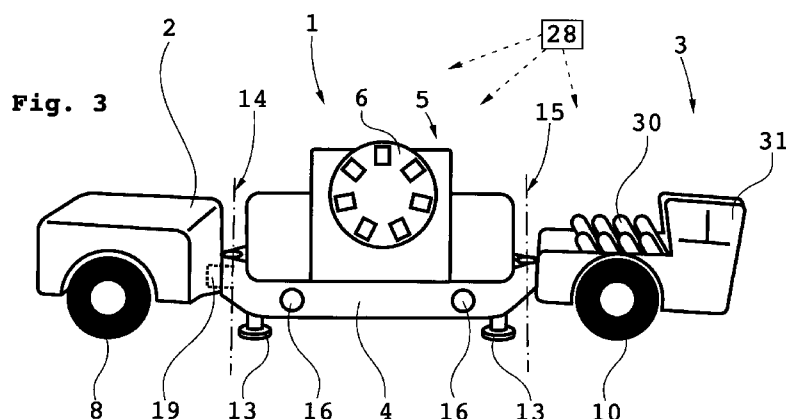




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(54) **Title:** DRILLING RIG AND METHOD OF MANOEUVRING A DRILLING RIG



(57) **Abstract:** Boring rig for extraction boring below ground, wherein the boring rig includes: a boring unit (1) having a length direction (L) and two lateral directions (S1,S2), and a boring aggregate (5) being supported by the boring unit (1) said boring aggregate (5) being equipped with rotation and thrusting means for a cutting head (6) and being pivotally adjustable for boring in direction essentially perpendicular to the length direction (L). The boring unit (1) at one end, as seen in said length direction, is connected over a first swing joint (14) to a first drive unit (2), that the boring unit (1) at its second end, as seen in said length direction, is connected over a second swing joint (15) to a second drive unit (3). Each drive unit (2,3) has at least two wheels (8,10) which are arranged in individually drivable on a wheel axis, and the position of the boring unit (1) is adjustable by the first swing joint (14) as well as the second swing joint (15) being adjustable. The invention also concerns a method.



DRILLING RIG AND METHOD OF MANOEUVRING A DRILLING RIG

FIELD OF THE INVENTION

The invention concerns a boring rig for extraction boring
5 below ground, including a boring unit, and, supported by the
boring unit, a boring aggregate having a cutting head. The
cutting head is pivotally adjustable for boring in different
directions. The invention also concerns a method of
maneuvering a boring rig.

10

BACKGROUND OF THE INVENTION

Bore rigs for extraction boring are previously known,
wherein a carrier vehicle supports a boring unit with a cutter
head. The boring unit is swingable in a plane at a right angle
15 to a general direction of movement of the boring rig with
respect to the substructure of the boring rig. The cutter head
is driven axially from a position inside the thrusting device
by means of rotation and forcing in order to provide the
boring operation.

20

A boring rig according to the background art is intended
for and functions well for underground operation but are time
consuming to set up and its usefulness for production boring
is limited to specific applications.

From US 7,357,458 is previously known a boring rig as
25 initially mentioned which is particularly suitable and adapted
for extracting ore from ore carrying rock where the ore is
present in relatively thin layers extending through the rock.

Such ore often comes in very large shallow cup-shaped
formations whereby excavating of the ore is carried out in
30 directions relatively closed to a horizontal plane.

Normally a boring unit of this kind is pivotal for action
only over an angle of about 10° below a horizontal plane to
about 30° over a horizontal plane.

AIM AND MOST IMPORTANT FEATURES OF THE INVENTION

It is an aim of this invention to provide a further development of a boring rig being suitable for production boring in limited locations according to US 7,357,458. In particular the invention relates to a boring rig being more flexible and allowing boring with further enhanced precision at the same time as reduced set-up time. This aims are achieved in that the boring unit, which has a length direction and two lateral directions, at one end, as seen in said length direction, is connected over a first swing joint to a first drive unit, that the boring unit at its second end, as seen in said length direction, is connected over a second swing joint to a second drive unit, that each drive unit has at least two wheels which are arranged individually drivable, and that a first angular position of the first swing joint as well as a second angular position of the second swing joint are adjustable, whereby the position of the boring unit in lateral direction as well as an angular direction of the length direction of the boring unit are adjustable.. The invention also concerns a method of manoeuvring a boring rig. A first angular position of the first swing joint as well as a second angular position of the second swing joint are adjustable, whereby the position of the boring unit in lateral direction as well as an angular direction of the longitudinal direction of the boring unit are adjustable.

Said at least two individually drivable wheels are positioned in sideways relationship to each other and can be arranged on a common wheel axis or be provided with separate wheel axes.

Boring rig here means a machine equipped with a boring unit, which supports a boring aggregate, to drive units and

further optionally one or more support units connected to the boring unit.

"Longitudinal direction" here means the direction from the first to the second swing joint irrespectively if the
5 boring unit is constructed such that any other one of its dimensions, for example laterally, exceeds the dimension in this longitudinal direction.

"Lateral directions" here means directions perpendicular to said longitudinal direction as seen in a base plane for the
10 boring unit, said base plane being defined as an imagined plane through the boring unit being parallel to a horizontal plane when the boring unit is ideally positioned horizontally.

The invention makes alternative movement patterns for the boring unit possible:

- 15 i) Setting of the angular position of one of the swing joints.
ii) Setting of angular position of both swing joints.

This gives the possibility of freedom of adjustment of the position of the boring unit after different needs and
20 starting positions.

The result will be fine-adjustment of an exactly desired position in lateral direction, angular direction and also in longitudinal direction.

Through the invention is provided great freedom of
25 uncomplicated accurate adjustment of the set-up position of the boring rig such that it will be possible to drill with high precision also relatively long holes in different directions, i.e. in such directions that truly follow a rock formation intended for extraction.

