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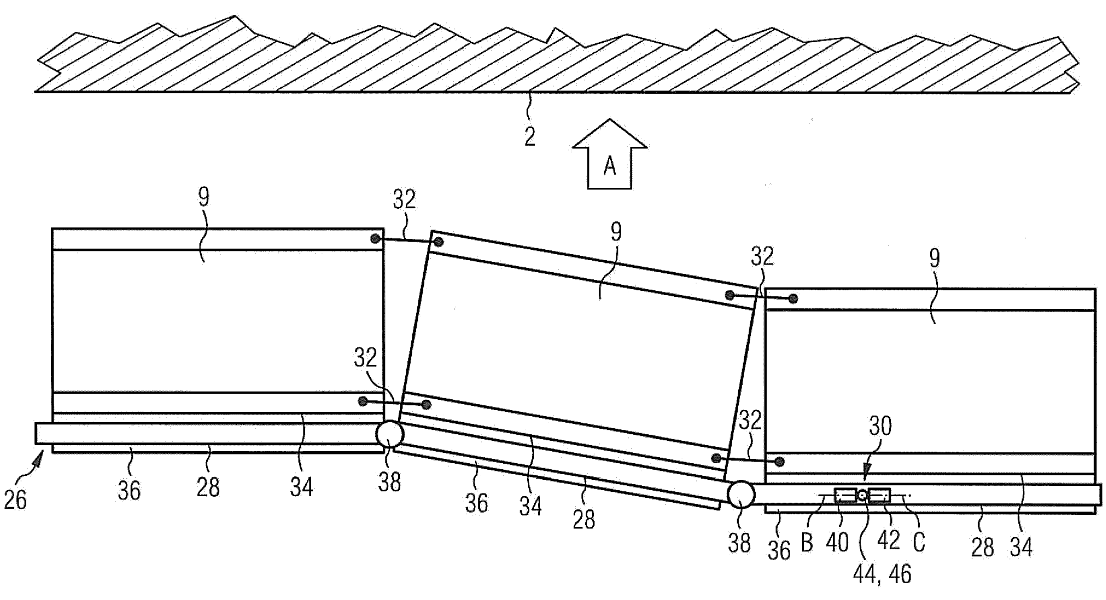
(54) Device and method for longwall mining installation course determination

(57) The present disclosure relates to a device and a method for measuring the course of a longwall mining installation (1) extending along a longwall face (2). A movable course measuring device (30) comprises a first segment (40) extending along a first axis (B), a second segment (42) extending along a second axis (C). The second segment (42) may be movably connected to the first segment (40). The course measuring device (30) may further comprise a course measuring unit (46) for measuring a spacial relationship between the first axis (B) and the second axis (C). Based on measurements of the movable course measuring device (30), it may be possible to determine a polygonal course of the longwall mining installation along the longwall face (2).

FIG 2



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Description

Technical Field

[0001] The present disclosure relates to longwall mining installations in underground mines, and, more particularly, to a device and method for measuring the course of a longwall mining installation extending along a longwall face.

Background

[0002] In longwall mining, a longwall mining installation extends along a longwall face to extract material therefrom, and subsequently advances in a working direction perpendicular to the longwall face. During each advancing step, the components of the longwall mining installation such as a face conveyor and shield supports move towards the longwall face.

[0003] For monitoring and/or controlling purposes, it is generally desireable to know the exact position and orientation of longwall mining components along the longwall face. Accordingly, mining equipment manufacturers developed several position and/or orientation measuring systems for the longwall mining installation in the past.

[0004] For example, EP 2 446 207 A2 of Caterpillar Global Mining discloses a method and apparatus for determining the position and/or situation of installation components of a longwall mining installation. A measuring system may include a detection unit with measurement sensor. The detection unit may be movable to and fro between two points of a guiding system along at least one installation component at the longwall face. The movement of the detection unit as disclosed in EP 2 446 207 A2 is decoupled from an extraction machine.

[0005] The present disclosure is directed, at least in part, to improving or overcoming one or more aspects of prior systems.

Summary of the Disclosure

[0006] In one aspect of the present disclosure, a course measuring device for measuring a course of a longwall mining installation along a longwall face is disclosed. The course measuring device may comprise a first segment extending along a first axis, and a second segment extending along a second axis. The second segment may be movably connected to the first segment. The course measuring device may further comprise a course measuring unit for measuring a spacial relationship between the first axis and the second axis. The course measuring device may be adapted to move along the longwall mining installation.

[0007] In another aspect of the present disclosure, a polygonal course measuring system for measuring a polygonal course of a longwall mining installation along a longwall face is disclosed. The polygonal course measuring system may comprise a guiding assembly for arranging along the longwall mining installation. The guiding assembly may include a series of guiding elements movably connected to one another for building a polygonal course. The polygonal course measuring system may further comprise a course measuring device as exemplary disclosed herein. The course measuring device may be adapted to move along the guiding assembly.

[0008] In yet another aspect of the present disclosure, a method for determining a polygonal course of a longwall mining installation along a longwall face by using a polygonal course measuring system as exemplary disclosed herein is disclosed. The method may comprise moving the course measuring device along the guiding assembly arranged along the longwall mining installation. The method may further comprise, during moving the course measuring device, measuring a plurality of spacial relationships between neighboring guiding elements of the guiding assembly, and determining a polygonal course of the guiding assembly, and, thus, of the longwall mining installation based on the plurality of measured spacial relationships.

