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(54) Safety connector arrangement

(57) 1. Safety electrical connector device, comprising a male contact and a female contact, the female connection being provided with a coaxial safety device, the female contact (100) being provided with a cavity (14) delimited by an at least partly electrically conductive wall (12), said connector device being characterised in that the safety device comprises a first protection (1) and a second protection (2), the first protection (1) being hollow and open in correspondence of the end faced toward the bottom (13) of the cavity (14), the second protection (2) being provided inside the first protection (1), said safety device further comprising check elastic means (4), diametrically occupying all the cavity (14), and coupled with said second protection (2), said elastic means being provided with ends (4') partially engaged with shoulders (5) realised on the inner side of the female contact wall (12) and partially contacting lower ends (1') of the first protection (1), the check elastic means (4) exerting an elastic force against the walls (12) in correspondence of said shoulders (5), so that, when the first protection (1) is pushed inward the cavity (14) by a male electrical contact, check elastic means (4) are disengaged from said shoulders (5), engaging with said lower ends (1'), and the safety device is integrally moved toward the inside of the cavity (14).

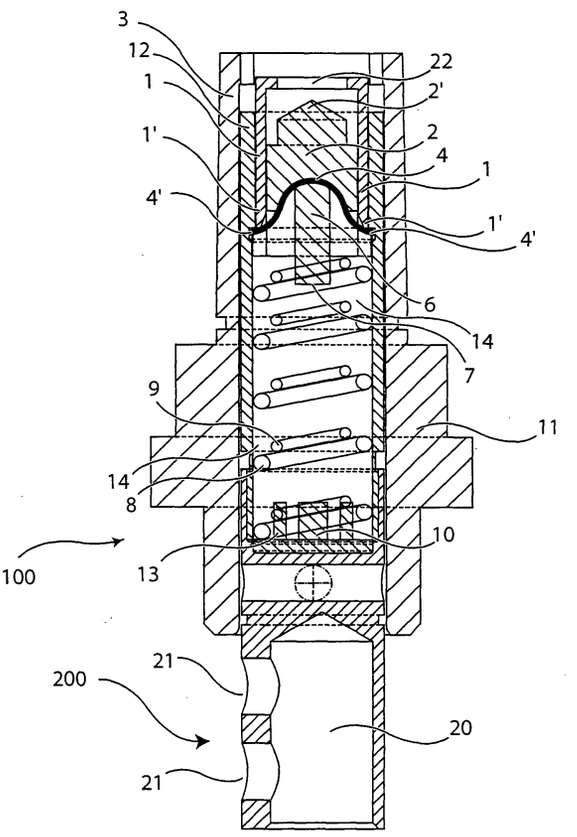

Fig. 1a

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Description

[0001] The present invention relates to a male-female electrical connector device provided with security device, security device and female electrical contact to be used in the male-female electrical connector device.

[0002] More specifically, the male-female electrical connector device provided with security device according to the invention is suitable to reduce the possibility of unintentional intrusion within the same electric contact, but the introduction of the male electrical contact, thanks to the use of an innovative safety device and to the use of a corresponding female electrical contact.

[0003] Male-female kind electric connector devices are universally known, such as the connector device comprised of the jack for numerous acoustic apparatuses, or those use to load numerous electronic devices, such as the cellular phone.

[0004] Male electric contact is usually comprised of a cylinder, or of a cylindrical crown, covered outside by metallic material.

[0005] Female contact is a hollow cylinder having dimensions corresponding to those of the male contact, and provided inside with a conductive surface, suitable to contact the corresponding surface of the male contact as soon as the latter is properly introduced within the same female contact.

[0006] However, for some electrical connector devices, these kind of connector devices, even working properly, are very dangerous.

[0007] In fact, in case of high power electrical connector devices, is there a serious risk of unintentionally touching the inner conductive surface of the female contact, e.g. by the tip of a screwdriver.

[0008] To overcome this drawback, different female contacts provided with safety devices have been proposed.

[0009] For example, the device described in the US patent n° 5,921,823 comprises a piston pushed by a spring inside the female contact.

[0010] In this way, when the male contact is not inserted as yet, cavity of the female contact would be protected by the piston. Unintentional contact with a conductive tip would be consequently less probable.

[0011] However, it is to be noted that this solution according to the US patent n° 5,921,823 has no inventive feature in its independent claim, and is not particularly efficient.

[0012] In fact, as to the inventiveness, spring systems (or similar elastic means) for electrical connector devices were already known before the filing date of the above patent.

[0013] For example, we can mention the US patent n° 4,652,067, describing an electrical connector device the female contact of which comprises a piston pushed by a spring. Said piston projects within the spring and contacts an inner conductive surface once the male contact is inserted.

[0014] US patent n° 5,175,493 further describes a piston device released by a spring to make current tests for single elements of a circuit.

[0015] US patent n° 5,118,301 describes a device similar to the one according to US patent n° 4,652,067, with a piston pushed by a spring, said spring, once pushed from outside, contacts a conductive surface within the female contact.

[0016] One skilled in the art, being aware of the male-female contacts similar to the jack type, and knowing the last three US patents, would have surely conformed the existing solutions to put the conductive surface within the female contact on the inner wall of a hollow cylinder and at the same time would have had used a piston for safety reasons, as in the first mentioned US patent n°5,921,823.

[0017] It is well clear that this last patent claims also particular arrangements, providing corresponding more or less innovative solutions.

[0018] Furthermore, and in any case, the solution of this patent is not so efficient as it would seem.

[0019] In fact, if on one side the inlet of the female contact is protected by the piston, on the other side it is not possible to use too stiff or to pre-loaded springs, otherwise it would be difficult the introduction of the male contact.

