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3,099,216

METHOD OF EXCAVATING ROCK, ORE AND THE LIKE BY
BLASTING AND MEANS FOR USE IN SAID METHOD

Filed Nov. 4, 1960

3 Sheets-Sheet 1

FIG. 1

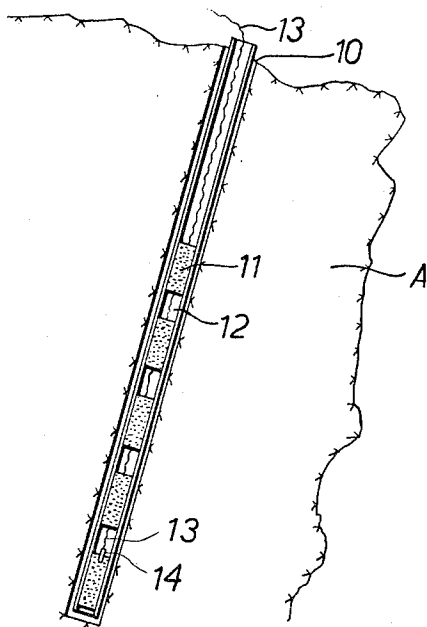
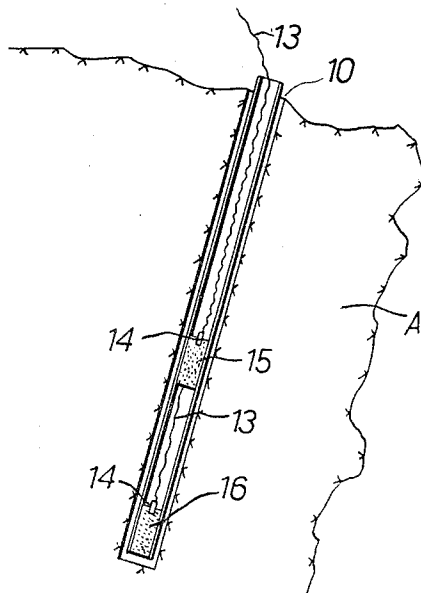


FIG. 2



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FIG. 3

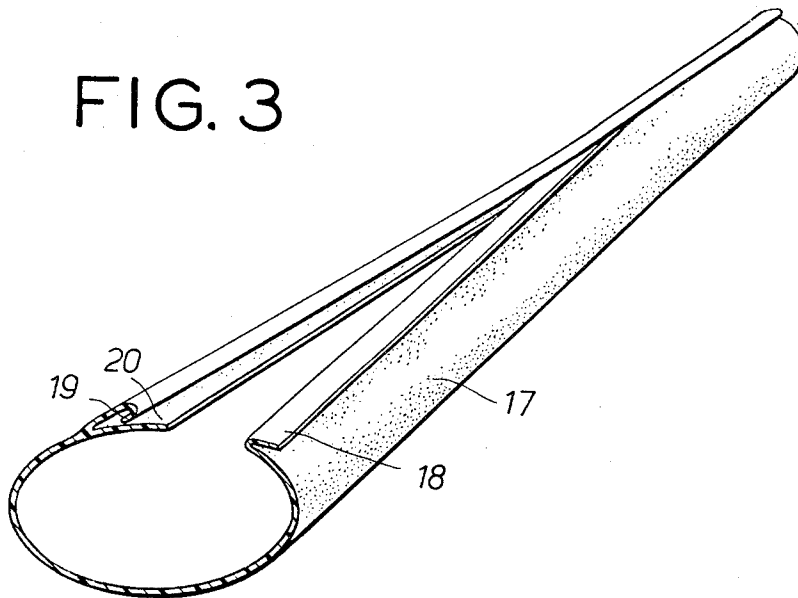
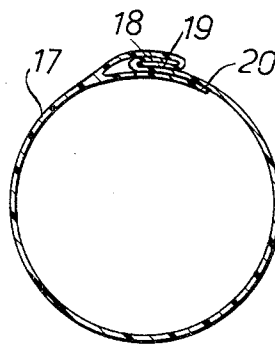


