



(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
13.11.2013 Bulletin 2013/46

(51) Int Cl.:
B24B 13/00 (2006.01) B24D 9/08 (2006.01)

(21) Application number: **13002495.3**

(22) Date of filing: **10.05.2013**

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA ME

(30) Priority: **11.05.2012 GB 201208467**
14.05.2012 GB 201208356

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(54) **A lens surfacing pad**

(57) A lens pad (24) for use in surfacing a lens work piece (30), one side (26) of which pad (24) provides a working surface and the other side (28) of which pad provides micro formations (29) spread out substantially uniformly over that other side of the pad (24). When the lens pad (24) is in use, it is attached to a surface of a lens surfacing tool (10). The latter surface provides micro formations (23) spread substantially uniformly over that

surface of the lens surfacing tool (10). The micro formations (29) of the pad (24) interengage or interlock with those (23) of such a surface of such a lens surfacing tool (10) when the pad (24) is in use.

Also, such a lens surfacing tool (10), a combination of such a pad (24) attached to such a tool (10), and a lens surfacing machine having such a tool (10), or such a combination.

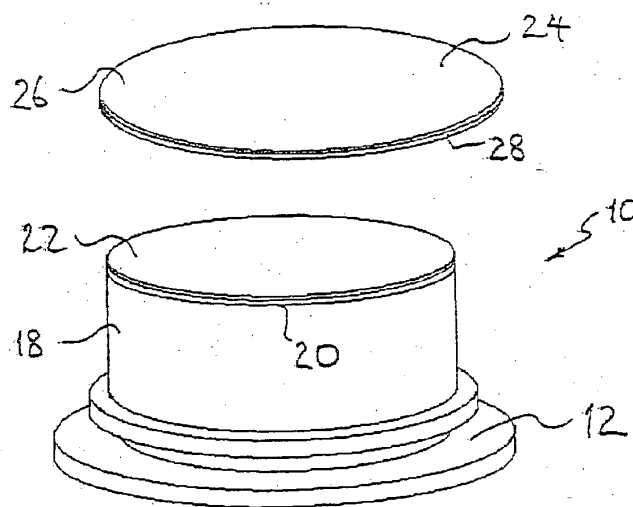


Fig. 2

Description

[0001] The present invention relates to a lens surfacing pad, especially but not exclusively to a lens polishing pad.

[0002] Such a polishing pad or disc is described in US 2011/0009035 A1. The latter discloses a polishing machine for lenses with at least one first polishing spindle having a polishing axis and a tool holder disposed on a first polishing spindle for a first polishing pad or disc being part of a polishing tool, further comprising at least one first work piece spindle having a rotary axis and a work piece holder disposed on the first work piece spindle for a lens, wherein the work piece holder and the tool holder are disposed so as to be moving in translation in the direction of a telescoping axis disposed parallel to the polishing axis and in the direction of a translation axis disposed at right angles to the rotary axis. The polishing machine further has at least one first tool changer for changing the tool and a working chamber formed of at least one wall substantially limiting a spread of polishing medium during processing, when at least the work piece holder and the tool holder are disposed within the working chamber, wherein the first tool changer is disposed at least partially within the working chamber during operation.

[0003] Such a machine is capable of polishing work pieces to form lenses at such a speed that the polishing pad or disc might not last for more than about three hundred seconds, even though during that time it may be used to polish as many as ten lens work pieces. This results in the necessity of providing an automatic tool changer so that polishing tools can be automatically replaced as their pads or discs wear out. At the same time, when the pad wears out, the whole of the polishing tool or head of which it is part is wasted.

[0004] The present invention seeks to provide a remedy.

[0005] Accordingly, the present invention is directed to a lens pad for use in surfacing a lens work piece, one side of which pad provides a working surface and the other side of which pad provides micro formations spread out substantially uniformly over that other side of the pad, for attachment, when the lens pad is in use, to a surface of a lens surfacing tool which surface provides micro formations spread substantially uniformly over that surface of the lens surfacing tool, so that the micro formations of the pad interengage or interlock with those of such a surface of such a lens surfacing tool when the pad is in use.