[0020] Not being possible loading too much the springs, an unintentional movement of a conductive tip could in any case pushing the piston, contacting the inner surface of the female contact, with high risks for the device connected with the tip or, even worse, for the operator.

[0021] Still, the Italian Patent Application n° RM99A000137 discloses a female contact provided with a safety device able to prevent unintentional introductions, but it provides that it is necessary to unlock the safety device pushing some buttons projecting out of the connector device. Said buttons are automatically pushed by the insulating female housing of the male contact. It is in any case necessary providing said buttons on the outer wall of the female contact, this requiring a particular working.

[0022] Always exploiting the principle of the piston and spring arrangement, even if in a very specific way for a particular application, device disclosed in US patent n° 6,275,054 allows a contact between at least a pair of male-female contacts.

[0023] It is object of the present invention that of providing a male-female electrical connector device, wherein the female contact is provided with a safety device and is suitable to receive and electrically connect a male contact, solving the drawbacks and overcoming the limitations mentioned in the above.

[0024] Further specific object of the present invention is that of providing a safety device to be used in said female contact.

[0025] Still, it is specific object of the present invention a female electrical contact for a male-female contact,

suitable to receive and to operate said safety device.

[0026] It is object of the present invention a safety electrical connector device, comprising a male contact and a female contact, the female connection being provided with a coaxial safety device, the female contact being provided with a cavity delimited by an at least partly electrically conductive wall, said connector device being characterised in that the safety device comprises a first protection and a second protection, the first protection being hollow and open in correspondence of the end faced toward the bottom of the cavity, the second protection being provided inside the first protection, said safety device further comprising check elastic means, diametrically occupying all the cavity, and coupled with said second protection, said elastic means being provided with ends partially engaged with shoulders realised on the inner side of the female contact wall and partially contacting lower ends of the first protection, the check elastic means exerting an elastic force against the walls in correspondence of said shoulders, so that, when the first protection is pushed inward the cavity by a male electrical contact, check elastic means are disengaged from said shoulders, engaging with said lower ends, and the safety device is integrally moved toward the inside of the cavity.

[0027] Preferably, according to the invention, said shoulders are cavities realised in the wall and the side of which faced toward the bottom of the cavity is oblique toward said bottom, i.e. The angle between the vertical profile of the wall and said oblique side is an obtuse angle.

[0028] According to the invention, the wall just under said oblique side can advantageously be, at least for a part of it, thinner than the wall just above said cavity, the profile of the side of the wall outward most with respect to the cavity not being modified.

[0029] Preferably, according to the invention, said obtuse angle is between 110° and 160° sexagesimal, still more preferably between 125 ° and 145 ° sexagesimal.

[0030] Preferably, according to the invention, said lower ends of the first protection have the side faced toward inside, opposite to the side faced toward the wall and parallel to the same, oblique, in such a way that the thickness of the lower ends reduces close to the bottom of the cavity.

[0031] Advantageously according to the invention, said first protection has an opening in correspondence of the end faced toward the inlet of the cavity.

[0032] Still advantageously, according to the invention, the second protection is provided with an upper end so shaped to partially penetrate within said opening of the upper base of the first protection.

[0033] Preferably, according to the invention, check elastic means are comprised of a arc spring, the arc being opened toward the cavity bottom, or of two elements joined by a spring, or of one or more lugs, laterally joined with the second protection and provided with elastic means, tending to open the same, said lugs realising, when their ends are engaged with said shoulders, in the direction of the inner part of the cavity, an acute angle with respect to the lateral profile of the second protection.

[0034] According to the invention, it is preferable that the electric contact comprises buckling elastic means of the safety device, always pushing said safety device toward the inlet of the female electrical contact.

[0035] Preferably, according to the invention, said buckling elastic means comprise first and second buckling means, said first buckling elastic means acting on the first protection, said second buckling means acting on the second protection.

[0036] Preferably, according to the invention, said buckling elastic means comprise helicoidal springs.

[0037] According to the invention, the above electric connector device preferably comprises a first stop shoulder element, integrally joined with the second protection, to make contact, at the end of stroke of the safety device within the female contact, with a corresponding second stop shoulder element joined with the bottom of said cavity.

[0038] According to the invention, male contact and female contact can be each one provided with an insulating female casing and with an insulating male casing, said insulating casings being provided with coupling and locking means, aid coupling and locking involving the introduction of the male electrical contact within the female electrical contact.

[0039] It is further object of the present invention a safety device for female electrical contact of an electric connector device comprising female electrical contact and male electrical contact, characterised in that said safety device is used in the above described electrical connector device.

[0040] It is further object of the present invention a female electrical contact of an electrical connector device comprising female electrical contact and male electrical contact, characterised in that it is the above described female contact.

[0041] The present invention will be now described, for illustrative but not limitative purposes, according to its preferred embodiments, with particular reference to the figures of the enclosed drawings, wherein:

Figure 1 a is a longitudinal section of a female contact according to the invention, in the inactive configuration;

Figure 1b is a perspective, section view of the first protection of the safety device according to the invention according to figure 1a, projecting outside the female contact;

Figure 1 c shows two different sections and perspectives of the second protection of the safety device according to invention;

Figure 1 d shows an enlargement of a part of the female contact of figure 1a;

Figure 2 is a longitudinal section of the configuration

of the female contact of figure 1 a when the male contact pushes the first protection for a part of its stroke, so as to release the second protection;

Figure 3 is a longitudinal section of the piston stop and of the two protections, corresponding to the electric contact position between a male contact (not shown) and the female contact of figures 1 and 2;

Figure 4 shows a different embodiment of the electrical contact and of the safety device according to the invention; and

Figure 5 shows a further different embodiment of the electrical contact and of the safety device according to the invention.

[0042] In the figures, the same reference numbers will be used for the same elements.

