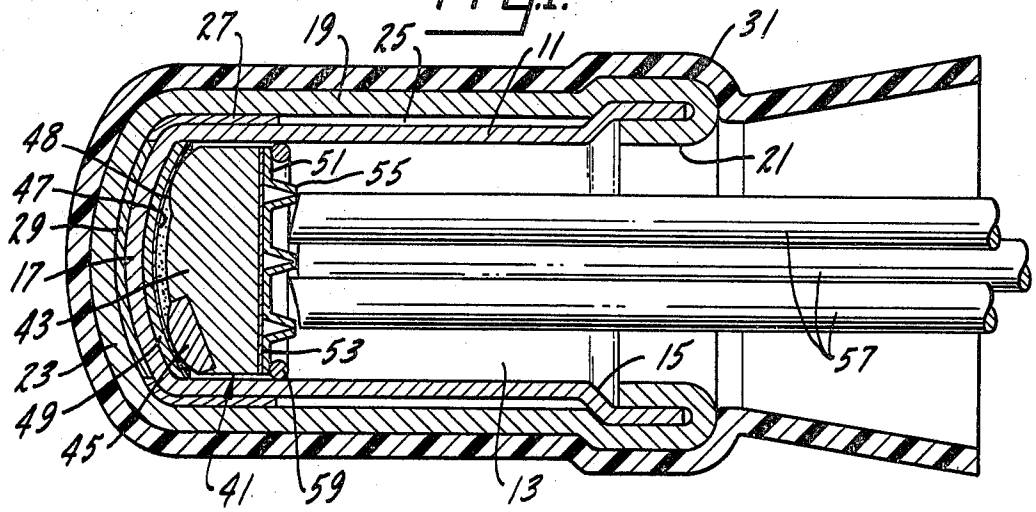
Dec. 9, 1969 H. M. McDONALD 3,483,311

WIRE ACTUATED IGNITOR FOR EXPLOSION CONNECTOR

Filed Dec. 24, 1968

Fig. 1.



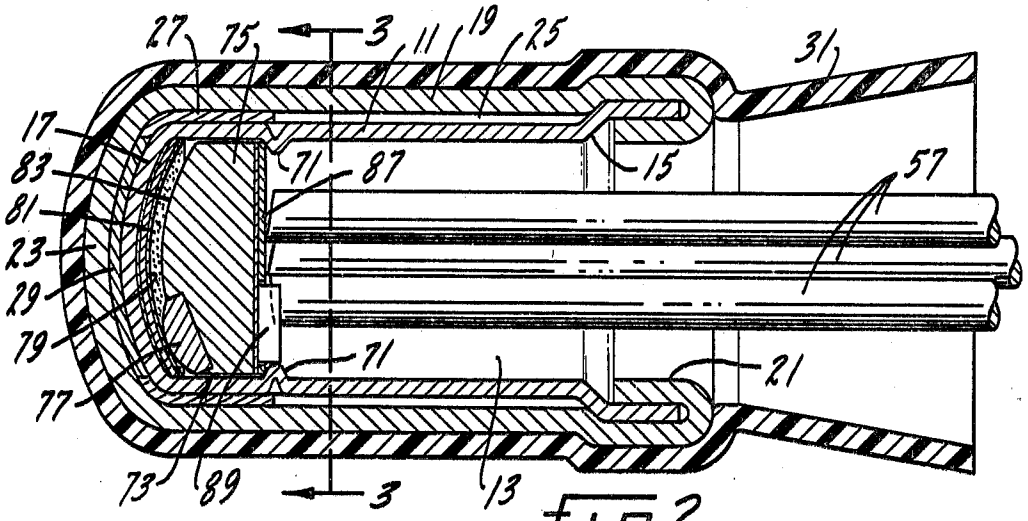
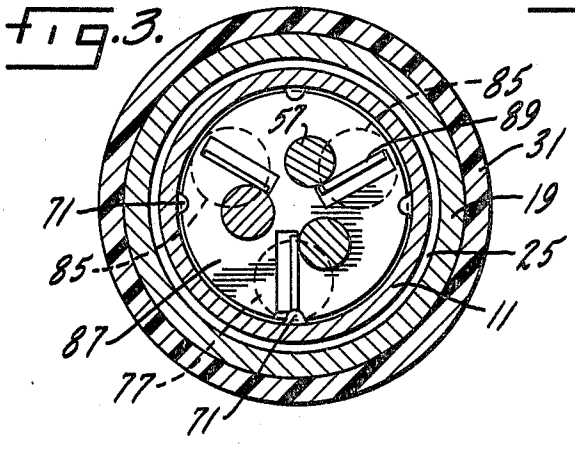