FIG. 4



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FIG. 5

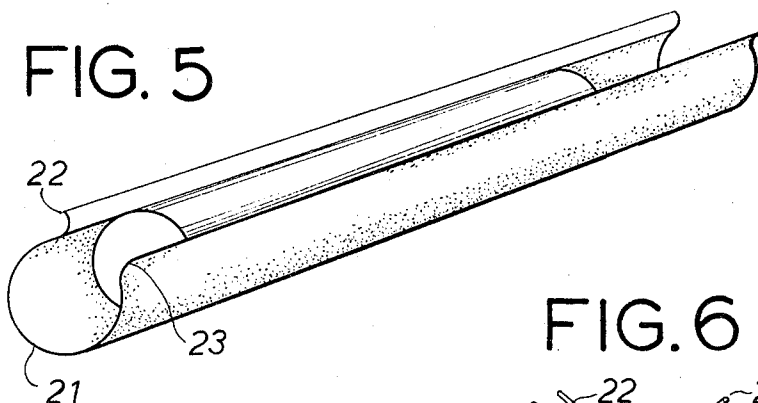


FIG. 6

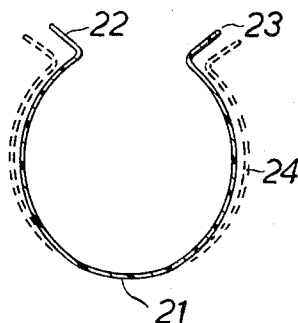


FIG. 7

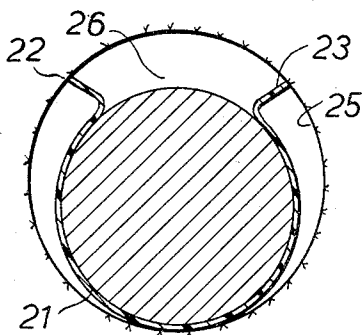
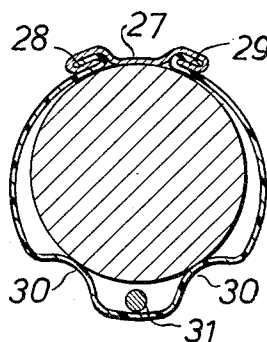


FIG. 8



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METHOD OF EXCAVATING ROCK, ORE AND THE LIKE BY BLASTING AND MEANS FOR USE IN SAID METHOD

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2 Claims. (Cl. 102—22)

This invention relates to the art of excavating rock, ore, soil and the like by blasting.

As is well known in the art, explosives such as dynamite for use in blasting operations are most commonly marketed in cylinders of brown paper from one to two inches in diameter and eight inches long, known as "sticks." In mining and other excavating operations, the sticks must be arranged in appropriate bore holes according to certain patterns, in order to obtain controlled effects. In many instances, it is desirable to maintain certain specific spacing between the individual sticks. This may involve the use of special spacing members, which are generally of wood. It is also known to market explosives packed in cardboard tubes wherein the explosive is appropriately arranged according to a predetermined pattern for various conventional mining operations. However, it may very often be necessary to depart from the pattern of such prefabricated packages. Another possibility is to use a rod of wood or the like to which the sticks are attached at desired intervals. This latter proposition involves, however, excessive handling of the explosive, which should preferably be avoided for obvious reasons.

One object of the present invention is to provide a method in which individual sticks of explosive may readily be located immediately prior to charging according to any desired pattern.

A further object of the invention is to provide means enabling easy charging of explosives into drilled bore holes whereby the danger of misfiring is reduced.

A third object of the invention is to provide an arrangement which will enable the charging to be effected without the danger of excess moisture penetrating into the explosive charge.

According to the present invention a method of excavating rock or the like by blasting comprises the steps of drilling a bore hole in the material to be excavated, arranging individual elements of explosive material according to a desired pattern along an elongated rod means, inserting said rod means in said bore hole and detonating the explosive material, the improvement being that the elongated rod means is made from a sheet material shaped into an undercut channelled cross-sectional shape to enable insertion of said individual elements therein in a lateral direction with respect to the channel and to locate the elements within the channelled cross-section by a gripping action afforded by resilience of the elongated rod means.

Furthermore, there is also provided, according to the present invention, a novel means for use in blasting operations for inserting explosive sticks into a drilled bore hole preparatory to detonating said sticks, said means comprising an extruded elongated member made from thin resilient strip material to a cross-sectional shape corresponding to the shape of the Greek letter "omega" the channel-forming portion of which extends over an angle of between 200° and 340°, said channel-forming portion terminating in outwardly protruding flanges which serve as resilient supporting means for said elongated member when inserted into a bore hole drilled for receiving an explosive charge, by engaging towards the walls of said bore hole.