[0043] Making reference to figures 1 a and 1 d, the female contact 100 is provided with a male insulating envelope 3, 11, and an inner wall 12, said wall 12 being at least partially conductive. Female electrical contact 100 is provided with a safety device essentially comprised of a first protection 1 and a second protection 2, check elastic means 4 (arc or "▯" spring) and two helicoidal springs 8 and 9.

[0044] The first protection 1 can be observed in a perspective view in figure 1b. it is comprised of a hollow cylinder, a fascia of its lower part, provided inside the female contact in the rest position shown in figure 1 a, has a progressively reduced thickness until its truncated lower end, so as its section is trapezoidal, as it can be observed in figure 1 b (part 1'). It provides notches 1" to let the ends 4' of the check elastic means passing, as it will described in the following.

[0045] It is also possible that the protection 1 is not completely solid.

[0046] The second protection 2 is of the "cylindrical type". For example, in figure 1a it is comprised of two cylinders and of a conical tip 2'. Tip 2 partially projects with respect to the upper base of the cavity 14 of the contact 100.

[0047] In figure 1 c it is shown a preferred embodiment of he second the second protection, with the curved housing 2" to introduce the check means 4. it must be noted that a second part of the second protection (not shown) can be restrained in such a way to limit the movement of the check means 4, or even to block the same.

[0048] The second protection 2 is lower than the upper base of the first protection 1.

[0049] Check means 4, that in the figure are comprised of the inverted "U" (or "▯") spring, prevent the advancement of the second protection 2.

[0050] Really, spring can be integral with the second protection 2, for example obtained by a single die and comprised of plastic material.

[0051] Ends 4' of the spring engage with the two shoulders 5 of the wall 12, e.g. notches. Said wall 12 has a different thickness between the upper part and the lower part (lower than the spring in the rest position of the safety device).

[0052] More specifically, in the example shown, a part of the end 4' engages with notches 5 and another part of the ends engages with the tip 1' of the first protection 1.

[0053] In this way, when the first protection 1 is pushed upward, by the male contact, tips 1' push the check means 4, said check means contracting horizontally up to sliding along the oblique side of the trapezoidal section tips 1', as shown in figure 2.

[0054] Now, prosecuting the pushing action on the first protection 1 and on the conical tip 2' of the second protection 2, check means 4 and the safety device is moved downward, buckling the elastic force of the two springs 8 and 9.

[0055] In any case, check elastic means 4 are provided with a "cylindrical" element 6, having base 7 lower than the same check means contacting a corresponding cylindrical element 10 raising on the base 13 of the cavity 14 of the female contact, thus realising the stop of the safety device, in the position of figure 3. It is clear that the dimensions of the parts can be chosen so as the base 7 directly contacts the bottom 13 of the cavity 14, thus eliminating the need of the presence of the shoulder 10.

[0056] Cylindrical element 7 is preferably integral with the second protection 2.

[0057] In correspondence of the stop position of the element 7 against the element 10, it is obtained the complete activation of the locking device of the male contact within the female contact.

[0058] This locking can occur thanks to coupling and locking means provided on the same electrical contacts, but it is more convenient coating the same before the coupling and thus using the insulating envelopes provided with similar coupling and locking means.

[0059] Advantageously, it is possible to use a female insulating element for the male contact and a male insulating envelope for the female contact, as those disclosed in US patent 5,685,730.

[0060] Said coupling and locking means also allow the releasing of the elements.

[0061] It is to be noted that according to the present invention it is possible to provide solutions for the check means 4 different with respect to the arc spring.

[0062] As it appears from figure 4, said check elastic means 4 are comprised of two elements 15, joined horizontally by a spring 16. ends of said means are engaged with the same shoulders 5 when the safety device is in the rest position and are disengaged by the first protection in the same way of the arc spring, when the male electric contact 300 is introduced within the female contact.

[0063] As further example, the second protection 2 of figure 5 is laterally provided with said check elastic means, being the latter comprised of two lugs 17, for

example returned by a spring (not shown). In this case too, the ends of the two lugs are engaged in said shoulders 5 and are disengaged from the first protection 1. Buckling elastic means 23 (e.g. springs) are laterally provided between the first 1 and the second 2 protection.

[0064] In all the previous embodiments, in the female contact there are distingushed the part 100, with the cavity 14, from the part 200, containing a further cavity 20, within which the electrical wires are inserted and fixed by suitable fixing means, even through the openings 21.

[0065] In this way, the above different embodiments are interchangeable with respect to the same part 200.

[0066] Thanks to the safety device according to the present invention, particularly suitable for high power electrical contacts, it is reduced the risk of unintentional introduction of conductive materials within the female contact.

[0067] In fact, pressure surface useful to release the safety device according to the present invention is minimum, it substantially being the section of a hollow cylinder. However, the pressure surface can can be further reduced to one or two very small areas, providing the hollow cylinder with two linear projections.

[0068] The present invention has been described for illustrative but not limitative purposes, according to its preferred embodiments, but it is to be understood that modifications and/or changes can be introduced by those skilled in the art without departing from the relevant scope as defined in the enclosed claims.

Claims

1. Safety electrical connector device, comprising a male contact and a female contact, the female connection being provided with a coaxial safety device, the female contact (100) being provided with a cavity (14) delimited by an at least partly electrically conductive wall (12), said connector device being **characterised in that** the safety device comprises a first protection (1) and a second protection (2), the first protection (1) being hollow and open in correspondence of the end faced toward the bottom (13) of the cavity (14), the second protection (2) being provided inside the first protection (1), said safety device further comprising check elastic means (4), diametrically occupying all the cavity (14), and coupled with said second protection (2), said elastic means being provided with ends (4') partially engaged with shoulders (5) realised on the inner side of the female contact wall (12) and partially contacting lower ends (1') of the first protection (1), the check elastic means (4) exerting an elastic force against the walls (12) in correspondence of said shoulders (5), so that, when the first protection (1) is pushed inward the cavity (14) by a male electrical contact, check elastic means (4) are disengaged from said shoulders (5), engaging with said lower ends (1'), and the safety device is integrally moved toward the inside of the cavity (14).

