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AIR DISTRIBUTION PROCEDURE AND APPARATUS USED IN THE PROCEDURE.

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Description

The present invention concerns an air distribution procedure and an apparatus used in the procedure.

In the Swedish publicizing print No. 348 548 is disclosed an air distribution procedure in which the air is arranged to discharge from an incoming air means, to pass, conforming to wall surfaces, upwards and furthermore, conforming to the ceiling surface, towards the other end of the room space. In the procedure disclosed in said SE publicizing print endeavours have been made to circulate the air of the room space from the incoming air means induced by the air flow. However, in said publication no problem solution has been introduced concerning the fact of how to control the circulation of the room air when the flow speed and/or flow quantity rates of the incoming air flow vary. No means design is therefore presented in said publication with which a global circulation of a room space air concerning various incoming air flows could be implemented in a satisfactory manner. In the Finnish patent application No. 841284 is disclosed an incoming air means which closes by means of gravity. Similarly, in the EP-A-0174002 is disclosed an incoming air means which closes by gravity and opens according to the flow. In neither of the above-mentioned patents is presented any global design for the ventilation system to be adjusted by means of the incoming air flow of the room space, wherein the air into said room space is carried vertically upwards from below.

In air quantity controlled installations the temperature of the incoming air is maintained approximately constant and the air quantity is increased or decreased in accordance with changes in loading. In the blowing from below, with subheated incoming air, problems arise because of the thermal forces. With a high air quantity, the incoming air means usually operates well but when the air quantity is decreased the injection is not able to arise upwards because of the small starting speed, and it falls down and causes draught. On the other hand, the injection range remains in general short, whereby air circulation and comfort are poor. The injection range and the starting speed are clearly interrelated. For the injection range to remain approximately constant, the starting speed is required to stay within a given range. However, with a small air quantity, the starting speed should grow in order to overcome the thermal counterforces.

The object of the invention is a procedure and an apparatus in which the above-mentioned drawbacks have been overcome.

The present invention provides an air distribution procedure in which an airflow is carried into the air space of a room from an air inlet comprising louvre means and a guide member controlled and closable by gravity, the air flow being directed upwards and

conforming to a wall surface, characterized in that the air flow is so directed to conform to the wall surface that with small quantities of air the throw length of the air flow is substantially at least as long as with great quantities of air.

The invention also provides an air inlet for delivering an airflow into the air space of a room so that the air flows upwards and conforming to a wall surface, the air inlet comprising louvre means and a guide member closable by gravity which controls the size of an air flow passage for controlling the velocity of the air flow, characterized in that the air inlet so directs the air flow to conform to the wall surface that with small quantities of air the throw length of the air flow is substantially at least as long as with great quantities of air.

In a preferred embodiment of the invention, the incoming air is brought into the room space through an incoming air means by focussing the air injection onto the guide plate which is for closing the flow duct and which is controlled by gravity. The force on the guide plate due to the air jet is counteracted by the torque in the opposite direction caused by the weight of the guide plate which is supported at a bearing point. At higher volumetric flow rates, a given speed can be measured on the surface of the louvre, being approximately constant over the entire surface. When the air current is reduced, the flow cross-sectional area tends to be reduced, with a smaller air quantity, a smaller force is focussed on the guide plate. When the guide plate is tilted, the force on the guide plate increases, and at a given tilt angle, a balance is achieved. The guide plate directs a small volumetric flow at high speed into a distributing chamber from where it passes through a louvre into the room space. When the volumetric flow rate is small, a high flow speed is achieved and a sufficient flow length for the flow results. The high speed is focussed to conform to the wall surface. Accordingly, the Coanda effect is utilised in the invention and the airflow from the incoming air means adjacent the wall surface is directed upwards.

A high-speed air flow may be focussed advantageously via a wall surface and/or batteries and/or window surfaces. In addition, in said vertical flow the Coanda effect of the vertical surface is made use of. With said flow, the surface temperature of the window and/or wall can be changed by means of incoming air. Consequently, the cool draught can be obstructed from the structures and efficiently reduce the heat loading caused by the sun. When the air flow is focussed on the thermobatteries, the heat emittance from said batteries is moreover aided. In the ventilation procedure of the invention, air may be carried from outside the staying zone and the air nucleus injection is circulated past the staying zone. Therefore, no draught is caused from the air injection to the staying zone of the room space. In the procedure of

the invention, a longer than normal throw length may be available for the air injection without causing any harm to a person staying in said room. As taught by the invention, a united control system of ventilation and heating may also be implemented.

The invention will be further described by way of example only and with reference to the accompanying drawings, in which:

In Fig. 1A, the ventilation procedure of the invention is presented schematically and in a first extreme position of the actuating means.

In Fig. 1B, the procedure of the invention is presented when the adjustment means is moved to a second extreme position.

In Figs 2A and 2B is presented schematically the operation of the incoming air means. Fig. 2A corresponds to the position of the incoming air means of Fig. 1A, respectively, Fig. 2B corresponds to the position of the actuating means of Fig. 1B.

In Fig. 3A is presented a section I-I of Fig. 2A, respectively, in Fig. 3B is presented a section II-II of Fig. 2B.

In Fig. 4A is presented the embodiment of the invention in which the deviation of a high-speed air current is not implemented with the aid of a louvre, but the air current is directed directly out through the louvre in the direction of the wall surfaces of the distribution chamber.

In Fig. 4B is presented the embodiment of the incoming air means used in the procedure of the invention in which the flow from the distribution chamber is deviated with the aid of the guide surfaces of the slats of the louvre.

In Fig. 5A is presented the embodiment of the incoming air means of the invention in which the member regulating the air flow comprises a separately disposed and disposable component guiding the flow.

In Fig. 5B is presented an embodiment of the incoming air means of the invention in which on the guide plate is disposed an air flow guide part disposable according to the temperature.

In Fig. 6 is presented the disposition of the incoming air means in the window sill underneath the window.

In Fig. 1A is presented a cross-section of a room space H. The wall surface is indicated by letter S and the floor by L. The incoming air flow is carried from an incoming air means 10, the louvre section thereof being disposed in the adjacency of the floor, advantageously on the floor level. The incoming air flow is carried upwards from below and conforming to the wall surface S. The flow is entered advantageously so that it sweeps the inner surfaces of the window I. The flow ascends conforming to the wall S to the adjacency of the ceiling K of the room space and there travels conforming to the ceiling. The flow rate is required to be sufficient in order to provide circulation for the staying zone of the room space H. In the figure is pre-

sented the circulation of the air of the room space H, this being induced by the incoming air from the incoming air means. Air is removed e.g. from an outlet duct C in the adjacency of the ceiling K of the room space H. The entry of the air from the incoming air means 10 is in the flow range indicated by L_1 .

