



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

<b>(51) International Patent Classification <sup>4</sup> :</b>  <b>B22F 3/02, 7/00</b>	<b>A1</b>	<b>(11) International Publication Number:</b> <b>WO 90/02619</b>  <b>(43) International Publication Date:</b> 22 March 1990 (22.03.90)
<p><b>(21) International Application Number:</b> PCT/FI89/00167</p> <p><b>(22) International Filing Date:</b> 5 September 1989 (05.09.89)</p> <p><b>(30) Priority data:</b> 884122 7 September 1988 (07.09.88) FI</p> <p><b>(71) Applicant (for all designated States except US):</b> NESTE OY [FI/FI]; Keilaniemi, SF-02150 Espoo (FI).</p> <p><b>(72) Inventor; and</b>  <b>(75) Inventor/Applicant (for US only) :</b> SUVANTO, Erkki [FI/FI]; Krouvarintie 7 as. 4, SF-06400 Porvoo (FI).</p> <p><b>(74) Agent:</b> FORSSÉN &amp; SALOMAA OY; Uudenmaankatu 40 A, SF-00120 Helsinki (FI).</p> <p><b>(81) Designated States:</b> 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),</p>		<p>NO, SE (European patent), SU, US.</p> <p><b>Published</b>  <i>With international search report.</i></p>
<p><b>(54) Title:</b> METHOD FOR THE MANUFACTURE OF RIVET FOR A FIXED SPIKE OR FOR A SLEEVE-MOUNTED SPIKE, RESPECTIVELY, AND EQUIPMENT FOR CARRYING OUT THE METHOD</p>		
<p><b>(57) Abstract</b></p> <p>The invention concerns a method for the manufacture of a rivet for a fixed spike or for a sleeve-mounted spike, respectively, by pressing in a mould. In the method of the invention, the cavity space in the mould (10, 20), corresponding to the shape of the spike to be manufactured, is first filled to the desired extent with a first material (1) to form the body part of the spike. Hereupon a first punch (30), whose diameter is substantially smaller than the diameter of the cavity space in the mould, is fitted into the cavity space concentrically with the cavity space, and the annular space between said first punch (30) and the cavity space is filled with a second material (2) so as to form the wear-resistant surface layer for the spike. Next, the first punch (30) is removed, and the space remaining after said punch is filled with a third material. Ultimately the spike is pressed to the desired shape and density, whereinafter the spike is removed from the mould. The invention also concerns equipment for carrying out the method.</p> <div data-bbox="917 1276 1332 2094" data-label="Image"> </div>		

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- 1 Method for the manufacture of rivet for a fixed spike or  
for a sleeve-mounted spike, respectively, and equipment  
for carrying out the method

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The invention concerns a method for the manufacture of a rivet for a fixed spike or for a sleeve-mounted spike, respectively, by pressing in a mould.

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The invention further concerns equipment for carrying out the method for the manufacture of a rivet for a fixed spike or for a sleeve-mounted spike, respectively, said equipment comprising a mould provided with a cavity space, pressing equipment, and filling equipment.

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The commonest solution in the prior-art fixed spikes and in the rivet parts of sleeve-mounted spikes, respectively, is such that the fixed spike or the rivet part of a sleeve-mounted spike, respectively, is provided with a separate hard-metal tip. Such a spike is usually

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manufactured in a mould consisting of several parts, so that the mould parts are provided with punches acting in the axial direction of the spike to be manufactured, the spike blank being pressed axially in opposite directions by means of said punches. It is a drawback of such methods of manufacture and equipment that they require several

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separate working steps and, moreover, the construction of the equipment and of the moulds is complicated. The object of the present invention is to provide an improvement over the prior art methods of manufacture and equipment. A more specific object of the invention is to provide a method of manufacture and an equipment intended for

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carrying out the method which are intended in particular for the manufacture of such a large-tip spike wherein the wear-resistant layer to be formed in the tip portion of the rivet is formed as an annular part around the tip. Such a spike has been described earlier in the FI Patent Application No. 880294.

