The invention relates to a metering applicator comprising a fluid container (101) with a passage (102) terminating in an applicator sponge (103), the passage (102) including a first valve (104) which is pretensioned into the closed position, this first valve (104) being in an open position if a pressure force greater than a specified opening pressure force is exerted on the sponge (103), the applicator further comprising a second valve (106), which is in open condition if a pressure force lower than a specified closing pressure force is exerted, this second valve (106) being in closed condition if a pressure force higher than the closing pressure force is exerted, the metering applicator further comprising a buffer chamber (107) arranged between the two valves (104, 106), the opening and the closing pressure forces being chosen such that in normal use of the applicator the buffer chamber (107) is intermittently filled and the fluid is intermittently delivered from the buffer chamber (107).
**FOR THE PURPOSES OF INFORMATION ONLY**

Codes used to identify States party to the PCT on the front pages of pamphlets publishing international applications under the PCT.

<table>
<thead>
<tr>
<th>AT</th>
<th>Austria</th>
<th>GB</th>
<th>United Kingdom</th>
</tr>
</thead>
<tbody>
<tr>
<td>AU</td>
<td>Australia</td>
<td>GE</td>
<td>Georgia</td>
</tr>
<tr>
<td>BB</td>
<td>Barbados</td>
<td>GN</td>
<td>Guinea</td>
</tr>
<tr>
<td>BE</td>
<td>Belgium</td>
<td>GR</td>
<td>Greece</td>
</tr>
<tr>
<td>BF</td>
<td>Burkina Faso</td>
<td>HU</td>
<td>Hungary</td>
</tr>
<tr>
<td>BG</td>
<td>Bulgaria</td>
<td>IE</td>
<td>Ireland</td>
</tr>
<tr>
<td>BJ</td>
<td>Benin</td>
<td>IT</td>
<td>Italy</td>
</tr>
<tr>
<td>BR</td>
<td>Brazil</td>
<td>JP</td>
<td>Japan</td>
</tr>
<tr>
<td>BY</td>
<td>Belarus</td>
<td>KE</td>
<td>Kenya</td>
</tr>
<tr>
<td>CA</td>
<td>Canada</td>
<td>KG</td>
<td>Kyrgyzstan</td>
</tr>
<tr>
<td>CF</td>
<td>Central African Republic</td>
<td>KP</td>
<td>Democratic People’s Republic of Korea</td>
</tr>
<tr>
<td>CG</td>
<td>Congo</td>
<td>KR</td>
<td>Republic of Korea</td>
</tr>
<tr>
<td>CH</td>
<td>Switzerland</td>
<td>KZ</td>
<td>Kazakhstan</td>
</tr>
<tr>
<td>CI</td>
<td>Côte d’Ivoire</td>
<td>LI</td>
<td>Liechtenstein</td>
</tr>
<tr>
<td>CM</td>
<td>Cameroon</td>
<td>LK</td>
<td>Sri Lanka</td>
</tr>
<tr>
<td>CN</td>
<td>China</td>
<td>LU</td>
<td>Luxembourg</td>
</tr>
<tr>
<td>CS</td>
<td>Czechoslovakia</td>
<td>LV</td>
<td>Latvia</td>
</tr>
<tr>
<td>CZ</td>
<td>Czech Republic</td>
<td>MC</td>
<td>Monaco</td>
</tr>
<tr>
<td>DE</td>
<td>Germany</td>
<td>MD</td>
<td>Republic of Moldova</td>
</tr>
<tr>
<td>DK</td>
<td>Denmark</td>
<td>MG</td>
<td>Madagascar</td>
</tr>
<tr>
<td>ES</td>
<td>Spain</td>
<td>ML</td>
<td>Mali</td>
</tr>
<tr>
<td>FI</td>
<td>Finland</td>
<td>MN</td>
<td>Mongolia</td>
</tr>
<tr>
<td>FR</td>
<td>France</td>
<td>MR</td>
<td>Mauritania</td>
</tr>
<tr>
<td>GA</td>
<td>Gabon</td>
<td>MW</td>
<td>Malawi</td>
</tr>
<tr>
<td>NE</td>
<td>Niger</td>
<td>NL</td>
<td>Netherlands</td>
</tr>
<tr>
<td>NO</td>
<td>Norway</td>
<td>NZ</td>
<td>New Zealand</td>
</tr>
<tr>
<td>PL</td>
<td>Poland</td>
<td>PT</td>
<td>Portugal</td>
</tr>
<tr>
<td>RO</td>
<td>Romania</td>
<td>RU</td>
<td>Russian Federation</td>
</tr>
<tr>
<td>SD</td>
<td>Sudan</td>
<td>SE</td>
<td>Sweden</td>
</tr>
<tr>
<td>SI</td>
<td>Slovenia</td>
<td>SK</td>
<td>Slovakia</td>
</tr>
<tr>
<td>SN</td>
<td>Senegal</td>
<td>TD</td>
<td>Chad</td>
</tr>
<tr>
<td>TG</td>
<td>Togo</td>
<td>TJ</td>
<td>Tajikistan</td>
</tr>
<tr>
<td>TT</td>
<td>Trinidad and Tobago</td>
<td>UA</td>
<td>Ukraine</td>
</tr>
<tr>
<td>US</td>
<td>United States of America</td>
<td>UZ</td>
<td>Uzbekistan</td>
</tr>
<tr>
<td>VN</td>
<td>Viet Nam</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Title: Metering applicator with double valve.