[0009] Other features and aspects of this disclosure will be apparent from the following description and the accompanying drawings.

Brief Description of the Drawings

[0010] The accompanying drawings, which are incorporated herein and constitute a part of the specification, illustrate exemplary embodiments of the disclosure and, together with the description, serve to explain the principles of the disclosure. In the drawings:

Fig. 1 is a schematic drawing of an exemplary longwall mining installation;

Fig. 2 is a schematic drawing of a section of a face conveyor having a course measuring system extending along the same;

Fig. 3 is a schematic drawing of a course measuring device operable along a guiding assembly of the course measuring system;

Fig. 4 is a schematic drawing of a course measuring unit; and

Fig. 5 is a schematic drawing of a further course measuring unit.

Detailed Description

[0011] The following is a detailed description of exemplary embodiments of the present disclosure. The exemplary embodiments described therein and illustrated in the drawings are intended to teach the principles of the present disclosure, enabling those of ordinary skill in the art to implement and use the present disclosure in many different environments and for many different applications. Therefore, the exemplary embodiments are not intended to be, and should not be considered as, a limiting description of the scope of patent protection. Rather, the scope of patent protection shall be defined by the appended claims.

[0012] The present disclosure is based at least in part on the realization that a movable course measuring device guided along a guiding assembly extending along a longwall mining installation may be used to determine a polygonal course of the longwall mining installation along a longwall face. The movable course measuring device as well as the guiding assembly for guiding the course measuring device may be designed to allow measuring individual spacial relationships between components of the longwall mining installation.

[0013] As used herein, the term "course" relates to a plurality of spacial positions and spacial orientations (also referred to as poses) representing a spacial route (path) along which the longwall mining installation, and/or components thereof extend along the longwall face.

[0014] In the following, a longwall mining installation utilizing a movable course measuring device is described in connection with Fig. 1. Thereafter, a guiding assembly for the course measuring device and the course measuring device itself are explained with reference to Figs. 2 to 5.

[0015] Referring to Fig. 1, a longwall mining installation is referred to in its entirety by reference numeral 1. Longwall mining installation 1 extends along a longwall face 2, and comprises a plurality of installation components such as an extraction machine 4, shield supports 6, and a face conveyor 8.

[0016] In operation, extraction machine 4 cuts along longwall face 2 in a reciprocating manner to extract material 10, for example, coal. As an example, extraction machine 4 may be a shearer, a mining plow or a hard rock cutter.

[0017] To maintain longwall face 2 accessible, shield supports 6 are arranged in series along longwall face 2. Surrounding rock can only break in and form the so-called old workings after advancing of shield supports 6.

[0018] Moving devices 12 are connected between shield supports 6 and face conveyor 8. Said moving devices 12 may comprise a pushing or walking bar, which is hydraulically loadable in two directions. In case moving device 12 is loaded in one of the two possible directions, a respective face conveyor segment 9 of face conveyor 8 is pushed forward in a work direction (indicated by an arrow A in Fig. 1). If loaded in the other one of the two possible directions, moving device 12 pulls up individual shield supports 6 in work direction (arrow A).

[0019] Material mined by extraction machine 4 drops onto face conveyor 8, which transports the extracted pieces of rock and minerals to a main roadway 14 (also referred to as drift). There, the extracted pieces are passed to a pass-over conveyor or roadway conveyor 16. The transported pieces may be crushed and further transported via, for example, a belt conveyor.

[0020] Particularly, face conveyor 8 extends along longwall face 2 and builds up of a plurality of face conveyor segments 9. To drive face conveyor 8, a main drive 18 is arranged in main roadway 14, and an auxiliary drive 20 may be arranged in an auxiliary roadway 22. To facilitate a material transport by means of traveling conveyor chains 17 of chain conveyor 8, a plurality of flight bars (scrapers) 24 are fastened at conveyor chains 17 at preset distances.

[0021] Along longwall mining installation 1, a polygonal course (traverse) measuring system 25 is provided. Polygonal course measuring system 25 includes a guiding assembly 26, a course measuring device 30, and a remote control unit 31.

[0022] Guiding assembly 26 comprises a series of guiding elements 28, which are generally coupled to face conveyor segments 9, Specifically, the series of guiding elements 28 is mounted to individual face conveyor segments 9 to project a course of face conveyor 8, and to follow advancing of the same in working direction (arrow A).

[0023] Guiding assembly 26 is arranged such that a course of guiding assembly 26 is representative of a course of face conveyor 8 along longwall face 2. Moreover, guiding assembly 26 may be arranged such that course changes of sections of face conveyor 8 also cause respective changes of the course of guiding assembly 26.

[0024] Course measuring device 30 is adapted to move along guiding assembly 26, and, thus, along face conveyor 8. As is described in greater detail later on, based on measurement of course measuring device 30, a course of guiding assembly 26, and, thus, of face conveyor 8 along longwall face 2 is determinable.

[0025] Measurements of course measuring device 30 are transmitted, for example, via a wireless communication link, from course measuring device 30 to remote control unit 31, which is is equipped with a receiver. In embodiments with bi-directional communication as explained later on in more detail, remote control unit 31 may further include a transmitter.

