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METHOD OF SPRINGING HOLES IN MINERALS AND MINERAL-LIKE MATERIALS

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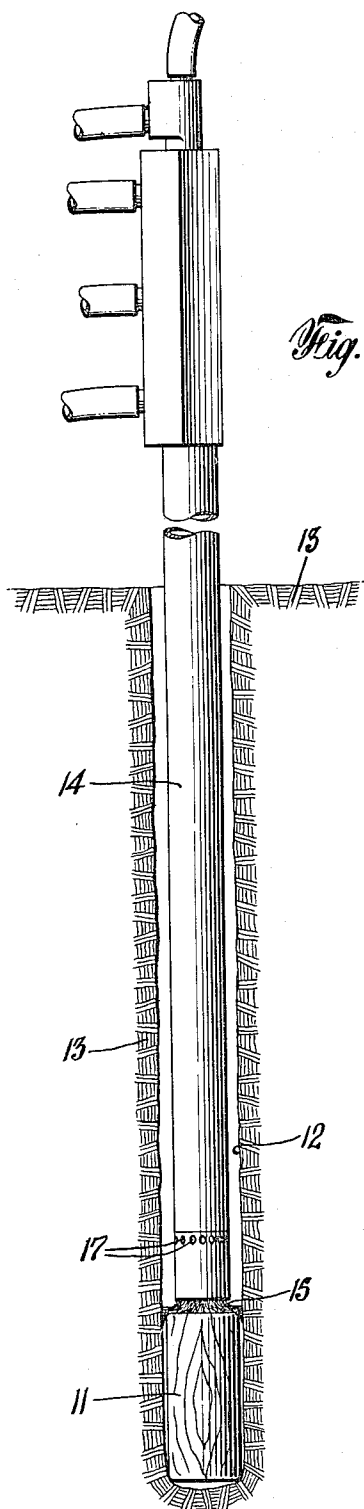


Fig. 1.

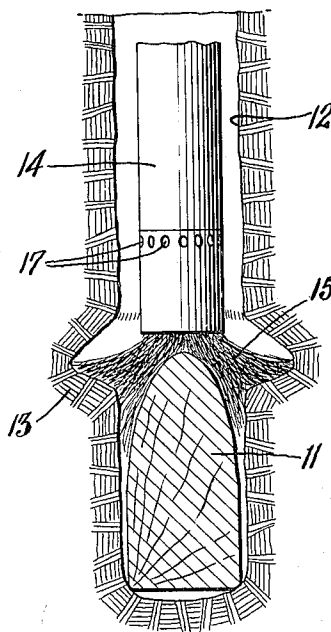


Fig. 2.

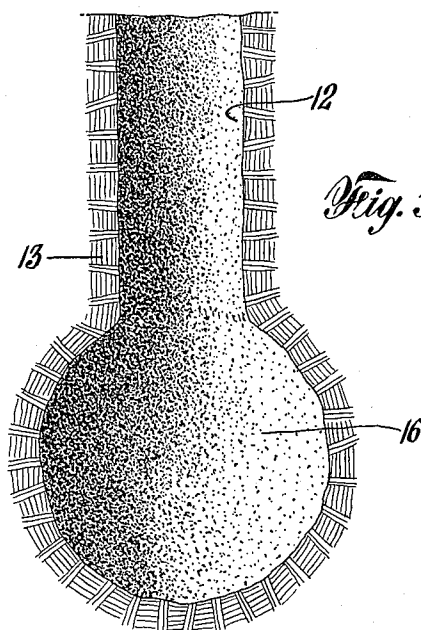


Fig. 3.

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METHOD OF SPRINGING HOLES IN MINERALS AND MINERALLIKE MATERIALS

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5 Claims. (Cl. 255—1.8)

This invention relates to a method of springing holes for blasting and other purposes in minerals and mineral-like materials. The term "springing," as used in the quarrying and mining arts, relates to the formation of an enlarged chamber at the bottom of a blasting hole to receive a larger quantity of dynamite or other explosive than otherwise could be charged.

