



(12) **EUROPEAN PATENT APPLICATION**
published in accordance with Art. 153(4) EPC

(43) Date of publication:
02.04.2014 Bulletin 2014/14

(51) Int Cl.:
E21F 15/06 ^(2006.01) **E21C 41/16** ^(2006.01)
E21C 25/68 ^(2006.01)

(21) Application number: **12785061.8**

(86) International application number:
PCT/CN2012/000642

(22) Date of filing: **14.05.2012**

(87) International publication number:
WO 2012/155531 (22.11.2012 Gazette 2012/47)

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR

(72) Inventor: **YOU, Buqiang**
Xintai
Shandong 271219 (CN)

(30) Priority: **17.05.2011 CN 201110127510**

(74) Representative: **Hryszkiewicz, Danuta**
Kancelaria Patentowa
Matthias Scholl, Inc.
Skrytka Poczтовая 13
75-454 Koszalin (PL)

(71) Applicant: **Shandong Xinmei Machinery Equipment Co., Ltd**
Xintai, Shandong 271219 (CN)

(54) **TECHNOLOGY AND EQUIPMENT FOR SEPARATING COAL AND GANGUE AND REFILLING GANGUE.**

(57) Disclosed in the present invention are a method and an equipment for separating coal and gangue and refilling gangue. The method comprises the following steps: cutting an upper coal layer by a coal mining machine (5) and conveying the coal to a well by a scraper conveyor (1), a transfer conveyor (2) and a belt conveyor; cutting a middle gangue layer by the coal mining machine (5) and reversely running the scraper conveyor (1) to convey the gangue to a gangue back-conveying transfer conveyor (3), conveying the gangue by the gangue back-conveying transfer conveyor to a gangue throwing scraper conveyor (4) which is suspended on the rear part of a hydraulic bracket (6) and provided with an open middle slot plate and throwing the gangue into a gob; and cutting a lower coal layer by using the coal mining machine and conveying the coal to the well by using the scraper conveyor (1), the transfer conveyor (2) and the belt conveyor. The method can realize the separation of coal and the gangue, and the gangue is refilled into the gob, so that mixed mining and conveying for the coal and the gangue are avoided, the cost is saved and the environment is protected.

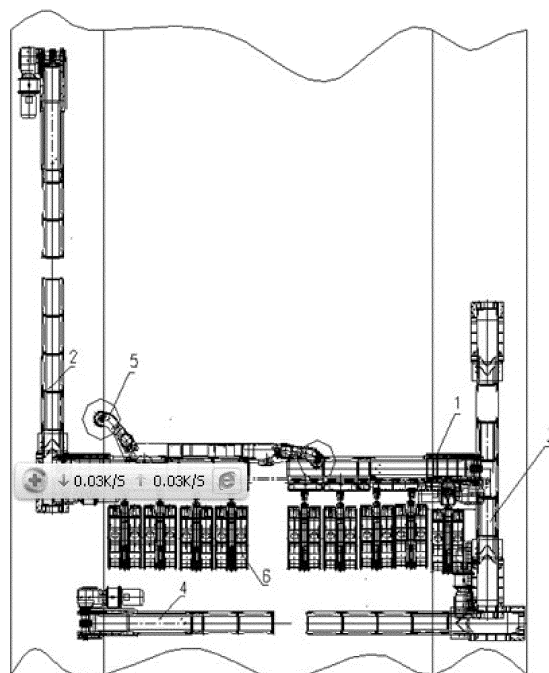


FIG. 1

Description

[0001] The invention relates to a method and device for separating coal from gangue and backfilling the gangue into a gob area.

[0002] As a main energy source, the coal plays a very important role in China's national economy. The coal industry has made a great contribution to the national economy in the past 60 years. The coal once accounted for 76% and 69% of the energy production and consumption structure, respectively, so that it well supported the national economy and the social development. The coal provides 78% of the energy for electric power generation. Besides, it is one of the main industrial chemicals in China, accounting for 70% of the total industrial chemicals. Finally, the coal is also an important material for agricultural production and urban living, and 60% of civil commodity energy and 94.3% of the lightening energy is provided by the coal. In the future 50-60 years, the consumption ratio of the coal will decrease with the development of the new energy, renewable energy, hydropower, and nuclear power. However, after the nuclear leakage resulting in the 9.0 earthquake in Fukushima, Japan, in 2011, the use of the nuclear power become more cautious. Thus, the coal is still the main energy source in China.

