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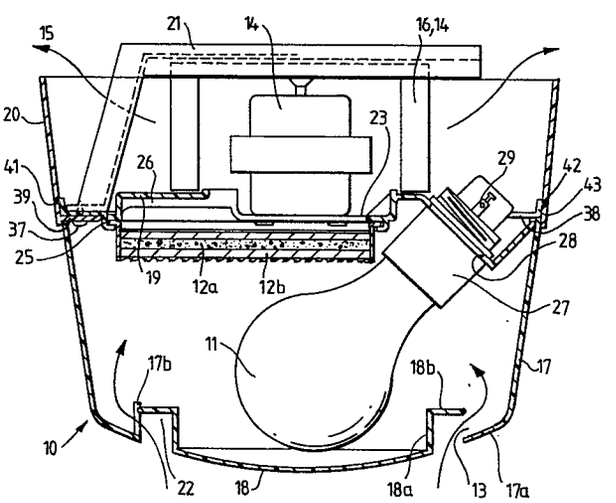
(54) Combined lighting and ventilation device.

(57) A combined lighting and ventilation device comprises a diffuser (17, 18) which forms at least part of a casing 10 for enclosing a light source (11). The casing (10) houses a chemical and particulate filter (12) and has openings (13, 15) by means of which air from the room may be circulated through the casing and through the filter (12) by a powered fan (14) mounted in the casing (10), to form a primary air flow between the openings (13, 15). The light source (11), the fan motor (14), and the filter (12) are all disposed in the primary air flow so created.

The device may be of a modular construction and is preferably separated into a lighting housing for the light source (11) and a fan housing for the fan (14). Advantageously the electrical connections are made in the fan housing so that they cannot inadvertently be touched.



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COMBINED LIGHTING AND VENTILATION DEVICE

The present invention relates to a combined lighting and ventilation device and particularly, but not exclusively to a device which is suitable for use in rooms such as toilets, kitchens, photographic dark rooms, dental surgeries and operating theatres.

BACKGROUND OF THE INVENTION

Lighting for rooms such as those specified above is usually in the form of tungsten or strip lights, often in high wattage, which are effective solely as lights. In situations where ventilation is also required, a separate ventilator is normally used to cleanse and circulate the air, or an extraction device ducted to the outside to remove the unclean or contaminated air and replace it with clean air from outside.

Extraction is not a desirable alternative for two reasons. Firstly ducting is required to the

outside, which is normally carried out by a builder, and secondly, by replacing the air with air from outside, heat is lost from the room. With separate ventilator or extraction devices separate wiring is required.

Some combined ventilation and light devices have been produced, such as a cooker hood. In this case the light is purely supplementary to the room lighting and therefore can be of low wattage. If the bulb in the cooker hood were to be replaced by one allowing adequate lighting for a room, the heat created would not be dispersed and would severely shorten the life of the bulb. The light merely compensates for the shadow created by the hood.

OBJECT OF THE INVENTION

It is the object of the present invention to provide an improved lighting and ventilation device which does away with the need for extraction and which provides an adequate lighting for a room.

SUMMARY OF THE INVENTION

According to the present invention there is provided a combined lighting and ventilation device having a diffuser which forms at least part of a casing for enclosing a light source, the casing housing a chemical and particulate filter and having first and second openings by means of which air from the room may be circulated through the casing and through the filter by a powered fan mounted in the casing to form an air flow between the said openings, the arrangement being such that the light source and the fan motor are disposed in the said air flow.

Advantageously the casing comprises a lighting housing, containing the light source, and a fan housing, and the electrical connections for the device are adapted to be outside the lighting housing.

Preferably the casing is divided into the said housings by a support member which carries the fan and the light source, and may also carry the filter. The casing may include a mounting bracket adapted to carry the electrical power cables to the device.

The second opening may be above the casing and defined partially by the wall or ceiling to which the device will be fitted, or by an air flow baffle designed to direct the air towards the centre of the room.

BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 is a front elevation of a device according to the invention,

Figure 2 is a cross section through the device of Figure 1,

Figure 3a is a plan view of the ceiling/wall mounting bracket of the device of Figure 1,

Figure 3b is a section on A-A of the mounting bracket of Figure 3a,

Figure 4 is a plan view of the support moulding of the device of Figure 1 and

Figure 5 is an underside view of the device of Figure 1.

SPECIFIC DESCRIPTION OF THE INVENTION

The device illustrated in the drawings comprises a casing 10 in which is mounted a 40-100 watt tungsten filament light bulb 11 with Eddison screw or bayonet fitting and a filter unit 12 which is located above the light bulb so as not to impede the light emitted to the room. Air is drawn into the device through inlet apertures 13 in the casing 10 by reduced pressure created by an impeller fan 14 mounted above the filter 12. The fan may be for example a forward curved impeller surrounding a concentric shaft 2-pole circular motor running at 2-pole speed. As it passes through the casing towards an annular outlet opening 15, the air flows over the light bulb, through the filter,

past the fan motor to cool the windings and is discharged by the fan impeller 16 through the outlet opening 15.

The filter unit 12 typically comprises a plastic moulding assembly containing an activated carbon odour filter 12a. The filter is in the form of carbon granules, preferably impregnated with iodine, supported between two large pore (e.g. 20 ppi) reticulated foam pads 12b. The pads 12b serve as a means of containing the carbon granules and act as a particulate filter for the contaminated air. Other filter media may replace the foam to increase or reduce the particulate filtration capability as is required for different applications. The unit 12 may be removeable, disposeable or regenerable and need not have a retaining frame.

The positioning of the bulb 11 in the mainstream air flow provides a full cooling effect on the bulb extending its useful life, and imparting an increase in sensible heat to the air which is returned to the room. The high air velocity, coupled with its reduced relative humidity serves to dry out excess moisture adsorbed by the filter 12a and increases the capacity of the carbon for odour adsorption. Whilst the absorption capacity of the carbon is marginally reduced by the higher air temperature, this is more than offset by the improvement in capacity due to the elimination of water vapour. In fact this improvement is sufficiently noticeable to envisage the use of a heat source to heat the air more than it is heated by passing the light bulb 11.

The iodine impregnant breaks down complex odour molecules and allows them to be readily adsorbed and at the same time gives a measure of bacteriastatic control.

The casing 10 comprises four plastics mouldings 17,18,19, 20. Suitable materials for these mouldings are thermoplastics such as ABS acrylic, polyvinyl chloride,

polyethylene, styrene, nylon (RTM) and polypropylene; and thermosets such as urea and phenol formaldehydes, polyurethanes and polyester. The casing 10 is mounted to the ceiling or wall by a mounting bracket 21 which may be of metal or plastics material. For the purposes of the following description it will be assumed that the device is to be fitted to the ceiling and the terms top, bottom, vertical and horizontal are to be read in this context.

The mouldings 17 and 18 are of translucent material and together form a diffuser for the light source 11. The diffuser should form at least one quarter of the externally visible portion of the casing, and can extend to over half the casing. The mouldings 17 and 18 can alternatively be formed as a single moulding.

The moulding 17 which forms the side of the diffuser is circular in section and converges inwardly towards the bottom thereof. At the bottom the moulding 17 has an inward flange 17a and an inwardly turned substantially vertical lip 17b, which lip is apertured at intervals to form the inlet opening 13. The diffuser is completed by the slightly convex circular moulding 18 which is connected across the bottom of the moulding 17 to the lip 17b. The moulding 18 has a substantially vertical flange of lesser diameter than that of the lip 17b which flange is bent outwardly of the moulding to form a horizontal annular lip 18b which is attached to the lip 17b. The flange 18a and lips 17b and 18b together form an annular channel-shaped groove 22 of sufficient diameter that undiffused light from the bulb 11 cannot leave the diffuser through the openings 13.

