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(54) Radiant heating device in particular for outdoor surroundings

(57) A heating device for outdoor surroundings comprises a gas-air mixing unit (7) and a combustion head (8) supported by a support element (2). The combustion head has an expansion chamber defined by an upper bottom element (14) and a lower bottom element (15) between which a confinement wall (16) made of porous material consisting of a fabric of metallic fibres perimetrically extends. The gas-air mixture passes through the porous material to be fired at an outer surface (16b) of the confinement wall (16). The device (1) comprises a reflecting element (18) in engagement with the combustion head (8) to diffuse heat in the surrounding environment. The reflecting element (18) has a mirror-like lower surface to better diffuse heat and an upper surface which is thermally insulated by application of a layer of insulating material (20).

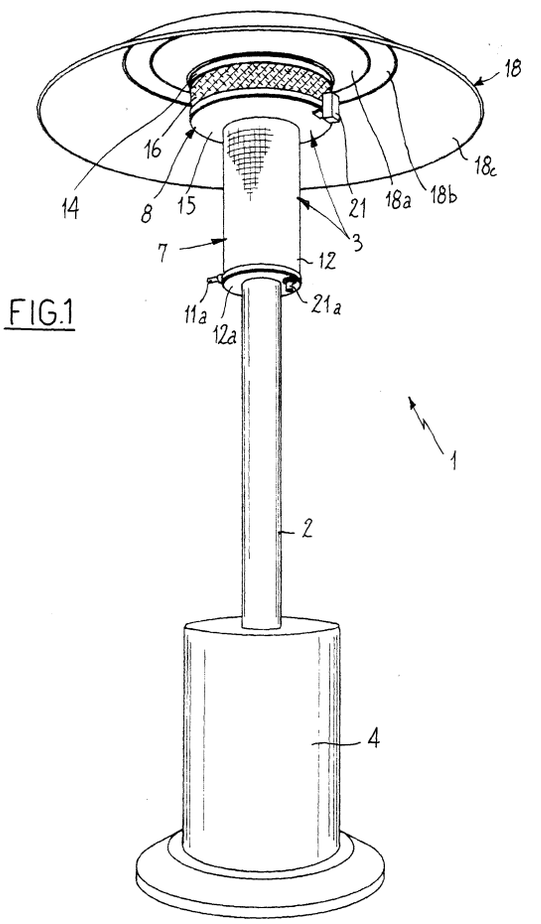

FIG.1

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Description

[0001] The present invention relates to a radiant heating device, in particular for outdoor surroundings, of the type comprising the features set forth in the preamble of claim 1.

[0002] It is known that there are devices which are particularly conceived for carrying out heating of outdoor surroundings, such as bar or restaurant terraces and the like.

[0003] Usually, these devices comprise a base from which a support element rigidly carrying a burner extends in a vertical direction.

[0004] The burner is comprised of a combustion head associated with a mixing unit arranged to mix the comburent air with a combustible substance, usually gas from a bottle housed in the base.

[0005] Once the mixture has reached the combustion head, it is delivered through emission openings formed in the perimetral edge of a circular plate. At the emission openings the mixture is fired thereby defining a plurality of circumferentially. distributed flames rising from the circular plate.

[0006] The combustion head further comprises a wire net circumscribing the circular plate to a short distance from the perimetral edge thereof.

[0007] Once the heating device has been switched on, the flames produced by mixture combustion lick the wire net and heat it until they make the same incandescent. The incandescent wire net in turn gives off thermal energy by radiation, part of which is directed downwardly thereby heating the underlying surroundings, and part of which, substantially directed upwardly, is deviated downwardly by a dome-shaped reflecting element associated with the burner element at the upper part thereof.

[0008] Devices of the above described type enable the surroundings to be heated by radiation. However, these devices have different limits and drawbacks.

[0009] In fact, the Applicant has perceived that yield of known devices is rather restricted because a major portion of the thermal energy produced by combustion is dispersed upwardly and/or transferred to the surrounding air by conduction.

[0010] This happens due to the device structure, and more particularly due to the structure and arrangement of the components forming the burner.