[0006] Such a lens pad may be held securely while in use, but readily replaced by a fresh pad when it is worn out. The fresh pad may be of different material or materials from the one it replaces, so long as it embodies the present invention.

[0007] Thus the interlocking or interengaging of the micro formations is such that it is necessary to exert sufficient force to overcome the interlocking or interengaging of the micro formations by pulling the pad away from such a surface of such a tool when the pad is worn out, so that

the interengagement or interlocking of the micro formations is resistant to a force which tends to separate the surfaces on which the micro formations are provided, but not so resistant that the pad can not be manually or automatically peeled away from the rest of the tool when it is worn out. An advantage of such engagement or interlocking with certain lens surfacing machines is that the pad is retained on the rest of the tool even when the latter is moved around rapidly on an indexed carousel of a lens surfacing machine and/or by a robot of such machine during replacement of a lens surfacing tool, or even turned upside down if the lens tool is one of many others held on the outside cylindrical surface of an indexed carousel which has a horizontal axis of indexing.

[0008] Individual ones of the micro formations may be in the form of a stem with a head, for example a mushroom-shaped head.

[0009] Preferably, however, the said other side of the said pad provides one of two micro formations, the first of which micro formations comprise hooks and the second of which micro formations comprise loops, the micro formations provided by such a surface of such a tool comprising the other of the said first and second micro formations.

[0010] Preferably, the micro formations on the lens pad comprise loops, although they could comprise hooks.

[0011] The surfacing which such a lens pad is used for may be grinding or lapping the lens work piece, but is preferably polishing the lens work piece.

[0012] The working surface of the pad may be provided by non-woven polyester, polyurethane, or a plastics foam material.

[0013] If the lens pad is provided with hooks, these may be provided by a polyester or polypropylene material.

[0014] If the polishing pad is provided with loops, these may be provided by a polyamide velour.

[0015] The hooks may have a length or height in the range from 0.2mm to 0.6mm, and are preferably substantially 0.4mm high.

[0016] The lens pad may be from 0.5mm in overall thickness to 2.5mm and is preferably substantially 1.5mm thick.

[0017] The diameter of the pad may be in the range of from 3cm to 7cm, and is preferably substantially 4.5cm.

[0018] The pad is preferably circular, in the form of a disc, but may have many other shapes, so that it may be generally oval or rectangular and may have radial slots opening out on to its periphery to enable the pad more readily to adopt a convex or concave curvature.

[0019] The present invention extends to a lens work piece surfacing tool for use in the surfacing of a lens work piece, a surface of which tool provides micro formations substantially uniformly spread over that surface, to which surface is attached a lens surfacing pad, one side of which provides a working surface and the other side of which is provided with micro formations spread substantially uniformly over the said other side of the lens pad,

so that the micro formations of the pad interengage or interlock with those of the said surface of the lens surfacing tool.

[0020] Such a lens pad may be held securely while in use, but readily replaced by a fresh pad when it is worn out. It is necessary however to exert sufficient force to overcome the interlocking or interengaging of the micro formations by pulling the pad away from such a surface of such a tool when the pad is worn out, so that the interengagement or interlocking of the micro formations is resistant to a force which tends to separate the surfaces on which the micro formations are provided. The fresh pad may be of different material or materials from the one it replaces, so long as it embodies the present invention.

[0021] Individual ones of the micro formations may be in the form of a stem with a head, for example a mushroom-shaped head.

[0022] Preferably, however, the said other side of the said pad provides one of two micro formations, the first of which micro formations comprise hooks and the second of which micro formations comprise loops, the micro formations provided by the said surface of the tool comprising the other of the said first and second micro formations.

[0023] Preferably, the micro formations on the lens pad comprise loops, although they could comprise hooks.

[0024] The surfacing for which such a tool is used may be grinding or lapping the lens work piece, but is preferably for polishing the lens work piece.

[0025] The working surface of the lens pad may be provided by a non-woven polyester material, polyurethane, or a plastics foam material, although it may be provided by other materials.