30 The invention finds its application, besides in rock boring machines of so called slot-boring type, also in respect of rock boring machines for raise boring and for box hole boring.

During slot boring, it is important that the boring of each hole being performed by the inventive boring rig, starts at an accurate level and with accurate direction in a drift formed through the formation, a drift, wherein the boring rig is positioned during boring. This can be easily achieved through the invention by the individually manoeuvrable swing joints allowing precision positioning of the boring unit, through adjustment of the swing joints for adequate position in the lateral direction and an adequate angle of the longitudinal direction within the drift directly after having forwarded the boring rig to an approximate boring position.

The achievement of adequate positioning and direction can be verified through conventional navigating equipment which is typically accessible in the mine. Thereupon the boring rig is stabilised vis-à-vis the side walls of the drift and possibly against its roof, possible the rig will be lifted with lifting jacks and the boring aggregate be pivoted to an intended production or elevation direction and be stabilized, whereupon boring can be initiated.

Adjustment of the swing joints is suitably performed in a particular setting mode. In this mode the adjustment can be performed entirely manually through individual/sequential or at least partly simultaneous manoeuvring of the swing joints/the drivable wheels, whereby a resulting positioning direction of the boring unit can be verified, with ocular inspection or with the aid of instruments in respect of a should-position and a should-direction.

According to the invention it is, however, also possible, depending on accessible hard ware and soft ware support to provide a control system for manoeuvring the boring rig in set-up mode, wherein for example an operator over entry devices such as for example a joy-stick or any other per se known entry device feeding data into the control system which

in turn actuates the swing joints and/or the drivable wheels for obtaining positioning and direction as desired.

It is possible during certain situations to ensure that the first and the second swing joints in a particular driving
5 mode are manoeuvrable together for facilitating driving of the boring rig for example in case of tight passage of curves between extractions sites. Having the swing joints manoeuvrable together here means that the same swing angle is automatically set for both swing joints for swinging the
10 boring rig.

It is preferred that one of the first or the second drive units is provided with a lockable rocking joint for allowing rocking in respect of the boring unit. Through the rocking movement, unevennesses in the ground are absorbed during
15 driving and locking gives the possibility of stabilization of a standing, possibly lifted boring rig. The lockable rocking joint suitably adjoins to the swing joint between the drive unit in question and the boring unit which gives the possibility of a simplified pendulum construction.

It is preferred that the first drive unit includes a
20 power unit for supplying the boring rig with hydraulic liquid under pressure and that the second drive unit is arranged for receiving drill string components and for providing drill string components to the boring unit. The power unit can be a
25 combustion motor or an electric motor.

It is, however, also possible to arrange separate, individually controllable hydraulic motors and/or electric motors in respect of each one of the wheels.

It is further preferred that the second drive unit is an
30 operator's unit and exhibits an interface for operator co-operation. This can for example be realised through an operator's cabin been equipped with the usual driving controls and switches for set-up mode and driving mode. Possibly the

boring rig is equipped with distance control means including driving controls and switches allowing manoeuvring of the boring rig from a distance.

According to an important aspect of the invention the first and the second drive units are constructed as modules being connectable as desired to the boring unit forming a boring module in order to form said first or second swing joint together therewith. Hereby the boring rig can be easily rearranged such that it can be adapted for boring in a desired lateral direction. This is accentuated by the first and second swing joints being constructed as quick release joints with mechanical as well as hydraulic quick couplings. This can be realised when it comes to the swing joints in that a swing shaft is simply retractable from a seat being formed by swing joint components on each module.

Said first and second swing joints are suitably manoeuvrable through any one of:

- 1) Through driving of at least one wheel and braking/locking of the remaining wheels. Driving can be in opposite direction and with the same or different rotational speeds for different wheels.
- 2) Through activation of swing motors such as hydraulic cylinders between the boring unit and the respective drive unit.
- 3) Through a combination of 1) and 2).

It is preferred that the boring unit is provided with lifting jacks for lifting the entire boring rig. This gives firstly an opportunity to align the boring rig at an accurate level in the drift, secondly to align the parts of the boring rig to each other after having determined the position of the boring unit. Normally the second drive unit has to be aligned in respect of and lined up with the boring unit for allowing

drill string components to be transferred between these bore rig parts.

Preferably the boring unit is provided with stabilizing jacks (for fastening the entire boring rig against adjacent
5 rock sides.

The invention also concerns a method for maneuvering a boring rig for boring below ground, wherein the boring rig includes: a boring unit with a longitudinal direction and two lateral directions, and a boring aggregate being supported by
10 the boring unit and being equipped with rotation and thrusting means for a cutting head for boring in directions at an angle to said longitudinal direction. The boring unit at one end, as seen in a length direction, over a first swing joint is swung in respect of a first drive unit, and at its second end, as
15 seen in said length direction, over a second swing joint in respect of a second drive unit. Each drive unit is driven by two wheels which are arranged individually drivable on a wheel axis, and the first and the second swing joint are maneuvered individually in an adjusting mode to adjust the position of
20 the boring unit in lateral direction as well as an angular direction of the length direction of the boring unit.

Advantages corresponding to what is indicated for corresponding device features are achieved in respect of features characterizing the inventive method. Further features
25 and advantages are evident from the following description of an embodiment.