[0026] Remote control unit 31 may be positioned at any suitable location of the longwall mining installation 1. For example, remote control unit 31 may be arranged next to one of drives 18 and 20 in roadway 14 and 22, respectively. For controlling longwall mining installation 1, remote control unit 31 may be integrated with and/or coupled to a central control unit (not shown in Fig. 1), which may be configured to control the components of longwall mining installation 1 at least in part.

[0027] Referring to Fig. 2, three face conveyor segments 9 of face conveyor 8, a section of guiding assembly 26, and a course measuring device 30 are schematically depicted. Here, a relative displacement between neighboring face conveyor segments 9, and, thus, of guiding elements 28 of guiding assembly 26 is shown overemphasized for the purpose of clarity.

[0028] Face conveyor segments 9 are connected in series via hinge connections 32 so as to resist separation when a tensile force is applied, and to restrict relative angular movement such that relative angular displacement is facilitated to a certain extend only.

[0029] At a goaf side of conveyor segment 9, a spill plate segment 34, which generally serves to lower the amount of material dropping from face conveyor 8 to the goaf side during material transport, may be provided.

[0030] A supply line duct 36, which may be also formed of a plurality of individual segments, may be part of spill plate segments 34. Inside of supply line duct 36, hydraulic, pneumatic, and/or electric supply lines as well as guiding elements 28 are disposed. Alternatively, guiding elements 28 may be disposed and/or connected to a respective face conveyor segment 9 in a manner which allows following the respective face conveyor segment 9 during advancing in working direction (arrow A) such as below or within face conveyor segments 9.

[0031] The section of guiding assembly 26 shown in Fig. 2 comprises three guiding elements 28 connected in series via guiding element hinges 38.

[0032] Individual guiding elements 28 are designed to guide movable course measuring device 30. For example, guiding elements 28 may be formed as rail segments or tube segments. In the case of tube segments, guiding elements 28 may be designed as so-called piggable tubes. Said piggable tubes allow a so-called pig (stands for pipe inspection gauge), which in this case may be formed by course measuring device 30, to be guided therein. For example, a piggable tube may include smoothened inner faces to lower friction between piggable tube and pig.

[0033] Guiding element hinges 38 allow relative movement between neighboring guiding elements 28. Said relative displacement between neighboring guiding elements 28 may be a result of a relative displacement between neighboring face conveyor segments 9. Furthermore, guiding element hinges 38 allow guiding course measuring device 30 around corners between relatively displaced guiding elements 28.

[0034] In some embodiments, guiding element hinges 38 may be capable to at least partially compensate length changes resulting from a relative displacement between two neighboring guiding elements 28. Additionally or alternatively, guiding elements 28 may be adapted to compensate those length changes, for example, by providing elastic sections and/or by providing the guiding elements 28 of a elastic material.

[0035] For example, guiding element hinges 38 may be formed as elastic bellows, or as double cardan joint, which may include an (inner) elastomer ring for providing a smooth transition between the guiding elements 28.

[0036] In some embodiments, guiding element hinges 38 may be formed as piggable hinges for guiding course measuring device 30 therein.

[0037] Course measuring device 30 is adapted to move along guiding assembly 26. In some embodiments, course measuring device 30 comprises first segment 40 and second segment 42, and is adapted to measure a spacial relationship between a first segment 40 and a second segment 42 of course measuring device 30. As exemplarily illustrated in Fig. 2, first segment 40 extends along a first axis B, and second segment 42 extends along a second axis C. First segment 40 is movably connected to second segment 42 via a segment hinge 44 schematically indicated by circle segments. Course measuring device 30 further comprises a course measuring unit 46 that is configured to measure a spacial relationship between first axis B and second axis C, for example, a relationship between the individual orientations and directions of axes B and C.

[0038] Course measuring device 30 may be propelled along guiding assembly 26 in any one of various manners. For example, course measuring device 30 may include a separate driving device. Additionally or alternatively, course measuring device 30 may be pushed and/or pulled in a hydraulic, pneumatic, and/or mechanical manner along guiding assembly 26.

[0039] In some embodiments, hinge 44 may be formed as ball joint, or cardan joint.

[0040] In Fig. 3, an exemplary configuration of course measuring device 30 is schematically shown. As already outlined, course measuring device 30 comprises first segment 40, second segment 42, and segment hinge 44. Furthermore, course measuring device 30 is equipped with course measuring unit 46 indicated in Fig. 3 to be between the circle segments indicating segment hinge 44, a data storage 48, a microprocessor 50, a transmitter 52, and an electric power supply 54.

[0041] Course measuring unit 46 is configured to measure a spacial relationship between first axis B and second axis C, and, thus, between, first segment 40 and second segment 42.

[0042] In some embodiments, course measuring unit 46 may be configured to measure an orientation of at least one of first segment 40, second segment 42, hinge 44, course measuring device 30, and/or articulation angle α with respect to a reference co-ordinate system, for example, a body-fixed coordinate system of longwall mining installation 1 (see Fig. 1), or an earth-fixed co-ordinate system.

[0043] To measure the spacial relationship between first axis B and second axis C, course measuring unit 46 may include any senor or sensor system, which facilitates such measurements. Examples of such sensor systems are described in connection with Figs. 4 and 5.

