



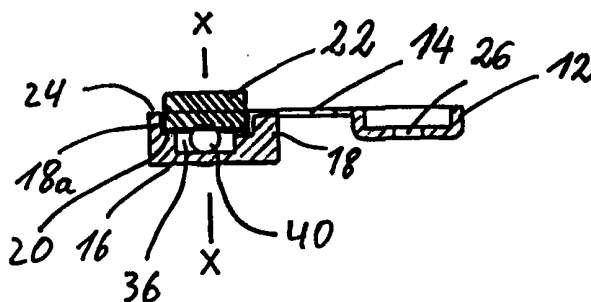
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(21) International Application Number: PCT/GB97/01806 (22) International Filing Date: 4 July 1997 (04.07.97) (71) Applicant (for all designated States except US): MAXON SYSTEMS INC. (LONDON) LTD. [GB/GB]; Maxon House, Honeycrook Lane, Salfords, Surrey RH1 5JP (GB). (72) Inventor; and (75) Inventor/Applicant (for US only): SPENCER, Duncan [GB/GB]; 18 Rennie Street, Burnley, Lancashire BB10 4PH (GB). (74) Agent: SCHMIDT, Steffen, J.; Wuesthoff & Wuesthoff, Schweigerstrasse 2, D-81541 München (DE).		(81) Designated States: KR, US, European patent (AT, BE, CH, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE). Published With international search report.

(54) Title: ENCLOSURE FOR A MICROPHONE

(57) Abstract

The present invention is related to a microphone enclosure, preferably for a handheld mobile telephone unit, said enclosure comprises: a hollow cylindrical body arranged to house a microphone means and to provide a hollow space adjacent to a first side of said microphone means, and a duct being in acoustical connection with said hollow space at one end of said duct and having a free second end, wherein said duct is provided at the outside of said hollow cylindrical body in a lateral orientation relative to said hollow space.



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Enclosure for a microphone

Description

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The present invention is related to an enclosure for a microphone, and more specifically to an enclosure for a microphone that is preferably used in a handheld mobile telephone, e.g. a mobile telephone using Code Division Multiple Access technology.

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Conventionally, microphones in mobile telephone units are supported in a foam cushion, a tubular sheath or the like. Such cushions or sheaths are provided to protect the microphone against vibrations, shock or other mechanical stress.

20

Certain arrangements of known enclosures also have an impact on the acoustical behaviour and properties of the microphone. However, the demand for more compact designs of the housings of the telephones imposes severe restrictions on the possibilities to provide an enclosure that has good mechanical and acoustical properties. This applies even more, as not all locations within the housing of the handheld telephone unit and at the outer surface of the housing are equally well suited and/or accessible to be an optimum location for a microphone and its enclosure.

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In another known arrangement, the microphone is tightly held in a rubber tube. One end of said tube points towards an opening in a wall of the housing of the telephone unit. The other end of the tube leads to another opening in an opposite wall of said housing. This arrangement has several significant disadvantages. First of all, the acoustical properties of the tube are governed by the distance of the two respective openings. Secondly, the possibilities to have

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5 the accumulator of the mobile telephone to be attached to a wall where one of said openings is provided, are restricted. Thirdly, the opening can be easily blocked by the hand of the user of the telephone, thereby effectively cancelling the acoustical properties of the tube.

10 In consideration of the above, it is an object of the present invention to provide an enclosure for a microphone, preferably to be used in a handheld mobile telephone unit that allows for a more versatile placement within the housing
15 of the telephone, and that provides improved acoustical characteristics while maintaining good mechanical protection and requiring reduced space.

To meet this object, the invention suggests an enclosure for
20 a microphone, preferably for a handheld mobile telephone unit, said enclosure comprising: a hollow cylindrical body arranged to house a microphone means and to provide a hollow space adjacent to one side of said microphone means, and a duct being in acoustical connection with said hollow space at
25 one end of said duct and having a free opening at a second end thereof, wherein said duct is provided at the outside of said hollow cylindrical body in a lateral orientation relative to said hollow space.

