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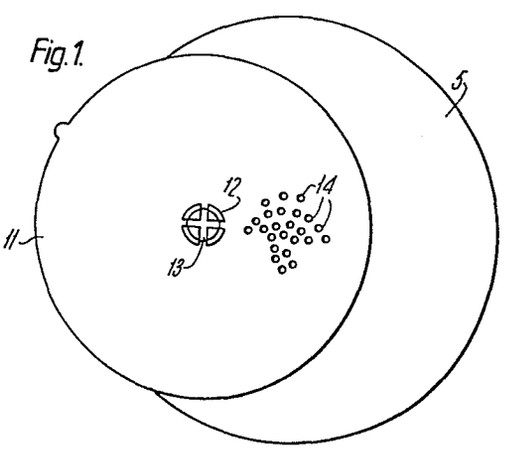
(54) **Electro-acoustic calling devices.**

(57) An electro-acoustic transducer (2) mounted in a housing (5, 6) in which a volume control is provided by an aperture (7) in the front of the housing (5) and a rotatable shutter plate (11) which is mounted on the front of the housing (5) and which has a plurality of smaller apertures (14). The smaller apertures (14) are positioned in such a way that linear movement of the shutter plate (11) causes a logarithmic change in the exposure of the aperture (7) in the front of the housing (5) to give a logarithmic change in the intensity of the sound output such that the linear movement causes an apparent linear change in the intensity of sound as heard by a human ear.



EP 0 087 908 A1

The present invention relates to electro-acoustic calling devices and is more particularly although not exclusively concerned with such devices for use in telephone instruments.

Whilst the majority of telephone instruments currently in use particularly in the United Kingdom are equipped with bells having an electromagnetically operable striker for calling purposes some instruments are now being fitted with other tone calling devices.

One such electro-acoustic tone calling device comprises a flat metal disc clamped at its edges and having an electrically responsive (piezzo) crystal attached thereto. When an electric current passes through the crystal in one direction the crystal tends to exert pressure on the metal plate in one direction. When current passes through the crystal in the opposed direction the pressure exerted on the metal plate is in the opposed direction.

Thus application of an alternating current to the crystal causes the metal plate to vibrate and such acoustic calling devices may produce a considerable noise. A specific form of such a calling device is disclosed in United Kingdom Patent No. 1434056.

Controlling the volume of the output of such calling devices may involve electrical circuits which are costly to manufacture.

It is one object of the present invention to provide an electro-acoustic calling device the volume of whose output may be controlled without alteration of the electric signals supplied thereto.

According to the present invention in an electro-acoustic calling device of the kind comprising an electro-acoustic transducer responsive to electrical

signals applied to inputs thereof to provide an audible signal, and a housing which surrounds said transducer said housing having a planar member including at least one aperture through which sound waves may pass substantially unimpeded, said housing has a second planar member which is moveable with respect to the first planar member and which includes at least one aperture, said second planar member being positioned such that movement of the planar members with respect to each other causes a variation in the unimpeded path of sound waves so as to provide variable attenuation of the output of the transducer and said apertures are of a size and positioned such that there is a logarithmic relationship between the attenuation of the output and the position of the planar members with respect to each other so that there is an apparent linear relationship between the distance through which one of the members is moved and the change in sound intensity of the device as heard by a human ear.

Preferably said second planar member is rotatably attached to the first planar member and is positioned such that at least a part of the second planar member extends beyond an edge of the first planar member to facilitate manual rotation thereof.

Said first planar member may be integral with the housing.

The planar members may be disc shaped members of plastics material, one of said members including a single aperture and the other planar member including a plurality of apertures which are substantially smaller than said single aperture.

A spigot and channel arrangement may be provided to limit movement of the planar members within minimum and maximum volume levels of the calling device.

An embodiment of a calling device in accordance with the invention will now be described with reference to the accompanying drawings of which:-

Figure 1 is a plan view of the calling device

Figure 2 is a reverse plan view of the device

of Figure 1;

Figure 3 is a cross section on the line III-III of Figure 2;

Figure 4 shows a part of Figure 1 in greater detail;

Figure 5 is another view of the part shown in Figure 4;

Figure 6 shows a cross section on the line VI - VI of Figure 4; and

Figure 7 shows the distribution of apertures of the part of Figure 4.