[0044] In some embodiments, course measuring unit 46 may further measure at least one of a roll angle φ of first segment 40 about first axis B, a pitch angle θ (not shown in Fig. 3) of first segment 40 about a pitch axis, which is perpendicular to first axis B, a travel distance, and/or a plumb line direction. For measuring a plumb line direction, course measuring unit 46 may include a two or three axes tilt angle sensor, and/or a two or three axes acceleration sensor.

[0045] Measured data from course measuring unit 46 is at least temporarily stored in data storage 48. To transmit data between course measuring unit 46 and data storage 48, a wireless or wired connection 56 is provided between the same. For the purpose of storing data, data storage 48 may include any type of temporally, and/or permanent memory known in the art.

[0046] Microprocessor 50 is configured and linked to process any kind of data and to perform any kind of command and operation, which are required for operating individual components of course measuring device 30.

[0047] Transmitter 52 is capable of transmitting stored data from data storage 48 to, for example, remote control unit 31 shown in Fig. 1. A wireless or wired connection 58 connects data storage 48 and transmitter 52 to transmit data between both. Alternatively or additionally, transmitter 52 may be able to directly transmit measured data from course measuring unit 46 to remote control unit 31 without using an intermediate storage such as data storage 48.

[0048] In some embodiments, transmitter 52 may be integrated with a receiver (not shown in further detail in Fig. 3) to form a so-called transceiver for facilitating bidirectional communication between the transceiver and remote control unit 31. For example, signals sent from remote control unit 31 may indicate that course measurements are required, electric power supply 54 shall switch-off, or data sent by transmitter 52 was not accurately received by control unit 31.

[0049] Electric power supply 54 is provided to energize at least one of course measuring unit 46, data storage 48, microprocessor 50, and transmitter 52. Electric power supply 54 may be replaceably provided in course measuring device 30. Alternatively or additionally, electric power supply 54 may be rechargeable, for example, via wireless power transmission. As an example, electric power supply 54 may be a (non-)rechargeable battery.

[0050] In some embodiments, electric power supply 54 may include a generator for converting kinetic energy to electric power. Said generator may be driven by the movement of course measuring device 30 along guiding assembly 26, for example, by a so-called omni wheel drivingly connected to the generator. In this case, course measuring device 30 may be externally propelled.

[0051] In some embodiments, course measuring device 30 may include one or more further segments, wherein neighboring segments may be movably connected to one another. Additional segments may accommodate any of the above mentioned components such as generator, drive, and/or electric power supply 54.

[0052] In Fig. 4, a first example of course measuring unit 46' is depicted. Here, course measuring unit 46' comprises an optical position sensor 60, and a light source 62 such as a laser device.

[0053] Optical position sensor 60 and laser device 62 are arranged at opposing sides of hinge 44 such that a spacial relationship, particularly an articulation angle as explained in connection with Fig. 3, between first segment 40 and second segment 42 is determinable.

[0054] In case hinge 44 is not angled, a light beam 64, for example, a laser beam generated by laser device 62 hits optical position sensor 60 in the form of a light dot 66 in a central section of optical position sensor 60. Light dot 66 on optical position sensor 60 moves in dependence of the articulation angle of hinge 44.

[0055] Optical position sensor 60 is configured to detect the position of light dot 66 on its surface such that an articulation angle between first segment 40 and second segment 42 is determinable.

[0056] Optical position sensor 60 may be formed as a one-dimensional optical position sensor, which allows position determination of a light dot along one axis only, or as a two-dimensional optical position sensor, which allows position determination of a light dot along two axis. In case optical position sensor 60 is formed as one-dimensional optical position sensor, a further one-dimensional optical position sensor may be arranged orthogonal to the former such that the articulation angle is determinable in two dimensions.

[0057] In Fig. 5, a further example of course measuring unit 46" is depicted.

[0058] Here, course measuring unit 46" is formed as a so-called magnetic linear encoder comprising a first measuring unit 68 and a second measuring unit 70. First measuring unit 68 and second measuring unit 70 are generally configured to be moved with respect to each other if first segment 40 and second segment 42 are inclined to one another.

[0059] First measuring unit 68 is provided with a linear encoder 72, and second measuring unit 70 is provided with a magnetic tape 74. Linear encoder 72 and magnetic tape 74 are arranged in respective measuring unit 68, 70 to oppose one another. Rigid connections 76 such as bolts are connected to measuring units 68, 70 and hinge 44 and/or second segment 42 such that articulation of hinge 44 causes a displacement of at least one movable measuring unit 68, 70. Said displacement is detected by a displacement between linear encoder 72 and magnetic tape 74.

[0060] In the embodiment of Fig. 5, first measuring unit 68 and second measuring unit 70 are movably arranged side-by-side within first segment 40. Alternatively, only one of first measuring unit 68 and second measuring unit 70 may be movably arranged.

[0061] The embodiment of Fig. 5 allows determining an articulation angle between first segment 40 and second segment 42 along one axis only. Accordingly, a further magnetic linear encoder may be arranged to measure an articulation angle along another axis.

[0062] Naturally, any other type of linear encoder may be used instead of magnetic linear encoder as explained.

[0063] It is noted that course measuring unit 46 may feature any other measuring principle allowing determination of a spacial relationship between a first axis of a first segment and a second axis of a second segment.