[0003] China has the largest coal yield in the world, and 25% of the coal layer is sandwiched between gangue layers. A conventional method for coal mining is mining the coal and the gangue together out of the well, as the coal is mixed with a large amount of the gangue, the quality of the coal is largely lowered. Meanwhile, the transporting of the gangue out of the well cost tremendous manpower and materials. Furthermore, after the gangue is mined and transported out of the well, the space of the gob area enlarges, thereby facilitating surface subsidence; and a large area is required to accumulate the gangue, meanwhile, sulfur in the gangue will be burnt after a long term of storage, thereby resulting serious pollution on the environment.

[0004] In view of the above-described problems, it is one objective of the invention to provide a device for separating coal from gangue and backfilling the gangue. The method and the device of the invention realize the separation between the coal and the gangue and the backfilling of the gangue into the gob area, thereby avoiding the process for transferring the coal and the gangue together out of the well, saving the production cost, and being environmentally friendly.

[0005] Technical scheme of the invention is as follows:

A method for separating coal from gangue and backfilling the gangue, the method comprises:

A. cutting an upper coal layer by a shearer and conveying the coal out of a well by a scraper conveyor, a coal-transfer conveyor, and a belt conveyor;

B. cutting a middle gangue layer by the shearer; conveying the gangue to a gangue-transfer conveyor laid on the other end of the scraper conveyor by operating the scraper conveyor backward; and conveying the gangue backward to a gangue-refilling scraper conveyor, in which, the gangue-refilling scraper conveyor comprises a central slot comprising a central plate comprising openings and is disposed on a rear part of a hydraulic support facing a gob area;

C. regulating a size of an opening of the central plate in sequence, and uniformly refilling the gangue to the gob area; and

D. cutting a lower coal layer by the shearer, and conveying the coal out of the well by the scraper conveyor, the coal-transfer conveyor, and the belt conveyor.

[0006] A device for separating coal from gangue and backfilling the gangue, the device comprises a shearer. A scraper conveyor is disposed beneath the shearer, and the scraper conveyor is forward and backward rotatable and fits the movement of the shearer. The scraper conveyor comprises: a forward conveying end fitting a coal-transfer conveyor, and a backward conveying end fitting a gangue-transfer conveying unit facing a gob area.

[0007] The gangue-transfer conveying unit comprises: a gangue-transfer conveyor, and a gangue-refilling scraper conveyor comprising a central slot comprising a central plate comprising openings. The gangue-refilling scraper conveyor fits with the gangue-transfer conveyor.

[0008] The gangue-refilling scraper conveyor is suspended on a rear part of a hydraulic support. A size of an opening of the central plate is adjustable. The gangue-refilling scraper conveyor is provided with a hydraulic jack. The coal-transfer conveyor is disposed in a transporting crossheading. The gangue-transfer conveyor is disposed in a return airway. The scraper conveyor is in parallel with the gangue-refilling scraper conveyor.

[0009] The following terms are defined for understanding the invention:

"Scraper conveyor" refers to a conveyor that matches with the shearer and is forward and backward rotatable for conveying the coal and the gangue, respectively.

[0010] "Coal-transfer conveyor" refers to a transfer machine that corresponds with a forward conveying end of the scraper conveyor and is used to transporting the coal upward.

[0011] "Gangue-transfer conveyor" refers to a transfer machine that corresponds with a backward conveying end of the scraper conveyor and is used to transfer the gangue to the gangue-refilling scraper conveyor.

[0012] "Gangue-refilling scraper conveyor" refers to a

transfer machine that matches with the gangue-transfer conveyor and is used to fill the gangue to the gob area.

[0013] Working principle and advantages of the invention are as follows:

When cutting the upper coal layer, the scraper conveyor disposed in the front of a working face rotates forward, a drum of the shearer rotates for cutting and loading the coal. The coal is transferred to the scraper conveyor. The coal is further discharged on the coal-transfer conveyor in the transporting crossheading, and is conveyed out of the well by the belt conveyor of a haulage roadway.

[0014] As the gangue-transfer conveyor is arranged at the other end of the scraper conveyor, that is, a backward conveying end of the scraper conveyor, for transporting materials to the gob area, the transporting direction of the scraper conveyor is reversed after the cut of the upper coal layer is completed, so that the scraper conveyor starts to backward rotate. The gangue cut by the shearer falls on the scraper conveyor, by which, the gangue is backward conveyed to the gangue-transfer conveyor. The gangue is then discharged by the gangue-transfer conveyor to the gangue-refilling scraper conveyor suspended on the rear part of the hydraulic support. Each section of the central slot of the rear part of the gangue-refilling scraper conveyor comprises the central plate comprising size-adjustable openings, and the gangue is backfilled to the gob area through the openings, thereby realizing the separation between the coal and the gangue, solving the problem of the gangue backfilling, and saving the production cost.

