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(54) Variable-configuration lighting apparatus with mutually movable elements.

(57) The apparatus (5) is composed substantially of a number of modular elements (1, 2) of curvilinear extension, in particular of arcuate extension, with their end cross-sections lying in planes forming an acute contained angle. The adjacent elements (1, 2) are connected together so that they cannot move relatively in the longitudinal direction, but are free to rotate relative to each other about the central axis of that end cross-section in correspondence with which they are connected together. The end element of the plurality of elements carries one or more lighting lamps. The ability of the elements to be rotated relative to each other and their curved shape enables the apparatus configuration to be varied and the light beam to be orientated in any direction.

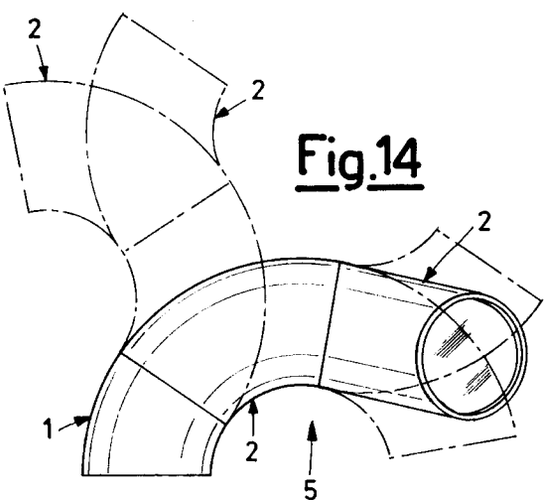

Fig.14

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This invention relates to a variable-configuration lighting apparatus with mutually movable elements.

In the lighting field, lamps are already known consisting of elements connected together articulatedly so that the arrangement and orientation of the lighting element can be varied. The elements are mostly conceived to provide a particular aesthetic effect to the system in its various obtainable configurations.

As the tendency is mostly to emphasize the aesthetic effect, known systems are often disadvantageous from the technical and functional viewpoint. These are mostly systems which are difficult to assemble and provide only difficult access for any repairs to the electrical part, or are systems composed of a large number of different components which can be assembled only by the manufacturer, using particular technical expedients.

Those systems which seek to simplify the construction and assembly of the parts, for example by using modular elements, are mostly defective from the aesthetic aspect and often have functional limitations, such as enabling the lamp or lighting element to be positioned only within limited angles.

A common drawback or limitation of known structures is that once constructed they can no longer be modified, ie it is difficult for the user to vary them at will for different lighting functions, by adding or removing component parts and adapting the system aesthetically to different requirements.

The first object of the present invention is to obviate these drawbacks and limitations of known apparatus by providing a lighting apparatus having mutually movable elements, in particular modular elements, which is constructionally simple and which besides allowing various operating configurations to be achieved very easily, can be modified without difficulty even after its construction.

A further object of the present invention is to achieve mobility of the constituent parts or elements of the apparatus in a particularly economical and simple but functional manner, using means not visible from the outside.

A further object of the invention is to provide an apparatus of the aforesaid type which is also satisfactory from the aesthetic aspect.

These and further objects which will be apparent hereinafter are attained by a variable-configuration lighting apparatus with mutually movable elements, comprising at least two elements with which lighting means are associated, characterised in that said at least two elements are tubular modular elements of curvilinear extension having equal end cross-sections, the ends of each element lying respectively in planes forming an acute angle between them, adjacent elements being rotatably connected together at their end with the ability to be rotated relative to each other about the central axis of the end cross-section.

Advantageously, with a structure of this type considerable versatility can be obtained with elements of very simple and economical construction, with a lighting field which can be directed in any direction by rotating a number of elements relatively to each other about axes lying in different planes. It is also possible to put together various modular elements to increase the variety of apparatus configurations and spatial positioning of the lighting element, while maintaining constructional simplicity. This build-up is not limited to the moment when the apparatus was constructed, but can be done subsequently by the user. The configuration resulting from this build-up of modular elements of the present invention is also agreeable from the aesthetic aspect.

According to a preferred embodiment of the invention, the modular elements are of arcuate extension, wherein the angle between the planes of the end cross-sections can be the same for all the elements or elements can have different contained angles. Various possibilities are logically available.