[0064] As a further example, determination of an articulation angle may be performed by utilizing a so-called linear variable differential transformer. In said linear variable differential transformer, a magnetic core is moved by a push rod, which is connected to pass over a displacement of a hinge between the two segments. The magnetic core moves along an arrangement of one primary windings and two secondary windings. Depending on the axial displacement of the magnetic core, a voltage amount induced in the secondary windings changes. Based on the differential voltage between the two secondary windings, a position of the magnetic core is determinable. Therefrom, an articulation angle may be derived.

Industrial Applicability

[0065] The course measuring device as generally disclosed herein is applicable in mining installations. Particularly, the course measuring device is applicable in longwall mining installations extending along a longwall face for the purpose of extracting material therefrom.

[0066] In the following, operation of the course measuring device 30 is described with reference to Figs. 1 to 3.

[0067] During operation of longwall mining installation 1, course measuring device 30 moves to and fro along longwall mining installation 1 via guiding assembly 26. Thereby, course measuring device passes the series of guiding elements 28. When transitioning between neighboring guiding elements 28, course measuring unit 46 measures an articulation angle α between respective neighboring guiding elements 28.

[0068] Specifically and in case first segment is the leading segment of course measuring device 30 in the respective moving direction, first segment 40 reaches a respective guiding element hinge 38 before second segment 42, and, thus, is redirected along element hinge 38 before second segment 42. Said second segment 42 subsequently reaches that respective guiding element hinge 38, and is redirected after first segment 40 already finished its redirection. As a result, articulation angle α continuously increases until a maximum value, which is reached in a state in which first and second segment 40, 42 are positioned in differing guiding elements 28. Afterwards, articulation angle α decreases to zero again, which is reached if both segments 40 and 42 are aligned again when both segments 40, 42 move in the same guiding element 28. The maximum value of articulation angle α represents the respective articulation angle between respective neighboring guiding elements 28.

[0069] Transmittal of measured data from course measuring device 30 to remote control unit 31 may be performed in a continuous manner, in which as soon as new measurements are taken, the same are transmitted to remote control unit 31. Alternatively or additionally, measured data may be provided in packages at preset timings, and/or upon request from remote control unit 31, or when passing by remote control unit 31.

[0070] A length of individual guiding elements 28 may be either known, or may be measured, for example, by course measuring device 30 during travel along the same.

[0071] Based on a series of measured articulation angles α for each couple of neighboring guiding elements and the individual lengths of guiding elements 28, a-so called polygonal course image/estmation (also referred to as traverse in literature) is build up by remote control unit 31.

[0072] The determined polygonal course not only represents the course of guiding assembly 26, but also of longwall mining installation 1 along longwall face 2. The determined polygonal course may be further utilized in many conceivable ways.

[0073] In some embodiments, the determined course of longwall mining installation 1 may be visualized via a display to an operator, and/or may be used to control longwall mining installation 1. For example, advancing of longwall mining installation 1 may be controlled based on the determined course. In particular, the actual course of longwall mining installation 1 along longwall face 2 may be adjusted based on the determined course to form a straight line along longwall face 2. Additionally or alternatively, extraction machine 4 may be controlled based on the determined course of longwall installation 1.

[0074] It is noted that guiding assembly 26 may be not necessarily connected to face conveyor 8, but to other components of longwall mining installation 1 extending along longwall face 2 such that a course of guiding assembly 26 follows a course of longwall mining installation 1 while projecting the course of the same. For example, guiding assembly 26 may be connected to shield supports 6, and/or to moving devices 12.

[0075] It should be appreciated that the course measuring system for measuring a course of a longwall mining installation along a longwall face as generally disclosed herein, may be also suitable for measuring a course of mining components along the roadway. For example, the course measuring system may be coupled to a roadway conveyor (for example roadway conveyor 16 shown in Fig. 1).

[0076] It is further noted that, in some embodiments, data acquisition and/or data processing based on measurements from measuring unit 62 may be conducted in accordance with the method disclosed in EP 2 446 207 A2, which is hereby entirely incorporated herein by reference as being an actual part of the present disclosure.

[0077] Although the preferred embodiments of this invention have been described herein, improvements and modifications may be incorporated without departing from the scope of the following claims.

Claims

1. A course measuring device (30) for measuring a course of a longwall mining installation (1) along a longwall face (2), the course measuring device (30) comprising:

   a first segment (40) extending along a first axis (B);
   a second segment (42) extending along a sec-

ond axis (C), the second segment (42) being movably connected to the first segment (40); and

a course measuring unit (46) for measuring a spacial relationship between the first axis (B) and the second axis (C);

wherein the course measuring device (30) is adapted to move along the longwall mining installation (1).

2. The course measuring device (30) of claim 1, wherein the course measuring unit (46) is configured to measure

an articulation angle (α) between the first axis (B) and the second axis (C);

a roll angle (φ) of the first segment (40) about the first axis (B);

a pitch angle (θ) of the first segment (40) about an axis perpendicular to the first axis (B); and/or

a travel distance.

3. The course measuring device (30) of claim 1 or 2, further comprising a segment hinge (44) movably connecting the first segment (40) to the second segment (42).

4. The course measuring device (30) of any one of the preceding claims, wherein the course measuring unit (46) comprises at least one of:

a magnetic linear encoder (67);

an optical position sensor (60) and a light source (62), the optical position sensor (60) being configured to determine a position of a light spot on the sensor surface, the light spot being generated by the light source (62);

a linear variable differential transformer;

a tilt angle sensor for measuring a plumb line direction; and/or

an acceleration sensor for measuring a plump line direction.