[0015] After the cut of the middle gangue layer is finished, the scraper conveyor disposed in the front of the working face starts to rotate forward, and the shearer continues to cut the lower coal layer. The shearer drum rotates for cutting, loading the coal to the scraper conveyor. The coal is further discharged on the coal-transfer conveyor in the transporting crossheading, and is conveyed out of the well by the belt conveyor of a haulage roadway. Thus, a cycle for the method is finished.

[0016] The scraper conveyor and the coal-transfer conveyor of the transporting system in the working face are reasonably arranged, occupy a small area. The structure of the whole device is compact and is convenient for maintenance and passage of the operating personals on the working face.

[0017] Thus, the device and the method of the invention solves the problem existing in mining coal layers sandwiched between gangue layers by separating the coal from the gangue and backfilling the gangue to the gob area rather than transporting the gangue out of the well, thereby saving the energy for transporting both the gangue and the coal out of the well, saving the area to be occupied by the gangue out of the well, and being environmentally friendly.

[0018] FIG. 1 is a structure diagram of a device for

separating coal from gangue and backfilling the gangue of the invention.

[0019] In the drawing, the following reference numbers are used: 1. Scraper conveyor disposed in the front of a working face; 2. Coal-transfer conveyor in a transporting crossheading; 3. Gangue-transfer conveyor; 4. Gangue-refilling scraper conveyor; 5. Shearer; and 6. Hydraulic support.

[0020] Technique of the invention is further described hereinbelow.

[0021] A device for separating coal from gangue and backfilling the gangue, as shown in FIG. 1, comprises a shearer 5. A scraper conveyor 1 disposed in the front of a working face that is capable of rotating forward and backward is disposed beneath the shearer 5. The scraper conveyor 1 disposed in the front of the working face fits the movement of the shearer 5 and bears the load of cut materials from the shearer 5.

[0022] A forward conveying end of the scraper conveyor 1 disposed in the front of the working face fits a coal-transfer conveyor 2 in a transporting crossheading, and the coal-transfer conveyor 2 in the crossheading is disposed in the transporting crossheading and matches with a telescopic belt conveyor.

[0023] A backward conveying end of the scraper conveyor 1 disposed in the front of the working face fits a gangue-transfer conveyor 3. The gangue-transfer conveyor 3 is arranged in a return airway and one end thereof for conveying materials faces a gob area and is suspended on a rear part of a hydraulic support 6.

[0024] The gangue-transfer conveyor 3 matches with a gangue-refilling scraper conveyor 4. The gangue-refilling scraper conveyor 4 is suspended on the rear part of the hydraulic support 6. The gangue-refilling scraper conveyor 4 comprises a central slot comprising a central plate comprising openings, and an opening of the central plate is adjustable. The gangue-refilling scraper conveyor 4 employs the opening of the central plate of the central slot to backfill the gangue to the gob area, and the gangue is uniformed backfilled to the gob area by controlling the opening of the central plate in sequence by a hydraulic jack.

[0025] To ensure a compact structure, the gangue-transfer conveyor 3 employs a short structure, and the scraper conveyor 1 disposed in the front of the working face is in parallel with the gangue-refilling scraper conveyor 4.

[0026] In use:

The upper coal layer is cut by the shearer 5 and the coal is conveyed out of a well by the scraper conveyor 1 disposed in the front of the working face, the coal-transfer conveyor 2 in the cross heading, and the belt conveyor.

[0027] The middle gangue layer is cut by the shearer 5 and the gangue is conveyed to the gangue-transfer conveyor 3 by operating the scraper conveyor backward.

The gangue is conveyed to a gangue-refilling scraper conveyor 4 that faces the gab area by the gangue-transfer conveyor 3.

[0028] The size of the opening of the central plate of the gangue-refilling scraper conveyor 4 is regulated in sequence for uniformly refilling the gangue to the gob area.

[0029] The lower coal layer is cut by the shearer 5, and the coal is conveyed out of the well by the scraper conveyor 1 disposed in the front of the working face, the coal-transfer conveyor, and the belt conveyor.