As marked in Fig. 1A, the quantity of flowing entering the incoming air means 10 through the duct T can be regulated in the room G with an adjustment means 20. Through an adjustment unit 21, a control message is carried to an adjustment means 22 located in a duct E, said means regulating the volumetric flow of the air flow.

In Fig. 1B is indicated an adjustment position of the incoming air means 10 in which through the incoming air means a higher quantity of air is carried into the room space H than in the instance of Fig. 1A. The adjustment is performed in the room H with the adjustment means 20.

By using the incoming air means of the invention as well as its positioning in the adjacency of the wall surface S, and by bringing the incoming air flow from below upwards into the room space H, conforming to the wall surface S, a sufficient circulation of both a small quantity of air, that is, as in Fig. 1A, and a great quantity of air, that is, as in Fig. 1B, is obtained for the air of the staying zone of the room space H.

It is essential in the apparatus arrangement and the procedure of the invention that the air is moved into the room space H upwards from below and so that the incoming air is disposed to enter the room space H advantageously from an incoming means in the adjacency of the floor. An essential feature of the invention is moreover that the incoming air means has been disposed to be located in the adjacency of one wall surface of the room H. One or several incoming air means may be placed in the adjacency of said wall surface.

In Figs 2A and 2B, the adjustments corresponding to Figs 1A and 1B are presented. As shown in Fig. 2A, a high-speed air flow L_2 is directed, conforming to a wall surface and/or window surface, straight upwards in the room space. In the lower part of Fig. 2A is presented a respective position of the incoming air means. The air mass is small but the flow rate is nevertheless great. The air flow L_2 is made to extend over a sufficient distance using the incoming air means 10 of the invention, the air flow guide plate 14 whereof compressing the air flow and reducing the flow cross-sectional surface in the flow duct 13. The guide plate 14 is not intended to shut the entire duct 13 but only a section thereof, whereby the flow is regulated in order to obtain speed.

In Fig. 2B is presented a completely open position of the air flow guide plate 14 of the incoming air means. Hereby, the quantity of the air flow is great, and the throw length of the air flow is, nevertheless, equivalent to the instance of small air mass of Fig. 2A.

In Fig. 3A is presented the operational position of Fig. 2A and in Fig. 3B is presented the operational position of the incoming air means of Fig. 2B. The discharge of the air flow from the incoming air means 10 is indicated by arrows L_2 and L_3 . In the instance of Fig. 3A, the air flow is directed to pass, conforming to the wall surface and/or the window surface and/or the battery surface, into the room space H. The nuclear injection of the flow does not hit the staying zone of the room space H. In the instance of Fig. 3B, the air mass is great and the throw length equivalent to the instance shown in Fig. 3A.

In Fig. 4A is presented an embodiment of the ventilation procedure and the incoming air means 10 of the invention in which a high-speed air flow is guided, conforming to the wall 13' of an air duct 13, directly to the adjacency of the wall surface S. The central axis X of the duct 13 is, when the means 10 is disposed to be in use, in the direction of the plane of the wall surface S. The incoming air means 10 comprises a body envelope 11 of the incoming air means 10. On an end of the body envelope 11 is disposed a louvre 12, comprising a plurality of adjacent slats 12a regulating the flow. The body envelope 11 encloses and delimits therein a flow duct 13. In the flow duct 13 is disposed a guide plate 14 guiding the air flow, and regulating the air flow, its flow rate and/or quantity of flowing. The guide plate 14 is pivotally carried to turn at one end 14a. The guide plate 14 is disposed in the flow duct 13 and it is disposed, when the air flow is not exerting an effect on the guide plate, to be in a position in which it totally shuts the flow duct 13. When the air flow starts to exert an effect on the guide plate 14, it deviates from the closed position up to the totally-open-position. Depending on the air flow, a balance position of the guide plate may also be formed between said extreme positions. The end to the louvre 12 of the guide plate 14 comprises a section 15 deviating the flow which on the surface plane is a plate-like section obliquely relative to the plane of the guide plate 14.

In Figs. 4A and 4B is presented a counterweight 16 which can be disposed on the plate 14. Changing the location of the counterweight, the torque caused by the counterweight is changed relative to the pivoting point 17, and to the force required of the air flow to move the guide plate 14. In the figure is indicated by reference numeral 16' an adjustment means of the counterweight 16, advantageously an adjustment screw. The counterweight may be attached to different positions in different recesses located in the guide plate 14, or it can be moved to a different position when the screw 16' moves in the groove of the guide plate 14. The guide plate 14 has been pivoted to turn carried by a collar component 18. The guide plate 14 compresses the flow and at the same time, the flow rate increases. Through a flow aperture defined between the guide section 15 in the end of the guide

plate 14 and the wall 13' of the flow duct 13, air flow enters the distribution chamber 19. From the distribution chamber 19 the flow passes, guided by the slats 12a of the louvre 12, out of the incoming air means.

In the instance presented in Fig. 4A, the guide plate 14 compresses the flow significantly and the flow rate increases. Said high-speed flow is guided from the incoming chamber 19 directly past the slats 12a conforming to the wall surface S.

In the instance of Fig. 4B a high-speed flow of small quantity of air also on the wall surface. In the embodiment of Fig. 4B, the turning point of the guide plate 14 is located on the opposite wall compared with the instance of Fig. 4A. The flow is directed from the distribution chamber 19 through the surfaces 12a', said surfaces deviating the flow, of the slats 12a of the louvre 12 onto the wall surface S. Conforming to the wall surface, the air flow passes upwards in the room space and sweeps the window surfaces and/or battery surfaces, and in the latter instance, increases the transfer of heat into the air of the room space H. As taught by the invention, a high-speed air flow induces the air of the room space H to circulate as shown in Figs 1A and 1B.

In Fig. 5A is presented an embodiment of the invention in which the guide plate 14 comprises a guide section 15 guiding the flow in oblique position relative to the plane of the guide plate. The guiding section 15 guiding the flow has been attached to be separate on the guide plate 14. The section 15 may moreover be positioned in various locations of the plate in order to achieve the desired adjustment incident.

The base part 15b of the plate 15 comprises an adjustment screw 15c with the aid of which the component 15 guiding the flow can be disposed advantageously relative to the guide plate 14 in the groove of the guide plate 14 or in separate recesses provided for the adjustment screw.

In Fig. 5B is presented an embodiment of the invention in which the guide plate 14 comprises a guiding component 15 located in the opposite end relative to the turning point 14a of the guide plate 14, said component being a bent part of the plate 14 or a separate part attached to the plate 14. In said embodiment of the invention, the guiding component 15 has been disposed on the end of the air flow guide plate 14 and said part is a bi-metallic part which according to the temperature bends into a position determined by the temperature. It is thus possible with said bi-metal component to adjust the air flow also in dependence on the temperature.

