

## INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
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| <p>(51) International Patent Classification<sup>4</sup> :<br/>A61B 17/32, B26B 29/02, 3/00</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | <p>A1</p> | <p>(11) International Publication Number: WO 87/ 05485<br/>(43) International Publication Date: 24 September 1987 (24.09.87)</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| <p>(21) International Application Number: PCT/GB87/00186<br/>(22) International Filing Date: 17 March 1987 (17.03.87)<br/>(31) Priority Application Number: 8606601<br/>(32) Priority Date: 18 March 1986 (18.03.86)<br/>(33) Priority Country: GB<br/>(71) Applicant (for all designated States except US): SABRE INTERNATIONAL PRODUCTS LIMITED [GB/GB]; Manor Farm Road, Reading, Berkshire RG2 0LQ (GB).<br/>(72) Inventors; and<br/>(75) Inventors/Applicants (for US only) : CHASE, Anthony, John [GB/GB]; 4 Jesse Close, Yateley, Camberley, Surrey GU17 7AH (GB). PAYNE, John, Ernest [GB/GB]; 5 Hardwick Road, Tilehurst, Reading, Berkshire RG3 4LH (GB).</p>                                                                                                           |           | <p>(74) Agent: SIMPSON, Ronald, Duncan, Innes; A.A. Thornton &amp; Co., Nothumberland House, 303-306 High Holborn, London WC1V 7LE (GB).<br/>(81) Designated States: AT (European patent), BE (European patent), CH (European patent), DE (European patent), DK, FR (European patent), GB (European patent), IT (European patent), JP, LU (European patent), NL (European patent), NO, SE (European patent), US.<br/><br/><b>Published</b><br/><i>With international search report.<br/>Before the expiration of the time limit for amending the claims and to be republished in the event of the receipt of amendments.</i></p> |
| <p>(54) Title: KNIVES</p> <div style="text-align: center;"> </div>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| <p>(57) Abstract</p> <p>A knife, such as a surgical scalpel or a handymans knife has a protective blade cover (3) moulded integrally with the handle of the knife. The end portion of the knife and the cover are both formed in mating halves about a common fold line and the knife blade is secured by folding the halves over each other to trap the blade and securing, as by welding. The cover has a part-circular recess (5) to receive a part-circular tip (7) at the end of the handle. The knife and cover are connected together only by a frangible web between the recess (5) and tip (7). When the web is ruptured for first removal of the cover, the tip (7) has snap-fitting engagement in the recess (5) to permit replacement and retention of the cover.</p> |           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |

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Knives

This invention relates to knives having removable protective covers for their cutting edges. The invention is particularly applicable to the design and manufacture of disposable surgical scalpels, but is  
5 also applicable to other knives, such as for model making or other domestic uses.

In accordance with a feature of the invention, a knife comprises a plastics moulded handle, to which a knife blade is secured, and a removable protective  
10 cover, for at least the cutting edge of the blade, formed integrally with the handle.

In a preferred form of the invention, both an end portion of the handle and the cover are each moulded in two generally co-planar halves connected together along  
15 a common fold line, and the halves of the cover are connected frangibly to the halves of the handle part, so that a blade can be located and secured in position by folding over the moulding and securing the respective halves together (as by welding).

20 This preferred form of the invention will now be described by way of example, with reference to the accompanying drawings, in which:

Figs. 1 and 2 show a disposable scalpel with the cover in position to protect the blade, and having  
25 been removed, respectively; and

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Figs. 3 and 4 are views of the unitary moulding for the handle and cover, as moulded, from opposite sides.

The scalpel shown in Figs. 1 and 2 comprises  
5 a handle 1 having a blade 2 set into one end of the handle, and a removable protective cover 3, which completely envelops the blade as shown in Fig. 1, until removed for use of the scalpel (Fig.2).

As will be described in detail below, the  
10 cover 3 is formed integrally with the handle and is actually closed and formed in the same operation in which the blade is secured in position, thus assuring the integrity of the blade edge from that time on, until deliberately removed when the scalpel is to be used.

15 The side walls of the cover are formed with matching notches 4 each having the form of an acute angle with a circular recess 5 at the apex, the recess having an arcuate extent in excess of 180°. The adjacent end portion 6 of the handle is shaped, on either side of  
20 the blade, to fit easily into the notch 4 and terminates in a part-circular tip 7 located in the recess 5. The cover 3, which is otherwise separate from the handle, is removed by pulling it longitudinally away from the handle, the resilience of the material enabling the tips  
25 7 to snap out the corresponding recesses 5.

