Sept. 24, 1963 C. C. WHITE 3,104,582

RESILIENT SHELL WITH ENLARGED END FOR ENGAGEMENT IN A MINE ROOF

Filed Jan. 14, 1959 2 Sheets-Sheet 1

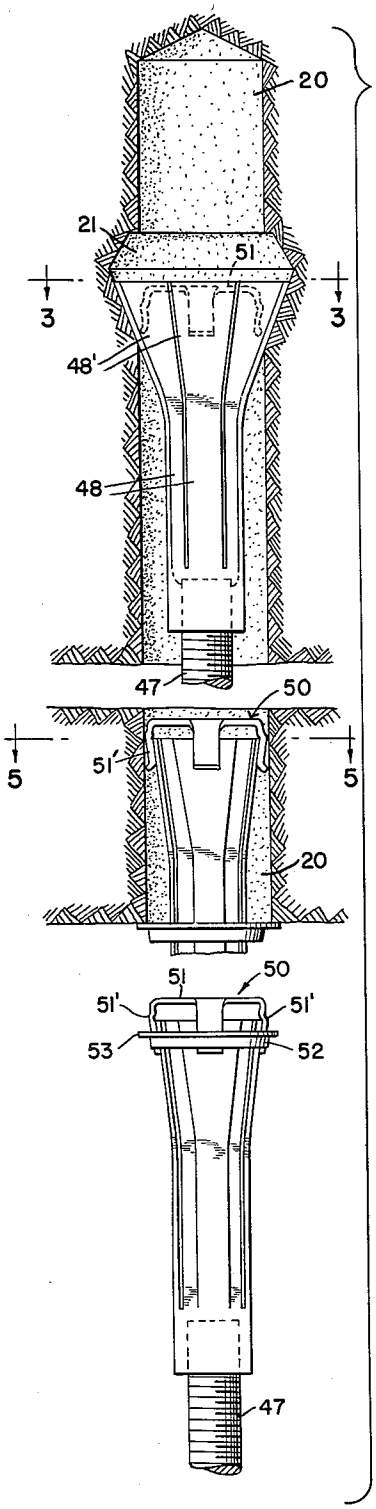

FIG. 1.

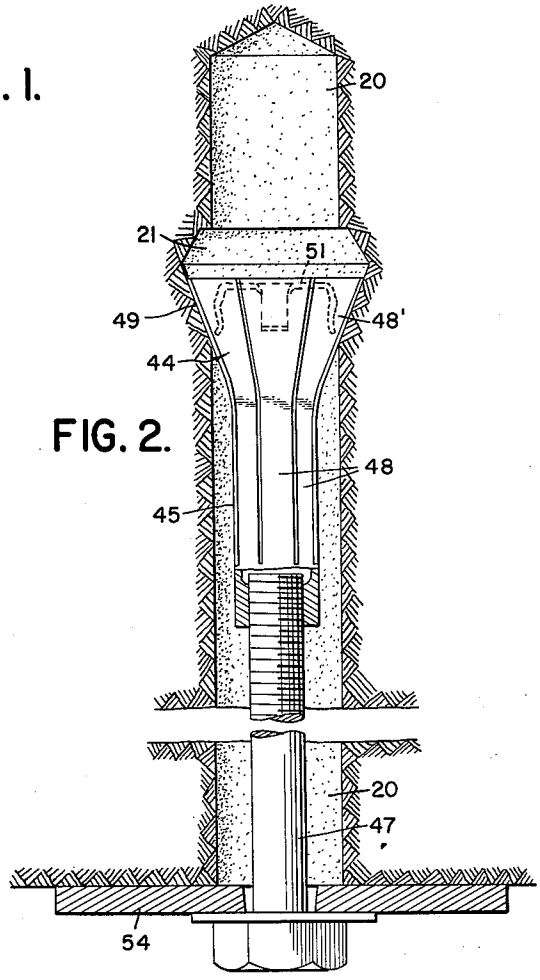

FIG. 2.

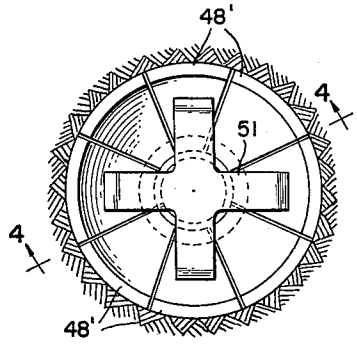

FIG. 3.

