Antiskid Measures for Equipment at Large Inclined Angle Coal Face

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Abstract – For large inclined angle coal face, the increasing coal seam dip angle and height of the hydraulic support, there is a tendency for toppling and downslide towards the work face and conveyor belt. Thus, in these cases it is vital to consider anti-skid measures for the hydraulic support and slip resistance of the conveyor, from the three machine equipment of hydraulic support, coal cutter and belt conveyor. In a fully mechanized coal face, the relationships among this set of equipment are based on a hydraulic support which must stands steadily to prevent conveyor belt slip, as a steady conveyor belt is essential to the coal cutter to form a reliable transportation channel. Considering these relationships, the measures of anti-skid and slip resistance at large inclined angle coal face are taken as factors in the design of the hydraulic support.

Keywords – large inclined angle coal face, equipment, antiskid, measures

I. INTRODUCTION

Geological conditions of coal seam hosting in China are the most complex in the world, as a result, all mining technologies in other country can be seen in China, besides, and some coal mining technologies only belong to our county which can’t be seen in other place. That proves coal mining technologies in China are the most complicated. With the gradual resource exhaustion and fewer and fewer well-mined coal beds under the better preservation condition, nowadays, more and more special coal seams are being mined in China, which include thin coal seams and deeply inclined coal seams and so on. For large inclined angle coal face, with the increasing coal seam dip angle and heightening hydraulic support, toppling trend and downslide toward working face angle of hydraulic support will be augmenting as well as channeling and sliding of working face belt conveyor will do. Thus, for large inclined angle coal face, it is very important to consider the anti-skid of hydraulic support and slip resistance of the conveyor, from the three machine equipments, hydraulic support, coal cutter, belt conveyor in fully mechanized coal face, the relationships among them are based on the hydraulic support, only which stands steadily, it can prevent the conveyor to slip, as the conveyor is steady, the coal cutter will be offered a reliable transportation channel. Considering the relationships, the measures of anti-skid and slip resistance of large inclined angle coal face are taken all factors into considerations from the design of hydraulic support [1-4].

II. ANTI-SKID AND SLIP RESISTANCE MEASURES OF HYDRAULIC SUPPORT

A. Anti-skid systems of hydraulic support

The anti-skid systems of hydraulic support are divided into active system and passive system, the former refers to side guard plate, the latter refers to anti-skid jack, rotating shaft and the systems made of its connectors[5-9].

1) Active anti-skid system of hydraulic support

The side plate system is made up of top girder side guard plate, shield girder side guard plate, some special supports also including front girder side guard plate, tail girder side guard plate, and linkage side plate and so on, among all the side guard plates, top girder side guard plate mainly plays the anti-skid role just a top girder of the hydraulic support in the Fig. (1).

Fig. (1). Top Girder of Hydraulic Support
During normal operating, side guard plates depend on the next-to-support top girder which the spring springs to make effects, when the support inclines a certain degree, it will push jack to jut, and the support is stabled by hydraulic pressure of jack, so, when hydraulic support equipped, the moving side guard plate of hydraulic support should face the bed slope of workface angle. While the top girder structure of hydraulic support is designed, different cylinder diameter side push jacks were chose to fit into workface angle according to different workface angle.

2) **Passive Anti-skid System of Hydraulic Support**

Passive anti-skid system of hydraulic support refers to the system which is made up of anti-skid jack and its connectors, as shown in Fig. (2).

![Fig. (2). Passive Anti-skid System of Hydraulic Support](image)

What is called “passive anti-skid” refers to top support controlling bottom support, due to its moving, the whole process includes descending, moving and ascending, that’s to say, the support will be descended first, down to the height from 150mm to 200mm, in order to make the top beam separated from the roof, and then it pulls the support to move ahead under the help of push jack, after the support moves a step distance, then it will be ascended to make top beam touch top beam of work face, having an effect of supporting. What is done is to reduce the obstruction of moving support to realize well-moved support. During the support descending, the works of passive anti-skid appears, and at the time after descending and before moving, or during it moving into its position and without ascending, then it is in a free state, if it is found to be declined, through the pull of anti-jack, it can be upended in time.

