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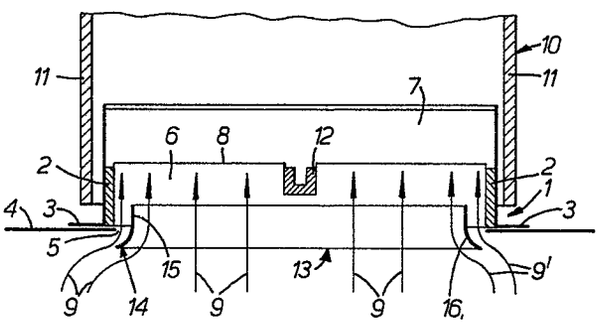
(54) Ventilating apparatus for buildings.

(57) A ventilating apparatus (10) for buildings is provided, having an air-outlet conduit (6) which is bounded laterally by a housing (1) and comprises an inlet opening (5) predetermined by a roof opening and an outlet opening (8) formed by the housing for spent air out of the interior of the building. Disposed inside the opening cross-section of the air-outlet conduit (6), in its marginal region, is an air guide device (13), the guide elements (14) of which each comprise an inner region (15) which extends substantially parallel to the longitudinal direction of the conduit (6) and which extends from the inlet opening (5) towards the outlet opening (8) and an outer region (16) diverging towards the edge of the air-outlet conduit (6) and extending, in an extension of the inner region (15) of the guide elements beyond the inlet opening (5) into the interior of the building. The ventilating apparatus has an improved aerodynamic efficiency, while the air guide device (13) does not cause any structural problems and occupies only a small amount of the interior of the building.



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"VENTILATING APPARATUS FOR BUILDINGS"

The invention relates to a ventilating apparatus for buildings having an air outlet conduit for exhausting spent air out of the interior of a building, the conduit extending between an inlet opening predetermined by a roof opening and an outlet opening formed by a housing, an air-guide device for the spent air being associated with the inlet opening with guide elements differing in their alignment at least locally from the longitudinal direction of the conduit.

The ventilating action of such natural ventilating apparatuses, which are also provided for operation as fire ventilators, is based on a pressure drop, caused thermally, between the air in the interior of the building and the outside air, which causes a flow of air, the cool outside air flowing into the building through openings situated low down in the building structure generally in the walls of the building, warming up, and flowing out of the building through the ventilating apparatus situated high up and generally disposed on the roof of the building.

The aerodynamic efficiency of the known ventilating apparatuses is reduced by losses during the flow through the ventilating apparatus as a result of friction and, in particular, turbulence. These losses occur particularly with inlet openings of the air-outlet conduit bounded by sharp edges, because the

air flow changes from laminar to turbulent flow at the edge of the inlet opening, so that a turbulence forms in the direction of flow behind the inlet opening of the air-outlet conduit, in its marginal region. The existing cross-sectional area of flow of the air-outlet conduit is reduced by this so that the aerodynamically effective cross-sectional area of flow is less than the actual geometric cross-sectional opening of the air-outlet conduit.

It is true that fundamentally it is possible, in order to achieve a predetermined throughput of air through the air-outlet conduit, to enlarge the aerodynamically effective cross-sectional area of flow as a result of the fact that the actual geometric opening cross-section of the air-outlet conduit is enlarged by the necessary amount. As a rule, however, structural obstacles stand in the way of this, which do not permit an indefinite enlargement of the opening cross-section of the air-outlet conduit or of the roof opening determining its inlet opening, particularly when the size of the roof opening is determined by a building pattern used.

An improvement in the efficiency of the ventilating apparatus can be achieved by an air guide device for the spent air flowing out of the interior of the building which device, with its guide elements differing at least locally from the longitudinal direction of the conduit,

is associated with the inlet opening of the air-outlet conduit. In a known ventilating apparatus of the kind indicated, the air guide device is formed by a mouthing which is disposed in front of the roof opening defining the inlet opening of the air-outlet conduit, with its arcuate guide elements projecting into the interior of the building in an extension of the lateral walls of the air-outlet conduit and there widen out in the form of a funnel. Even such mouthing placed in front of the inlet opening comes up against structural problems because of its not inconsiderable projection into the building in order to achieve the desired effect, particularly in warehouses and workshops in which workpieces and goods are conveyed by travelling cranes and other lifting devices close to the ceiling height because here projecting structures are likely to constitute unacceptable barriers.

