Drill Bit Magazine, Drill Bit Holder, and Method for Changing Drill Bit in Rock Drilling Unit

Abstract: The invention relates to a drill bit magazine, drill bit holder, and method for changing a drill bit in a rock drilling unit. The magazine (16) has several spaces (30), each arranged to receive one drill bit holder (22). The drill bit (12) is supported into the magazine by means of the drill bit holder. In addition, transfers between the magazine and retainer (14) take place by acting on the drill bit holder only. The drill bit holder is a projecting piece that is supported against at least one inside surface (41) of the drill bit.
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Drill bit magazine, drill bit holder, and method for changing drill bit in rock drilling unit

Background of the invention

[0001] The invention relates to a magazine to which replaceable drill bits for a rock drilling machine tool may be stored. A drill bit may be fastened to a drill rod belonging to the tool by means of a drill bit changer. The magazine has several spaces for storing drill bits, and a movable frame part, and each space supporting a drill bit is arrangeable one at a time into a changing station in the magazine for the purpose of taking a drill bit from the magazine and bringing one into it.

[0002] The invention further relates to a drill bit holder and to a method for handling a drill bit.

[0003] The subject matters of the invention are described in more detail in the preambles of the independent claims.

[0004] In rock drilling, a rock drilling machine is used with a tool connected thereto which can be rotated around its longitudinal axis and through which impact pulses may be delivered to the rock being drilled so that the rock will break and a drill bore will be formed. The tool may comprise one or more drill rods and a replaceable drill bit connected to its outermost end. Typically, the leading end of the drill bit is equipped with several bit buttons that penetrate the rock being drilled. The drill bit experiences wear and is occasionally also damaged, because very high loads are directed to it during drilling. Thus, it is necessary to change the drill bit at times so as to ensure the quality and efficiency of drilling. Changing drill bits manually by the operator is difficult and slow, and what is worse, also dangerous. Thus, drill bit changers have been developed so as to mechanize the changing. Present ways of storing and handling drill bits do not, however, fully satisfy the requirements of users. For instance, US publication 4 065 845 discloses a drill bit changer in which the drill bits are arranged against spaces in a magazine, which sets restrictions on the shape and dimensioning of the drill bits.

Brief description of the invention

[0005] It is an object of the present invention to provide a novel and improved magazine and drill bit holder for storing and handling drill bits. Another object is to provide a novel and improved method for changing drill bits.
[0006] The drill bit magazine of the invention is characterised in that each space in the magazine is arranged to detachably receive and connect one separate drill bit holder, that each stored drill bit is arranged to be supported by means of the drill bit holder into the magazine, and that the drill bit holder is supported against at least one inside surface of the drill bit.

[0007] The drill bit holder of the invention is characterised in that the drill bit holder is a separate projecting piece that is supportable against at least one inside surface of the drill bit, and that the drill bit holder comprises a gripping part for handling and fastening the drill bit holder.

[0008] The method of the invention is characterised by arranging inside each drill bit a projecting drill bit holder that is a separate piece from the magazine, handling each drill bit being replaced during transfers and storage by only affecting the drill bit holder, and taking the drill bit holder out of the drill bit before the drill rod and drill bit are connected to each other.

[0009] The idea of the invention is that during storage and transfer of drill bits, a projecting drill bit holder is arranged inside them to support against at least one inside surface of the drill bit. It is then not necessary to affect the outer surface of the drill bits during storage in the magazine and transfer between the magazine and retainer. The drill bit holder is a kind of adapter between the drill bit and magazine, and between the drill bit and transfer device. However, the drill bit holder does not participate in fastening the drill bit to a tool, but may act as a detachable and independent transfer and storage adapter.

[0010] The invention provides the advantage that by means of the drill bit holder, it is possible to store and handle without difficulty drill bits of different shapes and external dimensions. The same magazine and transfer device may then be used to handle different drill bits. This adds to the functional adaptability of the drill bit changer for using different drill bits. This, in turn, provides cost savings, since it is possible to manufacture a universal magazine and transfer device that may be widely utilised in rock drilling equipment intended for various drilling situations. Another advantage is that arranging the drill bit to a desired location with the retainer is easier, since the outer circumference of the drill bit is free of a gripping device or the like of the transfer device.