This invention relates to a metering applicator comprising a fluid container with a passage terminating in an applicator sponge, the passage including a first valve which is pretensioned into the closed position by a pretensioning spring, and which is in an open position if a pressure force greater than a specified opening pressure force is exerted on the sponge.

Such a metering applicator is disclosed in Dutch patent application 66.17959.

In particular when the metering applicator is used for applying fluids of low viscosity, such as for instance self-shine shoe polish which is watery, the fluid is often applied in too thick a layer, which leads to cracking of the glossy layer. With self-shine shoe polish, optimum shine is obtained when per shoe approx. 0.15-0.20 grams of fluid are applied.

After the application of such self-shine shoe polish, the fluid applied need only be spread.

Applicators of the instant type accordingly serve two purposes, viz., on the one hand, the application (metering) of the fluid and, on the other, the spreading of the fluid applied.

When during the spreading of the fluid applied the known applicator is pressed too hard, which can easily happen unconsciously, each time fluid is metered anew, resulting in the excessive metering of the fluid mentioned above, which, in the case of self-shine shoe polish, leads to cracking after drying.

The object of the invention is to provide a convenient metering applicator without the above-mentioned drawbacks.

To that end, the metering applicator of the type mentioned in the preamble is characterized by a second valve, included in the passage, which is in open condition if a pressure force lower than a specified closing force is exerted
on the sponge, and which is in closed condition if a pressure force higher than the closing pressure force is exerted on the sponge, the metering applicator further comprising a buffer chamber for the fluid, arranged between the first and the second valve, the opening and closing pressure forces being chosen such that in normal use of the applicator the buffer chamber is intermittently filled with fluid and the fluid is intermittently delivered from the buffer chamber to the applicator sponge.

Such a metering applicator provides the advantage that when the user, while spreading the fluid, presses the applicator too hard, the supply of fluid is discontinued. This prevents too thick a layer of, for instance, self-shine shoe polish from being applied to a shoe, so that cracking of the layer applied is avoided. If the opening pressure force and the closing pressure force are properly chosen, approx. 0.15-0.20 grams of fluid are applied per shoe by an average user employing the present applicator. Such an amount of fluid applied per shoe leads to an optimum polishing result. This moreover makes it possible to polish approx. 50 pair of shoes with a metering applicator of the size of a lipstick.

