(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) Publication number: **0 235 807**
A2

(12) EUROPEAN PATENT APPLICATION

(21) Application number: **87103055.7**

(51) Int. Cl.[4]: **F24F 13/00**

(22) Date of filing: **04.03.87**

(30) Priority: **05.03.86 CH 907/86**

(43) Date of publication of application:
09.09.87 Bulletin 87/37

(84) Designated Contracting States:
AT BE DE ES FR GB IT LU NL SE

(71) Applicant: **Hammes, Klaus Peter**
Blumenfeldstrasse 15
CH-9403 Goldach(CH)

(72) Inventor: **Hammes, Klaus Peter**
Blumenfeldstrasse 15
CH-9403 Goldach(CH)

(74) Representative: **Frankland, Nigel Howard et al**
FORRESTER & BOEHMERT
Widenmayerstrasse 4/I
D-8000 München 22(DE)

(54) A device for monitoring pollution in air.

(57) Existing air handling systems often incorporate an internal filter which tends to be poorly maintained due to it being located in an inaccessible region of the system where it may not readily be replaced or readily be inspected. A device for monitoring pollution in air flowing through an air handling system comprises a frame (2) and a filter (3) releasably mounted within the frame (2). The frame (2) is adapted to be mounted upon the periphery of an air inlet or outlet of an air handling system so that the filter - (3) extends across the air inlet or outlet. The device is arranged such that when mounted in position upon the air handling system, the filter (3) may readily be inspected by occupants within a room in which the device is located and the amount of pollution on the filter (3) indicates the operating efficiency of the filter in the air handling system. If necessary the filter (3) may be quickly and simply replaced.

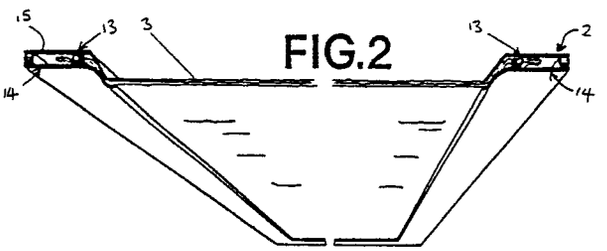

FIG.2

EP 0 235 807 A2

"A device for monitoring pollution in air.

THE PRESENT INVENTION relates to a device for monitoring pollution in air and more particularly to such a device intended to be used in connection with an air handling system.

In the present context an air handling system should be understood to include various types of air-conditioning equipment as well as heating apparatus and ventilating apparatus. The device of the present invention is intended to be used in connection with an air handling system in order to monitor the purity of air supplied to a room from the air handling system and also to purify the air.

Some conventional air handling systems are provided with an internal filter unit intended to remove dirt and other harmful substances from the air flowing through the system. However, the filters provided in such systems tend to be irregularly maintained, if at all, mainly because they are located within the system and are not easily accessible and cannot readily be monitored to check whether or not they need to be cleaned or replaced. Once the filter becomes soiled then it works inefficiently and will eventually do very little to prevent the passage of harmful matter suspended in the air into the room which is being heated or ventilated.

Other simpler forms of heating or ventilating systems do not include an internal filter and therefore do nothing to prevent the free circulation of harmful substances suspended in the air. This can pose significant problems particularly in an environment where several people may occupy the room being heated or ventilated, since germs or viruses from one person are carried freely throughout the room by the natural circulation of the air within the room.

The present invention seeks to provide a device which may be used with existing air handling systems in order to mitigate the above problems.

According to a first aspect of the present invention there is provided a device for monitoring pollution in air, said device comprising a frame and a filter, the filter being releasably mounted within the frame, the frame being adapted to be mounted upon the periphery of an air inlet or outlet of an air handling system such that the filter extends across the air inlet or outlet, the arrangement being such that when the frame is mounted upon the periphery of said air inlet or outlet, the filter is readily visible to occupants in a room within which the device is located.

Preferably the frame comprises a first member adapted to be secured upon the periphery of the air inlet or outlet of the air handling system and a second member adapted to cooperate with the first member in order to releasably mount the filter within the frame.

In one specific embodiment the first member defines a channel extending around the frame within which channel the periphery of the filter may be received, and the second member is in the form of a resilient, elongate member adapted to be received within the channel so as to retain the filter within the channel.

Conveniently, in this first embodiment the channel is U-shaped in cross-section and, when in a relaxed state, the elongate member has a width greater than the width of the channel, the elongate member being deformable so that it may be received tightly within the channel.