[0011] The idea of an embodiment is that the frame part of the magazine is a disc-like piece that is equipped with several fastening holes,
each of which is arranged to receive one drill bit holder. Each fastening hole opens toward the outer circumference of the disc-like frame part. The drill bit holder comprises a fastening part with fastening grooves so that the drill bit holder may be supported by means of the grooves to the fastening hole and moved in the changing station in the direction of the radius of the disc-like frame part. Further, the moving of the drill bit holders in the direction of the frame part radius away from the fastening space is prevented when not at the changing station. The disc-like frame part of the magazine is turnable relative to a turning axis for moving the drill bit holders relative to the changing station.

[0012] The idea of an embodiment is that a drill bit stored in the magazine is supported to the frame of the magazine solely by means of the drill bit holder.

[0013] The idea of an embodiment is that the drill bit holder has a gripping part with which the separate drill bit holder is fastened detachably to the magazine. Further, the drill bit holder may be transferred between the magazine and drilling centre by gripping the gripping part with the transfer device.

[0014] The idea of an embodiment is that the gripping part of the drill bit holder is at the free end of the holder.

[0015] The idea of an embodiment is that the drill bit holder comprises an elongated arm having on the portion of its first end a cylindrical gripping part. The gripping part has a longitudinal hole to which a transfer pin of the transfer device belonging to the drill bit changer may be pushed for attachment to the drill bit changer. Further, the outer surface of the gripping part has a circumferential fastening groove, by which the drill bit holder may be fastened to the magazine.

[0016] The idea of an embodiment is that the drill bit holder comprises an elongated arm and at least two support pieces that are arranged to support themselves against internal connection threads of the drill bit. The first support piece is arranged to be movable relative to the arm and the second support piece is arranged on the portion of the outermost end of the arm stationary relative to the arm. The support pieces may then be set at an axial distance to each other and correspondingly against each other by moving the arm in relation to the first support piece.

[0017] The idea of an embodiment is that the drill bit holder comprises at least one adjusting member for setting the maximum axial distance
between the first support piece and second support piece to correspond to the drill bit being handled. By means of the adjustment, drill bits of different lengths may be set into the magazine so that the leading ends of the drill bits are essentially level with each other. The leading ends of the drill bits may then be supported in the magazine in the axial direction against a suitable support plate or the like, whereby the drill bits will not detach from the drill bit holders, even though the drilling unit and magazine were directed downward. Further, when the leading ends of the drill bits are adjusted to be essentially level with each other and when the magazine is at the retainer, the transfers of drill bits between the retainer and magazine may be done using a simple crosswise linear movement.

[0018] The idea of an embodiment is that the first support piece of the drill bit holder comprises a cylindrical portion that may be arranged inside the drill bit, and a shoulder that may be arranged against the rear surface of the drill bit.

[0019] The idea of an embodiment is that the top part of the drill bit holder is arranged to support itself against the bottom of a hole in the drill bit and to support the drill bit in the axial direction. Thus, one support piece of the drill bit holder may be arranged to handle the axial support and the other support piece may be arranged to support the drill bit to be parallel to the drill bit holder.

[0020] The idea of an embodiment is that the first and second support pieces of the drill bit holder are detachable pieces, whereby they may be changed to correspond to the drill bit being handled at each time.

[0021] The idea of an embodiment is that at least two different drill bits that differ in outer dimensions or shape from each other are stored and handled with the drill bit changer simultaneously. The differing drill bits are supported into the magazine by means of similar drill bit holders. Widely different drill bits, even for special drilling situations, may be stored inside the magazine without structural changes.

[0022] The idea of an embodiment is that there is a shape lock between the drill bit holder and gripping member of the transfer device. The shape-locking is opened when the drill bit holder is inserted into the magazine. Shape-locking ensures good fastening. The movement of the shape-locking members into an open position may take place mechanically when the transfer device moves toward the magazine, and the shape-locking members may
move back into the locking position by means of a spring member, when the transfer member is moved away from the magazine.

[0023] The idea of an embodiment is that the shape-locking members between the drill bit holder and gripping member of the transfer device have in the gripping member at least one spring locking device arranged to settle in at least one locking groove or corresponding locking recess in the drill bit holder. Means to stop the flexing of the spring locking device away from the locking recess, that is, to stiffen the spring locking device, may be located in the gripping member.