30 The lateral orientation of the duct provides for the possibility to point the free opening of the duct towards a hole in a wall of the telephone that - in use thereof - is not shielded or covered by the hand of the user. Moreover, the physical dimensions of the housing of the telephone do
35 not have an impact on the acoustical properties of the enclosure. And, as the enclosure does not need to reach from one wall of the housing of the telephone to an opposite wall thereof, the required space is reduced.

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5 In a preferred embodiment, said hollow cylindrical body is provided with a lid portion, said lid portion covering said microphone means mounted in said hollow cylindrical body at least partially. This allows for an easy and convenient assembly of the microphone in said enclosure. Moreover, the
10 enclosure provides for a complete encapsulation of the microphone.

Further, in a preferred embodiment, said lid portion is held at said hollow cylindrical body by a hinge means. Thus, also prior to the assembly, the lid portion is unloosably
15 attached to said hollow cylindrical body.

Preferably, said lid portion or said hollow cylindrical body is provided with an opening to allow soundwaves to reach at least a second side of said microphone means.

20

In a further preferred embodiment, the inner walls of said hollow cylindrical body and for said lid portion are shaped and dimensioned to provide a substantially airtight seal for said microphone means between the first side and the second
25 side thereof. This prevents an acoustical shortcircuit between the first side of the microphone and the second side of the microphone. This is preferably obtained by an arrangement where the inner walls of said hollow cylindrical body are provided with a seat projecting radially from said
30 interior wall into the interior of the hollow cylindrical body, said seat being arranged for the microphone means to rest on it with a part of the second side of the microphone.

To adapt the enclosure to the specific acoustic properties
35 and requirements of the microphone and the mechanical restrictions in a specific given telephone design, the said duct projects laterally from the outer wall of said hollow cylindrical body at a predetermined angle of $90^\circ \pm 45^\circ$.

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5 Further, the shape of the duct may be bent, helical or of other shape. Although in a preferred embodiment, the cross-section of the duct is substantially constant, it may also vary to be e.g. conical, partially widened, narrowed or the like, to obtain the desired acoustical properties.

10 More specifically, said hollow cylindrical space and said duct are dimensioned to substantially cancel low frequency noises, preferably in the range of up to 300 Hz. Preferably, said enclosure is made of rubber, preferably silicone rubber
15 having 50 + 5 IRHD/SHORE A, and wherein said rubber preferably does not contain carbon black.

In a preferred aspect of the invention, said enclosure is dimensioned to house a pressure gradient microphone. Pressure
20 gradient microphones are two port devices that have an output signal that is proportional to the gradient of a pressure that exists between the two ports. In the present invention, one port of the pressure gradient microphone is acoustically connected to the hollow space inside the enclosure, and hence
25 with the duct, while the other port is oriented towards the opening in the lid portion to receive the user's speech.

A pressure gradient microphone is subject to a proximity effect when used in the near field of a spherical radiator. If such a microphone is corrected to have a flat frequency
30 response in the near field of such a spherical radiator there will be a reduction in sensitivity to low frequency radiation from the far field or from plane wave sources. When such a pressure gradient microphone is corrected to give a flat
35 response for human voices (that approximate to the near field of a spherical radiator), low frequency far field radiation (i.e. plane wave radiation) is attenuated with an accompanying improvement in the low frequency signal to noise ratio.

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5 Moreover, pressure gradient microphones exhibit a sensitivity that varies with the angle that the source of sound subtends to the microphone. A variety of "polar" responses may be achieved ranging from doublet to hyper-cardoid.

10 Due to the directivity of the pressure gradient microphone the device may be oriented within the housing of the CDMA mobile telephone to selectively reduce sensitivity to certain radiation from the environment or reflections from the user's head. This results in a considerable echo rejection.

