Feb. 13, 1968 YOSHITOSHI SOHDA ETAL 3,368,473

ROOF AND WALL CONSTRUCTION

Filed Nov. 20, 1964 8 Sheets-Sheet 1

Fig. 1.

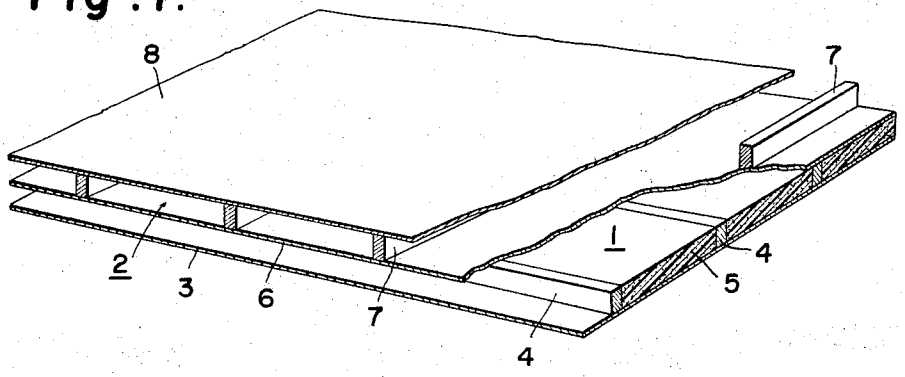


Fig. 2.

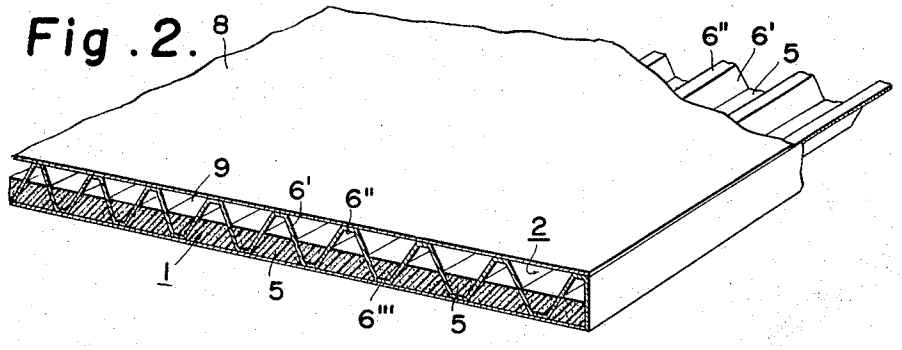
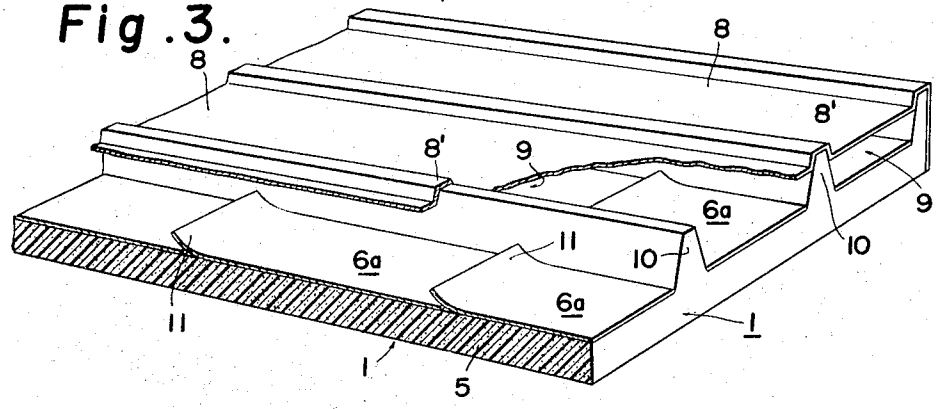


Fig. 3.



Feb. 13, 1968 YOSHITOSHI SOHDA ETAL 3,368,473

ROOF AND WALL CONSTRUCTION

Filed Nov. 20, 1964 8 Sheets-Sheet 2

Fig. 4.

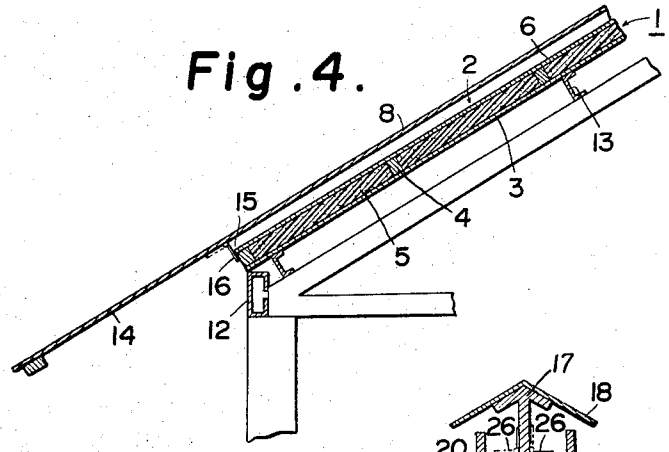


Fig. 5.

