Aug. 27, 1963 O. F. PYLE ET AL 3,101,706

METHOD FOR STONE SPLITTING

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Fig. 1.

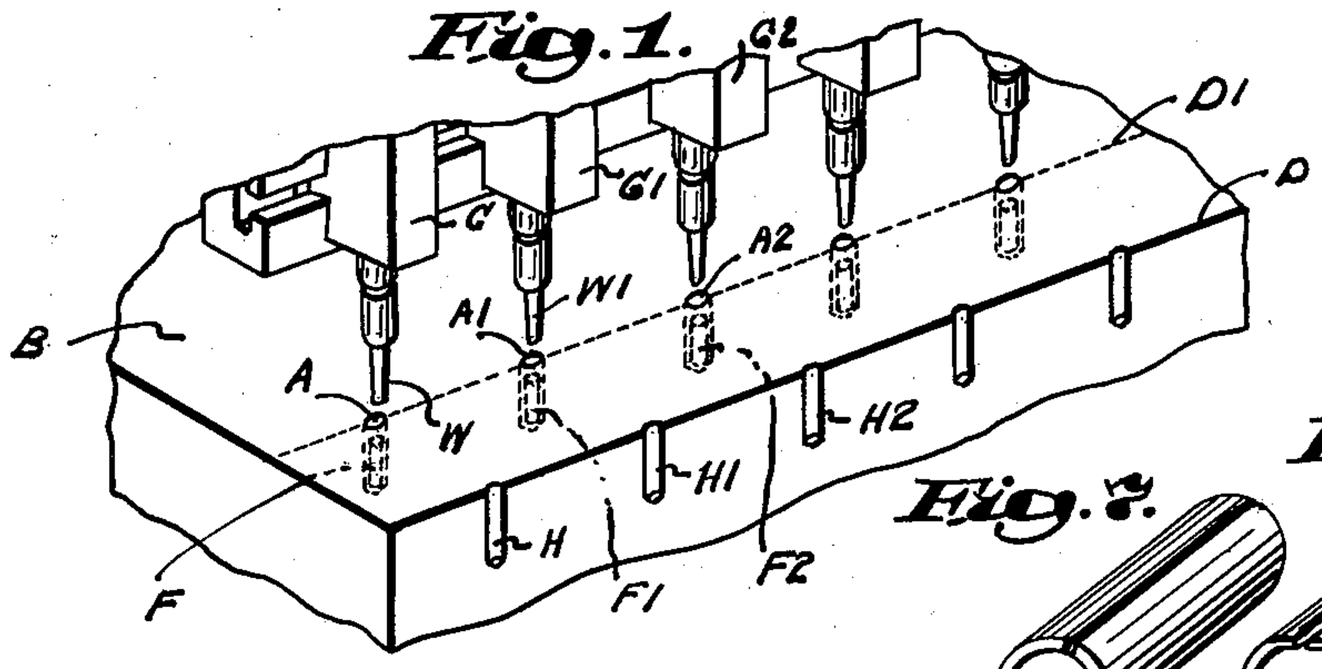


Fig. 8.

Fig. 7.

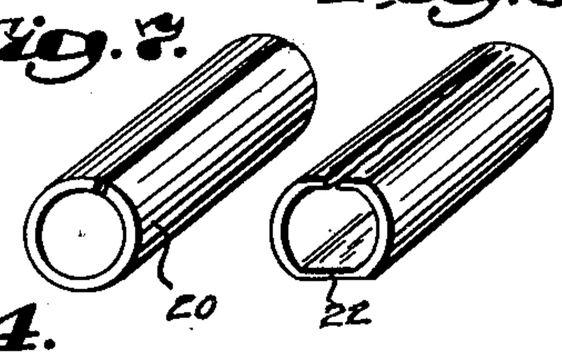


Fig. 4.

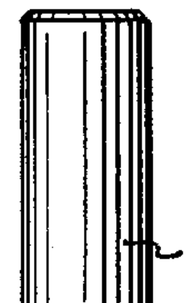


Fig. 2.

