

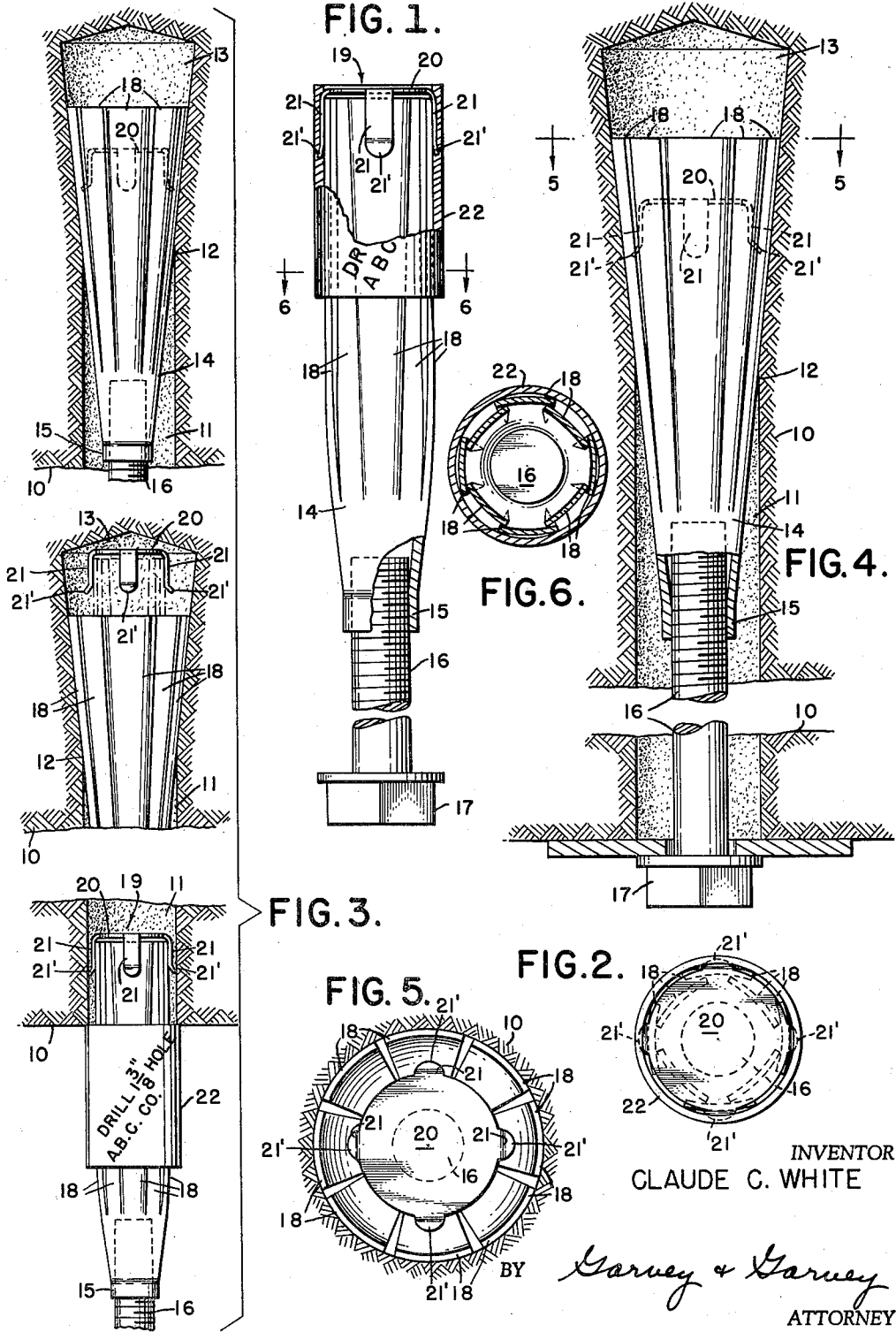
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MINE ROOF EXPANSION SHELL

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MINE ROOF EXPANSION SHELL

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1 Claim. (Cl. 85-80)

This application is a continuation-in-part of my application, Serial No. 786,887, filed January 14, 1959, now Patent No. 3,104,582.