BRIEF DESCRIPTION OF DRAWINGS

The present invention will be described in greater detail
30 below with reference to the annexed drawings, wherein:

Fig. 1 is a longitudinal section through a drift extending through rock, and with a boring rig drilling a series of overlapping holes,

Fig. 2 is a cross section through the drift in Fig. 1,
Fig. 3 is a perspective view of a boring rig according to
the invention,

Figs. 4 and 5 are plane views of differently ranged
5 boring rigs according to the invention,

Fig. 6 shows diagrammatically a method sequence according
to the invention,

Figs. 7a - 7c show the boring rig during a set-up phase
in a drift, and

10 Fig. 8 shows a swing joint arrangement.

DESCRIPTION OF EMBODIMENT

A boring rig in Fig. 1 globally includes three modules,
that is a boring module in the form a boring unit 1 with a
15 boring aggregate having means for rotation and thrusting of a
cutting head 6, a power module in the form of a first drive
unit 2 and an operator module in the form of a second drive
unit 3. Different machine part such as driving means,
stabilisation means, a drill string component supply and drill
20 string joining means are included in the boring rig. Some of
these machines are not shown in the Figures. The operation of
the boring rig is controlled by a computerised control system
28.

In the Figs. 1 and 2, 10 is a rock having a relatively
25 thin ore-bearing formation 11 extending therethrough. The
extension and approximate thickness of the ore-bearing
formation has been determined by drilling from the surface of
the ground above the formation. A drift 12 has been made
through the rock so as to have the ore-bearing formation 11
30 extending therealong. The extension and approximate thickness
t of the ore-bearing formation determined is indicated in
Figs. 1 and 2 by two spaced interrupted lines extending along
the drift.

As seen in Fig. 2, the ore-bearing formation 11 is shown to be inclined and the boring aggregate has consequently been pivoted to an elevation angle α .

A base plane of the boring unit 1 is indicated with
5 B. The cutting head 6 having a diameter d substantially corresponding to the approximate thickness t of the ore-bearing layer 11 determined is used to drill a first hole H_1 along an axis A_1 extending along an approximate mid-plane M of the layer 11 (Fig. 1).

10 After completion of the first hole H_1 (see Fig. 1), a second hole H_2 is drilled along a second axis A_2 also extending along the approximate mid-plane of the ore-bearing layer 11. The axes A_1 and A_2 are parallel if the layer is a 'plane' layer, but they may as well be non-parallel if the layer is
15 curved. The spacing s between the axes A_1 and A_2 is chosen such that the holes H_1 and H_2 intersect or overlap one another as shown in Fig. 1. In other words, the spacing s is less than the drill diameter d . Evidently, depending on the spacing chosen, more or less material is left unbroken in areas where
20 two holes do not intersect.

The drill cuttings yielded are continuously collected. An example how this can be realised is to arrange a suction equipment adjacent to the cutter head, said suction equipment discharging loosened material to a collecting
25 station for subsequent further handling.

In order to achieve acceptable economy of the boring rig in the process of boring the holes H_1 , H_2 , H_3 , H_4 and H_5 , rapid and accurate set-up of the boring rig is essential. This is provided for by the present invention.

The bore string consists of a number of axially aligned, connected bore string components 30, which are added to the bore string in a manner which is not part of the invention and therefore not further discussed here.

5 In Fig. 3 is shown an alternative boring rig in greater detail. The boring unit 1 which includes the base plane B, (see Figs. 1 and 2), has a body 4 which supports a boring aggregate 5 with rotation and trusting means for a cutter head 6. The boring aggregate 5 is in the shown example swingably
10 adjustable for boring in directions essentially perpendicular to a longitudinal direction L of the boring unit 1.

It shall be emphasized that the invention also relates to boring rigs having boring units equipped with boring aggregates being swingably adjustable for boring in other
15 directions than essentially perpendicular to the longitudinal direction L. Such boring aggregates can even be swingable 360° around an axis being perpendicular to the base plane of the boring unit besides being swingable in an elevation direction α .

20 The boring unit 1 is over a first swing joint 14 connected to a first drive unit 2 being a power module, which in a housing includes a power unit, hydraulic pumps etc for supply to the boring rig with hydraulic oil under pressure. The first drive unit 2 includes two individually drive
25 controllable/drivable wheels on one wheel axis, whereof one is indicated with 8 in the Figure. As is indicated above it is also possible to arrange supported wheels otherwise than on a common wheel axis and also to arrange separate individually controllable electric motors at each one of the wheels.

30 On the opposite side of the boring unit 1 it adjoins over a second swing joint 15 to a second drive unit 3 being operator's module. This unit has an interface for the co-

operation with an operator in an operator's cabin 31 and a supply of drill string components 31 which through a suitable supply mechanism are made accessible for the boring unit 1 during boring operation of the boring rig.

5 The first and the second swing joints 14 and 15 are only moveable in the base plane B and prevent movements at angles thereto.

 In connection with the first swing joint 14, there is arranged a lockable rocking joint 19 (indicated with
10 interrupted lines), in the first drive unit 2, allowing a rocking movement of the first drive unit 2 in respect of the boring unit 1 and the second drive unit 3 for facilitating driving on uneven ground.

 Also the second drive unit 3 includes two individually
15 drivable wheels on a wheel axis, whereof one is indicated with 10 on Fig. 3. The boring unit 1 exhibits lifting jacks 13 arranged on its body 4, in principle one lifting jack 13 in each one of the four corners of the body 4, for the application against ground and for support and/or lifting of
20 the entire boring rig from its support.

 When the entire boring rig is lifted by the lifting jacks 13, the drive units 2 and 3 are free to be aligning in line with the boring unit 1. In particular it is normally required to align the second drive unit 3 with its supply of drill
25 string components with the boring unit 1 for making it possible or at least facilitate transfer of drill string components between these units.

 On the body 4, there are also shown stabilizing jacks 16, which when actuated will come into stabilizing application
30 against a rock side in the drift where the boring rig is arranged to operate. Corresponding stabilizing jacks are provided on the second side of the boring rig for stabilizing application to an adjacent rock side.

Figs. 4 and 5 show the boring rig according to Fig. 3 in two plane views and arranged in two different ways. The boring unit 1 has a length direction L and a first and a second lateral direction S1 and S2, respectively.