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In view of achieving the objectives stated above and those that will come out in the following, the method in accordance with the invention

1 is mainly characterized in that the method comprises the following steps:

the cavity space in the mould, corresponding to the shape of the  
5 spike to be manufactured, is filled to the desired extent with a first material to form the body part of the spike,

a first punch, whose diameter is substantially smaller than the diameter of the cavity space in the mould, is fitted into the cavity  
10 space concentrically with the cavity space, and the annular space between said first punch and the cavity space is filled with a second material so as to form the wear-resistant surface layer for the spike,

the first punch is removed, and the space remaining after said punch  
15 is filled with a third material, and

the spike is pressed to the desired shape and density, whereinafter the spike is removed from the mould.

20 On the other hand, the equipment in accordance with the invention is mainly characterized in that the mould is formed as a two-part mould, so that the counter-faces of the first mould and of the second mould, to be placed one against the other, are placed in the widest portion of the cavity space in the mould in the area of the foot widenings  
25 of the cavity space and that the press equipment comprises punches, which are fitted to act towards the second mould substantially perpendicularly to the counter-faces.

Compared with the prior-art solutions, by means of the invention  
30 several advantages are obtained, whereof, e.g., the following may be stated. In the method in accordance with the invention, by pressing from one direction, it is possible to manufacture the hard tip part as well as the round forms in the foot part of the spike, the latter being of essential importance for the conduct of the spike in a  
35 tyre. In the method and equipment in accordance with the invention, the wear-resistant outer face of the spike tip may be formed as of desired thickness. If necessary, said wear-resistant outer face may

1 be composed of several different materials. Since, in the method of  
the invention, the spike is manufactured in the mould by pressing  
from one direction, the tip portion of the spike is compressed more  
densely than the foot part. Since the foot part of the spike remains  
5 less dense than the tip, a spike of lower weight and lower consumption  
of material are obtained. A remarkable advantage of the equipment is  
simplicity of the mould solution, by means of which, however, the  
foot part of the spike, placed against the rubber, can be shaped  
freely. Moreover, the method of manufacture in accordance with the  
10 invention can be automated very easily.

In the following, the invention will be described by way of example  
with reference to the figures in the accompanying drawing, the inven-  
tion being, however, in no way strictly confined to the exemplifying  
15 embodiment illustrated in same.

Figures 1 to 7 in the accompanying drawing are sectional views of a  
preferred equipment used in the method of manufacture in accordance  
with the invention in the different steps of the method.

20 The equipment for the manufacture of a spike, shown in the figures in  
the drawing, comprises a two-part mould, which comprises a first  
mould 10 and a second mould 20 to be fitted one against the other.  
Into the first mould 10 a through hole 11 has been formed for the  
25 body part and the tip of the spike to be manufactured. Into the hole  
11 a first foot widening 12 has been formed for the foot of the spike  
in the area of the counter-face of the first mould 10 to be fitted  
against the second mould 20. In a corresponding way, into the second  
mould 20, a second foot widening 21 has been formed in the area of  
30 the counter-face 22 of the second mould 20. The equipment in accord-  
ance with the invention further includes a press device, which com-  
prises a first and a second punch 30 and 40, by means of which the  
powdery materials of manufacture of the spike are pressed in the  
mould 10, 20 to the shape required by the mould and to the desired  
35 density. The equipment in accordance with the invention further  
comprises a filling equipment for filling the mould with the materials  
of manufacture of the spike. Said filling equipment is, however, not

1 shown in the figures in the drawing. The filling equipment may comprise, e.g., a suitable dosage funnel and related dosage means for filling the mould.

5 In Fig. 1 in the drawing, the first step of the method of the invention is shown. In the step shown in Fig. 1 the first mould 10 and the second mould 20 have been fitted one against the other by their counter-faces 13 and 22 so that the foot widenings 12 and 21 in the moulds 10,20 are placed facing each other. In the first step of the  
10 method of manufacture, shown in Fig. 1, the mould 10,20 is filled with a first material 1, of which the body part and the flange of the spike to be manufactured are composed.

Fig. 2 shows the second and the third step. In the second step of  
15 the method of manufacture, a first punch 30 is fitted into the hole 11 provided in the first mould 10, by means of which said punch 30 the first material 1 of the spike, fitted into the mould in the first step, is pressed towards the second mould 20 so that filling of the mould is also guaranteed in the areas of the foot widenings 12 and  
20 21. The diameter of the first punch 30 is smaller than the diameter of the hole 11, so that an annular space remains in the hole 11 around the first punch 30. In the third step of the method of manufacture, said annular space is filled with a second material 2 while the first punch 30 is in the hole 11 in the position shown in Fig.  
25 2. Out of said second material 2, the annular wear-resistant part to be provided at the tip of the spike is formed.