Although the cover of a disposable surgical  
scalpel does not strictly need to be replaced, since the scalpel should be used for only one incision, the cover can be snap fitted back into position if desired,  
30 e.g. to shield the edge for disposal of the scalpel. For knives intended for repeated use, the interconnecting portions can be dimensioned to be more durable to withstand repeated engagement and disengagement of the parts.

35 Figs. 3 and 4 show the plastics parts of the

- 3 -

knife on a larger scale, in the form in which they are moulded.

The major part of the handle is solid, of a generally flattened rectangular cross-section, but the end portion of the handle is formed in two generally co-planar halves 8,9 connected together along a fold line 10. The cover is correspondingly formed in two halves 11,12 connected to each other along an extension 13 of the fold line 10. The cover halves are connected to the handle halves only by frangible arcuate webs 15 around the tips 7, as seen in Fig. 3, which shows the eventual outer surfaces of the respective halves.

As seen in Fig. 4, the interior surfaces of the cover halves are completely smooth and planar, except for slightly raised boundary wall portions 11A, 12A extending along two sides. These portions have in turn a number of energy director pips 14 for eventual welding of the wall portions together by ultrasonic welding.

The inner surface of the handle half 8 is generally planar, except for raised rib 16 shaped to fit a standard, elongate hole in a scalpel blade. The rib also has two raised circular pips 17 and elongate energy directors 18.

The inner surface of the other half 12 is planar except for two circular recesses 19 destined to receive the pips 17 when the halves are folded over against each other.

At the transition between the solid portion of the handle and the adjacent edge of the half portion 8, there is a chamfered surface 20 having an energy director rib 20'. The corresponding rear edge 21 of the half 9 is also chamfered to mate with the surface 20.

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In assembly, a finished blade is positioned over the rib 16, and the half portions 9 and 12 are folded over through 180° about the common fold line 10,13, and ultrasonically welded to their opposite halves at the locations of the energy directors 14,18 and 20.

During these operations, the frangible webs 15 are ruptured, so that the cover is retained to the handle by the engagement of the tips 7 in the recesses 5, any residue of the frangible web is readily ruptured by the act of deliberate removal of the cover. The scalpel is now ready for packaging and despatch to its eventual destination.

The main advantages of the scalpel are:  
that the handle and cover are formed from a single moulding;  
the act of securing the blade to the handle also completes the cover, in situ over the blade;  
the blade edge is protected from the time the blade is secured to the handle;  
the cover is securely positioned against inadvertent removal;  
the blade is firmly secured in the handle and supported from both sides, by virtue of the sandwich construction.