[0011] In fact, as perceived by the Applicant, flames rising from the circular plate greatly heat the reflecting element, in particular at a central portion thereof placed above the combustion head. A great amount of the thermal energy consequently absorbed by the reflecting element is dispersed by conduction in the surrounding air, whereas only the remaining portion is transferred by radiation both upwards and downwards. In addition, the heat amount emanated upwards is dispersed without producing any benefit.

[0012] It is also to be considered that the flames of the circular plate are easily subject to blowing out due to gusts of wind or other unfavourable climatic conditions.

[0013] It is therefore an object of the present invention to solve the problems found in the known art by proposing a heating device, in particular for outdoor surroundings, which carries out a heating action more efficient than that carried out by known devices while greatly reducing losses of thermal energy, in particular through the reflecting element.

[0014] It is a further object of the invention to propose a heating device capable of withstanding strong draughts without any blowing out or backfire.

[0015] The foregoing and further objects that will become more apparent in the course of the following description are substantially achieved by a radiating heating device, in particular for outdoor surroundings, comprising the features set forth in the characterizing portion of claim 1.

[0016] Further features and advantages will be best understood from the detailed description of a preferred, but not exclusive, embodiment of a heating device for outdoor surroundings, in accordance with the present invention. This description will be set forth hereinafter with reference to the accompanying drawings, given by way of non-limiting example, in which:

- Fig. 1 is a perspective view of a heating device in accordance with the present invention;
- Fig. 2 is a fragmentary elevational view, partly in section, taken in a diametrical plane of the heating device shown in Fig. 1.

[0017] With reference to the drawings, a radiating heating device, in particular for outdoor surroundings in accordance with the present invention has been generally identified by reference numeral 1.

[0018] The heating device 1 comprises a support element 2 to which at least one burner 3 is rigidly connected. The support element 2 may consist of one or more suspension arms set to support burner 3 at a raised position or, as shown in the figures, the support element 2 may consist of a support post extending vertically from a base 4.

[0019] In the embodiment shown in Fig. 1, base 4 is of cylindrical shape and is internally hollow to house a supply unit (not shown), consisting of a bottle of liquid petroleum gas (LPG) for example, or of a methane gas bottle operatively connected to burner 3 by a connecting duct 6 extending through the support element 2.

[0020] Burner 3 comprises a mixing unit 7 set to mix combustible gas and comburent air together, and a combustion head 8 at which firing of the combustible gas-air mixture takes place.

[0021] In more detail, the mixing unit 7 comprises at least one delivery nozzle 9 operatively connected with the connecting duct 6 and arranged to direct a continuous combustible gas jet to a mixing duct 10 opening into

the combustion head 8 and aligned with the delivery nozzle 9, being spaced apart therefrom. Upstream of the delivery nozzle 9, on the connecting duct 6 a control valve 11 is operatively engaged, which valve can be switched over to opening by a control push-button lla projecting to the outside from the heating device 1.

[0022] Both the delivery nozzle 9 and the mixing duct 10 are housed in a protection casing defined by a cylindrical net 12 engaged between a lower closing disc 12a fastened to the support element 2 and an upper closing disc 12b rigidly carrying the combustion head 8.

[0023] The combustion head 8 has an expansion chamber 13 delimited between an upper bottom element 14 and a lower bottom element 15, which are coaxially opposite, and a confinement wall 16 having its opposite edges in engagement with the perimetral edges of the bottom elements 14, 15, respectively.

[0024] The lower bottom element 15 is fastened to the upper disc 12b and/or the cylindrical net 12 of the casing holding the mixing unit 7, and has a central opening 15a circumscribed by the confinement wall 16, through which the mixing duct 10 opens into the expansion chamber 13.

[0025] Preferably, both upper and lower bottom elements 14 and 15 have a substantially frusto-conical conformation or at all events a shape concave to the inside of the expansion chamber 13, so as to give rise to an advantageous increase of the inner volume of the expansion chamber itself, the axial size of the confinement wall 16 being the same.

[0026] The confinement wall 16 is completely or partly made of a porous material permeable to the combustible gas-air mixture coming out of the combustion chamber 13. In more detail, this porous material is preferably made up of a textile manufactured article consisting of metallic fibres. More specifically, the fibres forming the textile manufactured article are preferably comprised of an iron-chrome alloy having, just as an indication, a yttrium content which is higher than 0.1%. Such a textile manufactured article is presently available on the market under the name "Fecralloy" from the Belgian firm Acotech S.A.

