

Jan. 14, 1941.

C. R. JOHNSON ET AL

2,228,878

METHOD OF MAKING ELECTRIC BLASTING INITIATORS

Original Filed Dec. 24, 1937

2 Sheets-Sheet 1

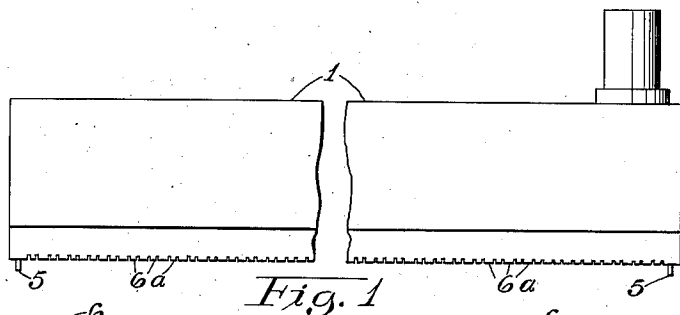


Fig. 1

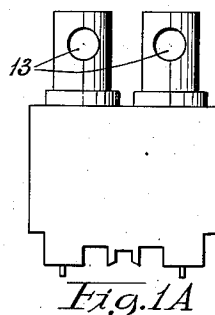


Fig. 1A

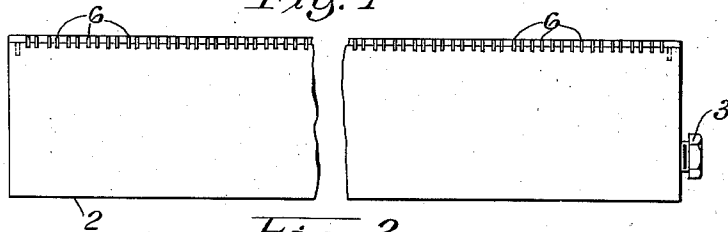


Fig. 2

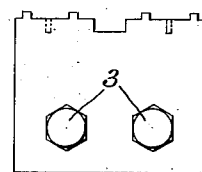


Fig. 2A

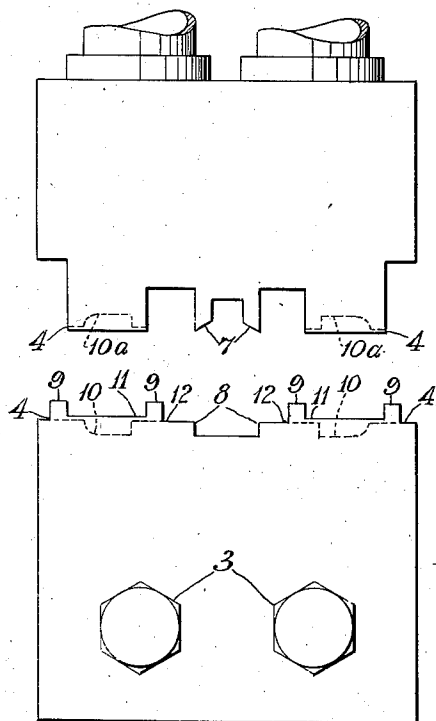


Fig. 1B

Fig. 2B

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2 Sheets-Sheet 2

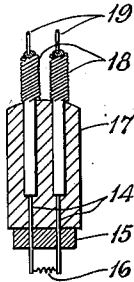


Fig. 3

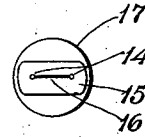


Fig. 4

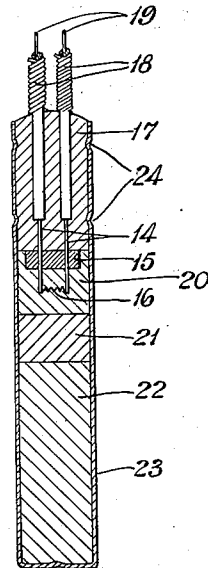


Fig. 5

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2,228,878

METHOD OF MAKING ELECTRIC BLASTING INITIATORS

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Original application December 24, 1937, Serial No. 181,644. Divided and this application December 7, 1938, Serial No. 244,334

3 Claims. (Cl. 18—59)

The present invention relates to electric blasting initiators and more particularly to a novel and improved method for the manufacture of water impervious electric blasting initiators.

This application is a division of application Serial No. 181,644, filed December 24, 1937.

As is well known, the usual procedure for the manufacture of electric blasting initiators comprises embedding the leg wires in a hard cast plug of sulfur-containing material and subsequently sealing this unit into place in a loaded shell by means of thermoplastic water-proofing compositions or similar sealing means. Such a procedure is not adaptable to a mechanical method of assembly, but includes several complicated and undesirable hand operations, involving both molten materials and loaded shells. Furthermore, due to the thermoplastic nature of the sealing compositions required, the resulting assembly fails to provide adequate moisture protection for the explosive charge under varying conditions of storage, and changing temperatures.