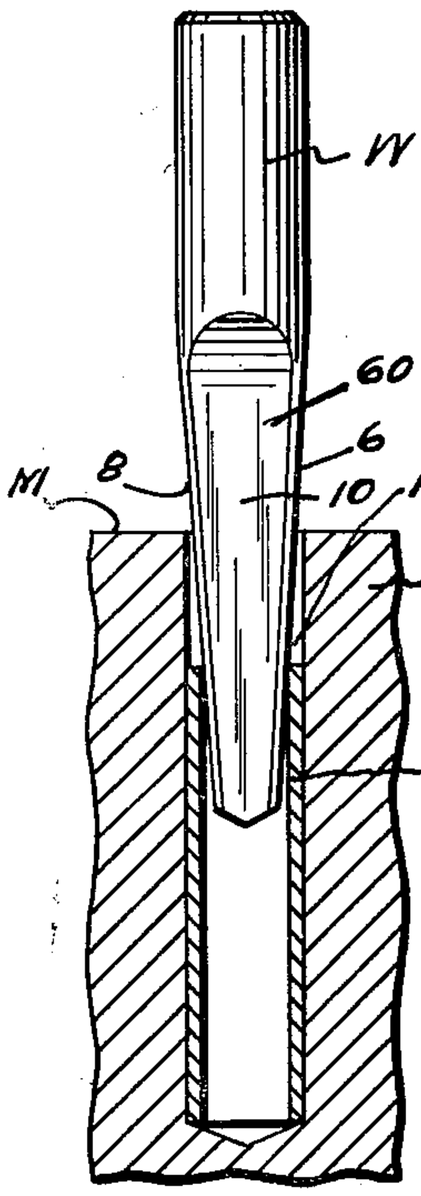


Fig. 3.

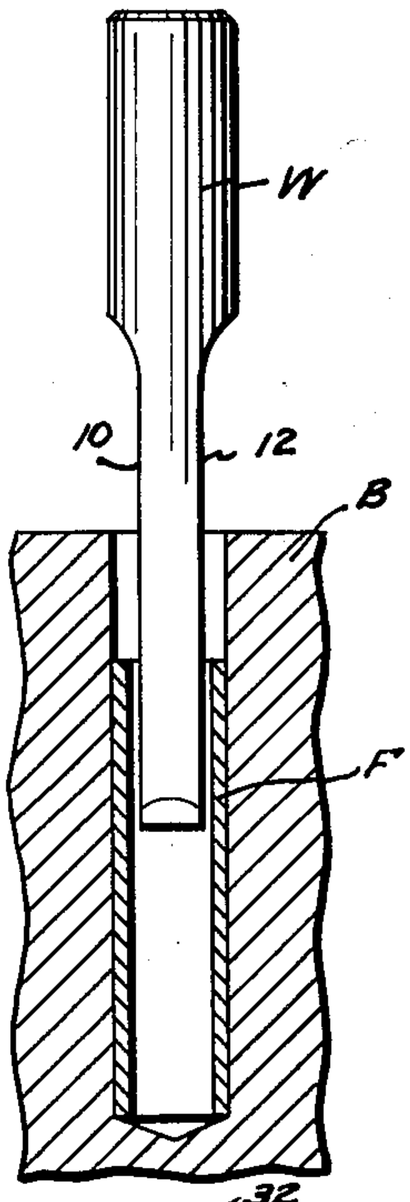


Fig. 5.

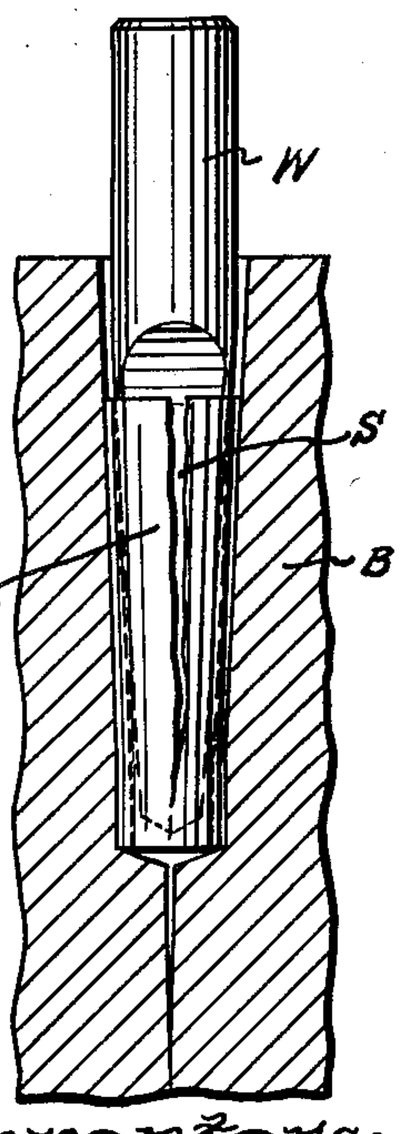
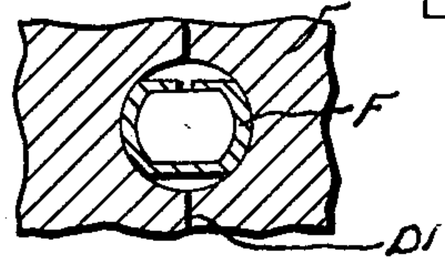