5. The course measuring device (30) of any one of the preceding claims, further comprising a drive for moving the course measuring device (30).

6. The course measuring device (30) of any one of the preceding claims, further comprising at least one of:

a transmitter (52) for transmitting data from the course measuring unit (46) to a remote control unit (31);

a data storage (48) for storing data;

a microprocessor (50);

an electric power supply (54) for supplying electric power, the electric power supply (54) being replaceable and/or rechargeable; and/or

a generator for converting kinetic energy into electric power.

7. A polygonal course measuring system (25) for measuring a polygonal course of a longwall mining installation (1) along a longwall face (2), the polygonal course measuring system (25) comprising:

a guiding assembly (26) for arranging along the longwall mining installation (1), the guiding assembly (26) including a series of guiding elements (28) movably connected to one another for building a polygonal course; and

a course measuring device (30) according to any one of the preceding claims, the course measuring device (30) being adapted to move along the guiding assembly (26).

8. The polygonal course measuring system (25) of claim 7, wherein the guiding assembly (26) is adapted for connecting to the longwall mining installation (1) to determine a course of the longwall mining installation (1) along the longwall face (2), and to follow advancing of the longwall mining installation (1) towards the longwall face (2).

9. The polygonal course measuring system (25) of claim 7 or 8, further comprising a plurality of guiding hinges (38) connecting two neighboring guiding elements (28) to one another.

10. The polygonal course measuring system (25) of claim 9, wherein at least one guiding hinge (38) is formed as

elastic bellows, and/or

a double cardan joint.

11. The polygonal course measuring system (25) of any one of claims 7 to 10, wherein the guiding elemnts (28) are formed as piggable tubes, and/or a plurality of guiding hinges (38) connecting the guiding elements (28) are formed as piggable hinges.

12. The polygonal course measuring system (25) of any one of claims 7 to 11, further comprising a drive for pushing and/or pulling the course measuring device (30) along the guiding assembly (26) in a hydraulic, pneumatic, and/or mechanical manner.

13. The polygonal course measuring system (25) of any one of claims 7 to 12, further comprising a remote control unit (31) connected to the course measuring device (30) for transmitting data.

14. A longwall mining installation (1) for underground mining, the longwall mining installation (1) comprising at least one of:

a plurality of shield supports (6);

a face conveyor (8) for transporting away extracted material;
a plurality of moving devices (12) for advancing the longwall mining installation (1) in a working direction (A) towards a longwall face (2); and
a polygonal course measuring system (25) of any one of claims 7 to 13, the guiding assembly (26) being connected to at least one of the shield supports (6), the face conveyor (8), and/or the moving devices (12) to follow the longwall mining installation (1) in the working direction (A), and to determine the course of the longwall mining installation (1) along the longwall face (2).

15. A method for determining a polygonal course of a longwall mining installation (1) along a longwall face (2) by using a polygonal course measuring system (25) of any of claims 7 to 13, the method comprising:

moving the course measuring device (30) along the guiding assembly (26) arranged along the longwall mining installation (1);
during moving the course measuring device (30), measuring a plurality of spacial relationships between neighboring guiding elements (28) of the guiding assembly (26); and
determining a polygonal course of the guiding assembly (26), and, thus, of the longwall mining installation (1) based on the plurality of measured spacial relationships.