The moulding 19 forms a support for the electrical components of the device. It is fitted on top of the diffuser moulding 17 and it divides the casing horizontally into a lower light housing and an upper fan housing. The moulding 19 comprises a seating 23 for the electrically powered fan motor 14 arranged axially of the device. The fan

motor is bolted to the upper side of the moulding 19 and the impeller blades 16 rotate in the space beteen the moulding 19 and the mounting bracket 21 which space defines the fan housing. The moulding 19 also comprises a horizontal discontinuous circular groove which surrounds an aperture 26 in the moulding 19. The filter unit 12 is fitted into the groove 25 to cover the aperture so that the main passage for air from the light housing to the fan housing is through the filter unit 12. The filter is mounted off-centre, partially to enable the light bulb 11 to be positioned with its filament as close to the axis of the device as possible, and partially to balance the weight of the light fitting and bulb 11 to keep the centre of gravity of the device as near to the axis as possible.

The moulding aperture 26 is funnel shaped and the smaller diameter end leads to the fan housing so that air can be drawn through the filter 12,when the device is in use, by the impeller blades 16.

The moulding 19 also carries a light fitting 27 for the bulb 11. The light fitting is disposed at an angle to the vertical which may be from 10^{o} to 80^{0} but is preferably from $30^{o}$to 60^{o}. In the present embodiment the fitting 27 is diposed at 45^{o} to the vertical. The light fitting 27 is located in an aperture 28 in the support moulding 19 with the bulb socket in the light housing and the electrical connections 29 in the fan housing. The light fitting is angled for two reasons. Firstly it enables the light bulb 11 to be positioned substantially axially of the device below the filter and in the air flow through the casing. Secondly it enables the electrical wiring to the fitting 27 to be kept out of the light housing so that changing the bulb is safer. Moreover electrical connections for the fitting 27 are more accessible for connection to the power supply. The socket 27 may be integral with the moulding 19 if preferred.

The moulding 20, which is preferably not translucent, is circular in section and is an upward

continuation of the diffuser. This moulding 20 defines the side limits of the fan housing and provides insulation from electric current and minimises the risk of electric shock or abrasion from contact with the fan impeller.

The mounting bracket 21 is illustrated in Figure 3 and comprises an annular disc 21a and three legs 30, each leg being in the form of a channel directed outwardly of the device. The annular disc 21a extends across the top of the fan and has three radial channels therein, which channels 21b form an extension of the leg channels 30.Each leg is connected to the support moulding 19 by a bolt 37 which passes through the foot 31of the leg 30 and through a hole in the support moulding. The moulding 21 shrouds the fan impeller. Each leg 30 has a slot 34. A connector 32 is attached to one of the legs by means of this slot for connecting the mains supply to the electrical components of the device.

The moulding 20 is not as high as the mounting bracket 21 so that when the device is fitted there is a gap between the moulding and the ceiling or wall to which it is fitted, or between the moulding and a further moulding (not shown), which gap forms the annular outlet opening 15 for the cleansed air.

Various holes are formed in the mouldings 19 and 21 for the electrical wiring and for fixing the device to the ceiling by means of screws. Holes 32 and 33 in the support moulding 19 enable the electric cables to pass from the fan motor to the rear of the light fitting 27 without interfering with the rotating impeller blades 16. The electrical wiring for the fan and the light bulb are connected to the cables from the power supply at the connector 32 which is mounted on the leg 30 nearest to the light fitting 27. The power supply cables can be routed down one leg of the mounting bracket 21 safely in the channel. The shape and design of the mounting bracket has the additional advantage that it obscures the hole in the

ceiling through which the power cables pass.

The moulding 21 has two holes 35a and three holes 35b in the disc 21a, by means of which the device can be secured to the ceiling or wall. The positioning of the holes 35a is such that the device can be fitted without disassembling the mouldings 19 and 21 if preferred. The moulding 19 has two holes 36 enabling a screw driver to pass through the moulding, outside the fan impeller, which can be used when securing the mounting bracket to the ceiling.