In Fig. 6 is presented the embodiment of the invention in which the incoming air means 10 has been disposed in the window sill under the window I. The incoming air flow has thus been disposed to sweep directly the window surfaces. With the arrangement of the invention the harmful draught caused by the leakage of the windows can be eliminated. The inducing

flow emitted from the incoming air means also carries the leakage flow emitted through the window therealong and in such manner, the flow entering from the incoming air means serves as a kind of curtain injection.

With the procedure and the means design of the invention, a plurality of advantages are gained. The efficiency of the ventilation remains good because the throw length is approximately constant at various volumetric flows. Efficient mixing of the air already in the lower part improves the quality of the air in the staying zone. In the system of the invention the space available for the throw length is significantly larger than in conventional in-blow designs. In the floor disposition it is possible with the guiding of the air injection to improve e.g. the emittance of battery heat. In the system of the invention, the air distribution means is inconspicuous in outlook and goes well with furniture and constructions. In the system of the invention, the interior flows and temperature are easy to control. In the system of the invention the effect of the temperature of the incoming air on the throw length may also be easily be compensated e.g. using the bi-metallic guide shown in Fig. 5B. Therefore, the starting speed and consequently, also the throw length are easy to adjust and, for instance, be limited to a given maximum value.

Claims

1. An air distribution procedure in which an air flow is carried into the air space of a room from an air inlet (10) comprising louvre means (12) and a guide member (14) controlled and closable by gravity, the air flow being directed upwards and conforming to a wall surface (S), characterized in that the air flow is so directed to conform to the wall surface (S) that with small quantities of air the throw length of the air flow is substantially at least as long as with great quantities of air.
2. A procedure according to Claim 1, wherein the air flow is directed conforming to the wall surface with a velocity which is greater for small quantities of air than for great quantities of air.
3. A procedure according to Claim 1 or 2, wherein the air flow is subsequently directed along a ceiling (K) of the room space (H), the ceiling (K) being adjacent said wall surface (S), the air flowing towards an outlet duct (C), whereby a circulation of air within the room space (H) is generated by the airflow.
4. A procedure according to any one of the preceding Claims, wherein the air flow is guided conforming to batteries and/or window surfaces to-

wards the ceiling (K) of the room space (H).

5. An air inlet (10) for delivering an air flow into the air space of a room so that the air flows upwards and conforming to a wall surface (S), the air inlet comprising louvre means (12) and a guide member (14) closable by gravity which controls the size of an air flow passage for controlling the velocity of the air flow, characterized in that the air inlet (10) so directs the air flow to conform to the wall surface (S) that with small quantities of air the throw length of the air flow is substantially at least as long as with great quantities of air.
6. The air inlet of Claim 5, wherein the guide member (14) is rotatably mounted in a flow duct (13) and closes part of the flow duct (13) in a first position and substantially conforms with a wall (11') of the flow duct (13) in a second position.
7. The air inlet of Claims 5 or 6, wherein the louvre means (12) are downstream of the guide member (14).
8. The air inlet of any of Claims 5 to 7, wherein the guide member (14) comprises a substantially planar plate.
9. The air inlet of any of Claims 5 to 8, wherein the guide member (14) is rotatably supported on one edge.
10. The air inlet of Claim 9, wherein the guide member (14) further comprises a guiding component (15) positioned at an inclined angle relative to the planar surface of the guide member (14).
11. The air inlet according to Claim 10, wherein the guiding component (15) comprises a bi-metallic part, the position of which relative to the guide member (14) varies according to the temperature.
12. The air inlet of any of Claims 5 to 11, wherein the guide plate (14) further comprises an additional mass (16), whose position on the guide plate (14) is alterable.
13. The air inlet of Claim 8, wherein the guide member (14) comprises an additional mass (16).

Patentansprüche

1. Luftverteilungsverfahren, bei dem ein Luftstrom in den Luftraum eines Raumes aus einer Luftzuführung (10) mit einer Luftklappeneinrichtung (12) und einem durch Schwerkraft gesteuertem

- und verschließbarem Führungsglied (14) gebracht wird, wobei der Luftstrom nach oben gerichtet und sich an eine Wandoberfläche (S) anpassend gelenkt wird, dadurch gekennzeichnet, daß der Luftstrom so zur Wandoberfläche (S) gelenkt wird, daß bei kleinen Luftmengen die Ausbringungsstrecke des Luftstroms weitgehend wenigstens genauso lang ist, wie bei groben Luftmengen.
2. Verfahren nach Anspruch 1, dadurch gekennzeichnet, daß der Luftstrom zur Anpassung an die Wandoberfläche mit einer Geschwindigkeit gelenkt wird, die bei kleinen Luftmengen größer ist, als bei großen Luftmengen.
3. Verfahren nach Anspruch 1 oder 2, dadurch gekennzeichnet, daß der Luftstrom nachfolgend entlang einer Zimmerdecke (K) eines Zimmers (H) gelenkt wird, wobei die Zimmerdecke (K) nahe der Wandoberfläche (S) angeordnet ist, und daß die Luft zu einer Auslaßröhrenleitung (C) strömt, wodurch durch den Luftstrom innerhalb des Zimmers (H) eine Luftzirkulation erzeugt wird.
4. Verfahren nach einem der vorstehenden Ansprüche, dadurch gekennzeichnet, daß der Luftstrom zur Anpassung an Speicherbatterien und/oder Fensterflächen zur Zimmerdecke (K) des Zimmers (H) hin geführt wird.
5. Luftzuführung (10) zur Abgabe eines Luftstromes in den Luftraum eines Raumes derart, daß die Luft nach oben gerichtet und sich einer Wandoberfläche (S) anpassend strömt, wobei die Luftzuführung Luftklappeneinrichtungen (12) und ein von der Schwerkraft verschließbares Führungsglied (14) aufweist, das die Größe eines Luftströmungsdurchlasses zur Steuerung der Geschwindigkeit des Luftstromes steuert, dadurch gekennzeichnet, daß die Luftzuführung (10) den Luftstrom so zur Anpassung an die Wandoberfläche (S) lenkt, daß bei kleinen Luftmengen die Ausbringungsstrecke des Luftstroms weitgehend wenigstens genauso lang ist, wie bei großen Luftmengen.
6. Luftzuführung nach Anspruch 5, dadurch gekennzeichnet, daß das Führungsglied (14) drehbar in einer Strömungsrohrleitung (13) angeordnet ist und einen Teil der Strömungsrohrleitung (13) in einer ersten Stellung verschließt und in einer zweiten Stellung weitgehend mit einer Wand (11') der Strömungsrohrleitung (13) übereinstimmt.
7. Luftzuführung nach Anspruch 5 oder 6, dadurch gekennzeichnet, daß die Luftklappeneinrichtungen (12) stromabwärts des Führungsglieds (14) angeordnet sind.
8. Luftzuführung nach einem der Ansprüche 5 bis 7, dadurch gekennzeichnet, daß das Führungsglied (14) eine weitgehend ebene Platte aufweist.
9. Luftzuführung nach einem der Ansprüche 5 bis 8, dadurch gekennzeichnet, daß das Führungsglied (14) an einem Rand drehbar angeordnet ist.
10. Luftzuführung nach Anspruch 9, dadurch gekennzeichnet, daß das Führungsglied (14) weiterhin ein in einem geneigten Winkel relativ zur ebenen Fläche des Führungsglieds (14) angeordnetes Führungsbauteil (15) aufweist.
11. Luftzuführung nach Anspruch 10, dadurch gekennzeichnet, daß das Führungsbauteil (15) ein bimetallisches Teil aufweist, dessen Stellung relativ zum Führungsglied (14) sich entsprechend der Temperatur ändert.
12. Luftzuführung nach einem der Ansprüche 5 bis 11, dadurch gekennzeichnet, daß die Führungsplatte (14) eine Zusatzmasse (16) aufweist, deren Stellung an der Führungsplatte (14) veränderbar ist.
13. Luftzuführung nach Anspruch 8, dadurch gekennzeichnet, daß die Führungsplatte (14) eine Zusatzmasse (16) aufweist.