The invention is described hereinafter by way of non-limiting example with reference to the accompanying drawings, in which:

Figures 1 and 2 are a schematic elevational view and a schematic plan view respectively of a simplified modular element of an apparatus according to the invention;

Figures 3 and 4 are a schematic elevational view and a schematic plan view respectively of a second modular element of an apparatus according to the invention;

Figures 5 and 6 are a schematic elevational view and a schematic plan view respectively of an apparatus obtained by connecting the elements of the preceding figures together;

Figures 7 and 8 are an elevational view and a plan view of a different arrangement of the modular elements of the preceding figures;

Figures 9 and 10 are a schematic elevational view and plan view of a further arrangement of the elements of the preceding figures;

Figures 11 and 12 are an elevational view and a plan view respectively of a further possible arrangement of the two elementary component modular elements of the apparatus according to the invention;

Figures 13, 14 and 15 are a schematic front elevation, side elevation and plan view respectively of an apparatus according to the invention obtained from three modular elements, the dashed and dotted lines indicating some of the various positions obtainable in addition to that indicated by full lines;

Figures 16 and 17 are elevational and plan

views respectively of some further compositional examples;

Figure 18 shows by way of example a curvilinear support element which can be associated with the modular elements of the preceding figures;

Figure 19 is a longitudinal plan section through an apparatus according to the invention;

Figures 20 and 21 are details of some parts of the apparatus of Figure 19, to an enlarged scale;

Figures 22 and 23 are perspective views of two examples of means for limiting the relative rotation of the modular elements.

With reference to these figures, a variable-configuration lighting apparatus according to the invention, for example a lamp for interior or exterior use, is composed of at least two tubular modular elements 1 and 2, with which lighting means are associated as described hereinafter. The modular elements 1 and 2 are of curved and preferably arcuate extension, with equal end cross-sections 1a and 2a. The end cross-sections of each element 1 and 2 lie respectively in planes which form an acute contained angle α. The elements 1 and 2 are placed in contact at their ends and are connected together rotatably, by means described hereinafter, such that the elements 1 and 2 can rotate relative to each other about the central axis of the end cross-section.

As can be seen from Figures 1, 3 and 5, in the preferred embodiment the axial line 3 of each modular element 1 and 2 extends as an arc of a circle having its centre on the line 4 on which the planes of the end cross-sections 1a or 2a of the respective element 1 or 2 meet, and a radius which is equal for all the modular elements. In this manner, when several elements 1 and/or 2 are connected together a continuous arcuate shape is achieved if the relative axial lines 3 lie in the same plane.

In the drawings, the elements 1 and 2 are shown as having different lengths, the element 1 having a mean length (measured along the axial line 3) less than the transverse dimension, and the element 2 having a mean length which is a multiple of the element 1. It is therefore apparent that the elements 1 and 2 could also be identical. In addition they can be combined with further equal or non-equal elements.

The modular elements 1 and 2 are preferably of circular cross-section as shown. They could however be of other than circular cross-section. The cross-section is preferably constant along the entire extension of the elements.

In the illustrated embodiment, the angle α is 33°45' for the element 1 and 67°30' for the element 2, but these angles could be different.

As stated, the two elements 1 and 2 are connected together rotatably at one end and preferably connected to other elements, again rotatably about the axis of the connection cross-section.

Figures 7-17 show by way of example some of the numerous positions which two or three of the modular elements 1 and 2 connected together in succession can assume by rotating one and/or the other of the elements relative to the adjacent one. It will be apparent that adding further elements 1 and/or 2 results in a still greater variety of configurations which can be given to a lighting apparatus 5 composed of the tubular modular elements 1 and 2.

Different elements can also be associated with the elements 1 and/or 2, to act as support elements for the system. One such support element is indicated by 6 in Figure 18. It is of curvilinear extension with an upper cross-section 6a equal to that of the elements 1 and 2. The cross-section decreases progressively from the upper end to the lower end, where the element 6 is securely connected to a support base 7. The cross-section of Figure 18 can for example be used for lighting gardens or the like.

The support element could also be of rectilinear extension, with its upper end cross-section equal to that of the elements 1 and 2.

The support element could also consist of the element 1 (Figures 13-17).

An important characteristic of the present invention is the connection between the modular elements, which restrains them axially but allows them to rotate circumferentially and assume stable positioning in any relative angular position. The connection could be made by geometrically coupling the ends of the modular elements by suitably shaping their edges with relative recesses in one of the elements and connection and guide appendices in the other element.

It has however been found preferable to provide connection means separate from the modular elements. An example of these means is shown in Figures 19, 22 and 23, in which the connection means comprise a connection ring 8 with a plurality of shaped appendices 9 extending from opposite sides of the connection ring 8 and having, on their radially outer end, inclined surfaces 10 acting as a lead-in for their insertion into the modular elements 1 and 2.

