



(51) International Patent Classification:

E21B 10/61 (2006.01) *E21B 10/54* (2006.01)
E21B 10/60 (2006.01)

(21) International Application Number:

PCT/SE2010/050691

(22) International Filing Date:

18 June 2010 (18.06.2010)

(25) Filing Language:

English

(26) Publication Language:

English

(30) Priority Data:

2009202702 19 June 2009 (19.06.2009) AU

(71) Applicant (for all designated States except US): **SANDVIK INTELLECTUAL PROPERTY AB** [SE/SE]; S-811 81 Sandviken (SE).

(72) Inventors; and

(75) Inventors/Applicants (for US only): **KENNY, Matthew** [AU/AU]; 1/13 Steel Street, Hamilton, New South Wales 2303 (AU). **WEAVER, Steven** [AU/AU]; 15 Poplar Close, Fletcher, New South Wales 2287 (AU).

(74) Agent: **CARLSSON, Lars-Åke**; Sandvik Intellectual Property AB, S-811 81 Sandviken (SE).

(81) Designated States (unless otherwise indicated, for every kind of national protection available): AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PE, PG, PH, PL, PT, RO, RS, RU, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) Designated States (unless otherwise indicated, for every kind of regional protection available): ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Published:

— with international search report (Art. 21(3))

[Continued on next page]

(54) Title: A DRILL BIT AND A DRILL TIP

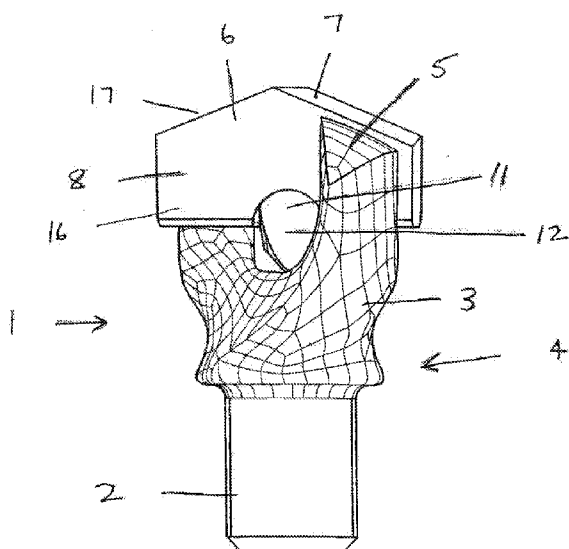


FIG. 1

(57) Abstract: A drill bit (1), rotatable about an axis, and including proximal and distal ends spaced apart along the axis, the drill bit having a drill tip (6) and a bit body (4), the drill tip being located at the distal end of the drill bit, the drill bit having a transverse flushing port (12) extending transverse to the axis and intermediate the proximal and distal ends and being defined partly by the drill tip and partly by the bit body. The invention also relates to a drill tip.



— *before the expiration of the time limit for amending the
claims and to be republished in the event of receipt of*

amendments (Rule 48.2(h))

A DRILL BIT AND A DRILL TIP

TECHNICAL FIELD

5 The present invention relates to drill bits and to drill tips for use in conjunction with drill bits. The invention has been developed especially, though not exclusively, for use in drilling for mining and tunneling operations and the invention is herein described in that context.

10 BACKGROUND OF THE DISCLOSURE

Roof and wall support is vital in mining and tunnelling operations. Mine and tunnel walls and roofs consist of rock strata, which must be reinforced to prevent the possibility of collapse. Rock bolts are widely
15 used for consolidating the rock strata.

In conventional strata support systems, a hole is drilled into the rock by a drill rod, which is then removed and a rock bolt is installed in the drilled hole and secured in place, typically using a resin or cement based grout.
20 Alternatively, self drilling rock bolts are utilised, whereby the bolt is also used as the drill rod.