Revendications

1. Procédé de diffusion d'air dans lequel un flux d'air est déversé dans le volume d'air d'une pièce à partir d'une prise (10) d'air comprenant des moyens formant claire-voie (12) et un élément de guidage (14) commandé et pouvant se fermer par gravité, le flux d'air étant dirigé vers le haut et suivant une surface de mur (S), caractérisé en ce que le flux d'air est dirigé pour suivre la surface du mur (S) de telle façon qu'avec de petites quantités d'air la distance d'injection du flux d'air soit sensiblement au moins aussi grande qu'avec de grandes quantités d'air.
2. Procédé selon la Revendication 1, dans lequel le flux d'air est dirigé pour suivre la surface du mur avec une vitesse plus grande pour de petites quantités d'air que pour de grandes quantités d'air.
3. Procédé selon la Revendication 1 ou 2, dans lequel le flux d'air est ensuite dirigé le long d'un pla-

- fond (K) de la pièce (H), le plafond (K) étant adjacent à ladite surface du mur (S), l'air circulant vers un conduit (C) de sortie, grâce à quoi une circulation d'air dans la pièce (H) est créée par le flux d'air. 5
4. Procédé selon l'une quelconque des revendications précédentes, dans lequel le flux d'air est guidé vers le plafond (K) de la pièce (H) en suivant les surfaces de batteries et/ou d'une fenêtre. 10
5. Prise (10) d'air pour délivrer un flux d'air dans le volume d'air d'une pièce de façon que l'air s'élève et suive la surface d'un mur (S), la prise d'air comprenant des moyens formant claire-voie(12) et un élément de guidage (14) pouvant se fermer par gravité, qui commande les dimensions d'un passage d'écoulement d'air pour commander la vitesse du flux d'air, caractérisée en ce que la prise (10) d'air dirige le flux d'air pour qu'il suive la surface d'un mur (S) de telle façon qu'avec de petites quantités d'air la distance d'injection du flux d'air soit sensiblement au moins aussi grande qu'avec de grandes quantités d'air. 15
20
25
6. Prise d'air selon la Revendication 5, dans laquelle l'élément de guidage (14) est monté rotatif dans un conduit d'écoulement (13) et ferme partiellement le conduit d'écoulement (13) dans une première position, et suit sensiblement une paroi (11') du conduit d'écoulement (13) dans une seconde position. 30
7. Prise d'air selon la Revendication 5 ou 6, dans laquelle les moyens formant claire-voie(12) sont en aval de l'élément de guidage (14). 35
8. Prise d'air selon l'une quelconque des revendications 5 à 7, dans laquelle l'élément de guidage (14) comporte une plaque sensiblement plane. 40
9. Prise d'air selon l'une quelconque des revendications 5 à 8, dans laquelle l'élément de guidage (14) est supporté d'une manière rotative sur un bord. 45
10. Prise d'air selon la Revendication 9, dans laquelle l'élément de guidage (14) comporte en outre un composant de guidage (15) disposé d'une manière oblique par rapport à la surface plane de l'élément de guidage (14). 50
11. Prise d'air selon la Revendication 10, dans laquelle le composant de guidage (15) comporte une partie bimétallique dont la position par rapport à l'élément de guidage (14) varie en fonction de la température. 55
12. Prise d'air selon l'une quelconque des revendications 5 à 11, dans laquelle la plaque de guidage (14) comporte en outre une masse supplémentaire (16) dont la position sur la plaque de guidage (14) est modifiable.
13. Prise d'air selon la Revendication 8, dans laquelle l'élément de guidage (14) comporte une masse supplémentaire (16).