The appendices 9 are arranged to cooperate with inwardly projecting edges 11 provided on the elements 1 and 2 at their ends, in such a manner as to axially fix the elements 1 and 2 by the engagement between an outer retention surface 12 on the appendices 9 and an inner radial surface 13 on the edges 11, while allowing circumferential sliding between the connection ring 8 and the elements 1 and 2 by rotating the elements relative

to each other. The ring 8 is snap-inserted into one of the modular elements, after which the other modular element is snapped onto that ring portion projecting from said element.

In the illustrated embodiment the appendices 9 are uniformly distributed along the entire circumference of the ring 8, however they could be provided along only parts of the ring, for example along three uniformly separate regions.

As can be seen from Figure 19, at its free end the more outer modular element 2 houses lighting means consisting of at least one lamp 14 positioned between a reflecting parabola 15 and a transparent protection screen 16. The screen is fixed for example as shown in Figure 21, by means of a retention ring 17 locked to the modular element 2. The lamp 14 and parabola 15 are fixed to the inner wall of the element 2.

Another of the modular elements 1 or 2 can house an electrical voltage reduction transformer 18 suitably fixed to the inner wall of the element. The electrical connection cables 19 leave from the support element 1. They could also leave from an aperture in one of the modular elements 1, 2. An aperture could also be provided in the element housing the lamp 14 for dissipating the heat produced.

Gaskets 20 can be advantageously provided housed in recesses 21 in correspondence with the thickened edges 11 of the elements 1 and/or 2 to act as seals and also to regularize the rotation of the elements 1 and 2 and stabilize the position into which the elements have been moved by the user.

The modular elements 1 and 2 can be rotatable one relative to the other through 360° or less than 360°. To limit the rotation, which could damage the electrical connections if effected through too large angles, rotation stop means are provided, consisting for example of a peripheral recess 22 provided in one of the modular elements and a tooth 23 provided on the other of the modular elements and slidingly engaging the recess 22, which extends through an arc of less than 360°, as shown in Figure 22.

A modification can consist of longitudinal appendices 24 and 25 rigid with the interior of one of the modular elements 1 and 2 respectively, the appendices having a length and arrangement such as to mutually interfere when the modular elements 1 and 2 are in a determined relative angular position.

From the aforegoing it will be apparent that when the elements of curvilinear extension are rotatably connected together at their ends, a lighting apparatus is formed which from the technical and functional aspect enables the light beam to be directed in any spatial direction, using a structure of overall dimensions reduced to their essential minimum, and which is particularly simple and economical, particularly with regard to the rotary connections between the modular elements. It should be particularly noted that the apparatus can be adapted to the most varied requirements by applying a greater or lesser number of modular elements, all easily connectable together in a manner invisible from the outside. The user himself can change the sequential arrangement of the elements.

It should also be noted that the direction of the axis of rotation of the elements, which direction can be different for each pair of adjacent elements, is substantially in the longitudinal direction of their end portions, in contrast to what is normally the case in known apparatus, in which the axis of rotation of the elements is generally perpendicular to the longitudinal extension of the articulatedly connected elements. In other words the elements of the apparatus according to the invention rotate substantially about themselves. This makes the connection between the elements particularly compact and simplifies its construction by eliminating pins and the like, which are generally present in known structures. The result is an increased robustness of the apparatus and a longer useful life.

Numerous modifications can be made to the described apparatus in addition to those already mentioned. For example, provided the end cross-sections of the modular elements remain identical, these latter could be of variable cross-section along their length.

Elements of equal cross-section but of rectilinear extension could be positioned between the elements of curvilinear extension, provided that at least two identical or different modular elements of curvilinear extension are included. All the elements, whether of curvilinear or rectilinear extension, can be connected together rotatably as described and illustrated for the elements 1 and 2.

The materials used can be chosen from a wide range, depending on specific requirements.

Claims

1. A variable-configuration lighting apparatus with mutually movable elements, comprising at least two elements with which lighting means are associated, characterised in that said at least two elements are tubular modular elements of curvilinear extension having equal end cross-sections, the ends of each element lying respectively in planes forming an acute angle between them, adjacent elements being rotatably connected together at their end with the ability to be rotated relative to each other about the central axis of the end cross-section.

2. An apparatus as claimed in claim 1, characterised in that the elements are connected together by connection means separate from the elements.