Brief description of the figures

[0024] Some embodiments of the invention will be described in more detail in the attached drawings, in which

Figure 1 is a schematic side view of a rock drilling rig, the drilling unit of which is furnished with a retainer and a drill bit changer attached thereto,

Figures 2a to 2c are schematic perspective views of drill bits, and Figure 2b also illustrates gripping to the hole inside the drill bit,

Figure 3 is a schematic top view of the operation of a drill bit changer,

Figure 4 is a schematic view of a magazine,

Figure 5 is a schematic, partly sectional detail of the magazine of Figure 4,

Figure 6 is a schematic side view of a possible shape-locking between the gripping member of the transfer device and the drill bit holder,

Figure 7 is a schematic, partly sectional side view of a gripping member of the transfer device,

Figures 8a and 8b are schematic top views of the locking principle of the gripping member according to Figure 7, and

Figures 9a and 9b show schematic, sectional side views of yet another arrangement for locking the gripping member to the drill bit holder by means of an expanding machine element.

[0025] In the figures, some embodiments of the invention are shown simplified for the sake of clarity. Similar parts are marked with the same reference numbers in the figures.
Detailed description of the invention

[0026] The rock drilling rig 1 shown in Figure 1 comprises a moveable carrier 2 on which one or more drilling booms 3 are arranged having a drilling unit 4 at their outermost ends. The drilling unit 4 comprises a feed beam 5 supporting a rock drilling machine 6 that may be moved by means of a feed device 7 in the drilling direction A and reverse direction B. In the figure, a dotted line marks a drilling line, that is, drilling centre C. The rock drilling machine 6 may comprise an impact device 8 for providing impact pulses on a tool 9 connected to the rock drilling machine 6. Further, the rock drilling machine 6 may comprise a rotating device 10 for turning the tool 9 about its longitudinal axis. During drilling, the tool 9 is in the drilling centre C and may comprise a drill rod 11 that has at its outermost end a replaceable drill bit 12. Further, in what is known as extension rod drilling, several drill rods 11 are connected consecutively to drill long bores 13. When drilling rock, the bit buttons of the drill bit 12 or corresponding parts cutting the rock wear and may also be damaged, which is why drill bits 12 are changed during drilling. Further, different special bits for various drilling situations and rock conditions may be used to improve rock drilling and drilling quality. The drill bit 12 is typically connected to the drill rod 11 with a threaded connection.

[0027] At the leading end of the feed beam 5, that is, in the outermost part of the feed beam 5 as seen in the drilling direction A, there is a retainer 14 that comprises jaws or corresponding holding members, with which a replaceable drill bit 12 may be fastened stationary at least for as long as the threaded connection between the drill rod 11 and drill bit 12 is opened or closed by rotating the drill rod by means of the rotating device 10 of the rock drilling machine 6. The retainer 14 may be positioned in such a manner that the held tool 9 is in the drilling centre C. The structure of the retainer 14 may be constructed in various ways.

[0028] On the leading edge portion of the feed beam 5, in connection with the retainer 14, a drill bit changer 15 is also arranged, and it comprises a magazine 16 in which a required number of drill bits, typically 5 to 10, may be stored. The magazine 16 may be a rotating disc, in which spaces are formed for supporting the drill bits 12 to be stored. Alternatively, the magazine 16 may be a chain magazine or any other suitable construction with several corresponding spaces. The drill bit changer 15 may further comprise one or more stopping members 17 with which the drill bit 12 may be mechanically
stopped at a predefined axial position in the drilling centre C. The stopping member 17 may be a slide, for instance, which may be pushed from the front side of the retainer 14 into the drilling centre C and against whose surface on the rock drilling machine 6 side the leading end of the drill bit 12 is pushed before the drill bit 12 is fastened with the retainer 14 stationary for the purpose of change. Yet further, the drill bit changer 15 comprises one or more transfer devices 18 with which the drill bits 12 may be transferred from the magazine 16 to the retainer 14 and vice versa.