A rotary drill bit is commonly used for drilling holes in rock walls. Conventionally the drill bit has a pair of flutes extending the length of the drill bit, dimensioned such that they do not contact the wall of the drill
25 hole. The flutes are utilized to withdraw cut material and flush the drill bit as the drill bit moves into the rock wall.

WO 2004085792 discloses a drill bit body to which a drill tip is fixed in a bonding position prior to brazing. The drill tip has means to resist shifting
30 movement of the drill tip in a drill bit slot away from the bonding position.

SUMMARY OF THE DISCLOSURE

Disclosed is a drill bit, rotatable about an axis, and including proximal and distal ends spaced apart along the axis, and a transverse flushing port extending through the bit transverse to the axis and intermediate the proximal and distal ends. In one form the flushing port is defined partly by the drill tip and partly by the bit body.

The flushing port extending transversely through the drill bit results in improved flushing characteristics, allowing for material to be flushed away from the drill bit. A larger flushing port area is allowed by defining the flushing port partly by the drill tip and partly by the bit body. Application of a fluid (most commonly air or water) to the drill bit through a central cavity in the drill bit flushes cut material from the drill bit and allows for more efficient drilling operation.

In one form the drill bit includes a bit body and a drill tip. In one form the distal end incorporates the drill tip.

In one form the proximal end is arranged to be connected to or integrally formed with a drill rod.

In one form the drill tip engages the bit body at a tip engagement portion. In one form the tip engagement portion comprises two engagement prongs extending from the bit body.

In one form the drill tip extends from a proximal engagement portion to a distal drilling portion and the engagement portion includes a cutout which defines at least a portion of the flushing port.

In one form the proximal end of the drill bit is arranged to be connected to

- 3 -

or integrally formed with a drill rod.

In one form the drill bit is adapted for drilling rock.

5 In a second aspect, disclosed is a drill tip, adapted to engage with a drill bit body for rotary drilling, the drill tip having a cutting edge and an opposite edge, the opposite edge including a cut out section. In one form the cut out section is adapted to engage with the drill bit body to define a flushing port extending between the drill tip and the drill bit body.

10

In a third aspect, disclosed is a drill tip having a cutting edge and an opposite edge, the cutting edge including cut out sections. In one form the cut out sections form grooves. These cut out sections form grooves and allow for the drill tip to move through the surface being drilled at a

15

faster speed

BRIEF DESCRIPTION OF THE DRAWINGS

20 Embodiments are described with reference to the accompanying drawings. The particularity of the drawings and related description is to be understood as not limiting the broad description of the invention.

In the figures:

25

Figure 1 is a side view of a drill bit according to one embodiment of the present invention;

30

Figure 2 is a side view of a drill tip of a second embodiment of the present invention;

Figure 3 is an end view of the drill tip of figure 2;

Figure 4 is a top view of the drill tip of figure 2; and

Figure 5 is a perspective view of the drill tip of figure 2.

5

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring to figure 1, disclosed is a drill bit 1 which is rotatable about an axis. In the illustrated form the drill bit 1 is for use in mining and tunneling operations for drilling in rock without using percussive force. The drill bit 1 comprises a shank 2, an engagement head 3 and a drill tip 6.

10

The shank 2 is elongate and is adapted to be affixed with a drill rod (not illustrated). In one form the shank 2 includes a male thread that cooperates with a female thread at the end of the drill rod. The drill rod in turn is connected with a rotary drive which provides rotary movement of the drill bit 1 about the longitudinal axis of the shank 2.

15

The engagement head 3 of the drill bit 1 is engaged with the shaft 2 at a point distal to the rotary drive. The engagement head 3 is either affixed with or integral to the shaft 2 such that rotation of the shaft 2 results in rotation of the engagement head 3 about the same longitudinal axis. The shaft 2 and engagement head 3 make up bit body 4.