[0026] The hooks may comprise a polyester or polypropylene material, and the loops may be provided by a polyamide velour.

[0027] The hooks may have a length or height in the range from 0.2mm to 0.6mm, and are preferably substantially 0.4mm high.

[0028] The lens pad may be from 0.5mm in overall thickness to 2.5mm and is preferably substantially 1.5mm thick.

[0029] The diameter of the pad may be in the range of from 3cm to 7cm, and is preferably substantially 4.5cm.

[0030] The pad is preferably circular in the form of a disc, but may have many other shapes, so that it may be generally oval or rectangular and may have radial slots opening out on to its periphery to enable the pad more readily to adopt a convex or concave curvature.

[0031] The surface to which the lens pad is attached may be across the top of a block of a synthetic plastics foam material which is yieldable and resilient.

[0032] The base of the foam block may be provided with a rigid connector, which may be of a synthetic plastics material, for connecting the lens tool to a lens tool holder of a lens polishing machine.

[0033] Examples of a lens pad and examples of a lens

work piece surfacing tool, each made in accordance with the present invention, will now be described in greater detail with reference to the accompanying drawings, in which:

- 5 Figure 1 shows a side elevational view of a lens work piece surfacing tool made in accordance with the present invention;
- 10 Figure 2 shows a side perspective view of a tool shown in Figure 1 with a lens pad thereof displaced from the rest of the tool, the lens pad also being made in accordance with the present invention;
- 15 Figure 2(a)(i) shows a side view of details, on a larger scale, of the tool shown in Figures 1 and 2;
- Figure 2(a)(ii) shows a side view of details, on a larger scale, of the pad shown in Figures 1 and 2;
- 20 Figure 2(a)(iii) shows a cross-sectional side view of details, on a larger scale, of a modified form of tool embodying the present invention; and
- 25 Figure 3 shows a side view of the tool shown in Figures 1 and 2 in use mounted on a lens tool holder and working on a lens work piece held by a lens work piece holder of a lens polishing machine.

30 **[0034]** Figures 1 to 3 show a lens work piece polishing tool 10 comprising a rigid synthetic plastics generally circular base 12 provided with formations 14 enabling it to be connected and securely mounted on a lens tool holder 14 supported on spring reinforced bellows 16. The latter enable a uniform pressure to be exerted by the lens work piece surfacing tool 10.

35 **[0035]** A synthetic plastics yieldable and resilient cylindrical block of foam 18 is secured to the base 12 by an adhesive (not shown). An intermediate disc of a plastics material 20 is secured to an intended upper face of the foam block 18 also by an adhesive. A disc 22 of a polypropylene material is secured to the intermediate disc 20 again by means of adhesive. The outward facing side of the disc 22 is covered substantially uniformly by a myriad of micro hooks, as shown in Figure 2(a)(i) labelled 23, standing on average about 0.39mm high. The disc 22 is constituted by a sheet material sold by Velcro USA, Inc., of Manchester, New Hampshire, United States of America, under the product code HTH 830 and under the registered trade mark ULTRA-MATE.

40 **[0036]** Releasably secured to the outer surface of the disc 22 is a lens pad 24 comprising an upper disc 26 of polishing material in the form of a fine synthetic plastics foam and a lower disc 28 secured to the upper disc 26 by means of adhesive and constituted by a polyamide velour sold by Velcro USA, Inc., under the product code Velour 3165. This velour provides a myriad of micro loops, as shown in Figure 2(a)(ii) labelled 29, spread sub-

stantially uniformly across the lower surface of the pad 24. The pad 24 is releasably secured to the outer surface of the disc 24 by the interengaging or interlocking of the hooks and loops.

[0037] It will be appreciated therefore that the Velcro® fastening of the lens pad 24 to the foam block 18 enables the pad 24 to be readily ripped off the surface 22 of the tool 10 to enable a replacement pad having the same construction as the one peeled off to be fixed by the Velcro fastening to the surface 22.

