

Remounting of a mechanized complex using Petitto Mule equipment in the conditions of mines in the south of Kuzbass

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Abstract. It is proposed to reduce the duration of mounting and dismantling works before starting to develop the next extraction panel in mines that operate according to the scheme ‘mine – longwall’, which will improve the safety and eliminate emergencies during mining operations.

1. Introduction

In the conditions of modern market requirements for the stable shipment and supply of coal, the mines operating according to the scheme ‘mine – longwall’ have problems with downtimes during coal mining due to remounting the mechanized complex.

In the ‘mines – longwalls’ there is no reserve extraction front. As practice shows, the duration of the remounting of the mechanized complex can increase by 1.5-2 times or more, compared to the corresponding figure calculated without considering the time spent on eliminating the consequences of roof collapses and the enclosing rocks inrush into the working space. Duration of mounting and dismantling works significantly exceeds the duration of a stop necessary from the technical point of view. So, in the mines of the South Kuzbass, the actual duration of faces downtime during the mechanized complex remounting is 20-150 days or more. At the same time, the economic damage associated with the irrecoverable losses of production reaches 3-7 million rubles per day [1].

2. Production experience

The carried out analysis of the mechanized complex remounting in the flat seams showed that the time of remounting works is mainly affected by the time of dismantling, since the mounting of the mechanized complex takes place together with the dismantling and on average is approximately two months. In this regard, the dismantling of the mechanized complex requires detailed consideration and solution of problems in this area. With an increase in the depth of development, due to a more active manifestation of rock pressure, the process of mechanized complex dismantling has become more complex and the possibility of a high rate of injuries would arise [2].

Based on the experience of dismantling works, the scheme with the use of polymer dismantling overlap and pilot sections of mechanized roof supports (figure 1) has got widespread use.

For many decades and today, to extract the mechanized roof supports in Kuzbass mines a standard set of equipment and mechanisms (winches LPK-10B, LMT-150.01, LShM, pump station SNT-32) is used. This technology of dismantling is distinguished by a high number of units of energy consumption and starting equipment, rather low indicators of performance, level of safety, costs for



the acquisition and maintenance of a fleet of dismantling equipment. In case of insufficient tractive effort, pulley systems are applied using several assembly blocks to increase the tractive effort.

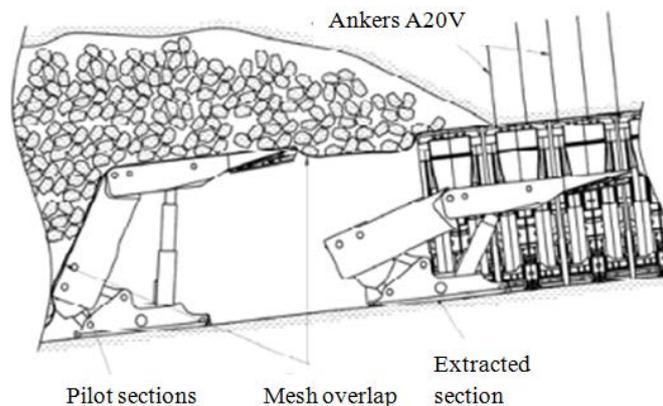


Figure 1. Scheme with the joint application of polymer mesh and pilot sections.

The first machines for extracting heavy support sections Petitto Mule appeared in the United States about 30 years ago, and now there are already several hundred of such machines working in many coal mines around the world, which confirms the reliability and quality of these machines. All machines have an option – they can be disassembled into four parts for easy descending into the mine. There are also cars in diesel version, explosion-proof, designed to extract the support sections weighing 50, 60, and 70 tonnes (figure 2).



Figure 2. Machine Petitto Mule model 1550 is designed to extract support sections with a mass up to 36 tonnes.

Advantages and disadvantages of Petitto Mule equipment:

- high cost of dismantling equipment (about 100 million rubles);
- increase in the width of the dismantling path;
- complicated organization of the place of its reloading on the diesel locomotive in the mounting chamber (poor compatibility with the monorail transportation technology);
- need to strengthen the soil (or concreting) for the movement of Petitto Mule (on weak soils);
- + high performance of dismantling works;
- + a small number of units of electrical equipment;
- + high level of dismantling safety, the absence of extensive hazardous areas.