20

The engagement head 3 includes a pair of drill tip engagement prongs 5 which extend from the engagement head 3 in a direction away from the shank 2. The drill tip engagement prongs 5 are configured to allow engagement with a drill tip 6 and are offset from one another such that a drill tip 6 can be positioned between the engagement prongs 5 and held in position by interaction with the tip engagement prongs 5. The drill tip 6 can thus be attached with the tip engagement prongs 5.

25

30

- 5 -

The drill tip 6 includes cutting edges 7 and a tip body 8. The tip body extends from a proximal end 16 to a distal end 17. Cutting edge 7 is formed on the distal end 17 of the tip body 8. The drill tip 6 is typically composed of hardened materials appropriate for drilling rock such as cemented tungsten carbide.

In use the drill tip 6 is inserted between the tip engagement prongs 5 transversely to the longitudinal axis of the shaft 2 about which the drill bit 1 rotates.

Tip body 8 includes cut-out portion 11 which is positioned in the proximal end 16 of the drill tip 6. Cut-out portion 11 is semi-circular in shape and extends from the proximal end 16 into the tip body 8.

When drill tip 6 is inserted between engagement prongs 5 in engagement head 3, it locates in a space defined by the engagement prongs 5. Cut-out portion 11 and the space defined by the engagement prongs 5 define flushing port 12 which extends through the drill bit 1. The flushing port 12 extends transversely to the longitudinal axis of shaft 2.

Flushing port 12 is adapted to facilitate the flow of material away from the cutting edge 7 of the drill tip 6.

In use the flushing port 12 can be utilized to move material away from the drill tip 6 as fluid flows through the drill bit 1 and flushes debris and loose material away from the drill tip 6. The shape of the engagement head 3 further assists in moving drilled material away from the cutting edges 7 of the drill tip 6 by allowing for flow down engagement head 3 away from drill tip 6.

While the flushing port 12 has been described in relation to a cavity which has formed between drill tip 6 and engagement head 3, there are alternative embodiments which are clear to one skilled in the art.

The flushing port 12 can alternatively be defined entirely by the engagement head 3 such that the flushing port 12 is a cavity extending transversely through the engagement head 3. Alternatively the flushing port 12 can be defined completely by a drill shaft 2, by being a cavity extending transversely through drill shaft 2. In another alternative, the flushing port 12 can be defined completely by drill tip 6. In this case the flushing port extends transversely through the drill tip 6. Each of these forms would be within the scope of the present disclosure.

10

The flushing port 12 extending transversely through the drill bit 1 and defined by the engagement prongs 5 and the cut-out portion 11, allows for a large flushing port 12. This improves the fluid flushing characteristics of the drill bit 1 and therefore improves the removal of material during drilling.

15

In a second embodiment of the drill tip, shown in Figures 2 through 5, the drill tip 25 includes cutting edge cutouts 35 positioned on cutting edges 27.

20

The drill tip 25 is shaped such that the cutting edges 27 are angled relative to one another. Upon rotation the cutting edges 27 are positioned facing forward as the drill tip 25 rotates about the rotational axis of the drill tip 25.

25

The drill tip 25 is an "A" frame house style tungsten carbide insert having a pair of oppositely facing, generally parallel side surfaces 31 and a pair of oppositely facing end surfaces 32. A pair of adjacent oppositely inclined top surfaces 26 extends between and interconnects the side 31 pairs of surfaces. Two bottom surfaces 34 are separated by an inverted U-shaped cut-out portion 30. The cut-out portion 30 is supposed to be free from any bonding areas such as for brazing.

30

The cutouts 35 form grooves extending through the cutting edges 27. The cutouts 35 are positioned such that the grooves formed face away from the cutting edges 27. The cutouts 35 act to reduce the surface area of the cutting edges 27 that contact the face of the rock within the hole being drilled, allowing for the drill tip to move through the surface being drilled at a faster speed.

The cutouts 35 are shown as curved grooves in this embodiment, however it is understood that the cutouts could take any reasonable shape to increase the surface area of the drill tip 25.

