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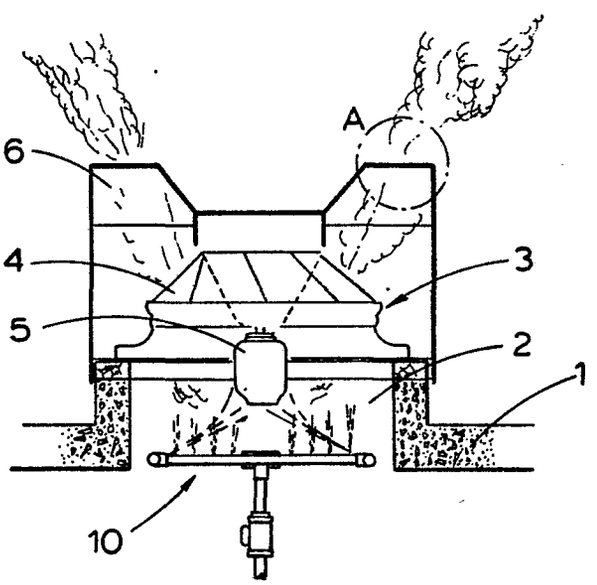
(54) Smoke extraction device.

(57) A smoke extraction device comprises a smoke outlet (102) and a fan (103) positioned to draw gaseous and particulate material through the smoke outlet. A spraying device (110) sprays water which cools the fan motor and the impeller, so that it can handle smoke and gas at a high temperature.



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Title: Smoke Extraction Device

This invention relates to a smoke extraction device.

It is known to provide buildings with smoke extraction devices, for example in the form of fans, which are designed to extract smoke from the buildings should a fire occur. In some types of buildings the use of such smoke extraction devices is required by law. Known smoke extraction devices suffer from a number of disadvantages. One is the risk of sparks and burning debris being ejected from the building and starting a secondary fire. Where the smoke extraction device includes a fan there are further disadvantages. Thus, the fan and its motor must be capable of handling gases which are at high temperatures (typically 600°C or more). Furthermore, it is difficult to make the fans insensitive to the sudden temperature peaks which are liable to occur during the course of a fire.

According to one aspect of the invention there is provided a smoke extraction device which comprises a smoke outlet, a fan positioned to draw gaseous and particulate material through the smoke outlet, and a spraying device for providing a spray of water in the smoke outlet, the fan and spraying device being arranged to operate at least partly simultaneously.

A smoke outlet provided in the roof of a building is often provided with a bird guard which takes the form of a wire mesh or other apertured screen covering the outlet. These guards can become blocked by debris, either debris such as leaves falling on the screens from outside or debris such as ash deposited on the inside during the course of a fire. Accordingly, in one embodiment of the invention there is provided a smoke extraction device comprising a smoke outlet, an apertured guard movable between a first position in which it covers the outlet and a second position in which it does not, and means for causing the guard to move from the said first position to the said second position in the event of a fire.

The invention will now be further described with reference to the accompanying drawings, in which:

Figure 1 is a vertical section through a device according to the invention;

Figure 2 is a perspective view, on a larger scale, showing part of the device of Figure 1;

Figure 3 is a scrap view on the circle A in Figure 1 showing a detail of the device of Figure 1;

Figure 4 is an exploded perspective view of another embodiment of the invention; and

Figure 5 is a scrap view on the circle B in Figure 4, showing a detail of the device of Figure 4.

Figure 1 shows the roof 1 of a building in which there is provided a smoke outlet 2. An extractor fan 3 is mounted in the outlet 2, the fan comprising an impeller 4 rotatably driven by a motor 5. The impeller serves to eject gaseous and particulate material upwardly and outwardly so that the material leaves through channels 6. Allowing materials to leave only through the channels 6 and not through the region between the channels increases the exit velocity of the material so that the material is thrown to a greater height than would otherwise be the case. This is helpful, for example, as regards the operations of fire-fighting personnel operating outside the building.

The channels 6 are closable by bird guards 7 which is shown in Figure 3. Each guard is mounted by means of a hinge 8 and is normally closed by a link 9. The link is formed of a fusible material such that if the temperature rises sufficiently, as will occur if a fire breaks out, for example under the influence of a spring (not shown).

A water spraying device 10 is arranged below the fan and is designed to direct spray at the motor 5. In the embodiment shown in Figure 2 the spraying device comprises four apertured tubes 11 mounted on the ends of arms 12 through which water is fed from a central inlet pipe 13 controlled by a control member 14.