15 The invention is also related to a mobile telephone unit, preferably a CDMA telephone unit, wherein an enclosure for a microphone as described above is provided adjacent to an edge of the housing of said telephone unit such that the lid
20 portion of said enclosure is oriented towards a first face of the housing, while the duct of the enclosure is oriented towards a second face of said housing said second face being adjacent said first face of said housing. Preferably, the first face of the housing is the wall bearing a keypad and a
25 display, while the second, adjacent face of the housing is the wall bearing a connector for power etc.

Further details, modifications, characteristics and advantages of the present invention will be explained with
30 reference to the enclosed drawings, which show a presently preferred embodiment of the enclosure according to the present invention.

Fig. 1 is an enlarged schematic drawing of an enclosure for a
35 microphone in an opened position, from a bottom view.

Fig. 2 is a sectional view of the enclosure of Fig. 1 along the lines C-C. in an inverted position.

40 Fig. 3 is a side view of the enclosure of Fig. 1.

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5 Fig. 4 is a top view of the enclosure of Fig. 1.

Fig. 5 is a sectional view of Fig. 1 along the lines A-A.

Fig. 5b is a sectional view of Fig. 1 along the lines B-B.

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Fig. 6 is a side view of the enclosure of Fig. 1 with the lid portion covering the hollow cylindrical body.

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Fig. 7 is a partial perspective view of a housing of a handheld mobile telephone unit.

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In the drawings, an enclosure according to the invention is shown. This enclosure is formed of two shell-shaped parts. The first part is a hollow cylindrical body 10 and the second part is a lid portion 12. The lid portion 12 is attached to the hollow cylindrical body 10 by a flexible stripe-shaped hinge 14. The hollow cylindrical body 10 has a substantially circular bottom part 16 and a cylindrical wall part 18. At the inside of the cylindrical wall part 18, approximately halfway along its axial extension, an annular seat 20 projects into the hollow interior of the hollow cylindrical body 10. The annular seat 20 has a rectangular cross-section and narrows the hollow interior of the hollow cylindrical body 10 towards the bottom part 16 thereof. The portion 18a of the wall part 18 above the seat 20 and the seat 20 itself are shaped and dimensioned such that a microphone 22 can be received on the seat 20 and in the annular wall part 18a above the seat 20 in a substantially airtight manner.

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The microphone 22 projects over the upper edge 24 of the hollow cylinder body 10 when it rests on the seat 20. The lid portion 12 is shaped and dimensioned such that when swung onto the projecting portion of the microphone 22 covers and seals the microphone 22 completely. The center of the lid portion 12 is provided with an opening 26 to allow sound

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5 waves to reach the surface forming a second side 28 of the microphone 22 projecting from the hollow cylindrical body 10.

The other surface 30 of the microphone 22, opposite to the surface 28, together with the thicker wall part 18b of the wall 18 and the bottom part 16 of the hollow cylindrical body 10 limits the hollow space 36 inside the hollow cylindrical body 10. The hollow space 36 and the microphone 22 are in a coaxial orientation relative to a geometrical axis X (see Fig. 2).

15 A duct 40 is provided on the outside of the wall part 18 in the region of the hollow space 36. The duct 40 has a substantially constant circular cross-section and has two ends 42, 44. The one end 42 feeds into the hollow space 36, while the other free end 44 projects radially from the hollow cylindrical body 10. The duct 40 and the hollow space 36 are shaped and dimensioned to substantially cancel out low frequency noises below approximately 300 Hz. In this present embodiment, the microphone 22 is a pressure gradient microphone.

25 Next to the hinge 14, a groove 46 is formed into the upper edge 24, the wall 18 and the seal 16 to accommodate signal lines and power lines (not shown) connected to the microphone 22 and leading outside the enclosure.

The enclosure is produced by injection molding and is entirely made of silicone rubber.