To clarify the invention, three exemplary embodiments of the metering applicator will now be described with reference to the accompanying drawings, wherein:

Fig. 1 is a longitudinal sectional view of a first embodiment of the metering applicator;

Fig. 2 is a longitudinal sectional view of a second embodiment; and

Fig. 3 is a longitudinal sectional view of a third embodiment.

In all three of the exemplary embodiments shown, the metering applicator comprises a fluid container 101, 201, 301, with a passage 102, 202, 302 terminating in an applicator sponge 103, 203, 303. Arranged in the passage 102, 202, 302 is a first valve 104, 204, 304 which is pretensioned into the closed position by a pretensioning spring 105, 205, 305. The
first valve 104, 204, 304 is in an open position if a pressure force greater than a specified opening pressure force is exerted on the sponge 103, 203, 303. The three embodiments are all three characterized by a second valve 106, 206, 306, arranged in the passage, which is in open condition if a pressure force lower than a specified closing pressure force is exerted on the sponge 103, 203, 303, and which second valve 106, 206, 306 is in closed condition if a pressure force higher than the closing pressure force is exerted on the sponge 103, 203, 303. Moreover, the metering applicator comprises a buffer chamber 107, 207, 307 for the fluid, arranged between the first and the second valve. The various valve parts and pretensioning means are so dimensioned that in normal use of the applicator the buffer chamber 107, 207, 307 is intermittently filled with fluid and the fluid is intermittently delivered from the buffer chamber to the applicator sponge 103, 203, 303. These features provide a metering applicator by means of which a very thin layer of fluid can be applied and spread. Moreover, the characterizing features can be realized in economic manner with constructively simple means.

A thus functioning metering applicator can, in accordance with a further elaboration of the invention, be characterized in that a valve member of the first valve 104, 204, 304 and a valve member of the second valve 106, 206, 306 are coupled with each other, such that the valve members in operation traverse a same pattern of motion in axial direction. This makes it possible for both valve members to be displaced in axial direction by one controlling motion. Generally, the controlling motion is caused by the pressure force exerted on the sponge. Such a coupling can for instance be realized by arranging for the valve members to be connected with each other or abut against each other, or by arranging for the two valves to have a common valve member.

In this connection, it is particularly advantageous if the closing pressure force is greater than the opening
pressure force. This prevents fluid from being delivered continuously when the metering applicator is continuously pressed with great force.

A first possible embodiment is shown in Fig. 1. This embodiment is characterized in that the first valve 104 cooperates with a valve seat provided on an axial end, proximal to the fluid container, of the buffer chamber 107. The first valve 104 comprises a first valve stem 108 reaching into the buffer chamber 107. A second valve 106 is designed as a dish 109 which, through a side thereof to be referred to as pressure surface 110, abuts against or is connected with the applicator sponge 103 and which, through a shut-off side 111, for instance conically shaped, located opposite the pressure surface 110, cooperates with a valve seat 112, provided on an axial end, proximal to the sponge 103, of the buffer chamber 107. The dish 109 abuts against or is connected with the first valve stem 108, optionally with an intervening second valve stem 113.

The operation of the embodiment shown in Fig. 1 is as follows. When a pressure force higher than the opening pressure force is exerted on the applicator sponge 103, the valve 104 is opened and the buffer chamber 107 is filled up with fluid. If the pressure force exerted on the sponge 103 is lower than the closing pressure force, the second valve 106 remains open and the fluid can flow from the buffer chamber 107 into the sponge 103. When during the spreading of the fluid the pressure force on the sponge 103 increases to above the closing pressure force, the second valve 106 is shut off and the supply of fluid to the sponge 103 is discontinued.

The exemplary embodiment described above is simple in construction and can be manufactured economically. The assembly may for instance take place as follows. The dish 109 can be connected with the applicator sponge by means of a jointing technique, such as for instance glueing or fusion welding. Then the sponge 103 can be fixed to a sponge bearing surface 114 remote from the fluid container 1. Thereafter the
valve stem 108 of the first valve 104 can be connected with
the dish 109 or be placed in abutment therewith and the thus
assembled applicator part can be fitted on the fluid container
101.