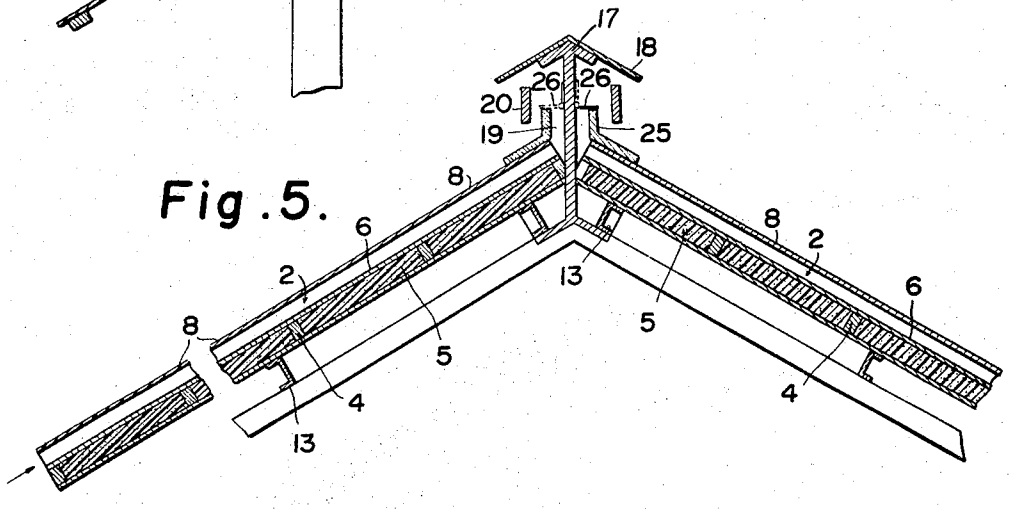
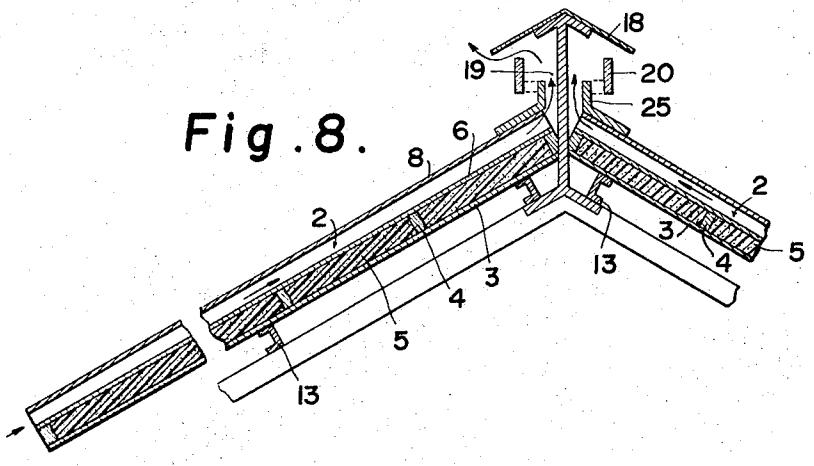


Fig. 8.



Feb. 13, 1968 YOSHITOSHI SOHDA ETAL 3,368,473

ROOF AND WALL CONSTRUCTION

Filed Nov. 20, 1964 8 Sheets-Sheet 3

Fig. 6.

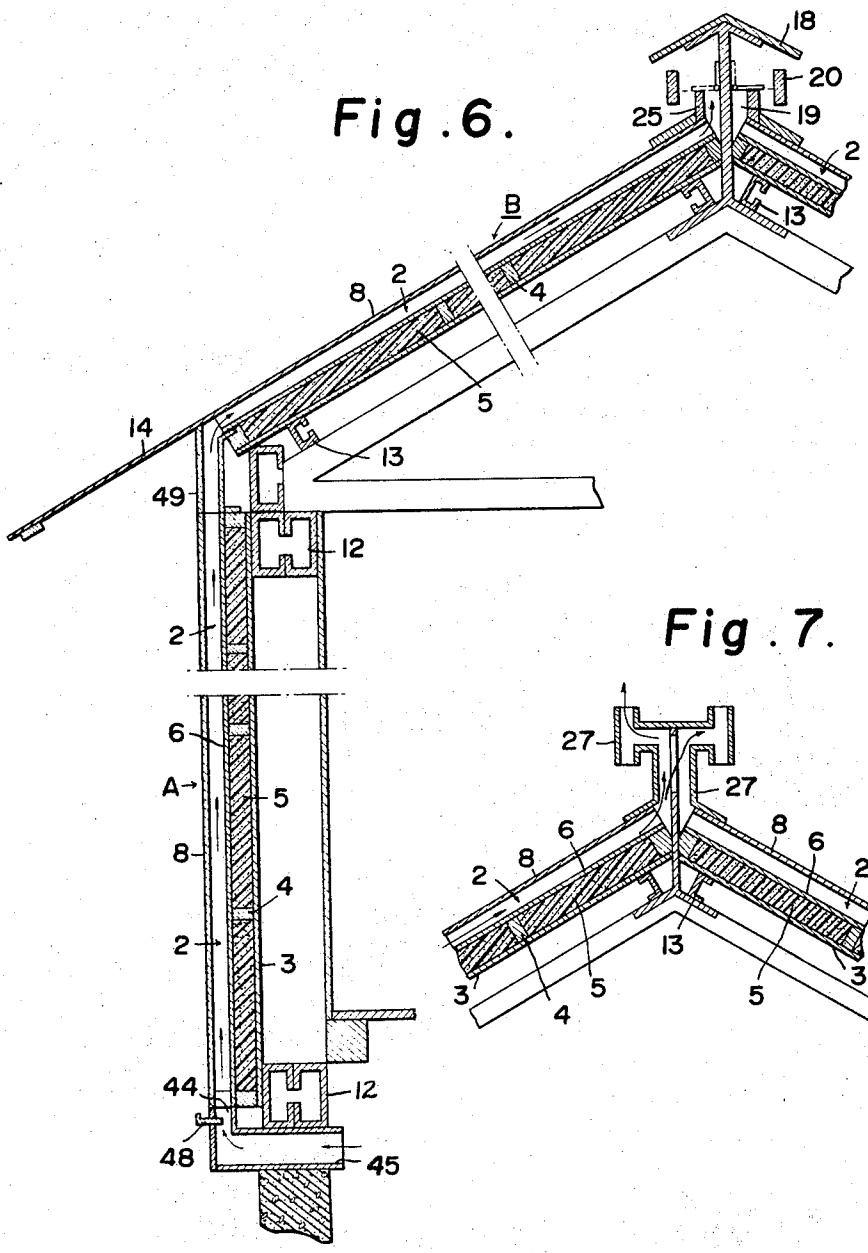


Fig. 7.