[0029] Figures 2a to 2c show different drill bits 12. As seen from the figures, the drill bits 12 are externally quite different. The drill bit 12 of Figure 2a has a spiral groove on the outer circumference of the frame part 12a, whereas in the drill bit 12 of Figure 2b, the frame part 12a is a smooth cylinder. Further, in Figure 2c, the frame part 12a is equipped with a grooved shoulder 20. Because the external appearances of different drill bits 12 may differ quite a lot from each other, it is difficult to handle the drill bits 12 at their frame parts 12a. It is demanding to create a universal gripper or the like. On the other hand, gripping the tip or working part 12b at the leading end of the drill bit 12 should be avoided, because it is the most critical part of the drill bit and equipped with hard, but fragile drill buttons 21. However, the drill bits 12 may be handled by means of a suitable projecting or pin-like separate drill bit holder 22 that may be pushed into the hole 23 in the frame part 12a of the drill bit arranged to normally receive the connecting part of the drill rod 11. Owing to the drill bit holder 22, the drill bits 12 may be handled in the magazine 16 and during transfers without the risk of damaging the working part 12b.

[0030] Figure 3 shows a drill bit changer 15 arranged to a retainer 14. The changer 15 may comprise a transfer device 18 that is a kind of manipulator. The transfer device 18 may comprise a first transfer device 18a and a second transfer device 18b that are connected to each other by means of a fastening piece 35. The first transfer device 18a is arranged to move the second transfer device 18b and a gripping member 36 connected thereto linearly in the transverse direction E so that the drill bit 12 may be transferred between the magazine 16 and the jaws 25 of the retainer 14. The second transfer device 18b is arranged to move the drill bit holder 22 in and out of the drill bit hole 23. The drill bit holder 22 is an elongated piece whose first end may comprise a gripping part 38 to which the gripping member 36 of the transfer device 18 may attach and by means of which the drill bit holder 22 is fastened to the
magazine 16. Further, the drill bit holder 22 may comprise an arm 39 with two or more support pieces 40a and 40b arranged thereto and dimensioned to support themselves against connection threads 41 when inside the hole 23 of the drill bit 12. Further, the rearmost first support piece 40a may comprise a shoulder 46, flange or the like that may support itself against the rear surface of the drill bit 12 and support the drill bit 12 in the axial direction. When the drill bit holder 22 is pushed by means of the second transfer device 18b into the hole 23, the first support piece 40a settles against the rear part of the drill bit 12, whereas the second support piece 40b that is rigidly connected to the arm 39 may push even further toward the leading end of the drill bit 12. The support pieces 40a and 40b then settle at a distance from each other, whereby the drill bit 12 is firmly supported by the surfaces of the hole 23. The spaced apart support pieces 40a, 40b ensure that the drill bit 12 remains straight. The bit holder 22 may have adjusting members 45, such as adjusting screws, with which the maximum distance between the support pieces 40a, 40b in the direction H may be adjusted. At the same time, the adjusting member 45 affects the distance between the gripping part 38 and first support piece 40a in the direction H. Because the drill bit 12 is supported at its rear by means of a shoulder 46, the adjustment of the drill bit holder 22 permits the setting of the leading ends of drill bits 12 of different lengths at the same point in the magazine 16. When the magazine is positioned at the retainer 14 in the axial direction and when the leading ends of the drill bits 12 are set level in the magazine 16, transfers between the magazine 16 and retainer 14 may be done using a simple crosswise linear movement E of the first transfer device 18a.

[0031] When the drill bit 12 is pressed between the jaws 25, the second transfer device 18b is used to pull the drill bit holder 22 backward, that is, in the reverse direction B, whereby the support pieces 40a, 40b settle against each other and emerge from the hole 23. Next, the drill bit holder 22 is transferred by means of the first transfer device 18a away from the drilling centre C, and the drill rod 11 is connected to the drill bit 12, after which the stopping member 17 and jaws 25 are opened. Normal drilling may then begin.

[0032] Figure 3 further shows that the drill rod 11 is transferred in the drilling centre C in the reverse direction B for the time of the drill bit 12 replacement. The leading end of the drill rod 11 is equipped with a connection part 43 with a connection thread 44 that may be connected to an internal connection thread 41 of the drill bit 12 in the retainer 14 by feeding the drill rod 11
in the drilling direction A and at the same time turning the drill rod 11 about its longitudinal axis by means of the rotating device 10 of the rock drilling machine 6. When the drill bit 12 connected to the drill rod 11 is detached, the stopping member 17 is closed and the drill bit 12 is pushed against the stopping member 17. This way, the drill bit 12 is always positioned correctly for the transfer device 18 and retainer 14.