5 The boring rig according to the invention is suitably made modular in such a way that the first and the second drive unit 2 and 3 respectively can be connected to an optional side (seen in the length direction L) of the boring unit 1. This way the boring rig can be arranged for boring in the desired
10 lateral direction S1 or S2 in a drift where it is arranged to operate. For this purpose, the modules are releasable from each other and fastenable to each other in both the intended positions. This is realized in an embodiment illustrated in the Figures by the first as well as the second swing joint
15 being constructed to be simply releasable swing joints. For example, in the swing joints there can be included extractable swing shafts allowing separation of the modules when they are extracted. Hydraulic conduits are advantageously arranged with quick couplings for quick switching during rearranging the
20 boring rig.

The first and the second drive units are suitably individually drivable such that they for example with the addition of one or two support wheels can be individually brought to be driven their selves and be controlled for
25 displacement to a chosen position for (re-) arranging or for any other purpose.

The boring unit 1 has no drive wheels and is normally displaced only with the first and the second drive units connected. It is, however, not excluded that the boring unit 1
30 is provided with or connectable with wheels to facilitate displacement, swinging etc. through for example towing thereof in order to, for example, change boring directions 180°.

For maneuvering the swing joints 14 and 15, suitably there are arranged hydraulic cylinders 7 positioned between the adjacent parts/modules. This is indicated with interrupted lines on Figs. 4 and 5. As alternatives the swing joints can
5 be maneuvered through precisions maneuvering of the drivable wheels on the drive units. As a further alternative, a combination of these variants can be adapted.

These principles can in turn be combined with control through a control system controlling wheel -
10 driving/braking/locking of the individually drivable wheels respectively the movements of the hydraulic cylinders starting out from data entered by an operator or from given should-values of the position of the boring unit 1 in lateral direction and alignment position of the boring unit 1 in the
15 length direction L. This procedure can be automated in different degrees all the way to complete automatization with computer-supported control starting out from detected position of the rig.

Fig. 6 shows diagrammatically a method sequence according
20 to the invention, wherein:

Position 20 indicates the start of the sequence.

Position 21 indicates driving of the boring rig into an approximate boring position, wherein each drive unit is driven
25 by two individually drivable wheels arranged on the wheel axis.

Position 22 indicates that the boring unit at its one end, as seen in said length direction, is swung relative to a first drive unit over a first swing joint.

Position 23 indicates that the boring unit at its second end,
30 as seen in said length direction, over a second swing joint is swung relative to a second drive unit.

Position 24 indicates that the position in the lateral direction as well as a length direction of the boring unit is

adjusted by setting a first angular position of the first swing joint as well as a second angular position of the second swing joint. Thereupon follows verification that the set position is accurate.

5 Position 25 indicates that lifting jacks lift the boring rig and that the boring rig is aligned.

Position 26 indicates the end of the sequence.

The events above can in certain cases occur simultaneously or partly simultaneously. The above is followed
10 by fastening into the drift, setting the boring aggregate, performing boring etc.

Figs. 7a - 7c show diagrammatically different positions during a set-up sequence for the boring rig according to the invention. In Fig. 7a, the boring rig has been driven into a
15 drift at a suitable distance from the rock wall 27 against which extraction boring is to be performed.

Fig. 7b shows maneuvering of one of the swing joints 14 for side displacement of the corresponding end of the boring unit 1 towards said rock wall 27.

20 Fig. 7c shows that also the second swing joint 15 has been swung for side displacement also of the second end of the boring unit 1 towards said rock wall 27 and wherein is ensured that the length direction L of the boring unit and its side position in the lateral directions S1 and S2 in respect of the
25 rock wall 27 and in particular to the rock formation to be extracted is according to what has been planned.

A control unit being included in the control system of the boring rig (28 in Fig. 3) advantageously controls the different stabilization means and motors for pivoting the
30 boring aggregate 5 before operation in order to obtain an elevation angle for boring purposes.

Fig. 8 shows a swing joint arrangement; wherein on the body 4 at each side of the swing joint 14 there are fastened

piston rods of hydraulic cylinders 7. These hydraulic cylinders 7 are in turn fastened on a component associated with any one of the drive units fastened to the swing joint. The swing joint 14 can be maneuvered through controlled hydraulic flow to the sides of the hydraulic cylinders in a per se known manner.

The invention can be modified within the scope of the following claims. For this purpose the different means and elements can be constructed otherwise than what is shown in the Figures. The modules comprising drive units can be equipped otherwise, and it is not excluded that one or further more use can also be attached (connected) to the boring rig, even if this is not preferred.

In an alternative embodiment of the invention, the boring unit 1 itself is equipped with power unit, hydraulic pumps etc. for supply of the boring rig with hydraulic oil under pressure. The individual drive controllable/drivable wheels on the first as well as on the second drive unit can in this case be driven from the boring unit to the extent that they do not have individual separate driving, for example electric or hydraulic.

It is also possible that in further alternative embodiments of the invention, instead or also equip a boring unit 1 as operating module with interface for co-operation with an operator in the form of a operator's cabin and/or with a supply of drill string components.

C L A I M S

1. Boring rig for extraction boring below ground, wherein the boring rig includes:

- 5 - a boring unit (1), and
- a boring aggregate (5) being supported by the boring unit (1) said boring aggregate (5) being equipped with rotation and thrusting means for a cutting head (6) and being pivotally adjustable for boring in different direction,
- 10 c h a r a c t e r i z e d i n
- that the boring unit (1) has a length direction (L) and two lateral directions (S1,S2),
- that the boring unit (1) at one end, as seen in said length direction, is connected over a first swing joint (14) to a
15 first drive unit (2),
- that the boring unit (1) at its second end, as seen in said length direction, is connected over a second swing joint (15) to a second drive unit (3),
- that each drive unit (2,3) has at least two wheels (8,10)
20 which are arranged individually drivable, and
- that a first angular position of the first swing joint (14) as well as a second angular position of the second swing joint (15) are adjustable, whereby the position of the boring unit (1) in lateral direction (S1,S2) as well as an angular
25 direction of the length direction (L) of the boring unit are adjustable.

