May 31, 1927. 1,630,470

W. B. CLIFFORD

APPARATUS FOR BREAKING DOWN ORE BODIES

Filed Aug. 24, 1922

Fig. 1

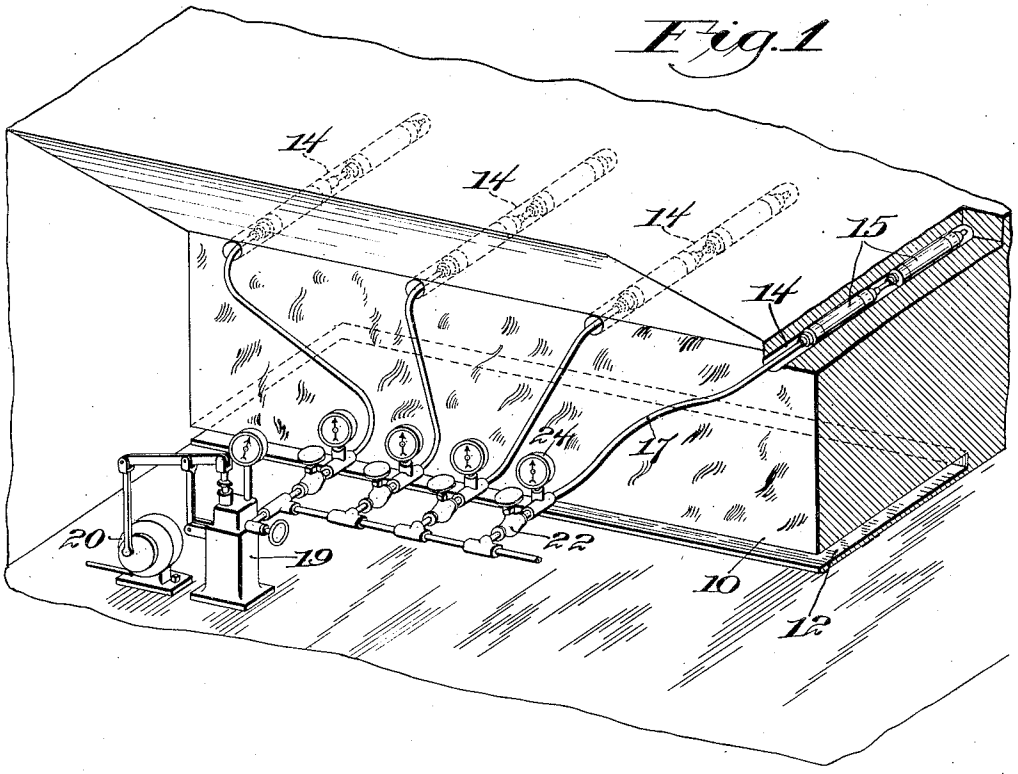
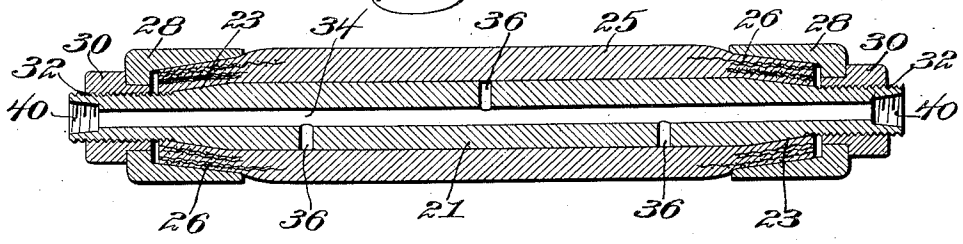


Fig. 2



Witness
Jas. J. Maloney.

Inventor
Walter B. Clifford
by his Attorneys
Van Cleve & Wilkinson & Coop.

Patented May 31, 1927. 1,630,470

UNITED STATES PATENT OFFICE.

WALTER B. CLIFFORD, OF KIMBALL, WEST VIRGINIA, ASSIGNOR TO THE CLIFFORD CORPORATION, OF BOSTON, MASSACHUSETTS, A CORPORATION OF MASSACHUSETTS.