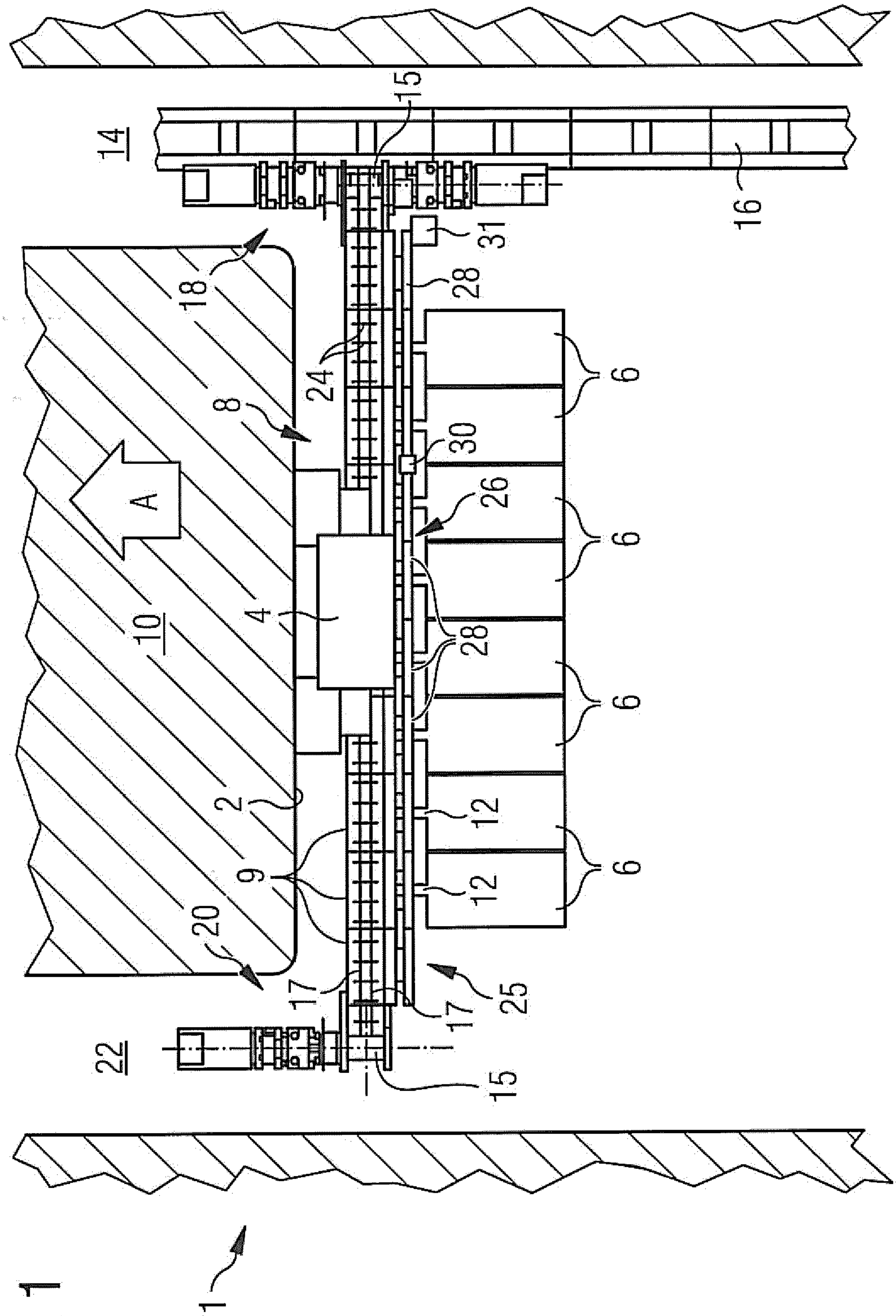


FIG 1

FIG 2

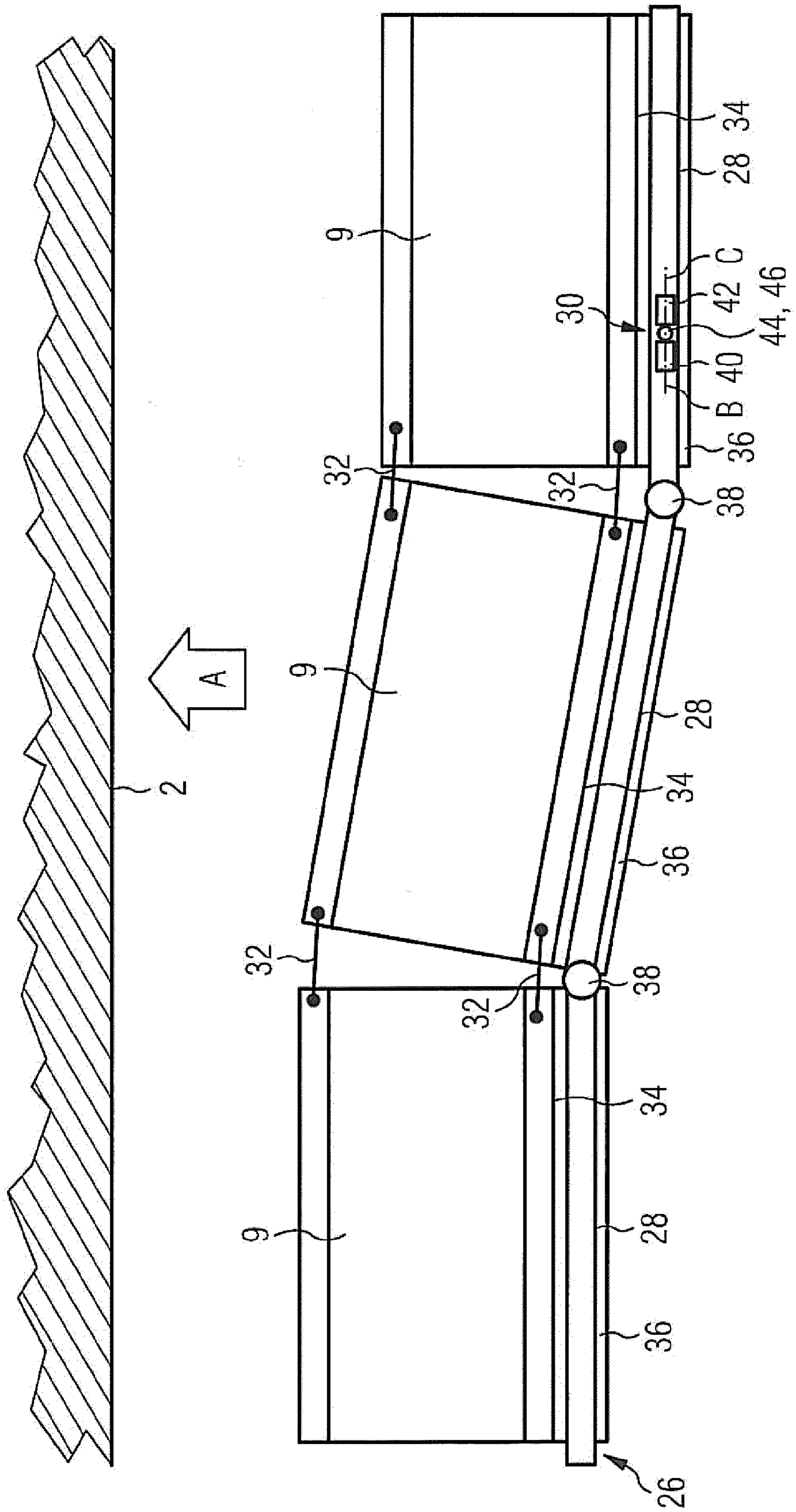


FIG 3

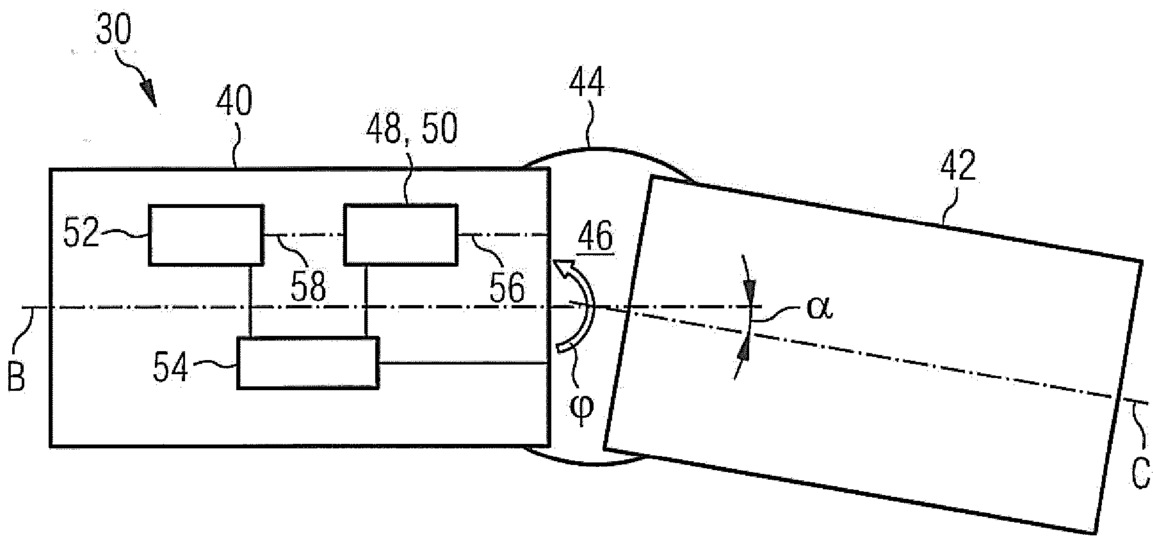


FIG 4

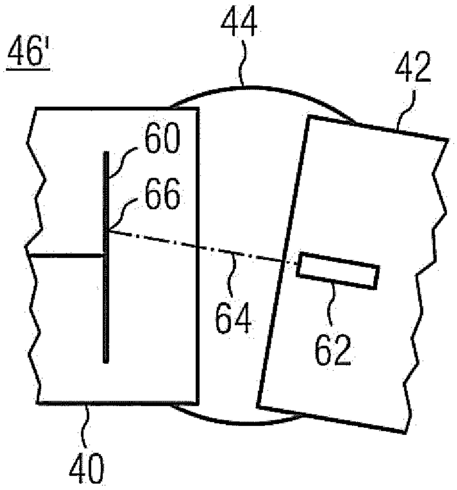
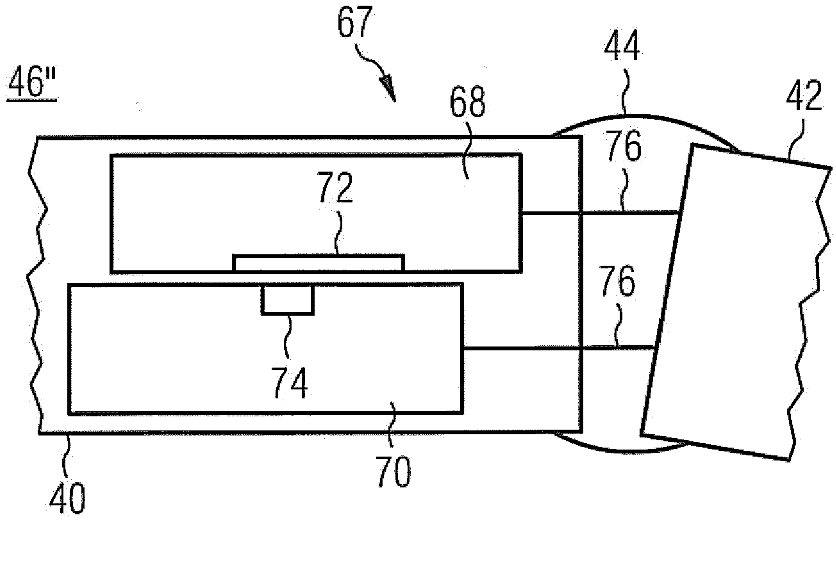


FIG 5



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EUROPEAN SEARCH REPORT

Application Number
EP 14 15 4380

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Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
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The present search report has been drawn up for all claims

1

Place of search	Date of completion of the search	Examiner
Munich	26 May 2014	Manolache, Iustin

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