3. An apparatus as claimed in claim 1 or 2, characterised in that the elements are of arcuate extension, the axial line of each element extending as an arc of a circle having its centre on the line on which the planes of the end cross-sections of the respective element meet, and a radius which is equal for all the elements.

4. An apparatus as claimed in one of the preceding claims, characterised in that said elements are of circular cross-section.

5. An apparatus as claimed in one or more of the preceding claims, characterised in that the elements have a constant cross-section along their entire extension.

6. An apparatus as claimed in one or more of the preceding claims, characterised in that at least one of said elements has a mean length less than its transverse dimension.

7. An apparatus as claimed in one or more of the preceding claims, characterised in that at least one of said elements has a mean length which is a multiple of that of the other of said elements or of another of said elements.

8. An apparatus as claimed in one or more of the preceding claims, characterised in that the angle between the planes of said end cross-sections is 33°45' or 67°30'.

9. An apparatus as claimed in one or more of the preceding claims, characterised in that the elements are rotatable through 360° relative to each other.

10. An apparatus as claimed in one or more of claims 1 to 8, characterised in that the elements are rotatable through less than 360° relative to each other.

11. An apparatus as claimed in one or more of the preceding claims, characterised by also comprising at least one support element of curvilinear extension, having a connection end with a cross-section equal to that of said modular elements.

12. An apparatus as claimed in claim 11, characterised in that said support element has a cross-section which decreases from one end to the other.

13. An apparatus as claimed in one or more of the preceding claims, characterised by further comprising at least one element of rectilinear extension having at least one end cross-section equal top that of said at least two modular elements.

14. An apparatus as claimed in claim 2, characterised in that said connection means comprise a connection ring having a plurality of shaped appendices arranged to axially lock together, but in a circumferentially slidable manner, end edges of said elements which project towards the element interior, the appendices extending from opposite sides of the connection ring.

15. An apparatus as claimed in claim 14, characterised in that said appendices are distributed uniformly along the entire circumference of said connection ring.

16. An apparatus as claimed in one or more of the preceding claims, characterised by comprising a plurality of said tubular modular elements, each rotatably connected to an adjacent one.

17. An apparatus as claimed in one or more of the preceding claims, characterised in that the end element of said elements houses said lighting means at its free end.

18. An apparatus as claimed in claim 17, characterised in that another of said elements houses an electrical voltage reduction transformer.

19. An apparatus as claimed in one or more of the preceding claims, characterised by comprising means for halting the relative rotation of said elements, said means comprising a peripheral recess in one of said elements and a tooth on the other of said elements and arranged to slidingly engage the recess, the recess extending through an arc of less than 360°.

20. An apparatus as claimed in one or more of claims 1 to 18, characterised by comprising means for halting the relative rotation of said elements, said means comprising on each of said elements respective longitudinal appendices arranged to mutually interfere when said elements are in a determined relative angular position.

21. An apparatus as claimed in one or more of the preceding claims, characterised in that seal

gaskets are provided in correspondence with the connection ends of the elements.

22. An apparatus as claimed in one or more of the preceding claims, characterised in that that end element housing the lighting means is provided with at least one aperture through its wall.

Fig.1

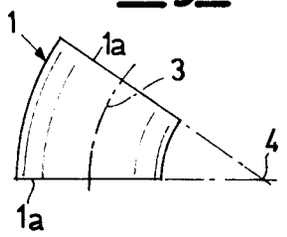
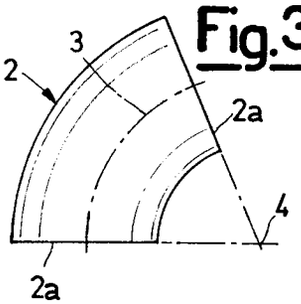