The cut outs 35 and the cut out portion 30 in the tungsten carbide reduce the amount of tungsten carbide or other hard material needed to manufacture the insert. For instance, in comparison to an insert bit dimensionally equivalent in size to applicants' insert that does not have a cut out or any other notches, 30-50% by weight less tungsten is needed to make applicants' insert bit. Cemented tungsten carbide is significantly more expensive per kilo than the cost of steel.

In the claims which follow and in the preceding description of the invention, except where the context requires otherwise due to express language or necessary implication, the word "comprise" or variations such as "comprises" or "comprising" is used in an inclusive sense, i.e. to specify the presence of the stated features but not to preclude the presence or addition of further features in various embodiments of the invention.

The disclosures in Australian patent application No. 2009202702, from which this application claims priority, are incorporated herein by reference.

CLAIMS

1. A drill bit, rotatable about an axis, and including proximal and distal ends spaced apart along the axis, the drill bit having a drill tip and a bit
5 body, the drill tip being located at the distal end of the drill bit, the drill bit having a transverse flushing port extending transverse to the axis and intermediate the proximal and distal ends and being defined partly by the drill tip and partly by the bit body.
- 10 2. A drill bit as defined in claim 1, wherein the drill tip engages the bit body at a tip engagement head.
3. A drill bit as defined in claim 2, wherein the tip engagement head comprises two engagement prongs extending from the bit body.
- 15 4. A drill bit as defined in any one of claims 1 through 3, wherein the flushing port is defined by interaction between the drill tip and the bit body.
- 20 5. A drill bit as defined in claim 4, wherein the drill tip extends from a proximal engagement portion to a distal drilling portion and the proximal engagement portion includes a cutout which defines at least a portion of the flushing port.
- 25 6. A drill bit as defined in any of the preceding claims, wherein the proximal end of the drill bit is arranged to be connected to or integrally formed with a drill rod.
7. A drill bit as defined in any of the preceding claims, adapted for drilling
30 rock.
8. A drill tip, adapted to engage with a drill bit body for rotary drilling, the

- 9 -

drill tip having a cutting edge and an opposite edge, the opposite edge including a cut out section.

5 9. A drill tip as defined in claim 8, wherein the cut out section is semi-circular in shape and extends from the opposite edge toward the cutting edge.

10 10. A drill tip as defined in claim 8 or 9, wherein the cut out section is adapted to engage with the drill bit body to define a flushing port extending transversely through the drill tip and drill bit body.

11. A drill tip as defined in any one of claims 8 to 10, wherein the cutting edge includes a plurality of cut out sections.

15 12. A drill bit, rotatable about an axis, the drill bit comprising a bit body and a drill tip, the drill tip having a drilling surface which includes cut-out sections.

20 13. A drill bit as defined in claim 12, wherein the cut-out sections in the drilling surface comprise grooves.

25 14. A drill tip, adapted to engage with a drill bit body, the drill tip having a cutting edge and an opposite edge, the cutting edge including cut-out sections.

15. A drill tip as defined in claim 14, wherein the cut-out sections comprise grooves.

30 16. A drill tip as defined in claim 14 or 15, wherein the opposite edge also includes a flushing cut-out section.