Fig. 9.

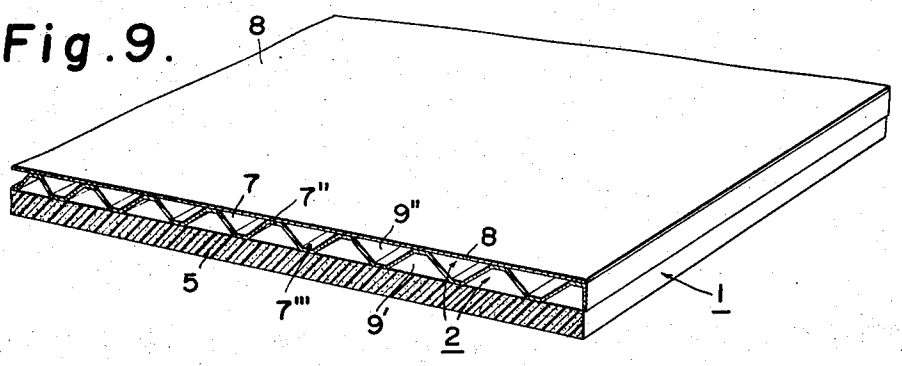


Fig. 10.

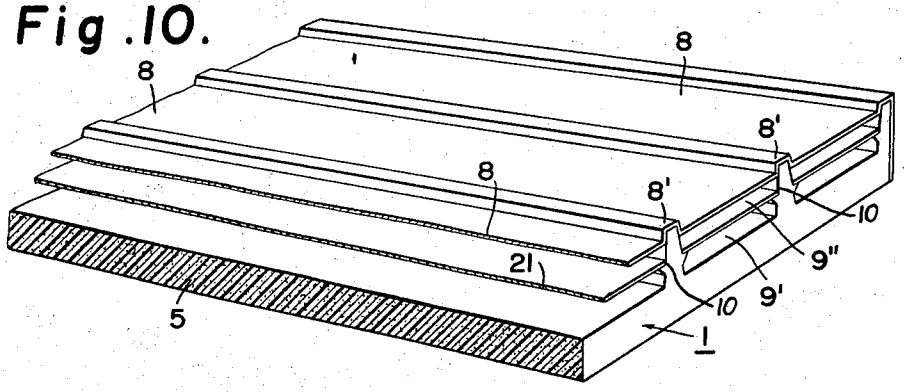


Fig. 11.

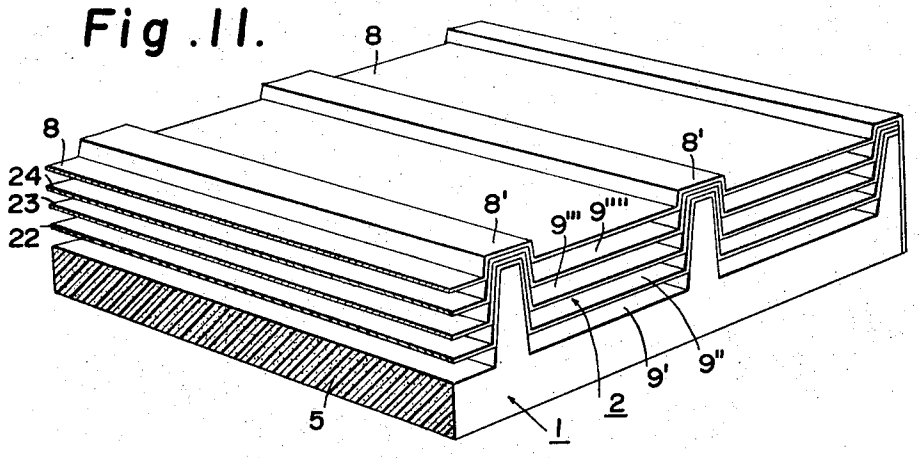


Fig. 12.