[0027] The textile fibres can be randomly interlinked by sintering or, as provided in a preferential embodiment, can be assembled in the form of mutually twined yarns, following a usual knitting technique for example, to form a true fabric.

[0028] As shown in Fig. 1, a stiffening wire net 17 can be arranged against an inner surface 16a of the confinement wall 16 to provide an appropriate structural stiffening to the confinement wall itself.

[0029] The porous material forming the confinement net 17 behaves, as regards its being passed through by the combustible gas-air mixture, as a sort of filter bed ensuring an intimate and homogeneous mixing between the air and combustible gas forming the mixture. As an alternative to the above solution, the filter bed may consist of granular elements of appropriate sizes, joined together by sintering or enclosed between two holding nets, as described in the patent application EP0892213, for example.

[0030] The heating device 1 further comprises at least one reflecting element 18 in engagement with the combustion head 8 of the burner element 3 to spread the emitted heat downwardly. As viewed from Fig. 2, the reflecting element 18 is linked to the upper bottom element 14 of the combustion head 8 by a central connecting portion 19, and radially projects from the combustion head itself preferably by a radially inner portion 18a rising away from the combustion head 8, followed, upon possible interposition of a substantially horizontal intermediate connecting portion 18b, by a radially outer portion 18c of a depending extension away from the combustion head.

[0031] Preferably, but not necessarily, the reflecting element 18 has a mirror-polished lower surface to reflect downwardly the radiation from the combustion head 8 to a greater extent. At least one layer of insulating material 20 (diagrammatically shown in Fig. 2) can be applied to an upper surface of the reflecting element 18 to limit heat dispersion upwardly.

[0032] Furthermore, associated with the combustion head 8 is a piezoelectric lighting device 21 to be operated by an actuation key 21a disposed at a position externally accessible to a user to fire the mixture coming out through the confinement wall 16.

[0033] For the purpose of lighting the heating device 1, a user switches over the control valve 11 to opening by the control bottom element lla, thereby enabling the combustible gas to flow from the above mentioned supply unit to the mixing unit 7.

[0034] Once the delivery nozzle 9 has been reached, the combustible gas is directed to the mixing duct 10. While entering the mixing duct 10 the combustible gas carries along therewith, by a Venture effect, part of the air flowing into the protection casing 12 through the meshes of the cylindrical net forming the casing itself. Subsequently, the gas combustible-air mixture produced in the mixing unit 7 is conveyed from the mixing duct 10 to the inside of the expansion chamber 13. The mixture thus admitted to the combustion head 8 flows through the confinement wall 16 made of porous material.

[0035] When the combustible gas-air mixture comes close to the outer surface 16b of the confinement wall 16, it is first fired upon the action of the piezoelectric lighting device 21 controlled by the actuation key 21a.

[0036] When lighting has started, the combustible gas-air mixture burns forming a homogeneous flame front extending over the whole outer surface 15b of the confinement wall 16 and continuously fed with the mixture coming out of the porosities of the confinement wall itself.

[0037] A thermocouple or equivalent element integrated into the piezoelectric lighting device 21 for example detects the firing state of the mixture coming out of

the combustion head 8 and enables gas passage through the control valve 11 without being any longer required any user's action on the control bottom element 11a.

[0038] Preferably, due to the structural sizes of the components of the mixing unit 7 and combustion unit 8, combustion of the mixture and the consequent flame front produced take place directly against the outer surface 16b of the confinement wall 16, as well as in the surface layers of the porous material immediately close to the outer surface itself.

[0039] Under this situation, heat produced by combustion heats the porous material until it is brought to incandescence, so that most of the thermal energy developed by combustion is emanated by radiation in all directions from the outer surface 16b of the confinement wall 16.

[0040] The heat portion radiated downwardly directly reaches the regions to be heated.

[0041] The upwardly-radiated heat is on the contrary deviated downwardly by the reflecting element and in particular the lower mirror-like surface of the latter, thereby increasing efficiency of heating.

[0042] It is to be noted that the ascendent and descending orientations of the inner and outer portions respectively, 18a and 18c, of the reflecting element 18 promote a homogeneous distribution of the reflected heat to the regions surrounding device 1.