INVENTOR.
CLAUDE C. WHITE
BY
Garvey & Garvey
ATTORNEYS

Sept. 24, 1963 C. C. WHITE 3,104,582

RESILIENT SHELL WITH ENLARGED END FOR ENGAGEMENT IN A MINE ROOF

Filed Jan. 14, 1959 2 Sheets-Sheet 2

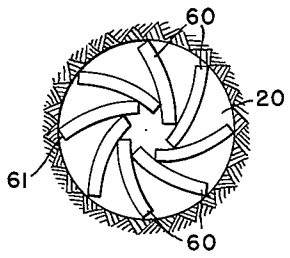

FIG. 7.

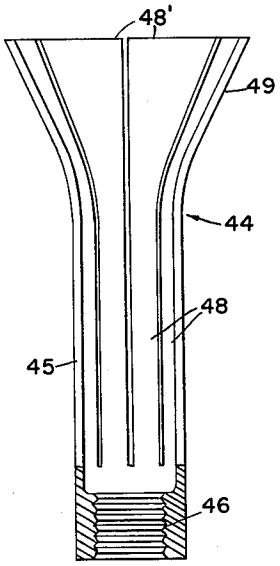

FIG. 4.

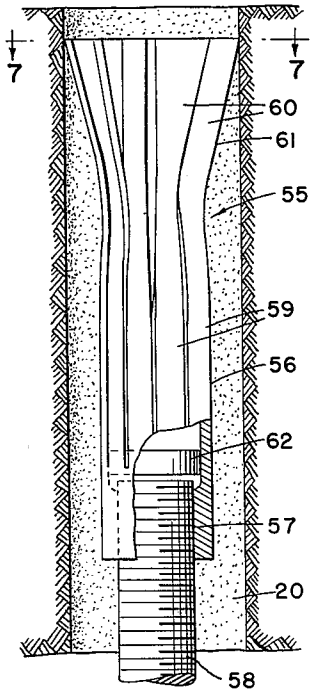

FIG. 6.

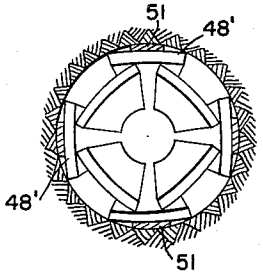

FIG. 5.

INVENTOR.
CLAUDE C. WHITE
BY
Garvey & Garvey
ATTORNEYS

United States Patent Office 3,104,582 Patented Sept. 24, 1963

3,104,582

RESILIENT SHELL WITH ENLARGED END FOR ENGAGEMENT IN A MINE ROOF

Claude C. White, 724 Ave. W, Ensley, Birmingham, Ala.

Filed Jan. 14, 1959, Ser. No. 786,887
2 Claims. (Cl. 85—2.4)

Expansion shells including expanding members for supporting coal mine roofs based on substantially the same principle of operation have been employed for a number of years with varying degrees of success. Numerous experiments conducted by myself under actual working conditions have revealed that, inter alia, these expansion shells exert less holding power on the mine roof than is necessary to insure proper mine safety. I have found this shortcoming is due to the fact that the holding force exerted by expansion shells heretofore employed is restricted entirely, or substantially entirely, to a lateral or outward direction. Consequently, any relative movement between the component parts under tension results in loosening of the bolt and the danger of a roof fall exists.

It is an object of this invention to provide an expansion shell of optimum holding power which is of inherently resilient construction and bears on a large mine roof area projected both vertically and horizontally, thereby simultaneously subjecting the mine roof to multidirectional gripping forces which prevent any relative movement of the components under stress when tension is applied to the bolt to firmly anchor the shell in the roof.

Other objects are to provide an inherently resilient expansion shell for a mine roof requiring no extraneous member for expanding it to operative position and comprising a plurality of compressible segments which are normally flexed outwardly to afford a substantially cone-shaped supporting surface; to provide a method for inserting an inherently resilient expansion shell in a mine roof by compressing the inner terminal thereof, followed by inserting the shell into the roof opening in its compressed condition, after which the shell automatically expands to operative position upon reaching a predetermined point; and to provide an expansion shell of the character described which emits a positive signal when the shell is properly seated in the complementary roof opening.