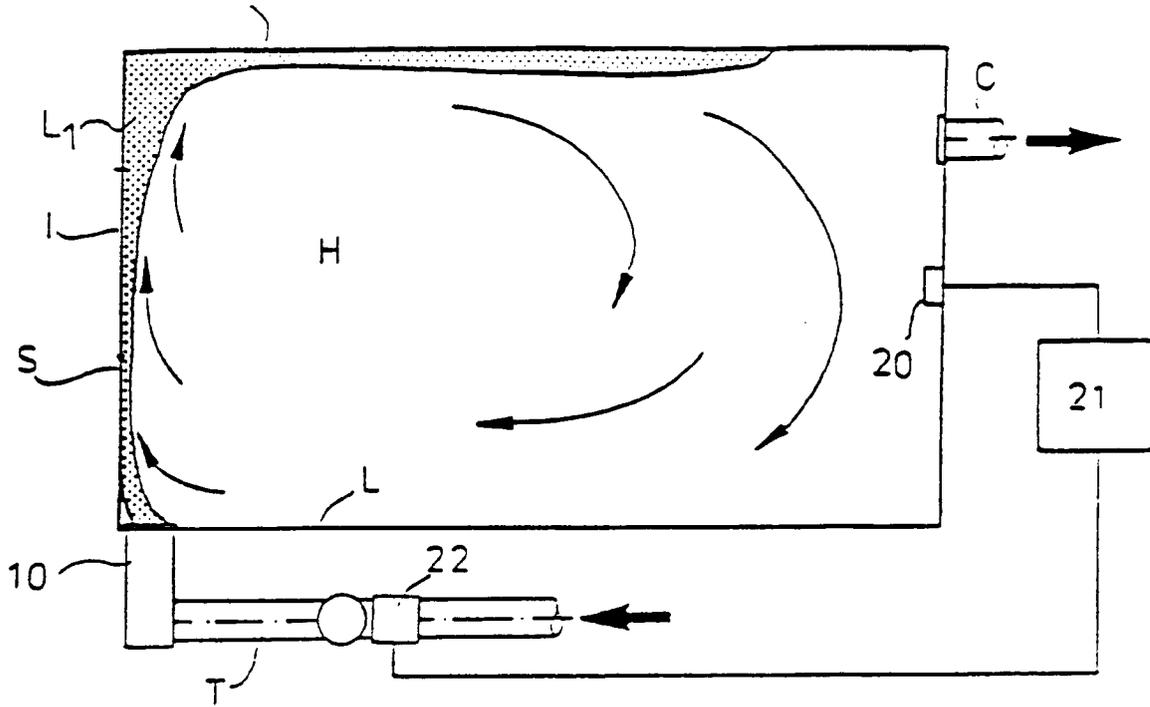


FIG 1A

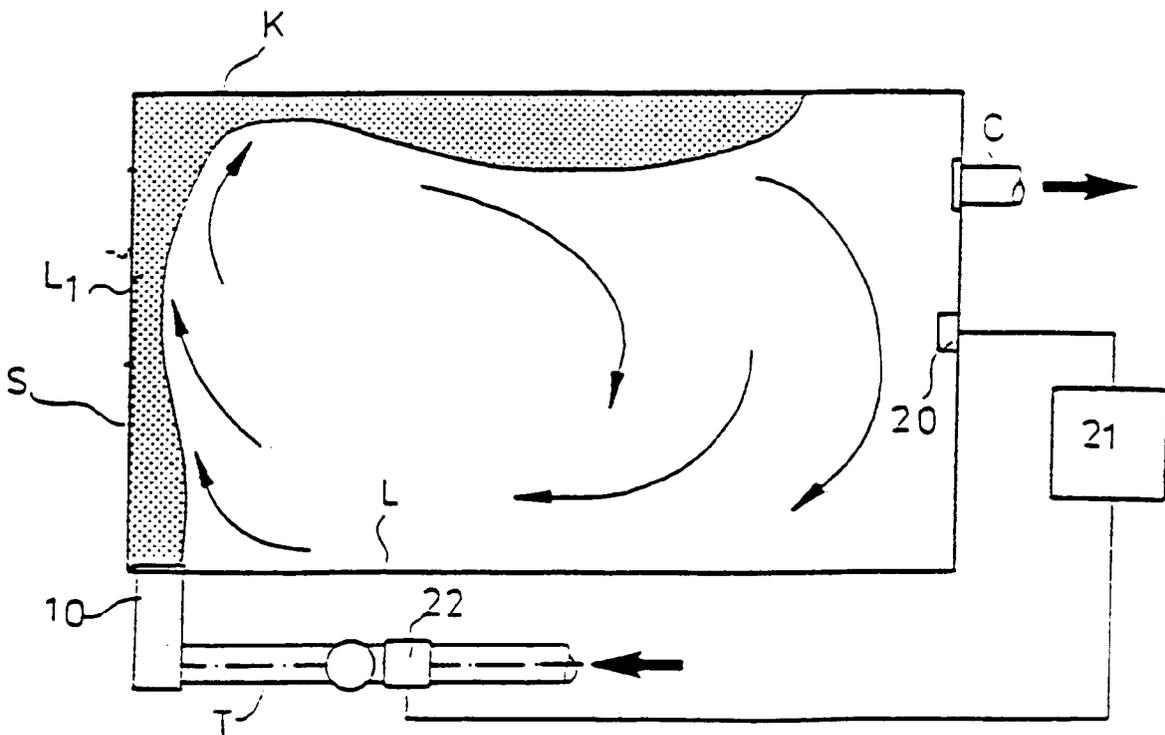


FIG 1B
8

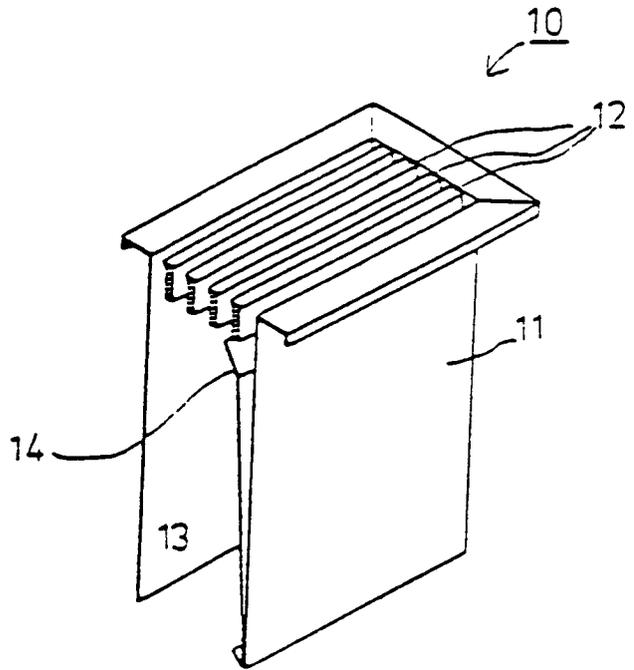