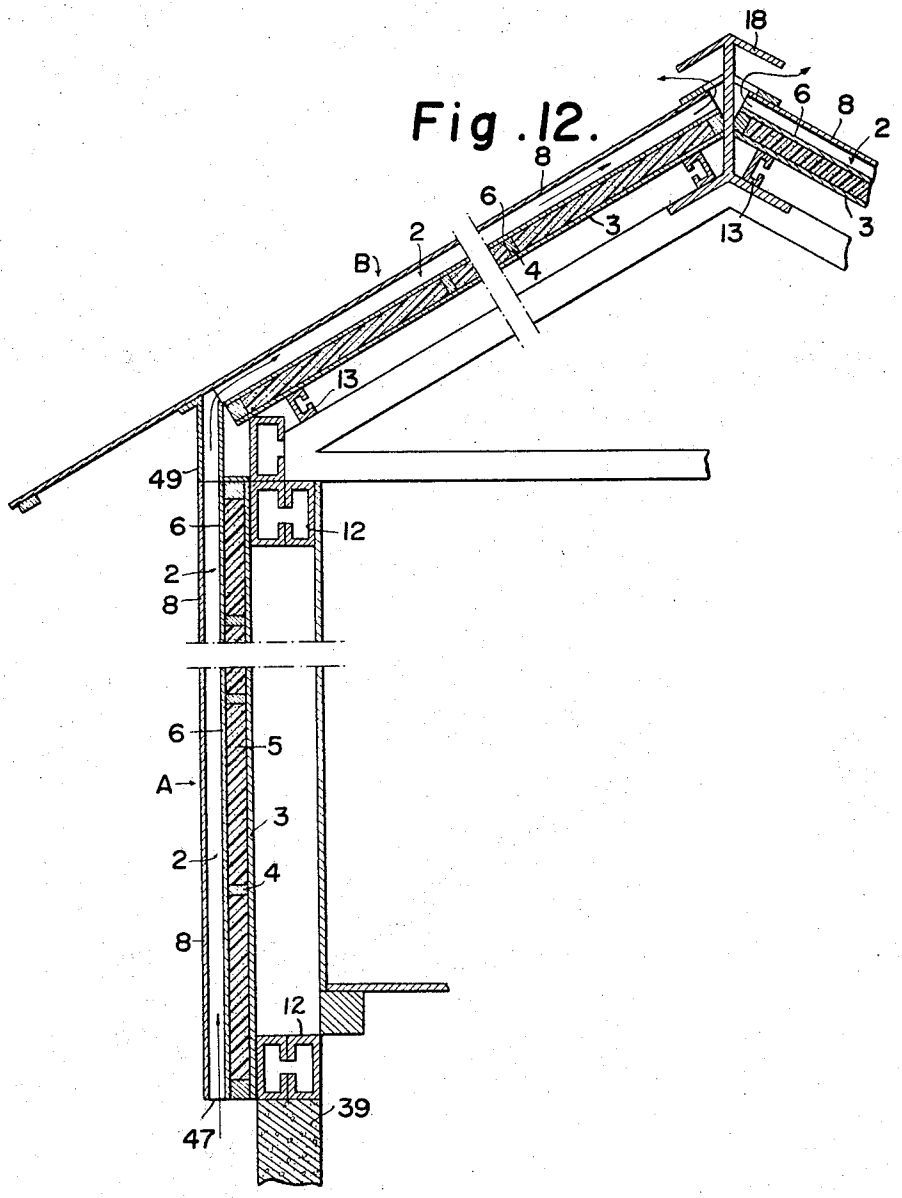


Fig .13.

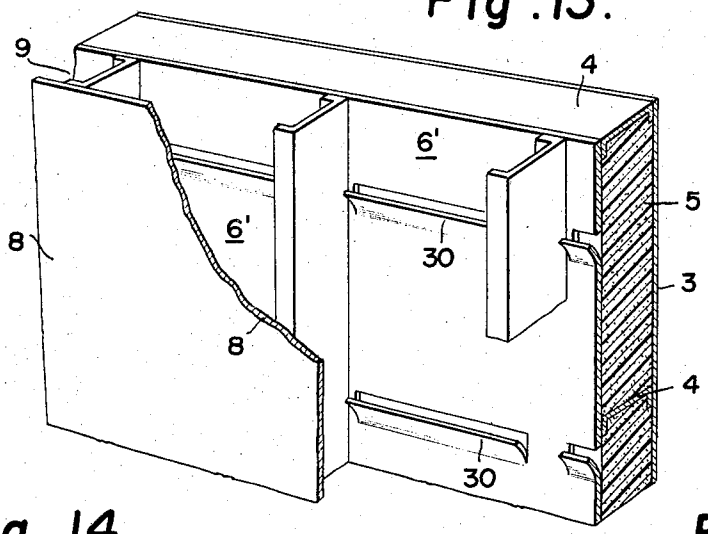


Fig .14.

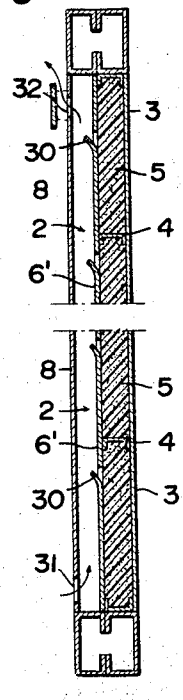


Fig .15.

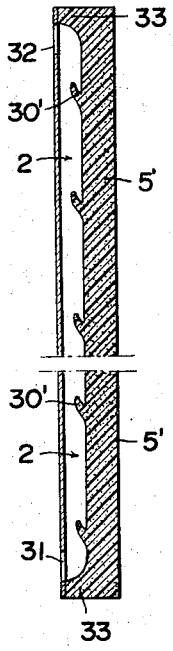
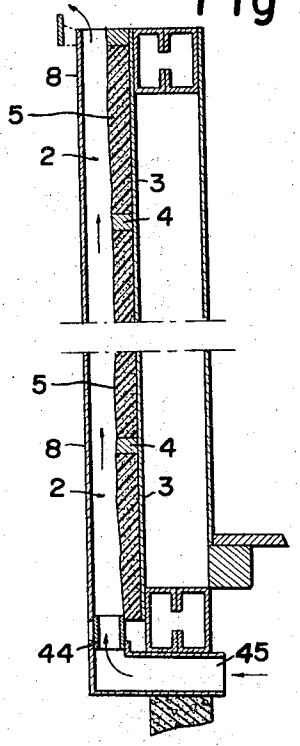


Fig .16.