Blasting holes are ordinarily sprung by introducing several successive small charges of explosive into the bottom of a hole and exploding them, the resulting detritus being mechanically cleared from the hole after each explosion. This method is a slow and expensive way to produce the desired result, and introduces the hazard of losing the hole altogether by caving or blocking if the explosive charges are incorrectly charged or detonated. An improvement over this method of springing, particularly applicable to rocks of a heat-spallable nature, such as quartzite, gneiss, and the like, is disclosed and claimed in application Serial No. 268,634, filed April 18, 1939, by the present inventor jointly with C. W. Swartout and V. C. Williams. In the method of that application, a blasting hole may be sprung thermally by introducing a long blowtorch into the hole and so rotating and agitating it that the flames play upon the side walls of the hole adjacent to its bottom and remove material. Suitably, a special blowtorch may be used having a tip formed to discharge flames directly against the sides of the hole. The detritus is continuously removed during the springing procedure either by the gaseous products of combustion, or by auxiliary flowing streams of water or compressed air. The present invention constitutes an improvement over the thermal method disclosed in application Serial No. 268,634.

The principal object of the present invention is to provide a simple, economical, and efficient method of thermally springing blast holes, particularly in minerals of a heat-spallable nature, which may be carried out without special equipment other than that normally required for the thermal piercing of holes. Another object is the provision of such a method whereby holes may be sprung either automatically or with a minimum of manipulation and attention by an operator. Still another object is to provide a novel method of forming a hole with an enlarged chamber adjacent to the bottom thereof in a mineral or mineral-like material.

The above and other objects and the novel features of the invention will become apparent

from the following description, having reference to the annexed drawing, wherein:

Fig. 1 is a sectional view through a mineral mass having a blasting hole therein, showing apparatus in position for starting the springing of a hole by the method of the invention;

Fig. 2 is a fragmentary view similar to Fig. 1, showing how springing progresses shortly after the start of the operation; and

Fig. 3 is a fragmentary sectional view corresponding to Figs. 1 and 2, showing the approximate appearance of the bottom of the blasting hole after completion of the springing operation.

By way of example only, the method of the invention will be described as performed on mineral materials of a heat-spallable nature, such as quartzite, from which fine unfused particles are spalled by intense heat and removed in the unfused condition from the blasting hole. Holes in mineral materials which fuse under the application of intense heat also may be sprung by the method of the invention, the resulting slag either being removed from the hole in the fluid condition, or being solidified and disintegrated in the hole and removed in the solid condition.

The term "dissolvable" is used hereinafter in its well-recognized dictionary meaning to characterize solid or compacted materials such as wood, stone, metal, and the like which are capable of being consumed, or destroyed as by fire; capable of being disintegrated, by or as if by heat, melted or crumbled.

Any desired method may have been followed for producing the initial hole to be sprung. For example, the hole may have been pierced by the thermal methods previously mentioned by applying to a mass of a mineral or mineral-like material a flame burning at the tip of a blowtorch, thereby causing material to separate from the mass, and advancing the blowtorch and flame into the mass to form a hole while removing the separated material from the hole. After the hole has advanced to the desired depth, the blowtorch or other piercing tool may be removed prior to the springing steps described in detail hereinafter.

As shown in Fig. 1, a block 11, of wood or other suitable thermally dissolvable material, is inserted into and rests upon the bottom or closed end of a hole 12 in a mass 13 of mineral material, such as quartzite. An elongated tubular blowtorch 14, for example of the type disclosed and claimed in application Serial No. 268,633 filed April 18, 1939, by the present in-