Claims

1. A method for separating coal from gangue and back-filling the gangue, the method comprising:

- a) cutting an upper coal layer by a shearer and conveying the coal out of a well by a scraper conveyor, a coal-transfer conveyor, and a belt conveyor;
- b) cutting a middle gangue layer by the shearer; conveying the gangue to a gangue-transfer conveyor laid on the other end of the scraper conveyor by operating the scraper conveyor backward; and conveying the gangue backward to a gangue-refilling scraper conveyor, wherein, the gangue-refilling scraper conveyor comprises a central slot comprising a central plate comprising openings and is disposed on a rear part of a hydraulic support facing a gob area;
- c) regulating a size of the openings of the central plate in sequence, and uniformly refilling the gangue to the gob area; and
- d) cutting a lower coal layer by the shearer, and conveying the coal out of the well by the scraper conveyor, the coal-transfer conveyor, and the belt conveyor.

2. A device for separating coal from gangue and back-filling the gangue, the device comprising a shearer, **characterized in that**

a scraper conveyor is disposed beneath the shearer, and the scraper conveyor is forward and backward rotatable and fits the movement of the shearer; and the scraper conveyor comprises: a forward conveying end fitting a coal-transfer conveyor, and a backward conveying end fitting a gangue-transfer conveying unit facing a gob area.

3. The device of claim 2, **characterized in that** the gangue-transfer conveying unit comprises: a gangue-transfer conveyor, and a gangue-refilling scraper conveyor comprising a central slot comprising a central plate comprising openings; and the gangue-refilling scraper conveyor fits with the gangue-transfer conveyor.

4. The device of claim 3, **characterized in that** the gangue-refilling scraper conveyor is suspended on a rear part of a hydraulic support.

5. The device of claim 3 or 4, **characterized in that** a size of the openings of the central plate is adjustable.

6. The device of claim 5, **characterized in that** the gangue-refilling scraper conveyor is provided with a hydraulic jack.

7. The device of claim 2, **characterized in that** the coal-transfer conveyor is disposed in a transporting crossheading.

8. The device of claim 2, **characterized in that** the gangue-transfer conveyor is disposed in a return airway.

9. The device of claim 2, **characterized in that** the scraper conveyor is in parallel with the gangue-refilling scraper conveyor.