From above-mentioned we can observe that the support of workface is connected into one group under the combination effects between positive and passive anti-skid with anti-skid jack, and the anti-skid problem of workface support is nearly resolved. After the inclination of workface tilts to some degree, the measures which the top beam of support is connect to the bottom will be taken to deviational anti-skid, as shown in Fig. (3).

![Fig. (3). Deviational Anti-skid System](image)

The principles of anti-skid equipment in the connective form are just the same as in 2). Under the combination effects of the three anti-skid equipments, the anti-skid problem of workface support is worked out thoroughly, and it fits into arbitrary angle workface.

B. **Anti-skid System of Hydraulic Support**

It is also divided into positive and passive systems, the positive system refers to bottom adjusting devices, that’s to say, lower jack or lower jack with bottom girder, and the passive system consists of anti-skid jack, circle chain and its attachments.

1) **Positive Anti-skid System of Hydraulic Support**

The positive system refers to that the lower jack is equipped on the bottom of the support, as shown in Fig. (4), or the lower jack with bottom girder is equipped, as shown in Fig. (5).
While the support somehow slides down, the lower jack will stretch out to strut the bottom next to support in order to upend it own self. The structure with bottom girder has more adjusting frame force and the effect of adjusting frame will be better and fit into the bigger pitch beam due to the two lower jacks and the large contact area between lower girder and support next to it.

2) Passive Anti-skid System of Hydraulic Support

The passive system consists of anti-skid jack and its connectors, as shown in Fig. (6).

What is so-called “passive anti-skid” refers to the upper support controlling down support, when the supports are found to glide down somehow, the down support will be forced to close to the upper through the strength of anti-skid jack, taking the next to support as the fulcrum, thus, the anti-skid of supports is realized.

Therefore from 1) and 2), we can conclude that the anti-skid problem of workface support is nearly resolved due to the two supports connected into one group through anti-skid jack under the combine effect between positive and passive anti-skid system of supports.

3) Anti-skid Measures of Crab Bearer

Whether supports of the whole workface stands steadily and stably is greatly relevant to the crab bearer, as long as the crab bearer of workface stands steadily and stably, and so is the whole workface, the anti-skid measures of crab bearer is shown in Fig. (7).

Besides the positive and passive anti-skid system in 1) and 2), crab bearer anti-skid system integrates the base of the first crab bearer and that of the third into the whole through anti-skid jack, circle chain and a leading chain equipment, to strengthen antiskid ability of crab bearer.

III. ANTI-SKID MEASURES OF CONVEYOR

The reasons which conveyor in large inclined angle face slips down are caused as follows:

- the gravity of conveyor itself, under the action of gravity, the conveyor itself has a declining tendency toward workface angle.

- Running resistance, during coal transportation, the scraper carries the stationary coal to move, it is easy for conveyor to decline owning to the dynamic from scraper chain [10-12].

- Acting force of coal cutter, because the cutter moves onto the conveyor and during the mining
process, the reacting force which coal wall gives to the cutter, the conveyor will decline, especially winning to the top, the conveyor dip down more obviously. So in the large angle work face, it is very important to prevent the conveyor to dip down and the anti-skid measures of conveyor as shown in Fig. (8).

Fig. (8). Anti-skid System of Conveyor

Anti-skid system of conveyor are made up of anti-skid jack, circle chain and it connectors, when conveyor somehow decline, the anti-skid jack will draw the conveyor to its position with pull, taking the base of hydraulic support as fulcrum, thus the declining problem of conveyor disappears.

For shield support and support and shield hydraulic support, it has only front conveyor, and it is advisable to adopt the abovementioned measures, for low-position top coal caving hydraulic support, due to the two conveyors before and after it, the anti-skid problem of back of conveyors will be taken into consideration, and the system as shown in Fig. (9).

Fig. (9). Anti-skid System of Back Conveyor

The back and front conveyors have the same disciplines, and also realize to antiskid through the support as the fulcrum.

IV. CONCLUSIONS

Taken the above mentioned measures (anti-skid systems of hydraulic support and anti-skid measures of conveyor), the anti-skid problems of the main equipments in the large pitched beam workface will be resolved completely, and the machines operate rather safe and reliable.

REFERENCES