The fourth step of the method of manufacture is shown in Fig. 3. In this step of the method the second punch 40, which is placed on the  
30 first punch and is coaxial with the first punch 30, is fitted into the hole 11 provided in the first mould, said second punch moving in the same direction with the first punch 30. In the fourth step of the method of manufacture, shown in Fig. 3, an intermediate pressing of the spike blank is carried out by means of both of the punches  
35 30,40 at the same time. On completion of said intermediate pressing the fifth step of the method of manufacture is reached, which is shown in Fig. 4. In this step the first punch 30, placed inside the second

1 punch 40, is pulled out of the mould, and the mould is filled with a  
third material 3 while the second punch 40 is still in its position  
in the position shown in Fig. 4. Thus, by means of the third material  
3, the space that remains inside the second material 2 and the second  
5 punch 40 is filled to the desired extent.

Upon completion of the filling with the third material 3 the sixth  
step of the method of manufacture is reached, which is shown in  
Figures 5 and 6 and in which the pressing of the materials 1,2,3 to  
10 the desired density is carried out. This is performed so that first  
the third material 3 is pressed by means of the first punch 30.  
Both of the punches 30,40 may reach the same level, as is shown in  
Fig. 5, but this is in no way necessary. Hereinafter the ultimate  
pressing of the spike is carried out by means of both of the punches  
15 30,40 at the same time in the way shown in Fig. 6, whereby the spike  
obtains its ultimate shape and density. It may be considered an  
alternative embodiment for this step of the manufacture that, after  
the first and the second punch 30,40 have been pressed to the same  
level, said punches 30,40 are removed and a single punch is fitted  
20 in their place, whose diameter corresponds to the diameter of the  
second punch. The ultimate pressing of the spike in accordance with  
Fig. 6 is then carried out by means of this single punch. After the  
ultimate pressing has been completed, the last step of the manufacture  
is reached, i.e. removal of the spike 5 out of the mould 10,20. This  
25 is carried out so that the mould is opened by pulling the second mould  
20 apart from the first mould 10. Hereupon the spike 5 is removed out  
of the first mould 10 by pushing by means of the punches 30,40.

As regards the materials to be used in the manufacture of the spike  
30 5, i.e. the first, second and the third material 1,2,3, the following  
can be stated briefly. As the first material 1, it is advantageously  
possible to use various ferritic, ceramic or equivalent sintering  
powders. Moreover, as material of the first material 1, it is also  
possible to use various mixtures or additives by means of which, for  
35 example, the compatibility of the spike foot with rubber or the  
gliding properties of the spike in the tyre rubber are improved. Such  
mixtures are, e.g., various aluminium and graphite mixtures or

1 equivalent. The use of sintering powders is essential for the method  
in accordance with the invention, because, after the spike has been  
given its ultimate shape in the mould, it is sintered, i.e. subjected  
to a high temperature in an oven or equivalent so as to give the  
5 product its ultimate hardness and strength. As the second material  
2, of which the hard wear-resistant surface layer is formed for the  
spike, materials are used which have sufficiently high hardness. Such  
materials are, e.g., various sintering powders alloyed with tungsten,  
tantalum or titanium carbides or equivalent. In the spike manufac-  
10 tured in accordance with the method, as the third material it is  
advantageously possible to use the same material as the first material  
1. As an alternative, as the third material, it is possible to use  
a material or a material alloy by means of which the toughness and/or  
the bending strength of the spike is improved. By means of the use  
15 of such a material, e.g., the risk of break of the spike can be  
reduced substantially.

Above, the invention has been described by way of example with  
reference to the figures in the accompanying drawing. This is, however  
20 not supposed to confine the invention to the exemplifying embodiment  
shown in the figures alone, but many variations are possible within  
the scope of the inventive idea defined the following patent claims.

