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(54) LONGWALL WORKING FACE, NON-PILLARED MINING METHOD

(57) Disclosed is a longwall working face, non-pillared mining method, comprising the following steps: 1. Excavating a tailentry (2) and a headentry (3); 2. Reinforcing a top panel (5) of the tailentry (3) and drilling on the top panel an energy collecting hole (7) for pre-splitting blasting; 3. Extracting until a goaf is formed; 4. Blasting at a position corresponding to the energy collecting hole and forming a kerf on the top panel; 5. The mining face collapsing to become a new roadway; 6. Taking the original headentry as the tailentry of the next mining face, and excavating a headentry relative to the tailentry, to form a new mining face; and 7. Repeating steps 2-6, and continuing to mine coal until the coal seam mining is completed. The present method involves continuity between every two mining faces, non-pillared support, a short process for forming roadways, and high efficiency of mining and forming roadways.

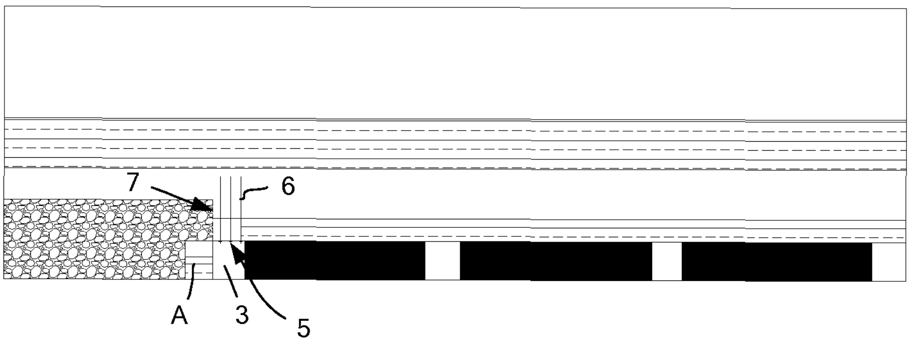

Fig. 5

EP 2 801 697 A1

Description

TECHNICAL FIELD

[0001] The present disclosure relates to a coal seam mining method, and particularly to a longwall working face coal seam mining method.

BACKGROUND

[0002] With the increased depth of coal mining, a longwall mining usually adopts means of retaining pillars to protect a tailentry roadway. In the case of a relatively deep roadway, the widths of retained pillars are increased due to the rapidly increased ground stress. In the goaf-side entry retaining (driving) mining process of the traditional longwall mining method, large engineering quantity of roadways, high development ratio, low production efficiency, severe resource waste in the deep mining process, and safety hazards such as gas outbursts, frequent rock bursts and air leakage in the goafs caused by the retained pillars, have become important problems that are disturbing and affecting mine safety and efficiency.

[0003] At present, the research on non-pillared mining in main mining countries domestically and abroad mainly focuses on two aspects: goaf-side entry driving and goaf-side entry retaining. Goaf-side entry driving refers to the following: after the previous working face extracting is completed, a top panel of the mining face is fully caved, waste rocks are extruded and compacted, the behaviors of the ground pressure in cover rocks stop, and surrounding rocks are stable, a pressure relief zone is formed in the goaf and the edge of coal mass, and a new roadway is driven again in the pressure relief zone. In the goaf-side entry driving, entry driving can only be performed after a working face of the previous district sublevel extracting is completed and the top panel of the mining face is completely caved and compacted, and hence a long time is required, thereby resulting in difficult production replacement of many mines in China.

[0004] Goaf-side entry retaining refers to the following: in the extracting process of the working face, a headentry in the working face is retained by relevant technology and taken as a tailentry for extracting of the next working face. In the current goaf-side entry retaining technology, in the aspect of roadway inner support, technology such as wooden shed, I-shaped steel shed, telescopic support and bolt mesh anchor has been developed in succession. In the aspect of roadway side support, technology such as timber crib, dense pillar, waste pack, concrete block, paste backfilling and high-water-content material refilling has been developed. Despite some achievements, there are still many deficiencies and problems: the supporting function of a roadway side coal mass is ignored; there are few applications for active roadway support technology; the roadway side support and the surrounding rock deformation are uncoordinated; and the support design is not systematic.