Referring first to Figures 1, 2 and 3 the calling device comprises a disc shaped aluminium plate 1 to which a ceramic disc 2 is bonded and electrical contact springs 3 and 4. The ceramic disc 2 is of the kind previously referred to. Thus if an electric current passes from the contact spring 3 to the contact spring 4 the disc 2, and consequentially the plate 1, flexes in one direction whilst if an electric current passes from the contact spring 4 to the contact spring 3 the disc 2 and the plate 1 flex in the opposed direction.

The plate 1 is fitted to a front housing member 5 and is clamped in position by a rear housing member 6. The plastics material from which the housing is made being semi-rigid co-operation of respective moulded interlocking joints 9 and 10 of the housing members 5 and 6 locks the two parts of the housing together.

The front housing member 5 has an aperture 7 centrally located therein. Thus sound waves characterised by variations in air pressure in the cavity 8 would, if the aperture 7 was unobstructed, pass freely to the surrounding atmosphere by way of the aperture 7. In order to reduce the volume of sound

passing into the atmosphere by way of the aperture 7 a disc member 11, also of plastics material is provided. The disc member 11 is rotatable about a split spigot 12 moulded integrally with the front housing member 5. The spigot 12 passes through a centrally located circular aperture 13 in the disc member 11 and holds the disc member 11 to the housing member 5 with four overlapping locking sections. The flexibility of the material of the housing member 5 is again used so that the disc member 11 is forced over the spigot 12, the locking sections then springing over the edges of the aperture 13. To facilitate fitting of the disc member 11, the spigot 12 is moulded with chamfered edges.

The disc member 11 is provided with a number of carefully positioned apertures 14 each of which is the same size and very much smaller than the aperture 7. As the disc member 11 is rotated about the spigot 12 varying number of the apertures 14 and parts of them permit free transfer of sound waves from the cavity 8. Thus in one extreme there may be none of the apertures 14 aligned with the aperture 7 whilst at the other extreme all twenty-four of the apertures 14 will be aligned. These two extremes represent the minimum and maximum volume positions of the calling device.

The location of each of the apertures, as will be explained hereinafter is extremely important. Volume of sound as detected by a human ear is not a linear function. In electrical volume controls a logarithmic variable resistance is used. Since the present invention aims to reduce the cost of calling devices provision of an electric volume control would be an undesirable expense. Thus the apertures 14 are positioned such that rotation of the disc member 11 from the minimum to the maximum positions causes a

logerithmically increasing exposure of the aperture 7 and vice-versa.

To prevent an additional exposure of the aperture 7 other than by way of the apertures 14 an acoustic seal 15 of, for example, polythene is provided. The seal 15 is a push fit to the housing member 5 and contacts the underside of the disc member 11.

Referring also to Figure 4, 5 and 6 the disc member 11 has a cutaway channel 16 formed in its underside which channel 16 cooperates with a spigot 17 of the front housing member 5 to prevent the disc member 11 being turned beyond the maximum and minimum volume levels.

To facilitate manual rotation of the disc member 11 the edge thereof may be knurled or formed with a knurled edge. A separate volume control operating member is not required when the calling device is suitably located for example in a telephone instrument, with part of the disc member 11 passing through a suitable aperture in the telephone instrument casing (not shown).

To assist implementation of the invention Figure 7 shows a co-ordinate chart giving respective X and Y coordinate location for one particular set of the apertures 14. It will be appreciated that other implementations of the set of apertures 14 may be used provided that the logarithmic exposure relationship is maintained.

It will also be realised that a set of apertures forming minor sound outlets may be included in the front housing member 5 with a large aperture being formed in the disc member 11.

Claims

1. An electro-acoustic calling device of the kind comprising an electro-acoustic transducer responsive to electric signals applied to inputs thereof to provide an audible output signal and a housing which surrounds said transducer, said housing having a planar member including at least one aperture through which sound waves may pass substantially unimpeded characterised in that said housing has a second planar member (11) which is moveable with respect to the first planar member (5) and which includes at least one aperture (14), said second planar member (4) being positioned such that movement of the planar members (5 and 11) with respect to each other causes a variation in the unimpeded path of sound waves so as to provide variable attenuation of the output of the transducer and said apertures (14 and 7) are of a size and positioned such that there is a logarithmic relationship between the attenuation of the output and the position of the planar members (5 and 11) with respect to each other so that there is an apparent linear relationship between the distance through which one of the members (11) is moved and the change in sound intensity of the device as heard by a human ear.