2. Electrical connector device according to claim 1, **characterised in that** it comprises buckling elastic means (8, 9) for the safety device, pushing said safety device always toward the inlet of the female electrical contact (100).

3. Electrical connector device according to claim 2, **characterised in that** said buckling elastic means (8, 9) comprise a first and a second buckling elastic means, said first buckling elastic means (8) acting on the first protection (1), said second buckling elastic means (8) acting on the second protection (2).

4. Electrical connector device according to claim 2 or 3, **characterised in that** said buckling elastic means (8, 9) comprise helicoidal springs.

5. Electrical connector device according to each one of the preceding claims, **characterised in that** said shoulders (5) are cavities realised in the wall (12) and the side (5') of which faced toward the bottom (13) of the cavity (14) is oblique toward said bottom, i.e. the angle between the vertical profile of the wall (12) and said oblique side (5') is an obtuse angle.

6. Electrical connector device according to claim 5, **characterised in that** the wall (12) just under said oblique (5') side can advantageously be, at least for a part of it, thinner than the wall (12) just above said cavity (14), the profile of the side of the wall outward most with respect to the cavity not being modified.

7. Electrical connector device according to claim 5 or 6, **characterised in that** said obtuse angle is between 110° and 160° sexagesimal.

8. Electrical connector device according to claim 6, **characterised in that** said obtuse angle is between 125° and 145° sexagesimal.

9. Electrical connector device according to each one of the preceding claims, **characterised in that** said lower ends (1') of the first protection (1) have the side faced toward inside (1''), opposite to the side faced toward the wall (12) and parallel to the same, oblique, in such a way that the thickness of the lower ends (1') reduces close to the bottom (13) of the cavity (14).

10. Electrical connector device according to each one of the preceding claims, **characterised in that** said first protection (1) has an opening (22) in correspondence of the end faced toward the inlet of the

cavity (14).

11. Electrical connector device according to claim 10, **characterised in that** the second protection (2) is provided with an upper end (2') so shaped to partially penetrate within said opening (22) of the upper base of the first protection (1).

12. Electrical connector device according to each one of the preceding claims, **characterised in that** said check elastic means (4) are comprised of a arc spring, the arc being opened toward the cavity (14) bottom (13).

13. Electrical connector device according to each one of the preceding claims 1 - 11, **characterised in that** said check elastic means (4) are comprised of two elements (15) joined by a spring (16).

14. Electrical connector device according to each one of the preceding claims 1 - 11, **characterised in that** said check elastic means (4) are comprised of one or more lugs (17), laterally joined with the second protection (2) and provided with elastic means, tending to open the same, said lugs (17) realising, when their ends are engaged with said shoulders (5), in the direction of the inner part of the cavity, an acute angle with respect to the lateral profile of the second protection (2).

15. Electrical connector device according to each one of the preceding claims, **characterised in that** it comprises a first stop shoulder element (7), integrally joined with the second protection, to make contact, at the end of stroke of the safety device within the female contact (100), with a corresponding second stop shoulder element (10) joined with the bottom (13) of said cavity (14).

16. Electrical connector device according to each one of the preceding claims, **characterised in that** male contact and female contact can be each one provided with an insulating female casing and with an insulating male casing, said insulating casings being provided with coupling and locking means, aid coupling and locking involving the introduction of the male electrical contact within the female electrical contact.

17. Safety device for female electrical contact of an electric connector device comprising female electrical contact and male electrical contact, **characterised in that** said safety device is used in the electrical connector device according to one of the claims 1 - 16.

18. Female electrical contact of an electrical connector device comprising female electrical contact and male electrical contact, **characterised in that** it is the female contact according to one of the claims 1 - 16.