SUMMARY

[0005] The objective of the present disclosure is to overcome the defects in the prior art and provide a longwall working face non-pillared mining method having advantages of reliable support, high mining efficiency and no requirement of pillars.

[0006] In order to achieve the objective of the present disclosure, the present disclosure provides a longwall working face non-pillared mining method, includes steps of:

(1) excavating two communicated roadways on a coal seam as a tailentry and a headentry of a first mining face;
(2) reinforcing a top panel of the headentry and drilling on the working face side of the top panel of the headentry a plurality of energy collecting holes for pre-splitting blasting;
(3) extracting until a goaf is formed, and the roadway is eliminated;
(4) blasting at a position corresponding to the energy collecting holes on the top panel of the original headentry of the goaf, and forming a directional kerf, extending up and down along the entire original headentry, on a side of the top panel close to the mining face;
(5) making the top panel of the mining face collapse by the pressure from a deep stratum on an upper portion of the goaf, and forming a new roadway at a position of the original headentry;
(6) taking the roadway, automatically formed at the position of the original headentry, as a tailentry of a next mining face, and excavating a headentry relative to the tailentry, to form a new mining face; and
(7) repeating steps (2) to (6), and continuing to mine coal until coal seam mining is completed.

[0007] In order to further achieve the objective of the present disclosure, step (2) further includes steps of: mounting a sensor on the top panel of the headentry, and wire-transmitting signals to the ground for remotely real-time monitoring of the status of the headentry. An anchor rod with constant resistance and large deformation is adopted in the step (2) to reinforce the top panel of the headentry. A bidirectional energy collecting pre-splitting blasting method is adopted in the step (4) to perform a directional kerfing. In the steps (1) and (6), the roadways need also to be subjected to leakproof and fireproof treatments. The sensor in the step (2) includes a top panel separation indicator and an anchor rod stress analyzer.

[0008] Compared with the prior art, the longwall working face non-pillared mining method provided by the present disclosure has one or more of the following prominent substantive features and notable progresses. In the longwall working face non-pillared mining method provided by the present disclosure, the energy collecting holes for pre-splitting blasting are drilled on the working face side of the top panel of the headentry; blasting is performed at the position corresponding to the energy collecting hole; the kerf extending along the original headentry is formed on a side of the top panel close to the mining face; the goaf is caved along the kerf, so that the roadway can be automatically formed at the position of the original headentry; the top panel of the roadway cannot be affected by goaf carving and can be kept in good state; then the roadway is taken as a tailentry of the next mining face, and the next mining process is performed continuously; and every two mining faces are continuous and not supported by pillars. Therefore, compared with the prior art, the longwall working face non-pillared mining method has prominent substantive features. In addition, the longwall working face non-pillared mining method provided by the present disclosure achieves the objective of non-pillared support and high coefficient of mining. Moreover, as long term is not required in the roadway forming process, the time of continuous coal seam mining can be reduced under the premise of safety, and hence the longwall working face non-pillared mining method provided by the present disclosure has significant progress compared with the prior art.

BRIEF DESCRIPTION OF THE DRAWINGS

[0009]

FIG. 1 is a schematic structural top view of a mining face in a longwall working face non-pillared mining method provided by the present disclosure;

FIG. 2 is a schematic structural front view of the mining face in the longwall working face non-pillared mining method provided by the present disclosure;

FIG. 3 is a schematic structural view illustrating the reinforcement and drilling of a headentry of a first mining face in the longwall working face non-pillared mining method provided by the present disclosure;

FIG. 4 is a schematic structural view illustrating the process of forming a goaf on the first mining face in the longwall working face non-pillared mining method provided by the present disclosure;

FIG. 5 is a schematic structural view illustrating the process of goaf carving in the longwall working face non-pillared mining method provided by the present disclosure; and

FIG. 6 is a schematic structural view of an anchor rod with constant resistance and large deformation in the longwall working face non-pillared mining method provided by the present disclosure.