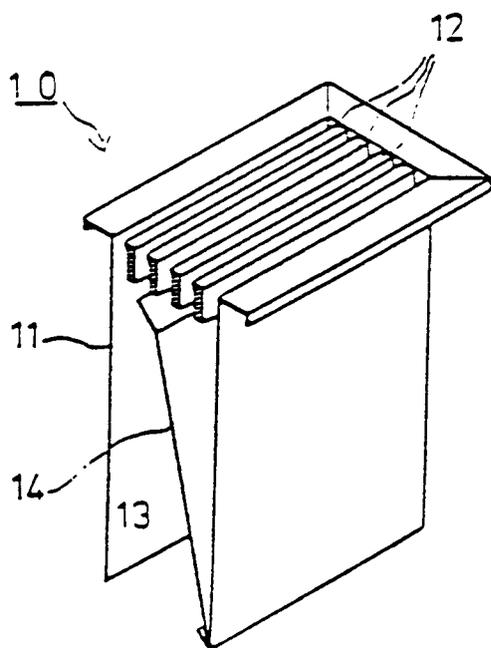
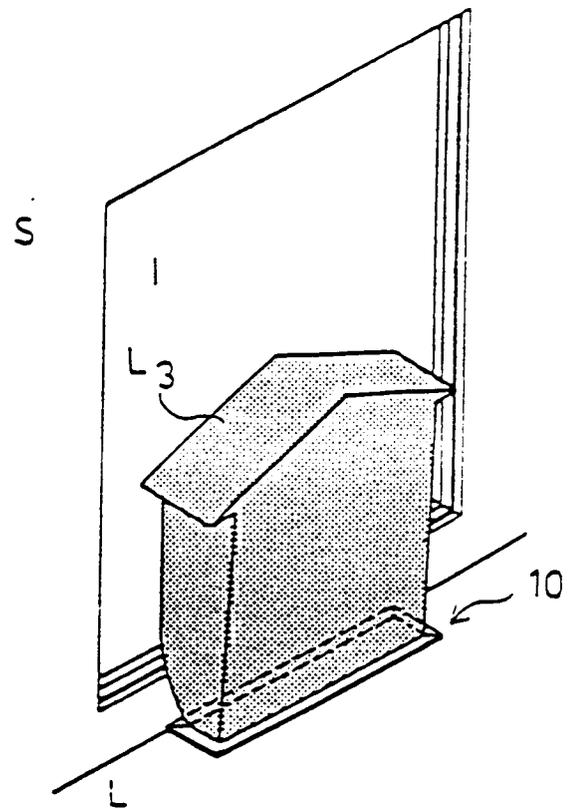
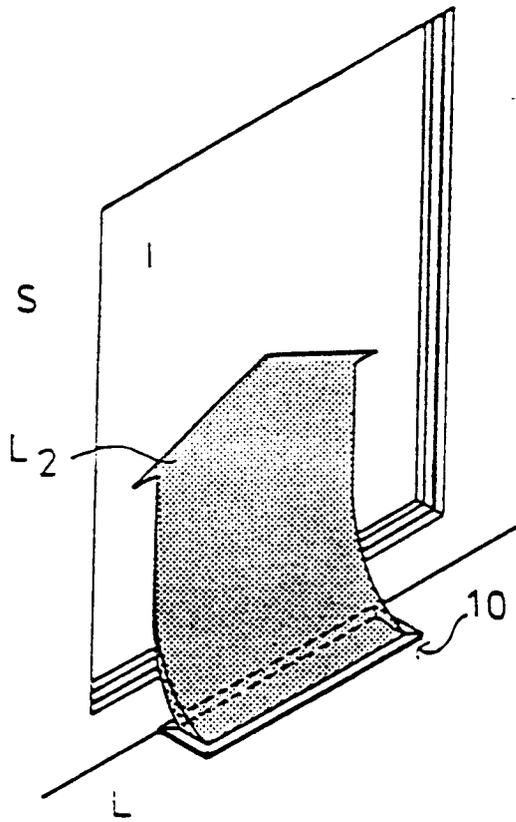