Fig. 2.

Fig. 3.



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WIRE ACTUATED IGNITOR FOR EXPLOSION CONNECTOR

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U.S. Cl. 174—87 9 Claims

ABSTRACT OF THE DISCLOSURE

A connector for joining wires, cables and the like having a deformable member with a bore to receive the wires to be connected. An ignitor is positioned in the bore so as to be actuated by manipulation of the wires. The ignitor is positioned in the bore with its actuating portions facing the bottom of the bore. The ignitor also has a twister plate, which is engaged by the wires, facing the open end of the bore.

SUMMARY OF THE INVENTION

This invention is concerned with an ignitor for an explosion connector which is actuated by manipulation of the wires to be connected.

An object of this invention is an ignitor that can be actuated by a relatively slight manipulation of the wires inserted in the connector.

Another object is an ignitor which is reliable in operation.

Another object is an ignitor which is constructed and positioned in a connector in such a manner that it cannot easily be contaminated during storage and use.

Another object is a multi-stage ignitor in which the heat produced upon ignition of the initial stages is concentrated upon the final stage.

Another object is an ignitor which utilizes rotation of the wires and the connector relative to one another to actuate the ignitor.

Another object is an ignitor that is relatively easy to construct.

Other objects will be found in the following specification, claims and drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

The invention is illustrated more or less diagrammatically in the following drawings wherein:

FIGURE 1 is a longitudinal cross-sectional view through an explosion connector showing the ignitor of this invention and the wires to be connected positioned in operative contact therewith;

FIGURE 2 is a longitudinal cross-section view similar to that of FIGURE 1 but showing a modified form of ignitor; and

FIGURE 3 is a cross-sectional view taken along line 3—3 of FIGURE 2.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

The drawings show aan explosive actuated connector utilizing the preferred forms of the ignitor of this invention. Referring specifically to FIG. 1, such a connector includes a deformable member such as a shell **11** having a bore **13** with an opening **15** at one end and a wall **17**

closing the opposite end. Surrounding the deformable shell is a non-deformable member also in the shape of a shell **19** having an opening **21** at one end thereof and a wall **23** closing the opposite end thereof. The non-deformable shell **19** is spaced from at least a portion of deformable shell **11** to form a chamber **25** between the shells. The portion of the shell **19** at its open end is folded over the portion of the shell **11** at its open end to form a seal for the chamber **25**.

Positioned in the chamber **25** is an explosive which may be of the heat-sensitive type. In this example, it is shown in the form of a thin sleeve **27** of nitrocellulose which fits tightly around the inner deformable shell **11**. The sleeve **27** may be molded, extruded, or thermoformed. It may be sized to fit tightly on the shell **11** or it may be pressed on the shell during assembly of the connector. An insulator such as a piece of cardboard **29** is placed in the chamber **25** between the end walls **19** and **23** of the deformable and non-deformable shell. As shown in FIG. 1, this insulator may completely fill the portion of the chamber between the sleeve **27** and the end walls. An insulating plastic cap **31** is fitted over the non-deformable outer shell **19**.

An ignitor **41** is located in the bore **13** of the shell **11** adjacent the end wall **17** and also adjacent the explosive **27**. This ignitor includes a heat producing generally disk shaped tablet or heat pill **43**, a match **45** and a striking or ignition surface **47**.

