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COMBINED DRILL AND EXPANSIBLE BREAKER MECHANISM

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Fig. 1.

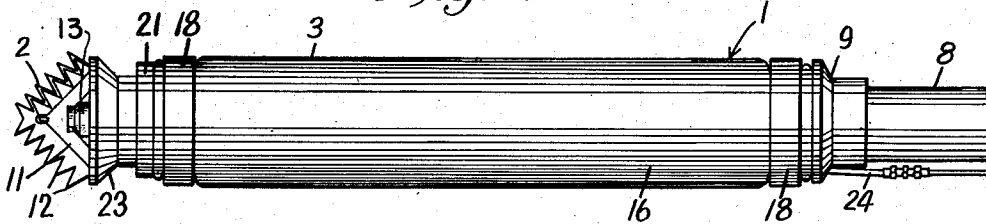


Fig. 2.

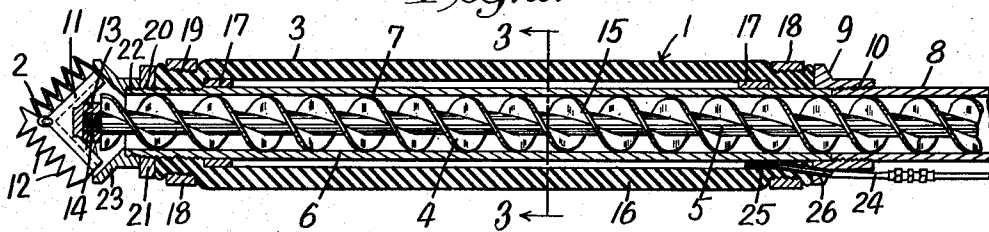


Fig. 4.

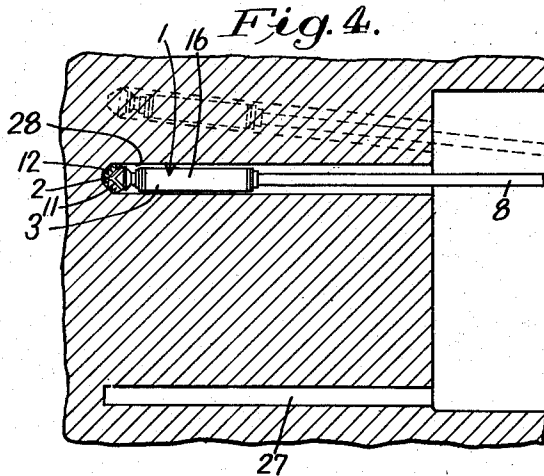


Fig. 3.

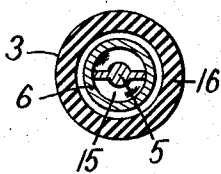
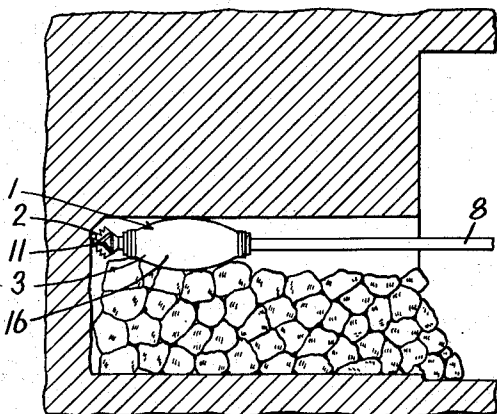


Fig. 5.



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UNITED STATES PATENT OFFICE

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COMBINED DRILL AND EXPANSIBLE
BREAKER MECHANISM

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694,779. Divided and this application March
10, 1948, Serial No. 14,057

4 Claims. (Cl. 262—12)

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This invention relates to material dislodging mechanism and more particularly to a combined drill and breaker mechanism especially designed for use in dislodging minerals such as coal in underground mines without the use of explosives.

In accordance with present day practice of mining coal or similar minerals in underground mines, the coal or other mineral is usually cut by a kerf cutting machine, and the face of the coal seam or mineral vein is drilled by a power drill to provide a series of appropriately located blast holes for receiving explosive charges, and, after tamping, the explosive charges are fired to dislodge the adjacent mass or body of coal or other mineral from the solid. The present invention contemplates improvements over previous mining practice in that the use of explosives and the attendant objections and dangers are avoided. In accordance with the present invention the coal or other mineral is drilled and dislodged from the coal seam or mineral vein by a mechanism embodying means for drilling the working face of the seam or vein and for dislodging the coal or other mineral by hydraulic pressure, thereby eliminating the necessity of blasting with explosives. The drill and hydraulic breaker of the present invention are combined in a single unit, and the breaker follows the drill into the bore hole as drilling progresses, and, when the bore hole is completed, the breaker is expanded to dislodge the coal or other mineral, thereby avoiding the need of separate pieces of special equipment, and greatly decreasing the time consumed in the drilling and dislodging operations.