[0043] In addition, the hot gases inevitably produced by combustion are collected between the radially inner 18a and radially outer 18b portions of the reflecting element 18, transferring most of their heat to the latter before it is dispersed in the atmosphere. The additional thermal energy thus absorbed by the reflecting element 18 is emitted again by the latter in the form of thermal radiation mainly directed downwardly, due to the presence of the insulating layer 20 on the upper surface of the reflecting element 18.

[0044] The invention achieves the intended purposed and reaches important advantages.

[0045] The subject heating device in fact allows heating of the surroundings to be carried out in a more efficient manner as compared with known devices, because heat losses greatly affecting yield of known devices have been reduced to an important extent.

[0046] The reduction in heat losses is mainly due to the structure of the combustion head and the components forming it. In fact, use of the porous material enabling a continuous flame front to be generated over the whole outer surface of the confinement wall allows a satisfactory radiation to be reached without heating the upper bottom element of the combustion head and/or the central portion of the reflecting element coupled with the upper bottom element itself.

[0047] In this connection it should be recognized that the gas-air mixture from the mixing unit flows at the inside of the expansion chamber of the combustion head cooling the upper bottom element of the same and as a result also cooling the reflecting element.

[0048] This feature is very important, because overheating of the reflecting element in known devices is the source of strong heat losses. The possible presence of the layer of thermally insulating material applied to the upper surface of the reflecting element allows upwardly-directed heat losses to be further reduced, thereby increasing the downwardly-directed radiation.

[0049] It will be also appreciated that the heating device of the present invention can also operate under unfavourable climatic conditions. In fact, should strong gusts of wind succeed in blowing out a portion of the surface flame front, the latter would be immediately restored.

[0050] In addition, use of the filter bed allows a more homogeneous combustible substance-air mixture to be obtained as compared with that obtained with known devices, thereby greatly reducing emission of polluting substances such as CO and NOx.

[0051] It will be also recognized that the volume increase of the expansion chamber resulting from the concave conformation of the upper and lower bottom elements, has allowed a reduction in the sizes of the mixing unit and in particular of the axial extension of said unit, while at all events reaching an excellent degree of mixing between air and gas.

[0052] Furthermore, the radiation carried out with the subject device shows important improvements with respect to a radiation carried out with known devices, because the particular shape of the reflecting element enables part of the heat emanated outwardly and part of the heat emanated inwardly to be reflected, so that all regions of the surroundings to be heated are concerned.

Claims

1. A radiating heating device (1), in particular for outdoor surroundings, comprising:

   - at least one combustion head (8);
   - at least one mixing unit (7) operatively connected with the combustion head (8) to send a combustible gas-air mixture into the latter;
   - at least one reflecting element (18) in engagement with the combustion head (8),

   characterized in that said combustion head (8) comprises an expansion chamber (13) communicating with said mixing unit and having at least one confinement wall (16) at least partly made of a porous material permeable to the combustible gas-air mixture coming out of the combustion head (8).

2. A device as claimed in claim 1, wherein said combustible gas-air mixture is fired at an outer surface (16b) of said confinement wall (16) facing away from the expansion chamber, to form a continuous

flame front extending over the whole extension of the outer surface itself.

3. A device as claimed in claim 2, wherein said flame front is disposed substantially in contact with the outer surface (16b) of the confinement wall (16) to bring the porous material to incandescence close to the outer surface itself.

4. A device as claimed in claim 1, wherein said porous material comprises metal fibres mutually interlinked to form a tissue.

5. A device as claimed in claim 1, wherein said combustion head (8) comprises an upper bottom element (14) and a lower bottom element (15) which are mutually opposite and have a concave conformation to the inside of the expansion chamber (13), said confinement wall (16) of porous material perimetrically extending between said bottom elements.

6. A device as claimed in claim 5, wherein said mixing unit (7) comprises:

- a mixing duct (10) opening into the expansion chamber (13) through the lower bottom element (15);
- at least one delivery nozzle (9) aligned with the mixing duct (10) at a spaced apart position therefrom to direct to the inside of said duct a combustible gas from the supply unit.

7. A device as claimed in claim 1, wherein said reflecting element (18) has:

- at least one radially inner portion (18a) having an ascendent extension away from the combustion head (8);
- at least one radially outer portion (18c) having a descending extension away from the combustion head (8).

