

April 6, 1937.

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2,076,512

BLASTING EQUIPMENT

Filed Jan. 9, 1936

2 Sheets-Sheet 1

FIG. 3

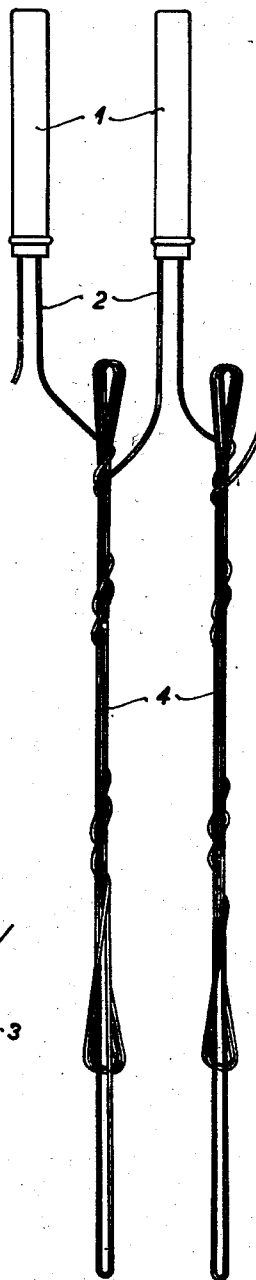


FIG. 4

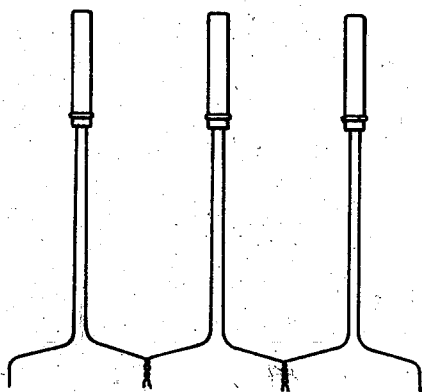
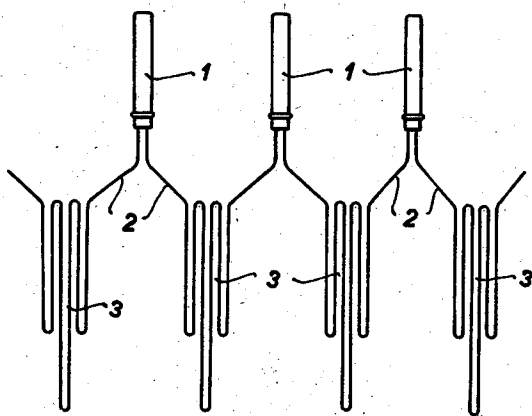


FIG. 2



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FIG. 4

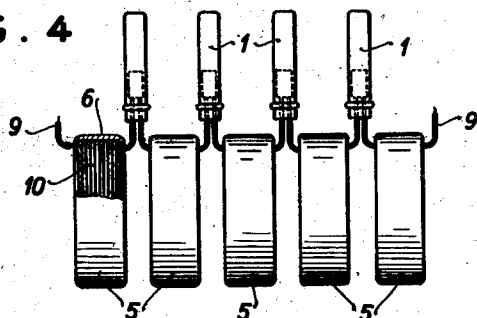


FIG. 5

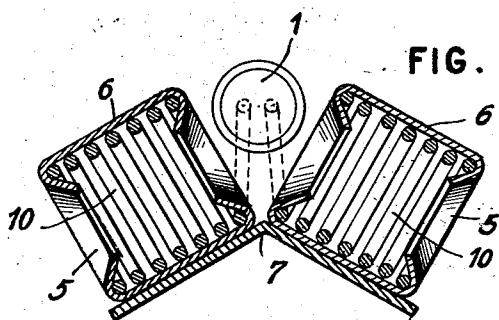
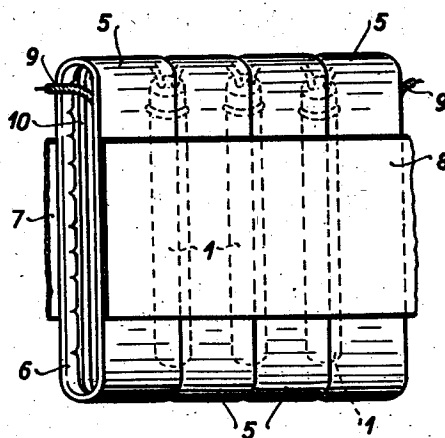


FIG. 6



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## UNITED STATES PATENT OFFICE

2,076,512

## BLASTING EQUIPMENT

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Application January 9, 1936, Serial No. 58,432

In Austria October 3, 1934

3 Claims. (Cl. 102-10)

This invention relates to blasting equipment, and more particularly to electric fuses and their appurtenances.

In the carrying out of blasting work in mines and the like it is usual to fire at any one time a considerable number of explosive charges each of which is laid in a separate shot-hole. If the firing of these charges be effected by means of electric current, each charge of explosive laid in a shot-hole has embedded in it a fuse provided with two current leads, the leads of each two adjacent fuses being laid bare and twisted up together so as to connect the fuses together electrically in series to form a continuous chain.

This hitherto usual method of making up the chain of fuses for firing a series of shots suffers from a number of serious drawbacks due to the conditions attendant on working under ground, insufficient lighting dampness of the ground, the nature of the operatives employed, and other factors. Examples of these drawbacks are poor contact at the connections in consequence of dirt, the missing out of some of the fuses in the chain in consequence of the necessity of laying and linking up the fuses in haste, with the result that some of the charges are not fired at all, and, first and foremost, the fact that, in spite of the strictest instructions, it is impossible to ensure with certainty that every connection shall be adequately insulated from contact with its surroundings. If two such deficiently insulated connections in the igniting current line should happen to touch damp ground simultaneously, and if, as is often the case, there be differences of electrical tension in this ground due to vagabond or leakage current (for instance from an electric mine railway), it is perfectly possible for leakage current to find its way into the fuses located between the said connections and to effect premature igniting of these fuses and consequent unexpected firing of the charges.