[0010] Reference numerals in the accompanying drawings: 1 - first mining face, 2 - tailentry, 3 - headentry, 4 - extracting face, 5 - top panel, 6 - anchor rod with constant resistance and large deformation, 7 - energy collecting hole, 61 - nut, 62 - ball pad, 63 - tray, 64 - constant-resistance device, 65 - connecting sleeve, 66 - rod body.

DETAILED DESCRIPTION

[0011] Detailed description will be given below to the specif structural details and the installation and use process of a sludge discharge pipe floating body provided by the present disclosure.

[0012] In the non-pillared mining method provided by the present disclosure, a first mining face needs to be formed at first. As illustrated in FIGS. 1 and 2, the method for forming the first mining face 1 is the same as the traditional method including steps of: determining a primary mining position on a mining edge of a coal seam, and excavating two parallel roadways 2 and 3 at the position by an S100A roadheader. The two parallel roadways 2 and 3 are communicated with each other at the tails through a roadway 4. The roadway 2 close to the edge is a tailentry; the roadway 3 close to the next mining face is a headentry; and the roadway for communicating the tailentry 2 and the headentry 3 is an extracting face 4. Each mining face must be provided with two roadways; the tailentry is a material delivery roadway; and the headentry is an air return roadway. In actual mining, the mining process begins from the extracting face 4 until all the coals in areas between the tailentry 2 and the headentry 3 are worked out, and then the next mining face is mined.

[0013] Subsequently, as illustrated in FIG. 3, the headentry 3 of the first mining face 1 is supported. The supporting process includes passive support and active support. The passive support is to set up a frame in the headentry 3, and the frame passively bears the pressure from a top panel of the headentry 3. The supporting means has the defects of high material consumption, high cost and limited supporting effect. The active support is to additionally arrange an anchor rod on the top panel 5 of the headentiy 3 to reinforce the top panel 5. The anchor rod 6 is usually 5 to 10 m in length and prop the top panel 5 of the headentry 3 by being connected with a relatively stable rock mass on an upper layer. The common anchor rod has a small deformation and can be easily broken. An anchor rod with constant resistance and a large deformation is adopted for reinforcement in the present disclosure. The anchor rod with constant resistance and a large deformation has been disclosed in detail in the patent publication document CN 01858225B. The anchor rods with constant resistance and large deformation 6 are uniformly distributed on the top panel 5 of the headentry 3 of the first mining face 1, and the spacing is set to be 2 to 5 m as required.

[0014] As illustrated in FIG. 6, the anchor rod with constant resistance and large deformation 6 is an anchor rod designed for large-deformation roadways and high-stress roadways, where the constant resistance can be maintained and the elongation is maintained by a mechanical slide means. The anchor rod with constant resistance and large deformation 6 includes a nut 61, a ball pad 62, a tray 63, a constant-resistance device 64, a connecting sleeve 65 and a rod body 66. The constant-resistance device 64 has a cylindrical structure and is sleeved at the tail of the rod body 66; the tray 63 and the nut 61 are sleeved at the tail of the constant-resistance device 64 in sequence; a central portion of the tray 63 is provided with a hole through which the constant-resistance device 64 passes; the nut 61 is in a threaded connection with the constant-resistance device 64; the ball pad 62 for buffer is disposed between the nut 61 and the tray 63; and the connecting sleeve is disposed at the other end of the constant-resistance device 64.