2. An electro-acoustic calling device as claimed in Claim 1 wherein said second planar member (11) is rotatably attached to said first planar member (5).

3. An electro-acoustic calling device as claimed in Claim 2 in which said second planar member (11) is a disc shaped member.

4. An electro-acoustic calling device as claimed in Claim 2 or Claim 3 wherein at least part of said second planar member (11) extends beyond an edge of said first planar member (5) to facilitate manual rotation thereof.

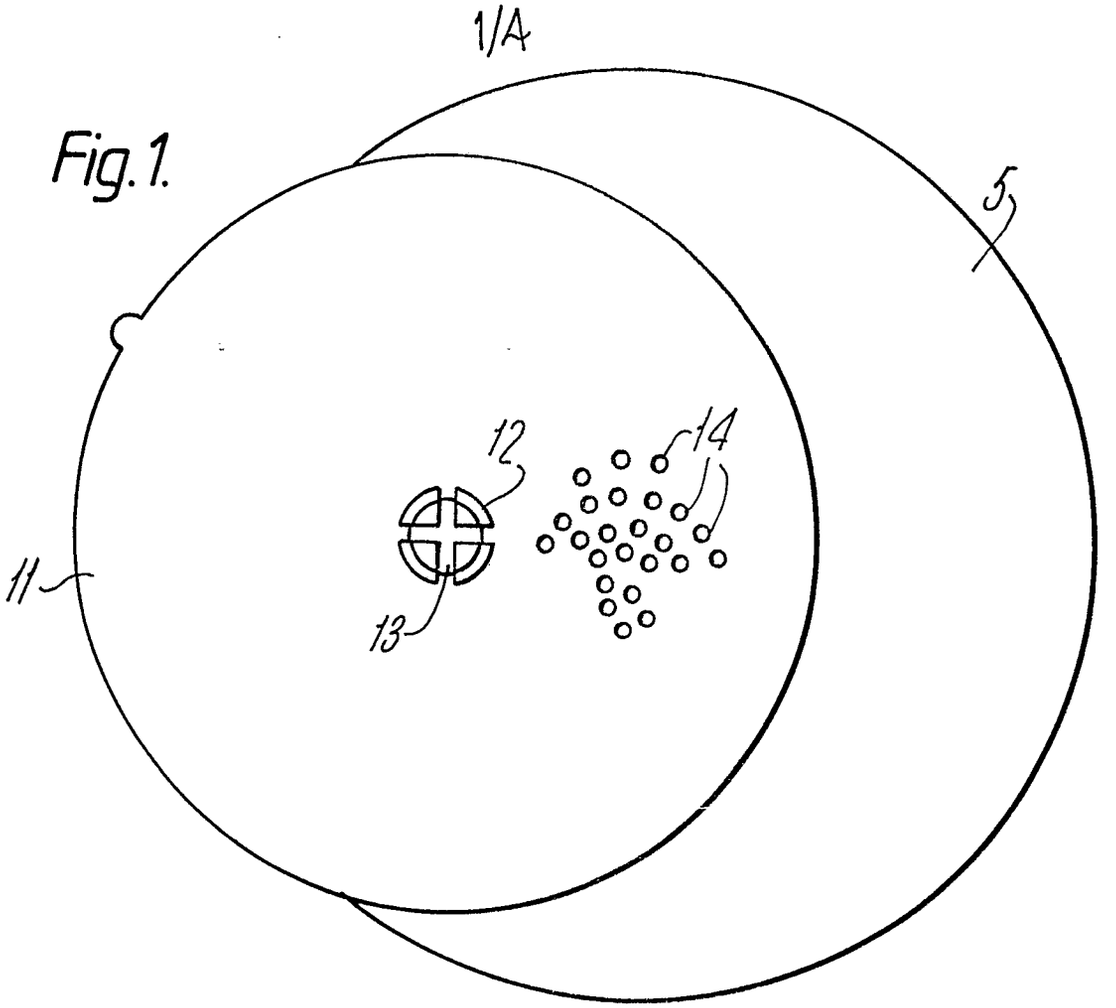
5. An electro-acoustic calling device as claimed in any preceding claim in which said first planar member (5) is integral with said housing.