35 Fig. 7 shows a handheld mobile telephone unit. A top surface 48 is provided with a numerical keypad 50, several function keys 52 and a liquid-crystal display 54. A front surface 56 adjacent to the top surface 48 is provided with a connector for power, car antenna, etc. According to the invention, the opening 26 of the lid portion 12 is situated at or close to the top surface 48 while the free end 44 of the noise

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5 cancelling duct 40 is situated at or close to the front
surface 56. It is understood, that the orientation of the
opening 26 and the free end 44 relative to the top and front
surfaces 48, 56 could also interchanged. Moreover, the free
end 44 could also be pointing to the side surface 60 of the
10 mobile telephone unit.

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5 CLAIMS

1. Enclosure for a microphone, preferably for a handheld mobile telephone unit,
10 - said enclosure comprising:
- a hollow cylindrical body (10) arranged to house a microphone means (22) and to provide a hollow space (36) adjacent to a first side (28) of said microphone means (22), and
15 - a duct (40) being in acoustical connection with said hollow space (36) at one end of said duct (42) and having a free second end (44), wherein
- said duct (40) is provided at the outside of said hollow cylindrical body (10) in a lateral orientation
20 relative to said hollow space.
2. Enclosure for a microphone according to claim 1, wherein
- said hollow cylindrical body (10) is provided with a lid portion (12), said lid portion (12) covering said
25 microphone means (22) mounted in said hollow cylindrical body (10) at least partially.
3. Enclosure for a microphone according to claims 1 or 2, wherein
30 - said lid portion (12) is held at said hollow cylindrical body (10) by a hinge means (14).
4. Enclosure for a microphone according to any of claims 1-3, wherein
35 said lid portion (12) or said hollow cylindrical body (10) is provided with an opening (26) to allow soundwaves to reach at least a second side (28) of said microphone means (22).

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5. Enclosure for a microphone according to any of claims 1-4, wherein the inner walls of said hollow cylindrical body (10) and/or said lid portion (12) are shaped and dimensioned to provide a substantially airtight seal for said microphone means (22).

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6. Enclosure for a microphone according to any of claims 1-5, wherein the inner wall of said hollow cylindrical body (10) is provided with a seat (20) projecting radially from said inner wall into the interior of the hollow cylindrical body (10), said seat (20) being arranged for the microphone means (22) to rest on it.

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7. Enclosure for a microphone according to any of claims 1-6, wherein
- said duct (40) projects laterally from the outer wall of said hollow cylindrical body (10) at a predetermined angle of $90^\circ \pm 45^\circ$.

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8. Enclosure for a microphone according to any of claims 1-7, wherein said hollow cylindrical space (36) and/or said duct (40) are dimensioned to substantially cancel low frequency noises, preferably in the range of up to 300 Hz.

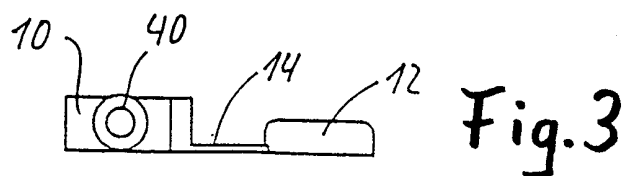
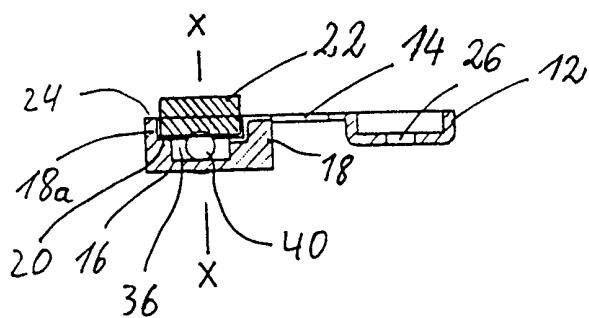
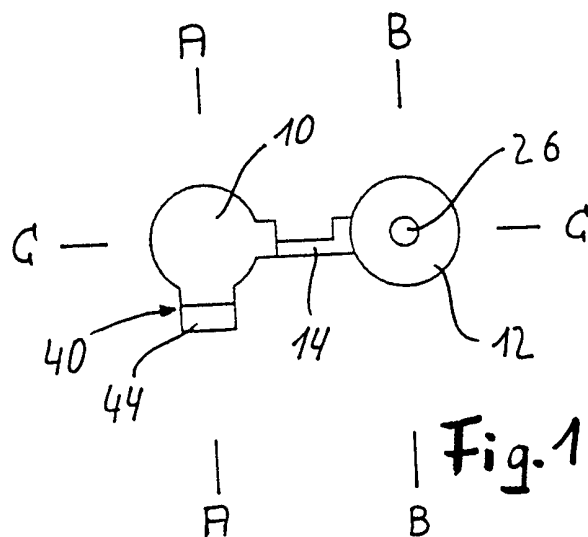
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9. Enclosure for a microphone according to any of claims 1-8, wherein
- said enclosure is made of rubber, preferably silicone rubber having 50 ± 5 IRHD/SHORE A, and wherein said rubber preferably does not contain carbon black.