The ignition surface **47** consists of a mixture of:

	Gm.
Red phosphorous	2.5
Antimony trisulfide	0.25
Manganese dioxide	1.25

These materials are mixed by sifting them together three times through a #40 sieve. They are then mixed with a binder and spread onto a paper having a pressure-sensitive adhesive spread thereon. The binder is a mixture of equal weights of water and "Elmer's" glue. The treated paper is cut into a flat disk **49** which is press fitted into the bottom of the bore adjacent the end wall **17**. The disk will deform to conform to the contour of the end wall.

The match **45** is implanted in the convex surface of the heat pill **43** which faces the striking surface **47**. In this embodiment, the match is located adjacent the outer edge of the heat pill. A portion of the match protrudes from the convex surface of the heat pill for engagement with the striking surface. A similar protuberance may be provided diametrically at **48** in the heat pill to prevent wobble of the pill during rotation by the wires.

The match **45** may be made from a mixture of the following chemicals:

	Gm.
Potassium chlorate (crystal, sifted smaller than number 60)	14.5
Powdered sugar (confectioner's 10–X)	4.0
Sulfur (commercial flower, ground)	1.0
Barium chromate (pigment grade)	0.5

These ingredients are sifted twice through a number 40 sieve. They are then mulled together with 0.40 ml. of water in a mortar and pestle until uniform. The mixture is then sifted twice through a number 40 sieve and tumbled with 0.2 gm. of calcium stearate (Swift Flexicem C5). This mixture then is tableted in a ⅛ inch diameter die using a slightly concave top punch and a flat bottom punch. The tablet should be 20 mg. in weight.

The heat pill **43** is made from the following:

	Gm.
Zinc dust (approximately 200 mesh)	30.6
Antimony trioxide (Thermoguard L-brand)	34.7
Cuprous oxide (Glidden commercial grade A)	34.7

The above mixture is mulled together with 2½ ml. of a freshly mixed 1:1 (weight) mixture of sodium silicate and water. When this mixture is thoroughly mulled, it is then sifted through a number 14 screen onto a number 40 screen. The 14/40 fraction of this material is tumbled with 5% of its weight of graphite (Asbury grade 280).

The resulting powder is tableted in an appropriate die by filling the die with the powder and placing one match **45** on top of the powder. The combination is then pressed with a top punch which has a concave surface having a dimple directly over the match. The resulting tablets are then dried and are attached to the wire engaging or twister plates **51** by means of a hot melt glue **53**. The twister plate is provided with tangs or barbs **55** which are adapted to engage wires **57** which are inserted into the bore **13** through the open end **15** of the deformable shell **11**. A split ring **59** is provided to contact the deformable shell **11** and the twister plate **51** to hold the ignitor **41** in position at the bottom of the bore.

A modified form of explosion connector and ignitor is shown in FIGS. 2 and 3. The connector is identical to the connector shown in FIG. 1 except that the inner deformable shell **11** is indented at **71** to hold the ignitor **73** in position at the bottom of the bore **13**. The ignitor **73** is similar in chemical composition to the ignitor **43** of FIG. 1. The ignitor, as in the previous embodiment, includes a heat producing pill **75**, a match **77** and a striking or ignition surface **79**. The striking or igniting surface **79** is similar in composition to the striking surface **47** of FIG. 1. It differs in construction in that its paper backing is cemented by an adhesive to a piece **81** of dished metal which is press fitted against the end wall **17** of the shell **11**. The igniting surface material is applied to the paper in the same manner as described in the previous embodiment. The paper is attached to a flat, thin sheet of metal by a pressure sensitive adhesive. The paper coated metal piece **81** is then blanked by a suitable punch and die. An alternate method of forming the striking surface is to apply the ignition surface material directly to a thin sheet of metal. The coated sheet of metal is then blanked to form the dish shaped piece **81**.

The inner surface **83** of the heat pill **75** is convex to mate with the dished striking surface **79**. The match **77** is molded into the surface **83** of the heat pill adjoining the outer peripheral edge thereof and two additional protuberances **85** are formed in the surface **83** of the pill to provide stability for the heat pill during rotation.