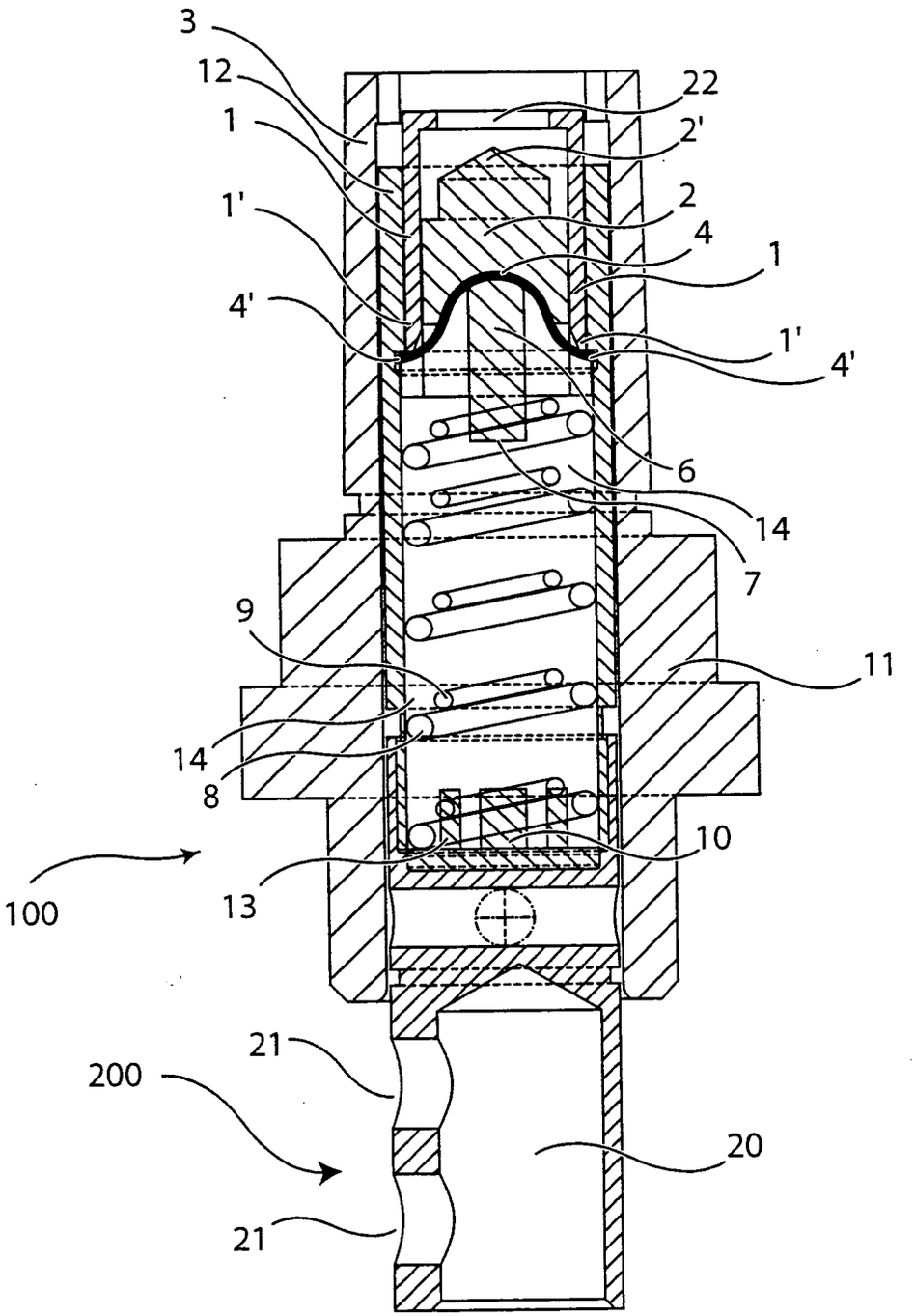


Fig. 1a

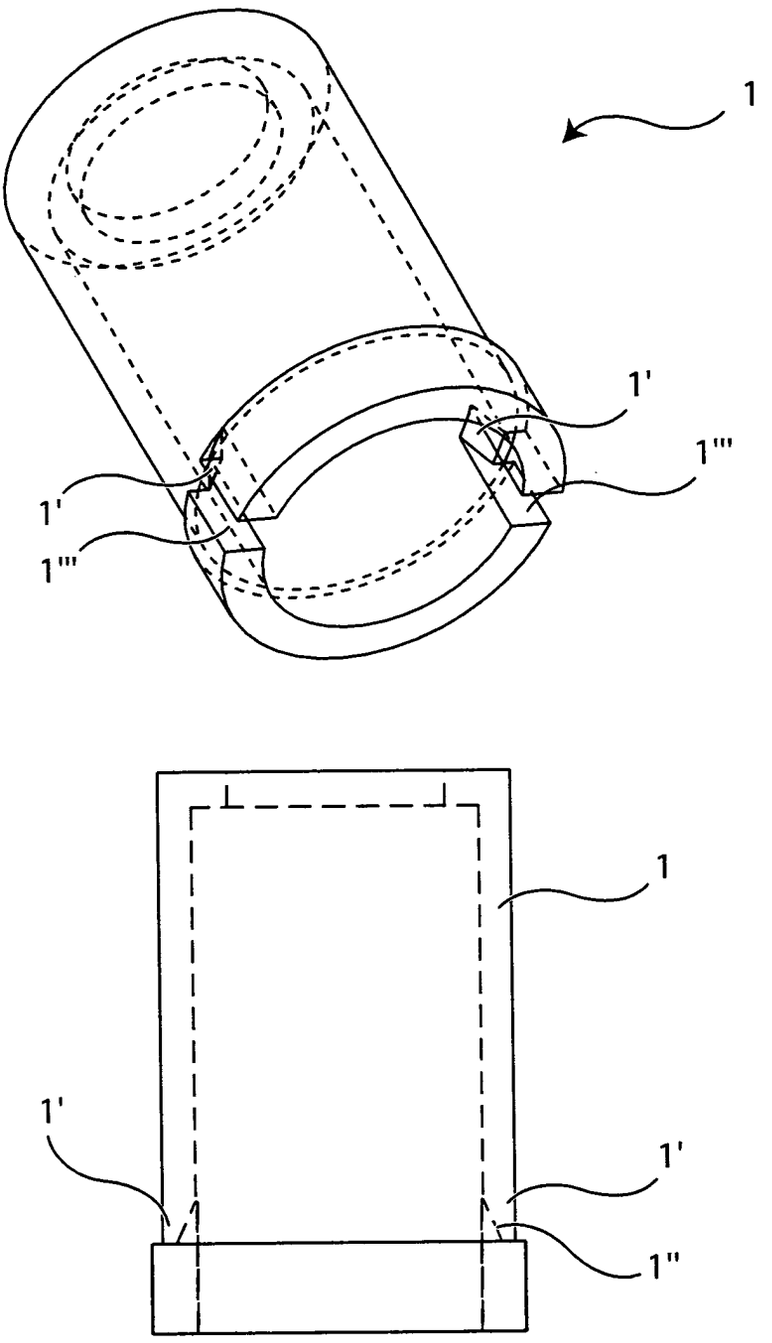
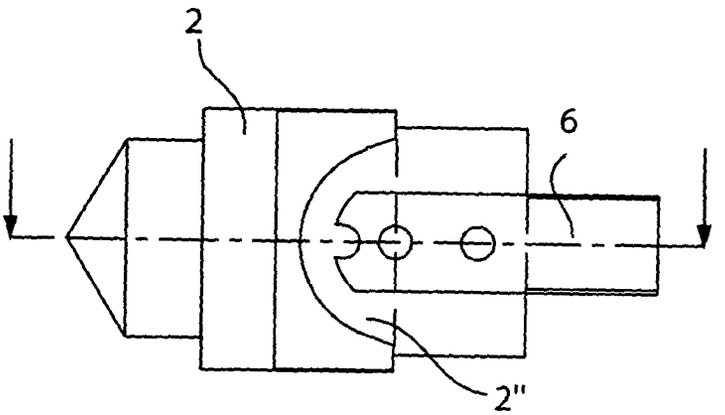
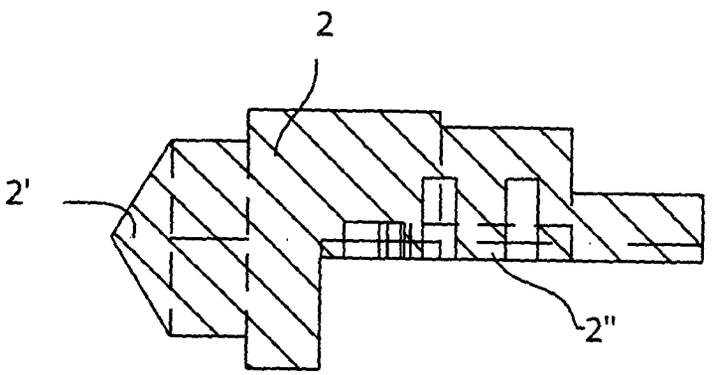