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## 1 WHAT IS CLAIMED IS:

1. Method for the manufacture of a rivet for a fixed spike or for a sleeve-mounted spike, respectively, by pressing in a mould, c h a r -  
5 a c t e r i z e d in that the method comprises the following steps:

the cavity space (11,12,21) in the mould (10,20), corresponding to the shape of the spike to be manufactured, is filled to the desired extent with a first material (1) to form the body part of the spike,  
10 a first punch (30), whose diameter is substantially smaller than the diameter of the cavity space (11,12,21) in the mould, is fitted into the cavity space concentrically with the cavity space, and the annular space between said first punch (30) and the cavity space is filled  
15 with a second material (2) so as to form the wear-resistant surface layer for the spike,

the first punch (30) is removed, and the space remaining after said punch is filled with a third material (3), and  
20 the spike is pressed to the desired shape and density, whereinafter the spike is removed from the mould.

2. Method as claimed in claim 1, c h a r a c t e r i z e d in  
25 that, after the second material (2), which forms the surface layer, has been fitted into the mould (10,20), an intermediate pressing is carried out to compact at least said second material (2).

3. Method as claimed in claim 2, c h a r a c t e r i z e d in that  
30 the intermediate pressing is carried out by means of a hollow second punch (40), which is fitted concentrically on the first punch (30) while the first punch (30) is fitted in the cavity space (11,12, 21) in the mould.

35 4. Method as claimed in claims 2 and 3, c h a r a c t e r i z e d in that the intermediate pressing is carried out by pressing by means of the first and the second punch (30,40) at the same time.

- 1 5. Method as claimed in any of the preceding claims, c h a r a c -  
t e r i z e d in that the filling with the third material is carried  
out through the axial central hole in the second punch (40).
- 5 6. Method as claimed in any of the preceding claims, c h a r a c -  
t e r i z e d in that, after the filling with the third material  
(3) has been carried out, said third material (3) is pressed by  
means of the first punch (30) to the desired degree of compression.
- 10 7. Method as claimed in any of the preceding claims, c h a r a c -  
t e r i z e d in that the ultimate pressing of the product is carried  
out by at the same time pressing by means of the first and the second  
punch (30,40).
- 15 8. Method as claimed in any of the claims 1 to 6, c h a r a c -  
t e r i z e d in that for the ultimate pressing of the product the  
first and the second punch (30,40) are removed and the ultimate  
pressing is carried out by means of a single third punch.
- 20 9. Method as claimed in any of the preceding claims, c h a r a c -  
t e r i z e d in that the removal of the product out of the mould  
(10,20) is carried out after opening of the mould by means of a  
punch/punches (30,40) by pushing in the pressing direction of the  
punch/punches.
- 25 10. Method as claimed in any of the preceding claims, c h a r a c -  
t e r i z e d in that ferrous-metal based sintering powders, ceramic  
sintering powders or equivalent are used as the first material (1).
- 30 11. Method as claimed in claim 10, c h a r a c t e r i z e d in  
that the material of the first material (1) is alloyed with aluminium,  
graphite or equivalent.
- 35 12. Method as claimed in any of the preceding claims, c h a r a c -  
t e r i z e d in that a sintering powder alloyed with hardness-  
improving materials, such as with tungsten, tantalum or titanium  
carbides, is used as the second material (2).

- 1 13. Method as claimed in any of the preceding claims, c h a r a c -  
t e r i z e d in that the same material as the first material is  
used as the third material.
- 5 14. Equipment intended for carrying out the method as claimed in any  
of the preceding claims for the manufacture of a rivet for a fixed  
spike or for a sleeve-mounted spike, respectively, said equipment  
comprising a mould (10,20) provided with a cavity space (11,12,21),  
pressing equipment (30,40), and filling equipment, c h a r a c -  
10 t e r i z e d in that the mould is formed as a two-part mould so  
that the counter-faces (13,22) of the first mould (10) and of the  
second mould (20), to be placed one against the other, are placed in  
the widest portion of the cavity space of the mould in the area of the  
foot widenings (12,21) of the cavity space and that the press equip-  
15 ment (30,40) comprises punches (30,40), which are fitted to act  
towards the second mould (20) substantially perpendicularly to the  
counter-faces (12,21).
- 20 15. Equipment as claimed in claim 14, c h a r a c t e r i z e d in  
that the punches (30,40) are arranged to act jointly and in the same  
direction of pressing.
- 25 16. Equipment as claimed in claim 14 or 15, c h a r a c t e r -  
i z e d in that the punches (30,40), which constitute the press  
equipment, are arranged coaxially one inside the other.