One or two thermal devices 40 may be fitted in the moulding 19, passing through a hole in the moulding 19 to be in contact with the air in the light housing. The device is designed to protect the appliance from overheating in the event of an inadequate flow of air. The thermal device is typically a bi-metal contactor or a fusible electrical connector so fitted as to interrupt the flow of electrical current and cut off the source of power to the fan and/or the light. The second switch would be used in a situation where the light and fan have separate on/off switches to cut in the fan in the event of overheating of the light.

It is envisaged that filter resistance will increase with dust load and that the thermal device 40 will, through its normal functioning, signal the need to replace the filters by repetitive switching on and off of the lamp and thus give a visual warning of the abnormal operating conditions and the need to change or clean the filter.

Thus in the event of reduced air flow over the bulb, the tendency to overheat can be minimised and safe cut-out of the electricity supply is ensured.

Other embodiments of the invention will include electrical interval timers or delays which permit the ventilation fan to run on after the light has been extinguished, for a set time, so that residual odours

can be completely removed from the room. This device may be a simple electromechanical unit, or a more complex electronic or micro-electronic device.

Alternatively the appliance may be controlled by means of external standard devices for controlling speed, interval timing and operational programming.

The simplest embodiment has no timer and is controlled by a single new or existing wall switch which effects power to the whole appliance at once.

The support moulding 19 and the mounting bracket 21 are assembled by means of bolts 37 which secure the feet 31 to an annular rim 38 thereof. This assembly and the connection of the wiring for the fan and light to the electrical connector would normally be carried out at the factory. With the diffusers 17 and 18 and the moulding 20 separate from the assembly, the assembly can then be screwed to the ceiling or wall using the holes 35a by means of a screw driver which can pass through holes 36 in the moulding 19, to turn the screws, without dismantling the mouldings 19 and 21. The wiring from the mains supply can be channeled down the leg 30 to the connector 32 for fitting. If the device is to be attached using the three holes 35b it is necessary first to dismantle the mouldings 19 and 21.

Once the assembly 19, 21 is attached to the ceiling or wall, the moulding 20 can be lifted up until a rim 39 of the moulding 20 engages under the rim 38 of the support moulding 19. The rim 39 is slotted to fit over the bolts 37. The moulding 20 is held on the assembly by means of an interlocking connection between an annular groove 41 on the inside of the moulding 20 and an annular protrusion 42 on the outside of an annular flange 43 which forms the outer limit of the support moulding. The mouldings 19 and 20 may additionally be secured together by means of one or more screws (not shown).

Once the moulding 20 is in place, the diffuser 17,18 can be fitted. The upper end of the diffuser fits

inside a depending portion of the moulding 20 and is locked in position, for example by co-operating bayonet components on the mouldings 17 and 20.

Thus there is provided a device which circulates air in a room without losing energy from the air, with no visible extraction or ventilation means and no diminution of the light output. It can be made of plastics materials, which need not be heat resistant, and no additional structural holes or wiring are required.

By circulating air within the room, the warm air found at high level close to the ceiling is recirculated and to this is added the heat given out by the light source and the fan motor. It is possible to use a specially shaped ceiling moulding, which may be part of the mounting bracket 21, for directing the air leaving the device downwardly into the room. In this case the air outlet would be between the moulding 20 and the ceiling bracket 21.

As optional extras, the appliance could be provided with a scented pad, or other deodoriser attached to one of the mouldings; and/or a small heater for heating the air as it passes through the appliance.

In an alternative arrangement the second opening may be arranged in the moulding 20 adjacent the diffuser moulding 17. In such an arrangement the moulding **20** would have a greater diameter than the moulding 17 and the opening or openings would be directed downwardly into the room.

An alternative adsorbent contained in the filter can be activated alumina impregnated with potassium permanganate. Other carriers (such as silica gel) of impregnants may also be used, the impregnants being typified as being strong oxidising agents or calalysts for decomposition. The carriers are typified by being high surface area, porous substrates.

WHAT I CLAIM IS:

1. A combined lighting and ventilation device having a diffuser which forms at least part of a casing for enclosing a light source, the casing housing a chemical and particulate filter and having first and second openings by means of which air from the room may be circulated through the casing and through the filter by a powered fan mounted in the casing to form an air flow between the said openings, the arrangement being such that the light source and the fan motor are disposed in the said air flow.