The shell of my copending application, Serial Number 786,887, has been a recognized advance in the art. After much experiment, under actual work conditions, I have perfected a shell which is particularly adapted for use in walls of low shear strength, where there exists a problem of slippage. The shell of the present invention increases the wedging action, over a considerable area of the wall of the opening, which receives the shell, to force weak rock radially into comparatively pure compression, the wall being of special shape to implement the expansive force of the shell.

Objects of the invention are to provide a shell and method of using the same which includes boring an opening in a mine roof, of uniform diameter for a predetermined distance, following which the diameter of the opening is gradually increased to provide a tapered uninterrupted wall; to provide an expansion shell, one end of which is formed to provide expansive segments which are overlapped and held compressed, until the inner extremity of roof opening is reached and the shell retracted a very short distance, which permits releasing of a residual compressing element on said segments, at which time the segments expand into contiguity with a major portion of said tapered part of the wall; and to provide a novel restraining assembly for the compressed segments which, in addition to the clip heretofore used, also includes an inexpensive tube, which may be made of paper or the like, to encase the outer ends of the segments and clip and also to encompass the segments to a point considerably beyond the free ends of the clip fingers.

Other objects of the invention will be manifest from the following description of the present preferred form of the invention, taken in connection with the accompanying drawings, wherein:

FIG. 1 is an elevational view of a mine roof expansion shell constructed in accordance with the present invention, illustrating the application of the same with a mine roof bolt, the segments of the shell being shown compressed under force of a restraining entity, a part of which is fragmentarily shown to disclose details;

FIG. 2 is a top plan view of the same;

FIG. 3 is an elevational view illustrating the three steps in inserting the expansion shell and roof bolt of the present invention into a mine roof opening;

FIG. 4 is an elevational view of the expansion shell illustrating its application in a tapering mine roof opening, a part of the shell being broken away to disclose a mine roof bolt threaded therein;

FIG. 5 is a sectional view taken along the lines 5-5 of FIG. 4, looking in the direction of the arrows, showing the clip of the restraining entity after it has been disengaged from the shell and permitted to gravitate to the center of the latter; and

FIG. 6 is a sectional view taken along the lines 6-6 of FIG. 1, looking in the direction of the arrows, showing the manner in which the tube portion of the restraining entity is engaged with the outermost compressed shell segments.

In order to illustrate the application of this invention, I have shown in the drawings, a mine roof 10, three sections of which are illustrated in FIG. 3; two sections of which are illustrated in FIG. 4; and one section of which is illustrated in FIG. 5, to facilitate understanding of the

precise operation of the invention. The mine roof is provided with an opening 11, the lower or inner end of which is of uniform diameter for an appreciable distance, as illustrated in FIG. 4. This part of the opening issues into a gradually tapering wall, the taper beginning at approximately point 12 and continuing to the top of innermost end 13 of the opening. This provides an uninterrupted tapering wall gradually increasing in diameter from the point 12 to the upper or innermost extremity of the opening.

The expansion shell of this invention is indicated at 14 and includes a circular stem part 15, which is internally threaded to complement threads 16 on a mine roof bolt 17. The shell 14 issues into a plurality of resilient segments 18. The segments are of uniform construction and taper toward their upper or inner ends. These segments are constructed of a material which will permit them to be overlapped and compressed after the fashion shown in FIG. 2 of the drawing. For the purpose of holding the segments compressed, I provide a restraining entity, generally designated 19, including a resilient metal clip 20, the body of which is in the shape of a disk, with parts of the periphery extended at intervals and bent at right angles to provide resilient fingers 21, which fingers are slidably engaged over the outermost of the compressed shell segments, as shown in FIG. 2. The free ends of the fingers 21 are flared outwardly, as shown in the drawing at 21', to permit the clip to be slid with facility, over the outer free terminals of said outermost segments of the shell. The flared out terminals also are adapted to bite into the tapered wall 13, effecting positive disengagement of the clip when the shell is retracted in the roof opening. The fingers are not of sufficient tensile strength to retain the segments compressed, and supplemental restraining means is necessary for this purpose, which here consists of an elongated tube 22, forming a part of the restraining entity 19. The tube 22 is of cylindrical configuration and may be made of paper, tested to a strength sufficient to positively hold the overlapped segments in this position. Preferably, the length of the tube 22 is substantially as shown in FIG. 1 of the drawing, the upper or inner end of the tube being at least coplanar with the top of the metal clip 20 and extending downwardly to provide a skirt portion which encompasses the segments for a considerable distance, and embraces the outermost segments as shown in FIG. 6. The tube, being made of paper, has the further advantage of utilizing the outer surface of the paper tube for carrying indicia, such as the name of the manufacturer, and also to give the drill size of the hole to be used for this particular shell. The outer periphery of the tube is smooth and uniplanar, to eliminate protruberances which might result in the accidental removal of the tube from the shell.