Fig. 6.



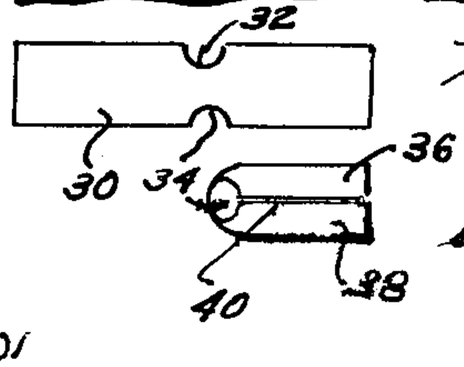


Fig. 10.

Fig. 9

Inventors:
Oden Fletcher Pyle
Wesley E. Middolo

Marion T. Hamilton
Attorney

United States Patent Office

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METHOD FOR STONE SPLITTING

Oden Fletcher Pyle, Tyngsboro, Mass., and Wesley E. Nichols, Nashua, N.H., assignors to H. E. Fletcher Co., West Chelmsford, Mass., a corporation of Massachusetts

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This invention relates to a method for splitting granite and other mineral bodies. In particular the invention is concerned with a plug and feather type of stone splitting operation in which a series of spaced apart holes are drilled along a desired line and provided with plug and feather assemblies. When subjected to repeated hammering the plug and feather members exert forces of cleavage at right angles to the plane of splitting, and in this way split off a desired block of stone.

In locating conventional plug and feather assemblies in drilled holes a handling problem is present. The conventional plug and feather unit as commonly used in the art comprises two feather components and a plug or wedge which is driven between them to exert cleavage forces. It is necessary that each pair of feather components be correctly located so as to provide for forces of cleavage occurring at right angles to the plane of desired splitting. Where a considerable number of these plug and feather assemblies are used, considerable time and labor is required to properly position the assemblies in drilled holes. Feather orientation is especially troublesome in connection with carrying out machine drilling and wedging where a plurality of wedges may be correctly aligned in a holder so that no further handling is necessary, but the corresponding feathers have to be located individually with respect to each of the wedges.

It is a principal object of the present invention to improve the plug and feather type of stone splitting operation and to devise a method of developing cleavage forces, in a plug and feather assembly, which method eliminates the need for orienting conventional pairs of feather components in any one particular relationship to a line of required splitting.

It is a still further object of the invention to provide one simplified feather component which may occur in any one of a number of forms and which may take the place of the standard pair of feathers presently used. This simplified feather component of the invention will necessarily assume a workable position regardless of how it may be placed in a drilled hole.

With these objectives in mind, we have conceived of a combination plug and feather assembly in which a single tubular feather element is designed to receive and support a plug or wedge in such a way that the position of the wedge determines the direction in which the cleavage forces are exerted regardless of the feather position. The tubular feather cooperates with the plug or wedge to permit an expanding effect to occur and thus the need for further orientation is eliminated, and only the plug or wedge component is required to be positioned with reference to the line of splitting. We have further conceived that a series of wedges may be so held mechanically that their position, in regard to the line along which they are held mechanically, will always exert their cleavage force at right angles to that line.

The tubular feather concept is based on the idea of supporting a plug or wedge element within an annular body which is capable of being reformed when subjected to wedge pressure, and yet which is sufficiently resistant to transmit cleavage forces in an effective manner.