In a second and third embodiment the first member and the second member are designed so that they may be snap fitted together in order to trap the filter in position within the frame, between the first member and the second member.

In the second embodiment the first member and the second member both comprise elongate regions of uniform cross-section, each elongate region of the first member defining, in cross-section, a planar portion provided with two spaced apart depending L-shaped projections, the free ends of the depending L-shaped projections extending away from each other in opposite directions, each elongate region of the second member defining, in cross-section, a planar portion provided with two spaced apart, upstanding L-shaped projections, the free ends of the upstanding L-shaped projections extending towards each other, the projections on the first member and the second member respectively, being arranged such that the filter 3 may be received between the first member and the second member and such that the second member may be mounted upon the first member by way of the respective projections in order to releasably clamp the filter in position.

In the third embodiment the first member and the second member both comprise elongate regions of uniform cross-section, each elongate region of the first member defining, in cross-section, a planar portion provided with a depending projection, the depending projection having a thickened region adjacent its free end, and each elongate region of the second member defining a channel between a pair of resilient arms, the arrangement being such that the periphery of the filter may be received within the channel and the second mem-

ber may be mounted upon the first member with the free end of the projection being received within the channel, in order to retain the filter in position between the first member and the second member.

In any of the above embodiments the filter may be formed from a fabric material and may incorporate carbon flakes.

According to a second aspect of the present invention there is provided an air handling system incorporating an internal filter and provided with a device for monitoring pollution in air flowing through the system, said device comprising a frame and a filter, the filter being releasbly mounted within the frame, the frame being adapted to be mounted upon the periphery of an air inlet or outlet of the air handling system such that the filter extends across the air inlet or outlet, the arrangement being such that when the frame is mounted upon the periphery of said air inlet or outlet, the filter is readily visible to occupants in a room within which the device is located.

According to a further aspect of the present invention there is provided a method of monitoring residual pollution in air flowing through an air air handling system incorporating an internal filter, said method comprising the steps of mounting a device for monitoring said residual pollution upon the periphery of an air inlet or outlet of the system, and inspecting the device, said device comprising a frame and a filter, the filter being releasably mounted within the frame, the frame being adapted to be mounted upon the periphery of the air inlet or outlet of the air handling system such that the filter extends across the air inlet or outlet, the arrangement being such that when the frame is mounted upon the periphery of said air inlet or outlet, the filter is readily visible to occupants in a room within which the device is located.

In order that the present invention may be more readily understood and so that further features thereof may be appreciated, the invention will now be described by way of example with reference to the accompanying drawings, in which:

FIGURE 1 is an exploded perspective view of the components of a device in accordance with the present invention;

FIGURE 2 is a perspective view of an alternative embodiment of a device in accordance with the present invention;

FIGURE 3 is a perspective view of a part of the device of Figure 2 shown on an enlarged scale; and

FIGURE 4 is a perspective view corresponding to Figure 3 showing, on an enlarged scale, part of a third embodiment of device in accordance with the present invention.

Referring to Figure 1 of the drawings a device 1 for monitoring pollution in air comprises a rectangular frame 2 within which a filter 3 is releasably mounted so as to extend across the opening defined by the frame 2. The frame 2 is adapted to be mounted upon the periphery of an air outlet of an air handling system so that the filter 3 extends across the outlet and removes harmful matter from the air flowing out of the air handling system.

The frame 2 comprises a plurality of elongate members 4 inter connected by corner pieces 5 to define a rectangular frame. Each elongate member 4 is of uniform cross-section and defines, in cross-section, a horizontal arm 6, formed integrally along one elongate edge with a depending vertical arm 7. Part of the veritical arm 7 serves as one side wall of a U-shaped channel 8 defined by the member 4 beneath its horizontal arm 6. The horizontal arm 6 of the member 4 is provided adjacent each end with apertures 9, by way of which the frame 2, when assembled, may be mounted upon the periphery of an air outlet of an air handling system using screws or the like. The corner pieces 5 serve to interconnect two members 4 in a perpendicularly disposed arrangement by way of lugs 10 provided on the corner piece, which engage within the space defined between the base of the U-shaped channel 8 and the underside of the horizontal arm 6 of each elongate member 4. When fitted on two members 4 a wall 11 of the corner piece 5 is aligned with the vertical arm 7 of each elongate member.