[0033] Figure 4 also shows that the magazine 16 may comprise a disc-like frame part 50 that may be turned relative to the rotation axis 29 to select the required drill bit. The circumference of the frame part 50 of the magazine 16 has several spaces 30 into which a drill bit holder 22 like the one described in Figures 2b and 3 may be detachably arranged. By turning the frame part 50 in the direction G, each space 50 may be set one at a time into the changing station 37, in which the drill bit holder and a possible drill bit in it may be removed from the magazine by using the transfer device or, alternatively, a drill bit holder may be arranged into an empty space 30 by means of the transfer device. The spaces 30 are elongated holes that open towards the outer circumference of the frame part 50. A protective part 51 may surround the outer circumference of the frame part 50 to prevent the exit of drill bit holders from the spaces 30 when not at the changing station 37.

[0034] Figure 5 shows a detail of the magazine 16 according to Figure 4. The gripping part 38 of the drill bit holder may be cylindrical and may comprise a circumferential fastening groove 52, with which the gripping part 38 may fasten to the elongated space 30 in the frame part 50 of the magazine. The figure also shows the protective part 51 that prevents the drill bit holder from sliding away from the space 30 in the direction of the radius of the disc-like frame part.

[0035] Naturally, the gripping part 38 of the drill bit holder 22 may also be constructed in some other manner, as may the spaces 30 in the magazine and the transfer pin or corresponding gripping member 36 of the transfer device.

[0036] If the magazine 16 is a chain magazine, a movable chain forms its frame part that is equipped with several fastening spaces for receiving the drill bit holders 22. Correspondingly, the frame part of the magazine may also be of a different shape and it may be moved linearly instead of a turning movement.
[0037] It should be noted that the support pieces 40a, 40b of the drill bit holder 22 may comprise means for gripping the drill bit hole 23 so that the drill bit 12 will not detach from the holder 22 even though the feed beam 5 was directed downward. The support pieces 40a, 40b may comprise friction pieces, such as retaining rings made of rubber or a corresponding elastic material. Further, the drill bit holder 22 may have an expanding section that may expand under the effect of a pressure medium or mechanical movement and press against the inner surfaces of the hole 23 of the drill bit 14.

[0038] Figure 6 shows in a very simplified manner an arrangement for fastening the drill bit holder 22 to the gripping member 36 of the transfer device. The gripping member 36 may be equipped with spring locking members 60 having locking nails or corresponding protrusions 61 that in their locking position may be inside a locking groove or a corresponding locking recess 63 in a hole 62 belonging to the gripping part 38 of the drill bit holder 22. This forms a shape lock between each spring locking member 60 and locking recess 63 to prevent the drill bit holder 22 from inadvertently detaching from the gripping member 36. The spring locking members 60 may be stiffened in their locking position so that the locking protrusions 61 cannot move away from the locking recess 63 in the manner shown by the dashed line in Figure 6. The gripping member 36 may have means with which the locking protrusions 61 may, when desired, be released, whereby the drill bit holder 22 and gripping member 36 may be detached from each other. Instead of the spring-like locking members 60, it is naturally also possible to use rigid locking members that shape-lock with the form surfaces in the hole 62. The relative movement of the shape-locking members to open and close the shape lock may take place mechanically, for instance due to the movement of the transfer device, or alternatively it is possible to use a pressure medium-operated or electrically operated actuator to provide the necessary movement.

[0039] Figure 7 shows a gripping member 36 that comprises two spring locking members 60 fastened to the frame 64. Further, the gripping member has a centre pin 65 arranged rotatably relative to the frame 64. The centre pin 65 is furnished with longitudinal grooves 66, whereby the centre pin 65 may be turned about its longitudinal axis into a position where the grooves 66 are at the spring locking members 60. The spring locking members 60 may then push into the grooves 66, which permits the spring locking members to move away from the locking groove or the like of the drill bit holder. In their
locking position, the spring locking members 60 are against the outer surface of the centre pin 65, whereby they cannot yield away from the locking groove of the drill bit holder. In this embodiment, the spring locking members 60 are thus stiffened in their locking position, whereby the shape lock between the drill bit holder and gripping member 36 is rigid. When the spring locking members 60 are at the grooves 66 and the gripping member 36 is pushed to the gripping part of the drill bit holder, the spring locking members 60 may bend toward the grooves 66 and yield until they finally push into the locking groove of the drill bit holder.