[0015] When the anchor rod with constant resistance and large deformation 6 is applied to a roadway, if the deformation of surrounding rocks of the roadway exceeds the bearing range of the anchor rod, a relative displacement is generated by the rod body 66 of the anchor rod and the constant-resistance device 64 provided with threaded structures on junction surfaces thereof, namely the anchor rod 6 is subjected to a large deformation representing a radial extension as the large deformation of the surrounding rocks. After the large deformation of the surrounding rocks, the energy thereof is released, but the anchor rod with constant resistance and large deformation 6 can still maintain constant working resistance after extension; when the deformation energy of the surrounding rocks is less than the constant working resistance of the anchor rod with constant resistance and large deformation 6, and the constant-resistance device 64 is restored and tightly sleeved on the rod body 66, the roadway is in a stable state again, and hence the stability of the roadway can be achieved and the safety hazards such as the impact of the top panel falling can be eliminated. The bearing capacity of the anchor rod with constant resistance and large deformation 6 is in a range of 15 to 20 KN and the elongation thereof can reach 300 to 600 mm. Therefore, the anchor rod with constant resistance and large deformation 6 has a large deformability so as to be adapted to the high deformability of goaf roadways.

[0016] In addition, energy collecting holes 7 linearly arranged are drilled up on the top panel 5 of the headentry 3 of the first mining face 1, close to a side of the first mining face, in sequence by an MQT-120J drill, so that the blasting process can be conveniently achieved by the energy collecting holes 7 and hence the directional kerf can be achieved. The pitch of the energy collecting holes 7 is 2 to 5 m and determined by the characteristics of actual strata. Meanwhile, the roadways 2, 3 and 4 need also to be sprayed with urea-formaldehyde polystyrene foam for leakage resistance and fire resistance.

[0017] In the present disclosure, a top panel separation indicator and an anchor rod stress analyzer are also disposed on the top panel 5 of the headentry 3 of the first mining face, and shape and position sensors may be also mounted at a corresponding position of the side wall and bottom surface of the headentry 3. The top panel separation indicator is mounted on the top panel 5 and can detect the variation of the relative displacement of a determined near point relative to a determined far point, so as to monitor the fall state of the top panel 5; the anchor rod stress analyzer is mounted on the top panel 5 through the anchor rod 6 and can detect the pressure of the top panel 5 on a top face of the tray 63 of the anchor rod with constant resistance and large deformation 6, so as to monitor the variation of the fall pressure of the top panel 5; and the shape and position sensors are respectively mounted on the top panel 5, the bottom surface and two side walls of the headentry 3 and configured to monitor the variation of the cross-sectional shape of the headentry. 3. Signals monitored by the top panel separation indicator, the anchor rod stress analyzer and the shape and position sensors are all transmitted to the ground through a wire and subjected to data conversion on the ground; converted data are remotely transmitted by means of Ethernet and the like; hence workers can remotely monitor and analyze the data, so as to remotely monitor the state of the headentry 3 in real time.

[0018] After completion of above works, the mining face is gradually extracted until a goaf is formed. As illustrated in FIG. 4, after the goaf is formed, a side wall on a side of the headentry 3 of the first mining face 1 is eliminated; the headentry 3 and the goaf are merged together; and the roadway is eliminated.

[0019] After the goaf is formed on the first mining face 1, a bidirectional energy collecting pre-splitting blasting device is mounted at the position corresponding to energy collecting holes 7 on the top panel 5 of the original headentry 3; a blasting lead is connected for the pre-splitting blasting of the top panel 5 at the position; and a pre-splitting face is formed on a side of the top panel 5 of the original headentry 3, close to the goaf. The pre-splitting face is a kerf, bidirectionally extending along the original headentry 3, on a side of the top panel 5 close to the mining face, namely a directional kerfing is achieved on the top panel 5 of the original headentry 3. The bidirectional energy collecting pre-splitting blasting method is recorded in a Chinese patent ZL200610113007X. The blasting method can not only have the function of pre-splitting the surrounding rocks of the top panel 5 but also protect the top panel 5 from being damaged by blasting. Moreover, the blasting method has the advantages of simplicity, ease of use, good blasting effect, low cost and convenient operation.