Fig. 1b





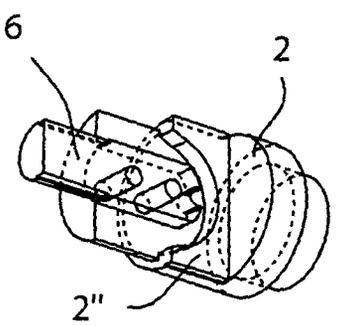


Fig. 1c

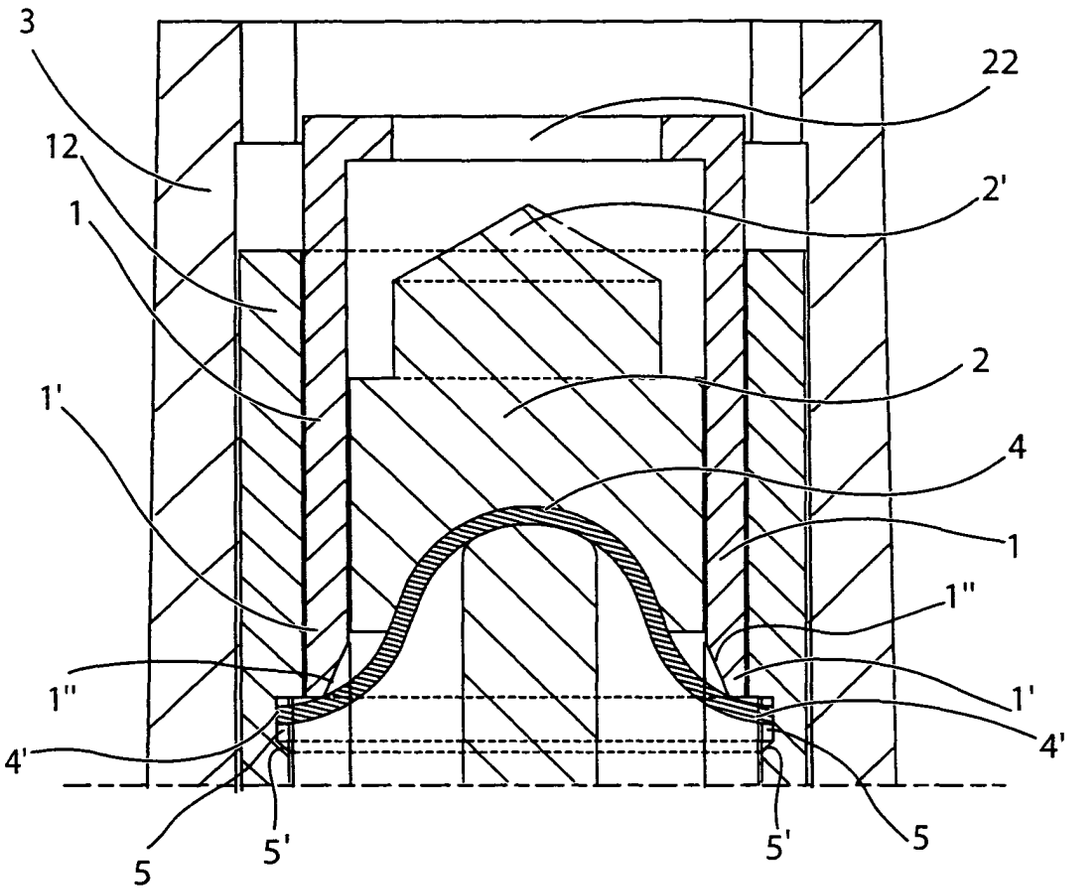


Fig. 1d