It is the object of the invention to provide a ventilating apparatus of the kind indicated at the beginning with improved aerodynamic efficiency, the air guide device of which does not cause any structural problems and the structural height of which only occupies a small amount of the interior space of the building.

According to the invention, this problem is solved in that the air guide device is disposed inside the opening cross-section of the air outlet conduit in its marginal region and its guide elements each comprise an

inner region which extends substantially parallel to the longitudinal direction of the conduit from the inlet opening towards the outlet opening and an outer region which diverges towards the edge of the air-outlet conduit and which extends, in an extension of its inner region, beyond the inlet opening into the interior of the building.

As a result of the fact that with this development, the air guide device is disposed inside the opening cross-section of the air-outlet conduit, in its marginal region, and only the outer region of its guide elements projects into the interior of the building, the ventilating apparatus according to the invention only occupies a small amount of the interior of the building with its air guide device and in particular does not require any alteration or enlargement of the roof opening defining the inlet opening of the air-outlet conduit. At the same time, the outer region of the guide elements, diverging towards the edge of the air-outlet conduit and projecting into the interior of the building ensures a gentle introduction of the spent air into the air-outlet conduit in its marginal regions into which streams of spent air moving along the ceiling of the interior of the building are introduced without force and are conveyed further in the outflow direction by the inner regions of the guide elements extending parallel to the longitudinal direction

of the conduit, avoiding turbulence. In this manner, a considerable improvement in the aeordynamic efficiency of the ventilating apparatus is achieved by increased throughput of air, without appreciably lowering its installation height with respect to the interior of the building and without influencing the dimensions of the existing or predetermined roof opening defining the inlet opening of the air-outlet conduit.

Some ways of carrying out the invention will now be described in detail by way of example and not by way of limitation with reference to accompanying drawings which illustrate a number of specific embodiments.

In the accompanying drawings:-

FIGS. 1 to 4 each show, in cross-section, a different ventilating apparatus according to the present invention; and

FIG. 5 illustrates a modified part which may be substituted in Fig. 4.

The ventilating apparatus illustrated in Figs. 1, 2 and 3 comprises, in each embodiment, a housing, designated as a whole by 1, with two pairs of opposite vertical walls 2, at the lower end of which an encircling flange 3 is provided for securing the usually rectangular housing 1 to the roof of a building indicated at 4 in the form of a thin roofing, via a roof opening 5. In the installed state of the

ventilating apparatus illustrated in these Figures the inner faces of the walls 2 of the housing are disposed in alignment with the edge of the roof opening 5. Instead of this, it is possible to extend the inner faces of the housing walls 2 downwards by means of facing panels which line the roof opening 5 through a thicker roof structure at the edge.

The space bounded by the housing walls 2 and the edge of the roof opening 5 forms an air-outlet conduit 6, the inlet opening of which is formed by the roof opening 5. At opposite ends, the housing 1 is provided with screening walls 7. At the upper end of the air-outlet conduit 6, the housing 1 forms with its walls 2 an outlet opening 8 through which the spent air flowing in through the roof opening 5 in accordance with the arrows 9, guided through the air-outlet conduit 6 and rising from the interior of the building, flows away into the atmosphere.

In the region of the outlet opening 8, the housing 1 is provided with a closing device 10 which closes or opens the air-outlet conduit 6 and which, in the example illustrated, is formed by two ventilating flaps 11 which are articulated on two opposite housing walls 2 and which are pivotable between the vertical position illustrated in the drawing and freeing the air-outlet conduit 6, and a horizontal position closing the air-outlet conduit 6, in which they are held on a central

U-shaped girder 12 which in turn extends between a pair of the opposite housing walls 2, parallel to the pivotal axis of the ventilating flaps 11.