[0040] Figure 8a illustrates in a very simplified manner a situation, in which the grooves 66 and the spring locking members 60 are at different points. When the transfer device moves the gripping member 36 in the direction R, a first mating surface 67 meets a second mating surface 68 in the magazine 16, which provides a turning movement S of the centre pin 65. As a result of this, the grooves 66 settle at the position of the spring locking members 60, as shown in Figure 8b. A spring member may act on the centre pin 65 to turn it back to its locking position after the gripping member 36 is moved away from the magazine 16.

[0041] Figure 9a shows an arrangement, in which the gripping member 36 is locked to the drill bit holder 22 by means of an expanding locking member 70, such as a rubber sleeve or the like. The drill bit holder 22 may have a locking recess 63 or groove, to which the locking member 70 may push sideways as shown in Figure 9b after the turning member 71 has been acted on and the centre pin 72 has made the pressing sleeve 73 press the locking member 70. Between the centre pin 72 and pressing sleeve 73, there may be a high-pitch thread 74 that converts the turning movement of the centre pin 72 to a linear movement of the pressing sleeve 73. The turning member 71 may be acted on in the same way as the first mating surface 67 is acted on in Figures 8a and 8b. Naturally, the turning of the centre pin 72 may also be provided with a suitable rotating device. The expanding locking member 70 may also be a spring member, such as a spring plate which under pressure expands sideways and pushes into the locking recess 63.

[0042] It should be noted that the locking solution shown in Figures 8a to 9b may also be applied to situations where the gripping member 36 grips the drill bit or some other drill component directly.
[0043] In some cases, the features described in this application may be used as such, regardless of other features. On the other hand, the features described in this application may also be combined to provide various combinations as necessary.

[0044] The drawings and the related description is only intended to illustrate the idea of the invention. The invention may vary in detail within the scope of the claims.
Claims

1. A drill bit magazine, into which several replaceable drill bits used in rock drilling are storable,
   and the magazine (16) comprises:
   a movable frame part (50),
   several spaces (30), each of which is arranged to retain one drill bit (12), and
   at least one changing station (37), to which each space (30) is moved at a time by moving the frame part (50), whereby a drill bit (12) may be brought to an empty space (30) at the changing station (37) and a drill bit (12) may be removed from a space (30) at the changing station (30),
   characterised in that
   each space (30) in the magazine (16) is arranged to detachably receive and connect one separate drill bit holder (22),
   each stored drill bit (12) is arranged to be supported by means of the drill bit holder (22) into the magazine (16), and
   the drill bit holder (22) is supported against at least one inside surface (41) of the drill bit (12).

2. A drill bit magazine as claimed in claim 1, characterised in that
   the frame part (50) of the magazine is a disc-like piece equipped with several fastening holes (30), each of which is arranged to receive one drill bit holder (22),
   each fastening hole (30) opens toward the outer circumference of the disc-like frame part (50),
   the drill bit holder (22) comprises a gripping part (38) having a fastening groove (52) so that the drill bit holder (22) is supported by means of the groove (52) to said fastening hole (30) and movable at the changing station (37) in the direction of the radius of the disc-like frame part (50),
   the movement of the drill bit holders (22) is prevented by means of at least one protecting member (51) when not at the changing station (37), and
   the disc-like frame part (50) is turnable relative to a turning axis (29) for moving the fastening holes (30) relative to the changing station (37).

3. A drill bit magazine as claimed in claim 1 or 2, characterised in that
the drill bit (12) stored in the magazine (16) is supported to the
frame part (50) of the magazine by means of the drill bit holder (22) only.

4. A drill bit holder for handling replaceable drill bits used in rock
drilling, characterised in that
the drill bit holder (22) is a separate projecting piece that is support-
able against at least one inside surface (41) of the drill bit (12), and
the drill bit holder (22) comprises a gripping part (38) for handling
and fastening the drill bit holder (22).