[0020] A blasthole is formed on a pre-splitting line by blasting technology; the bidirectional energy collecting device is adopted for charging; and the energy collecting direction is driven to correspond to the pre-splitting direction of a rock mass. A cohesive energy flow is formed by detonation products in two predetermined directions; a concentrated tensile stress is produced; and the pre-splitting hole is driven to run through the energy collecting direction to form the pre-splitting face. As rocks between drill holes are torn down, the explosive consumption is greatly reduced. Meanwhile, as the energy collecting device protects the surrounding rocks, the damage on the rock mass on the periphery of the drill hole is also greatly reduced. Therefore, the technology can not only achieve the objective of pre-splitting but also protect goaf roadway top panels. The bidirectional energy collecting device is processed by tubular products (including PVC pipes and metal pipes) with certain strength (the uniaxial compressive strength is 1.6 MPa to 2.0 MPa); the diameter of the energy collecting device is different according to the diameter of the hole and determined by the coefficient of the decoupling charge of specified rock mass; the energy collecting holes on the bidirectional tensile energy collecting device have various shapes and may be round, elliptical, square, rectangular and the like; and parameters of the energy collecting holes are determined by the lithologic characters and explosives. The pore size and the hole pitch of the energy collecting holes on the bidirectional tensile energy collecting device are relevant to the lithologic characters, the rock mass structure, the initial stress state of the engineering rock mass, and the like. Corresponding functional expressions need to be established. The parameters are designed according to relevant calculation results.

[0021] As illustrated in FIG. 5, the goaf is caved under the influence of the directional kerfing and the pressure from a deep stratum above the goaf. As a directional kerfing is applied to the top panel 5 of the headentry 3 of the original first mining face, the top panel 5 of the headentry 3 of the original first mining face will not fall in the case of goaf caving; a slope of the haulage roadway 3 (namely an A area in FIG. 5) is formed after the caved goaf is caved along the pre-splitting face, on a pre-splitting side of the headentry 3; and a roadway is formed again at the position of the original headentry 3. The slope of the newly formed tailentry 3 is sprayed and sealed by plain concrete so as to prevent harmful gas such as gas and CO in the goaf from entering into the newly formed tailentry 3. In this way, the headentry 3 of the original mining face is retained and reutilized as a tailentry of the second mining face. Similarly, in the case of extracting of the third mining face, a headentry of the second mining face is used as a tailentry of the third mining face by the technique of the present disclosure.

[0022] Finally, the roadway 3 automatically formed at the position of the headentry of the original first mining face is taken as a tailentry of the next mining face; a headentry relative to the tailentry 3 is excavated; and a new mining face is formed. Meanwhile, the roadways must also be sprayed with urea-formaldehyde polystyrene foam for leakage resistance and fire resistance.

[0023] The above mining steps are repeated for continuing to mine coal until the coal seam mining is completed. And hence the longwall working face non-pillared mining process is achieved.

[0024] In the present disclosure, the energy collecting holes 7 for pre-splitting blasting are drilled on the working face side of the top panel 5 of the headentry 3; blasting is performed at the position corresponding to energy collecting holes; a kerf extending along the original headentry 3 is formed on a side of the top panel 5 close to the mining face; the goaf is caved along the kerf, so that the roadway can be automatically formed at the position of the original headentry 3; the top panel 5 of the roadway 3 will not be affected by goaf caving and can be kept in good state; the roadway 3 is taken as a tailentry of the next mining face and the next mining process is continued; and every two mining faces are continuous and not supported by pillars. Therefore, compared with the prior art, the longwall working face non-pillared mining method provided by the present disclosure has prominent substantive features.

Industrial Applicability

[0025] The longwall working face non-pillared mining method provided by the present disclosure achieves a non-pillared support, has a high mining coefficient, does not require a long-term wait in the roadway forming process, and hence not only guarantees the safety but also reduces the time of continuous coal seam mining.

