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Improving Spore Clamping with Pair of Hydroampules in Blast Mining

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Abstract: At present, the share of coal and oil in the world energy balance is almost equal. The article envisages the use of two pairs of hydraulic ampoules to block the boreholes in the blasting of layered deposits, which will increase the blasting efficiency by directing the bulk of the blast energy to the decomposition of the ore mass. In addition, information is provided on the types of pipes used for sealing, as well as the effect of placing the plugged hole using two hydraulic ampoules.

Keywords: solid fuel, potential energy, thermodynamic loss, chemical loss, flagship, borehole, hydraulic ampoule, compacted felt, wave shock, fracture rate.

The problem of energy supply has always been in the minds of mankind, and each historical period has its own problems. The use of coal, oil, natural gas and other energy sources (in fixed units) has changed over the years. At present, the share of coal and oil in the world energy balance is almost equal. In the future, it is planned to increase the production of solid fuels (coal, shale, peat). This is because the world's reserves of solid fuels are 90%, while oil and gas reserves are only 7% [1].

Combustible minerals are the basis of the fuel energy industry. No industry can exist without combustible minerals. Combustible minerals are the main products for the chemical, metallurgical and energy industries. 85 % of the minerals mined worldwide are combustible minerals. The main elements of combustible minerals are carbon (C) and hydrogen (H).

The process of coal formation begins with the deposition of a layer of peat at the bottom sedimentary rocks. Brown coal is formed at 60-70 degrees, in an oxygen-free environment, in the presence of anaerobic bacteria living in a shallow area. Hard coal is formed from brown coal under high pressure and in an environment of 300 degrees. For these reasons, hard coal is usually formed at depths of 100 meters and more than. Anthracite is the hardest coal. The formation of anthracite is associated with the high pressure of the hard coal and a 500 degrre environment. First brown coal, then hard coal, and finally anthracite formed. While peat takes several tens of thousands of years to form, it takes millions of years for it to turn into coal. The carbon content of peat is about 60 percent, brown coal 78 percent, hard coal – 92 percent, anthracite- 98 percent [2].

With this in mind, it is important to ensure the efficiency of each mining process in coal mining. The proposed method is aimed at further increasing the efficiency of the blasting process.

The total work done by the explosion is not equal to the potential energy of the explosive (PM), as chemical and thermodynamic losses of the explosion energy are observed during the explosion. Chemical losses are explained by the fact that the charge of an explosive (PM) does not fully react during an explosion. Thermodynamic losses can be explained as follows: explosive products formed after an explosion andas a result of the explosion, the crushed rock becomes hot, which retains the residual energy. Typically, the conversion of blast heat energy into mechanical work does not exceed 40-60%. The efficiency of the explosion does not exceed 15% of the explosion energy [2].

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The effectiveness of blasting in underground mining can be determined by the following requirements:

1. After the explosion, the rock must be crushed to the required level. The maximum rock size is limited by the bucket capacity of the loading and unloading machines.
2. Toxic gases must be released to a minimum after an explosion.
3. After blasting, the surface should be flat. After blasting, the cross-sectional area of the mine shaft must be maintained.
4. It is necessary to achieve the maximum efficiency of the borehole during blasting.

Proper selection of blasting methods and parameters is required to meet the above requirements [2].

Depending on the size of the yard, only one or two toys will fit.

a) Plastic materials - a mixture of clay, clay and sand.

b) Scattered materials - sand, granulated slag, gravel.

c) Hydro-paints - filling the polyethylene shell in the form of ampoules filled with water or pulp.

The risk of explosion of a mixture of methane and dust in the air as a result of blasting is reduced by: ensures the stability of the detonation during the explosion due to the prolongation of the time of discharge of explosive products into the cavity becomes phlegmatized.

It is relatively easy to mine coal deposits (deposits with high emissions of methane and gas) that are not deposited in a large area with straight deposits and high strength, and the calculation of charges is relatively simple. The bulk of the coal mined underground is mined by blasting boreholes. In lava coal mining, one or two rows (when the layer thickness is more than 1 m) are placed on the slope without cutting the holes [3].

The aim is to increase the efficiency of blasting using hydraulic pumps in the blocking of such holes. It is important to ensure that the energy of the explosive charge placed in the borehole is used to completely destroy the ore body. To do this, pay attention to the compaction of the borehole by means of hydraulic jacks (Fig. 1).