FIG 2 A

FIG 2 B

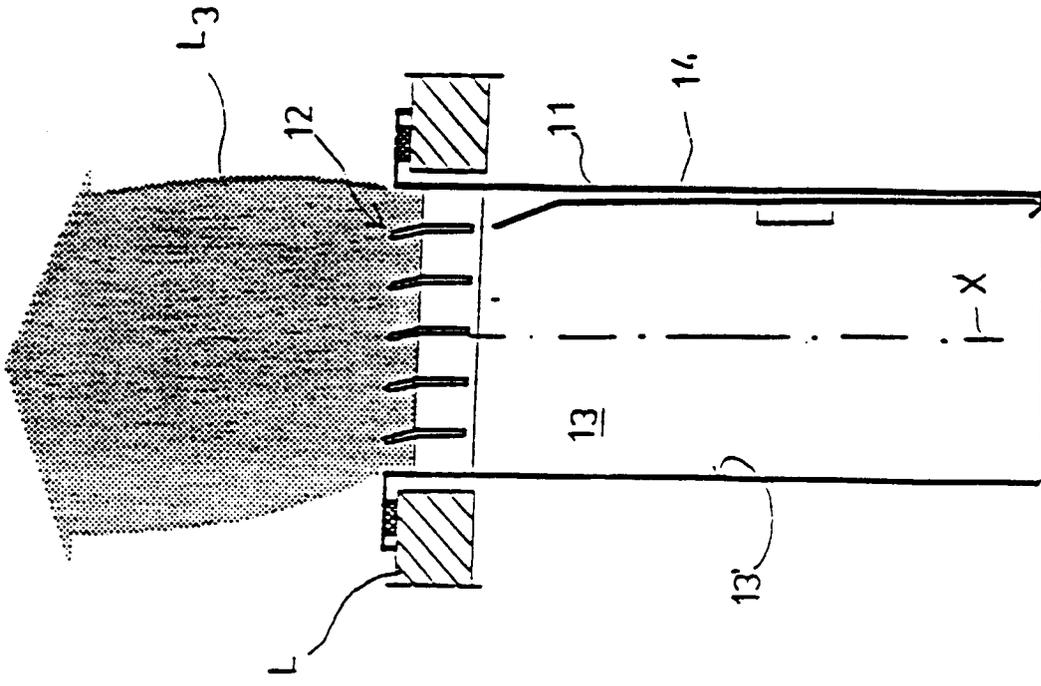


FIG 3 B

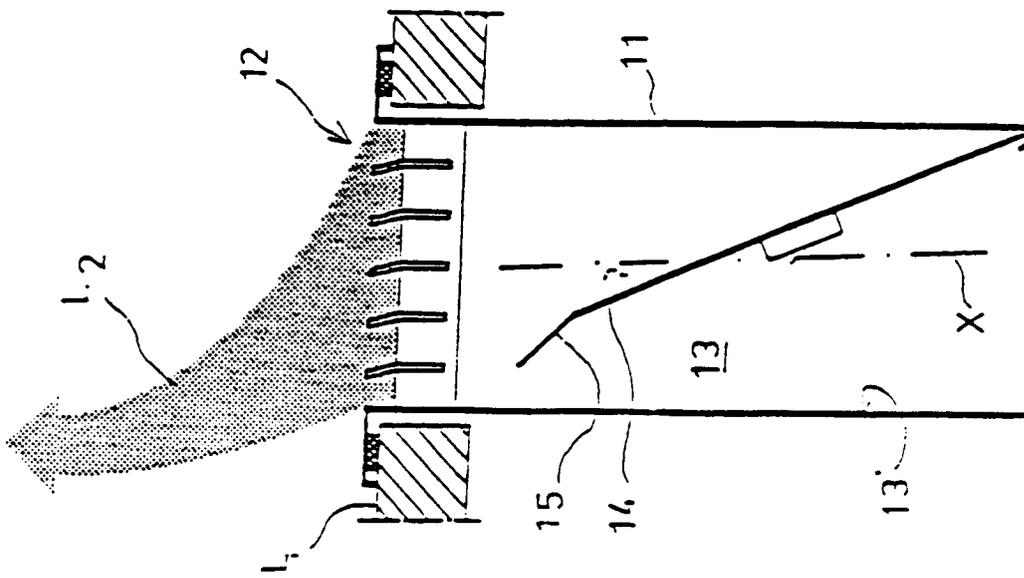
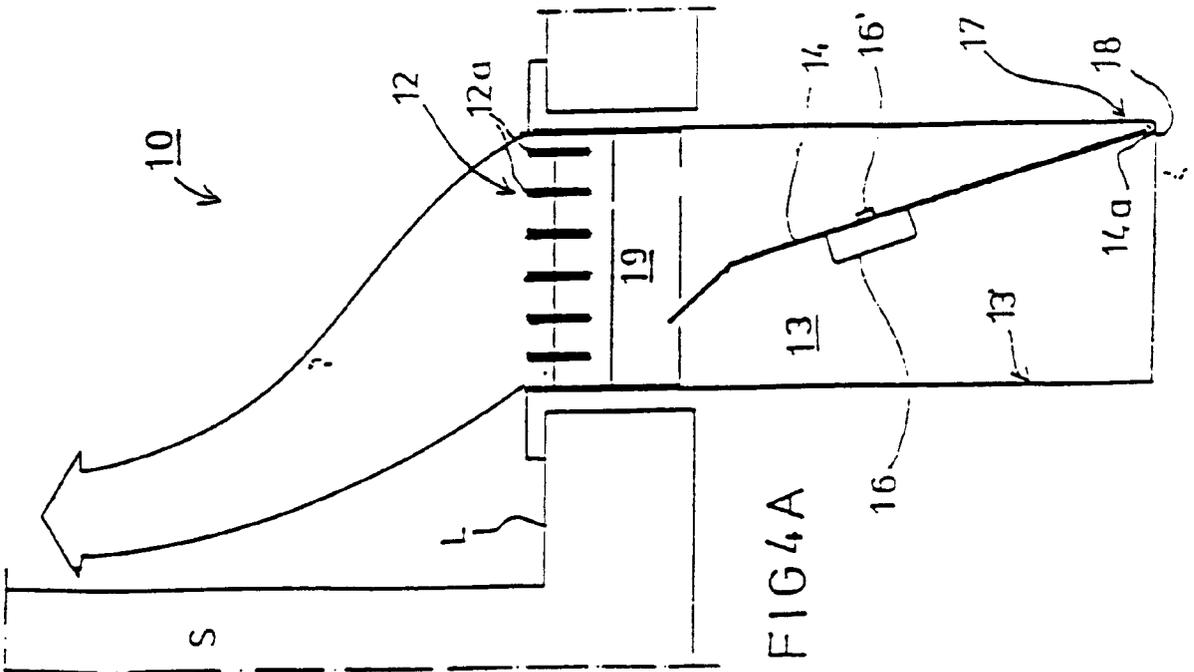
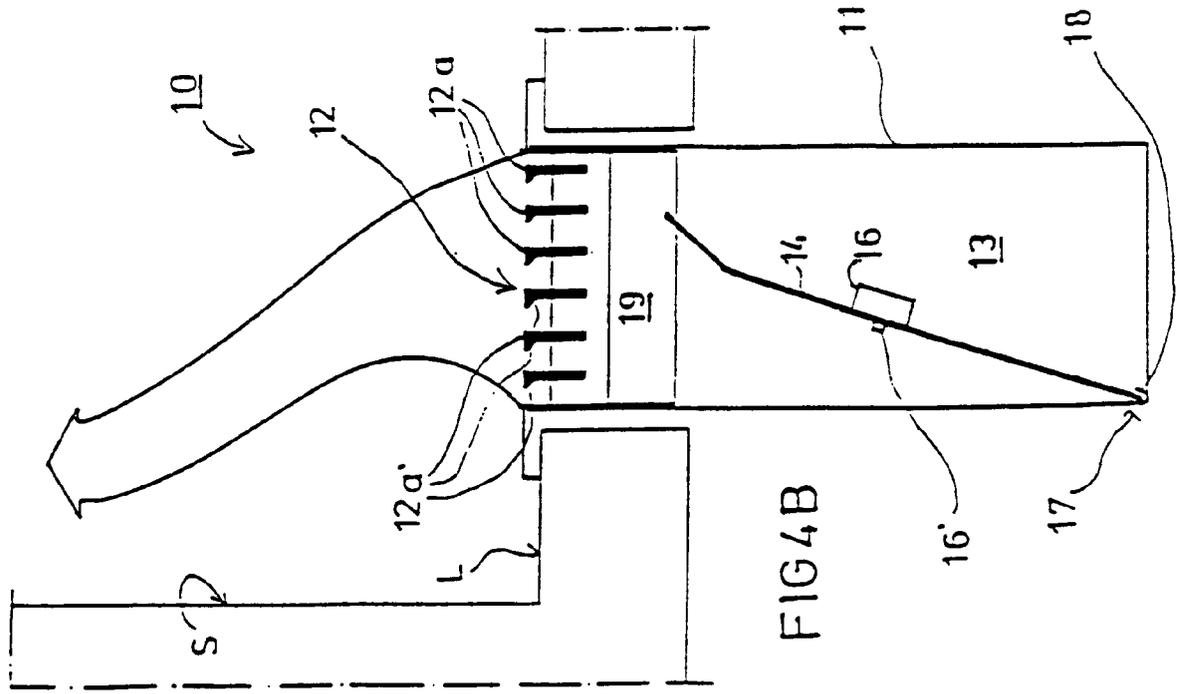