APPARATUS FOR BREAKING DOWN ORE BODIES.

Application filed August 24, 1922. Serial No. 584,042.

The present invention relates to mining apparatus and more particularly to apparatus of this type adapted to break down ore bodies through pressure exerted upon the interior of previously formed bore holes.

It will be evident to those skilled in the art that the method of breaking down ore bodies or more particularly bodies of coal consists in first undercutting the coal and thereafter forming a series of bore holes in which pressure is exerted to break down the undercut body of coal as a whole. The actual breaking down of the body of coal is commonly accomplished by the use of explosives received in the bore holes and ignited, the pressure resulting from the explosion serving to break down the coal. This method has many serious objections as it tends to break up the mass of coal into small lumps and causes the formation of a large amount of slack and in addition creates objectionable fumes which must be removed. In order to overcome the objections incident to the use of an explosive for this purpose, attempts have been made over a long period of years to provide mechanical methods of breaking down coal and other ore bodies, more particularly through the employment of mechanical wedging devices and through apparatus which is intended to be inserted within previously formed bore holes and thereafter actuated through a gas or liquid to exert the necessary breakdown pressure. For one reason or another none of this apparatus has ever been used commercially except to a limited degree and the breaking down of coal and similar ore bodies through the use of explosives continues to be the accepted and generally used method.

The object of the present invention is to provide a new, improved and practical form of apparatus for insertion in the bore holes to break down a previously undercut mass of coal or similar material.

With this object in view the several features of the invention consist in certain novel features of construction, combinations and arrangements of parts hereinafter described and claimed, the advantages of which will be obvious to those skilled in the art from the following description.

In the accompanying drawings illustrating the preferred form of the invention Fig. 1 represents a view of the apparatus in position to break down a previously undercut mass of coal and Fig. 2 is a longitudinal section of one of the hydraulic cartridges employed in connection therewith.

According to the present invention, the necessary pressure for breaking down the coal body is exerted by a series of hydraulic cartridges located within previously formed bore holes. Each of these cartridges comprises a flexible envelope confined at opposite ends in a manner to resist longitudinal expansion but free to expand laterally or transversely within the bore hole to exert pressure thereon. The cartridges are connected with a suitable form of pumping apparatus for supplying liquid under the desired pressure. In addition, the pressure line connecting each cartridge or series of cartridges in a bore hole is provided with a pressure gage and control valve permitting the cartridges in any individual bore hole to be shut off from the pressure supply in the event that the pressure suddenly drops, due to a fracture of a portion of the mass of coal or the development of a fissure which permits undue expansion of the cartridge. It will be evident in this connection that when employing water or similar incompressible liquid as the source of pressure a relatively slight expanding movement of the cartridges causes an immediate drop in the pressure.

The illustrated embodiment of the invention indicates a block of coal 10 undercut at 12 and having a series of bore holes 14 formed in the uppermost portion. These bore holes may average several feet in length and it is desirable to insert therein a plurality of relatively short cartridges in tandem rather than a single cartridge approximating the length of the hole. To this end, as shown, each of the bore holes contains two cartridges 15 received within the opening. Each series of cartridges is connected through a pressure line 17 with a hydraulic pump indicated generally at 19, the pump being driven through a motor 20. Located in the branch pressure line connected with each series of cartridges is a controlling valve 22 and a pressure gage 24, the gage serving to indicate the pressure exerted upon any given bore hole and the valves controlling the supply of liquid to each series of cartridges from the pump.