Claims

1. A longwall working face non-pillared mining method, comprising steps of:

    (1) excavating two communicated roadways on a coal seam as a tailentry and a headentry of a first mining face;
    (2) reinforcing a top panel of the headentry and drilling on a working face side of the top panel of the headentry a plurality of energy collecting holes for pre-splitting blasting;
    (3) extracting until a goaf is formed, and the roadway is eliminated;
    (4) blasting at a position corresponding to the energy collecting holes on the top panel of the original headentry of the goaf, and forming a directional kerf, extending up and down along the entire original headentry, on a side of the top panel close to the mining face;
    (5) making the top panel of the mining face collapse by a pressure from a deep stratum on an upper portion of the goaf, and forming a new roadway at a position of the original headentry;
    (6) taking a roadway, automatically formed at the position of the original headentry, as a tailentry of a next mining face, and excavating a headentry relative to the tailentry, to form a new mining face; and
    (7) repeating steps (2) to (6), and continuing to mine coal until the coal seam mining is completed.

2. The longwall working face non-pillared mining meth-

od according to claim 1, **characterized in that** the step (2) further includes steps of: mounting a sensor on the top panel of the headentry, and wire-transmitting signals to the ground for remotely real-time monitoring of a status of the headentry.

3. The longwall working face non-pillared mining method according to claim 1. **characterized in that** an anchor rod with constant resistance and large deformation is adopted in the step (2) to reinforce the top panel of the headentry.

4. The longwall working face non-pillared mining method according to claim 1, **characterized in that** a bidirectional energy collecting pre-splitting blasting method is adopted in the step (4) to perform a directional kerfing.

5. The longwall working face non-pillared mining method according to claim 1, **characterized in that** in the steps (1) and (6), the roadway is subjected to leak-proof and fireproof treatments.

6. The longwall working face non-pillared mining method according to claim 2, **characterized in that** the sensor in the step (2) includes a top panel separation indicator and an anchor rod stress analyzer.