The air-outlet conduit 6 is provided, inside its opening cross-section, in its marginal region, with an air guide device 13 which is formed by guide elements 14. The guide elements 14 each have an inner region 15 which extends substantially parallel to the longitudinal direction of the air-outlet conduit 6 and which extends from the inlet or roof opening 5 to the outlet opening 8, and an outer region 16 which diverges towards the edge of the air-outlet conduit 6 and which extends in an extension of the inner region 15 beyond the plane of the roof opening 5 into the interior of the building while maintaining spacing from the lateral walls of the air-outlet conduit 6.

The guide elements 14, which themselves have only a slight thickness and may be formed from thin metal sheets or laminations, are secured to the housing walls 2 by means of thin struts (not illustrated) and form, with their inner regions 15, a frame which is disposed with spacing from the lateral walls of the air-outlet conduit 6, which spacing corresponds substantially to 1/2 to 1 times the length dimension of the guide elements 14 in the direction of flow of the spent air.

According to the examples illustrated, the inner region 15 and the outer region 16 of the guide elements

14 have substantially the same length in the direction of flow of the spent air. With their inner regions 15, the guide elements 14 in the embodiments shown in Figures 1 and 2 occupy about 1/3 to 1/2 of the height of the air-outlet conduit 6. The length of the outer region 16 of the guide elements 14 is selected to be at least substantially equal to the spacing of the inner regions 15 from the housing walls 2 which define the lateral walls of the air-outlet conduit 6.

In the embodiment shown in Figure 1, the outer region 16 is inclined at an angle from the inner region 15 of the guide elements 14 along a linear region 17. The guide elements 14 shaped in this manner can be produced in a particularly simple manner by a simple bending operation. In the embodiment shown in Figure 2, on the other hand, the outer region 16' of the guide elements 14 is made arcuate in the form of a channel open towards the edge of the air-outlet conduit 6, in the manner of a concave fillet, which can further improve the inflow movement of the spent air out of the interior of the building. The angle at which the outer region 16 diverges in relation to the inner region 15 of the guide elements 14 may appropriately lie in the range from about 30° to 60° and preferably amounts to about 45°.

The embodiment shown in Figure 3 corresponds substantially to the embodiment shown in Figure 1 but

as distinct from Figure 1, the roof 4 is formed from a roofing panel 4' which is relatively thick in comparison with the thin roofing of Figure 1. The roof panel 4' is included with the extent of its thickness or height in the air-outlet conduit 6 in such a manner that the edge of the roof opening continues the housing walls 2 downwards. With this form of embodiment in particular, as already mentioned at the beginning, the housing walls 2 may be extended downwards by facing panels which line the roof opening 5 at the edge. In the embodiment shown in Figure 3, the guide elements 14 extend with the top of their inner region 15 substantially up to half the height of the roof panel 4' into the air-outlet conduit 6 and only occupy about 1/5 of the height of the air-outlet conduit 6.

In all the embodiments so far described, a flow of the spent air, free of turbulence, out of the interior of the building into the air-outlet conduit is achieved in its critical marginal regions by an equalization of the air flow at each side of the guide elements 14, as illustrated by the arrows 9'.

In Figure 4 extension panels 100 form a rectangular sectioned air outlet conduit or ventilator throat 112 corresponding with the air-outlet conduit 6 in the embodiments of Figures 1, 2 and 3 and extending upwardly from a roof opening 50 to an outlet opening 51

of a natural roof ventilator having a housing 114 mounted to the outside of the roof sheeting 116 carried on purlins 117. The panels 100 extend two opposite pairs of vertical housing walls 115 downwardly through the roof structure. In the present example the housing 114 carries pivotably adjustable louvre blades 118 pivotably movable on axes 120 to open and close the ventilator. In their closed position, the louvre blades combine together to cover over the ventilator throat 112 to prevent the entry of rain. Rain water drains from the outside surfaces of the blades 118 into drain channels 122 in the housing which lead water outside the housing onto the outside of the sheeting 116.