Feb. 13, 1968 YOSHITOSHI SOHDA ETAL 3,368,473

ROOF AND WALL CONSTRUCTION

Filed Nov. 20, 1964 8 Sheets-Sheet 7

Fig. 17.

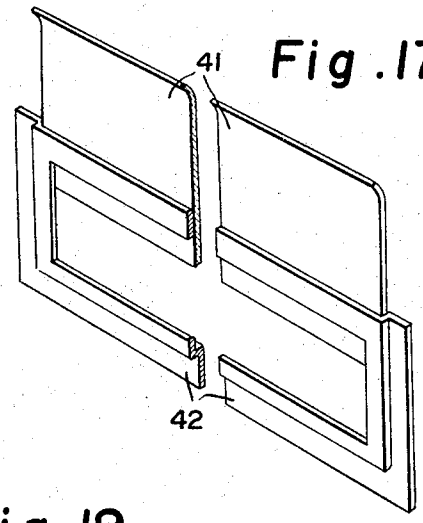


Fig. 18.

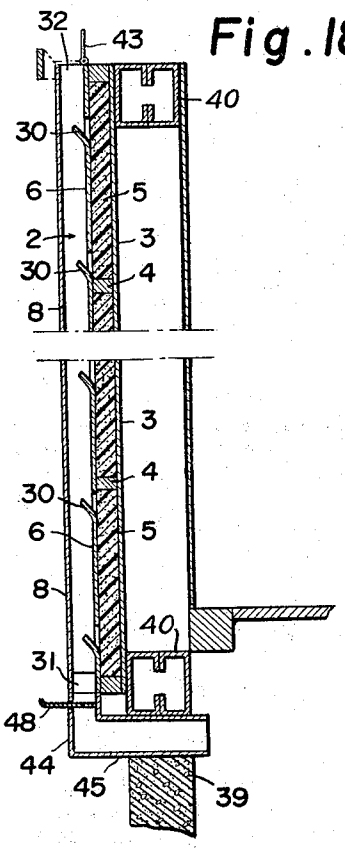
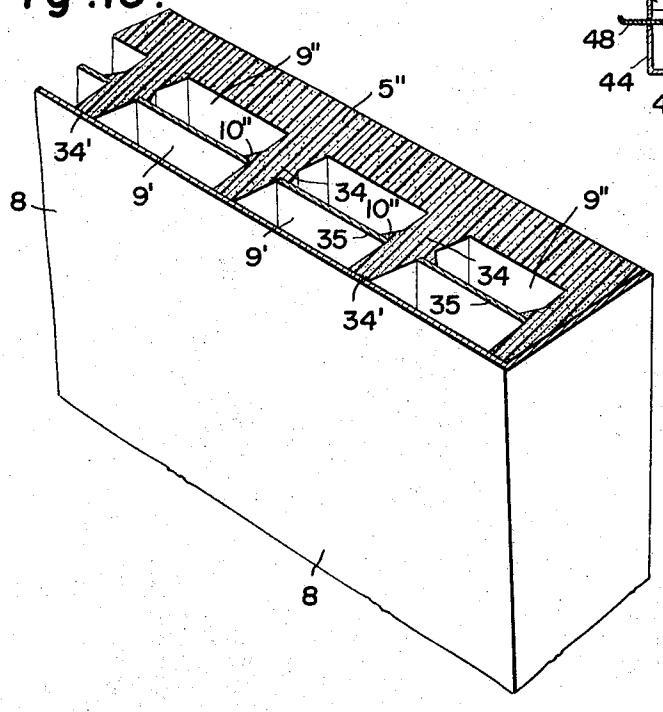


Fig. 19.



Feb. 13, 1968 YOSHITOSHI SOHDA ETAL 3,368,473

ROOF AND WALL CONSTRUCTION

Filed Nov. 20, 1964 8 Sheets-Sheet 8

Fig. 20.

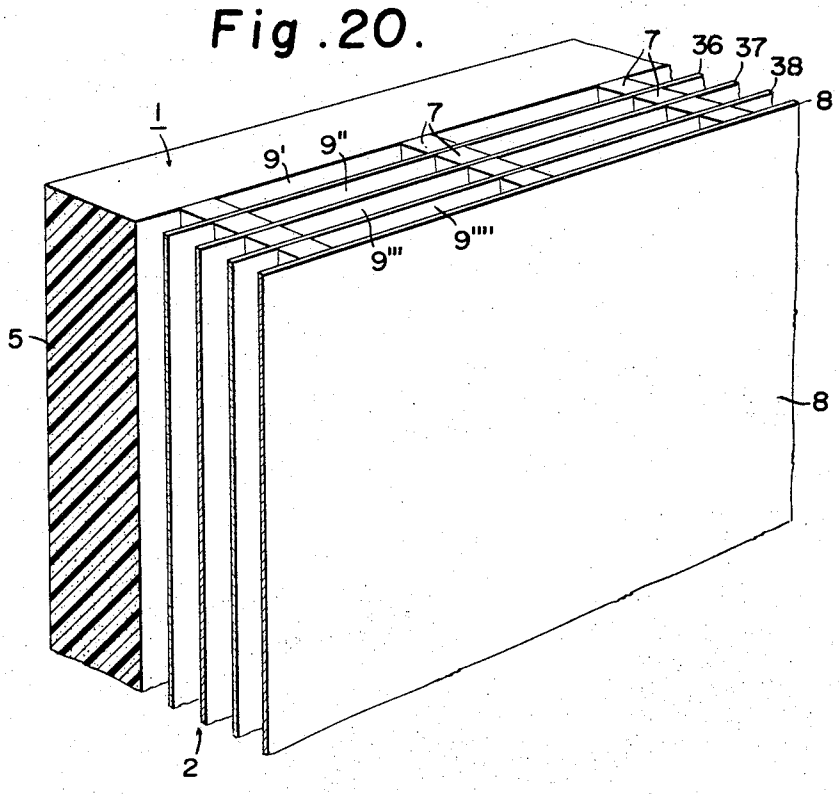
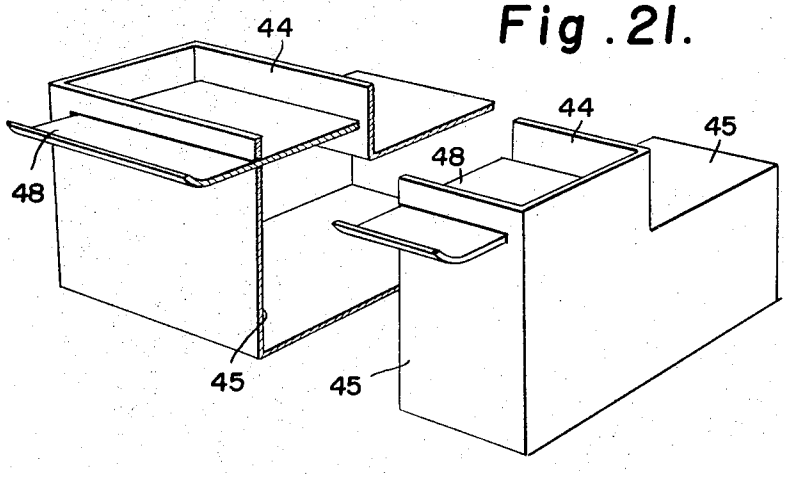