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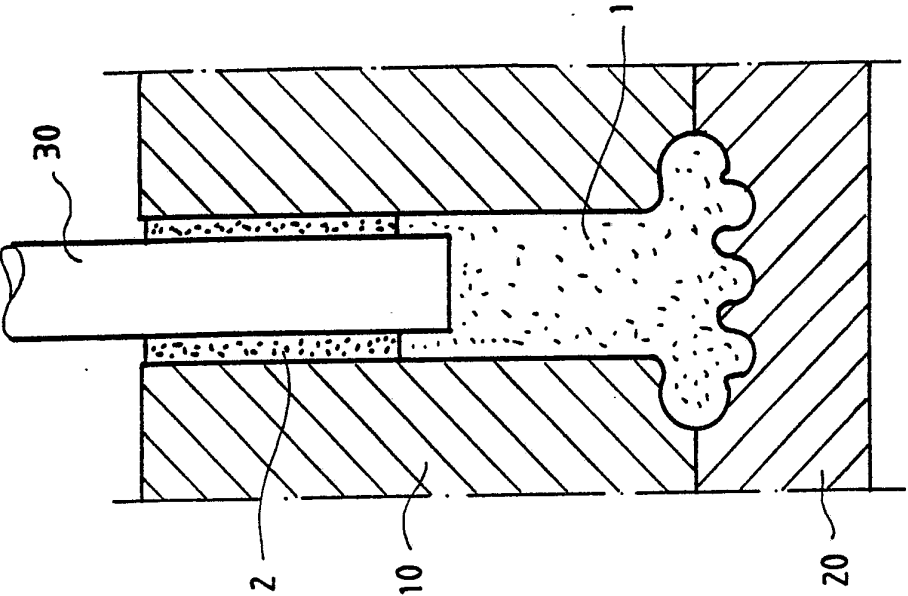


