the primer, a shear pin **18** can be inserted in a radial opening in the bushing, with the inner end of the pin projecting into a hole in the ram. Before the primer will fire, sufficient force will have to be applied to the ram to shear the pin.

This primer can be applied to any pyrotechnic system where a small, lightweight primer is needed for low-energy, low-velocity firing. For example, such a primer has been made to operate at a level of only 8 inch-ounces of energy at 3 feet per second. Such a firing energy is far below most conventional primers.

I claim:

1. A primer comprising a hollow expandable perforated cone, a rigid a ram extending into the cone but spaced therefrom, the ram inside the cone being the same shape in cross section and being tapered at substantially the same angle as the inside of the cone, pyrotechnic coatings on the opposed side surfaces of the cone and ram, said coatings being spaced apart but ignitable when subjected to compression and shear forces, means supporting the ram for longitudinal movement so that it can be moved farther into the cone to engage and expand the cone and thereby ignite said pyrotechnic coatings, and a body of ignitable material around the cone for ignition by said ignited coatings through the perforations of cone.

2. A primer according to claim **1**, including a shear pin extending into said supporting means and the side of the ram to hold the ram stationary until sufficient pressure is applied to it to shear the pin.

3. A primer according to claim **1**, including a bellows surrounding the outer end of the ram and secured thereto, and means supporting the bellows and sealing the space between it and the cone.

4. A primer according to claim **1**, including means supporting the cone and said ram-supporting means in fixed position relative to each other.

5. A primer according to claim **4**, in which said ram-supporting means is a bushing surrounding the ram.

6. A primer according to claim **1**, in which the outer end portion of the ram is straight, and said supporting means is a bushing slidably receiving said straight portion of the ram.

7. A primer according to claim **1**, including a case for said body of ignitable material, and a sleeve surrounding the case at the larger end of the cone, said ram-supporting means being connected to the outer end of the sleeve.

Disclaimer

3,563,178.—*Allen Scott Caples*, Baltimore, Md. MECHANICAL PRIMER. Patent dated Feb. 16, 1971. Disclaimer filed Aug. 2, 1971, by the assignee, *Catalyst Research Corporation.*

Hereby enters this disclaimer to claims 4 and 5 of said patent.

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