All these drawbacks are obviated by the pre-assembled fuse chain according to the present invention, since it does away with the necessity for making any connections in situ, so that there can be no defective connections, nor can there be any points at which leakage current can find its way into the line, since all the fuses are connected together from the outset by uninterrupted lengths of wire insulated throughout. The manner of making up the fuse chain according to the present invention thus solves the problem of the leakage current proof fuse, which has not proved capable of satisfactory solution hitherto either by the provision of series or shunt

resistances in the fuses or by the employment of gap fuses or the like, and that without the use of any supplementary means, so that all the expensive modifications to the firing machine and fuses conditioned by the special measures hitherto proposed can be avoided. Whereas up to the present all efforts have been directed towards preventing the leakage current, when it has once found its way into the line, from igniting the match head, the present invention aims at preventing any outside current from entering the line at all, and thus combats the cause instead of the effect of the above-mentioned evil in connection with electric firing fuses.

Whereas it is already known, with a view to saving space and improving storability and transportability, to wrap the two leads pertaining to each individual fuse in several turns around the fuse to which they pertain, to hold these turns in position by means of a layer of paper applied thereover, and to tie up a number of such elements into bundles or the like by means of tying wire, in a preferred form of carrying out the present invention a number, say ten, twenty, fifty, or more, of fuses are linked up in series to form a chain and assembled in such a manner that the two wires connecting together any two consecutive or adjacent fuses are wound up to form a coil corresponding to the size of the fuse and adapted to provide a recess in which the fuse can be stowed, after which these coils with the fuses between them, are placed one against the other in a tight and continuous row which is held together by a paper strip or the like to form a neat packet suitable for storage and transportation.

In laying the chain of fuses, the described coils are unwound one by one, and the fuses inserted in turn in their appropriate shot-holes. It will be clear at once that the laying of a train of fuses in this manner requires very considerably less time than the hitherto usual method of laying in which ten to fifty or even more fuses have first to be connected up together in situ and all the connections carefully insulated.

Two forms of construction embodying the invention are shown, by way of example, in the accompanying drawings, in which:

Fig. 1 is an elevational view showing, by way of comparison, the hitherto usual method of connecting up the fuses by twisting together the bared ends of the leads.

Fig. 2 is an elevational view showing the manner in which, according to the invention, each pair of adjacent fuses is connected together by a single uninterrupted piece of wire.

Fig. 3 is an elevational view showing a portion of a chain of fuses according to Fig. 2 in which the wire slack between the fuses is made up into bundles.

5 Fig. 4 is an elevational view showing a series of fuses with coiled leads before the stowing of the fuses in their respective recesses in the coils.

Fig. 5 is a detail cross-sectional view (the fuse being shown in end elevation) showing two adjacent wire coils held together at one side by an adhesive paper strip, these coils being gaped to show the intervening fuse.

Fig. 6 is a perspective view showing a section of a finished packet comprising a chain of fuses stowed between intervening coiled leads and held together by a strip of paper or the like laid around and stuck on.

In the form of the fuse chain according to the invention shown in Figs. 2 and 3 the connecting wires 2 of each pair of adjacent fuses 1 are laid in loops which are then made up into bundles by wrapping round the wire ends leading to the fuses, in order to simplify manipulation in laying the fuses.

25 In the form shown in Fig. 4 the connecting wires are wound to form coils 5 for example of rectangular cross-section. The individual windings 10 of the coils 5 are preferably first held together by means of paper strips 6 laid around them, or in any other manner. The coils can then be attached in close juxtaposition, by means of adhesive, on one side, to a paper strip 7, the appropriate fuse inserted into the recess between each coil and the next, and the coils then closed up together on the other side and there held together by the application of a second adhesive strip 8 (Fig. 6) to form a closed packet. In this manner the fuse chain is put up in a form particularly well suited both for storage and transport, and also for laying at the place where it is to be used.

I claim:

1. A chain assembly made up of a plurality of electric fuses for the ignition of blasting charges, said assembly comprising fuses connected by conductors which are continuous their entire length and insulated throughout, said conductors being wound into the form of a coil between each pair of fuses, said coils being laid end to end in contact with one another with the fuses located between and enclosed by the adjacent coils, and fragile means for holding the several coils in their assembled end to end relation.

2. A chain of electric fuses comprising a plurality of fuses connected in series by means of insulated conductor wires, said wires between each pair of fuses being brought into the form of a coil, individual wrappers for the several coils to hold the loops thereof in assembled position, the several coils being laid end to end in contact and having end depressions in which the fuses are located and enclosed by adjacent coils, and a fragile tie-strip embracing the several coils for holding them in end to end contact, thereby forming a unitary packet.

3. A chain of electric fuses comprising a plurality of fuses connected in series by means of insulated conductor wires, said wires between each pair of fuses being brought into the form of a coil, individual wrappers for the several coils to hold the loops thereof in assembled position, the several coils being laid end to end in contact and having end depressions in which the fuses are located and enclosed by adjacent coils, and a fragile tie-strip embracing the several coils for holding them in end to end contact, thereby forming a unitary packet, said tie-strip comprising an adhesive paper strip passed over each of the wrappers of the several coils in virtue of which the coils may be separated at one side while remaining "hinged" together by the paper strip at the other side.

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