8. A device as claimed in claim 1, further comprising at least one layer of insulating material (20) applied to an upper surface of the reflecting element (18).

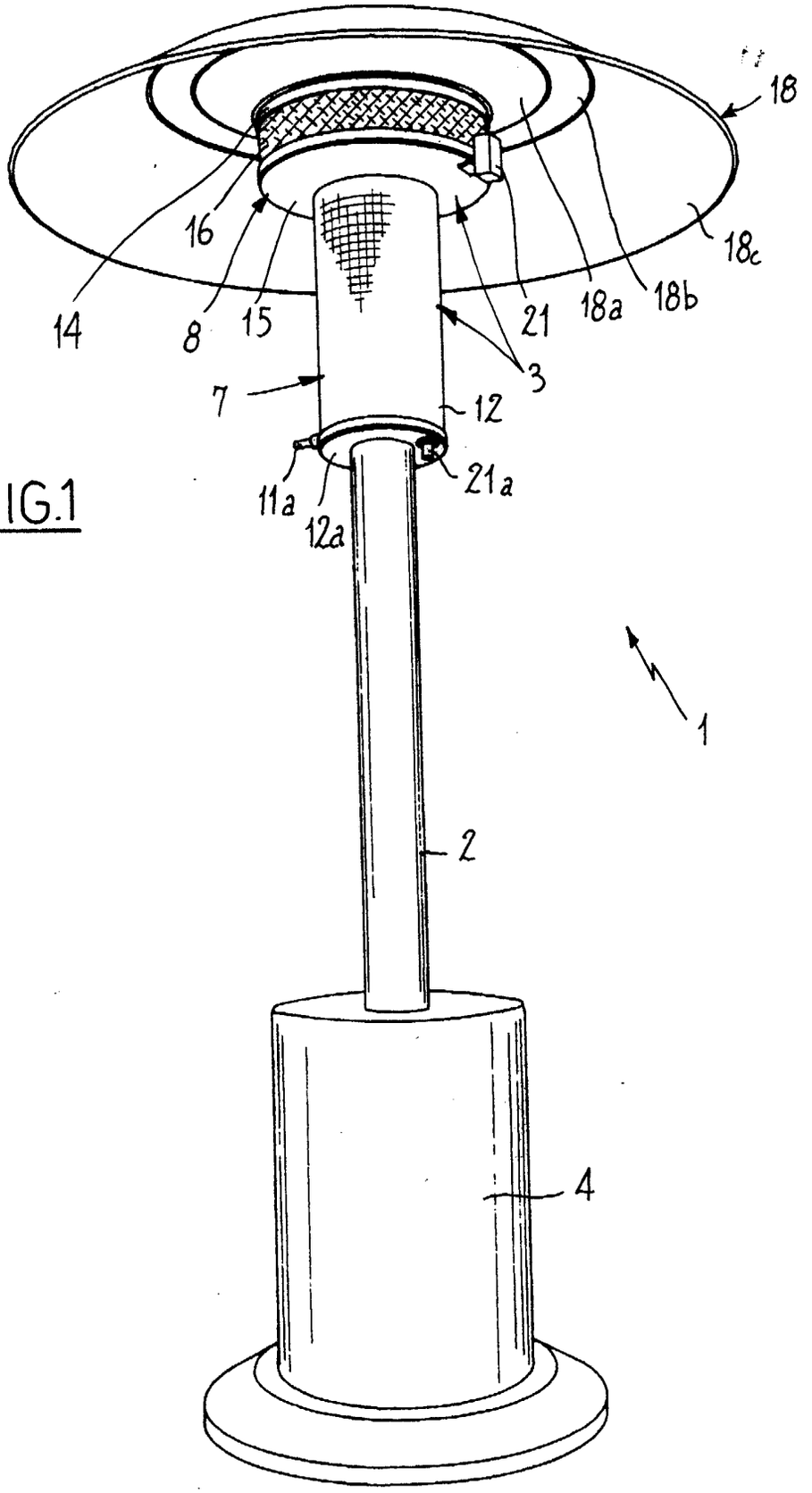
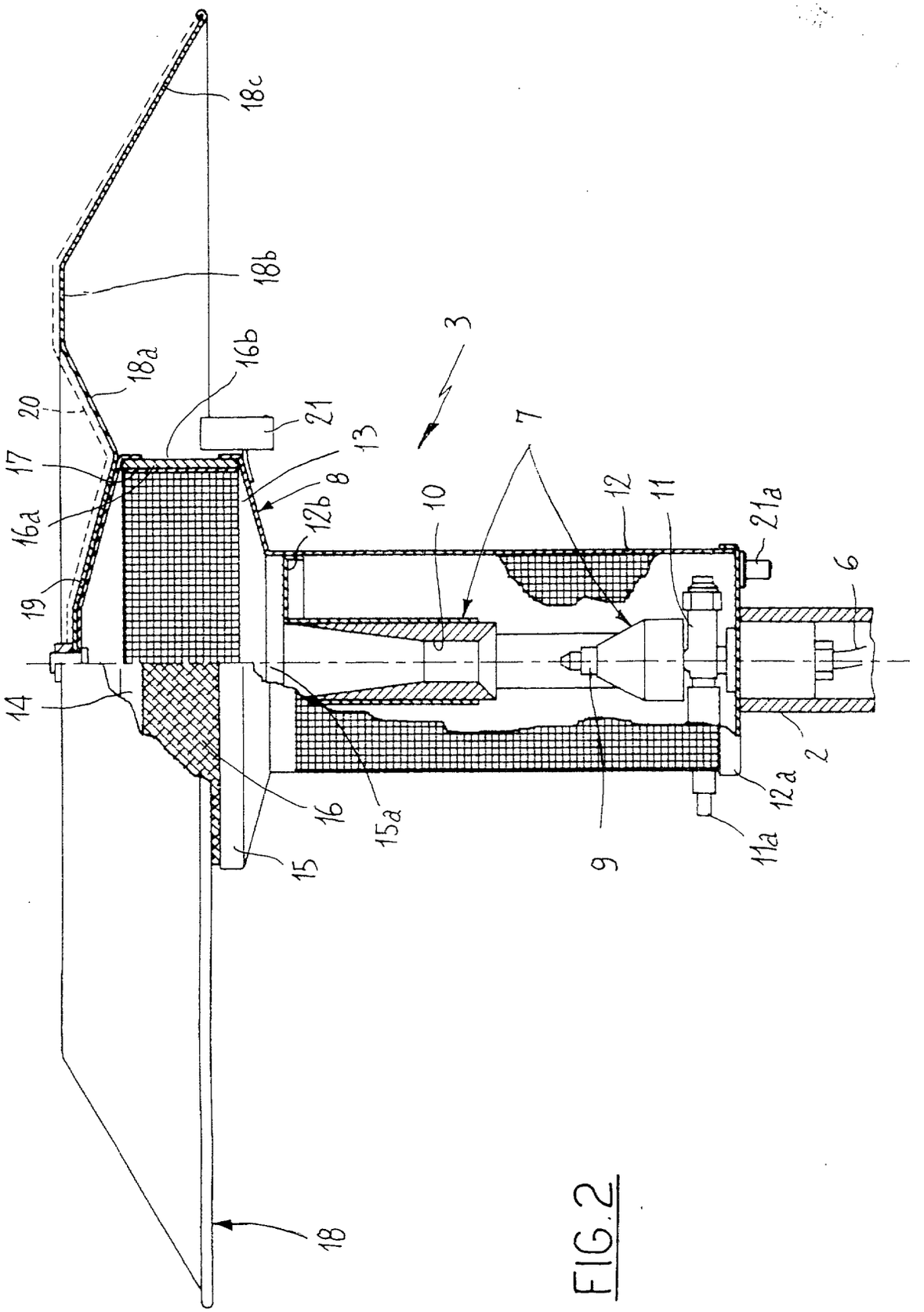


FIG.1


18c
18b
18a
16b
21
3
20
17
13
7
16a
8
12b
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11
21a
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14
16
15a
15
9
11a
12a
2
18

FIG.2

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EUROPEAN SEARCH REPORT

Application Number
EP 00 83 0213

DOCUMENTS CONSIDERED TO BE RELEVANT

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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	14 June 2000	Coli, E

CATEGORY OF CITED DOCUMENTS

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