[0038] When in use, the tool or head shown in Figure 1 is mounted on a tool holder 14 as shown in Figure 3. The polishing surface provided by the polishing disc 26 is urged against a lens work piece 30 held by the lens work piece holder 32. The tool mount 14 and the lens holder 32 constitute parts of a polishing machine (not shown as a whole) which by means of motors and drive couplings bring about relative motion between the lens work piece holder 32 and the tool holder 14 to impart a relative movement between the lens work piece 30 and the lens tool 10 so that the polishing disc 26 polishes the optical surface of the lens work piece 30.

[0039] The polishing machine is also provided with nozzles (not shown) directing polishing fluid on to the lens work piece 30 and the lens tool 10.

[0040] The polishing machine is also provided with robots (not shown) to enable the lens tool 10 to be replaced when its polishing pad is worn out.

[0041] Used lens tools rejected by the machine can have their polishing pads 24, now worn by use, ripped off without damage to the rest of the tool by virtue of the use of the Velcro® fastening. A fresh polishing pad 24 may be attached again by the Velcro fastening on to the surface 22 of the used tool so that the latter is now ready for re-use.

[0042] Numerous variations and modifications to the illustrated construction of pad and tool may occur to the reader without taking the resulting construction outside the scope of the present invention. For example, the pad 24 might be made of a single material, so that it is not composite. The intermediate disc 20 might be omitted so that the disc 22 is secured by adhesive directly on to the foam block 18. The adhesives used may comprise a permanent rubber base adhesive or a permanent acrylic base adhesive. Instead of hooks 23 of the tool 10, there may be provided micro-formations each comprising a stem 40 at the outer end of which there is a head 42, which may be mushroom shaped, as shown in Figure 2 (a)(iii).

Claims

1. A lens pad (24) for use in surfacing a lens work piece (30), one side (26) of which pad (24) provides a working surface and the other side (28) of which pad (24) provides micro formations (29) spread out substantially uniformly over that other side (28) of the pad

(24), for attachment, when the lens pad (24) is in use, to a surface of a lens surfacing tool (10) which surface provides micro formations (23) spread substantially uniformly over that surface of the lens surfacing tool (10), so that the micro formations of the pad (24) interengage or interlock with those of such a surface of such a lens surfacing tool (10) when the pad is in use.

2. A lens pad according to claim 1, **characterized in that** the micro formations on the lens pad (24) comprise loops (29).

3. A lens pad according to claim 2, **characterized in that** the loops (29) are provided by a polyamide velour.

4. A lens pad according to any preceding claim, **characterized in that** the micro formations on the lens pad (24) comprise hooks.

5. A lens pad according to claim 4, **characterized in that** the hooks are provided by a polyester or polypropylene material.

6. A lens pad according to claim 4, **characterized in that** the hooks have a length or height in the range from 0.2mm to 0.6mm.

7. A lens pad according to any preceding claim, **characterized in that** the overall thickness of the pad is in the range from 0.5mm to 2.5mm.

8. A lens pad according to any preceding claim, **characterized in that** the diameter of the pad is in the range from 3cm to 7cm.

9. A lens pad according to any preceding claim, **characterized in that** the pad is circular, in the form of a disc.

10. A lens work piece surfacing tool (10) for use in the surfacing of a lens work piece (30), a surface of which tool (10) provides micro formations (23) substantially uniformly spread over that surface, to which surface is attached a lens surfacing pad (24) when the tool is in use, one side (26) of which pad provides a working surface and the other side (28) of which is provided with micro formations (29) spread substantially uniformly over the said other side of the lens pad (24), so that the micro formations of such a pad (24) interengage or interlock with those of the said surface of the lens surfacing tool (10) when the tool is in use.

11. A lens work piece surfacing tool (10) according to claim 10, **characterized in that** the tool (10) comprises a block (18) of a synthetic plastics foam ma-

terial which is yieldable and resilient, the surface to which such a lens pad is attached being across the top of the said block (18).