The louvre blades may be replaced by a cowl (not shown) which permanently shelters the ventilator throat against the entry of rain and drains the rain water directly onto the outside of the roof sheeting, outside the housing 114.

Brackets 124 mount an air guide device 126 comprised of guide elements 53 in the throat 112, the device 126 projecting into the space 130 inside the roof structure being ventilated by the ventilator. The device 126 has a bell mouthed entry or outer portion or region 126' followed by a parallel sided, downstream, inner portion or region 126" spaced from the throat walls formed by the extension panels 100 by 40 to 50 mm.

The annular passage 134 formed between the air guide device 126 and the throat has a constant through flow cross-section. However, this through flow cross-sectional area may decrease from the passage entry to the plane of the ceiling 140, and thereafter remain constant, using an air guide device 126a having a frusto-conical entry portion 126a' as shown in Figure 5, mounted in the ventilator throat at the position indicated for the device 126. The device 126a has a downstream portion 126a" corresponding with the portion 126" and joining therewith along a linear region 54' which lies in the inlet opening 50.

When air rises through the ventilator from the space being ventilated the device 126 or 126a smooths the entry of air into the ventilator and air is additionally drawn into the ventilator through the passage 134 from the region immediately below the ceiling level.

The efficiency of extraction of air through the ventilator is accordingly improved whilst a minimum of space is occupied by the ventilator below the ceiling level.

In the case of a circular ventilator having a cylindrical throat 112, a circular sectioned air guide device 126 is used.

Where only natural ventilators have been specifically described, the invention extends to powered extract ventilators employing a fan.

CLAIMS:

1. A ventilating apparatus for buildings having an air-outlet conduit (6 or 112) for exhausting spent air out of the interior of a building, the conduit extending between an inlet opening (5 or 50) predetermined by a roof opening and an outlet opening (8 or 51) formed by a housing (1 or 114), an air-guide device (13 or 126 or 126a) for the spent air being associated with the inlet opening with guide elements (14 or 53 or 53') differing in their alignment at least locally from the longitudinal direction of the conduit (6 or 112) characterised in that the air guide device (13 or 126 or 126a) is disposed inside the opening cross-section of the air-outlet conduit (6 or 112), in its marginal region, and its guide elements (14 or 53 or 53') each comprise an inner region (15 or 126" or 126a") which extends substantially parallel to the longitudinal direction of the conduit (6 or 112) and which extends from the inlet opening (5 or 50) to the outlet opening (8 or 51), and an outer region (16 or 126' or 126a') which diverges towards the edge of the air-outlet conduit (6 or 112) and which extends, in an extension of its inner region, beyond the inlet opening (5 or 50) into the interior (130) of the building.

2. An apparatus as claimed in claim 1, in which the guide elements (14 or 53 or 53') of the air guide device (13 or 126 or 126a) form, with their inner regions

(15 or 126" or 126a") a frame which is disposed in relation to the lateral walls (2 or 100) of the air-outlet conduit (6 or 112) at a distance which corresponds to about 1/2 to 1 times the length dimension of the guide elements (14 or 53 or 53') in the direction of flow of the spent air.

3. An apparatus as claimed in claim 1 or 2, in which the outer region (16 or 126' or 126a') and the inner region (15 or 126" or 126a") of the guide elements (14 or 53 or 53') have substantially equal lengths in the direction of flow of the spent air.

4. An apparatus as claimed in any one of claims 1 to 3, in which the guide elements (14) occupy about 1/5th to 1/2 of the height of the air-outlet conduit (6) with their inner regions (15).

5. An apparatus as claimed in any one of claims 1 to 3, in which the length of the outer region (16 or 126' or 126a') of the guide elements (14 or 53 or 53') is at least substantially equal to the spacing of the inner regions (15 or 126" or 126a") from the lateral walls (2 or 100) of the air-outlet conduit (6 or 112).

6. An apparatus as claimed in any one of claims 1 to 5, in which the outer region (16 or 126a') is inclined at an angle from the inner region (15 or 126a") of the guide elements (14 or 53') along a linear region (17 or 54').