Fig.3



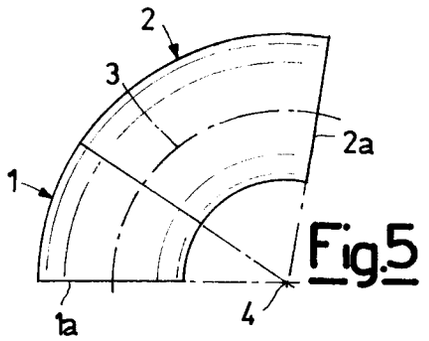


Fig.5

Fig.2

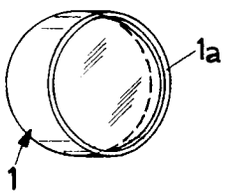


Fig.4

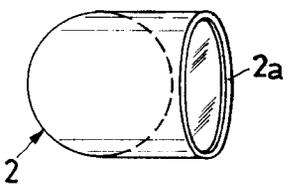


Fig.6

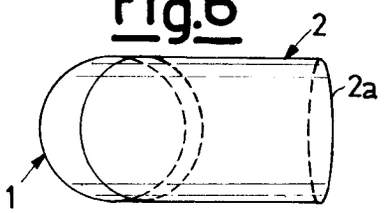


Fig.7

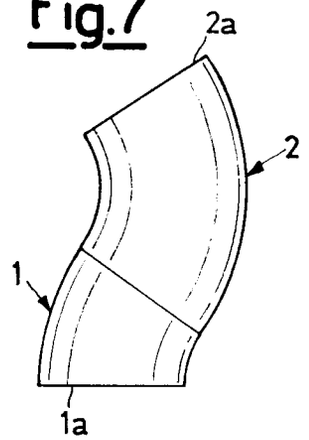


Fig.9

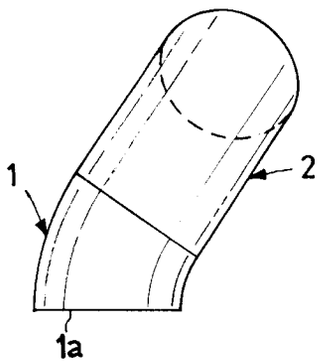


Fig.11

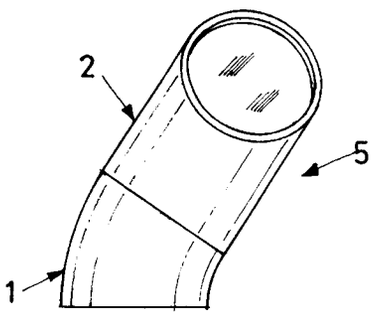


Fig.8

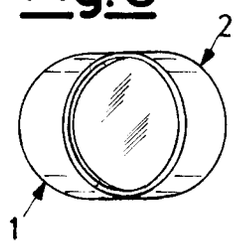


Fig.10

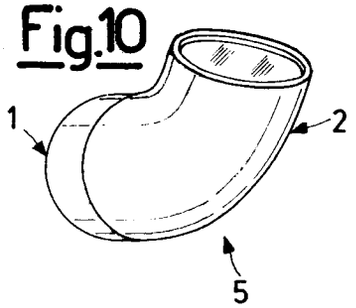
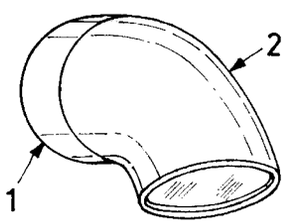