12. A lens work piece surfacing tool (10) according to claim 11, **characterized in that** the base of the said block (18) is provided with a rigid connector (12), which may be of a synthetic plastics material, for connecting the lens tool (10) to a lens tool holder (14) of a lens polishing machine. 5 10
13. A combination of a lens pad (24) as claimed in any one of claims 1 to 9 attached to a lens work piece surfacing tool (10) as claimed in any one of claims 10 to 12. 15
14. A lens surfacing machine having a lens work piece surfacing tool (10) as claimed in any one of claims 10 to 12. 20
15. A lens surfacing machine having a combination of a lens pad (24) and a lens work piece surfacing tool (10) as claimed in claim 13. 25

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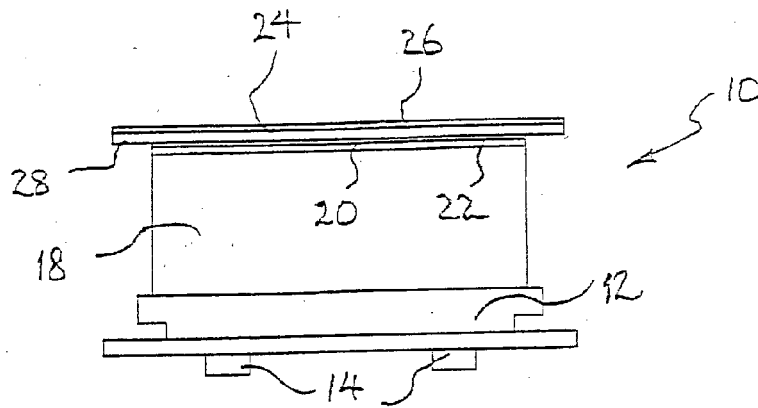