2. A device according to claim 1 wherein the casing comprises a lighting housing, containing the light source,and a fan housing, and the electrical connections for the device are adapted to be outside the lighting housing.

3. A device according to claim 2 comprising a support component on which the light source, the filter and the fan are supported, which support component separates the lighting housing from the fan housing.

4. A device according to any of claims 1 to 3 wherein the diffuser forms at least one quarter of the externally visible portion of the casing and the first opening is formed in or adjacent the diffuser.

5. A device according to any of the preceding claims wherein the first opening is in the form of a series of apertures arranged in or around the diffuser.

6. A device according to claim 5 wherein the apertures are formed in a channel-shaped groove in the lower face of the diffuser.

7. A device according to any of the preceding claims wherein the light source is a tungsten bulb and the socket fitting for the bulb is angled to the vertical.

8. A device according to claim 7 wherein the bulb socket is angled at 30^{o} to 60^{o}.

9. A device according to any of the preceding claims wherein the filter includes a carbon filter impregnated with iodine.

10. A device according to any of the preceding claims including a thermal switch arranged to switch the device off in the event of overheating.

11. A device according to any of the preceding claims wherein the second opening is in the top part of the casing.

12. A device according to any of the preceding claims including a mounting bracket by means of which the device may be attached to a ceiling or wall, the mounting bracket having means for conveying electrical supply cables to an electrical connector..

13. A combined lighting and ventilation device substantially as herein described, with reference to the accompanying drawings.

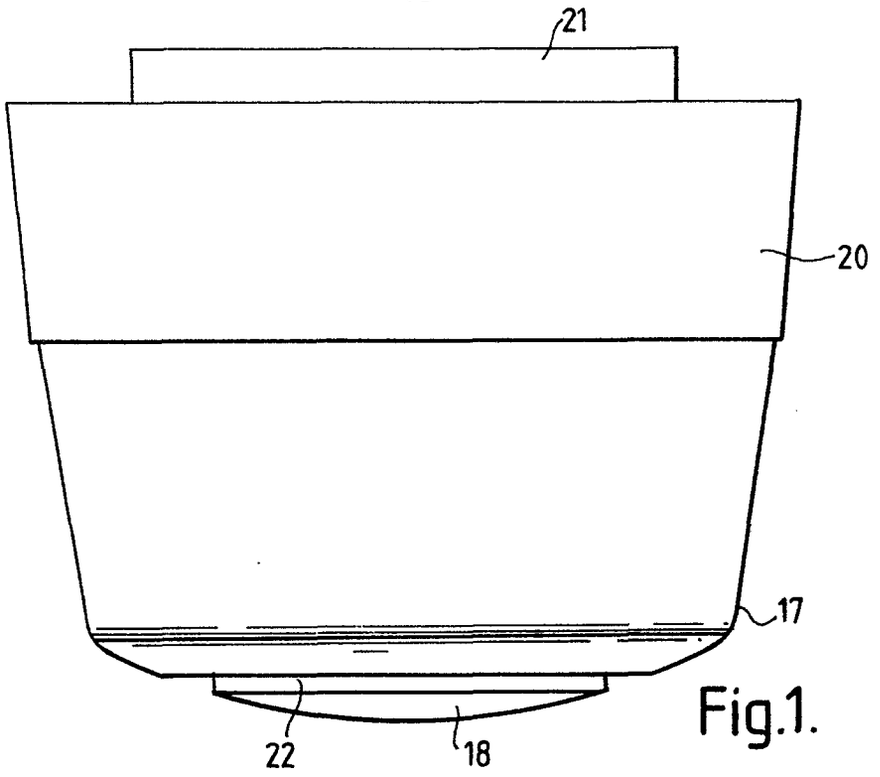
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Fig.1.