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

FIG. 1 is a plan view illustrating the three steps in inserting the expansion shell and roof bolt of the present invention into a mine roof opening;

FIG. 2 is a plan view illustrating the expansion shell in the roof bolt in operative position in the mine roof, a portion thereof being shown in section;

FIG. 3 is a sectional view taken along the lines 3—3 of FIG. 1 looking in the direction of the arrows;

FIG. 4 is a sectional view taken along the lines 4—4 of FIG. 3 looking in the direction of the arrows with member 51 removed;

FIG. 5 is a sectional view taken along the lines 5—5 of FIG. 1 looking in the direction of the arrows;

FIG. 6 is an elevational view partly in section of a modified form of the present expansion shell; and

FIG. 7 is a sectional view taken along the lines 7—7 of FIG. 6, showing to advantage the modified form of expansion shell in compressed position.

The expansion shell designated 44 is of substantially funnel-shape and includes a lower tubular section 45 which is internally threaded adjacent its lower terminal at 46 for the reception of a mine roof bolt 47. As shown

to advantage in FIG. 4, lower section 45 is provided with a plurality of like segments 48 (preferably eight) at a point spaced from the lower terminal thereof, which segments extend upwardly in a vertical plane to a point intermediate the length of the shell, where the segments are enlarged and flexed outwardly at 48' to form an upper section 49 of substantially truncated cone-shape. Since these segments must be flexible enough to spring back to their original shape after being compressed, the expansion shell is preferably made of a high carbon heat-treated steel. This enables the segments of upper section 49 to be lapped together and compressed, as shown in FIG. 5 of the drawing, before insertion thereof into an opening 20 in the mine roof.

In order that expansion shell 44 may be readily inserted in a mine roof opening, there is provided a restraining assembly 50 for holding the segments in lapped and compressed condition prior to positioning thereof in the mine roof. This restraining assembly includes a clip 51 of disc-shape, fitted over the top of the shell, portions of the outer periphery being extended to provide a plurality of downwardly extending arms or flanges 51' adapted to engage the outermost segments of the compressed shell. Clip 51 is of such a size that when the shell is inserted into the lower portion of the roof opening 20, arms or flanges 51' thereof engage the wall of the mine roof opening. Clip 51 is constructed of a light-weight metal which, in itself, is incapable of holding the segments of the expansion shell in their compressed position. Therefore, a ring 52 is placed over the flanges 51 and reenforces the latter to prevent accidental expansion of the shell. Ring 52 additionally includes a flange or rim 53 extending outwardly from the upper portion thereof, the diameter of said rim exceeding the diameter of the mine roof opening. Therefore, as shown to advantage in FIG. 1, when the expansion shell of the present invention, equipped with clip 51 and ring 52, is inserted into the mine roof opening, ring 52 is stripped off the shell and clip, since rim 53 thereof is too large to pass through the opening in the mine roof. Segments 48' of upper portion 49 remain compressed by virtue of the impingement of flanges 51' upon the wall of the roof opening and clip 51 remains in restraining engagement with segments 48' upon continued upward movement of the shell until they reach the enlarged cone-shaped opening 21 in roof opening 20. At this point, since the portion of the mine roof defining the opening is no longer in reenforcing engagement with clip flanges 51', the expansion forces of the segments overcome the compression forces of the light-weight clip to effect disengagement of the clip from the segments and clip 51 snaps off and falls down into a harmless position within the cone-shaped upper portion 49 of the expansion shell. The head of bolt 47 is drawn up against a conventional roof plate 54 a predetermined amount to move expansion shell 44 into gripping engagement with the mine roof.

As shown in FIG. 1, at the time of manufacture, the upper segments 48' of expansion shell 44 are retained in a lapped and compressed state by restraining assembly 50. As the shell is pushed upwardly into opening 20, ring 52 is stripped from clip 51 upon engagement of flange 53 with the wall of opening 20. Compressed shell 44 is forced upwardly until it reaches enlarged opening 21, at which point the expanding force of the shell bends arms 51' of clip 51 and segments 48' flex outwardly to assume their normal conical shape. As this occurs, an audible sound is produced indicating the shell is in operative position. Clip 51 flies off the top of shell 44 when it expands and usually falls back within the upper cone-shaped portion 49, where it does not interfere with the shell's operation. As bolt 47 is screwed into engagement with

threads 46 of shell 44 and tightened, the lateral edges of segments 43' are compressed together and radial pressure is exerted equally on the segment components by the cone-shaped seat formed by the conical recess in the mine roof. At this time, the segments are in pure compression and will not collapse.