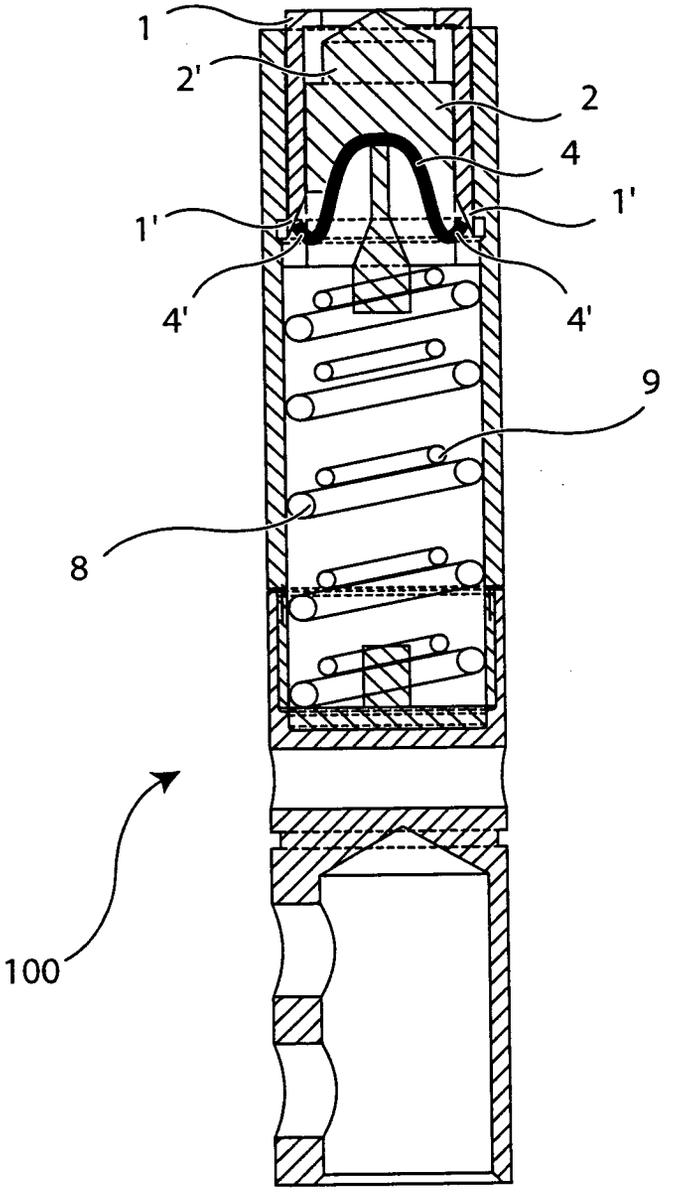


Fig. 2

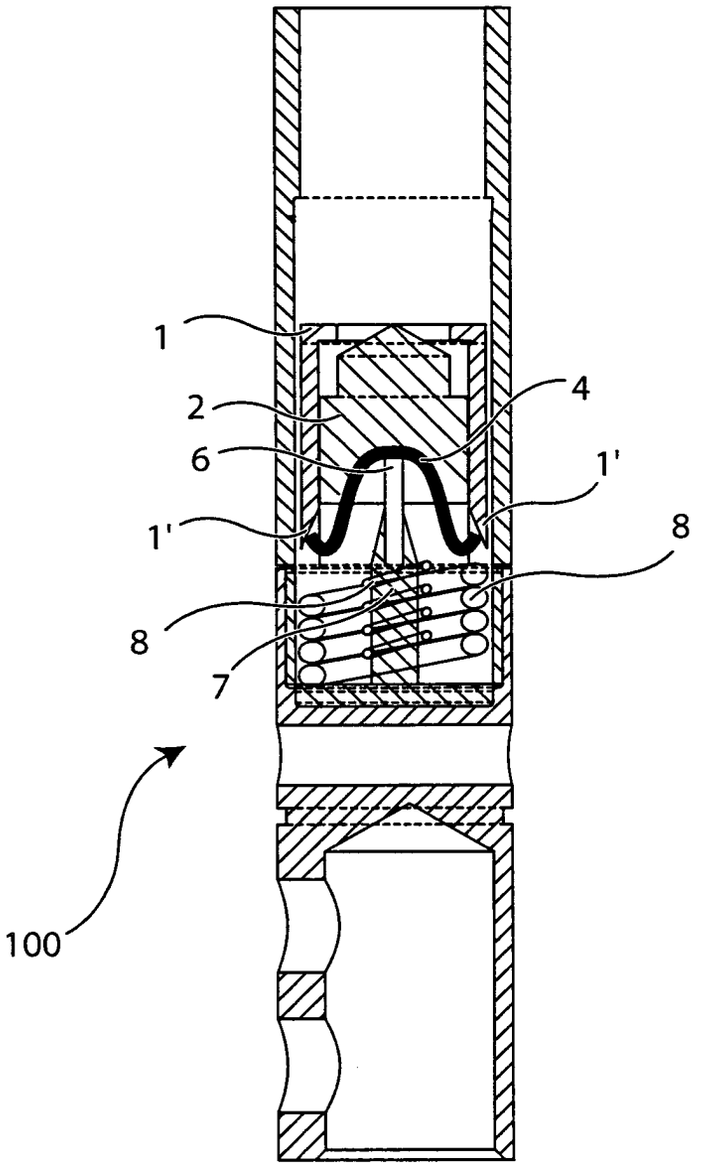
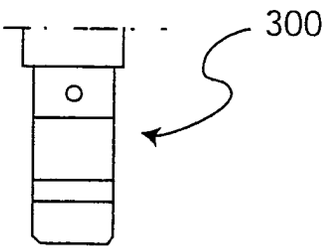


