Study on Strata Behavior Regularity of 1301 Face in Thick Bedrock of Wei-qiang Coal Mine

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Abstract. In order to ensure the safe and efficient production of the thick bedrock face, the rule of the strata behavior of the thick bedrock face is discussed through the observation of the strata pressure of the 1301 first mining face in Wei qiang coal mine. The initial face is to press the average distance of 50.75m, the periodic weighing is to press the average distance of 12.1m; during the normal mining period, although the upper roof can not be broken at the same time, but the pressure step is basically the same; the working face for the first weighting and periodical weighting is more obvious to the change of pressure step change, when the pressure of the working face is coming, the stent force increased significantly, but there are still part of the stent work resistance exceeds the rated working resistance, low stability, still need to strengthen management.

1. Introduction
Coal is the main energy of our country, accounting for 76% and 69% of the total energy production and consumption. For a long period of time, China will still be coal-based energy structure. In the process of coal mining, reasonable control of mine pressure in working face is one of the important tasks to ensure safety production. However, due to the many influencing factors of mine pressure, it is difficult to monitor on-site and the effect of control measures is difficult to predict. Resulting in serious damage to the roof, the top and bottom plate closer to the amount of excessive, and ultimately caused when the stroke is too large, and even cause the stent "crushed" phenomenon, which seriously threaten the safety of personnel and equipment, while the production efficiency of adverse effects. What a difference it makes is the thickness of coal seam in Wei qiang coal mine is relatively large, the thickness of bedrock is 291 ~ 325m, and Wei-qiang coal mine is a new coal mine and there is no similar research before. In this paper, we study the thick bedrock shallow buried coal seam, mine pressure behavior and adaptability analysis of the support.

2. General Situation of Mine
2.1 General situation of working face
Wei qiang Coal Mine is a large-scale coal production base established by Shaanxi Yanchang Petroleum (Group) Co., Ltd. in accordance with the new model of "oil and gas change simultaneously, The overall development of the oil and gas coal salt". Wei qiang coal mine production and design scale of 3 million tons / year, the mine using inclined shaft development approach, the main roadway anchor with cable support form. There are 2 layers of coal mining in the field, and No. 3 coal seam is the stable medium-thick coal seam which can be adopted in the whole area. The No. 4 coal seam is a relatively stable thin coal seam. The thickness of the coal seam is 2.70 ~ 4.31m, with an average of 3.38m. The thickness of the coal seam in the field is increased from south to north, and the distance between the coal seam is 4.13~16.34m, with an average of 8.84m. The thickness of the No. 4 coal seam is 0.81 ~ 1.44m,
the average thickness of 1.02m. Mine design to mining 3 in the thick coal-based, mainly on the 4th thin coal seam. The main development system of the mine is arranged in the No. 3 coal seam, and the No. 4 coal seam in the northwest of the field is recovered by the No. 3 coal seam development system. According to the top and bottom of the working face and the thickness of coal seam, mining high conditions, and with reference to other mine experience, the choice of Shanxi Pingyang Machinery Plant production of two-column shielded hydraulic support and supporting the end of the transition bracket a total of 175 units, the maximum resistance 10000kN, the first support force 7912kN.

3. observing mine pressure in face
Along the work surface tend to arrange five observation stations, station 1 observation 30°~32° stent, 2 station observation 60°~62° stent, 3 station observation 90°~92° stent, No. 4 station Observation of 120°~122° stent, station 5 observation 150°~152° stent, in order to improve the reliability of observation, focus on observation of the middle section of the work surface bracket, that is, No. 2 observation station to No. 4 observation station.

The monitoring time is April 30, 2016 to May 11, 2016, the monitoring range for the work surface recovery to about 809m~923m range.

4. The law of the mine pressure

![Figure 1 for the stent working resistance curve.](image)

4.1 strike face
4.1.1 the first time to pressure analysis. Wei qiang coal mine 1301 face began to recover from November 16, 2015 mid-class, as of November 20 zero point, the face of the nose to promote 6.4m, tail to promote 5.6m. November 20 from eight o'clock to four o'clock class, 1301 face cut-hole crack burst work successfully completed, and achieved good results. Since the beginning of November 21, the face began to normal recovery, the process of promoting the work of the upper empty directly with the mining along with the fall, the overall support pressure is not obvious, maintained at 30MPa below, to December 9. When the head is advanced by 34.3m and the tail is advanced at 31m, the pressure of the working face is obvious. The phenomenon of coal wall is increasing and the pressure of the central part (60°~120°) is obviously increased. Analysis, initially thought that the old top began to pressure at this time. As of December 18, the face of the nose to promote 60.1m, tail to promote 55.6m, stent pressure appears to be stable, and the overall pressure is low, basically maintained at 29MPa or so, at the same time, through the subsequent three days of continuous observation, The overall pressure on the face are no major changes, regional stability, to maintain a low pressure state, the upper roof to the end of the pressure is over.

According to the comprehensive analysis of the field observation, it can be seen that the pressure of the head part (1°~30°) and the tail part (150°~152°) of the 1301 working face always shows the pressure in the whole observation process, (60°~121°) from the beginning of December 9 to pressure, has continued until the end of December 18, changes significantly, the difference is greater. 1301 working face of the upper roof to press the minimum distance of 43.65m, the maximum is 57.85m, an average of 50.75m.
4.1.2 Periodic weighting analyzing. Figure 1 for the 1301 face during the progress of the stent pressure observation results, Table 1 for the stent pressure curve.