2. Boring rig according to claim 1,

- c h a r a c t e r i z e d i n that the first and the second
30 swing joints (14,15) in a driving mode are maneuverable together.

3. Boring rig according to claim 1 or 2,

characterized in that the first or the second drive unit (2,3) exhibits a lockable rocking joint (19) for allowing rocking in respect of the boring unit (1).

- 5 4. Boring rig according to claim 3, characterized in that the lockable rocking joint (19) adjoins to the swing joint (14,15) between the associated drive unit (2,3) and the boring unit (1).
- 10 5. Boring rig according to any one of the previous claims, characterized in
- that the first drive unit (2) includes a power unit for supplying the boring rig with hydraulic liquid under pressure.
- 15 6. Boring rig according to any one of the previous claims, characterized in
- that the second drive unit (3) is arranged for receiving drill string components and for providing drill string components to the boring unit (1).
- 20 7. Boring rig according to claim 6, characterized in that the second drive unit (3) is an operator's unit and exhibits an interface for operator co-operation.
- 25 8. Boring rig according to any one of the previous claims, characterized in that the boring unit (1) and the first and the second drive units (2,3) are constructed as modules being connectable as desired to the boring unit (1) forming a boring module in order to form said first or second
30 swing joint (14,15) together therewith.
9. Boring rig according to claim 8, characterized in that said first and second swing joints (14,15) are

constructed as quick releasable joints with mechanical as well as hydraulic quick couplings.

10. Boring rig according to anyone of the previous claims,
5 c h a r a c t e r i z e d in that said first and second swing joints (2,3) are maneuverable through anyone of: hydraulic cylinders (7) acting between the boring unit and the respective drive unit; individual control of the drivable wheels (8,10) of the drive units.

10

11. Boring rig according to any one of the previous claims, c h a r a c t e r i z e d in that the boring unit (1) is provided with lifting jacks (13) for lifting the entire boring rig.

15

12. Boring rig according to any one of the previous claims, c h a r a c t e r i z e d in that the boring unit (1) is provided with stabilizing jacks (16) for fastening the entire boring rig against adjacent rock sides.

20

13. Method for maneuvering a boring rig for boring below ground, wherein the boring rig includes:

- a boring unit (1), and
- a boring aggregate (5) being supported by the boring unit (1) said boring aggregate (5) being equipped with rotation and thrusting means for a cutting head (6) and being pivotally adjustable for boring in different direction,
25 c h a r a c t e r i z e d in
- that the boring unit (1) at one end, as seen in a length direction, over a first swing joint (14) is swung in respect
30 of a first drive unit (2),

- that the boring unit (1) at its second end, as seen in said length direction, over a second swing joint (15) is swung in respect of a second drive unit (3),
- that each drive unit (2,3) is driven by two wheels (8,10) which are arranged individually drivable on a wheel axis, and
- that a first angular position of the first swing joint (14) as well as a second angular position of the second swing joint (15) are adjusted, whereby the position of the boring unit (1) in lateral direction (S1,S2) as well as an angular direction of the length direction (L) of the boring unit are adjusted.

14. Method according to claim 13,
c h a r a c t e r i z e d in that the first and the second swing joints (14,15) in a driving mode are maneuvered together.

15. Method according to claim 13 or 14,
c h a r a c t e r i z e d in that the boring unit (1) rocks in respect of one of the first or the second drive unit (2,3) through a lockable rocking joint (19).

16. Method according to any one of the claims 13 - 15,
c h a r a c t e r i z e d in
- that the boring rig is supplied with hydraulic liquid under pressure from a power unit placed in the first drive unit (2).

17. Method according to any one of the claims 13 - 16,
c h a r a c t e r i z e d in
- that the second drive unit (3) receives drill string components and provides drill string components to the boring unit (1).

18. Method according to any one of the claims 13 - 17,

c h a r a c t e r i z e d in that the boring unit (1) and the first and the second drive units (2,3) are constructed as modules and are connected as desired to the boring unit (1) forming a boring module in order to form said first or second
5 swing joint (14,15) together therewith.

19. Method according to any one of the claims 13 - 18,
c h a r a c t e r i z e d in that the entire boring rig is lifted through lifting jacks (13) being provided on the boring
10 unit (1).

20. Method according to any one of the claims 13 - 19,
c h a r a c t e r i z e d in that the entire boring rig is fastened against adjacent rock sides through stabilizing jacks
15 (16) provided on the boring unit (1).