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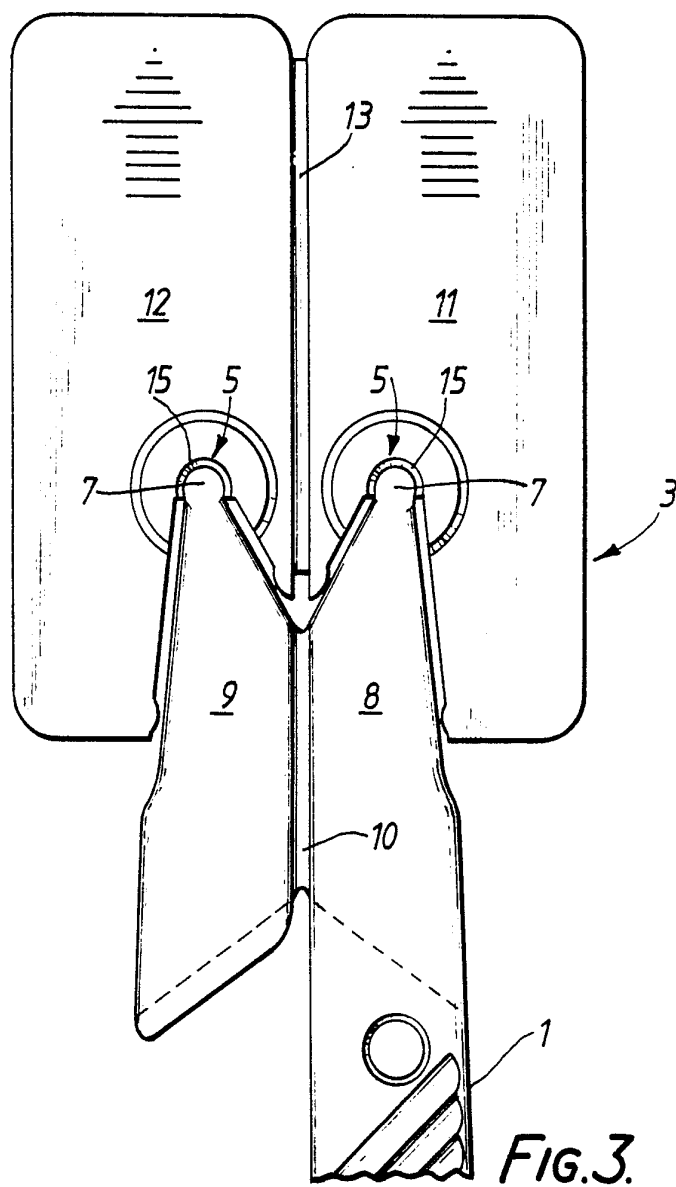
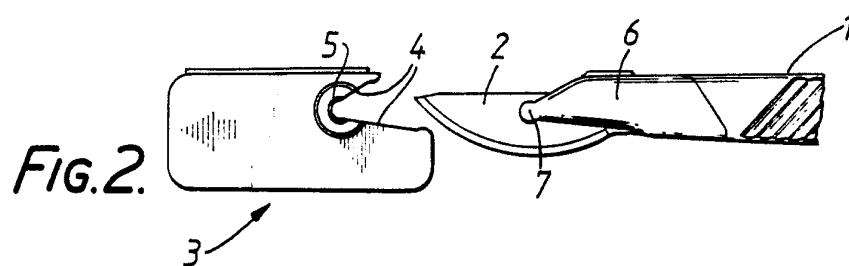
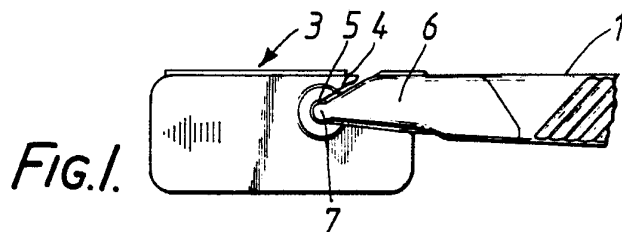
CLAIMS:

1. A knife comprising a plastics moulded handle to which a knife blade is secured, and a removable protective cover for at least the cutting edge of the blade, the said cover being formed integrally with the handle.
2. A knife in accordance with claim 1, in which an end portion of the handle and the cover are each moulded in two generally co-planar halves connected together along a common fold line, the halves of the cover being frangibly connected to the halves of the handle portion, the blade being secured in position by folding over of the moulding about the common fold line and securing together of the respective halves.
3. A knife in accordance with claim 1 or 2, wherein the cover and the handle are integrally connected together by frangible web means formed between a part-circular recess formed in the cover and a part-circular tip formed at the adjacent end of the handle, the tip having snap-fitting engagement with the recess after initial rupture of the web.
4. A knife substantially as herein described with reference to the accompanying drawings.