In actual use, the tube 22 is sleeved over the clip 20, after the clip is engaged with the segments, as shown in FIG. 2. When it is adapted to use the expansion shell in the mine roof opening 11, the restraining entity 19 is pressed against the outer wall of the mine roof, at the locus of the opening 11. The diameter of the tube 22 of the restraining entity, being greater than the diameter of the mine roof opening 11, the tube is intercepted by the mine roof wall, and held, while the shell, with the clip attached, is moved into the opening, as shown in the bottom view of FIG. 3. As the shell is moved further into the opening, the tube drops from the shell, and the shell forced into the top or inner extremity 13 of the opening 11, as shown in the intermediate view of FIG. 3. When this position has been reached, the operator then pulls downwardly, approximately one inch, on the bolt 17. The fingers 21, are thereby gradually dilated radially, under the expanding action of the segments, because

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of the increasing diameter of the mine roof opening, which results in the flared terminals 21' of the fingers, protruding into the tapered surface of the wall opening, at which point the clip is momentarily held. After the upper terminals of the segments have been pulled beyond the free ends of the fingers, the clip 20 will gravitate into the position shown in dotted lines in FIG. 4.

In this position, the expanded segments of the shell are in contiguity with the tapered portion of the wall 11 from the point 12 to a point approximately one inch from the top or inner end of the mine roof opening, providing a cone-type structure which is uninterrupted. This long tapered cone surface has been found to hold rock of low shear strength, even under great load, and will prevent slipping of the shell. This results in an increased wedging action, so as to force weak rock radially into comparatively pure compression. This has solved a troubled problem heretofore encountered, where weak geologic formations existed.

While I have herein described a preferred embodiment of my invention, it is nevertheless to be understood that various changes may be made therein, without departing from the spirit and scope of the appended claim.

I claim:

In combination with a mine roof provided with an opening which issues into a tapering wall gradually increasing in diameter toward the upper or inner end of the opening, a mine roof bolt, an expansion shell comprising a resilient compressible part carried by the mine roof bolt for insertion in the opening to effect anchorage of the inner end of the shell against the wall of the recess, the expansion shell including a lower tubular section threadedly engaged with said mine roof bolt, said lower tubular section comprising a plurality of like segments extending upwardly from the lower terminal thereof,

the segments being flexed outwardly, at a point intermediate the length of the shell, to form a resilient compressible conical part, said segments being adapted to be lapped together and compressed before insertion into the mine roof opening, and a restraining assembly for holding said upper segments in lapped and compressed condition, said restraining assembly including a clip of disk-shape fitted over the top of the shell, portions of the outer periphery of said clip being extended to provide a plurality of downwardly extending fingers adapted to engage the outermost compressed shell segments, the restraining assembly further including a tube encircling the clip having a skirt portion which pends below the lower ends of the clip fingers, the fingers having outwardly inclined ends which are embedded in the inner surface of the tube, the upper end of the tube being of a diameter in excess of the diameter of the mine roof opening, to effect stripping off of the tube when the overlapped and compressed segments of the shell are inserted in the mine roof opening, the free ends of the compressed segments first entering the roof opening, said segments, upon expansion, engaging the tapered portion of the wall of said roof opening, the upper end of the tube being substantially coplanar with the top of the clip, the outer periphery of the tube being smooth and uniplanar, to eliminate protuberances and minimize casual removal of the tube from the shell.

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EDWARD C. ALLEN, *Primary Examiner*.