6. An electro-acoustic calling device as claimed in any preceding claim wherein one of the planar members (5) includes a single aperture (7) and the other planar member (11) includes a plurality of apertures (14) which are substantially smaller than said single aperture (7).

7. An electro-acoustic calling device as claimed in Claim 6 in which said planar members (5 and 11) are moveable with respect to each other between a minimum position in which a minority of said plurality of smaller apertures (14) are in alignment with said single aperture (7) and a maximum position in which a majority of said plurality of smaller apertures (14) are in alignment with said single aperture (7).

8. An electro-acoustic calling device as claimed in any preceding claim in which limiting means are provided to limit movement of said planar members between predetermined minimum and maximum positions, said limiting means comprising a channel (16) in one of the planar members (11) and a spigot (17) which runs in said channel (16) and which is attached to the other planar member (5), said channel being obstructed at said predetermined positions.

Fig.1.



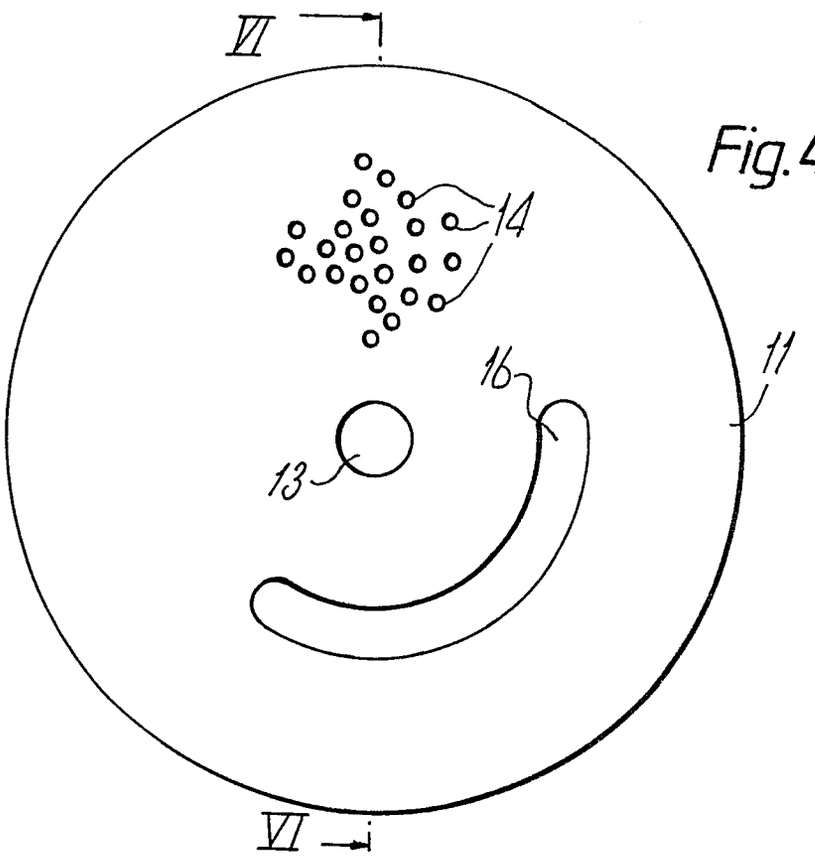


Fig.4.

Fig.2.