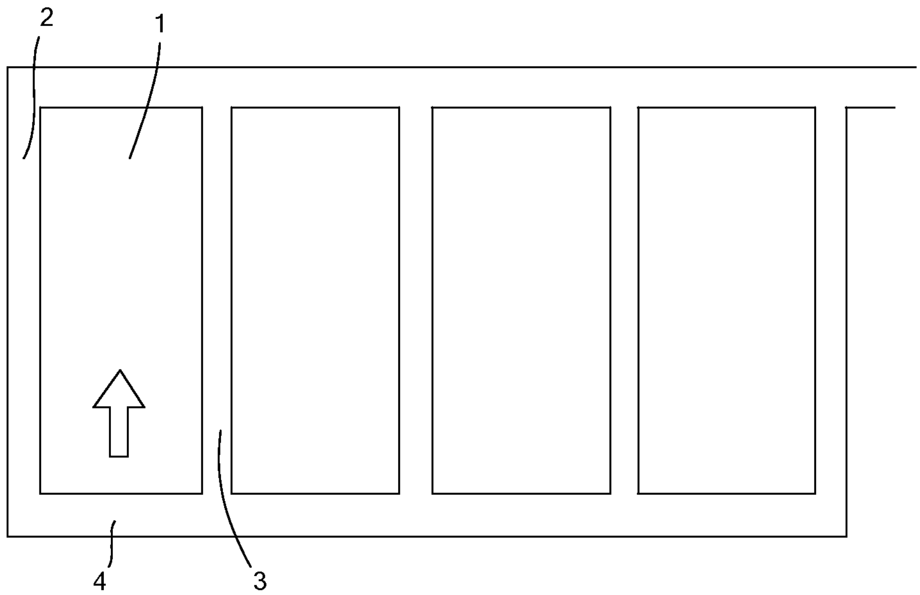

Fig. 1

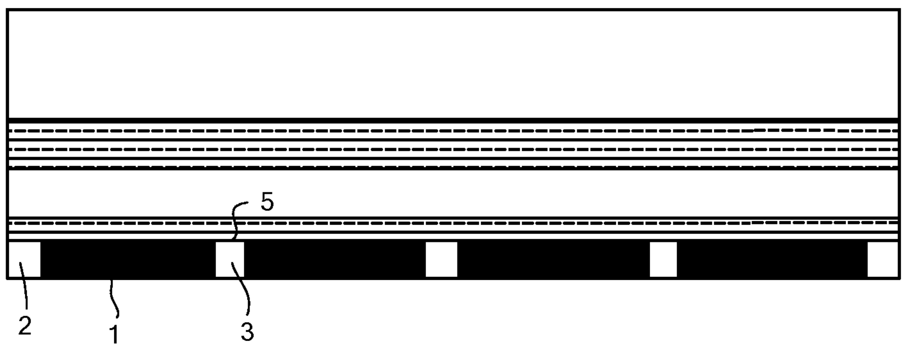

Fig. 2

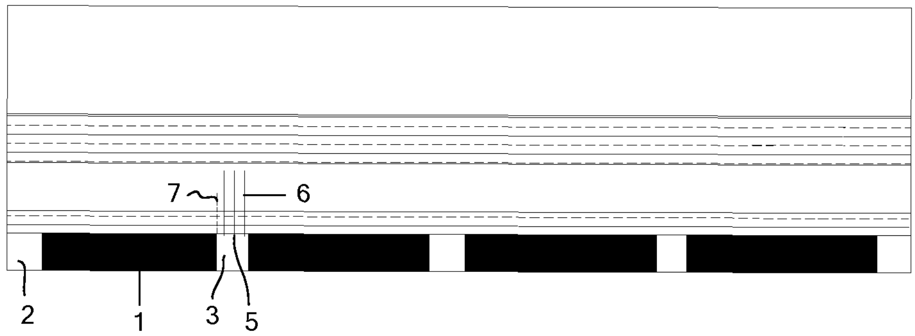

Fig. 3

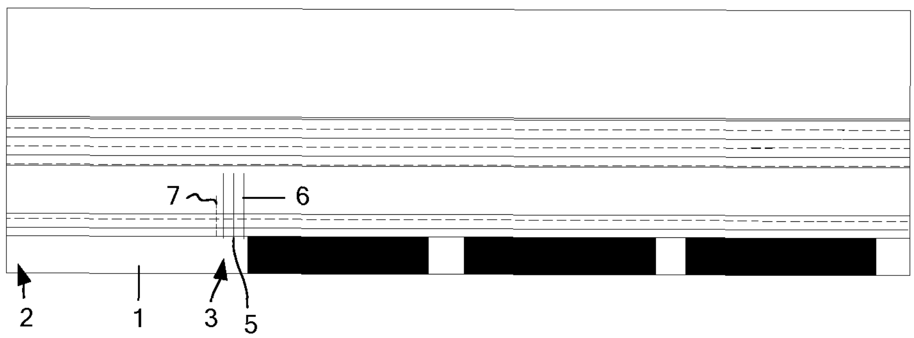

Fig. 4

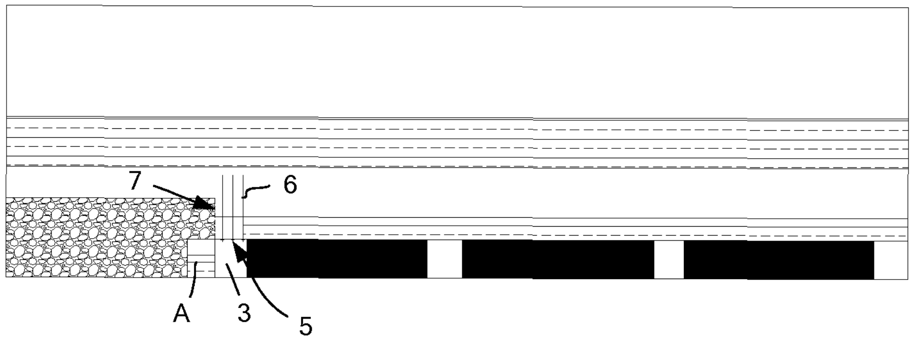

Fig. 5

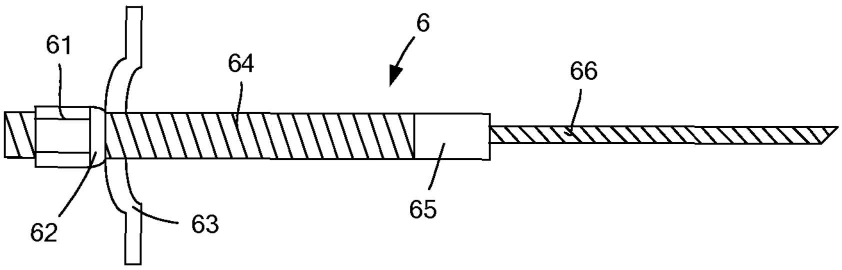

fig. 6

INTERNATIONAL SEARCH REPORT

International application No.
PCT/CN2012/070109

A. CLASSIFICATION OF SUBJECT MATTER

E21C 41/16 (2006.01) i

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC: E21C; E21F

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

CNKI, CNPAT, EPODOC, WPI: pillar, pillarless, longwall, roadway, roof, destres+, gob, retaining, blast+, spit+

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	ZHANG, G.F. et al. Research on the Technique of No-Pillar Mining with Gob-Side Entry Formed by Advanced Roof Caving in the Protective Seam in Baijiao Coal Mine. Journal of Mining & Safety Engineering. December 2011, vol. 28, No. 4, pages 511-516, ISSN 1673-3363	1-6
A	CN 101140152 A (HE, MANCHAO) 12 March 2008 (12.03.2008) the whole document	1-6
A	CN 101858225 A (BEIJING ZHONGKUANG SHENYUAN ENERGY ENVIRONMENT SCIENCE RES INST et al.) 13 October 2010 (13.10.2010) the whole document	1-6
A	CN 101082283 A (HUAINAN MINING GROUP CO LTD et al.) 05 December 2007 (05.12.2007) the whole document	1-6

☒ Further documents are listed in the continuation of Box C. ☒ See patent family annex.

* Special categories of cited documents:

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"&"document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
07 May 2012 (07.05.2012)	**31 May 2012 (31.05.2012)**