Fig. 1

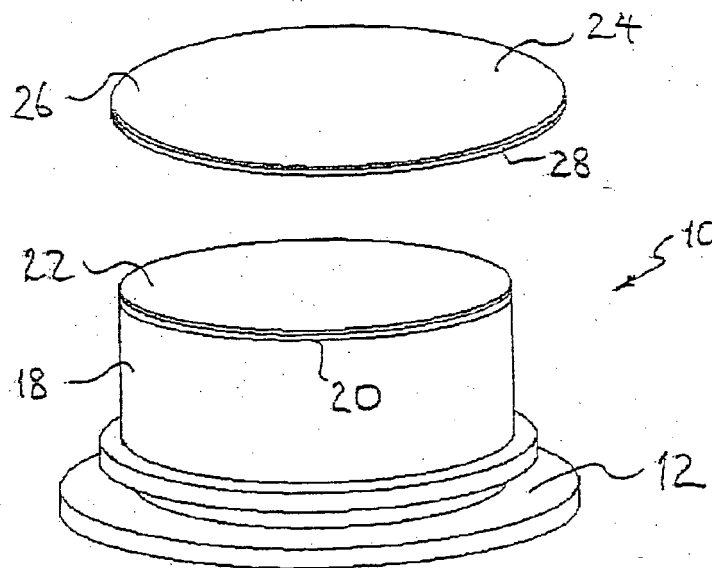


Fig. 2

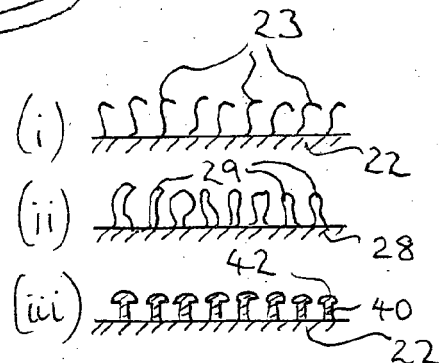


Fig. 2a

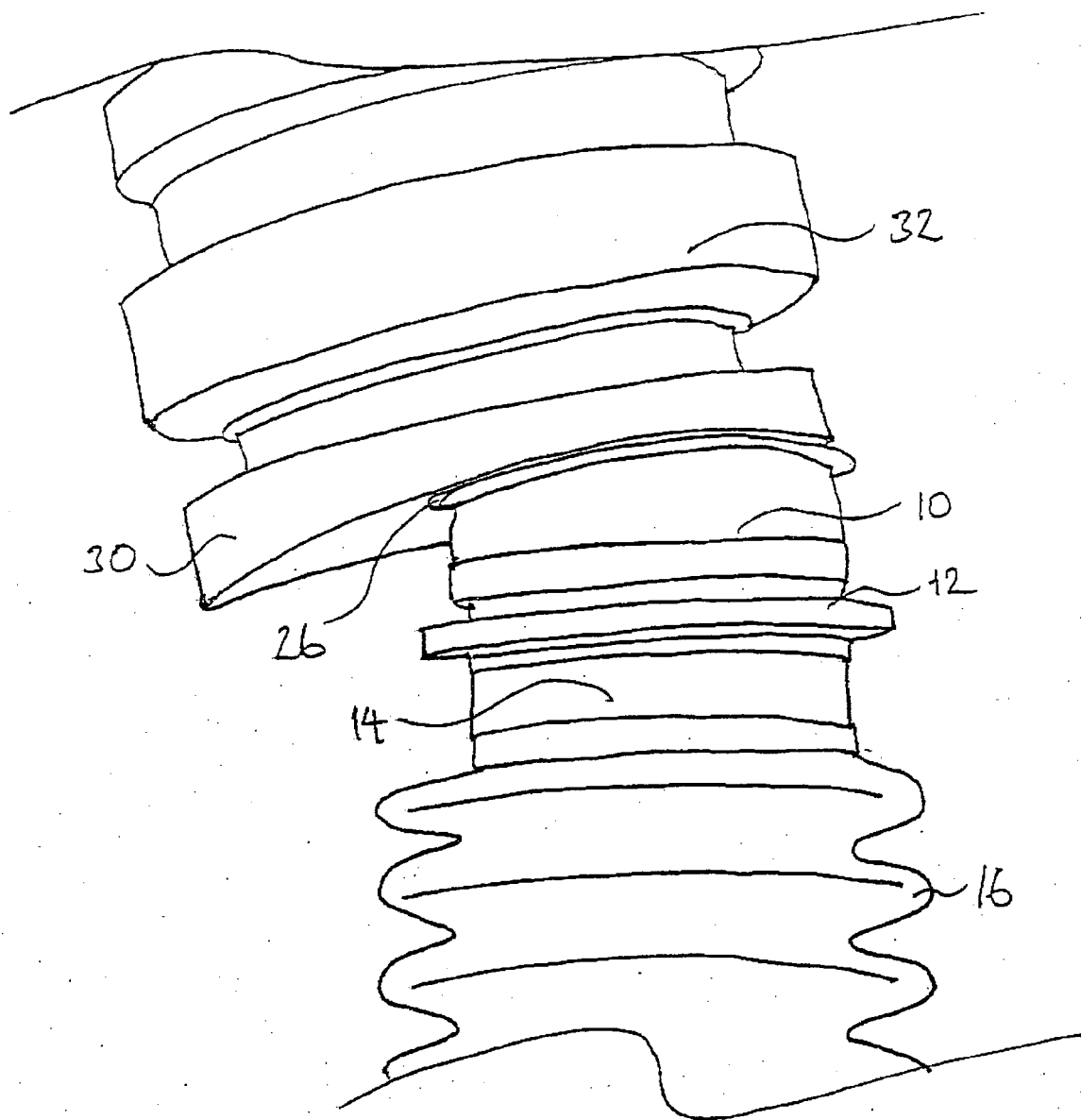


Fig. 3



EUROPEAN SEARCH REPORT

Application Number
EP 13 00 2495

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Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	WO 95/19242 A1 (MINNESOTA MINING & MFG [US]) 20 July 1995 (1995-07-20) * page 42, line 23 - page 43, line 22; figures 9,10 *	1-15	INV. B24B13/00 B24D9/08
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			TECHNICAL FIELDS SEARCHED (IPC)
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The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 27 August 2013	Examiner Koller, Stefan
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document	

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EPO FORM 1503 03.82 (P04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
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The members are as contained in the European Patent Office EDP file on
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