If a fire occurs this is sensed by appropriate means which cause the control 14 to allow water to pass through the pipes 13 and 12 into the apertured pipes 11 from which the water passes outwardly in the form of a spray. The sprayed water keeps the motor, and the impeller, relatively cool, by the formation of a film of water thereon, so that it can handle smoke and gas which are at a much higher temperature than it could otherwise handle. The jets of water also make the fan much less sensitive to some temperature peaks. Furthermore, the spraying of water reduces the chance of sparks and burning debris being ejected by the fan, and thus reduces the risk of starting secondary fires.

Reference will now be made to the embodiment shown in Figures 4 and 5 of the drawings. Figure 4 shows a smoke outlet 102 which is located in the roof of a building. An extractor fan 103 is mounted in the outlet 102, the fan comprising an impeller 104 of the mixed flow type rotatably driven by a motor (not shown) which is positioned immediately below the impeller. The impeller serves to eject gaseous and particulate material upwardly and outwardly so that the material leaves through channels 106. Each channel 106 is closable by bird guards 107. Each guard is mounted by means of a hinge 108 and is normally closed by a catch 109. The guards are spring-biassed to their open positions, but are normally closed against the spring bias by the catches 109. The bird guards 107 are apertured to allow gas and debris to pass therethrough. If, however, the apertures in the guards become blocked, or substantially blocked, as a result of debris collecting thereon, the air pressure below the guards, resulting from the operation of the fan, will be sufficient to overcome the holding force of the catches 109 and will thus allow the guards to spring open into the position indicated in Figure 5.

A fixed cover 120 is mounted immediately above the fan. On either side of the fixed cover are a pair of plates 121 which are mounted for pivotal movement, as indicated by the

arrows X, about horizontal axes located at the lower ends of the plates. The plates 121 are mounted for pivotal movement between an open position (illustrated in Figure 4) in which gas and debris is free to pass into the channels 106, and a closed position in which lips 122 at the upper edges of the plates 121 engage over corresponding lips 123 on the fixed cover 120.

When the fan is not operating the plates 121 will normally be in their closed position, and when the fan is operating the plates will normally move, under the influence of pressure produced by the fan, into their open position, However, for reasons which are explained below, an additional means is provided for moving the plates 121 to their open position, this means comprising an arm 124 mounted for pivotal movement about a central vertical axis. The arm 124 is normally held in a position parallel to the plates 121 by means of a link 125, against the force of a spring which tends to bias it into the position illustrated. The link 125 is fusible and is arranged to melt at a predetermined temperature, say 72 °C. When the link melts the arm moves under the influence of the biassing spring into the position illustrated, thus forcing the plates 121 into their open position. The link 125 is shown in Figure 4 in its condition after fusing, and the rotation of the arm is indicated by the arrow Y.

A water spraying device 110 is arranged below the fan and is designed to direct spray at, or into the region adjacent to, the motor which propels the fan. The spraying device comprises a square casing 130 provided with a flange 131 which rests on the upper surface of the material defining the outlet 102. Water is fed from a central inlet pipe 113 via a control member 114 to a pair of arms 112 at the outer ends of which are two nozzles 132 of the window drench type. These nozzles have arcuate openings 133 which extend over an angle of more than 90°. Operating in conjunction with one another the nozzles 132 provide a substantially continuous curtain of water across

the interior of the casing 130, so that all gas and debris passing the opening 102 must pass through the curtain. The number of nozzles 132 may be varied as desired, and in a small installation a single nozzle might suffice, whereas in a large installation four nozzles, one at each corner, might be used.

The control member 114 comprises a glass bulb which is arranged to break at a predetermined temperature, for example 93°C. When the glass breaks water is able to pass from the central inlet pipe into the arms 112 and thence through the nozzles 132.

To complete the description of the construction of the embodiment of Figures 4 and 5, it is pointed out that the fan is mounted in a housing which contains a downwardly depending skirt 134, the skirt passing over the outside of the flange 131 and over the outside of the outlet 102.

In the operation of the embodiment of Figures 4 and 5, if a fire or smoke occurs it is sensed by an appropriate detector which causes the fan to start operating. The air pressure produced by the fan causes the plates 121 to move to their open position. When the temperature rises further to, say, 93°C the glass bulb of the control 114 breaks and water is sprayed from the nozzles 132. Should the fan fail to operate so that the plates 121 are not forced to their open position by air pressure, when the temperature reaches 72°C the fusible link 125 will break and the arm 124 will force the plates to their open position.