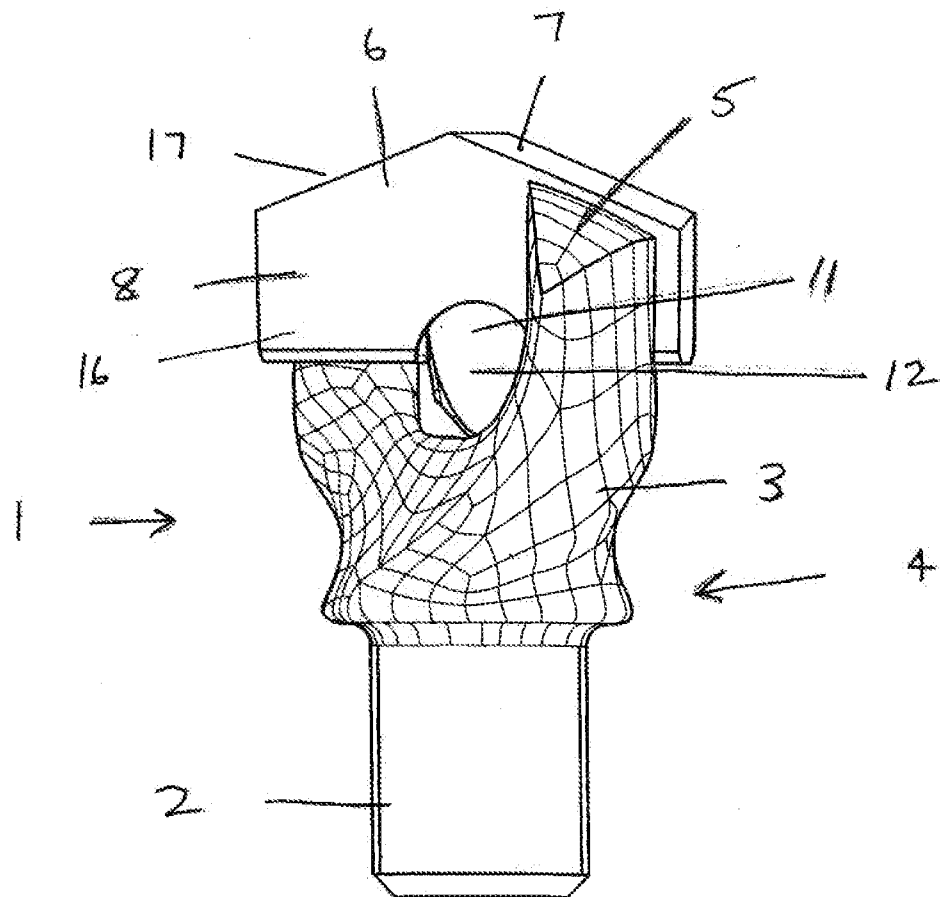
17. A drill tip as defined in claim 16, wherein the flushing cut-out