7. An apparatus as claimed in any one of claims

1 to 5, in which the outer region (16' or 126') of the guide elements (14 or 53) is made arcuate in the form of a channel open towards the edge of the air-outlet conduit (6 or 112).

8. An apparatus as claimed in any one of claims 1 to 7, in which the angle of divergence of the outer region (16 or 126a') of the guide elements (14 or 53') in relation to their inner region (15 or 126a") amounts to about 45°.

9. An apparatus as claimed in any preceding claim, in which the guide elements (14 or 53 or 53') of the air guide device (13 or 126 or 126a) form with their inner regions (15 or 126" or 126a") a frame which is disposed in relation to the lateral walls (2 or 100) of the air-outlet conduit (6 or 112) at a distance of 40 to 50 mm.

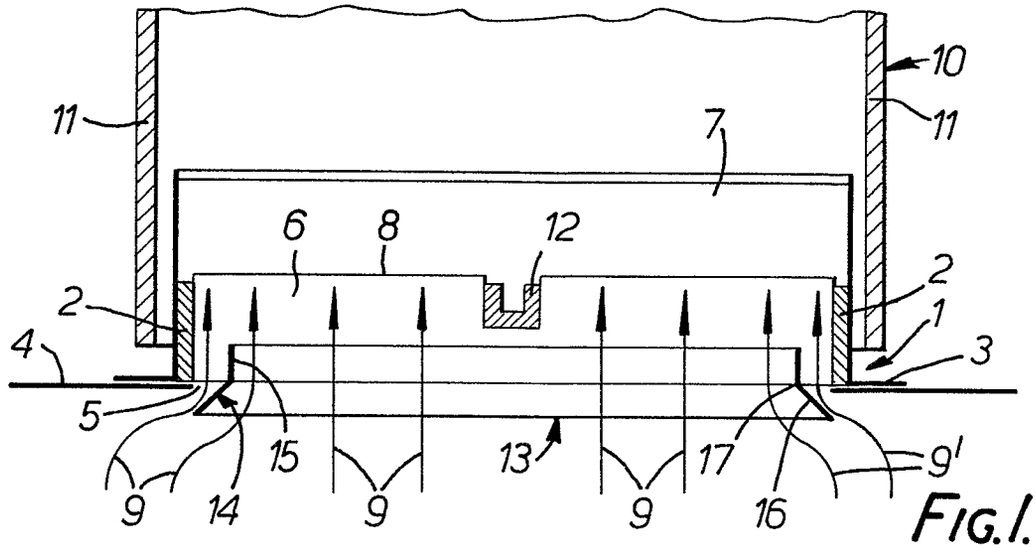

FIG. 1.

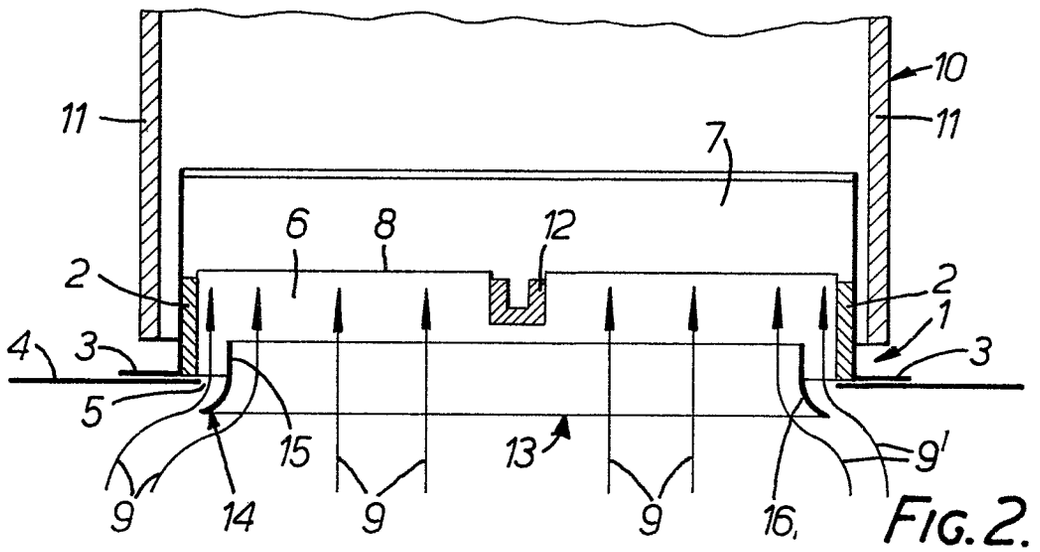

FIG. 2.