In an alternative mode of operation the fan operates continuously, whether or not a fire is detected, leaving only the nozzles to come into operation when a fire occurs.

The drawings show the smoke extraction device according to the invention mounted on the roof of a building. However, it is alternatively possible for the interior of the building to communicate with the exterior through a duct and for the smoke extraction device to be mounted

in that duct. This may be preferred in some circumstances, for example, where the roof is not strong enought to carry the weight of the smoke extraction device, or where extraction is required from a lower floor than that immediately below the roof.

CLAIMS:

1. A smoke extraction device which comprises a smoke outlet, a fan positioned to draw gaseous and particulate material through the smoke outlet, and a spraying device for providing a spray of water in the smoke outlet, the fan and spraying device being arranged to operate at least partly simultaneously.

2. A device according to claim 1, wherein the spraying device is arranged to provide a substantially continuous curtain of water across the free cross-section of the smoke outlet.

3. A device according to either preceding claim, which is provided with at least one apertured guard through which, in normal use, material leaving the smoke outlet passes.

4. A device according to claim 3, wherein the or each guard is held in it normal position by a fusible link against a biassing force, the link being arranged to fuse above a predetermined temperature and permit the guard to open under the said bias.

5. A device according to claim 3, wherein the guard is held in its normal position by a clip against a biassing force, the guard being designed to move to an open position under the influence of the biassing force, when pressure on the upstream side thereof exceeds a predetermined value.

6. A device according to any preceding claim, wherein the exit from the smoke outlet is partially closed to force material leaving to pass through at least one outlet channel, thereby to increase the exit velocity of the material.

7. A device according to claim 6, wherein the or each said channel is closable by a plate movable between a closed position and an open position, the pressure produced by the fan being sufficient to move the plate from the closed position to the open position.

8. A device according to claim 7, comprising an arm movable between a first, neutral position and a second position in which it forces the or each plate to the open position, the arm being biassed towards the second position but normally retained in the first position by a fusible link.

9. A device according to any preceding claim, wherein the fan is arranged to operate continuously and the spraying device is arranged to operate only if an increase in temperature is detected.

10. A device according to any one of claims 1 to 8, wherein the fan is arranged to operate only if smoke or an increase in temperature is detected and a spraying device arranged to operate only if an increase in temperature is detected.