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- 5 10. Enclosure for a microphone according to any of claims
 1-9, wherein
 - said enclosure is dimensioned and shaped to house a
 pressure gradient microphone.
- 10 11. Mobile telephone unit, preferably a CDMA telephone unit,
 wherein an enclosure for a microphone according to any
 of claims 1-10 is provided adjacent to an edge of the
 housing of said telephone unit such that the lid portion
 (12) of said enclosure is oriented towards a first face
15 (48) of the housing, while the duct (40) of the
 enclosure is oriented towards a second face (56) of said
 housing, said second face (56) being adjacent said first
 face (48) of said housing.



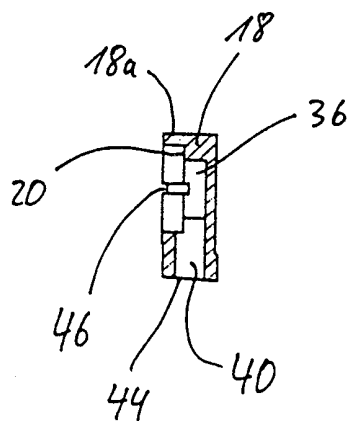
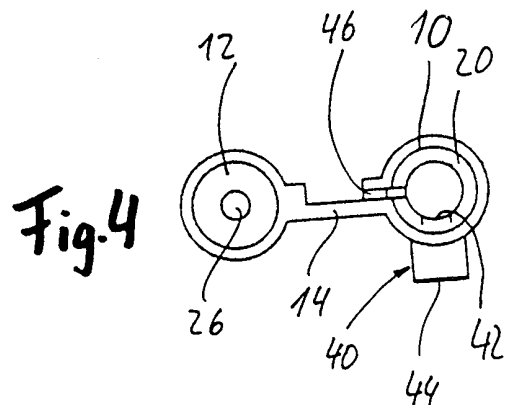


Fig. 5a

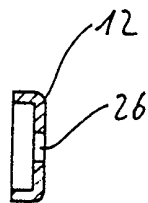
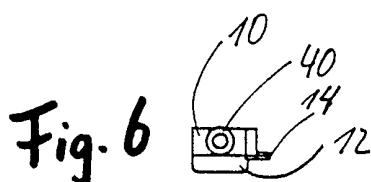