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1/2



2/2

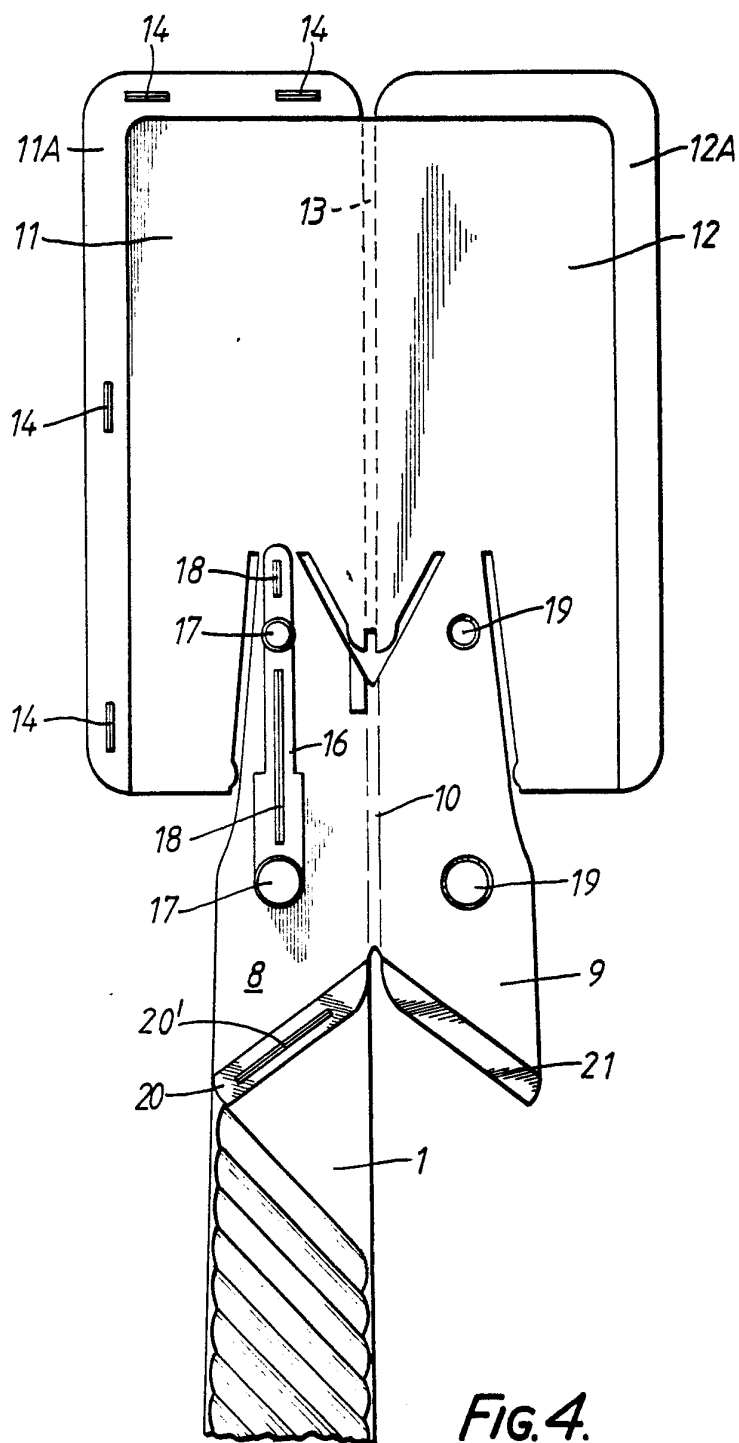


FIG. 4.