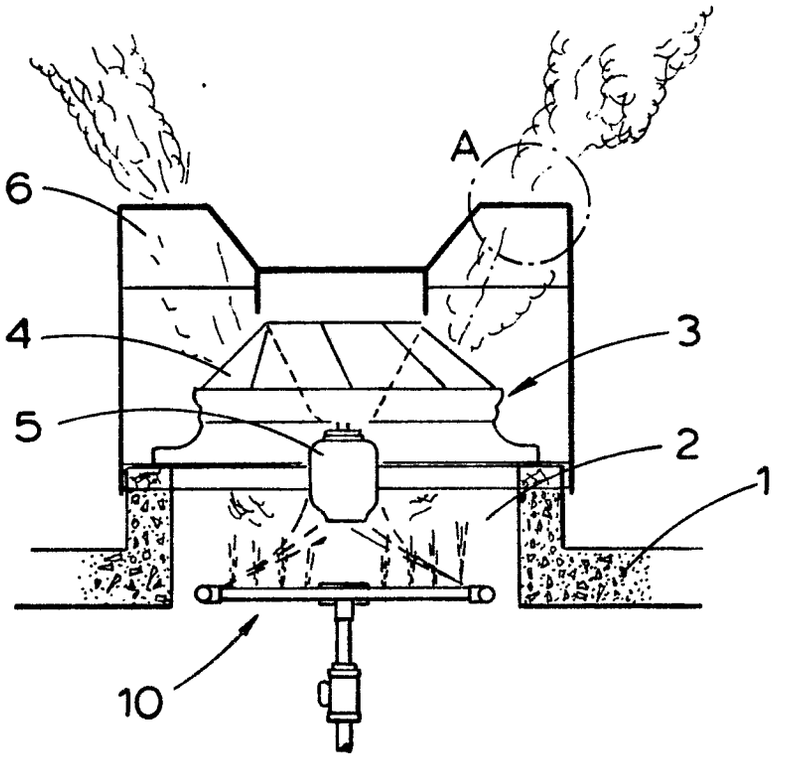


Fig. 1

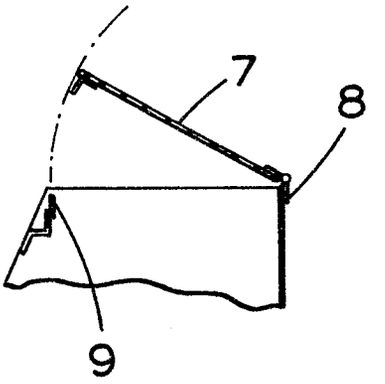


Fig. 3

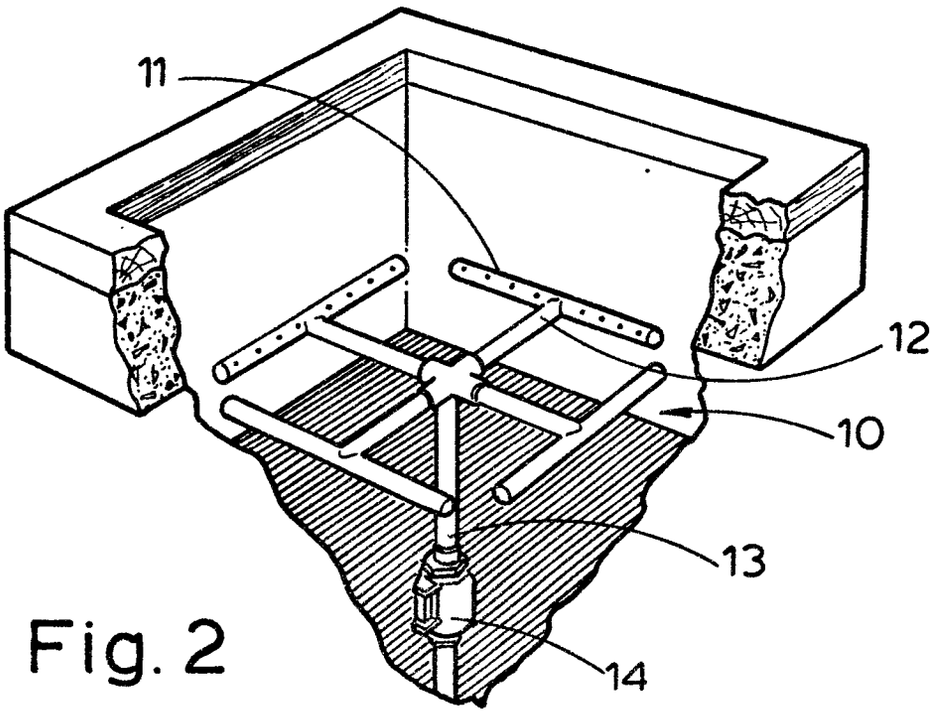
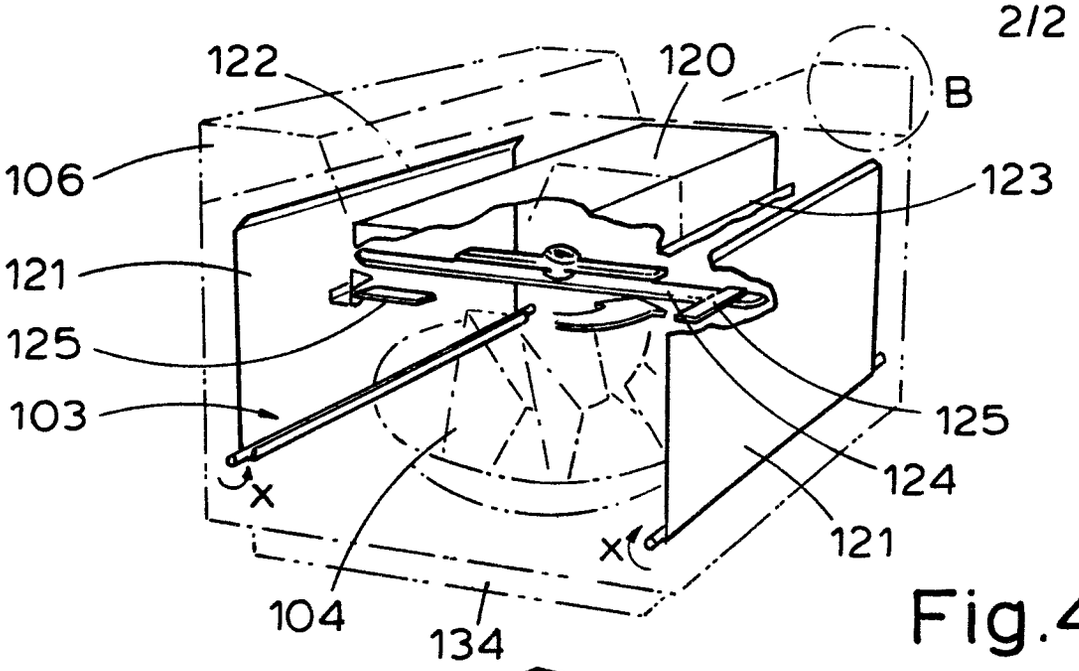