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The invention will be described further, by way of example, with reference to the accompanying drawings, in which:

FIG. 1 is a vertical sectional elevation showing a rock to be excavated by a blasting operation with an appropriate explosive charge in position, the explosive sticks arranged according to the invention and in a first pattern.

FIG. 2 is a sectional elevation corresponding to FIG. 1, but showing another arrangement of the explosive sticks for use under other conditions.

FIG. 3 is a perspective view of an arrangement according to a first embodiment of the present invention for use in blasting operations such as are illustrated in FIGS. 1 and 2.

FIG. 4 is a sectional view as taken on the line IV—IV of FIG. 3.

FIG. 5 is a perspective view of a second embodiment of an arrangement according to the invention.

FIG. 6 is a sectional view as taken on the line VI—VI of FIG. 5.

FIG. 7 corresponds substantially to FIG. 6, but shows the arrangement when in use.

FIG. 8 is a sectional view of a modification to be used in the arrangement of FIGS. 5, 6 and 7.

In FIG. 1 there is shown a vertical section through a rock of which a portion designated by the reference letter A is desired to be removed by blasting.

As is well known in the art, this involved drilling of a bore hole 10 and introducing a charge of explosive into such bore hole, whereupon the explosive is fired.

According to the prevailing conditions, such as the hardness of the rock, the presence of cracks and the like, the explosive charge should be arranged so that maximum effect is obtained from a minimum charge. Additionally, the arrangement should be such that all of the explosive is fired. In the arrangement of FIG. 1, individual dynamite sticks 11 are arranged in a row, with a space, as indicated at 12, between each adjacent pair of sticks. This spacing may be up to about five inches (12 centimetres) which is about the maximum spacing commensurate with certain firing of the entire charge. Electric lead-in wires 13 are arranged to fire a detonator 14 located in the lowermost dynamite stick, and this arrangement will ensure that the entire charge is detonated.

With reference to FIG. 2, it is to be assumed that it is again desired to remove the rock portion A in a blasting operation, but, however, for some reason that it is impossible or undesirable to use more than two dynamite sticks, or at any rate that only a greatly reduced total charge can be employed. Accordingly, a bore hole 10 is drilled, whereupon a first charge 16 is arranged at one location and a second charge 15 at another location both charges being detonated by an electric detonating mechanism 14 fired by means of an electric lead-in wire 13.

The charges 15, 16 may each consist of a single dynamite stick.

It is obvious to one skilled in the art of mining and excavating that the arrangement of the charge or charges will vary considerably, according to the effects desired from the blasting operation, it being difficult to predetermine precisely the correct arrangement for giving optimum results with a minimum of explosive. However, even if one should happen to know the correct arrangement, it has hitherto been extremely difficult to locate the sticks properly and correctly particularly having regard to the fact that safety considerations demand, above all, that the firing charge or detonator must be kept securely in position to prevent misfiring.

In the arrangements according to the present invention, this is achieved by employing a prefabricated sheath in which the sticks are properly located in correct mutual

positions one embodiment of which will now be described with reference to FIGS. 3 and 4.

In the arrangement of FIGS. 3 and 4 the sheath 17 is in the form of an extrusion of a plastics material produced to the general shape of a cylindrical tube which is split lengthwise. At one longitudinal edge, said tube has a flange portion 18 turned outwards and backwards to form a hook portion. At the opposing longitudinal edge, a complementary hook portion 19 is provided. Preferably, a flange member 20 is provided beneath the hook portion 19. With this arrangement insertion of the first-mentioned flange or hook portion 18 into the space defined by the flange member 20 and the complementary hook portion 19 will bring the hook portions 18, 19 into latching engagement with one another to form a tubular sheath enclosing the dynamite sticks. By correlating the diameter of the tube to the conventional diameter of the dynamite sticks, the sheath will be such as to locate the sticks firmly in their respective positions within the tube at desired locations, together with appropriate electric leads, fuses or the like for firing of the charge. As will be seen from FIG. 4, the flange member 20 serves to ensure the sheath is substantially of true tubular form internally.