FIG. 2

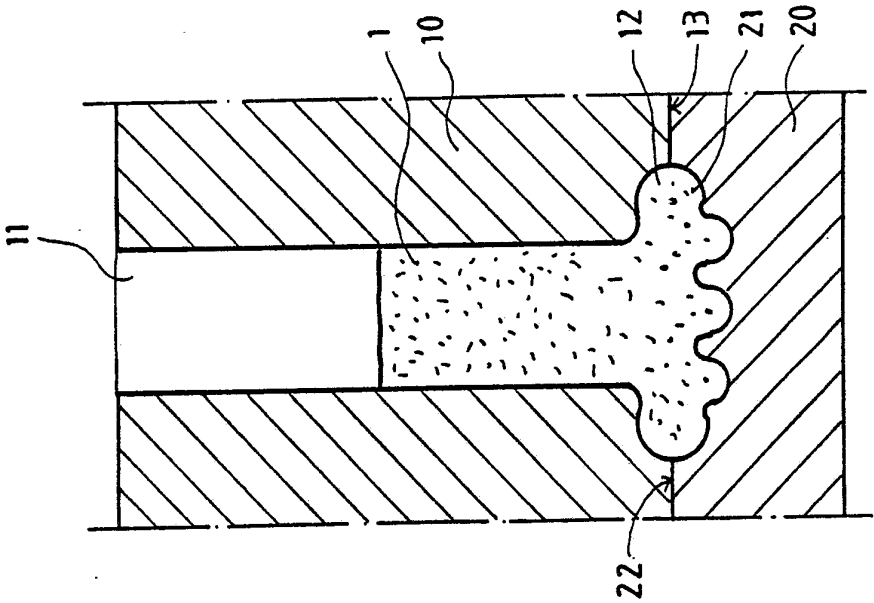


FIG. 1

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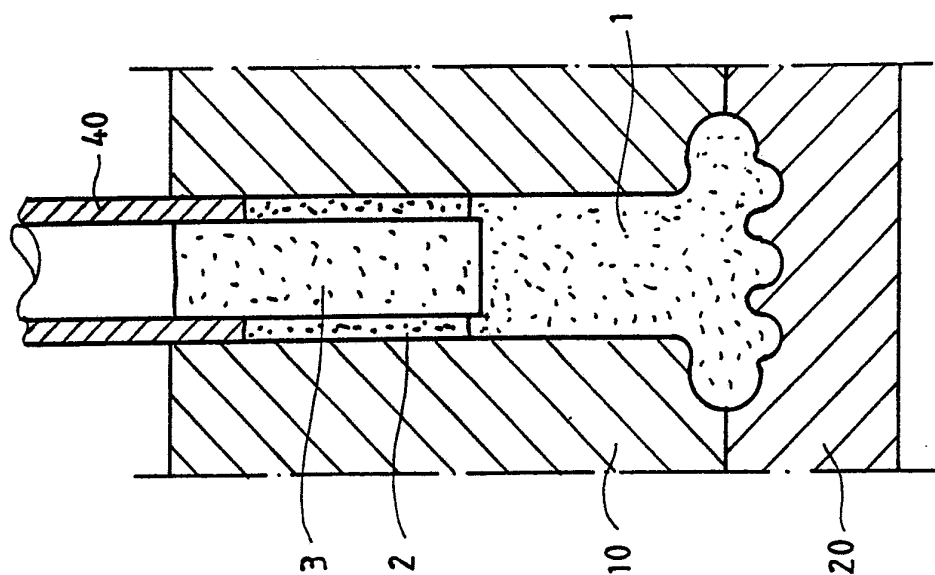