The frame 2 also comprises an elongate resilient band 12, made, for example, of rubber. The band 12 is formed as a loop and only part of the loop is shown in Figure 1. The band 12 is of circular cross-section and has a diameter slightly greater than the width of the U-shaped channel 8 defined by each elongate member 4. The band may be deformed in order to insert the band into the U-shaped channel 8, as illustrated in Figure 1. The length of the band 12 is selected so that when the frame 2 is assembled the band 12 may be received within the channel 8 around the frame 2 when slightly stretched. The band 12 may be removed from the channel 8 simply by pulling it away from the elongate members 4.

The filter 3 is in the form of a sheet of fabric material, cut to have overall dimensions approximately equal to those of the frame 2 when assembled. The filter 3 may be formed from a synthetic material where the fibres are formed into a cloth or matting like material with an open structure and which carry a dielectric charge. The positive and negative charges of the fibres of the filter 3 serve to attract particles of an opposite charge which are suspended in air flowing through the filter. Thus, in addition to the usual mechanical filtering effect the filter 3 has an electrostatic filtering action. The

open structure of the fibres forming the filter 3 allow air to flow through the filter with only minimal resistance. The efficiency of the filter is such that it may even trap sub-micron dust particles. Activated carbon flakes may be disposed on the filter 3 in order to trap gases or odourous substances passing through the filter.

In order to mount the device 1 upon an existing air handling system the frame 2 is initially assembled and mounted upon the periphery of an outlet in the air handling system by way of screws or the like passing through the apertures 9 in the arms 6 of the frame. The filter 3 is then stretched across the frame 2 and the periphery of the filter is pushed into the U-shaped channel 8, with the band 12 subsequently being forced into the channel 8 in order to retain the filter 3 in position across the opening defined by the frame 2.

Figures 2 and 3 illustrate a second embodiment of device 1 having a different design of frame 2. The frame 2 of the second embodiment comprises a first member 13 and a second member 14 adapted to be mounted upon the first member 13. Both the first member 13 and the second member 14 comprise four elongate regions of uniform cross-section, each region constituting one side of the rectangular frame 2. Each elongate region of the first member 13 defines, in cross-section, a horizontal, planar portion 15 provided with two spaced apart, depending L-shaped projections 16. The free ends constituting the bases of the L-shaped projections 16 extend away from each other in opposite directions. The inner edge of the horizontal portion 15 merges into a downwardly sloping arm 17. Each elongate region of the second member 14 of the frame 2 defines a horizontal portion 18 provided with two upstanding, spaced apart L-shaped projections 19. The free end of each L-shaped projection 19 is directed inwardly towards the other projection. The projections 19 are slightly resilient and may bend about their point of attachment to the horizontal portion 18. The inner edge of the horizontal porition 18 merges into an arcuate, downwardly directed portion 20 which terminates in a horizontal lip 21. The projections 19 on the second member 14 are spaced apart so that the projections 16 on the first member 13 may be received therebetween when the projections 19 have been bent outwardly to allow the projection 16 to pass between the free ends of the projections 19. The second member 14 may be separated from the first member 13 simply by pulling the two members apart.

In order to mount the device of Figures 2 and 3 upon the periphery of an air outlet of an air handling system the first member 13 is initially screwed into position in a manner similar to that of the embodiment shown in Figure 1. The filter 3 is then stretched across the opening defined by the first member 13 so that the periphery of the filter 3 is located over the inner depending projection 16 of the first member 13 and then the second member 14 is snap-fitted into position upon the first member 13. As mentioned above, the respective projections 16, 19 on the first and second members are designed so that the projection 16 will be received within the projections 19, the free ends of the respective projections interconnecting in order to retain the second member 14 in position on the first member. When the two members have been interconnected in this manner, the filter 3 is effectively clamped between the first member 13 and the second member 14 and the arcuate portion 20 and horizontal lip 21 of the second member 14 serves as a guide for the filter 3.