5

The exemplary embodiment shown in Fig. 2 is characterized
in that the passage 202 extends on either side of the buffer
chamber 207, a shut-off element 208, serving as a valve
member, being disposed in the buffer chamber 207 and being
accommodated therein with clearance. The pretensioning
spring 205 comprises a first pin 209 extending into the buffer
chamber 207 in a first passage section 202a located between
the fluid container 201 and the buffer chamber 207. The first
pin 209 presses the shut-off element 208 into sealing abutment
with an opening provided with a first valve seat 204, this
opening being formed by a second passage section 202b
extending between the buffer chamber 207 and the applicator
sponge 203. The metering applicator further comprises a dish
210 which, through a side thereof to be referred to as
pressure surface 211, abuts against or is connected with the
side of the sponge 203 proximal to the fluid container 201 and
which, on a side thereof located opposite the pressure
surface, is provided with a second pin 212 extending through
the second passage section 202b into the buffer chamber 207.
If a pressure force greater than the closing pressure force is
exerted on the sponge 203, the second pin 212 pushes the shut-
off element 208, against the pressure force of the
pretensioning spring 205, into sealing abutment with an
opening formed by the first passage 202a in the buffer chamber
207 and provided with a second valve seat 206.

10

The operation of a thus designed metering applicator is
as follows. When a pressure force higher than the opening
pressure force is exerted on the applicator sponge 203, the
valve 204 is opened and the fluid contained in the buffer
chamber flows into the sponge 203. If the pressure force
exerted on the sponge 203 is lower than the closing pressure
force, the second valve 206 remains open and the fluid can
continue to flow from the fluid container 201 into the buffer chamber 207. When during the spreading of the fluid the pressure force on the sponge 203 increases to above the closing pressure force, the second valve 206 is shut off and the supply of fluid to the buffer chamber 207 is discontinued.

The operation is accordingly opposite to that of the first exemplary embodiment shown in Fig. 1, where the buffer chamber 107 is not filled if a pressure force lower than the opening pressure force is exerted on the sponge, whereas in the second exemplary embodiment the buffer chamber 207 is not emptied if a pressure force lower than the opening pressure force is exerted on the sponge 203.

The exemplary embodiment of the metering applicator shown in Fig. 2, too, is simple in construction and can be manufactured economically.

An inexpensive and standard commercially available shut-off element 208 can be designed as a ball with the buffer chamber 207 enclosing a substantially spherical space.

In both of the exemplary embodiments discussed above, it is particularly advantageous if the sponge 103, 203, on the side proximal to the fluid container 102, 201, is provided with an annular incision 115, 215 of substantially the same dimensions as the outer contour of the dish 109, 210. The effect of such an annular incision 115, 215 is that the motion of the dish 109, 210 is not hampered by the bond of the sponge 103, 203 to the sponge bearing surface 114, 214.

Further, in both of the exemplary embodiments described above, optimum results are obtained if the pretension of the spring and the various valve components are so designed that the opening pressure force is approx. 2 N and the closing pressure force is approx. 4 N. In practice it has been found that if opening and closing pressure forces so selected are employed and the metering applicator is used for applying watery self-shine shoe polish, in normal use of the average user, the exact desired amount of fluid is applied to the shoe to be treated.
The third exemplary embodiment, shown in Fig. 3, is characterized in that the first valve 304 cooperates with a valve seat provided on an axial end, proximal to the fluid container, of the buffer chamber 307. The first valve comprises a first valve stem 308 reaching into the buffer chamber 307 and abutting or being connected to a solid cylindrical or block-shaped valve member 309 of the second valve 306. The second valve member 309 is accommodated with clearance in the portion of the sponge 303 that is proximal to the fluid container 301, whilst the second valve member 309, on the side remote from the fluid container, comprises a concave surface 310 bounded at its peripheral edge by a sealing edge 306. The sponge is made up of at least two sponge portions 303a, 303b. The first, annular sponge portion 303a, proximal to the fluid container 301, includes the second valve member 309, has a height substantially corresponding to the height of the second valve member 309, and is not permeable to fluid. The second, solid sponge portion 303b is fixed to the first sponge portion 303a on the side remote from the fluid container 301. The sealing edge 306 of the second valve member 309 abuts against the second sponge portion 303b and the second sponge portion 303b is semipermeable to fluid. If a pressure force greater than the closing pressure force is exerted on the sponge 303, the sealing edge 306 of the second valve member 309 is sealingly pressed into the second sponge 303b.