# INTERNATIONAL SEARCH REPORT

International Application No PCT/GB 87/00186

| <b>I. CLASSIFICATION OF SUBJECT MATTER</b> (if several classification symbols apply, indicate all) <sup>6</sup><br>According to International Patent Classification (IPC) or to both National Classification and IPC<br>IPC <sup>4</sup> :     A 61 B 17/32; B 26 B 29/02; B 26 B 3/00                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         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| <b>II. FIELDS SEARCHED</b><br><div style="text-align: center; border-top: 1px solid black; border-bottom: 1px solid black; margin: 5px 0;">Minimum Documentation Searched <sup>7</sup></div> <table style="width: 100%; border-collapse: collapse;"> <tr> <th style="width: 25%; border-bottom: 1px solid black;">Classification System</th> <th style="border-bottom: 1px solid black;">Classification Symbols</th> </tr> <tr> <td style="border-right: 1px solid black; padding: 5px;">IPC<sup>4</sup></td> <td style="padding: 5px;">A 61 B; B 26 B; B 25 G; B 65 D; B 29 C</td> </tr> </table> <div style="text-align: center; border-top: 1px solid black; border-bottom: 1px solid black; margin: 5px 0;">Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched <sup>8</sup></div>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                     | Classification System                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Classification Symbols                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | IPC <sup>4</sup>                                                                                   | A 61 B; B 26 B; B 25 G; B 65 D; B 29 C                                                |                                                                                      |   |   |    |   |   |                                                                                                    |   |   |    |   |   |                                                                                                 |   |   |    |   |   |                                                                                                       |   |     |                                                                                                                         |     |    |    |    |
| Classification System                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  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| IPC <sup>4</sup>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | A 61 B; B 26 B; B 25 G; B 65 D; B 29 C                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                    |                                                                                       |                                                                                      |   |   |    |   |   |                                                                                                    |   |   |    |   |   |                                                                                                 |   |   |    |   |   |                                                                                                       |   |     |                                                                                                                         |     |    |    |    |
| <b>III. DOCUMENTS CONSIDERED TO BE RELEVANT <sup>9</sup></b> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 10%; padding: 5px;">Category <sup>9</sup></th> <th style="width: 70%; padding: 5px;">Citation of Document, <sup>11</sup> with indication, where appropriate, of the relevant passages <sup>12</sup></th> <th style="width: 20%; padding: 5px;">Relevant to Claim No. <sup>13</sup></th> </tr> </thead> <tbody> <tr> <td style="text-align: center; vertical-align: top; padding: 5px;">X</td> <td style="padding: 5px;">US, A, 3748736 (S.EISEN) 31 July 1973,<br/>see column 2, lines 30-61; figures 1,2,4,5</td> <td style="text-align: center; vertical-align: top; padding: 5px;">1</td> </tr> <tr> <td style="text-align: center; vertical-align: top; padding: 5px;">Y</td> <td style="text-align: center; vertical-align: top; padding: 5px;">--</td> <td style="text-align: center; vertical-align: top; padding: 5px;">2</td> </tr> <tr> <td style="text-align: center; vertical-align: top; padding: 5px;">Y</td> <td style="padding: 5px;">US, A, 1332254 (H.C. HART) 2 March 1920,<br/>see page 1, line 91 - page 2, line 6;<br/>figures 2,3,6</td> <td style="text-align: center; vertical-align: top; padding: 5px;">2</td> </tr> <tr> <td style="text-align: center; vertical-align: top; padding: 5px;">X</td> <td style="text-align: center; vertical-align: top; padding: 5px;">--</td> <td style="text-align: center; vertical-align: top; padding: 5px;">1</td> </tr> <tr> <td style="text-align: center; vertical-align: top; padding: 5px;">Y</td> <td style="padding: 5px;">FR, A, 2487188 (SFIT) 29 January 1982,<br/>see page 2, line 20 - page 3, line 27;<br/>figures 1-3</td> <td style="text-align: center; vertical-align: top; padding: 5px;">3</td> </tr> <tr> <td style="text-align: center; vertical-align: top; padding: 5px;">X</td> <td style="text-align: center; vertical-align: top; padding: 5px;">--</td> <td style="text-align: center; vertical-align: top; padding: 5px;">1</td> </tr> <tr> <td style="text-align: center; vertical-align: top; padding: 5px;">Y</td> <td style="padding: 5px;">US, A, 3793726 (G.I. SCHRANK) 26 February 1974, see column 3, line 39 - column 4, line 2; figures 1-5</td> <td style="text-align: center; vertical-align: top; padding: 5px;">3</td> </tr> <tr> <td style="text-align: center; vertical-align: top; padding: 5px;">P,X</td> <td style="padding: 5px;">DE, U, 8535978 (E. &amp; W. SCHMIDT) 27 March 1986, see page 4, line 25 - page 5, line 17; page 3, lines 21-30; figures 1-3</td> <td style="text-align: center; vertical-align: top; padding: 5px;">1,3</td> </tr> <tr> <td style="text-align: center; vertical-align: top; padding: 5px;">--</td> <td style="text-align: center; vertical-align: top; padding: 5px;">--</td> <td style="text-align: center; vertical-align: top; padding: 5px;">--</td> </tr> </tbody> </table> |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                     | Category <sup>9</sup>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Citation of Document, <sup>11</sup> with indication, where appropriate, of the relevant passages <sup>12</sup>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Relevant to Claim No. <sup>13</sup>                                                                | X                                                                                     | US, A, 3748736 (S.EISEN) 31 July 1973,<br>see column 2, lines 30-61; figures 1,2,4,5 | 1 | Y | -- | 2 | Y | US, A, 1332254 (H.C. HART) 2 March 1920,<br>see page 1, line 91 - page 2, line 6;<br>figures 2,3,6 | 2 | X | -- | 1 | Y | FR, A, 2487188 (SFIT) 29 January 1982,<br>see page 2, line 20 - page 3, line 27;<br>figures 1-3 | 3 | X | -- | 1 | Y | US, A, 3793726 (G.I. SCHRANK) 26 February 1974, see column 3, line 39 - column 4, line 2; figures 1-5 | 3 | P,X | DE, U, 8535978 (E. & W. SCHMIDT) 27 March 1986, see page 4, line 25 - page 5, line 17; page 3, lines 21-30; figures 1-3 | 1,3 | -- | -- | -- |
| Category <sup>9</sup>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  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HART) 2 March 1920,<br>see page 1, line 91 - page 2, line 6;<br>figures 2,3,6                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 2                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                    |                                                                                       |                                                                                      |   |   |    |   |   |                                                                                                    |   |   |    |   |   |                                                                                                 |   |   |    |   |   |                                                                                                       |   |     |                                                                                                                         |     |    |    |    |
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page 3, line 27;<br>figures 1-3                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 3                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                    |                                                                                       |                                                                                      |   |   |    |   |   |                                                                                                    |   |   |    |   |   |                                                                                                 |   |   |    |   |   |                                                                                                       |   |     |                                                                                                                         |     |    |    |    |
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| Y                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | US, A, 3793726 (G.I. SCHRANK) 26 February 1974, see column 3, line 39 - column 4, line 2; figures 1-5                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 3                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                    |                                                                                       |                                                                                      |   |   |    |   |   |                                                                                                    |   |   |    |   |   |                                                                                                 |   |   |    |   |   |                                                                                                       |   |     |                                                                                                                         |     |    |    |    |
| P,X                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | DE, U, 8535978 (E. & W. SCHMIDT) 27 March 1986, see page 4, line 25 - page 5, line 17; page 3, lines 21-30; figures 1-3                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 1,3                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                    |                                                                                       |                                                                                      |   |   |    |   |   |                                                                                                    |   |   |    |   |   |                                                                                                 |   |   |    |   |   |                                                                                                       |   |     |                                                                                                                         |     |    |    |    |
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| <table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 50%; vertical-align: top; padding: 5px;"> <sup>10</sup> Special categories of cited documents: <sup>10</sup><br/>           "A" document defining the general state of the art which is not considered to be of particular relevance<br/>           "E" earlier document but published on or after the international filing date<br/>           "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)<br/>           "O" document referring to an oral disclosure, use, exhibition or other means<br/>           "P" document published prior to the international filing date but later than the priority date claimed         </td> <td style="width: 50%; vertical-align: top; padding: 5px;">           "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<br/>           "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step<br/>           "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.<br/>           "&amp;" document member of the same patent family         </td> </tr> </table>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                     | <sup>10</sup> Special categories of cited documents: <sup>10</sup><br>"A" document defining the general state of the art which is not considered to be of particular relevance<br>"E" earlier document but published on or after the international filing date<br>"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)<br>"O" document referring to an oral disclosure, use, exhibition or other means<br>"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<br>"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step<br>"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.<br>"&" document member of the same patent family |                                                                                                    |                                                                                       |                                                                                      |   |   |    |   |   |                                                                                                    |   |   |    |   |   |                                                                                                 |   |   |    |   |   |                                                                                                       |   |     |                                                                                                                         |     |    |    |    |
| <sup>10</sup> Special categories of cited documents: <sup>10</sup><br>"A" document defining the general state of the art which is not considered to be of particular relevance<br>"E" earlier document but published on or after the international filing date<br>"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)<br>"O" document referring to an oral disclosure, use, exhibition or other means<br>"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<br>"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step<br>"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.<br>"&" document member of the same patent family |                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                    |                                                                                       |                                                                                      |   |   |    |   |   |                                                                                                    |   |   |    |   |   |                                                                                                 |   |   |    |   |   |                                                                                                       |   |     |                                                                                                                         |     |    |    |    |
| <b>IV. CERTIFICATION</b> <table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 50%; border-right: 1px solid black; padding: 5px;">           Date of the Actual Completion of the International Search<br/>           12th June 1987         </td> <td style="width: 50%; padding: 5px;">           Date of Mailing of this International Search Report<br/> <div style="text-align: right; font-weight: bold;">17 JUL 1987</div> </td> </tr> <tr> <td style="border-right: 1px solid black; padding: 5px;">           International Searching Authority<br/> <div style="text-align: center;">EUROPEAN PATENT OFFICE</div> </td> <td style="padding: 5px;">           Signature of Authorized Officer<br/> <div style="text-align: center;">M. VAN MOL </div> </td> </tr> </table>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                     | Date of the Actual Completion of the International Search<br>12th June 1987                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Date of Mailing of this International Search Report<br><div style="text-align: right; font-weight: bold;">17 JUL 1987</div>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | International Searching Authority<br><div style="text-align: center;">EUROPEAN PATENT OFFICE</div> | Signature of Authorized Officer<br><div style="text-align: center;">M. VAN MOL </div> |                                                                                      |   |   |    |   |   |                                                                                                    |   |   |    |   |   |                                                                                                 |   |   |    |   |   |                                                                                                       |   |     |                                                                                                                         |     |    |    |    |
| Date of the Actual Completion of the International Search<br>12th June 1987                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Date of Mailing of this International Search Report<br><div style="text-align: right; font-weight: bold;">17 JUL 1987</div>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                    |                                                                                       |                                                                                      |   |   |    |   |   |                                                                                                    |   |   |    |   |   |                                                                                                 |   |   |    |   |   |                                                                                                       |   |     |                                                                                                                         |     |    |    |    |
| International Searching Authority<br><div style="text-align: center;">EUROPEAN PATENT OFFICE</div>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Signature of Authorized Officer<br><div style="text-align: center;">M. VAN MOL </div>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                    |                                                                                       |                                                                                      |   |   |    |   |   |                                                                                                    |   |   |    |   |   |                                                                                                 |   |   |    |   |   |                                                                                                       |   |     |                                                                                                                         |     |    |    |    |