Fig.12



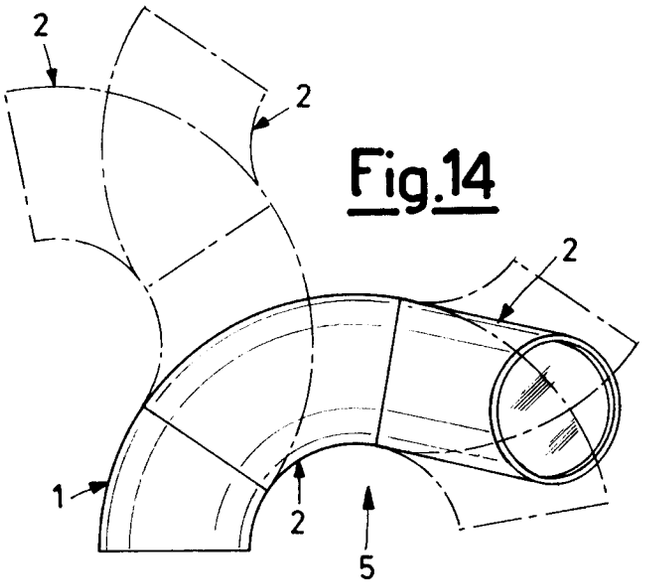


Fig.14

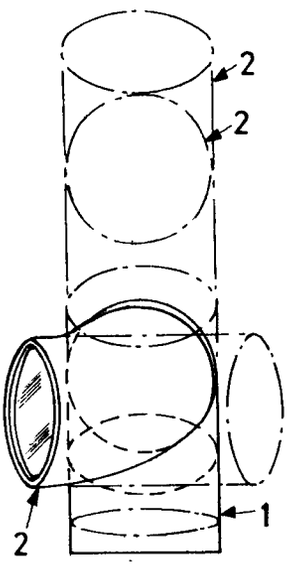
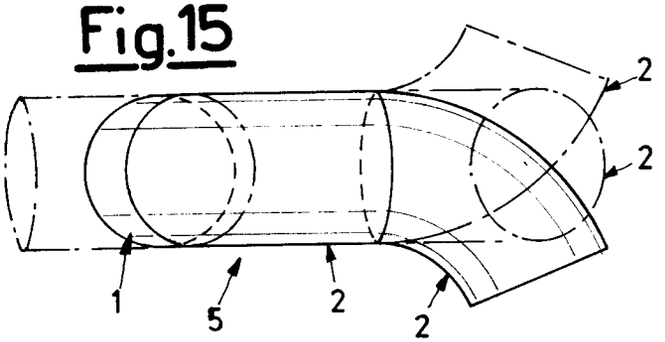