Name and mailing address of the ISA
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Facsimile No. (86-10)62019451

Authorized officer
LI, Quanxiao
Telephone No. (86-10) **62085426**

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INTERNATIONAL SEARCH REPORT

International application No.
PCT/CN2012/070109

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	CN 101033689 A (YAN ZHENDONG) 12 September 2007 (12.09.2007) the whole document	1-6
A	CN 101824985 A (GONG QINGGANG) 08 September 2010 (08.09.2010) the whole document	1-6
A	CN 101864956 A (UNIV CHINA MINING) 20 October 2010 (20.10.2010) the whole document	1-6
A	CN 102011588 A (ZIBO WANGZHUANG COAL MINE) 13 April 2011 (13.04.2011) the whole document	1-6
A	RU 2008114693 A (ALEKSANDROV GRIGORIJ KONDRAT EVICH et al.) 20 October 2009 (20.10.2009) the whole document	1-6
A	RU 2209315 C2 (SANKT PETERBURGSKIJ G GORNYJ I et al.) 27 July 2003 (27.07.2003)	1-6

Form PCT/ISA /210 (continuation of second sheet) (July 2009)

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.
PCT/CN2012/070109

Patent Documents referred in the Report	Publication Date	Patent Family	Publication Date
CN 101140152 A	12.03.2008	None	
CN 101858225 A	13.10.2010	WO 2011153810 A	15.12.2011
CN 101082283 A	05.12.2007	None	
CN 101033689 A	12.09.2007	None	
CN 101824985 A	08.09.2010	None	
CN 101864956 A	20.10.2010	None	
CN 102011588 A	13.04.2011	CN 102155226 A	17.08.2011
RU 2008114693 A	20.10.2009	None	
RU 2209315 C2	27.07.2003	None	

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REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- CN 01858225 B **[0013]**
- CN ZL200610113007X **[0019]**