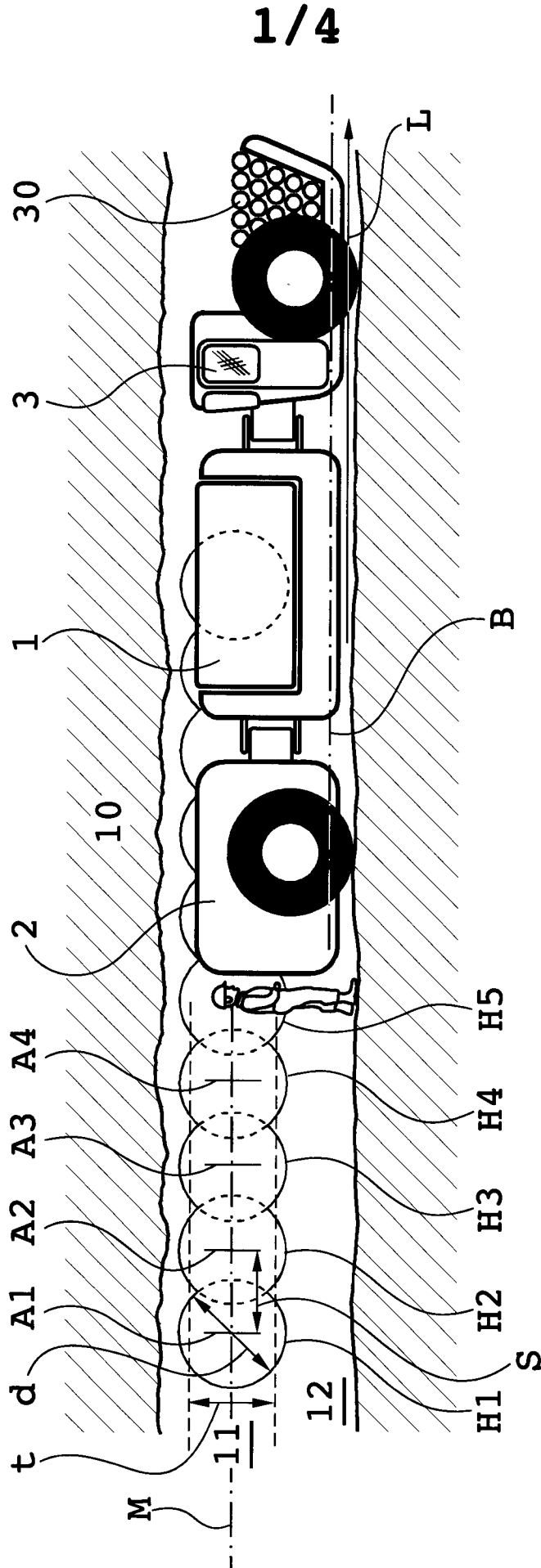


Fig. 1

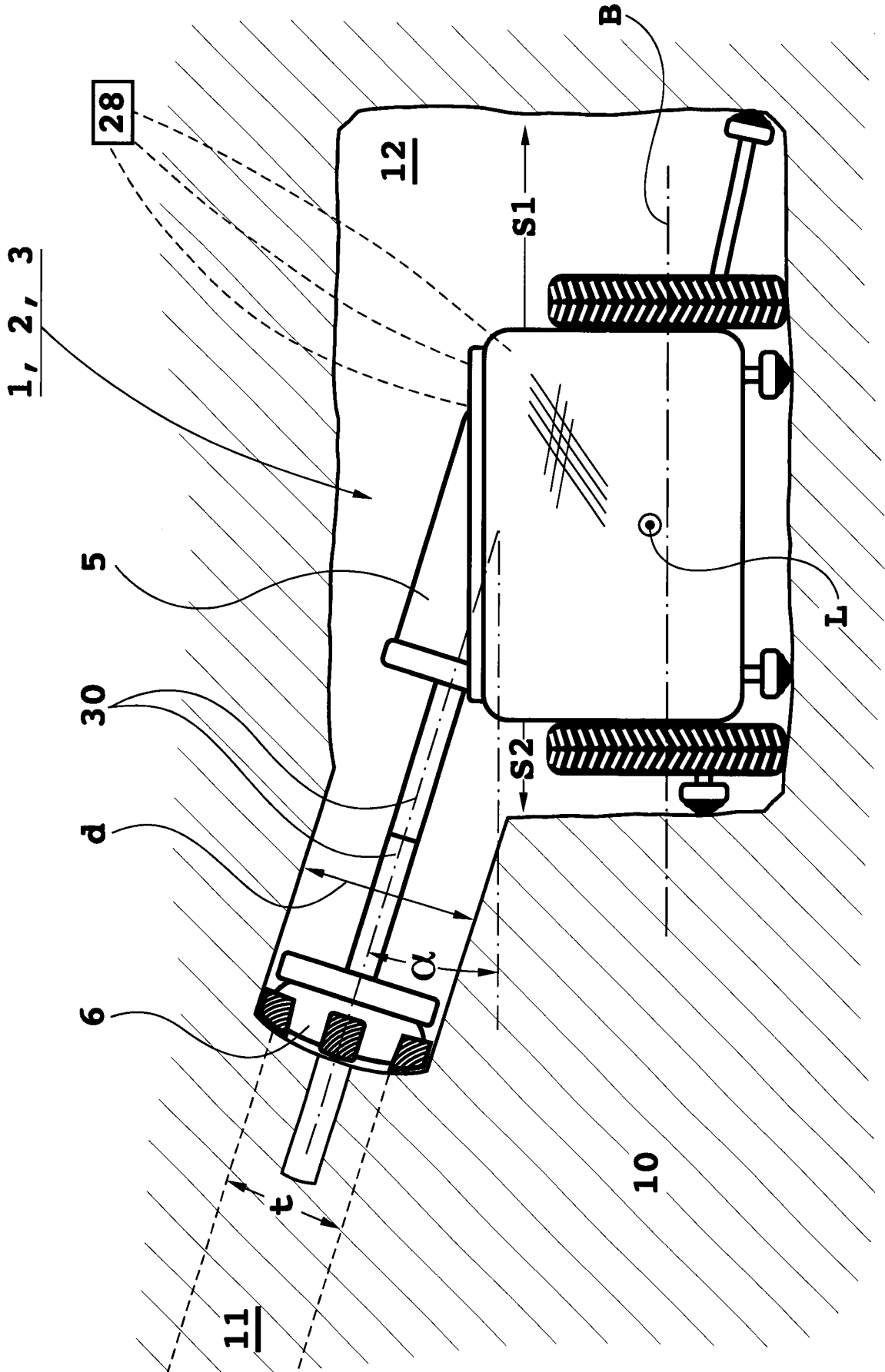