Fig.13

Fig.15



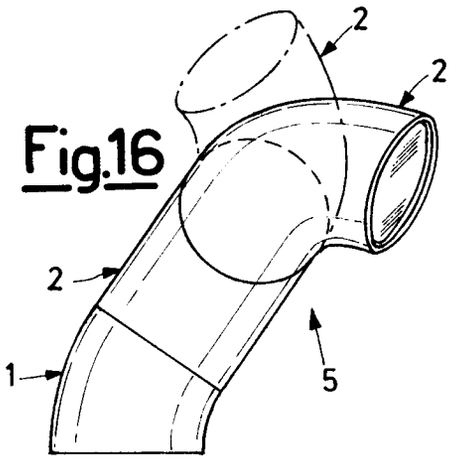


Fig.16

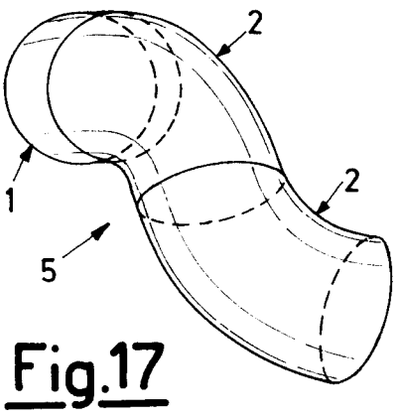


Fig.17

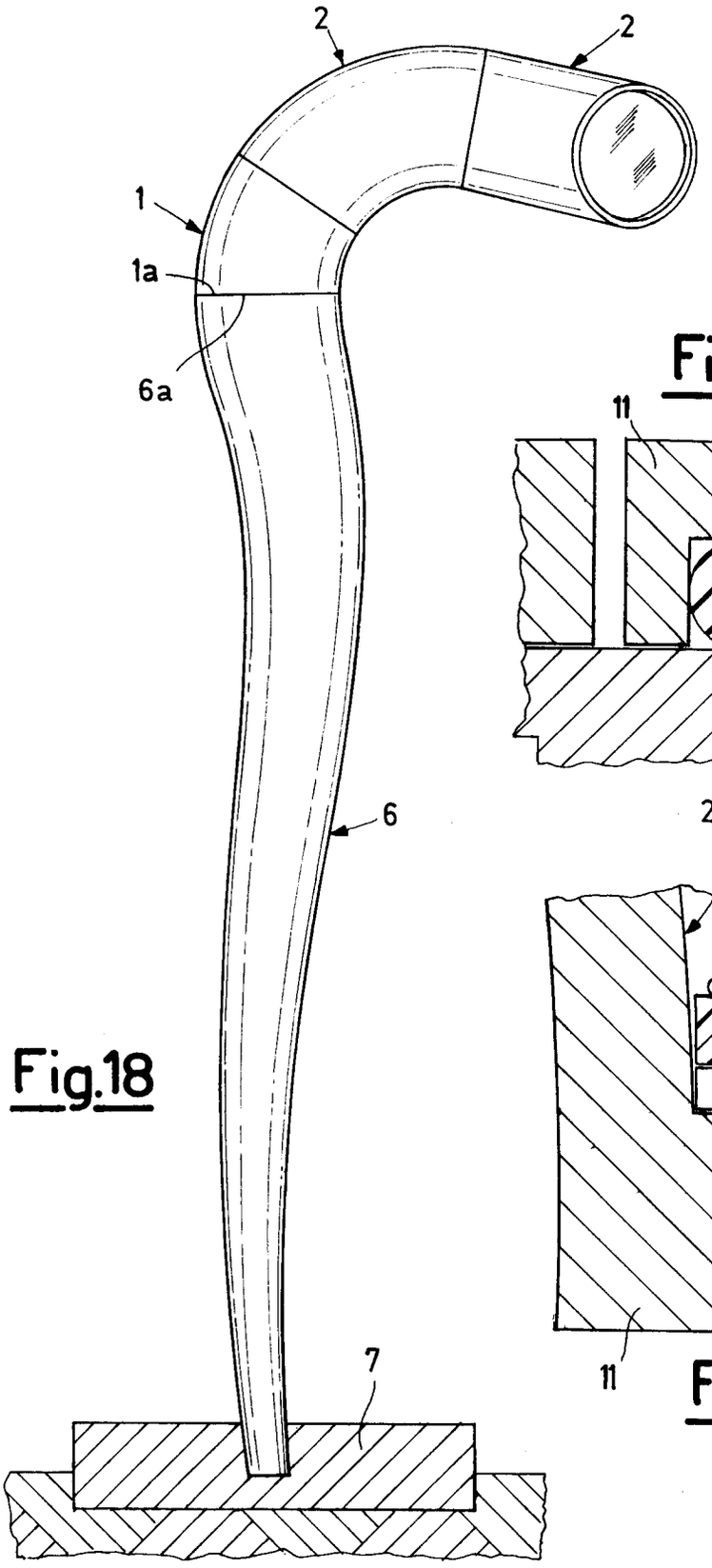


Fig.18

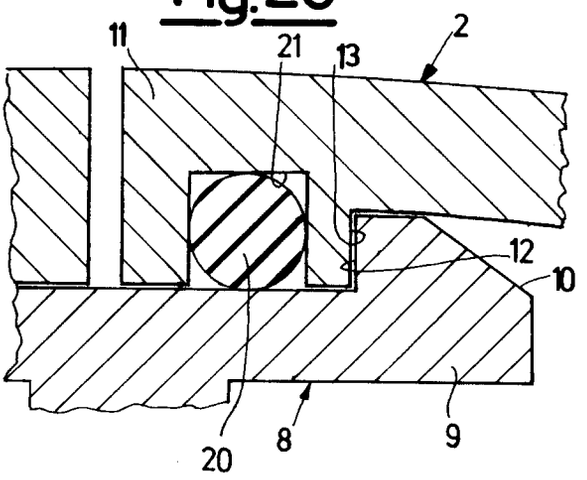


Fig.20

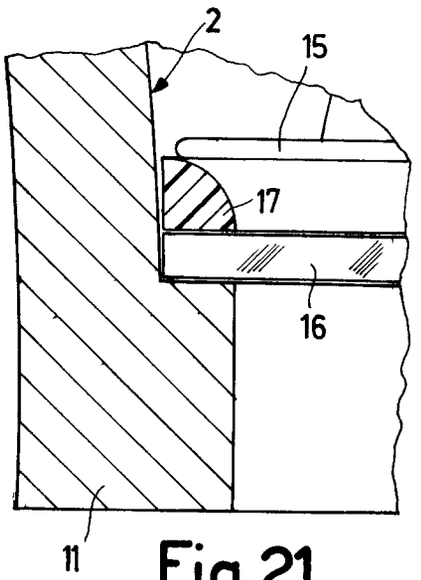
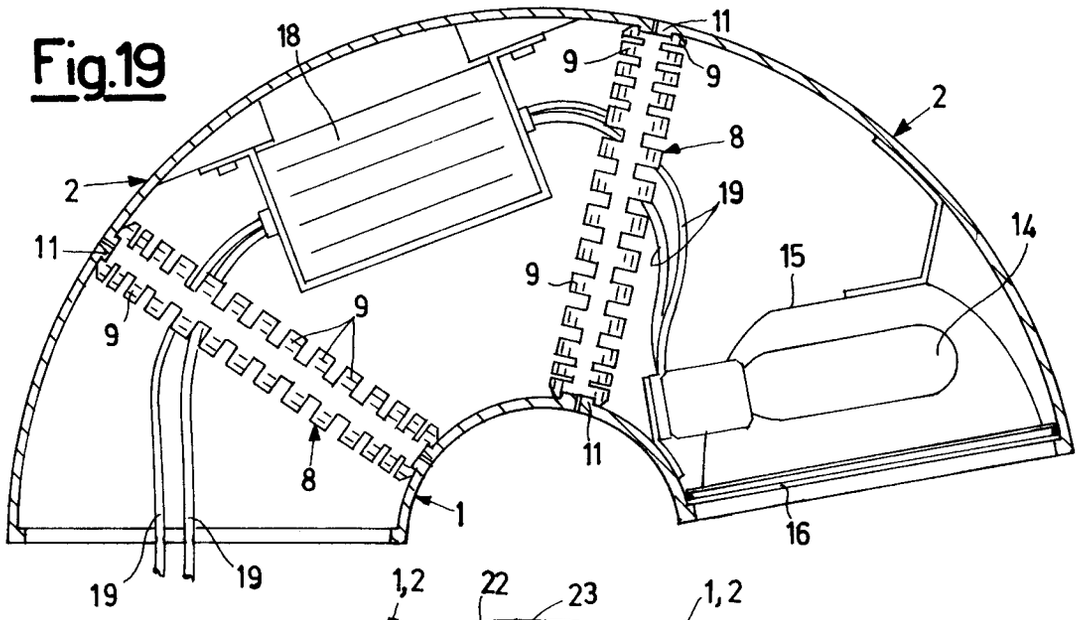