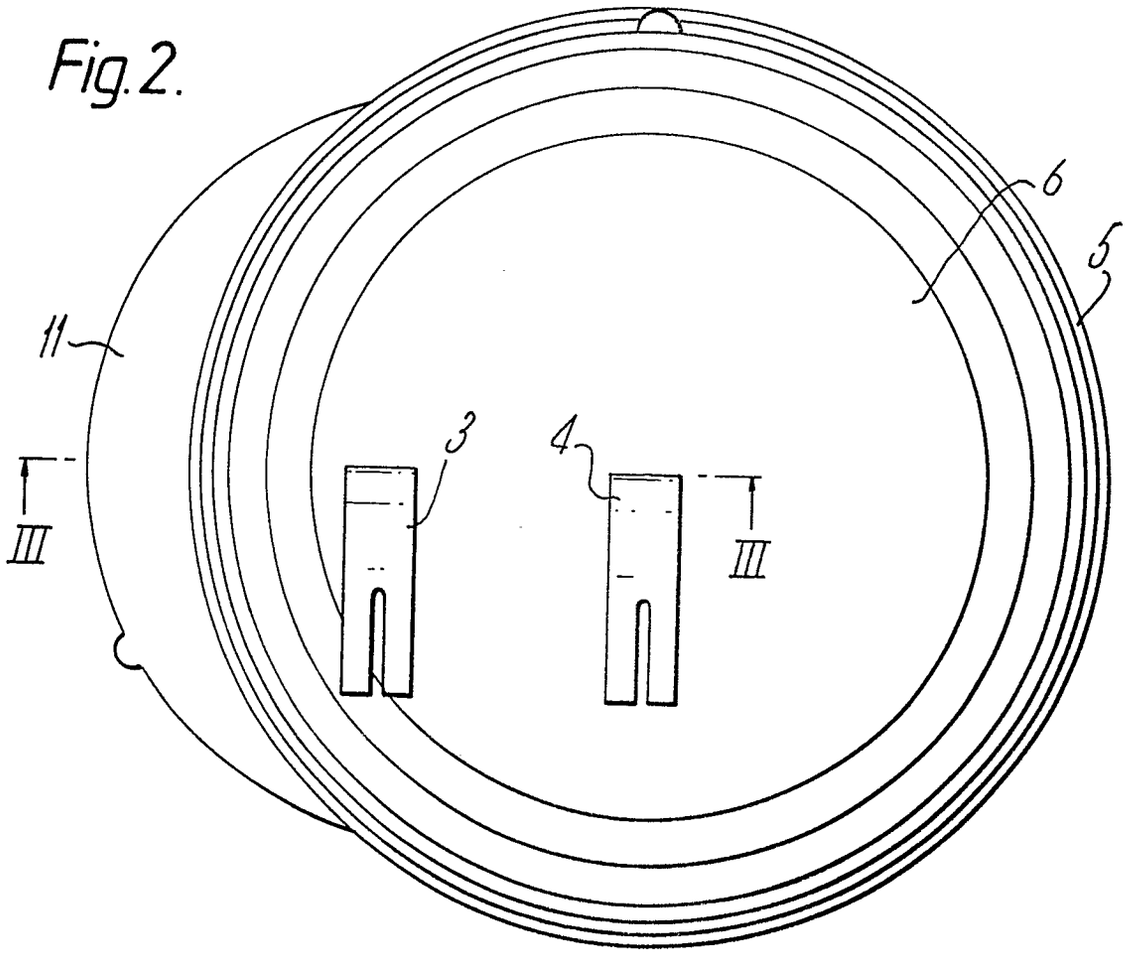


Fig.5.

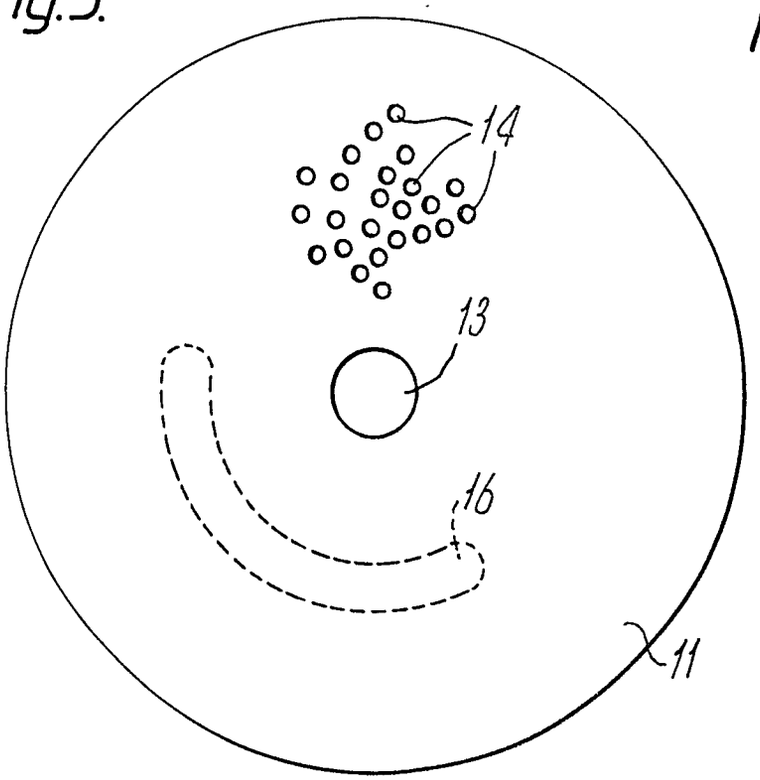
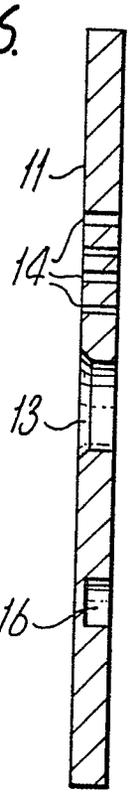


