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REMOTE IGNITION LINE

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Fig. 1

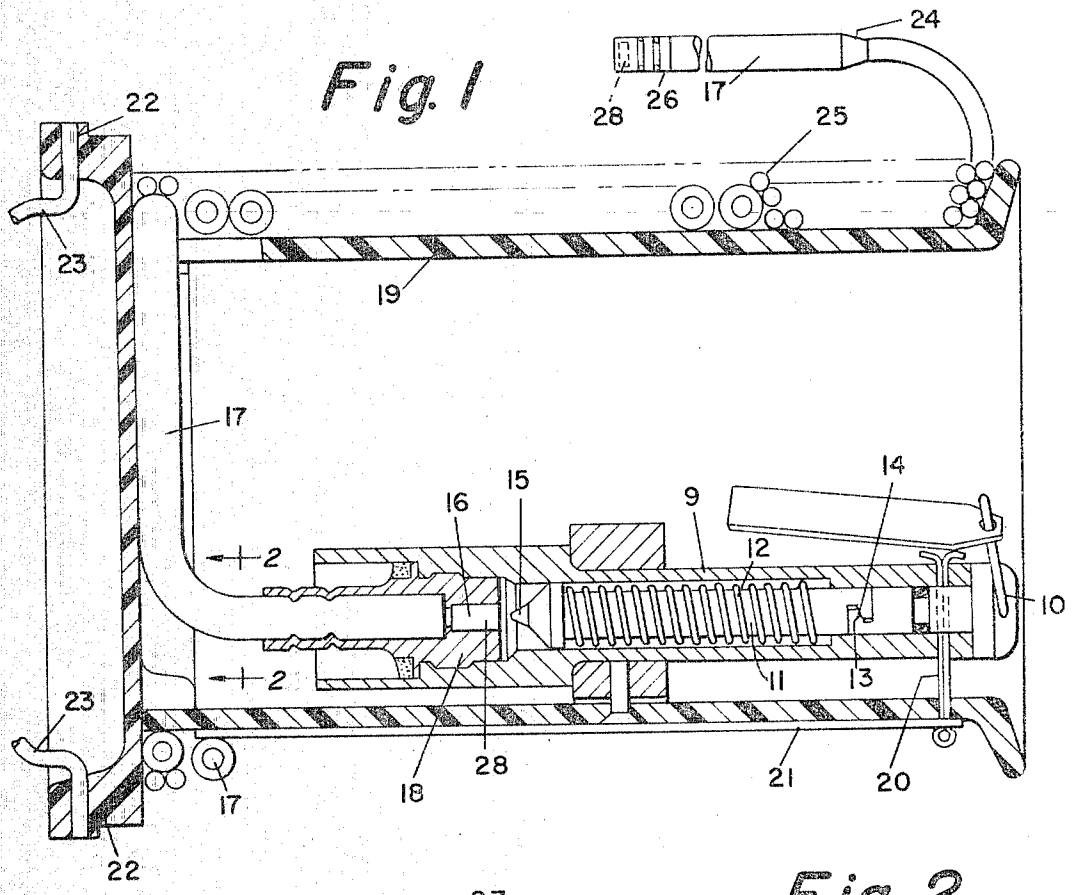
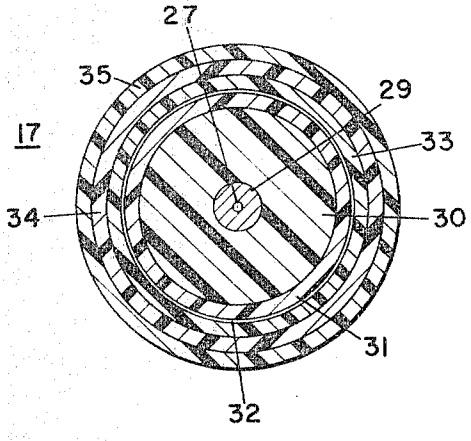


Fig. 2



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REMOTE IGNITION LINE

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12 Claims. (Cl. 102—27)

The invention described herein may be manufactured and used by or for the Government for governmental purposes without the payment to us of any royalty thereon.

This invention relates to a device for firing a gun at a safe distance without danger of shock and with an unusually light weight apparatus. An object is to provide such an apparatus which is reliable, adapted to withstand all degrees of natural temperatures and weighs substantially less than 60 pounds for an entire apparatus capable of firing a gun at a distance of 75 feet.