| III. DOCUMENTS CONSIDERED TO BE RELEVANT (CONTINUED FROM THE SECOND SHEET) |                                                                                                           |                      |
|----------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------|----------------------|
| Category *                                                                 | Citation of Document, with indication, where appropriate, of the relevant passages                        | Relevant to Claim No |
| X                                                                          | FR, A, 1501959 (Y. DES HORTS) 18 November 1967, see page 1, column 2, lines 3-15,36,37; figures 1-5<br>-- | 1                    |
| A                                                                          | GB, A, 257482 (J.E. EVANS-JACKSON) 23 September 1926, see figures 1,2<br>--                               | 2                    |
| A                                                                          | GB, A, 24671 A.D. 1910 (E.B. KOOPMAN et al.) 24 October 1911, see the whole document<br>--                | 2                    |
| A                                                                          | DE, A, 2158367 (ALTENBACH) 7 June 1973, see page 8, lines 2-15; figures<br>--                             | 2                    |
| A                                                                          | US, A, 4511035 (M. ALPERN) 16 April 1985, see figures 2,3<br>--                                           | 2                    |
| A                                                                          | US, A, 3512631 (C.B. PRICE et al.) 19 May 1970, see abstract; column 1, lines 61-71; figures 1-4<br>--    | 2                    |
| A                                                                          | GB, A, 1601889 (D.J. COLGATE) 4 November 1980, see the whole document                                     | 1,3                  |
| -----                                                                      |                                                                                                           |                      |