An object of the present invention is to provide an improved dislodging mechanism for drilling and dislodging coal or other minerals from a mine vein. A further object is to provide an improved drilling and breaking down mechanism for drilling the coal or other mineral, and thereafter, without removing the drill from the bore hole, applying a powerful breaking down pressure to the adjacent mass or body of coal or other mineral to dislodge the latter from the solid. A still further object is to provide an improved drilling and breaking down mechanism embodying a rotary drill and an expansible breaker device surrounding the drill spindle rearwardly of the drill head and having conducting means for the expanding power medium extending from the breaker device outwardly along the drill spindle to a point extraneous of the bore hole. Still another object is to provide improved conveying means associated in a novel manner with

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the drill head and breaker device for conveying the cuttings created by the drill head during drilling outwardly through the breaker device along the drill spindle to a suitable point of discharge outside of the working face. A further object is to provide an improved drill and breaker device embodying a drill head rotated by a drill spindle which extends axially through a tube, and an elongated expansible breaker bag surrounding the tube rearwardly of the drill head. Still another object is to provide a screw conveyor arranged within the tube and extending axially through the breaker bag for conveying the cuttings from the drill head outwardly of the bore hole. A still further object is to provide an improved drilling and dislodging mechanism having a novel combination and arrangement of parts. These and other objects and advantages of the invention will, however, hereinafter more fully appear.

This application is a division of my copending application, Serial No. 694,779, filed September 4, 1946, now matured into Patent No. 2,581,667, granted January 8, 1952.

In the accompanying drawing there is shown for purposes of illustration one form which the invention may assume in practice.

In this drawing:

Fig. 1 is a side elevational view of a material dislodging mechanism constructed in accordance with a preferred illustrative embodiment of the invention.

Fig. 2 is a view in central longitudinal section through the dislodging mechanism shown in Fig. 1, and illustrating details of construction.

Fig. 3 is a cross-sectional view taken on line 3—3 of Fig. 2.

Fig. 4 is a diagrammatic side view showing the dislodging mechanism in operating position in a mine.

Fig. 5 is a diagrammatic view similar to Fig. 4, showing the dislodging mechanism in expanded material dislodging position, with the adjacent mass of material broken down.

In this illustrative embodiment of the invention, as shown in the drawing, the combined drilling and dislodging mechanism is generally designated 1, and is adapted to be mounted and operated in the manner fully disclosed in my copending application above referred to. Evidently the mechanism may be mounted and operated in various other manners.

The drilling and dislodging mechanism includes a rotary drill head 2, an expansible breaker device 3 and conveying means 4. A motor driven

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shaft or drill spindle 5 extends longitudinally centrally within a non-rotatable outer tube or tubular housing 6. This tubular housing is herein preferably made up of aligned tubular sections 7 and 8, and a collar 9 secured as by welding to the rear end of the front section is threadedly connected at 10 to the front end of the rear section for rigidly uniting the sections. The rotary drill head 2 is attached to the front end of the drill spindle 5 and includes a drill bit 11 having suitable cutting teeth 12. The drill bit, in this instance, has a central body portion 13 threadedly secured to a reduced front projection 14 of the shaft 5. The drill spindle or shaft 5 has spiral conveyor vanes or flights 15 secured thereto as by welding to provide a screw conveyor for conveying the cuttings created by the drill bit during drilling rearwardly through the tube 5 to discharge at a suitable point outside of the face of the coal seam or mineral vein. Surrounding the front tube section 7 of the tubular housing is a compactly arranged, expansible tubular breaker in the form of an elongated bag 16 of reinforced rubber or rubberlike material secured at its ends to the tube section 7 as by means of inner and outer collars 17 and 18, the former secured as by welding to the ends of the front tube section, and the latter surrounding and embedded at 19 in the ends of the rubber bag. Thus fluid-tight joints are provided between the rubber bag and the tube 5 at the ends of the bag. Secured as by threading at 20 on the forward end of the front tube section is a collar 21 herein arranged between the front end of the bag and the rear side of the drill bit as shown in Fig. 2. Secured at 22 as by threads to the front end of the front tube section in advance of the collar 21 is a bell-mouthed member 23 which substantially fits the bore hole and serves to direct the cuttings created by the drill bit during drilling into the tubular housing toward the receiving end of the screw conveyor. This bell-mouthed member also serves to impede the passage of cuttings outwardly toward the breaker bag, thereby reducing the possibility of the latter becoming bound within the bore hole. The drill bit is of such size as to form a bore hole of a diameter sufficient to receive the bell-mouthed member 23 and the expansible breaker as the drill bit forms a bore hole in the material to be broken. A conduit 24 is embedded at 25 within the breaker bag 16 in communication with the interior thereof, and leads rearwardly through an opening 26 in the collar 9 along the exterior of the tube 5 to a suitable source of liquid under pressure, so that the rubber bag may be expanded to effect its breaking down or dislodging function when desired.