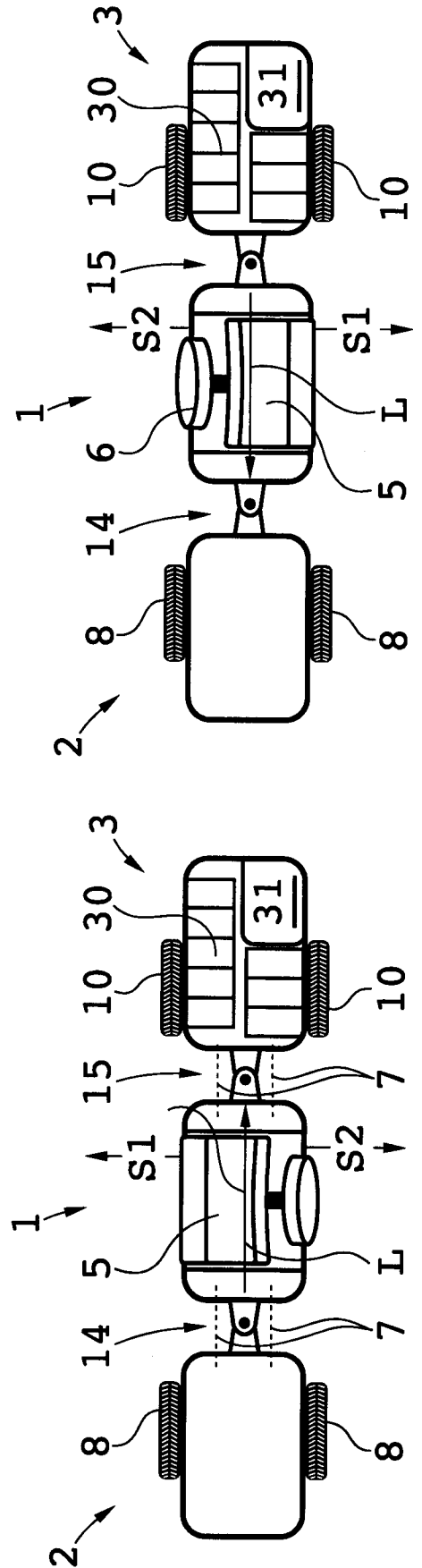
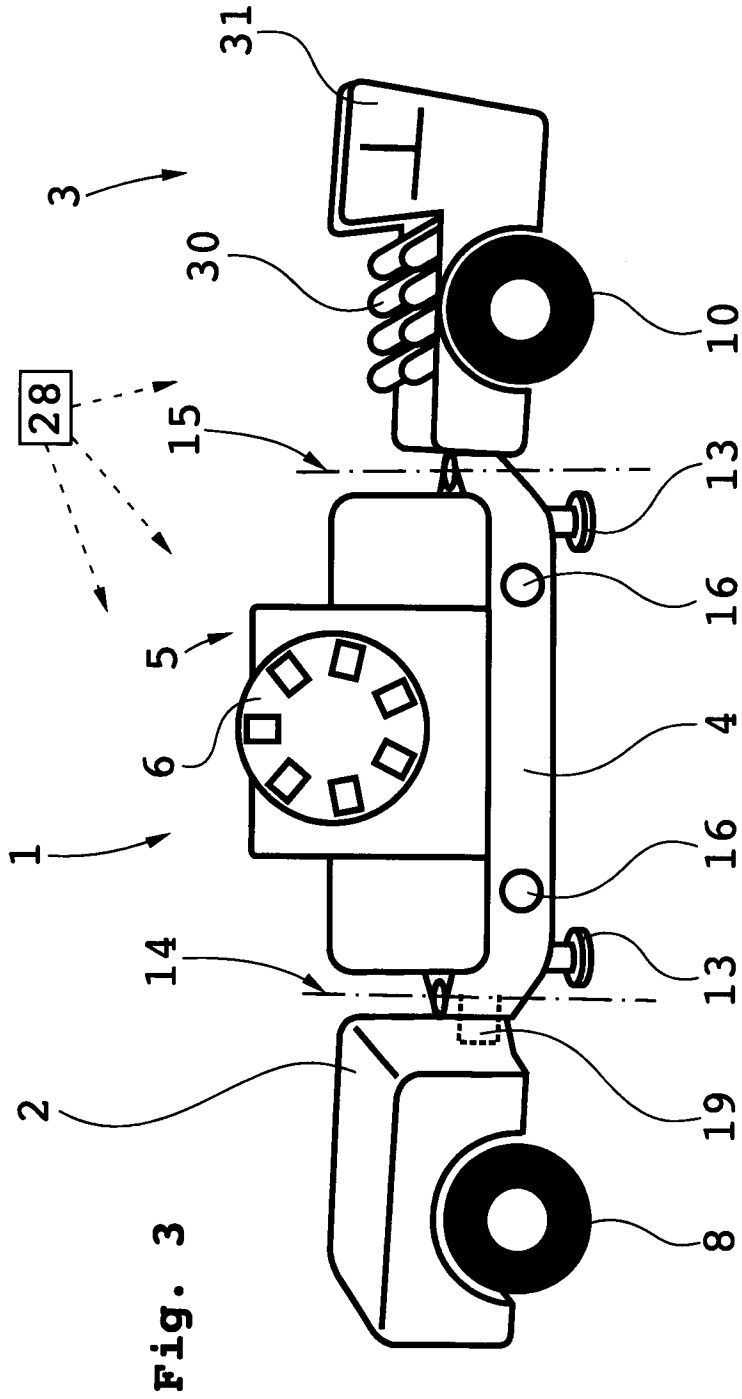