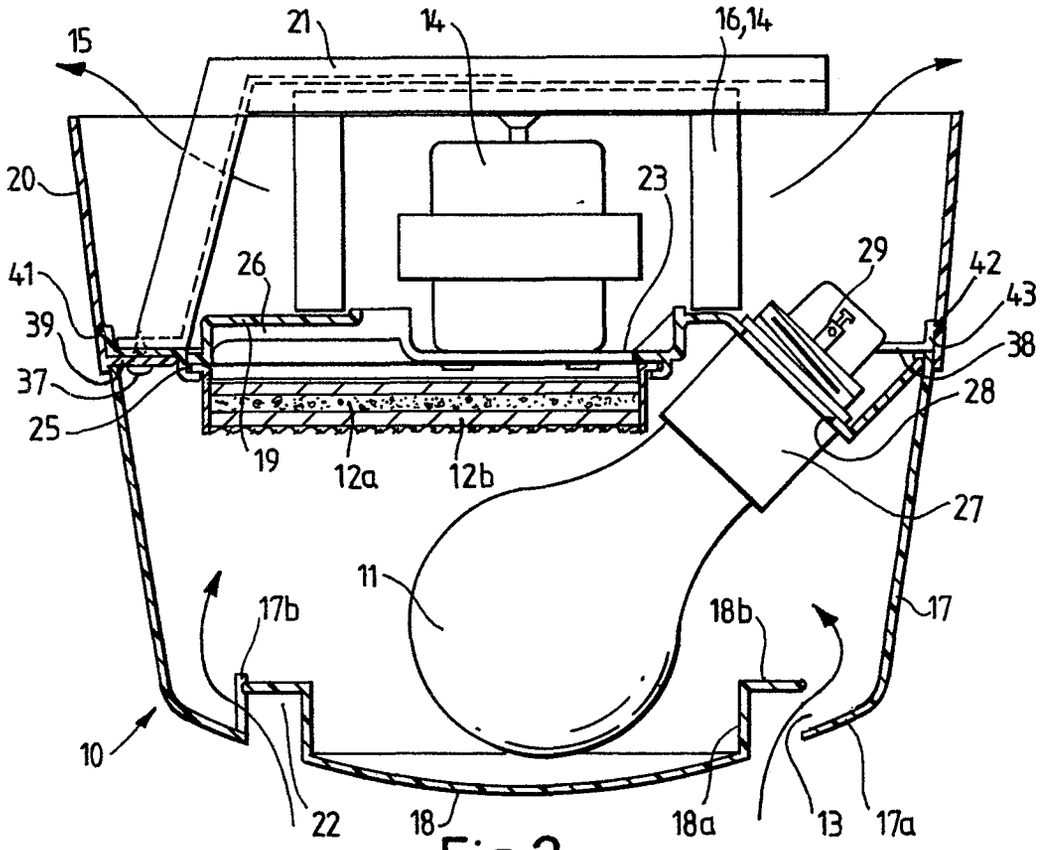
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Fig.2.