In the arrangement of FIGS. 5, 6 and 7, the sheath comprises a part cylindrical main portion 21 terminating at the longitudinal edges thereof in outwardly flaring flanges 22, 23 so that it has the shape of the Greek letter "omega." As shown in FIG. 6, the main portion 21 is not, in its unstressed condition, exactly cylindrical in shape but is slightly ovate, in order that the portion 21 will yield outwardly to assume the shape shown by dotted lines 24 in FIG. 6, when a stick of explosive is inserted therein. Preferably, this sheath 21, 22, 23 is made from a cheap plastics material having relatively high resilience, such as polyvinyl chloride or the like, so that the explosive sticks will be held firmly in their correct positions within the said portion 21. It will readily be appreciated that insertion of the explosive sticks at desired locations within the sheath is extremely easy, and also that they are maintained securely in their inserted positions.

When the arrangement of FIGS. 5 and 6 is used in a bore hole the flanges 22, 23 serve as spacing members which locate the sheath and charge in the bore hole. This is illustrated in FIG. 7 wherein it will be seen that the flanges 22, 23 engage the wall 25 of drilled hole. Usually, it will be unnecessary to cover the opening remaining at 26 between the flange 22 and 23. However, as shown in FIG. 8, this opening may be covered by means of a clip 27 having a hook-shaped formation 28, 29 at each longitudinal edge thereof, said formations 28, 29 co-operating with the respective flange 22, 23 to complete the cylindrical sheath enclosing the explosive sticks.

In this embodiment, the main portion 21 of the sheath may be provided with axially extending ridges or grooves 30 to provide definite resilience in the circumferential direction in order to increase the grip of the main portion 21 on the sticks. This arrangement will enable one size of sheath to be employed for accommodating a range of sizes of explosive sticks, a feature easily obtainable in the arrangement of FIGS. 3 and 4.

Furthermore electric lead-in wires 31 for use in detonating the charge may be arranged in the channel-like space defined by the ridges or grooves 30, so that such wires will be adequately protected against damage by being compressed by the explosive sticks when the entire assembly of sheath explosive charge, wires and detonator is to be introduced into the bore hole.

A significant feature of the arrangement of the present invention is that the assembly may readily be inserted into the drilled bore hole without fear that the detonator or the detonator wires may break loose, resulting in misfiring. Where rock covered by some inches of soil, rubble or the like is being blasted, proper introduction of the explosive sticks has hitherto proved extremely difficult, this difficulty is readily obviated by use of the invention.

Furthermore, the arrangements of FIGS. 3, 4 and 8 may readily be converted into fully closed assemblies by suitably sealing the ends of the sheath and, if desired, the longitudinal join or joins thereof. This will prevent moisture from penetrating to the explosive. Although conventional dynamite is relatively indifferent to the presence of moisture, several other explosives used for blasting purposes are highly susceptible to misfiring, when even small amounts of moisture are present. Because water is generally used as a lubricant when drilling bore holes in rock, the use of such water-susceptible explosive in rock blasting operations has not heretofore been practicable. The present invention can be used to eliminate penetration of moisture and therefore enable such use.

It will be appreciated from the foregoing that arrangement according to the present invention provides a simple solution to the problem of arranging charges of dynamite or like explosive in a drilled hole according to desired patterns and, the sheath is simple and cheap to manufacture. By suitable choice of the material of the sheath, it can be ensured that the latter will not result in any undesired residues after firing. More particularly in excavating operations, the arrangement of the invention enables quick and exact charging of the drilled bore holes.

It will be understood that the invention is not confined to the precise details of the foregoing examples which are for the purpose of illustration only and that modifications and variations may be made thereto without departing from the scope of the invention as defined by the appended claims.

What we claim is:

1. A member for holding a plurality of cylindrical explosive charges and maintaining the charges in axially aligned condition and in predetermined axially spaced relationship, said charges being intended for insertion into a bore hole in the material to be excavated, said member comprising a thin-walled cylindrical tube fabricated of material having the resilience characteristics of polyvinyl chloride, said tube having a longitudinal opening smaller in width than the diameter of said tube extending the full length of the tube through which individual explosive charges may be forced into said tube, the smallest internal diameter of said tube normally being at most equal to the diameter of the individual charges which are used with the tube, the longitudinal margins of said tube on either side of said opening defining outwardly flaring flanges giving said tube the cross-sectional shape of the capital Greek letter "omega," and after the explosive-filled tube has been inserted into the bore hole, said flanges together with a circumferential portion of the body of said tube engaging the walls of the bore hole so as to frictionally maintain said tube at any depth within the bore hole.

2. An explosive-charge-holding member according to claim 1 wherein said tube is provided with at least one longitudinal inwardly projecting ridge against which said cylindrical explosive charges are seated, said ridge and charges making only line contact.

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