As the tension in the bolt increases, there is no relative movement possible between the components under stress, since no extraneous wedge members are required to effect expansion of the shell. Consequently, there can be no loosening of the bolt. Therefore, any increase in the distance from the anchorage point to the head of the bolt is limited purely to the elastic flexure of the steel of which the expansion shell is constructed.

The expansion shell of the present invention also possesses superior holding power, since it bears on a larger area, projected vertically, than any other shell which can be inserted in a given size mine roof opening. With the shell of the present invention, therefore, multidirectional gripping forces are exerted on the mine roof.

In addition to its superior operating characteristics, the present expansion shell is more economical to manufacture than expansion shells heretofore used. This is due, for one reason, to the fact that it is of one-piece construction, preferably pressed steel sheets. Also, it will be noted from the drawings that, in contrast to other expansion shells, the present shell anchors above the end of the rod and, consequently, a roof bolt approximately four inches shorter in length can be used. The saving realized amounts to approximately 15 percent of the cost of manufacturing the shell.

In FIGS. 6 and 7, there is illustrated a modified form of the present invention embodying a combination reamer and expansion shell 55. The construction of this device is substantially the same as that of expansion shell 44, illustrated in FIGS. 1 to 5, and includes a tubular lower section 56, the lower terminal of which is internally threaded at 57 for engagement with a bolt 58. Lower section 56 includes a plurality of segments 59 which, at a point intermediate the length of the shell, are enlarged and flexed outwardly to provide segments 60 comprising an upper section 61. Segments 59 and 60 are lapped together so that one lateral edge of each segment is proximate the center of the shell and the opposite lateral edge serves as a cutting surface, as shown to advantage in FIG. 7. A plug 62 is positioned near the lower end of the shell to increase the expanding force of segment 60 upon rotation of bolt 58.

In this form of the invention, as the bolt 58 and shell are rotated, the lateral cutting edges thereof ream the mine roof opening 20 and the segments gradually expand to fully operative position which corresponds to the position of expansion shell 44 in FIG. 2. With this modified form of shell, therefore, no separate drilling tool is needed.

While we have herein described and shown the invention in its preferred forms, it is, nevertheless, to be understood that various changes may be made therein without departing from the scope and spirit of the claims hereto appended.

What I claim is:

1. In combination with a mine roof provided with an opening which issues into an enlarged recess, 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 at the inner end of the shell to 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 enlarged and 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 disc-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 arms adapted to engage the outermost compressed shell segments, the restraining assembly further including a ring positioned over the arms of said clip and reinforcing the latter, to prevent accidental expansion of the shell, the ring including a rim extending outwardly therefrom, the diameter of which rim exceeds the diameter of the mine roof opening, to effect stripping off of the ring when the lapped and compressed segments are inserted in the mine roof opening the free ends of the flexed segments first entering the hole, said segments, upon expansion, abutting each other and engaging the wall of said enlarged recess.

2. A shell for engagement in a mine roof, including an annular circumferentially continuous body having an internally threaded bore, a plurality of like separated resilient fingers integral with and extending axially from one end of said body, the finger portions adjacent to said body being parallel to the axis of said threaded bore and collectively defining a cylinder, the finger portions remote from said body diverging radially outwardly relative to the axis of said bore, said diverging finger portions progressively increasing in width toward their free ends whereby each diverging finger portion defines a segment of a cone, said diverging finger portions collectively defining a cone like member, the lateral edges of said fingers being adjacent each other whereby they will abut upon radial compression and further collapsing of the cone like member will be prevented.

References Cited in the file of this patent

UNITED STATES PATENTS

1,049,376	Le Manquais	Jan. 7, 1913
1,244,992	Lee	Oct. 30, 1917
1,452,515	Kearney et al.	Apr. 24, 1923
1,887,698	Perusick	Nov. 15, 1932
2,010,553	McIntosh	Aug. 6, 1935
2,013,257	Vanderlick	Sept. 3, 1935
2,667,037	Thomas et al.	Jan. 26, 1954
2,696,138	Olschwang	Dec. 7, 1954
2,771,746	Fischer et al.	Nov. 27, 1956
2,829,502	Dempsey	Apr. 8, 1958
2,857,177	Loetz	Oct. 21, 1958
2,878,709	Horvath	Mar. 24, 1959

FOREIGN PATENTS

503,811	Canada	June 22, 1954