FIG 3 A



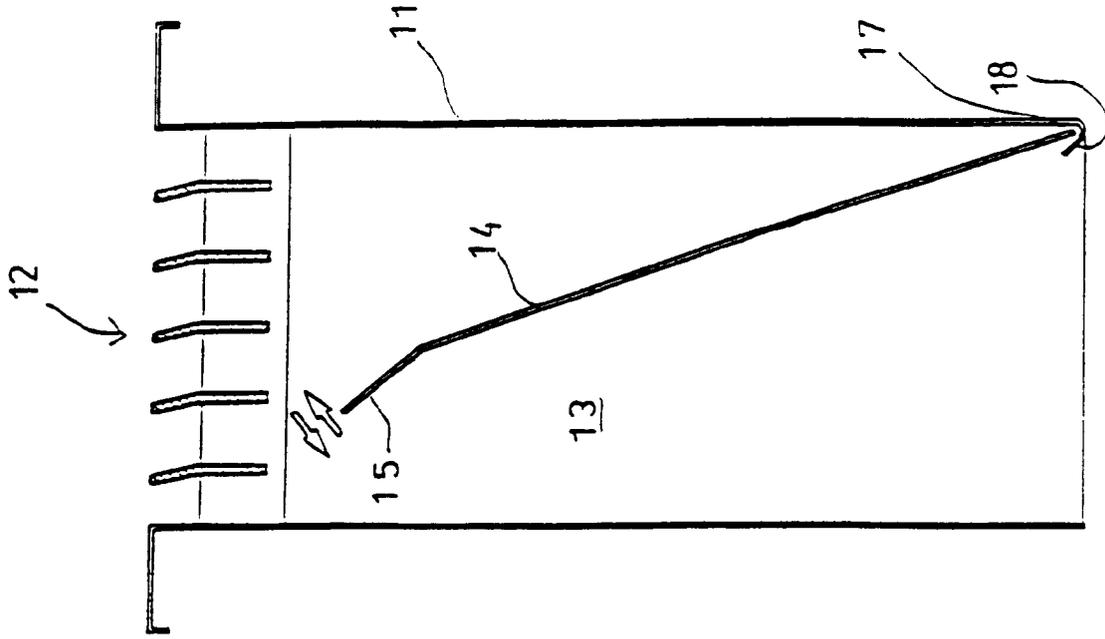


FIG 5B

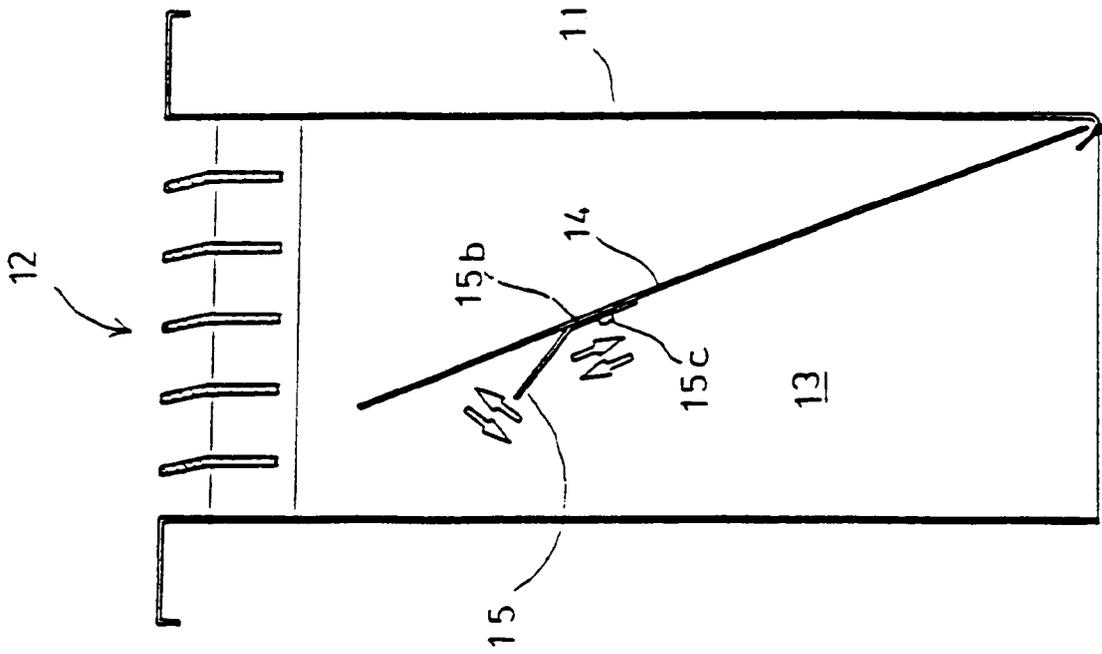


FIG 5A

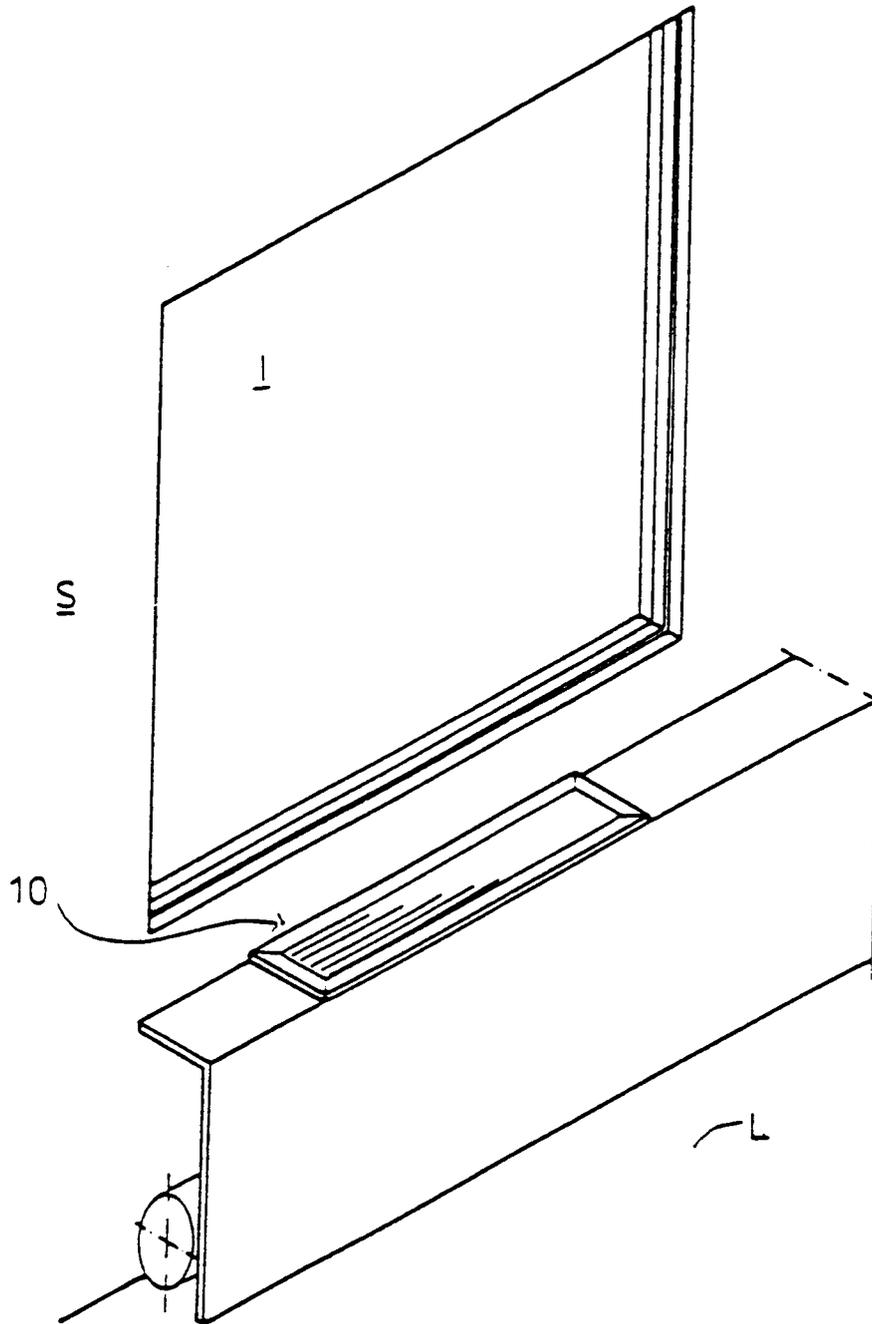


FIG 6