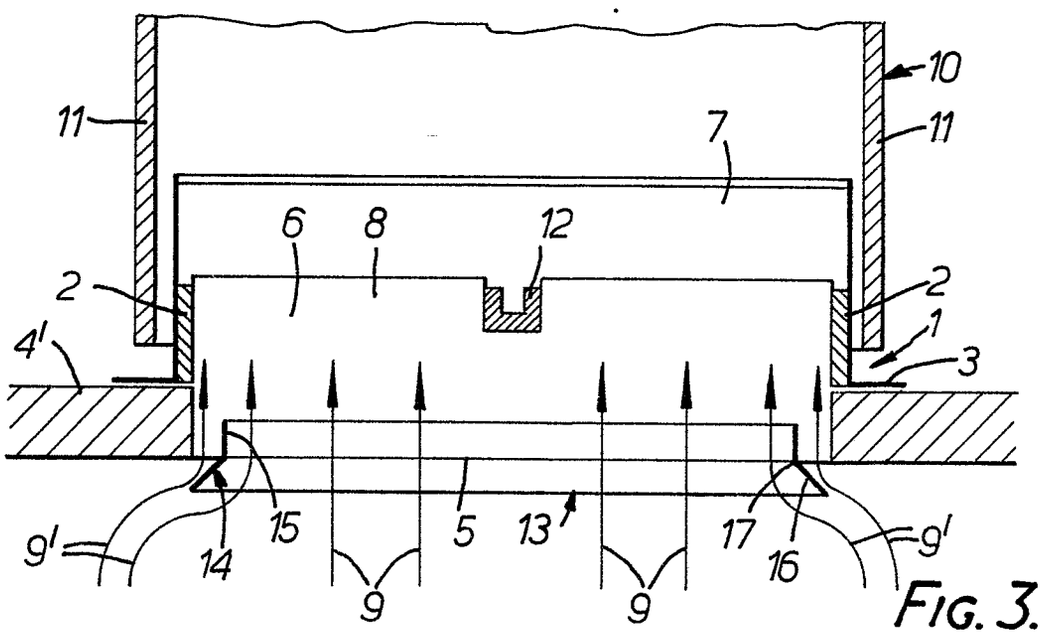

FIG. 3.