The operation of a thus designed metering applicator is as follows. When a pressure force higher than the opening pressure force is exerted on the applicator sponge 303, the valve 304 is opened via the second valve member 309 and the valve stem 308, and the fluid contained in the fluid container 301 flows into the buffer chamber 307. The buffer chamber 307 is in open communication with the hollow space which is provided in the annular, first, non-permeable sponge portion 303a and accommodates the second valve member 309. If the pressure force exerted on the sponge 303 is lower than the
closing pressure force, the fluid can pass the sealing edge 306 of the valve member 309 and flow into a reservoir 311 located between the concave surface of the second valve member 309 and the second sponge portion 303b. When during the spreading of the fluid the pressure force on the sponge 303 increases to above the closing pressure force, the second valve member 309 is pressed into the second, semipermeable sponge portion 303b to the extent where the fluid can no longer pass the sealing edge 306 and the supply of fluid from the buffer chamber 307 to the reservoir 311 is discontinued.

In this embodiment in particular, it is very well possible for the closing pressure force to be smaller than the opening pressure force. The fluid is not delivered to the surface to be treated until the second sponge portion 303b is pressed into the reservoir 311. The reservoir 311 has the function of a second buffer chamber and the second sponge portion 303b has the function of a third valve. The reservoir 311 is intermittently filled from the buffer chamber 307 and depleted when the pressure force on the sponge 303 becomes so large that the sponge portion 303b is pressed into the reservoir 311. Accordingly, the reservoir 311 is depleted intermittently too.

This embodiment, too, is simple in construction and can be manufactured economically. Moreover, the semipermeable sponge portion 303b exhibits eminent spreading properties.

In order to simplify the delivery of the fluid from the reservoir 311 to the surface to be treated, it is particularly advantageous if the second sponge portion 303b is provided with a narrow channel 312 terminating in the reservoir 311 bounded by the concave surface 310 of the second valve member 309 and the side of the second sponge portion 303b that is proximal to the fluid container 301.

In the third embodiment, shown in Fig. 3, optimum results are obtained if the pretension of the spring 305 and the various valve components are so designed that the opening pressure force of the first valve 304 is approx. 4 N and the
closing pressure force of the second valve 306 is approx. 2 N. In practice it has been found that if opening and closing pressure forces so chosen are employed and the metering applicator according to the third embodiment is used for applying watery self-shine shoe polish, in normal use of the average user, the exact desired amount of fluid is applied to the shoe to be treated.

In a practical design, the sponge 103, 203, 303 may be cylindrical and have a diameter of approx. 1-2 cm. The fluid container 101, 201, 301 can for instance have a volume of approx. 25 ml. With a thus designed fluid container, approx. 50 pair of shoes can be polished. Moreover, such a metering applicator can be readily taken along when travelling and accordingly is handy in use.

It will be clear that the invention is not limited to the exemplary embodiments described, but various modifications are possible within the scope of the invention. Thus, in all three of the exemplary embodiments, the valve members are movably arranged and the buffer chamber is fixedly arranged with respect to the fluid container. In an alternative embodiment, however, the valve members could be arranged stationarily and the buffer chamber movably.