Fig. 2


122
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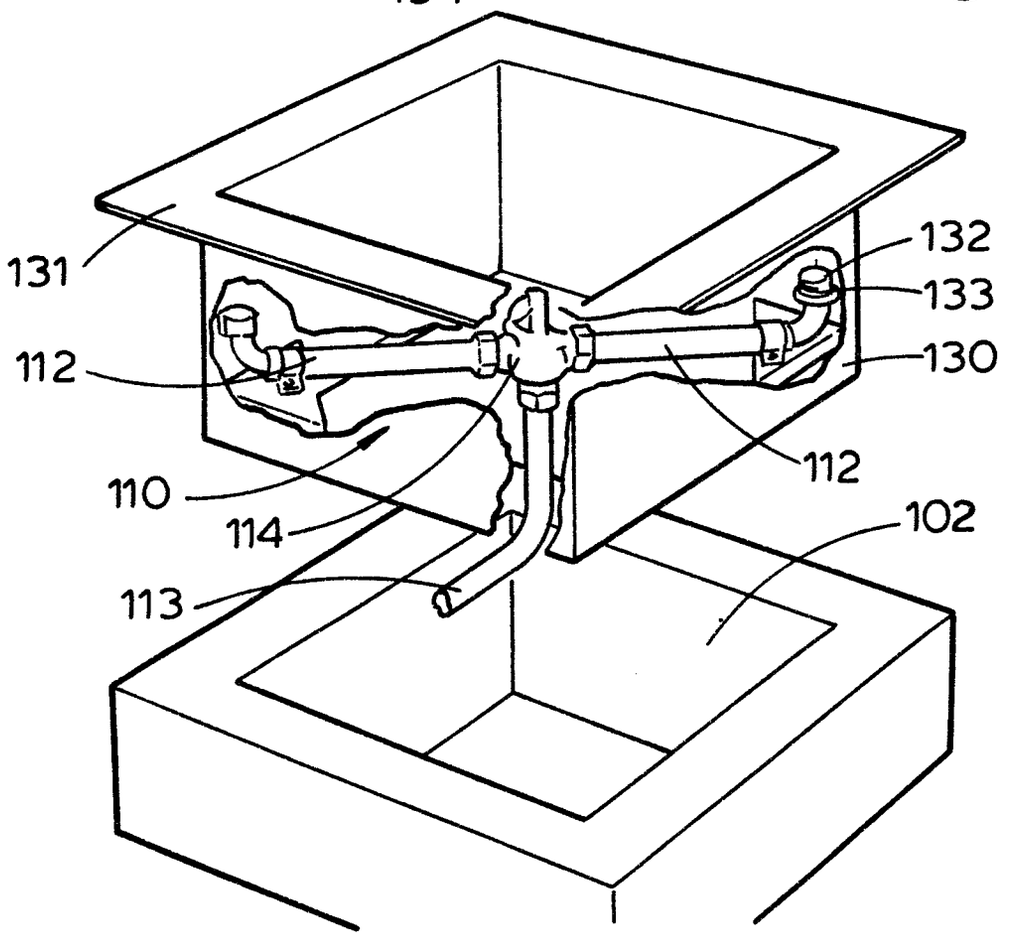
134

Fig.4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113

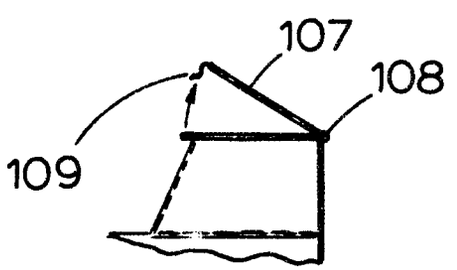
107
108
109

Fig.5

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EUROPEAN SEARCH REPORT

Application number

EP 82 30 5287

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	US-A-3 895 568 (STONE)		A 62 C 3/14
A	FR-A- 960 452 (CORTIJO)		

TECHNICAL FIELDS SEARCHED (Int. Cl. ³)

A 62 C
F 24 F
F 23 L

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	08-02-1983	WOHLRAPP R.G.

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
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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

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