A lanyard is open to the objection that its pull tends to move the gun off the target in a horizontal plane especially when not exactly in rear of the piece. A recoilless rifle has the breech open to a flame issuing rearward wherefore this more modern weapon is not well adapted for being fired exactly in rear of it. Electric ignition becomes heavy when consideration is given to a heavy magneto or battery in addition to the wiring and its use is not favored because electric ignition provides only heat and not both heat and pressure and its connections become difficult in extremes of weather. A field of combat may also be filled with stray magnetic fields, radio impulses, etc. to endanger premature ignition.

Specifically it has been found that a previously used blasting ignition line by slight modification may be rendered immune to explosive shock to personnel at each end of the line. This possibility of adaption had not been appreciated by the manufacturers of explosives. An existing low energy detonation line has been changed by reducing the quantity of its detonation material from 2 grains per foot of PETN (pentaerythritol tetranitrate) to one grain per foot and the protection of its entire length in not only the lead sheath previously used to absorb energy by becoming vaporized but also enclosing the lead sheath in strong plastic fibers and in an elastic and abrasion resistant sheath of polyethylene. To further protect personnel at each end of the line additional protection for say ten feet from each end has been provided with an additional layer of elastic or shock absorbing polyethylene, then a layer of woven fabric of glass fibers, and finally an outer layer of polyethylene.

This PETN has a linear velocity shock wave and some travelling flame front of 18,000 to 20,000 feet per second or almost instantaneous and much faster than black powder.

In the drawings:

FIG. 1 illustrates the preferred embodiment of this invention for firing a gun from a distance of about 75 feet away from it.

FIG. 2 is an enlarged section on the line 2—2 of FIG. 1.

At the initiating end of the present low energy detonating cord there is shown in FIG. 1, a pull ring **10** by means of which the firing operation is started by holding the starting device **9** in one hand and pulling ring **10** with the other hand. This firing device **9** is not broadly new and includes a firing pin **11** pulled with ring **10** against the spring **12** which is compressed by such pull. When the pull has moved the connector **13** far enough for it to be free of the guiding function performed by the end of device **9** adjacent the ring **10**, the bevelled or inclined portion of this connector is released from the complementary end **14** of the firing pin with the assistance of the bevelled portion **14**. On connector **13** being forced away from the firing pin **11** by these bevelled or inclined portions as soon as connector **13** is freed from the guiding cylindrical walls of the starting device **9**, then the spring **12** drives the firing pin **11** forward with enough force for the blunt end **15** of pin **11** to strike primer **16** firing it and the PETN (pentaerythritol tetranitrate) in the reinforced cord **17**. An aluminum body **18** around this cord **17** provides a slightly yieldable enclosure for the detonating cord. As a convenience the reinforced cord is wound upon a spool **19** for substantially its entire length. A cotter pin **20** through the connector **13** or firing pin **14** prevents premature firing of this cord. A further safeguard against such premature firing before cord **17** has been unwound from the spool **19** includes a narrow plate **21** secured to the pin **20** and preventing pin **20** from being removed until all convolutions of cord **17** have been unwound from this plate **21**. A handle **23** for convenience in carrying spool **19** and its contents is sprung into holes **22** in an end of the spool.

The unwound cord **17** has its ends reinforced for about 10 feet or more from each end with the central part or main length **25** of the cord reinforced to a much less extent as will be shown hereinafter in connection with FIG. 2. The reinforced ends of larger diameter than longer central portion **25**, are preferably provided with aluminum terminals **26** and **18**. In each such terminal a booster of lead azide **28** is desirable for firing the core **27** and for enabling the fired core to penetrate an end of the terminal **26** and enable the primer in a gun to be fired. Best results accrue when terminal **26** substantially touches the primer in the gun to be fired, and when the primer **16** touches the adjacent end of the reinforced cord.

As shown in FIG. 2 where the cord reinforced ends are shown magnified, the central core **27** of PETN has been reduced from its formerly used strength in a blasting cord to only about a weight of one grain per foot of length, having a diameter of about .015 inch. Around this central core is a lead sheath **29** having a diameter of about .04 inch. When the core detonates the lead sheath is believed to be vaporized absorbing considerable heat of the detonation. Around the lead sheath is wound a 600 denier rayon layer **30** having a diameter of about .15 inch. Surrounding that is a layer of polyethylene **31** having a diameter of about .17 inch. This much of the cord applies to its entire length. Wherever used above and hereinafter the diameter given is an outside diameter for any layer.