Fig. 21.



United States Patent Office 3,368,473
Patented Feb. 13, 1968

3,368,473

ROOF AND WALL CONSTRUCTION

Yoshitoshi Sohda, 53 Konno-cho, Shibuya-ku, Tokyo, and Yoshimi Sohda, 38 95-banchi, Hosoyama, Kawasaki-shi, Kanagawa-ken, Japan

Filed Nov. 20, 1964, Ser. No. 412,689
Claims priority, application Japan, Nov. 21, 1963, 38/62,277
3 Claims. (Cl. 98—31)

This invention relates generally to construction panels and prefabricated structural members made therefrom, and more particularly to such structural prefabrications having a section to provide ventilation and a section to provide insulation; the prefabrications being readily used as wall or roof members for the construction of modern buildings. The present invention further includes novel wall or roof structures fabricated with the sectioned construction members.

In accordance with the invention, such construction members are built into a wall or roof structure having a ventilation section and an insulation section, the ventilation section being adapted to allow the passage of air therethrough, thereby removing and prohibiting the communication of solar heat with the interior of a building.

It is an object of the invention to provide novel means of eliminating the communication of the radiant energy of the sun into the interior of an office building or house.

It is another object of the invention to provide simple methods and means of controlling the entrance of external heat into a building so as to provide for maximum living comfort.

It is a further object of the invention to provide improved, useful construction members and prefabricated structures made therefrom which are adapted to dissipate the heat radiating inwardly from the exterior walls of a building and to create an air stream, the velocity of which being proportional with the amount of solar heat radiation, thereby controlling the amount of heat discharged to the atmosphere.

In order to achieve the above objects with success, the present invention further contemplates the provision of means of controlling the flow of air through the ventilating section of a wall or roof structure, said means being hermetically sealed, if desired, to provide an insulation zone having a greater resistance to heat communication, and said means thus cooperating with the internal insulation section of the structure in preventing warm internal air from escaping into the atmosphere. In this manner it is possible according to the invention to provide roof structures which serve to maintain optimum temperatures in the interior of the building at all times.

These and other features of the present invention will become more apparent from the following description taken in conjunction with the embodiments of the invention illustrated in the accompanying drawings, in which:

FIG. 1 is a perspective view, partially cross-sectional, of a roof structural layout having a plurality of channels for the passage of air, this being a first embodiment of the invention;

FIG. 2 is a perspective view, partially cross-sectional, of a roof structural layout similarly provided with ventilating channels, this being a second embodiment of the invention;

FIG. 3 is a perspective view, partially cross-sectional, of a structural member, this being a third embodiment of the invention;

FIG. 4 is a longitudinal cross-sectional side view of the roof structure particularly showing the eaves according to the invention;

FIG. 5 is a longitudinal cross-sectional front view of the roof structure particularly showing the ridge-beam arrangement embodying the invention;

FIG. 6 is a side view, partially cross-sectional, of the roof structure illustrated as being combined with the wall structure according to the invention;

FIG. 7 and 8 are longitudinal cross-sectional front views of another embodiment of the invention shown respectively as applied to the ridge-pole;

FIG. 9 is a perspective view, partially cross-sectional, of a roof structural layout, this being a fourth embodiment of the invention;

FIG. 10 is a perspective view, partially cross-sectional, of a roof structural layout, this being a fifth embodiment of the invention;

FIG. 11 is a perspective view, partially cross-sectional, of a roof structural layout, this being a sixth embodiment of the invention;

FIG. 12 is a side view, partially cross-sectinoal, of the framework of a house to which the roof structural member and the wall structural member of the invention are applied in combination;

FIG. 13 is a perspective view, partially cross-sectional, of a wall structural layout having ventilating sections, this being a second embodiment of the invention, the first embodiment of the wall structural features of the invention corresponding to the roof structural member illustrated in FIG. 1;

FIG. 14 is a sectional side view of FIG. 13;

FIG. 15 is a sectional view of a wall structural layout, this being a fourth embodiment of the invention, the third embodiment of the wall structural features of the invention corresponding to the roof structural member illustrated in FIG. 9;

FIG. 16 is a sectional side view of the wall structure being provided with a ventilation pipe underneath the floor.