5. A drill bit holder as claimed in claim 4, characterised in that
the drill bit holder (22) comprises an elongated arm (39), and
along the first end portion of the arm (39), there is a cylindrical grip-
ing part (38),
the centre axis of the gripping part (38) has a longitudinal hole (54)
that a transfer device (18) of a drill bit changer acts on, and
the outer surface of the gripping part (38) has a circumferential fast-
tening groove (52), by which the drill bit holder (22) is fastenable to the maga-
zine (16).

6. A drill bit holder as claimed in claim 4 or 5, characterised in that
the drill bit holder (22) comprises an elongated arm (39) and at least
two support pieces (40a, 40b) that are arranged to support themselves against
inside connection threads (41) of the drill bit (12),
the first support piece (40a) is arranged movable relative to the arm
(39),
the second support piece (40b) is arranged on the outermost end
portion of the arm (3) stationary relative to the arm (39), and
the first support piece (40a) and second support piece (40b) are
settable at an axial distance from each other and correspondingly against each
other by moving the arm (39) relative to the first support piece (40a).

7. A drill bit holder as claimed in claim 6, characterised in that
the drill bit holder (22) comprises at least one adjusting member (45)
for setting the maximum axial distance between the first support piece (40a)
and second support piece (40b) to correspond the drill bit (12) being handled.
8. A drill bit holder as claimed in claim 6 or 7, characterised in that
the first support piece (40a) comprises a cylindrical portion that is
arrangeable inside the drill bit (12) and a shoulder (46) that is arrangeable
against the rear surface of the drill bit (12).
9. A drill bit holder as claimed in any one of the preceding claims 6
to 8, characterised in that
the first support piece (40a) and second support piece (40b) are de-
tachable pieces, whereby they are changeable to correspond to the drill bit
(12) being handled at each time.
10. A method for changing a drill bit in a rock drilling unit,
the method comprising:
storing several replaceable drill bits (12) into a magazine (16),
detaching the connection between a drill rod (11) and drill bit (12),
bringing the detached drill bit (12) into the magazine (16) by means
of a transfer device (18),
taking with the transfer device (18) a new drill bit (12) from the
magazine and taking it to a drilling centre (C), and
connecting a drill rod (11) into the new drill bit (12),
characterised by
arranging inside each drill bit (12) a projecting drill bit holder (22)
that is a separate piece from the magazine (16),
handling each drill bit (12) being replaced during transfers and stor-
age by only affecting the drill bit holder (22), and
taking the drill bit holder (22) out of the drill bit (12) before the drill
rod (11) and drill bit (12) are connected to each other.
11. A method as claimed in claim 10, characterised by
supporting the drill bit holder (22) to the inside connection threads
(41) of the hole (23) in the drill bit (12).
12. A method as claimed in claim 10 or 11, characterised by
storing into the magazine simultaneously at least several different
drill bits (12) that differ from each other in outer dimensions or shapes, and
supporting the differing drill bits (12) into the magazine (16) by
means of drill bit holders (22) that are similar to each other.
### INTERNATIONAL SEARCH REPORT

**International application No.**

PCT/FI2009/050510

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### A. CLASSIFICATION OF SUBJECT MATTER

See extra sheet

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

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### B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

**IPC:** E21B

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

FI, SE, NO, DK

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

EPO-INTERNAL, WPI, INSPEC, XPESP, COMPDX

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### C. DOCUMENTS CONSIDERED TO BE RELEVANT

<table>
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<tr>
<th>Category</th>
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<th>Relevant to claim No.</th>
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<td>A</td>
<td>WO 2008054302 A1 (ATLAS COPCO ROCK DRILLS AB et al.) 08 May 2008 (08.05.2008)</td>
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<tr>
<td>A</td>
<td>IT 1243319 B (CLEMENTI AGOSTINO) 26 May 1994 (26.05.1994)</td>
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☑ □ Further documents are listed in the continuation of Box C.

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**Date of the actual completion of the international search**

15 September 2009 (15.09.2009)

**Date of mailing of the international search report**

07 October 2009 (07.10.2009)

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