The wire engaging or twister plate **87** is adhered to the side of the heat pill facing the opening **15**. Attached to this plate are three bars **89** of L-shaped or angle iron cross section located close to the outer edge of the twister plate. Each of these bars is aligned either with the match **77** or a protuberance **85**. As previously mentioned, the indentations **71** hold the ignitor **73** in position and in this example four indentations are provided in the shell **11**.

The use, operation and function of this invention are as follows:

The ignitors of this invention are actuated by manipulation of the wires in the bore of the explosion connector. Upon manipulation, which is usually rotation, the twister plate and its attached heat pill rotate with the wires relative to the striking surface which is affixed to the connector. The passage of the match across the surface of the striker plate brings about ignition of the match which in turn brings about ignition of the heat pill. The heat from the heat pill is conducted through the wall of the inner shell **11** and heats the explosive **27** to its ignition temperature.

The cardboard insulator **29** concentrates the heat produced by the heat pill against the explosive by preventing the loss of heat through the outer shell **19**. The positioning of the match and striking surface between the bottom wall **17** of the bore and the heat pill aids ignition by preventing the escape of heat produced by the match. The heat produced by the match is concentrated on the pill to bring about its ignition. Also, during the initial stages of burning of the pill, minimum heat is lost to the twister plate, wires, etc., since the burning starts on the inside surface of the pill.

The positioning of the match adjacent the outer periphery of the heat pill insures the maximum contact between the match and the striking surface during any rotation of the ignitor and also provides the maximum linear speed of the match relative to the striking surface, both of which will aid in reliable ignition of the ignitor with minimum rotational turns of the wires and connector relative to one another.

Locating the ignitor striking surface between the base of the bore and the heat pill protects this surface from contamination due to moisture or foreign matter which may find their way into the bore **13** of the connector.

Whereas preferred forms of the invention have been shown and described, it should be understood that there are many modifications, substitutions and alterations thereto which may be made without departing from the fundamental theme of the invention.

I claim:

1. A connector including:
- a deformable member having a bore adapted to receive at least one wire, cable or the like,
- an opening into one end of the bore and a wall closing the opposite end thereof,
- a generally non-deformable member enclosing and spaced from at least a portion of said deformable member to form a chamber therebetween,
- an explosive located in said chamber and of sufficient quantity, when exploded, to deform said deformable member into crimping contact with said wire, cable or the like, and
- an ignitor for said explosive located in said bore,
- said ignitor including an ignition actuating substance positioned adjacent said wall, and
- a twister plate affixed to said ignitor and positioned to be contacted by a wire, cable or the like inserted through said opening and into said bore,
- said ignitor being movable relative to said deformable member.

2. The structure of claim **1** further characterized in that:
- said explosive is of a heat-sensitive type,
- said ignitor is of a heat-producing type and is capable of producing sufficient heat upon actuation to bring about the ignition of said heat-sensitive explosive,
- said ignition actuating substance is a heat producing friction sensitive substance.

3. The structure of claim **1** further characterized in that means are provided to hold said ignitor in said bore.

4. The structure of claim **3** further characterized in that said means to hold said ignitor in said bore is a split locking ring.

5. The structure of claim **3** further characterized in that said means to hold said ignitor in said bore includes a plurality of deformations in said deformable member.

6. The structure of claim **2** further characterized in that said ignitor includes a heat producing pill that is generally disk shaped:
- said pill has at least one protuberance which engages said heat producing friction sensitive substance, and
- said protuberance is formed of a heat producing material, more sensitive to heat than the material of the heat producing pill.

7. The structure of claim **6** further characterized in

that said protuberance is located adjacent the outer edge of said pill.

8. The structure of claim 2 further characterized in that said end wall is concave, and the ignitor actuating substance is positioned against said end wall and conforms to the shape thereof.

9. The structure of claim 1 further characterized in that said non-deformable outer shell has an end wall positioned adjacent to and located outwardly of said end wall of said deformable member and an insulating material is located in the chamber portion between said end walls.

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DARRELL L. CLAY, Primary Examiner

U.S. Cl. X.R.

29—628; 102—28; 174—84; 287—109; 339—276