We have discovered in one preferred embodiment of

the invention that we may, for example, employ a relatively hard steel plug or wedge element, and a relatively soft steel tubular feather whose hardness characteristics are chosen such that when the plug or wedge element is driven down into the tubular body a reformation of the tubular body is caused to take place either by the tubular element spliting apart or by metal flowing or in some cases by both of these occurrences. In its reformed state the tubular feather functions as an excellent medium for transmitting cleavage forces.

We have also discovered that we may employ as a tubular feather a number of different forms of tubular structures which may be uninterrupted, split, or fabricated from a preformed blank and these various forms provide for maintaining cost at a minimum so that the feather is practical to utilize as a disposable item.

These forms also present the possibility of being reusable many times, and when eventually distorted beyond usability, of being crimped back in a simple die to usable shape.

The nature of the invention and other objects and novel features will be more fully understood and appreciated from the following description of a preferred embodiment of the invention selected for purposes of illustration and shown in the accompanying drawings, in which:

FIG. 1 is a perspective view illustrating fragmentarily a block of stone having holes drilled along a desired line of splitting, and further illustrating tubular feather elements mounted in the holes with a series of block or wedge elements arranged in a holder in a position ready to be brought into contact with respect to the tubular feather components in accordance with the method of the invention;

FIG. 2 is a detail fragmentary view in cross section illustrating a tubular feather component and plug assembly of the invention in a position to start a splitting operation;

FIG. 3 is a view similar to FIG. 2, but further showing the plug or wedge element viewed from a point at right angles to that shown in FIG. 2;

FIG. 4 illustrates the plug and feather assembly in separated relationship;

FIG. 5 is a view similar to FIGS. 2 and 3, but further indicating the plug and feather in a position to start cleavage of a stone body with the tubular feather separated along one side;

FIG. 6 is a detail fragmentary plan view of a tubular feather element in a drilled hole;

FIG. 7 illustrates a modified form of a tubular feather;

FIG. 8 illustrates a tubular feather after having been used and illustrating flowing of metal in this member;

FIG. 9 is a plan view of a strip of material used to form a tubular type feather; and

FIG. 10 is a side elevational view of a fabricated tubular type feather produced by bending the strip shown in FIG. 9 into a desired tubular shape.

In carrying out the method of stone splitting of the invention, it should be understood that we may employ hand tools for drilling and hammering, or we may utilize machines for simultaneously drilling a number of holes along a required line. Similarly, means may be employed to simultaneously hammer a plurality of plug and feather units mounted in the holes.

In FIG. 1 we have illustrated diagrammatically the latter type of operation although the invention is not in any way limited to this type of operation. As noted in FIG. 1, B denotes a block of granite which is being processed to provide a section of dimension stone included between dimension lines D and D1. At the point illustrated one piece of stone has already been split off along the dimen-

sion line D and drilled holes H, H1, H2 are shown partly broken away. Drilled holes A, A1, A2, etc. are shown provided with the tubular feather elements of the invention and denoted by reference characters F, F1, F2, etc. Arranged above the holes A, A1, A2, etc. are respective plug or wedge elements W, W1, etc. which are received in reciprocating holders G, G1, G2, etc. When a gang splitting operation is to be carried out the holders G, G1, G2, etc. are lowered to engage the wedges in respective tubular feathers, and are then actuated to provide hammering.

The tubular feather which we have devised for use with a plug and feather operation of the class just above described, is indicated, on a larger scale, in one simple tubular form in FIGS. 2–6 inclusive. As shown therein, F denotes a tubular feather which is received in a drilled hole A in the Block B. W refers to the plug or wedge which is formed with opposite tapered surfaces 6 and 8, and relieved flats 10 and 12.

The tubular feather 2 is chosen of a diameter slightly less than the diameter of the drilled hole A so that the tubular member may be readily inserted and will drop down into the bottom of the hole. The hole A, and tubular feather F, are also chosen of a diameter such that the two tapered sides 6 and 8 of the wedge W will engage part way in the hole A and feather F as shown in FIGS. 2 and 3. The tapered sides 6 and 8 are also curved to generally fit into the curvature of the hole A. With the tubular feather, wedge, and hole sizes chosen substantially as indicated in FIGS. 2–6, we find that we may, for example, successfully utilize a steel feather hardness of 8–12 R_c (Rockwell Hardness C Scale), and a steel wedge hardness of from 56–59 R_c, the wedge surfaces 6, 8 being 7° out of parallel. As illustrative of other suitable tubular feather characteristics, there may be cited an outer diameter of 5/16" and a 22 gauge wall thickness corresponding to .028".