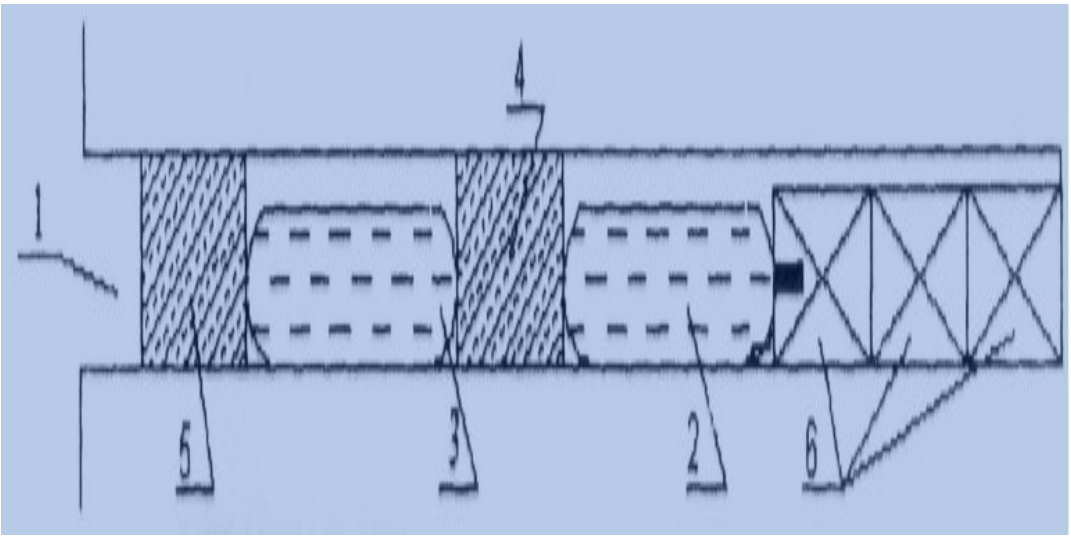

Figure 1. Scheme of plugging the hole using 2 hydraulic ampoules of intermediate material.

1 hydro-painted hole; 2 and 3 - hydroampular; 4 -additional intermediate compacted felt; 5- main sealing felt; 6 Explosives (PM).

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The shock wave generated by the explosion of an explosive charge (PM) acts directly on the first (adjacent to the PM) hydroampule (2). The force of the explosion, which creates the maximum pressure, is horizontal, and hitting the opposite hydraulic ampoule (2) allows it to be directed at a certain angle vertically. That is, it is directed towards the inner side walls of the hole. The extra spacing of the compacted felt (4) not only prevents the hydraulic ampoule (2) from being pushed back, but also prolongs the duration of the movement. The effect of the pressure wave is to transfer the process from the intermediate felt (4) to the second hydroampule (3). This also involves observing a certain amount of resistance to the shock wave and hitting the side walls of the borehole at a certain angle to the direction of the shock wave. The shock wave acting on the second hydroampule (3) acts on the main sealing felt (5) with a certain amount of reduced pressure. The effect on the main dense felt (5) also serves as a barrier in the direction of the wave shock, as does the effect on the intermediate dense felt (4).The resulting pressure increases the effect on the side walls of the borehole [4].

It is also possible to increase the utilization rate of the borehole by placing a pair of hydraulic bulbs in a row. This method is used to prolong the life of the plug in the borehole after the explosion, to increase the consumption of blast energy for crushing the ore mass, to reduce the emission of gases from the explosion, to increase the safety and efficiency of blasting (Figure 2).

The placement of the plug, which is blocked by two hydraulic ampoules, as follows (Figure 2) also has a unique effect.

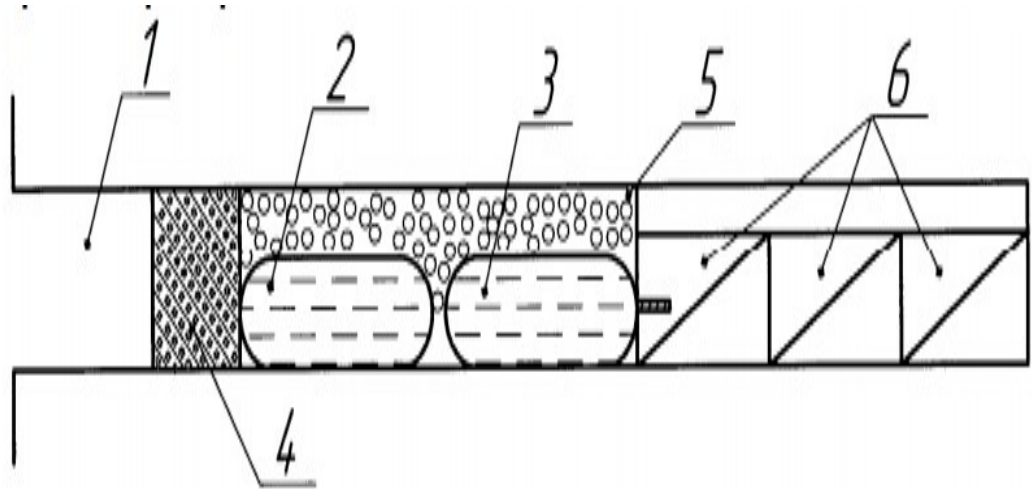

Figure 2: Scheme of plugging a borehole using two hydraulic ampoules.

1 hydro-painted hole; 2 and 3 - hydroampular; 4 - sealing dense felt; 5- plastic materials; 6 Explosives (PM).

An explosive (PM) explosion produces gases and shock waves. However, they do not pass freely through the space between the hydraulic ampoules (2 and 3). The filled plastic material (5) and the sealing compressed felt (4) between the hydraulic ampoules serve to keep the plug in the nozzle for a longer period of time and to reduce the formation of explosive gases. The longer the plug is at the mouth of the hole, the more likely it is that the direction of the wave will hit the inner walls of the hole rather than the horizontal direction (towards the mouth of the hole). This, in turn, increases the amount of energy consumed by the explosion that serves to decompose the ore body [5].

The use of the above options for filling the boreholes with watercolors in the blasting of coal deposits ensures safe and efficient blasting. At the same time, the above-mentioned underground mining significantly increases the efficiency required for blasting.

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