inventor jointly with C. J. Burch and C. W. Swart-out, then is introduced into the hole 12, and a flame 15 is produced by gas discharged from outlets in the forward end of the blowtorch. If the initial hole has been thermally produced, the same blowtorch used for piercing the hole advantageously may be reintroduced for the springing operation. The high temperature flame, which preferably is of the "diffusion" type wherein the fuel gas and combustion-supporting gas are not mixed until after they discharge from the gas outlets in the end of the torch, impinges against the block 11 and is deflected laterally against the side wall of the hole fanwise, thereby causing the removal of mineral material. As the flame 15 is played against the block 11, the block itself is burned or otherwise gradually dissolved by the heat of the flame, and the blowtorch 14 and the flame thereof are progressively advanced toward the closed end of the hole, as shown in Fig. 2, until the block 11 is destroyed and an enlarged chamber 16, as shown in Fig. 3, is produced. If desired, the operation may be halted before the block 11 is completely destroyed, so as to produce an enlarged chamber more or less remote from the closed end of the hole. In such a situation, the block 11 need not be of a completely consumable material, but may be merely deformable, as by melting or softening under the influence of heat.

During the springing operation the material removed from the side walls of the hole 12 as the flame 15 advances into the hole may be continuously removed from the hole either by and with the gaseous products of combustion, or by auxiliary compressed air or other fluid streams discharged from the blowtorch 14 through a circular row of discharge ports 17 in the side of the blowtorch near its front end.

The method described generally above may be performed when blasting holes are pierced in any direction whatsoever. When a hole which extends in a downward direction is to be sprung, moreover, the method of the invention may be made substantially automatic by actually resting the lower or tip end of the blowtorch 14 against the block 11 and permitting the blowtorch to advance into the hole under the influence of gravity, while maintaining the lower end in contact with the block as the latter is dissolved by the heat of the flame.

It is evident that variations within the spirit of the invention may be made in the specific procedure described herein, so that the scope of the invention is to be determined only by the claims appended hereto.

What is claimed is:

1. A method of springing a hole in a mineral or mineral-like material which comprises inserting a block of thermally dissolvable material in such hole adjacent to the bottom thereof;

impinging a flame against said block, thereby deflecting the flame against the side wall of the hole and causing material to separate from said wall; advancing the flame toward the bottom of the hole as said block is dissolved by the heat of the flame; and removing the separated material from the hole during the advance of the flame.

2. A method as claimed in claim 1 wherein said block is formed of wood.

3. A method of springing holes which extend in a downward direction into masses of minerals and mineral-like materials, which method comprises inserting a block of thermally dissolvable material in a hole adjacent to the bottom thereof; introducing a blowtorch into the hole and resting the lower end thereof against said block; impinging the flame of said blowtorch against said block, thereby deflecting the flame against the side walls of the hole and causing material to separate from said walls; advancing said blowtorch into the hole under the influence of gravity while maintaining said lower end in contact with said block as the latter is dissolved by the heat of the flame; and removing the separated material from the hole during the advance of said blowtorch.

4. A method of springing holes in minerals and mineral-like materials of a heat-spallable nature which comprises inserting a block of thermally dissolvable material in a hole adjacent to the bottom thereof; impinging a flame against said block, thereby deflecting the flame against the side walls of the hole and causing material to separate from said walls in an unfused condition; advancing the flame toward the bottom of the hole as said block is dissolved by the heat of the flame; and continuously removing the separated material from the hole in the unfused condition during the advance of the flame.

5. A method of forming a hole with an enlarged chamber adjacent to the bottom thereof in a mineral or mineral-like material, which comprises applying to a mass of such material a flame burning at the tip of a blowtorch, thereby causing material to separate from said mass; advancing said blowtorch and such flame into said mass to form a hole while removing the separated material from such hole; removing said blowtorch from such hole when the desired depth has been reached; inserting a block of thermally dissolvable material into such hole adjacent to the closed end thereof; reintroducing said blowtorch into such hole and impinging such flame against said block, thereby deflecting the flame against the side wall of the hole and causing material to separate from said wall; advancing said blowtorch into the hole as said block is dissolved by the heat of the flame; and removing the separated material from the hole during the advance of said blowtorch.

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