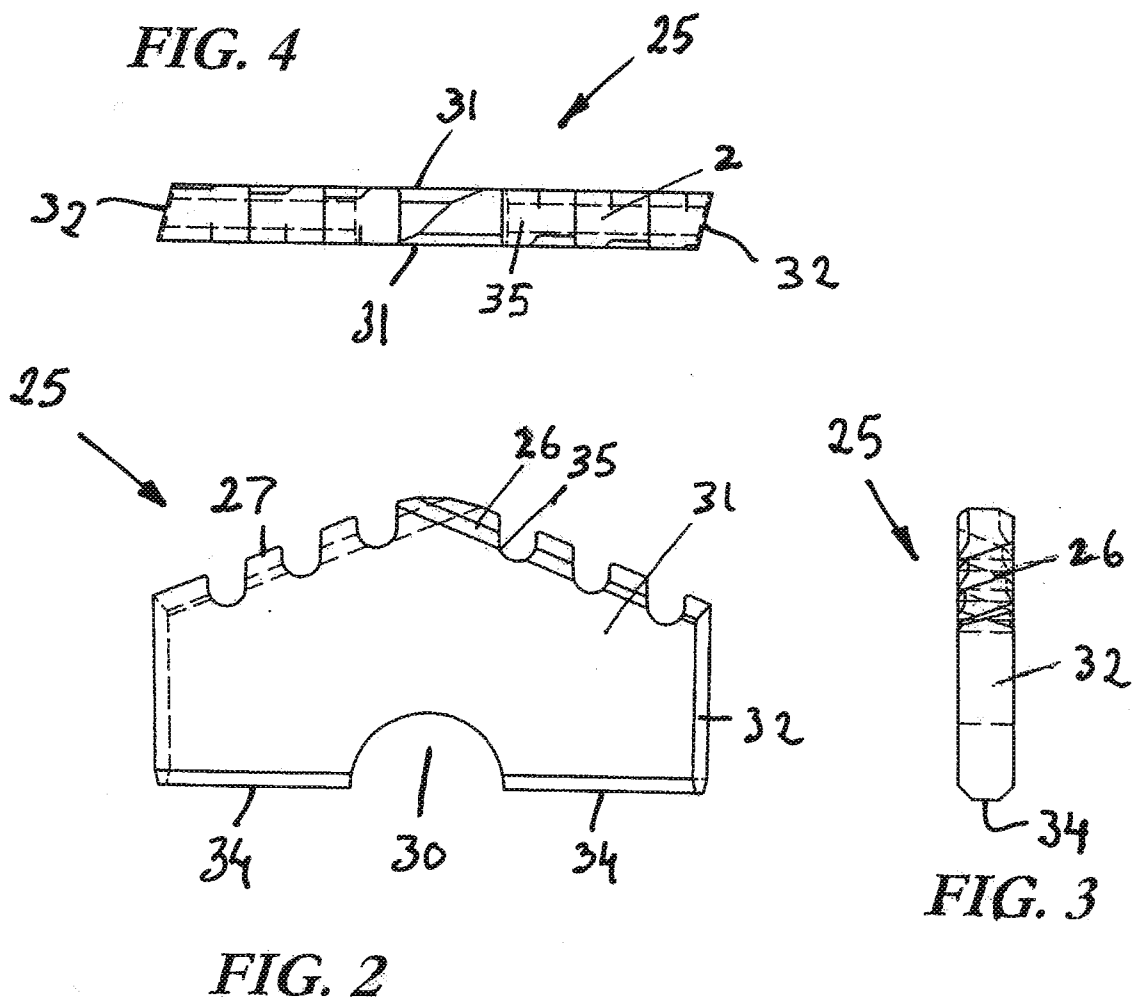
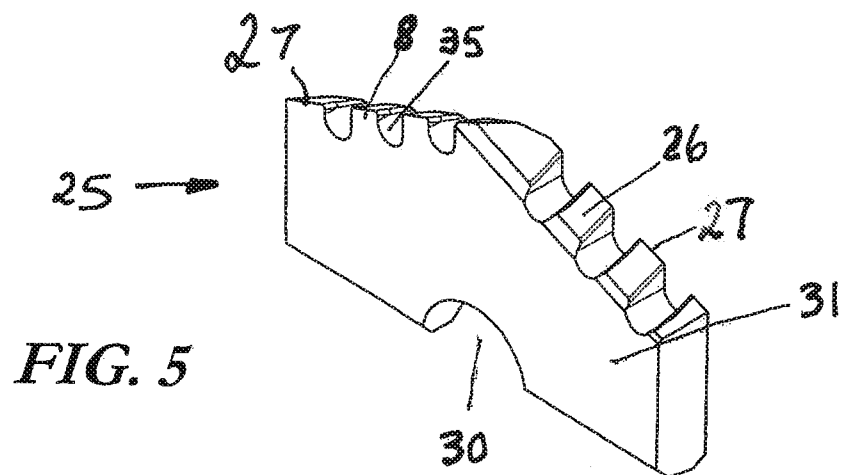
– 10 –

section is semicircular and extends from the opposite surface towards the drilling surface.

- 18. A drill tip as defined in claim 16 or 17, wherein the flushing cut out**
5 **section is adapted to engage with the drill bit body to define a flushing**
port extending transversely through the drill tip and drill bit body.