The following portions of FIG. 2 apply to the reinforced or enlarged ends. Being an addition to an already formed cord, an air space of about .001 inch in thickness is provided to permit a sliding fit of the outer layers upon the previously described cord. This air space **32** acts as an attenuation means in that it helps reduce the shock waves created by the explosive. This is why the air space **32** is given a diameter of .172 inch. A polyethylene tube **33** having a diameter of .196 inch provides a good surface to slide over layer **31** and each is yieldable under tension due to internal pressure should the detonation for some reason be heavier than expected. The layer **34** having a diameter of about .220 inch is formed from a woven fabric of glass fibers and glass fibers are known to have a tensile strength exceeding many kinds of strong steel. The outer layer **35** of polyethylene has a diameter of .244 inch and provides a satisfactory abrasion resistant coating in addition to pos-

sessing the other advantages mentioned for such a layer. Instead of having abrupt termination of the protective layers which extend from each end about 10 feet, it has been found desirable to have them gradually taper off to the thickness of the mid-section and the ends coated with a moisture proof plastic to keep out fungi etc.

The chief advantage of this invention has been proven to be the protection of personnel at each end of the detonation cord. Another advantage is the small radius of bend to which the entire cord portions are able to withstand, as small as a bend around an eighth of an inch or less. The temperature range that this invention is able to withstand is from —40° to +160° F. The average weight for the entire cord is .75 pounds per foot. The strip **21** will be held in the position shown until the last convolution of cord wound over it has been unwound before it may be raised into prolongation of the cotter pin **20** and only then is the pin **20** able to be withdrawn preparatory to pulling ring **10** for firing the cord.

What is claimed is:

1. In a low detonating cord having a core of pentaerythritol tetranitrate encased in a lead sheath, the combination therewith of the improvement for enhancing the safety and utility of such cord for firing a gun from a distance as well as reducing the weight of said cord, said improvement including said sheath enclosed in a layer of 600 denier rayon having a thickness of about 0.55 inch, a layer of polyethylene about .01 inch thick and said core within said lead sheath weighing only about 1 grain per foot and the lead sheath being about .04 inch in diameter, said cord being reinforced for about 10 feet from each end with a second layer of polyethylene about .196 inch in diameter, a layer of fiber glass woven fabric outside the foregoing about .22 inch in diameter, and an outer layer of polyethylene about .244 inch outside diameter.

2. A cord according to claim **1** in which cord is wound on a spool and provided with a pull device for firing said cord.

3. A combination according to claim **1** in which a primer for firing said cord is enclosed in an aluminum terminal.

4. A combination according to claim **1** in which an aluminum terminal is provided also at an end of said cord opposite its initiating end, and a lead azide booster material is enclosed in the terminal at said opposite end and such a booster is also enclosed in said primer at the initiating end of said cord.

5. A low energy detonating cord including throughout the length of said cord,

a lead sheath encasing said explosive core,

a sheath of strong plastic fibers encasing said lead sheath, and

a first sheath of elastic material encasing said plastic fibers, and at the handling end of said cord,

a second sheath of elastic material encasing said first sheath of elastic material, said first and second elastic sheaths being radially spaced from each other to provide an air space,

a sheath of fiber glass material encasing said second sheath of elastic material, and

a third sheath of elastic material encasing said sheath of fiber glass material.

6. A cord of the type described in claim **5** wherein said explosive core is pentaerythritol tetranitrate.

7. A cord of the type described in claim **5** wherein said sheath of strong plastic fibers is made of rayon.

8. A cord of the type described in claim **5** wherein said first, second and third sheaths of elastic material are abrasion resistant.

9. A cord of the type described in claim **5** wherein said first, second and third sheaths of elastic material are made of polyethylene.

10. A cord of the type described in claim **5** wherein said sheath of fiber glass material is woven.

11. A low energy detonating cord including:

an explosive core,

a lead sheath encasing said core,

a layer of rayon encasing said lead sheath,

a first layer of polyethylene encasing said layer of rayon, and

a second layer of polyethylene loosely encasing said first layer of polyethylene, said first and second layer of polyethylene sheaths being spaced from each other to provide an air space.

12. A cord of the type described in claim **11** including:

a layer of fiber glass encasing said second polyethylene layer, and

a third layer of polyethylene encasing said layer of fiber glass.

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