The essence is that the passage includes two valves which are so designed that the fluid, in normal use of the metering applicator, is intermittently delivered to the surface to be treated.
CLAIMS

1. A metering applicator comprising a fluid container with a passage terminating in an applicator sponge, said passage including a first valve which is pretensioned into the closed position by a pretensioning spring, said first valve being in an open position if a pressure force greater than a specified opening pressure force is exerted on the sponge, characterized by a second valve (106, 206, 306) arranged in said passage (102, 202, 302), which is in open condition if a pressure force lower than a specified closing pressure force is exerted on the sponge (103, 203, 303), said second valve (106, 206, 306) being in closed condition if a pressure force higher than the closing pressure force is exerted on the sponge (103, 203, 303), the metering applicator further comprising a buffer chamber (107, 207, 307) for the liquid, arranged between the first and the second valve, the opening and the closing pressure forces being chosen such that in normal use of the applicator the buffer chamber (107, 207, 307) is intermittently filled with fluid and the fluid is intermittently delivered from the buffer chamber to the applicator sponge (103, 203, 303).

2. A metering applicator according to claim 1, characterized in that a valve member of the first valve (104, 204, 304) and a valve member of the second valve (106, 206, 306) are coupled with each other, such that the valve members in operation traverse a same pattern of motion in axial direction.

3. A metering applicator according to claim 1 or 2, characterized in that the closing pressure force is greater than the opening pressure force.

4. A metering applicator according to any one of claims 1-3, characterized in that the first valve (104) cooperates with a valve seat provided on an axial end, proximal to the fluid container (101), of the buffer chamber (107), the first valve
(104) comprising a first valve stem (108) reaching into the buffer chamber (107), whilst the second valve (106) is designed as a dish (109) which, through a side to be referred to as pressure surface (110), abuts against or is connected with the applicator sponge (103) and which, through a shut-off side (111), located opposite the pressure surface (110), cooperates with a valve seat (112) provided on an axial end, proximal to the sponge (103), of the buffer chamber (107), the dish (109), optionally with an intervening second valve stem (113), abutting against or being connected with the first valve stem (108).

5. A metering applicator according to any one of claims 1-3, characterized in that the passage (202) extends on either side of the buffer chamber (207); a shut-off element (208), serving as a valve member, is located in the buffer chamber and accommodated therein with clearance; the pretensioning spring (205) comprises a first pin (209) extending into the buffer chamber (207) in a first passage section (202a) located between the fluid container (201) and the buffer chamber (207); the first pin (209) sealingly pushes the shut-off element (208) against an opening provided with a first valve seat (204) and formed by a second passage section (202b) extending between the buffer chamber (207) and the applicator sponge (203); the metering applicator comprises a dish (210) which, through a side to be referred to as pressure surface (211), abuts against or is connected with the side of the sponge (203) proximal to the fluid container (201) and which, on a side located opposite the pressure surface (211), is provided with a second pin (212) extending through the second passage section (202b) into the buffer chamber (207); the second pin (212), if a pressure force greater than the closing pressure force is exerted on the sponge (203), pushes the shut-off element (208), against the pressure force of the pretensioning spring (205), into sealing abutment with an opening formed in the buffer chamber (207) by the first passage (202a) and provided with a second valve seat (206).
6. A metering applicator according to claim 5, characterized in that the shut-off element (208) is designed as a ball, whilst the buffer chamber (207) encloses a substantially spherical space.

7. A metering applicator according to any one of claims 4-6, characterized in that the sponge (103, 203), on the side proximal to the fluid container (101, 201), is provided with an annular incision (115, 215) of substantially the same dimensions as the outer contour of the dish (109, 210).

8. A metering applicator according to any one of claims 1-7, characterized in that the pretension of the spring (105, 205) and the various valve components are so designed that the opening pressure force is approx. 2 N and the closing pressure force is approx. 4 N.