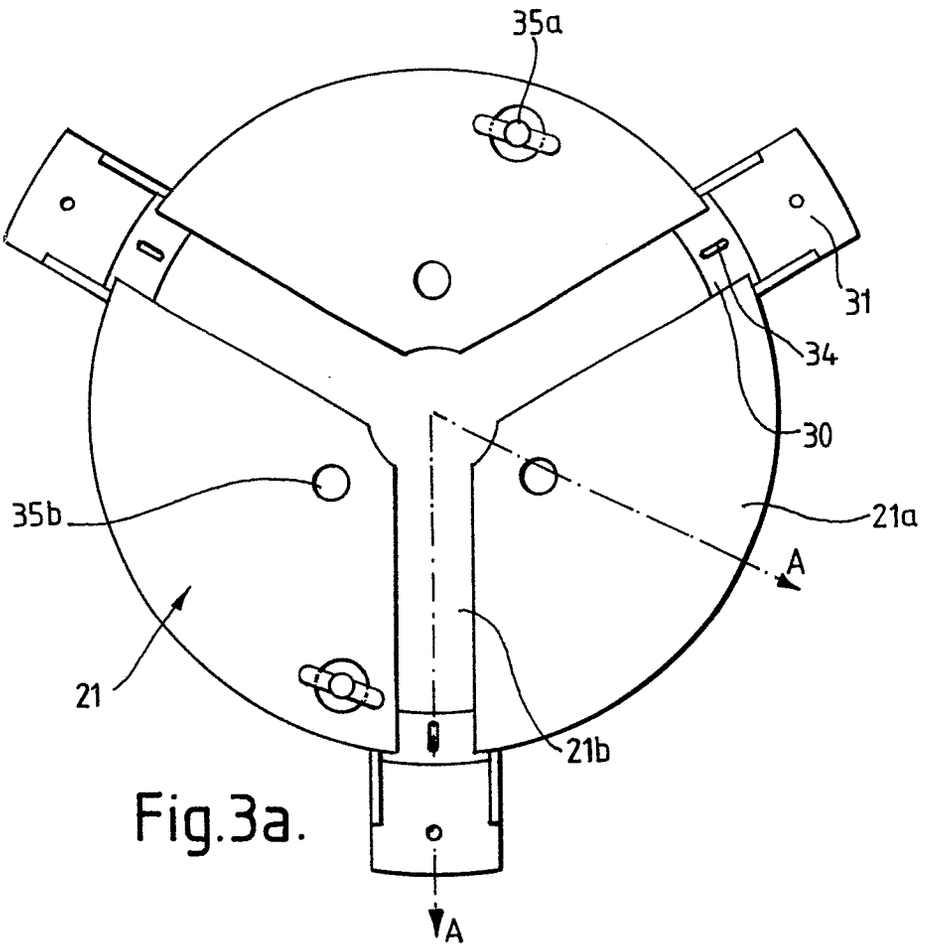

Fig.3a.

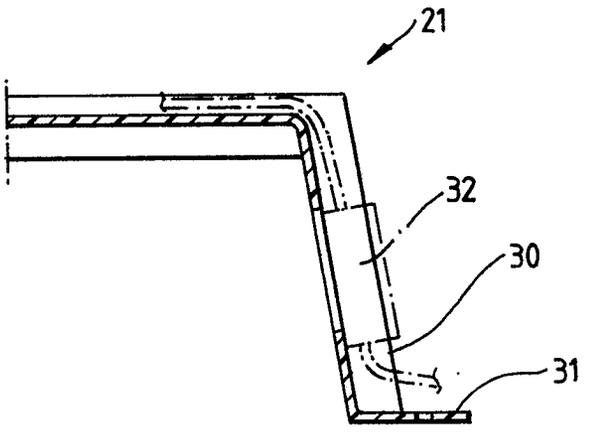

Fig.3b.

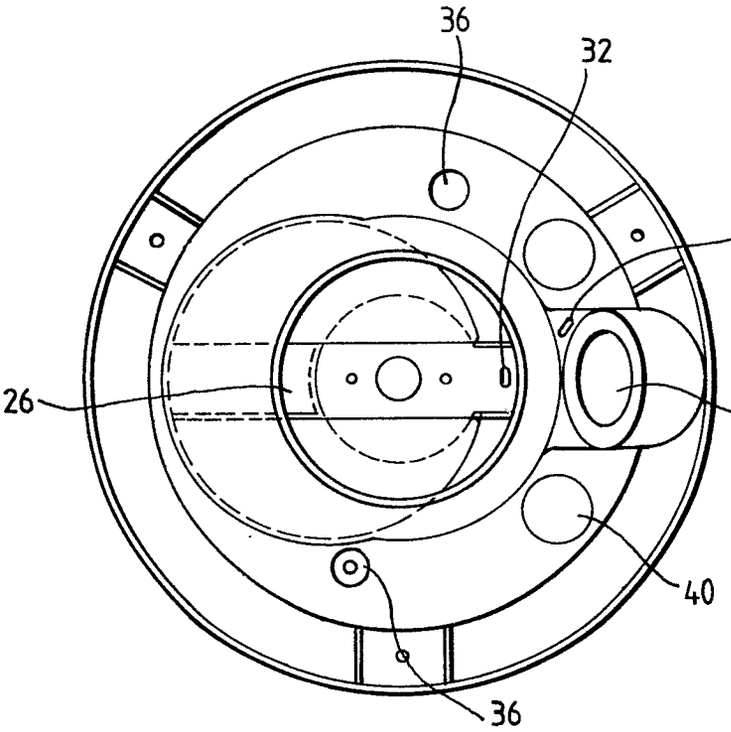

Fig.4.