So, for example, the mounting and dismantling works at the mine “Alardinskaya” are carried out by equipment that was used to remounting the mechanized complexes, the weight of the support sections of which was within 20 tonnes (KM-142, KM-130, FAZOS): the winches LPK-10B, LMT-

150.01, LShM, the pumping station SNT-32. At the moment, Glinnik 22/47Poz cleaning complex is used at the mine, the weight of the support section of which is 32 tonnes. When using the above mentioned equipment for mounting and dismantling works, a number of problems arise [3]:

- equipment failure due to overload;
- labour-intensive and time-consuming preparatory and face end operations due to the use of a pulley system;
- daily equipment remounting, switching of starting equipment;
- delivery of sections from the dismantling chamber (by traction) takes a lot of time due to the limited speed of the rope;
- maintenance and repair of starting equipment and mechanisms;
- high rate of injuries.

Let us analyze the time spent on each process separately while dismantling support sections of a mechanized complex according to the schedule of works (figures 3 and 4).

№ n/n	The name of the operation	Duration, min	Number of employees per shift	1 shift																
				8	9	10	11	12	13	14	15									
1	Shift reception, transfer, inspection of production, equipment	10	5	-																
2	Preparation for dismantling (hook-up, hydraulics switching, shortening)	15	4	-																
3	Dismantling the section with PM	5	4																	
4	Issuance of sections to the place of loading on the vent drift (200m)	10	2																	
5	Loading on a diesel locomotive (mine)	15	2																	
6	Shunting operations of the RM on the vent line	10	2																	
7	Loading of fastening materials	5	2																	
8	Moving the RM to the place of dismantling	10	2																	
9	Mounting the dismantling space	35	2																	
10	Moving pilot sections with PM	15	4																	
11	Maintenance of oil stations	460	1																	
Total		70	5																	

Figure 3. Schedule of dismantling works using winches.

The dismantling and turning of the support section takes 90 minutes of working time. This is due to a large number of preparatory and face end operations, (stretching the rope, hanging blocks) that are repeated 4-5 times per cycle, disconnection of the section to be dismantled from the general hydraulic system of the mechanized complex. The movement of the pilot sections also consists of a variety of manipulations with rope and blocks. This leads not only to a great waste of time, but this process is also very labour intensive. Also, people who dismantle the support sections are in close proximity to the dangerous zones of the rope action.

When moving a support section from a line a number of the roof rocks falls into the working space of the dismantling chamber, which subsequently prevents the pushing-in of the support pilot sections. At the mine “Alardinskaya”, the roof rocks of the seams are represented by sandstones with a large collapse step, due to which the rock intrushes are quite large blocks of sandstone. The clearing of the workplace is carried out manually using small-scale mechanization (a jackhammer) and shipment of the rock mass into the transportation container, which is also time consuming.