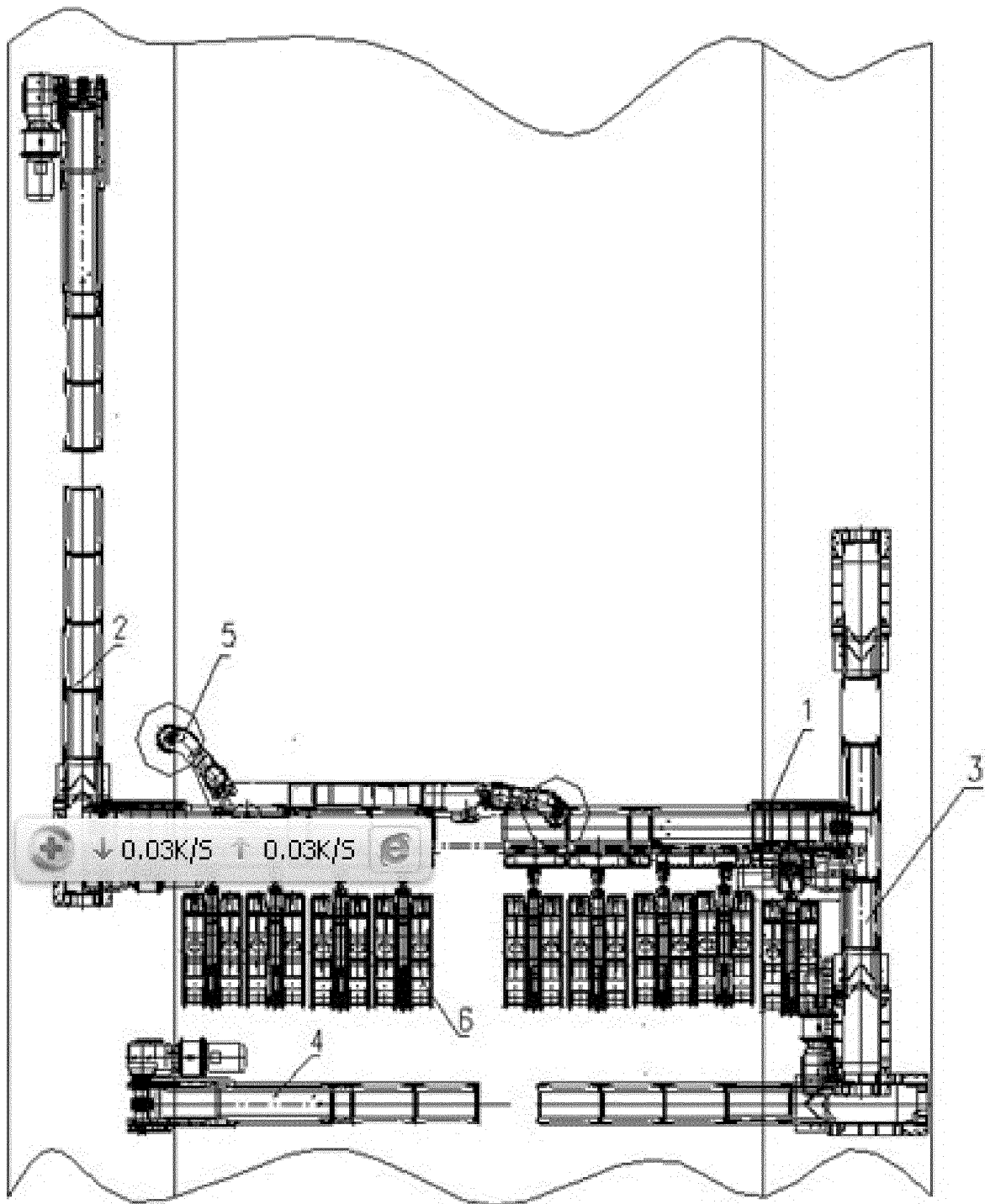


FIG. 1

INTERNATIONAL SEARCH REPORT

International application No.

PCT/CN2012/000642

A. CLASSIFICATION OF SUBJECT MATTER

See the extra sheet

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: E21F E21C

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)

EPODOC, WPI, CNPAT, CNKI: mine, coal, cutter, rock, fill, reverse, layering, backfill, convey, coal cutter, gangue

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	CN 2804388 Y (TONG, Qiang), 09 August 2006 (09.08.2006), see description, the section of contents of the invention, and figures 1-9 and corresponding description thereof	1-9
Y	CN 100567703 C (YANCON GROUP CO., LTD.), 09 December 2009 (09.12.2009), see description, embodiment 1, and figure 1	1-9
Y	CN 101871363 A (SUNCUN COAL MINE, XINWEN MINING GROUP CO., LTD.), 27 October 2010 (27.10.2010), see description, paragraph 5, and figure 1	1-9
A	CN 101660426 A (SHENYANG DESIGN AND RESEARCH INSTITUTE OF CHINA COAL TECHNOLOGY & ENGINEERING GROUP), 03 March 2010 (03.03.2010), see the whole document	1-9
A	EP 0184720 A1 (SASKATCHEWAN POTASH), 18 June 1986 (18.06.1986), see the whole document	1-9

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

* Special categories of cited documents:	"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"A" document defining the general state of the art which is not considered to be of particular relevance	"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"E" earlier application or patent but published on or after the international filing date	"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	"&" document member of the same patent family
"O" document referring to an oral disclosure, use, exhibition or other means	
"P" document published prior to the international filing date but later than the priority date claimed	

Date of the actual completion of the international search 09 August 2012 (09.08.2012)	Date of mailing of the international search report 23 August 2012 (23.08.2012)
Name and mailing address of the ISA/CN: State Intellectual Property Office of the P. R. China No. 6, Xitucheng Road, Jimenqiao Haidian District, Beijing 100088, China Facsimile No.: (86-10) 62019451	Authorized officer LIU, Jianping Telephone No.: (86-10) 62085344

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INTERNATIONAL SEARCH REPORT

International application No.

PCT/CN2012/000642

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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Form PCT/ISA/210 (continuation of second sheet) (July 2009)

INTERNATIONAL SEARCH REPORT
 Information on patent family members

International application No.

PCT/CN2012/000642

Patent Documents referred in the Report	Publication Date	Patent Family	Publication Date
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CN 100567703 C	09.12.2009	ZA 200506698 A	31.05.2006
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INTERNATIONAL SEARCH REPORT

International application No.

PCT/CN2012/000642

A. CLASSIFICATION OF SUBJECT MATTER

E21F 15/06 (2006.01) i

E21C 41/16 (2006.01) i

E21C 25/68 (2006.01) i