FIG. 4

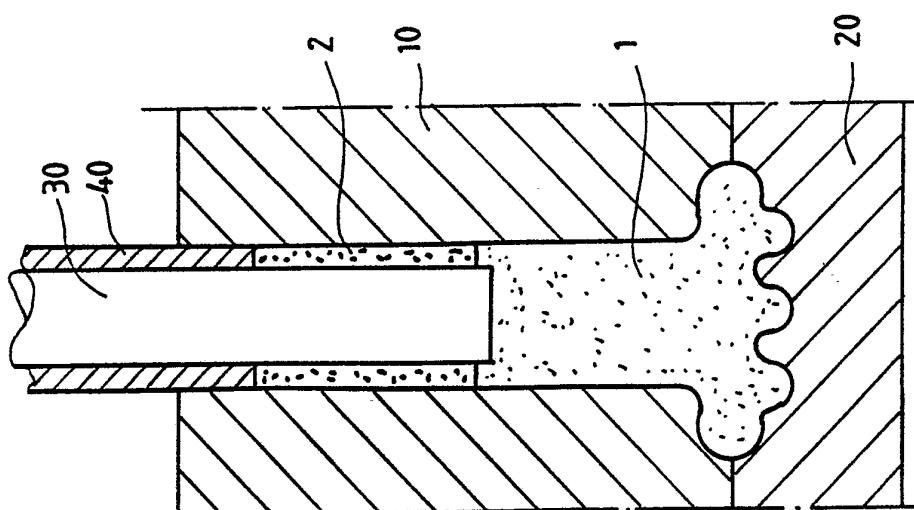


FIG. 3

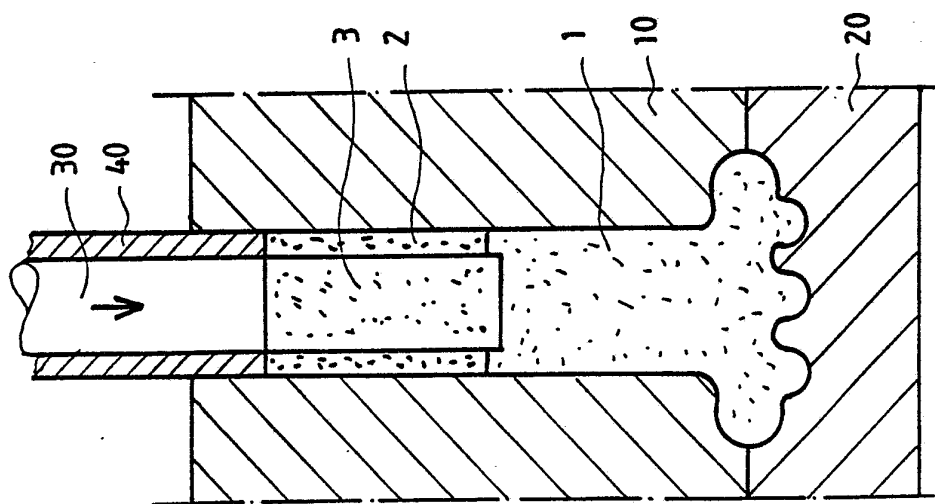


FIG. 5

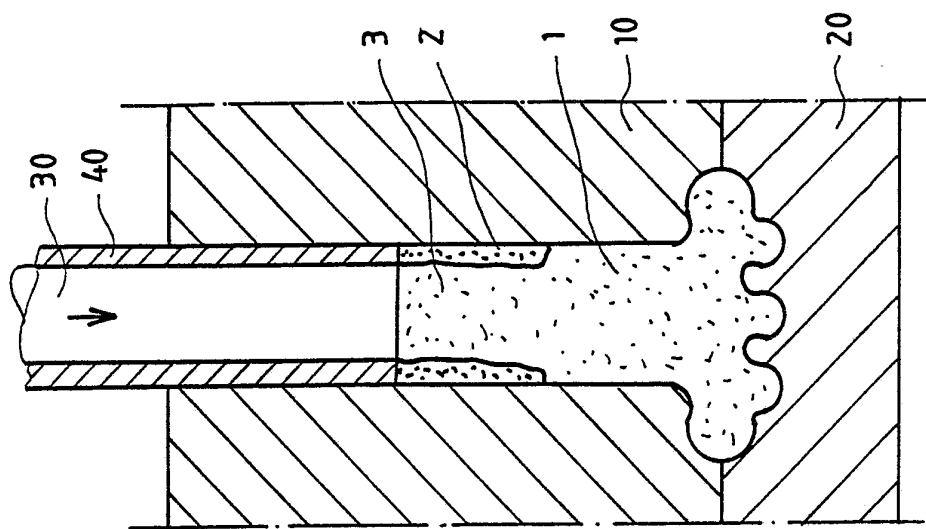


FIG. 6

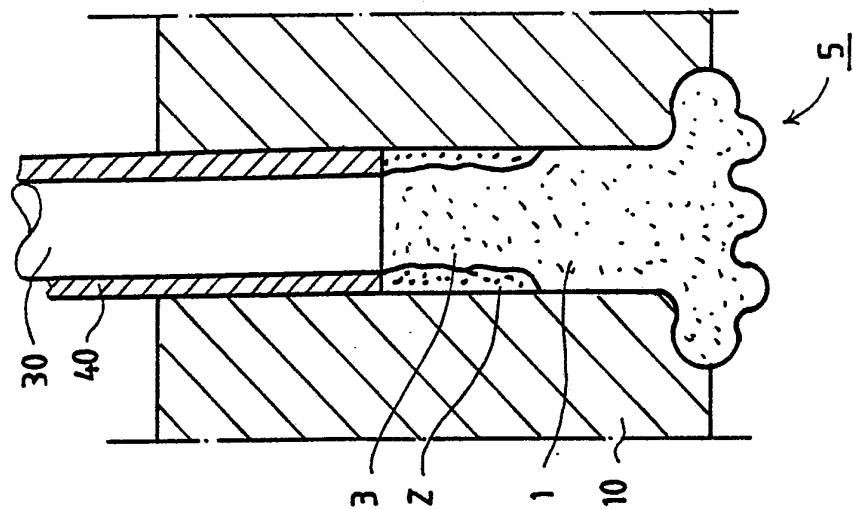


FIG. 7

# INTERNATIONAL SEARCH REPORT

International Application No PCT/FI 89/00167

<b>I. CLASSIFICATION OF SUBJECT MATTER</b> (if several classification symbols apply, indicate all) <sup>6</sup> According to International Patent Classification (IPC) or to both National Classification and IPC IPC4: B 22 F 3/02, 7/00																				
<b>II. FIELDS SEARCHED</b> <div style="text-align: center; border-top: 1px solid black; border-bottom: 1px solid black;">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="padding: 5px;">IPC4</td> <td style="padding: 5px;">B 22 F</td> </tr> </table> <div style="text-align: center; border-top: 1px solid black; border-bottom: 1px solid black;">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	IPC4	B 22 F														
Classification System	Classification Symbols																			
IPC4	B 22 F																			
SE,DK,FI,NO classes as above																				
<b>III. DOCUMENTS CONSIDERED TO BE RELEVANT <sup>9</sup></b> <table style="width: 100%; border-collapse: collapse;"> <tr> <th style="width: 10%; border-bottom: 1px solid black;">Category <sup>10</sup></th> <th style="width: 60%; border-bottom: 1px solid black;">Citation of Document, <sup>11</sup> with Indication, where appropriate, of the relevant passages <sup>12</sup></th> <th style="width: 30%; border-bottom: 1px solid black;">Relevant to Claim No. <sup>13</sup></th> </tr> <tr> <td style="vertical-align: top; padding: 5px;">X,Y</td> <td style="vertical-align: top; padding: 5px;">DE, B, 1282869 (C. OLIVETTI &amp; C., S.P.A.) 14 November 1968, see the whole document --</td> <td style="vertical-align: top; text-align: center; padding: 5px;">14</td> </tr> <tr> <td style="vertical-align: top; padding: 5px;">X</td> <td style="vertical-align: top; padding: 5px;">Derwent's abstract, No. 84 93 938/15, SU 1 026 958, publ. week 8415</td> <td style="vertical-align: top; text-align: center; padding: 5px;">15-16</td> </tr> <tr> <td style="vertical-align: top; padding: 5px;">Y</td> <td style="vertical-align: top; padding: 5px;">--</td> <td style="vertical-align: top; text-align: center; padding: 5px;">14</td> </tr> <tr> <td style="vertical-align: top; padding: 5px;">Y</td> <td style="vertical-align: top; padding: 5px;">US, A, 2815535 (ALBERT G. BODINE, JR.) 10 December 1957, see figures 1,2,4 --</td> <td style="vertical-align: top; text-align: center; padding: 5px;">14</td> </tr> <tr> <td style="vertical-align: top; padding: 5px;">A</td> <td style="vertical-align: top; padding: 5px;">SE, B, 383278 (OY AIRAM AB) 8 March 1976, see the whole document -- -----</td> <td style="vertical-align: top; text-align: center; padding: 5px;">1-16</td> </tr> </table>			Category <sup>10</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,Y	DE, B, 1282869 (C. OLIVETTI & C., S.P.A.) 14 November 1968, see the whole document --	14	X	Derwent's abstract, No. 84 93 938/15, SU 1 026 958, publ. week 8415	15-16	Y	--	14	Y	US, A, 2815535 (ALBERT G. BODINE, JR.) 10 December 1957, see figures 1,2,4 --	14	A	SE, B, 383278 (OY AIRAM AB) 8 March 1976, see the whole document -- -----	1-16
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<div style="display: flex; justify-content: space-between;"> <div style="width: 45%;"> <p><sup>10</sup> Special categories of cited documents: <sup>10</sup></p> <p>"A" document defining the general state of the art which is not considered to be of particular relevance</p> <p>"E" earlier document but published on or after the international filing date</p> <p>"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)</p> <p>"O" document referring to an oral disclosure, use, exhibition or other means</p> <p>"P" document published prior to the international filing date but later than the priority date claimed</p> </div> <div style="width: 50%;"> <p>"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</p> <p>"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step</p> <p>"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.</p> <p>"&amp;" document member of the same patent family</p> </div> </div>																				
<b>IV. CERTIFICATION</b> <table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 50%; border-bottom: 1px solid black; padding: 5px;">           Date of the Actual Completion of the International Search            4th December 1989         </td> <td style="width: 50%; border-bottom: 1px solid black; padding: 5px;">           Date of Mailing of this International Search Report            1989 -12- 14         </td> </tr> <tr> <td style="border-bottom: 1px solid black; padding: 5px;">           International Searching Authority            SWEDISH PATENT OFFICE         </td> <td style="border-bottom: 1px solid black; padding: 5px;">           Signature of Authorized Officer            Nils Engnell <i>Nils Engnell</i> </td> </tr> </table>			Date of the Actual Completion of the International Search 4th December 1989	Date of Mailing of this International Search Report 1989 -12- 14	International Searching Authority SWEDISH PATENT OFFICE	Signature of Authorized Officer Nils Engnell <i>Nils Engnell</i>														
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**ANNEX TO THE INTERNATIONAL SEARCH REPORT  
ON INTERNATIONAL PATENT APPLICATION NO. PCT/FI 89/00167**

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 08/11/89. The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

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