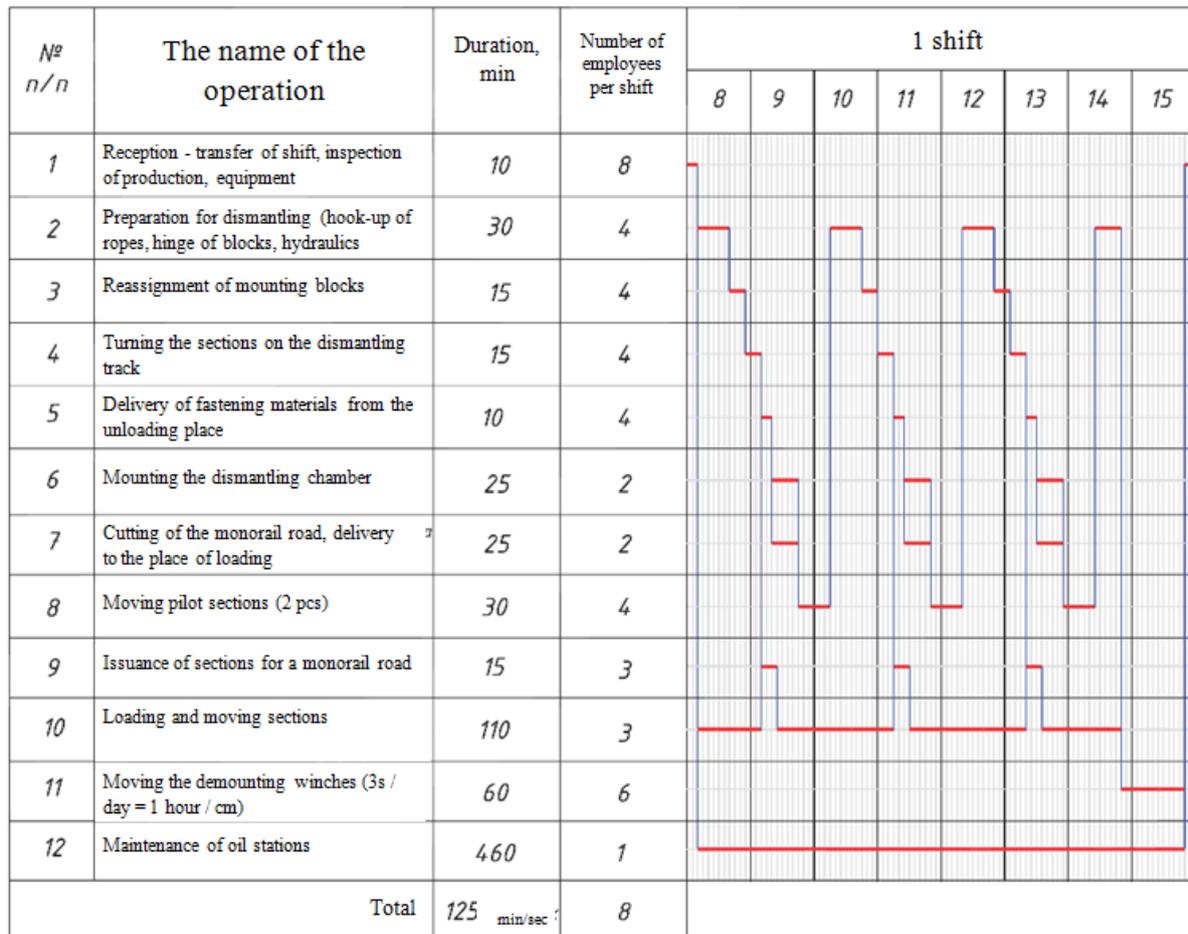


Figure 4. Schedule of dismantling works using Petitto Mule.

The return of the section in the dismantling chamber is carried out by diesel locomotive DLZ-110 FERRIT or by LSHM winches dragging over the soil of the dismantling chamber using the system of pulley blocks (in the case of a decrease in the spacing of the hydraulic props of the complex as a result of the effect of rock pressure on the mechanized support section). The average time of return of the mechanized support section in the dismantling chamber is 55 minutes.

The process of lining the place of dismantling is one of the most labor-intensive processes when dismantling the support sections of the mechanized complex. Lining is carried out by a pitprop with a diameter of 200-240 mm. At the same time, after every 3-5 dismantled support section of the mechanized complex in the goaf side of the dismantling chamber, a pigsty crib 2500x2500 is lined from pitprops. All operations are performed manually, which also leads to a great waste of time.

The repair shift almost all the time is preparing for dismantling works (shifting, mounting of dismantling winches, switching electrical equipment, moving of fire-extinguishing means). With such

schedule of works performance, the time for dismantling sections of the mechanized complex will be 32-42 days.

Based on the experience of dismantling operations in the conditions of the mine “Alardinskaya”, it is proposed to conduct dismantling operations under the protection of the roof overlap with a net from polymeric materials. The calculation of the sections dismantling time is given in table 1.

Table 1. Calculation of the sections dismantling period.

Parameter	Units amend.	Index	
		Winches	Petitto Mule
Number of sections	PC	130	
Time for dismantling of the 1st section	minutes	125	70
Removable capacity technological scheme (1 shoulder)	sec / cm	2.4	4.9
The daily productivity of the technological scheme	sec / day	9.6	19.7
Duration of dismantling of sections (1 shoulder)	day	13.5	6.6
Duration of dismantling of sections (2 arms)	day	6.8	3.3

3. Recommendations and results of the use of Petitto Mule equipment

It is recommended to use the equipment for mechanized clearing the dismantling place and the dismantling chamber by the ripper loader Deilmann-Haniel L513. Dismantling of sections should be produced by the machine Petitto Mule. The delivery of mechanized support sections should be carried out by the hydraulic winch MW-250. The lining of the place of dismantling should be performed with a system of wooden pigsty cribs LINK-N-LOCK. It is also recommended to use the equipment delivery from the dismantling chamber to the mounting chamber on inclined workings to accumulating turnouts located on the ventilation drift of the excavation column being prepared by the outboard diesel locomotives DLZ-110F. From the accumulating turnout to the mounting chamber, the delivery should be performed by a multifunctional LHD with the trailer CHT-50.

Reduction of time for the main operations of the mechanized complex dismantling:

- dismantling of the mechanized support section from 90 minutes to 15 minutes;
- lining the place of dismantling from 40 minutes to 30 minutes;
- shifting of the pilot sections from 50 minutes to 20 minutes.

These measures will allow the number of cycles per day to be increased from three to ten, the period of remounting to be shortened by 20 days, which in turn will save up to 140 million rubles.

4. Conclusion

The dismantling with the help of the self-propelled dismantling machine Petitto Mule allows the shortest possible time for re-installing cleaning equipment to be achieved, as well as the risk of injury to personnel during dismantling to be reduced.

References

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