1/2

**FIG. 1**



INTERNATIONAL SEARCH REPORT

International application No.
PCT/SE2010/050691

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

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	DE 3738942 A1 (EASTMAN CHRISTENSEN CO), 1 June 1989 (1989-06-01); whole document	1-11
A	US 5996714 A1 (MASSA TED R ET AL), 7 December 1999 (1999-12-07); whole document	1-11
A	US 4190128 A1 (EMMERICH KENNETH C), 26 February 1980 (1980-02-26); whole document	1-11
A	GB 705020 A1 (CONS PNEUMATIC TOOL COMPANY LT ET AL), 3 March 1954 (1954-03-03); whole document	1-11



Further documents are listed in the continuation of Box C.



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

04-11-2010

Date of mailing of the international search report

08-11-2010

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/SE2010/050691

Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:

2. ☐ Claims Nos.:
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:

3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box No. III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

The following separate inventions were identified:

- 1: Claims 1-11 directed to a drill bit and a drill tip of the drill bit, including a transverse flushing port.
- 2: Claims 12-18 directed to a drill bit and a drill tip of the drill bit, the drilling surface of which includes cut-out sections.

.../...

1. ☐ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.
2. ☐ As all searchable claims could be searched without effort justifying additional fees, this Authority did not invite payment of additional fees.
3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:
4. ☒ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.: 1-11

Remark on Protest

- ☐ The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.
- ☐ The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.
- ☐ No protest accompanied the payment of additional search fees.

Continuation of: Box No. III

A partial search has been carried out, which relates to the invention 1 mentioned above.

The present application has been considered to contain two inventions which are not linked such that they form a single general inventive concept, as required by Rule 13 PCT for the following reasons:

Independent claims 1 and 8 relate to the problem of improving the flushing characteristics of a drill bit which includes a transverse flushing port. This problem appears to be solved by forming the transverse flushing port in such a way that it, simultaneously, is partly defined by the drill tip and partly defined by the bit body.

Independent claims 12 and 14 relate to the problem of improving the rate of penetration of the drill bit. This problem is solved by forming cut-out sections in the drilling surface of the drill tip.

As both the problems and solutions are technically different, no single general concept can be formulated based on the technical features of the inventions. Consequently, the requirements of Rule 13.1 PCT are not met.

It was investigated under Rule 13.2 if any further feature, either in the claims or derivable from the description, could be considered as a same or corresponding feature, and could be considered a special technical feature establishing a technical link between the two groups of inventions.

No such features were identified.

Consequently, the two groups of inventions are not so linked as to form a single general inventive concept as required by Rule 13.1 PCT.

Continuation of: second sheet

International Patent Classification (IPC)

E21B 10/61 (2006.01)

E21B 10/60 (2006.01)

E21B 10/54 (2006.01)

Download your patent documents at www.prv.se

The cited patent documents can be downloaded:

- From "Cited documents" found under our online services at www.prv.se
(English version)
- From "Anförda dokument" found under "e-tjänster" at www.prv.se
(Swedish version)

Use the application number as username. The password is **HJSIPCCPMX**.

Paper copies can be ordered at a cost of 50 SEK per copy from PRV InterPat (telephone number 08-782 28 85).

Cited literature, if any, will be enclosed in paper form.

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

PCT/SE2010/050691

DE	3738942 A1	01/06/1989	SE	8804048 A	09/11/1988
US	5996714 A	07/12/1999	AU	8255798 A	10/02/1999
			AU	728745 B2	18/01/2001
			CA	2293251 A1	28/01/1999
			DE	69803677 D1	14/03/2002
			EP	0996807 A1	03/05/2000
			PL	337671 A1	28/08/2000
			US	6260638 B1	17/07/2001
			WO	9904129 A1	28/01/1999
			ZA	9805662 A	26/01/1999
US	4190128 A	26/02/1980	AU	522868 B2	01/07/1982
			AU	5197279 A	26/06/1980
			CA	1120918 A1	30/03/1982
			DE	2945766 C2	20/10/1983
			ZA	7905775 A	29/10/1980
GB	705020 A	03/03/1954	NONE		