ANNEX TO THE INTERNATIONAL SEARCH REPORT ON

INTERNATIONAL APPLICATION NO.

PCT/GB 87/00186 (SA 16496)

This Annex lists the patent family members relating to the patent documents cited in the above-mentioned international search report. The members are as contained in the European Patent Office EDP file on 01/07/87

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| Patent document<br>cited in search<br>report | Publication<br>date | Patent family<br>member(s) | Publication<br>date |
|----------------------------------------------|---------------------|----------------------------|---------------------|
| US-A- 3748736                                | 31/07/73            | None                       |                     |
| US-A- 1332254                                |                     | None                       |                     |
| FR-A- 2487188                                | 29/01/82            | None                       |                     |
| US-A- 3793726                                | 26/02/74            | None                       |                     |
| DE-U- 8535978                                | 13/02/86            | None                       |                     |
| FR-A- 1501959                                |                     | None                       |                     |
| GB-A- 257482                                 |                     | None                       |                     |
| GB-A- 24671                                  |                     | None                       |                     |
| DE-A- 2158367                                | 07/06/73            | None                       |                     |
| US-A- 4511035                                | 16/04/85            | None                       |                     |
| US-A- 3512631                                | 19/05/70            | None                       |                     |
| GB-A- 1601889                                | 04/11/81            | None                       |                     |

For more details about this annex :  
see Official Journal of the European Patent Office, No. 12/82