9. A metering applicator according to any one of claims 1-2, characterized in that the first valve (304) cooperates with a valve seat provided on an axial end, proximal to the fluid container (301), of the buffer chamber (307); the first valve (304) comprises a first valve stem (308) reaching into the buffer chamber (307) and abutting against or being connected to a solid cylindrical or block-shaped valve member (309) of the second valve (306), said second valve member (309) being accommodated with clearance in the portion of the sponge (303) proximal to the fluid container (301); the second valve member (309), on the side remote from the fluid container, is provided with a concave surface (310) bounded at the circumferential edge thereof by a sealing edge (306); the sponge (303) is made up of at least two sponge portions; the first annular sponge portion (303a), proximal to the fluid container (301), includes the second valve member (309), has a height substantially corresponding to the height of the second valve member (309) and is non-permeable to fluid; the second, solid sponge portion (303b), on the side remote from the fluid container (301), is fixed to the first sponge portion (303a) and the sealing edge (306) of the second valve member (309) abuts against said second sponge portion (303b); the second
sponge portion (303b) is semipermeable to fluid; and the sealing edge (306) of the second valve member (309) is sealingly pressed into the second sponge portion (303b) if a pressure force greater than the closing pressure force is exerted on the sponge (303).

10. A metering applicator according to claim 9, characterized in that the second sponge portion (303b) comprises a narrow channel (312) terminating in a reservoir (311) bounded by the concave surface (310) of the second valve member (309) and the side of the second sponge portion (303b) proximal to the fluid container (301).

11. A metering applicator according to claim 9 or 10, characterized in that the pretension of the spring (305) and the various valve components are so designed that the opening pressure force is approx. 4 N and the closing pressure force is approx. 2 N.

12. A metering applicator according to any one of the preceding claims, characterized in that the sponge (103, 203, 303) is cylindrical and has a diameter of approx. 1-2 cm.
INTERNATIONAL SEARCH REPORT

A. CLASSIFICATION OF SUBJECT MATTER
IPC 5   B65D 47/42

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 5   B65D   A45D

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

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

<table>
<thead>
<tr>
<th>Category</th>
<th>Citation of document, with indication, where appropriate, of the relevant passages</th>
<th>Relevant to claim No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>NL,A,6 617 959 (NIGRIN) 26 June 1967 cited in the application see claim 1; figures 1,2</td>
<td>1</td>
</tr>
<tr>
<td>A</td>
<td>US,A,3 400 997 (SCHWARTZMAN) 10 September 1968 see claims 1-4; figures 1-7</td>
<td>1</td>
</tr>
<tr>
<td>A</td>
<td>DE,A,15 86 797 (BESZEDES) 9 July 1970 see figures 1,2</td>
<td>1</td>
</tr>
<tr>
<td>A</td>
<td>DE,A,14 32 257 (SCHWARTZMAN) 30 January 1969</td>
<td></td>
</tr>
</tbody>
</table>

Further documents are listed in the continuation of box C.

X Patent family members are listed in annex.

* Special categories of cited documents:

'A' document defining the general state of the art which is not considered to be of particular relevance

'B' earlier document 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 citution 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

'I' 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: 2 March 1994

Date of mailing of the international search report: 8 March 1994

Name and mailing address of the ISA
European Patent Office, P.B. 5818 Patentlaan 2
NL - 2280 HV Rijswijk
Tel. (+ 31-70) 340-2040, Tx. 31 651 epo nl,
Fax (+ 31-70) 340-3016

Authorized officer

Bessy, M
<table>
<thead>
<tr>
<th>Patent document cited in search report</th>
<th>Publication date</th>
<th>Patent family member(s)</th>
<th>Publication date</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>CH-A- 446631</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>DE-A- 1503859</td>
<td>22-05-69</td>
</tr>
<tr>
<td></td>
<td></td>
<td>FR-A- 1504381</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>LU-A- 52616</td>
<td>16-02-67</td>
</tr>
<tr>
<td>US-A-3400997</td>
<td>NONE</td>
<td></td>
<td></td>
</tr>
<tr>
<td>DE-A-1586797</td>
<td>09-07-70</td>
<td>NONE</td>
<td></td>
</tr>
<tr>
<td>DE-A-1432257</td>
<td>30-01-69</td>
<td>NONE</td>
<td></td>
</tr>
</tbody>
</table>