Fig.6.



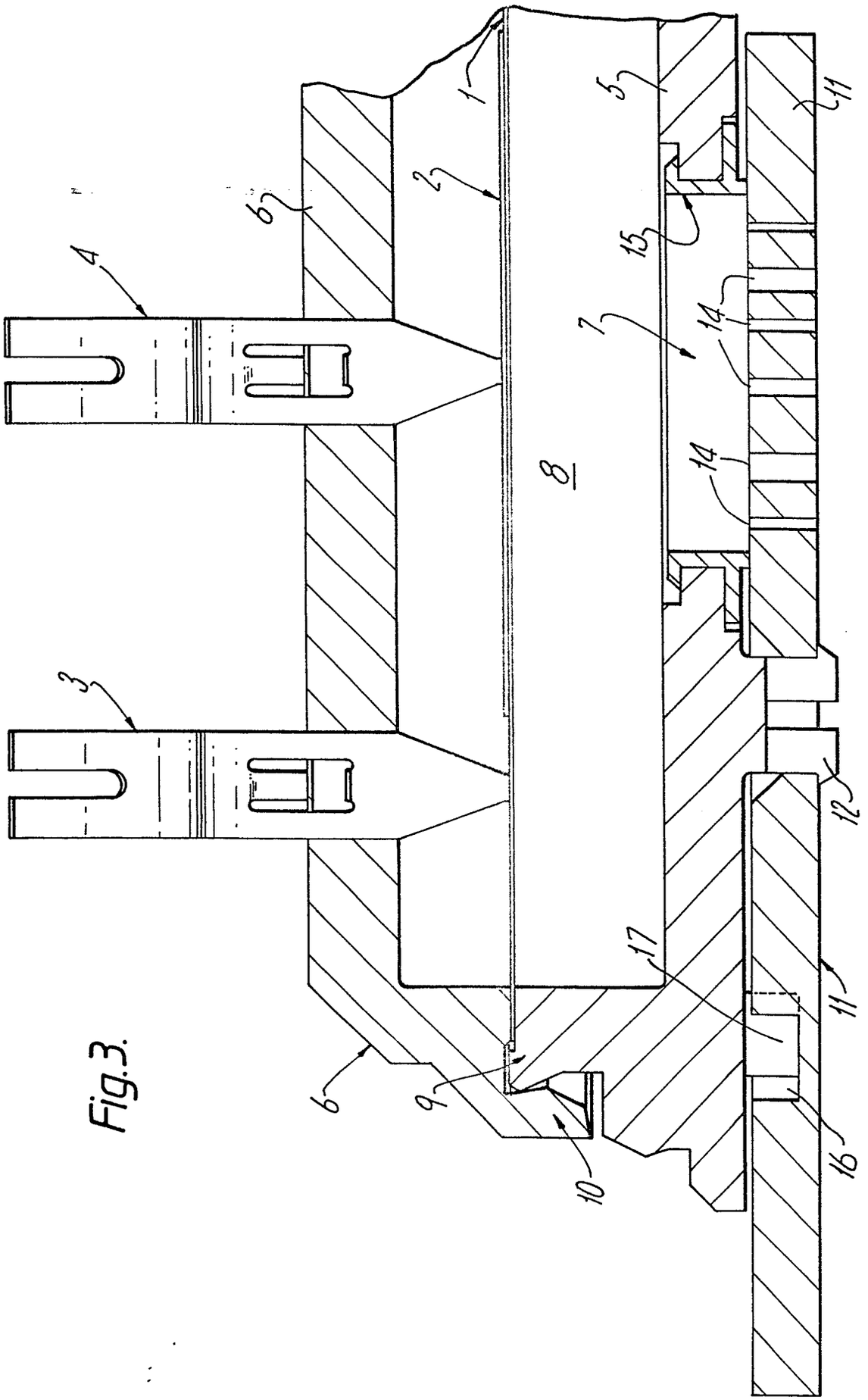
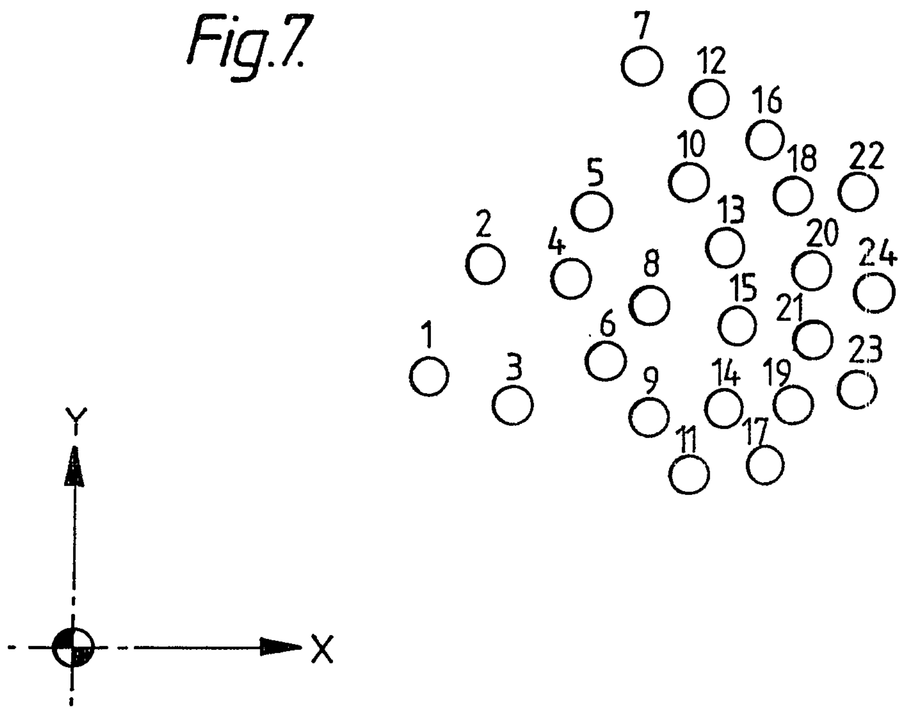