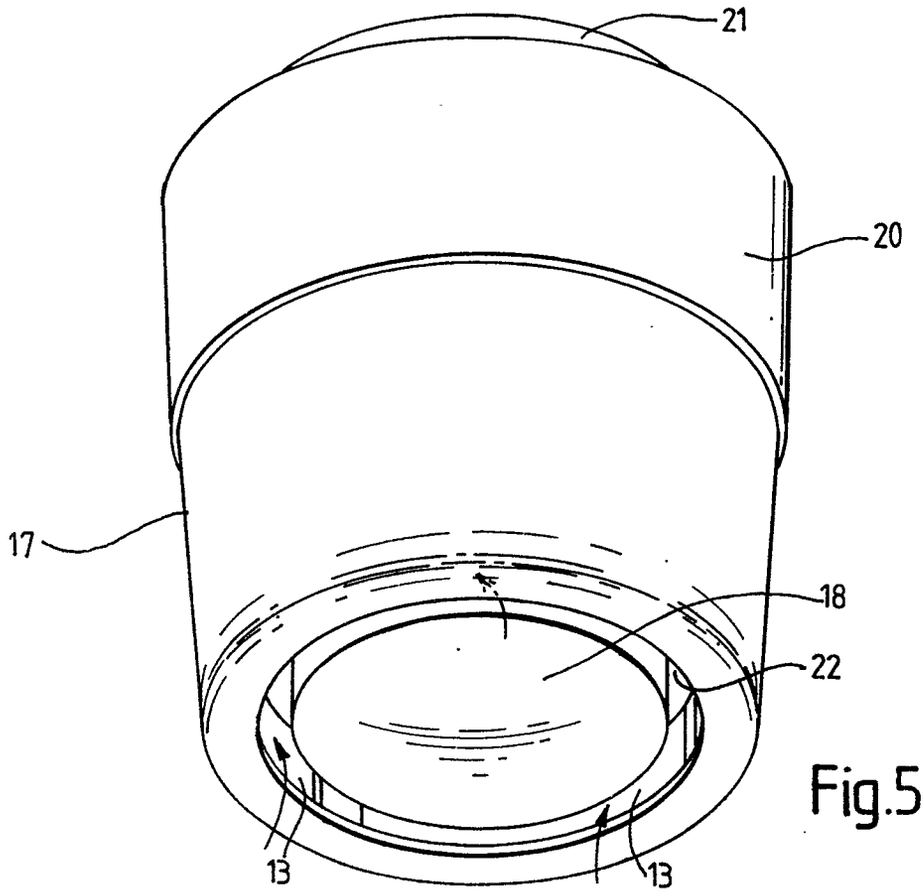

Fig.5.

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EUROPEAN SEARCH REPORT

Application number

EP 83 30 1038

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)
X	DE-A-2 428 568 (RIEDEL) * Page 2, lines 6-16 *	1,2,6, 11-13	F 21 V 33/00 F 24 F 13/078 F 24 F 7/007
X	US-A-3 104 307 (GAROFALOW) * The whole document *	1,2,11 ,13	
A	DE-A-2 255 381 (SCHAUMANN) * Figure *	1,2,4, 10,11-13	
A	US-A-3 132 578 (SHERRON) * Figure 2 *	5	

TECHNICAL FIELDS SEARCHED (Int. Cl. ³)

F 21 V
F 24 F

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	13-06-1983	FOUCRAY R.B.F.

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
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E : earlier patent document, but published on, or after the filing date
D : document cited in the application
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