Fig.21

Fig.19



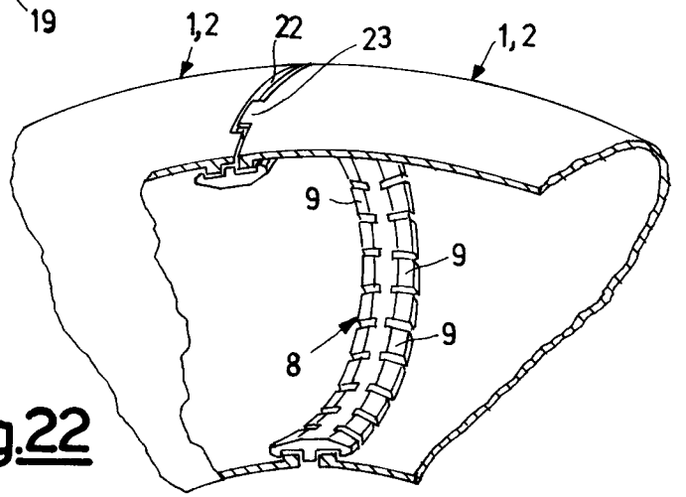


Fig.22

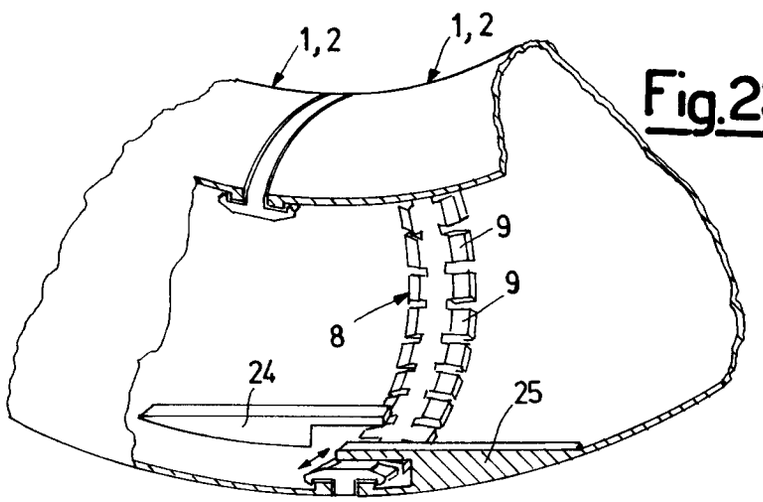


Fig.23

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 92 20 1782

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.5)
X	US-A-3 798 438 (MENICHETTI) * the whole document *	1,3-7,9, 13,16,17	F21V21/28 F21S1/12
Y		2	
Y	FR-A-1 406 687 (REYNAUD) * page 1, column 2, line 19 - page 2, column 1, line 11; figures 1,4,5 *	2	
A		14,15	
A	US-A-4 305 560 (BAN) *abstract; figures 1-4*	1	
A	US-A-4 716 505 (CHAN) *abstract; figures 1,5*	1	

TECHNICAL FIELDS SEARCHED (Int. Cl.5)
F21V F21S

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	25 SEPTEMBER 1992	MARTIN C.P.A.

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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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

EPO FORM 1503 03.82 (P0401)