The general mode of operation of the improved material dislodging mechanism is as follows. It will be understood that prior to the drilling and dislodging operations the face of the coal seam or mineral vein is cut by a kerf cutting machine, and, in Fig. 4, the kerf or slot cut by the cutting machine is designated 27. It is possible, however, under certain conditions such as during the dislodging of the open ends of pillars to dislodge the coal or other mineral without previous cutting by a kerf cutting machine. The drilling and breaker mechanism is suitably supported with respect to the working face, and the drill and conveyor driving shaft 5 is rapidly rotated, in the manners disclosed in the copending application above referred to. As the drill bit 11 is rapidly rotated, it is advanced in a suitable manner toward the

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working face to form a bore hole 28 at the desired location in the coal or other mineral and the conveyor 15 conveys the cuttings created by the drill bit rearwardly through the tube 6 to a suitable point of discharge outside of the bore hole. As drilling progresses, the expansible breaker device enters the bore hole, and upon completion of the bore hole, when the breaker device has assumed the position shown in Fig. 4 and while the drill remains in the bore hole, liquid under pressure may be admitted through the conduit 24 to the interior of the breaker bag 16, thereby to apply a powerful dislodging force to the adjacent mass or body of coal or other mineral to dislodge the latter, in the manner shown in Fig. 5. After the coal is dislodged, the drill and breaker mechanism may be withdrawn from the coal or other mineral. During expansion of the breaker bag 16, its walls are placed under sufficient tension, so that when the expanding liquid is discharged from the bag through the conduit 24 the bag will contract to its original normal retracted position as shown in Fig. 2.

As a result of this invention, an improved material dislodging mechanism is provided whereby a bore hole may be drilled in a coal seam or mine vein, and thereafter the adjacent mass or body of coal or other mineral may be dislodged from the solid without the use of explosives. By associating the breaker device with the drill, the breaker device may enter the bore hole formed by the drill, and on completion of the drilling operation, and without removing the drill from the bore hole, the breaker device may be expanded to dislodge the coal or other mineral in an extremely expeditious manner. By arranging the conveyor centrally within the breaker device, the cuttings created by the drill bit during drilling are effectively removed from the bore hole in advance of the breaker device, so that binding of the latter during advance thereof within the bore hole is substantially prevented. The dislodging mechanism is not only efficient in operation but is also extremely compact and relatively simple and rugged in design. Other uses and advantages of the invention will be clearly apparent to those skilled in the art.

While there is in this application specifically described one form which the invention may assume in practice, it will be understood that this form of the same is shown for purposes of illustration, and that the invention may be modified and embodied in various other forms without departing from its spirit or the scope of the appended claims.

What I claim as new and desire to secure by Letters Patent is:

1. A combined drill and breaker mechanism comprising, in combination, a rotary drill bit for forming a hole in the material to be broken, an elongated non-rotatable tubular support, rotation transmission means extending axially through and enclosed within said support for rotating said drill bit, an elongated expansible breaker device surrounding said tubular support and when collapsed being of smaller external diameter than the diameter of said drill bit whereby said breaker device may enter the hole formed by the bit as drilling progresses, means for mounting said breaker device on said support for axial movement therewith with said device held in sealed relation with respect to said support to prevent fluid leakage, and with the forward ends of said breaker device and its mounting means located close to said drill bit, and fluid

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conducting means extending longitudinally of said support and communicating with the interior of said breaker device to supply fluid under pressure to said breaker device between the latter and said support for expanding said device to apply a powerful breaking pressure to the material surrounding the hole to effect breaking down of the material.

2. A combined drill and breaker mechanism as set forth in claim 1 wherein conveyor means is rotatable with said rotation transmitting means and enclosed in and movable with said transmitting means relative to said tubular support for receiving the cuttings created by said drill bit during the drilling operation and for conveying the cuttings rearwardly through said tubular support from the drill hole, and a bell-mouthed deflector is secured to the front end of said tubular support in close adjacency to said drill bit for directing the cuttings into said tubular support whereby said conveying means may receive the cuttings and move them rearwardly.

3. A combined drill and breaker mechanism as set forth in claim 2 wherein said rotation transmitting means is in the form of a drive shaft and said conveying means comprises a spiral conveyor vane secured to said shaft, said shaft projecting axially in advance of the front end of said tubular support and extending within said bell-mouthed deflector and said bit having a central portion attached to said projecting end of said shaft.

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4. A combined drill and breaker mechanism as set forth in claim 1 wherein said breaker device is in the form of a tubular expansible bag and said mounting means for the ends of said tubular bag comprises collars of smaller diameter than said drill bit and embedded in the ends of said bag for compressing said bag ends into tight sealing contact with the exterior periphery of said tubular support.

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