Figure 4 illustrates a further alternative embodiment of device 1 having another alternative design for the frame 2. Again the frame 2 of this embodiment comprises a first member 22 and a second member 23, both comprising elongate regions of uniform cross-section. Only a short length of one elongate region is shown in Figure 4. Each elongate region of the first member 22 defines a horizontal portion 24 provided with means for mounting the first member 22 upon the periphery of an air outlet of an air handling system. The horizontal portion 24 is formed integrally with two depending projections 25, 26, the first projection 25 being formed integrally along one elongate outer edge of the horizontal portion 24. The second depending portion 26 is of greater length than the projection 25 and is formed at a position spaced from the inner elongate edge of the horizontal portion 24. The projection 25 provided at the outer edge of the horizontal portion 24 has a thickened region 27 at its free end. The second member 23 defines a substantially horizontal portion 28 which merges at its outer edge into an upwardly and outwardly directed lip 29, and which extends along its inner edge into an arcutate, downwardly directed portion 30. Formed integrally on the upper surface of the horizontal portion 28 are a pair of opposed, semi-circular resilient arms 31 which define a channel 32. The channel 32 has a narrow opening at its upper end, by way of which access to the channel may be gained. The free end of the projection 25 may be received within the channel 32 by pushing the thickened region 27 against the narrow opening between the lips 31 so that the lips are prised apart and the thickened region 27 gains entry to the channel 32. The lips 31 then return to their original position due to their inherent resilience and thereby serve to retain the thickened region 27 within the channel 32. The first member 22 and the second member 23 may be separated from one another

simply by pulling the second member 23 away from the first member so that the thickened region 27 of the projection 25 again acts to prise the lips 31 apart.

The device of Figure 4 is mounted upon an air outlet of an air handling system by securing the first member 22 in position using screws or the like and then stretching the filter 3 across the opening defined by the first member so that the edges of the filter 3 lie over the projections 25, 26. The second member 23 is then brought up to the first member 22 and then pushed onto the first member so that the thickened region 27 of the projection 25 passes into the channel 32 and the filter 3 is effectively clamped between the first and second members.

With all of the above described embodiments the filter 3 is intended to be located in position in such a way that the filter is visible, so that the filter may readily be inspected and if necessary removed and replaced, when it begins to shows signs of accumulating dirt or other particulate pollution. All that will be required in order to effect removal of the filter 3 is to separate the component which retains the filter in position from the component which is secured upon the periphery of the air outlet of the air handling system. The filter may then be replaced with a new filter. In the case of an air handling system provided with an internal filter, the condition of the filter 3 will give an indication of how efficiently the internal filter is working and as to whether the internal filter may need replacing. The ease with which the filter 3 may be inspected effectively provides a method of monitoring the pollution in air flowing through the outlet of the air handling system.

It will be appreciated that the specific design of the frame 2 may be varied in order to allow the device 1 to be used upon various designs of air handling system.

The features disclosed in the aforegoing description, in the following claims and/or in the accompanying drawings may, both separately and in any combination thereof, be material for realising the invention in diverse forms thereof.

Claims

1. A device for monitoring pollution in air, said device comprising a frame (2) and a filter (3), the filter (3) being releasably mounted within the frame (2), the frame (2) being adapted to be mounted upon the periphery of an air inlet or outlet of an air handling system such that the filter (3) extends across the air inlet or outlet, the arrangement being such that when the frame (2) is mounted upon the periphery of said air inlet or outlet, the filter (3) is readily visible to occupants in a room within which the device is located.

2. A device according to Claim 1, wherein the frame (2) comprises a first member (4, 13, 22) adapted to be secured upon the periphery of the air inlet or outlet of the air handling system and a second member (12, 14, 23) adapted to cooperate with the first member in order to releasably mount the filter within the frame (2).

3. A device according to Claim 2, wherein the first member (4) defines a channel (8) extending around the frame (2) within which channel the periphery of the filter (3) may be received, and the second member (12) is in the form of a resilient, elongate member adapted to be received within the channel (8) so as to retain the filter (3) within the channel (8).

4. A device according to Claim 3, wherein the channel (8) is U-shaped in cross-section and, when in a relaxed state, the elongate member (12) has a width greater than the width of the channel (8), the elongate member being deformable so that it may be received tightly within the channel (8).

5. A device according to Claim 2, wherein the first member and the second member are designed so that they may be snap fitted together in order to trap the filter (3) in position within the frame (2), between the first member and the second member.

6. A device according to Claim 5, wherein the first member (13) and the second member (14) both comprise elongate regions of uniform cross-section, each elongate region of the first member - (13) defining, in cross-section, a planar portion - (15) provided with two spaced apart depending L-shaped projections (16), the free ends of the depending L-shaped projections (16) extending away from each other in opposite directions, each elongate region of the second member (14) defining, in cross-section, a planar portion (18) provided with two spaced apart, upstanding L-shaped projections (19), the free ends of the upstanding L-shaped projections (19) extending towards each other, the projections (16), (19) on the first member (13) and the second member (14) respectively, being arranged such that the filter 3 may be received between the first member (13) and the second member (14) and such that the second member - (14) may be mounted upon the first member (13) by way of the respective projections (16), (19) in order to releasably clamp the filter in position.