Fig. 2



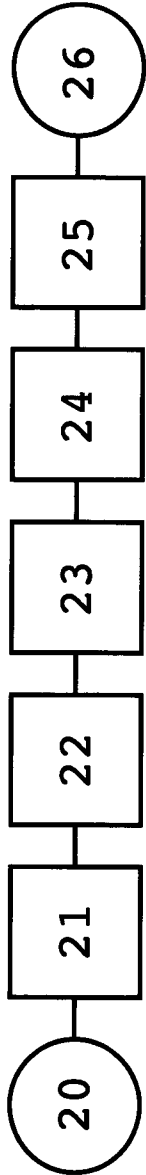


Fig. 6

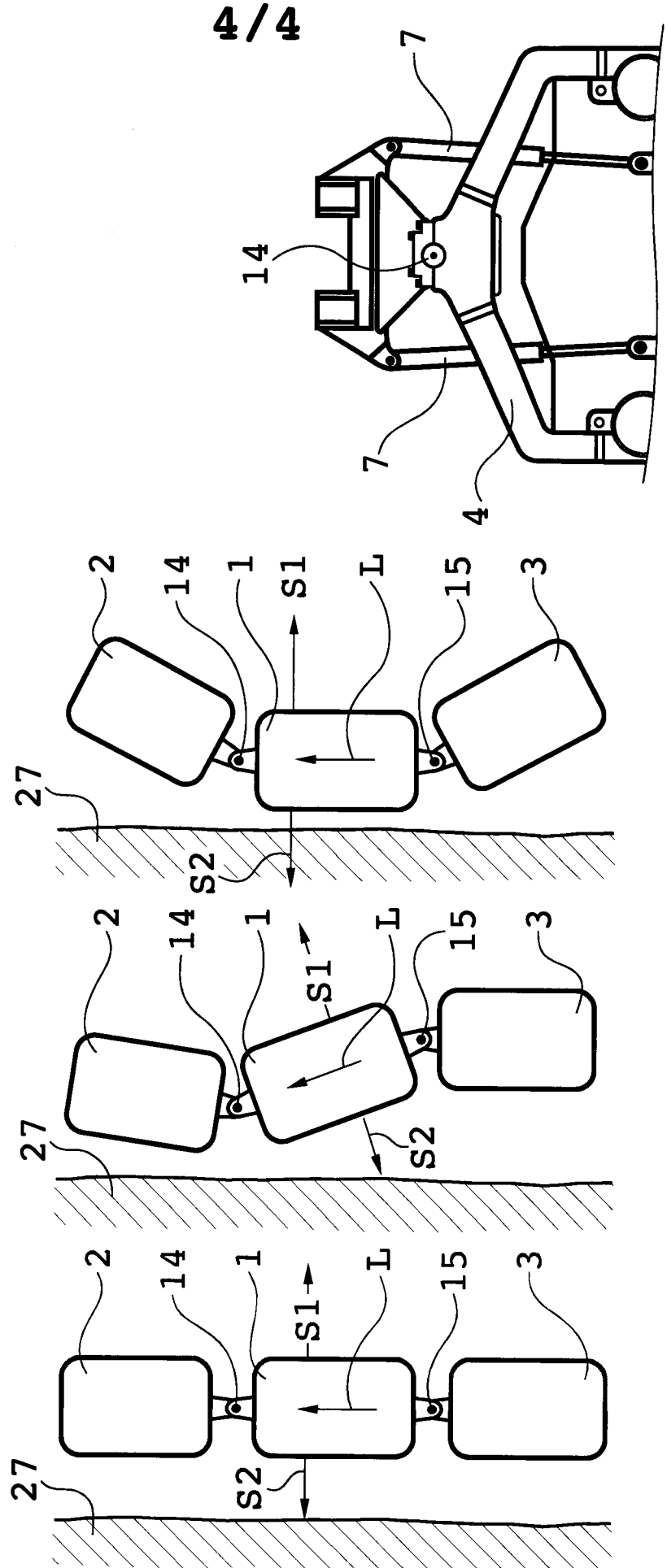


Fig. 8

Fig. 7c

Fig. 7b

Fig. 7a

INTERNATIONAL SEARCH REPORT

International application No.
PCT/SE2013/051206

A. CLASSIFICATION OF SUBJECT MATTER		
IPC: see 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: E21B, E21C		
Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched		
SE, DK, FI, NO classes as above		
Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)		
EPO-Internal, PAJ, WPI data		
C. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 20060278418 A1 (VANDELIGT GERALD J ET AL), 14 December 2006 (2006-12-14); whole document --	1-20
A	DE 3331032 A1 (FARKAS INGENIEURBUERO DR ING), 14 March 1985 (1985-03-14); page 10, paragraph [0004] - page 12, paragraph [0002]; figures 1-2 --	1-20
A	US 20050230934 A1 (WILT H WILLIAM B), 20 October 2005 (2005-10-20); whole document; figures 6-7 --	1-20
<input checked="" type="checkbox"/> Further documents are listed in the continuation of Box C. <input checked="" type="checkbox"/> See patent family annex.		
* Special categories of cited documents: "A" document defining the general state of the art which is not considered to be of particular relevance "E" earlier application or patent but published on or after the international filing date "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) "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 "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 "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 "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 "&" document member of the same patent family		
Date of the actual completion of the international search		Date of mailing of the international search report
06-02-2014		06-02-2014
Name and mailing address of the ISA/SE Patent- och registreringsverket Box 5055 S-102 42 STOCKHOLM Facsimile No. + 46 8 666 02 86		Authorized officer Christer Bäcknert Telephone No. + 46 8 782 25 00

INTERNATIONAL SEARCH REPORT

International application No.
PCT/SE2013/051206

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	EP 0890704 A1 (TAMROCK SECOMA S A -(B1) SANDVIK TAMROCK SECOMA S A [FR]), 13 January 1999 (1999-01-13); whole document -- -----	1-20

Continuation of: second sheet

International Patent Classification (IPC)

E21B 7/02 (2006.01)

E21B 15/00 (2006.01)

E21C 27/00 (2006.01)

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

PCT/SE2013/051206

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