Fig.3.

Fig.7.



HOLE No	X	Y
1	14·98	6·97
2	16·51	9·86
3	17·22	6·35
4	18·66	9·44
5	19·26	11·29
6	19·41	7·40
7	20·36	14·85
8	20·62	8·89
9	20·72	6·01
10	21·62	11·93
11	21·69	4·44
12	21·99	14·07
13	22·52	10·16
14	22·57	6·23
15	22·86	8·20
16	23·31	12·92
17	23·50	4·67
18	24·27	11·41
19	24·40	6·19
20	24·81	9·69
21	24·84	7·92
22	26·11	11·06
23	26·11	6·66
24	26·52	8·85

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EUROPEAN SEARCH REPORT

0087908
Application number

EP 83 30 0910

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. ³)
A	GB-A-2 082 018 (STANDARD TELEPHONES AND CABLES) * The whole document *	1-5,7, 8	H 04 R 1/22
A	FR-A-2 273 335 (KLAXON) * The whole document *	1-5,7, 8	
A	US-A-3 826 333 (J.K. BUCKWALTER) * Column 2, line 44 - column 4, line 5; figures *	1-3,5	
A	US-A-1 884 724 (A.C. KELLER) * Figures 3,4; page 1, lines 65-72 *	1-3,7	

TECHNICAL FIELDS SEARCHED (Int. Cl. ³)

H 04 R
G 10 K

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	03-06-1983	MINNOYE G.W.

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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