7. A device according to Claim 5, wherein the first member (22) and the second member (23) both comprise elongate regions of uniform cross-section, each elongate region of the first member - (22) defining, in cross-section, a planar portion - (24) provided with a depending projection (25), the depending projection (25) having a thickened re-

gion (27) adjacent its free end, and each elongate region of the second member (23) defining a channel (32) between a pair of resilient arms (31), the arrangement being such that the periphery of the filter (3) may be received within the channel (32) and the second member (23) may be mounted upon the first member (22) with the free end of the projection (25) being received within the channel (32), in order to retain the filter (3) in position between the first member (22) and the second member (23).

8. A device according to any one of the preceding claims, wherein the filter (3) is formed from a fabric material and incorporates carbon flakes.

9. An air handling system incorporating an internal filter and provided with a device for monitoring pollution in air flowing through the system, said device comprising a frame (2) and a filter (3), the filter (3) being releasbly mounted within the frame (2), the frame (2) being adapted to be mounted upon the periphery of an air inlet or outlet of the air handling system such that the filter (3) extends across the air inlet or outlet, the arrangement being such that when the frame (2) is mounted upon the periphery of said air inlet or outlet, the filter (3) is readily visible to occupants in a room within which the device is located.

10. A method of monitoring residual pollution in air flowing through an air air handling system incorporating an internal filter, said method comprising the steps of mounting a device for monitoring said residual pollution upon the periphery of an air inlet or outlet of the system, and inspecting the device, said device comprising a frame (2) and a filter (3), the filter (3) being releasably mounted within the frame (2), the frame (2) being adapted to be mounted upon the periphery of the air inlet or outlet of the air handling system such that the filter (3) extends across the air inlet or outlet, the arrangement being such that when the frame (2) is mounted upon the periphery of said air inlet or outlet, the filter (3) is readily visible to occupants in a room within which the device is located.