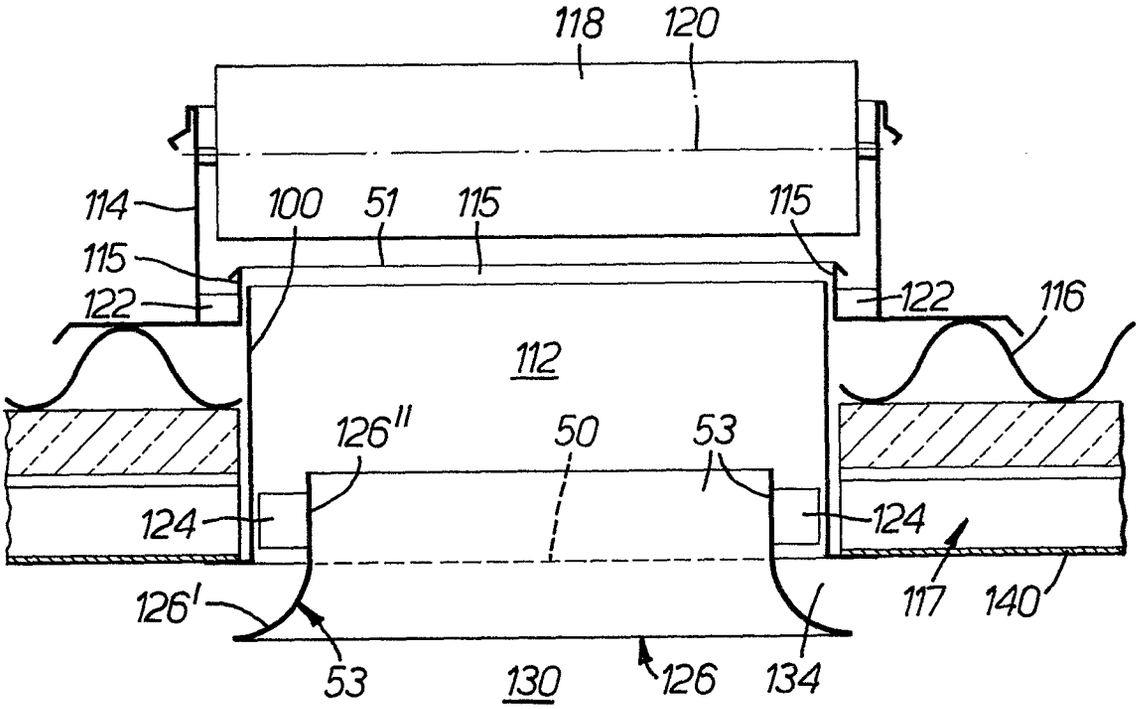
118
120
114
100
51
115
115
115
122
122
116
112
126II
50
53
124
124
126I
117
140
53
130
126
134

FIG. 4.

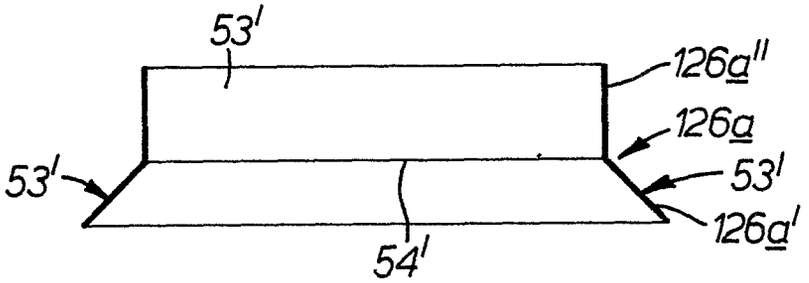
53I
126aII
126a
53I
53I
126aI
54I

FIG. 5.

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EUROPEAN SEARCH REPORT

Application number

EP 82 30 4928

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)
Y	DE-A-2 652 838 (COLT INTERNATIONAL GmbH) *Page 7, first line - last line; page 8, missing in the document; page 9, first line - line 14; figure 1*	1	F 24 F 13/06 F 24 F 7/02
A		3,4	
Y	DE-A-2 653 161 (SCHAKO METALLWARENFABRIK FERDINAND SCHAD KG) *Figure 1*	1	
A		2,3,6, 8	
A	GB-A-1 594 964 (POLYMATE INDUSTRIES) *Page 2, lines 16-41; figure 4*	1,2,3, 6,8	TECHNICAL FIELDS SEARCHED (Int. Cl. ³) F 24 F
A	US-A-2 727 456 (DAVIES) *Column 2, line 60 - column 3, line 12; figure 1*	1,2,3, 6,8	
A	US-A-3 046 866 (STRAUB) *Column 3, line 45 - column 4, line 5; figure 3*	1,2,3, 6,8	

-/-

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	22-12-1982	SARRE K.J.K.TH.

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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A : technological background
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D : document cited in the application
L : document cited for other reasons

& : member of the same patent family, corresponding document

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EUROPEAN SEARCH REPORT

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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-2 735 352 (DEMUTH) *Column 1, line 67 - column 2, line 58; figure 2*	1,2,6, 8	
Y	US-A-3 177 795 (SCHUTT) *Column 2, lines 17-44; figure 3*	1	
A		2,3,6, 8	
			TECHNICAL FIELDS SEARCHED (Int. Cl. ³)

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