In accordance with the method of the invention the wedge W is subjected to repeated hammering. As this occurs the relatively softer steel surface of the feather F cooperates with the wedge W by yielding slightly at points of contact of the tapered sides 6 and 8, and these surfaces are permitted to slide downwardly into the tubular feather.

As this sliding action takes place, the wedge begins to exert forces of cleavage along line D1 and simultaneously the metal of the feather expands and flows slightly so that the wedge resists jumping out of the feather notwithstanding the fact that the wedge diameter progressively exceeds the feather diameter. As the hammering continues greater stresses are developed in the tubular feather F and gradually the feather tends to split along a line of separation S, and the wedge is driven to the necessary point for splitting of the stone to take place as suggested in FIG. 5.

With the stone section having been split off along the desired dimension line, the wedges are ready to be used with a new set of drilled holes, also provided with tubular feather members, and the operation is repeated.

In addition to the seamless mechanical tubing suggested in FIGS. 2–6 inclusive, we may also employ a split tubing 20 as shown in FIG. 7, which may be readily produced by rolling a length of flat stock into a cylindrical form. Desired lengths of tubular feather material may then be cut off from this rolled stock. This tube 20 operates in the manner already described, and after having been employed in a stone splitting operation, will appear with flowed sections 22 as suggested in FIG. 8.

Such split tubular feathers may be placed at random in the holes with no particular regard to the position of the split. We have found such feathers work successfully regardless of the location of the split in the tube in relation to the working faces of the wedge.

Another form of tubular feather has been indicated in FIGS. 9 and 10 in which a blank strip of material 30 is formed with notches 32 and 34, and then folded upon itself in the manner suggested in FIG. 10 to provide tubular sides 36 and 38 of generally cylindrical section and separated by slots as 40. These feathers may also be placed at random in the holes.

In utilizing the wedge and tubular feather various lengths may be employed with any of the forms above described. Thus in the case of the arrangement shown in FIGS. 2–5 inclusive, the tubular feather may be chosen of a length so that it occurs well below the top surface M of the block B. This results in prevention of spalling at the uppermost edges of the block where a very sharply defined line of separation is required. In other cases where occasional spalling may not be important, the tube may extend all the way to the top of the block, or even above it.

From the foregoing description of the invention it will be apparent that we have disclosed a novel method and device for stone splitting which can be employed with substantial saving in time and labor, and with excellent operating results.

While we have shown preferred embodiments of the invention, it is intended that various other changes and modifications may be resorted to in keeping with the scope of the invention and defined by the appended claims.

We claim:

1. In a method of splitting stone, the steps which include forming in a surface of stone a series of spaced-apart cylindrical holes whose centers lie along a desired line of splitting, dropping into each of the holes, with random orientation, a unitary tubular feather body of annular cross sectional shape to provide a plurality of pressure transmitting linings each of which extends substantially continuously around the inner peripheral surface of a respective cylindrical hole in loosely engageable relationship therewith and each of which linings are of an axial length less than the depth of a respective cylindrical hole into which it is dropped, introducing into the holes a plurality of wedge elements having opposed tapering curved wedge surfaces and relieved surfaces extending between the tapering curved surfaces, said tapering curved wedge surfaces being oriented and arranged to exert wedging forces in directions substantially at right angles to the said desired line of splitting, and inserting the opposed tapered wedge surfaces of respective wedge elements into engagement with the annular feather bodies at points below the said surface of the stone, and then subjecting the wedges to successive hammering blows to flow portions of the tubular feathers and to simultaneously drive the wedges downwardly into the tubular feathers and exert forces of cleavage whereby the stone is separated along the said desired line of splitting.

2. A method according to claim 1 in which the wedges are simultaneously introduced into the feathers by mechanical means.

References Cited in the file of this patent

UNITED STATES PATENTS

20,885	Lyon	July 13, 1858

FOREIGN PATENTS

360,513	Italy	June 23, 1938
817,574	Great Britain	Aug. 6, 1959