The object of the present invention is a new and improved electric blasting initiator. A further object is an improved process for the construction of electric blasting initiators. A still further object is a method whereby a water-proof initiator is produced without the use of sealing compounds. An additional object is an electric blasting initiator which is readily adaptable to mechanical assembly. Additional objects will be apparent from the following detailed description of our invention.

We have found that these objects are accomplished and the foregoing disadvantages overcome by manufacturing electric blasting initiators according to the process of our invention, which comprises molding and compressing a heated material about the leg wires of the electric blasting initiator to form a resilient plug, and to form an extension of decreased area of cross-section beyond the base of said plug, said extension surrounding and closely adhering to said leg wires, providing a waterproof seal between said wires and plug. The material employed may be a rubber composition or any other vulcanizable or thermoplastic material possessing resilient properties.

The extension beyond the base of the plug may take any shape provided that it has a decreased area of cross-section with respect to that of the body of the plug with which it is in immediate relationship, and surrounds and closely adheres to the leg wires. For example the extension may be cylindrical in shape, or it may take the form

of a pyramid, truncated cone, or the like. It may be in one piece or in two separate portions, one surrounding each leg wire. Preferably, however, we employ a wedge shaped extension so constructed that the ratio of the area of cross-section of said wedge to the combined area of cross-section of the leg wires is relatively small. We prefer to employ a wedge from $\frac{1}{8}$ to $\frac{1}{4}$ of an inch in thickness, and find a wedge of $\frac{3}{8}$ of an inch in thickness to be ideal. We have obtained desirable results with a wedge in a single piece, preferably extending lengthwise across the base of the plug, so that this lengthwise dimension of the wedge across the base of the plug will approximate to the diameter of the plug itself, the thickness of the wedge across the base of the plug being appreciably less than the diameter of the plug itself and preferably being within the range noted in the foregoing. This extension arrangement is desirable in order to effect an absolutely waterproof relationship between said leg wires and said plug, especially in mass production. Likewise the extension is of particular advantage for rendering the completed initiator assembly resistant against any forces which would otherwise tend to pull the leg wires and plug from the shell.

In order to describe our invention more clearly, we shall refer to the attached drawings which illustrate a preferred embodiment thereof. This is done solely by way of illustration and is not to be regarded as a limitation upon the scope of our invention, since many variations within the purview of this invention will be readily apparent to any one skilled in the art.

Referring generally to the various figures of the drawings, Fig. 1 is a vertical elevation of the upper portion of the mold, while Fig. 1—A represents a similar end view of the same portion. Fig. 2 is a vertical view of the bottom portion of the mold, Fig. 2—A being a vertical end view of the bottom portion. Figures 1—B and 2—B are enlarged vertical end sections of the top and bottom portions respectively, showing some of the parts in detail. Fig. 3 is a vertical section of the preferred form of resilient plug according to our invention. Fig. 4 is an end view of said plug showing the wedge thereon. Fig. 5 is a vertical section of a complete electric blasting cap assembly containing the resilient plug of our invention.

Similar characters are used throughout the several views and in the following description to designate corresponding parts.

Referring in greater detail to the drawings of the mold, numerals 1 and 2 designate the top and

bottom sections of the mold respectively as shown in Figures 1 and 2. 3 is the covering for pipe taps through which steam is passed in order to heat the mold to the desired temperature. The taps 13 in the top section of the mold as shown in Fig. 1—A serve as inlets and outlets for the steam, but are not connected with the pipe taps of the bottom section. The pins 5 of Figures 1 and 1—A serve to align properly the two sections, as well as to prevent any slipping during the molding operation. The centering guides 6 in conjunction with the corresponding openings 6—A of the upper portion of the mold serve to hold the ends of the leg wires 14 firmly in place during the molding operation. The knives 7 of the upper portion are adapted to fall into shearing relationship with the shoulder 8 of the bottom portion of the mold for the purpose of shearing off any length of leg wire extending beyond the shoulders 8. The cylindrical concavity 10 of Fig. 2—B is adapted to join with the corresponding concavity 10—A of the upper portion of the mold in Fig. 1—B, to shape the main body of the plug, while the adjacent concavity 11 in similar fashion is adapted to form the wedge extending beyond the base of the plug. The leg wires are extended on through the plug and wedge chambers and emerge at 12. The shape of the labyrinth is determined by the shape of the concavity or tapped entry 4, extending through the outer guide posts 9.

Referring in greater detail to the drawings of the finished plug, the bare ends 14 of the leg wires are shown in Fig. 3 to be embedded in the body of the rubber plug 17, and also in the relatively narrow wedge 15, which extends beyond the central portion of the base of said plug. It will be noted that the insulated portions 19 of the leg wires, are likewise embedded in the plug 2. The labyrinth 18 has been formed immediately above the bridge plug as a result of the preferred process for molding said plug about the leg wires, as described in detail hereinafter. The bridge wire 16 connects the bare ends of the leg wires.

In Fig. 4 the general relative proportions of the area of the cross-section of the wedge 15 and that of the bridge plug 17, may be observed. The leg wires 14 are shown in position and are connected by the bridge wire 16.