FIG. 17 is a perspective view of an air-adjusting panel provided at the air suction side of a member according to the invention;

FIG. 18 is a cross-sectional view of the wall structural member of FIG. 13 shown as mounted in a house;

FIG. 19 illustrates in partial cross section a fifth embodiment of the wall structural features of the invention;

FIG. 20 illustrates in partial cross section a sixth embodiment of the wall structural features of the invention; and

FIG. 21 is a perspective view of a ventilation damper according to the invention.

Referring to FIG. 1, the invention is shown as comprising an insulating zone or section **1**, with a ventilating section **2** provided adjacent to and to the outside thereof, a base board **3**, a plurality of transverse members **4** spaced similarly apart on the base **3**, an insulating material **5** such as of polystyrol, vinylchloride, polyurethane or similar synthetic resin foams, filled in the insulating section **1**, an intermediate board **6** secured to the transverse members **4**, a plurality of longitudinal members **7** spaced similarly apart on the intermediate board **6** and aligned at right angles to the transverse members **4**, and an external decorative plate **8** secured above the longitudinal members **7** thereby forming a plurality of ventilation channels **9** constituting the ventilating zone or section **2**.

This structural arrangement of FIG. 1 may be applied readily either to the roof construction or to the wall construction of a building, the only difference being whether it is erected upright as a wall or mounted in a sloped plane as a roof. The same may also be said of any of the other embodiments of the invention which will be hereinafter discussed.

Referring to FIG. 2, the intermediate board **6'** is shown as being bent alternatingly in a wavy fashion, with upper

and lower bends 6'' and 6''' adapted to join the base 3 with the decorative board 8. An insulating material 5 fills in about half of each triangular area formed by a wave of the intermediate plate 6', thereby providing the insulating section 1, while the remaining half of the triangle is utilized as a ventilation channel 9 for the ventilating section 2.

In the embodiment of the invention illustrated in FIG. 3, the insulating section 1 is formed with a solid piece of insulating material 5 having projections 10. The projections 10 are spaced apart an equal distance to serve as longitudinal members. An intermediate plate 6a is formed of overlapping portions and is secured between the projections 10 of the insulating material 5. The overlap of each portion is bent with an upward bend 11 which is adapted to serve as a baffle for preventing counter-current of air. The projections 10 are joined at the tops with counterparts 8' of the decorative board 8, thereby providing open channels 9 for the passage of air streams.

FIG. 9 illustrates a modification of the structure of FIG. 2 in which a solid piece of insulating material 5 is adapted to form the insulating layer 1 and a longitudinal member is bent alternatingly in a wavy fashion with upper and lower bends 7'' and 7''' adapted to join the insulating board 5 with the decorative board 8, thereby creating congruent triangles 9' and 9'' which constitute the ventilation section 2. It will be appreciated that the decorative board 8 in this case may be removed with accomplishment of somewhat similar results.

In the fifth embodiment of the invention shown in FIG. 10, the insulating section 1 is formed with a single piece of insulating material 5 having projections 10 integrally formed therewith and spaced apart an equal distance to serve as longitudinal members. The projections 10 are joined with counterparts 8' of the decorative board 8. A spacer 21 is inserted between and parallel with the insulating board 5 and the decorative board 8. In this manner, there are provided two stages of ventilating channels 9' and 9''. Similarly in the sixth embodiment of the invention shown in FIG. 11, there is used a single piece of insulation material 5 having projections integrally formed therewith and spaced apart equally to serve as longitudinal members. The projections 10 are joined with counterparts 8' of the decorative board 8. In this modification, there are used three sheets of spacer 22, 23 and 24 to form four stages of insulating channels 9', 9'', 9''' and 9'''', as shown.

It will be appreciated that the number of spacers or stages of insulating section may be increased in consideration of the geographic latitudes surrounding the site of construction and other conditions.

The above roof structures may be mounted in a sloping plane so that the air coming up through the eaves into the insulating section 2 tends to flow upwardly while absorbing the solar heat applied to the decorative board 8 for discharge into the atmosphere. This upward movement of air in the presence of the insulating material 5 prevents the temperature of the outside atmosphere from affecting the temperature conditions of the building. In such instance, the bends 11, FIG. 3, effectively avoid creation of a counter-current thereby eliminating the tendency of the air current to descend. The avoidance of down drafts facilitates the discharge of the air into the atmosphere and further accelerates the velocity of the upward movement of the air thereby increasing the efficiency of absorption of the external heat radiating from the decorative board 8.

Turning to FIGS. 4 and 5 illustrating the invention in its application to the roofing of a house, the prefabricated roof structure described hereinbefore may be secured to framing angles 12 and 13 of the house. The decorative board 8 may be extended to form an eaves portion 14. The ventilating section 2 may be provided at one end thereof with an air inlet 15 having a damper 16. At the top of the ridge-pole 17 is mounted a shelter 18, while a bracket member 25 having a wind-breaking flashing 20 is mounted on each side of the ridge-pole 17, thereby forming a ventilation path 19. Alternatively, there may be provided a damper 26 instead of locating the damper 16 at the air inlet 15. This flapper means or damper 26, 16 serves to control the air current in such a manner that while in open position, it allows the air to enter from the suction 15 and travel upwardly through the ventilating section 2, taking with it the solar heat emanating from the external decorative board 8 and causing it to rise through the discharge opening 19 into the atmosphere. This air current is maintained constantly by opening of the damper 26 or 16 during the summer season such that warm air may be held from communicating with the interior of the house by discharging it into the atmosphere as a part of the air current. However, in the winter season the damper 16 or 26 may be held in fully closed position so that the ventilating section 2 presents significant resistance to the communication of warm air from the interior to the atmosphere, this effect being augmented by the presence of the insulating layer 5.