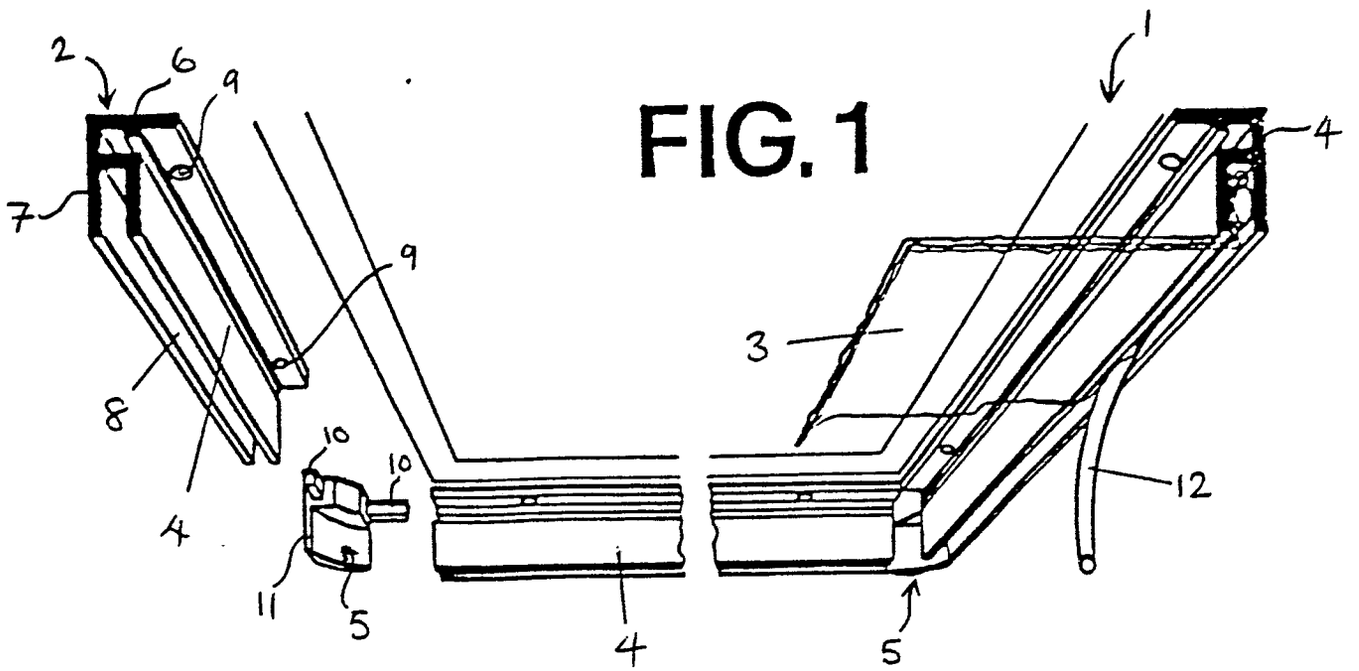

FIG.1

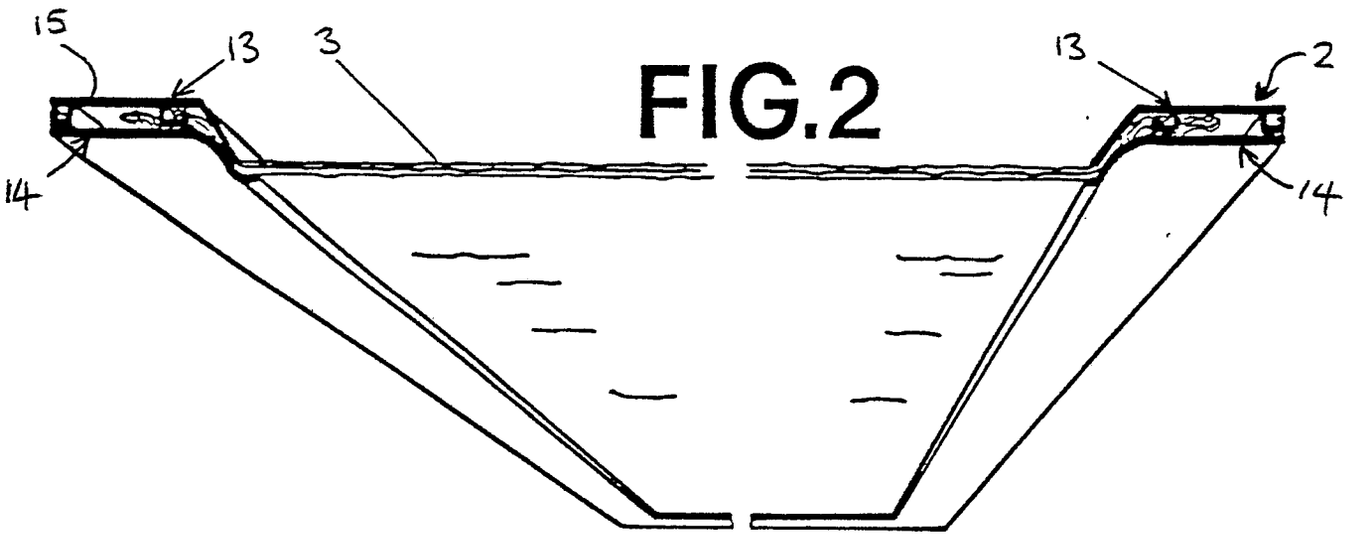

FIG.2

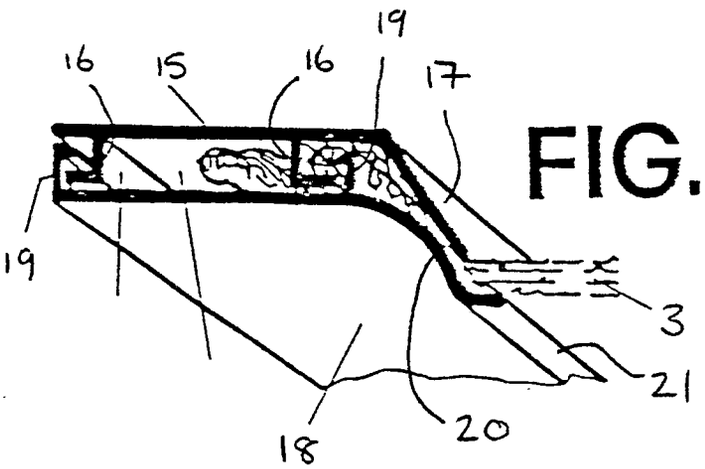

FIG.3

FIG. 4