In Fig. 5 may be seen the location of the resilient bridge plug in the assembled electric blasting cap. The plug is crimped in place in the open end of the electric blasting cap shell 23, said closure being effected by means of the internal annular beads or grooves 24 in the shell wall, whereby the plug is gripped and held firmly in position. The bridge wire 16 is embedded in an ignition composition 20, below which is a priming composition 21 and a base charge 22.

A detailed description of the preferred process of our invention is as follows: The leg wires are introduced into the mold by passing them through the tapped entries 4, and on through the plug and wedge concavities 10 and 11 emerging at 12 to extend across the space between the shoulders 8, thus passing continuously through both the left and right hand units of the mold as indicated in Fig. 2—B. Two strips of rubber are introduced along the entire length of each mold unit between the guide posts 9. The two sections of the mold are then brought together. In making contact, the knives 7 of the top section come into immediate proximity with the shoulders 8 of the bottom section and thus shear off the wire which extends beyond the shoulders 8. These severed

sections of wire merely remain in the space between these shoulders. Steam being continuously circulated through taps 3 and 13, maintains the temperature of the mold at a point at which the rubber composition becomes fluid and takes the shape of the concavity shown by the dotted lines in Figures 1—B and 2—B. The upper and lower portions of the mold are held together so tightly as to cause the compression of the hot rubber composition about the leg wires, thus effecting the water impervious seal between the plug and said leg wires. During this compression period, the molten rubber composition is prevented from being exuded from the mold along the insulated portion of the leg wires by means of the labyrinth formed by the tapped entries 4 which tightly grip said insulation. After the desired molding period, the two sections of the mold are separated and the wires, enclosed in the rubber plug of preferred characteristics, are removed. The labyrinth bounded by the tapped entries 4 is reproduced in the corrugated portions 18 formed on the leg wires immediately above the plug. Accordingly, this corrugation itself will be referred to as a labyrinth. The labyrinth, of course, is not functional in the finished plug, but serves as an efficient check to prevent the flow of plastic materials out of the mold during the compression period. The labyrinth will, of course, take the shape of the particular entry employed. If a tortuous entry is employed the labyrinth will be tortuous. If a direct entry is used, there will be no noticeable labyrinth formed. Whereas any vulcanizable resilient material, including the so-called rubber substitutes, as well as varying degrees of vulcanized rubber may be employed for the formation of our improved plug, we prefer to use a crude rubber composition.

The finished bridge plug is then introduced into the open end of the charged electric blasting cap shell 23 and crimped into a water impervious relationship with said shell.

The foregoing method of assembly as well as the electric blasting initiator resulting therefrom, offer outstanding advantages over the art. By the development of a method of assembly wherein no waterproofing or sealing materials are necessary, we have eliminated the hazards inherent in the old process of pouring molten materials by hand into a loaded shell. In our process, the bridge plug is simply crimped in place in the loaded shell, a step which may be readily mechanized, and carried out at normal temperatures. Furthermore, our assembly is an exceptionally strong one mechanically, thus permitting greater exposure security without damage to the blasting cap. Tests have demonstrated that blasting caps made by our invention are capable of consistently withstanding much higher water pressures than the ordinary type wherein waterproofing and sealing materials are employed. In addition, the elimination of such waterproofing and sealing compounds makes possible an initiator of much smaller length.

The double molding feature disclosed in the foregoing, including the step of molding two plugs on the same set of leg wires and severing the wires between said plugs, is disclosed and claimed in U. S. Patent No. 2,204,994 to Johnson granted June 18, 1940, and accordingly is not claimed as part of the present application.

In the foregoing, we have described our improved initiator in detail. It will be apparent, however, that many variations may be made without departing from the scope of our invention.

We intend, therefore, to be limited only by the following claims.

We claim:

1. The method of producing a water impervious electric blasting initiator, which comprises molding a rubber-like material about the leg wires of said initiator under conditions of heat and pressure to form simultaneously a rubber-like bridge plug and an extension of decreased area of cross-section extending from the base of said plug surrounding and closely adhering to said leg wires as a waterproof seal and crimping a charged shell about said rubber-like plug in waterproof relationship therewith.
2. The method of producing a water impervious electric blasting initiator, which comprises molding and vulcanizing a rubber-like material about the leg wires of said initiator under conditions of heat and pressure to form simultaneously a rubber-like bridge plug and a relatively narrow rubber-like extension beyond the base of said plug surrounding and closely adhering to said leg wires and crimping a charged shell about said rubber-like plug in waterproof relationship therewith.

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3. The method of producing a water impervious electric blasting initiator, which comprises passing each of the leg wires of said initiator through a tortuous entry into a mold, molding and vulcanizing a rubber-like material about said wires of said initiator under conditions of heat and pressure to form simultaneously a rubber-like bridge plug and a relatively narrow rubber-like extension beyond the base of said plug surrounding and closely adhering to said leg wires and crimping a charged shell about said rubber-like plug in waterproof relationship therewith.

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