Fig. 5b



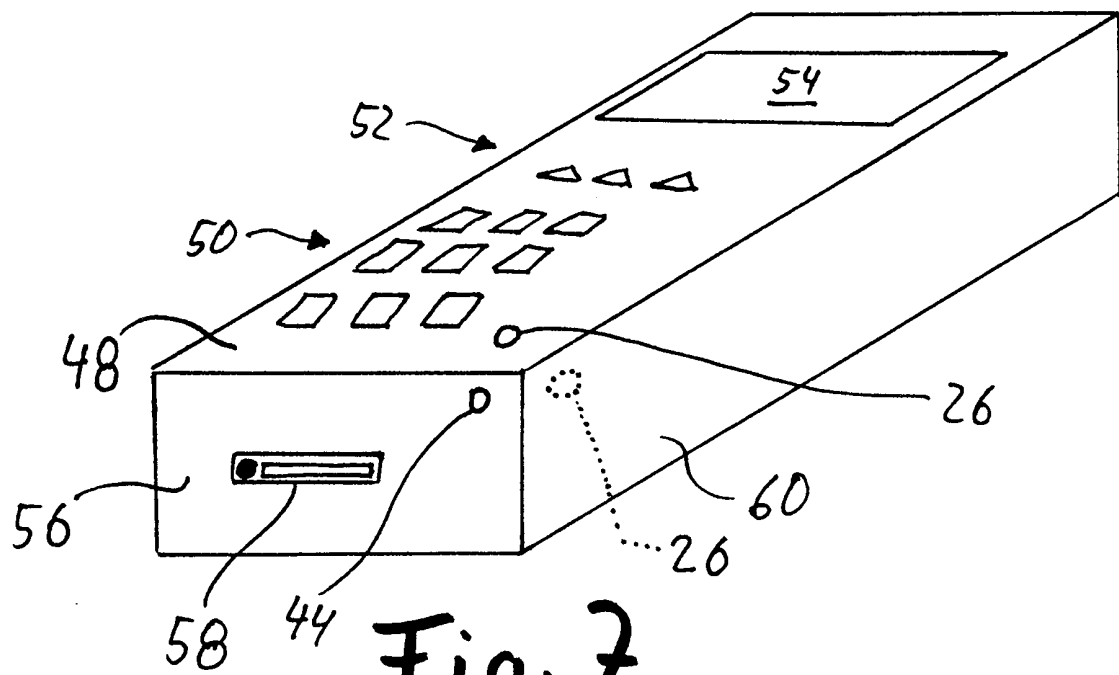


Fig. 7

INTERNATIONAL SEARCH REPORT

International Application No

PCT/GB 97/01806

A. CLASSIFICATION OF SUBJECT MATTER

IPC 6 H04R1/08

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 6 H04R H04M

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

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	EP 0 742 678 A (AT&T) 13 November 1996 see column 1, line 5-56 see column 2, line 57 - column 3, line 38 see column 4, line 53 - column 6, line 21 see column 6, line 36 - column 7, line 11 see column 8, line 18 - column 12, line 5 ---	1-11
Y	WO 97 12495 A (NORTHERN TELECOM) 3 April 1997 see page 1, line 4-7 see page 3, line 2-20 see page 4, line 8 - page 5, line 35 ---	1-11
Y	WO 92 22176 A (MOTOROLA) 10 December 1992	1-8, 10, 11
A	see page 1, line 14-16 see page 3, line 30 - page 5, line 22 --- -/--	9

☒ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

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Date of the actual completion of the international search

12 March 1998

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19/03/1998

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INTERNATIONAL SEARCH REPORT

II. national Application No

PCT/GB 97/01806

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	GB 1 317 112 A (S.G.BROWN LIMITED) 16 May 1973	1,4-11
A	see page 1, line 38-55 see page 2, line 10-59 ---	2,3
A	PATENT ABSTRACTS OF JAPAN vol. 96, no. 4, 30 April 1996 & JP 07 336262 A (KOKUSAI ELECTRIC CO.), 22 December 1995, see abstract -----	1,9

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

PCT/GB 97/01806

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
EP 742678 A	13-11-96	US 5651074 A CA 2173010 A JP 8340592 A	22-07-97 12-11-96 24-12-96
WO 9712495 A	03-04-97	AU 4325796 A	17-04-97
WO 9222176 A	10-12-92	US 5204907 A	20-04-93
GB 1317112 A	16-05-73	NONE	