Each cartridge, as indicated clearly in Fig. 2, comprises a length of steel tubing 21 having reduced end portions 23 and a flexible envelope 25 of rubber or similar material closely surrounding the steel tubing. The opposite reduced ends of the envelope are strongly reinforced with layers of fabric 26 which extend inwardly from the ends throughout the clamping area. The flexible envelope is rigidly clamped at opposite ends to the steel tubing through clamping collars 28 mounted upon heads 30, which threadedly engage with the ends of the tubing, as indicated at 32. It will be evident that with this construction inward movement of the collars serves to rigidly clamp the ends of the envelope to the tapered portions 23 of the tubing in a manner to prevent any movement thereof, even under the exertion of relatively high pressures. This rigid clamping of the envelope to the tubing is aided by the provision of the reinforcement 26, which, however, does not interfere with the lateral expansion of the envelope between the clamping areas. The inner tubing 21 is provided with a longitudinal bore 34 through which the liquid passes and communicating with a series of pressure passages 36 extending at right angles to the longitudinal bore and permitting the pressure within the bore to be communicated to the inner portion of the flexible envelope 25. With this construction, the application of hydraulic pressure to the longitudinal bore 34 causes the exertion of a like pressure throughout the periphery of the flexible envelope between the clamping areas, which in turn is transmitted to the interior of the bore holes. The provision of this form of cartridge permits the employment of relatively high pressures per unit area and causes these pressures to be distributed over the major portion of the cartridge with the result that enormous effective pressures may be exerted upon the interior of the bore hole. The cartridges are connected at their opposite ends to one another and to the pressure line through any suitable form of union, the opposite ends of the tubing being threaded interiorly at 40 for this purpose. It will be evident that when employing hydraulic pressure within the cartridges a relatively slight expansion of the cartridges causes the pressure to immediately drop until the pump has again restored the pressure to the desired value. This characteristic of an incompressible liquid may be utilized to prevent failure of the cartridges, due to an unusual expansion in the event that a fissure or fault develops in the body of coal or in the event that a portion of the coal slabs off under the pressure, exposing the cartridges. Although the failure of the cartridges under such conditions may be prevented by shutting off the pumping apparatus, nevertheless the cartridges, owing to the form of construction and the relatively massive envelope which is employed, are capable of withstanding the maximum pressures which are employed for breaking down the coal.

While it is preferred to employ the specific construction and arrangement of parts shown and described it will be understood that this construction and arrangement is not essential except so far as specified in the claims and may be changed or modified without departing from the broader features of the invention.

The invention having been described, what is claimed is:

1. Mining apparatus comprising a metallic tube having a longitudinal bore formed therein and lateral passages communicating therewith, an integral flexible envelope surrounding the metallic tube, separate connections between opposite ends of the tube and ends of the envelope for positively and rigidly clamping the latter to the tube at both ends to prevent longitudinal movement of the envelope, and means for supplying liquid under pressure to the longitudinal bore.

2. Mining apparatus comprising a metallic tube having a longitudinal bore formed therein and tapered end portions, and passages affording communication between the internal bore and the outer periphery of the tube, an integral flexible envelope surrounding the tube and extending over the tapered end portions, clamping members connecting opposite ends of the envelope with the metallic tube and designed to clamp the ends of the envelope rigidly in engagement with the tapered end portions of the tube to prevent longitudinal movement of the envelope, and means for supplying liquid under pressure to the longitudinal bore in the tube.

3. Mining apparatus comprising a metallic tube having a longitudinal bore and passages affording communication between the bore and the outer periphery of the tube, a flexible envelope surrounding the tube and having its opposite ends strongly reinforced to prevent lateral expansion while permitting lateral expansion therebetween, separate means for rigidly clamping both ends of the envelope to the tube to prevent longitudinal movement of the envelope, and means for supplying liquid under pressure to the longitudinal bore.

4. Mining apparatus comprising a plurality of flexible hydraulic cartridges arranged in tandem in a bore hole, detachable connections between adjacent cartridges, liquid pumping apparatus, and connections between the plurality of cartridges and the pumping apparatus for introducing liquid under pressure into the cartridges.

5. Mining apparatus comprising a hollow

metallic tube having reduced tapered end portions and passages affording communication between the internal bore and the outer periphery of the tube, an integral flexible envelope surrounding the tube intermediate the ends and having reinforced portions adjacent the tapered end portions, clamping collars having tapered faces engaging with the outer ends of the envelope, and means for forcing the collars longitudinally of the tube to clamp the ends of the envelope to the tapered portions of the tube.

WALTER B. CLIFFORD.