Table 1: the stent pressure curve

| observation station | roof weighting step/m | pressure sustained length/m | pressure duration/h | weighting intensity/M Pa | dynamic factor |
|---------------------|-------------------------|-----------------------------|---------------------|--------------------------|----------------|
| 1                   | 10.8                    | 2.0                         | 3.4                 | 40.80                    | 1.2            |
| 2                   | 11.8                    | 2.81                        | 5.0                 | 38.11                    | 1.33           |
| 3                   | 11.28                   | 2.31                        | 3.66                | 44.30                    | 1.29           |
| 4                   | 13.20                   | 2.54                        | 5.0                 | 30.30                    | 1.50           |
| 5                   | 13.28                   | 2.24                        | 5.56                | 34.33                    | 1.40           |
| average             | 12.07                   | 2.25                        | 4.52                | 37.57                    | 1.37           |

The ratio of the working resistance of the stent in the range of 30-39.8MPa is the largest, the value is 28.57%, the proportion of the working resistance of the stent in the 0-10MPa section is 28.15%, and the ratio of the rated working resistance is 6.96%. From the above data, it can be seen that the support can play a better role in the recovery process. Considering the influence of the recovery rate, the periodic weighting has a tendency to increase with the increase of the recovery rate, but because of the two The boundary conditions and geologic conditions of the roof at the end and the middle position are different, so the amplitude of the periodic weighting is increased.

4.2 Face tendency

Through the analysis of the distribution of the pressure zone and the propulsion distance curve, it can be seen that the periodic weighting has the following characteristics: the pressure of each of the five zones is not the same at the same time, but the pressure step is similar, indicating that each periodic weighting The upper roof can be completely broken. Figure 3 and Figure 4 show the spatial distribution of pressure.
5. Stent force characteristics

According to the rated initial support force of 31.5MPa (7913kN), the operating procedures require the initial support force to reach the specified value (70% ~ 80% of the rated value), should be 22.05MPa ~ 25.2MPa, 50.3% hydraulic support of the initial support force Reach the specified value. The proportion of the initial support force in the initial support force of 15 ~ 35 MPa is 63.92%, of which the ratio is greater than 22.05MPa is 49.67%. Less than 15MPa initial support force accounted for 36.08%; 1301 test bench hydraulic support rated working force of 39.8MPa (10000kN), the average end resistance of the survey area of 22.33 ~ 25.37MPa, an average of 24.73MPa, (39.8 MPa) of 62.13%; On the average resistance point of view, play only 62.13%, the average working resistance has a greater surplus, the hydraulic support at the end of the resistance in the proportion of 20 ~ 39.8 MPa greater than 48.39%, the range of the proportion of the initial support To 51.61%, of which the proportion of 30 ~ 39.8 MPa high, and beyond the rated working resistance of 12.56%.

During the working face, the working resistance of the stent is the largest in the 30-39.8MPa section, the value is 28.57%, the proportion of the working resistance of the stent in the 0-10MPa section is 28.15%, and the ratio of the rated working resistance 6.96%; the working resistance of the stent is the largest in the range of 30-39.8MPa, the value is 52.9%, followed by the working resistance in the 20-30MPa section, the frequency value is 30.27%, while 9.39% The rated working resistance, and the work resistance of less than 20MPa stent share of 7.95%. The frequency distribution histogram and the working resistance section of the frequency distribution of the frequency distribution in the working resistance section are shown in Fig. 5.

| Testing zone I | Testing zone II | Testing zone III | Testing zone IV | Testing zone V |
|----------------|----------------|-----------------|----------------|----------------|
| The first cycle | 809.00 | 809.10 | 815.00 | 813.00 | 809.10 |
| The second cycle | 819.70 | 822.00 | 825.00 | 830.00 | 824.30 |
| the third cycle | 827.70 | 829.40 | 833.75 | 846.00 | 840.90 |
| the forth cycle | 839.00 | 839.60 | 851.50 | 858.50 | 858.30 |
| the fifth cycle | 844.60 | 850.40 | 865.25 | 864.12 | 871.00 |
| the sixth cycle | 856.30 | 861.80 | 875.50 | 877.75 | 882.30 |
| The seventh cycle | 867.10 | 869.90 | 889.00 | 890.75 | 896.00 |
| the eighth cycle | 884.30 | 881.70 | 905.00 | 905.33 | 906.90 |
| the ninth cycle | 896.00 | 899.10 | 915.25 | 917.75 | 915.30 |
| the tenth cycle | 915.30 |  |  |  |  |
6. conclusion
Under the condition of thick bedrock in Wei qiang coal mine, the initial pressure step is 50.75m, the average pressure step is 12.07m, the dynamic load factor of the support is 1.37, and the working area has uniformity period change.

In the first periodic weighting and the second periodic weighting, with the working surface forward, the upper roof can basically break at the same time, but after the third pressure periodic weighting, area I, II survey area of the upper roof fracture position was significantly delayed, But to step by step with III, IV, V area basically consistent.

In the whole mining process, the work surface support can play a supporting role better, but still in the lower working resistance of the stent still accounts for a large proportion, which shows that the stent still need to strengthen management in order to support the support of the waving support Role, to improve the stability of the face.

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