Fig. 3



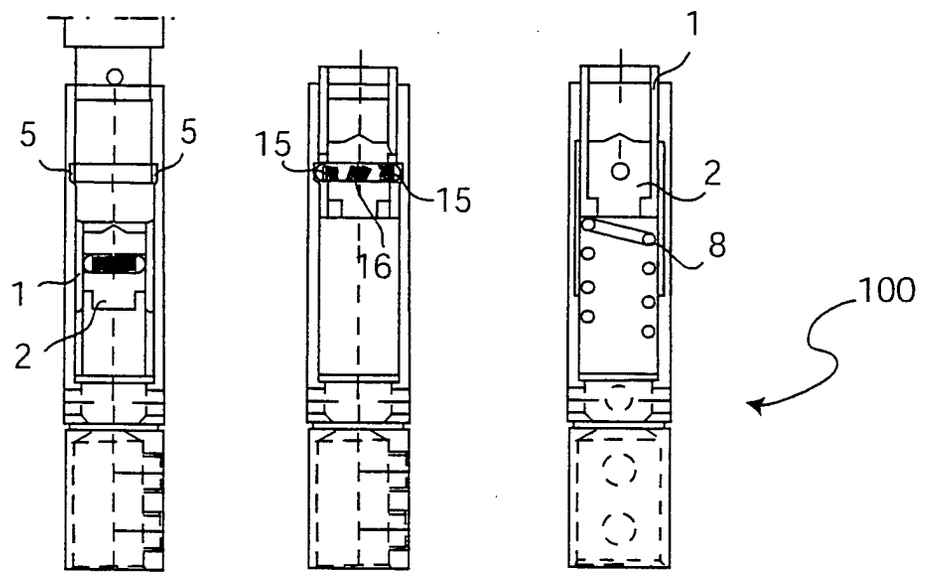
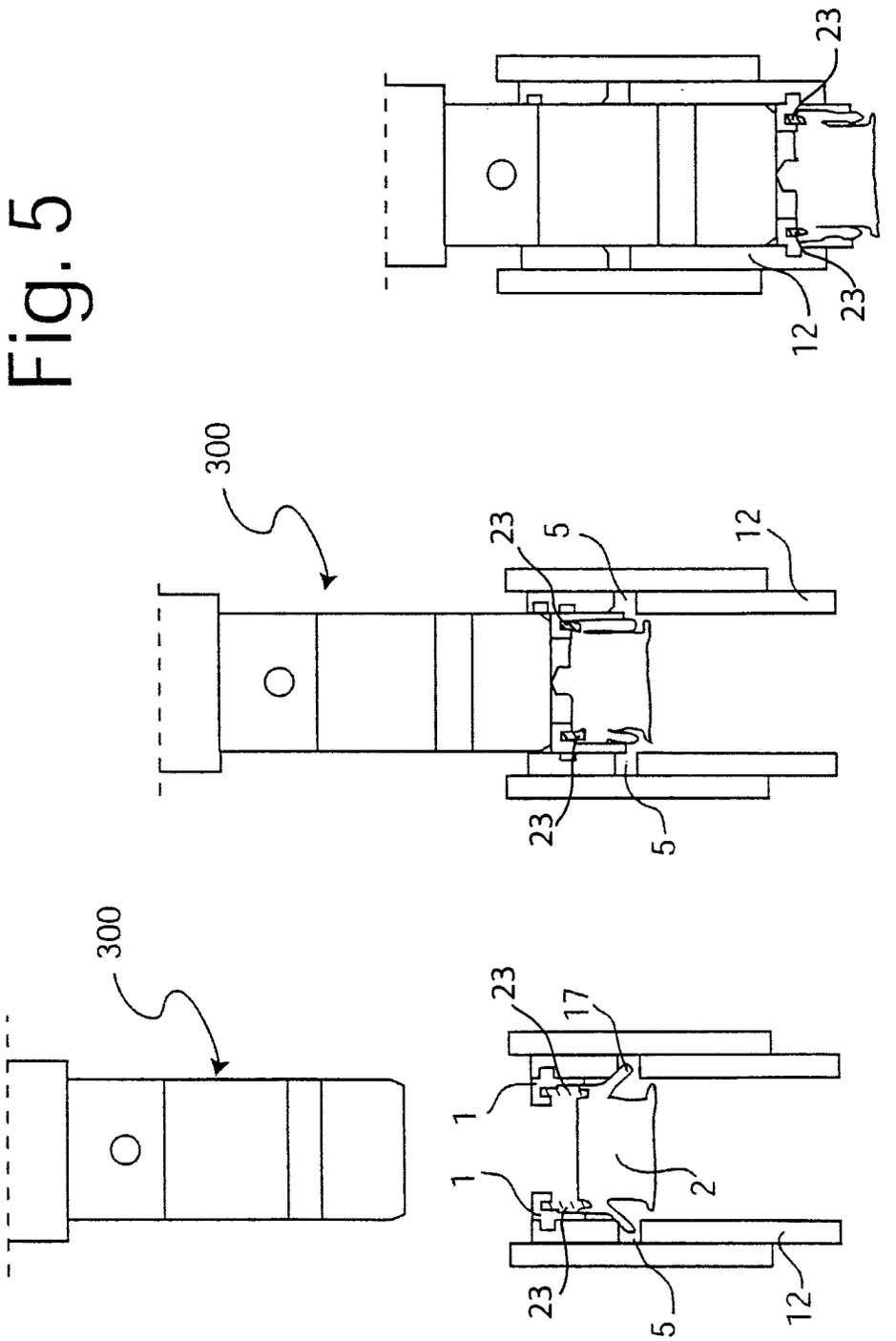


Fig. 4

Fig. 5



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EUROPEAN SEARCH REPORT

Application Number
EP 04 42 5430

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.7)
A	GB 2 308 244 A (OTTER CONTROLS LTD) 18 June 1997 (1997-06-18) * abstract * -----	1	H01R13/453

TECHNICAL FIELDS SEARCHED (Int.Cl.7)

H01R

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	23 July 2004	Bertin, M

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 04 42 5430

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