In FIG. 7 there is provided a ventilation frame 27 which comprises a combination rain shelter and windbreaker at the ridge-pole of the house. This arrangement has been tested for ventilation with excellent results.

The invention will now be described in its application to walls of a building. As already stated, the prefabricated roof structural members according to the invention may equally be used for construction of wall members.

The wall structural members, illustrated in FIG. 13 and FIG. 14, respectively, comprise an intermediate board 6' partially bent upwardly at 30 which serves to prevent a counter-current of air in the ventilating section 2, and a decorative board 8 having an oblong hole 32 at the upper end and another similar hole 31 at the lower end thereof, the former being adapted to discharge the air admitted through the latter.

Referring to FIG. 15, illustrating the fourth embodiment of the invention, a single piece of insulating material 5' is shown as having a projection 33 each at the top and at the bottom by which is formed the ventilating section 2, and further as having small protuberances 30' adapted to prevent tendency of the air to reverse its flow. The decorative board 8, which is secured to the projections 33 of the insulating layer 5', may be provided with oblong holes, one at the lower end 31 for air inlet and the other at the upper end 32 for air discharge.

FIG. 19 illustrates the fifth embodiment of the invention in which a single layer of insulating material 5'' is shown as having projections 34 equally spaced and integrally formed therewith, the projections 34 being adapted to join the insulating layer at the ends 34' with the decorative board 8, thereby forming ventilation channels 9' and 9''. Intermediate and in parallel with the insulating layer 5'' and the decorative board 8 is inserted a spacer 35 having both ends thereof joined to lateral ribs 10'' of projections 34. With this construction, there is provided two stages of ventilation channels, 9'' and 9'.

In the sixth embodiment of the invention illustrated in FIG. 20, the insulating section 2 is formed with a single layer of insulating material 5, on which are arranged a plurality of longitudinal members 7 equally spaced apart, and a first partition 36 is aligned parallel with and secured to the decorative board by member 7, 8 thereby creating a first row of ventilation channels 9'. In a similar manner, successive partitions 37 and 38 may be inserted between the first partition 36 and the decorative board 8 so as to provide a second, a third and a fourth row of ventilation channels as designated at 9'', 9''' and 9'''', respectively.

The number of these rows of ventilation channels may be increased at will depending upon geographical conditions of the site of a building.

FIG. 18 illustrates the structural members of the invention as applied to the wall of a building, in which the wall structure is mounted on the base 39 to the beams

40 with the insulating section 1 facing the interior of the house.

According to the invention, there may be further provided a frame 42 having an air-adjusting damper 41 at the air suction opening 31 as illustrated in FIG. 17. Alternatively, an air-adjusting damper 43 may be provided at the air discharge opening 32. This is intended to control the amount of air in the ventilating section 2. During the winter season the damper 43 or 41 may be held in fully closed position thereby creating an insulating air layer in the system which cooperates with the internal insulating section 1 to prevent the internal warm air from escaping to the atmosphere.

Advantageous applications of the invention include providing a suction pipe 45 of L shape underneath the floor which serves to take moist air from underneath the floor and to discharge it through the air passage coupling 44 into the atmosphere, thereby maintaining the floor dry and sanitary at all times.

FIG. 12 shows the wall structural member, generally designated at A, and the roof structural member generally designated at B, as suitably combined to cover the framework of a house. A modification of this combination layout is illustrated in FIG. 6. In either case, the wall structural member A is secured at its base to the beam 12 and to the foundation 39, with the lower end of the ventilating section 2, through an L-shaped air guide tube 44, communicating with the suction pipe 45 having a removable door 48 underneath the floor as illustrated in FIG. 6. Alternatively, the wall structural member A may be simply secured per se to the framework of the house as shown in FIG. 12.

As illustrated in FIGS. 6 and 12 the wall structural member A is provided at the upper end thereof with an air suction tube 49 secured to the framework of the house and communicating with the ventilating section 2 of the wall member A and with the ventilating section 2 of the roof structural member B.

Having thus described the roof and wall structural arrangements according to the invention, it will be understood that a building or house constructed with these novel structures can be maintained in a comfortable living condition throughout all seasons of the year. To wit, the solar heat in contact with the decorative board 8 externally mounted on the framework of a house causes the air in the ventilating section 2 to move upwardly with a relatively low temperature air from the inlet 47 at the lower end of the wall structural member A and to flow through the air vent 19 at the top of the roof structural member B and into the atmosphere.

It will be obvious to those skilled in the art that there may be made various modifications and changes in the specific construction herein described, without departing from the inventive concept of this invention set forth in the appended claims.

What is claimed is:

1. A prefabricated construction for roof or wall members comprising:

an outer plate,

an inner insulating section including a planar layer of insulating material bounded by sheets on each side thereof,

longitudinal members arranged in parallel spaced relation and fixed to the outer plate and the inner insulating section whereby the plate and section are in spaced parallel relation,

the members, plate and section forming a ventilating section having at least one continuous channel with the members forming the sidewalls of the channel such that air currents are directed through one end of the panel and out the other and heat radiated from the outer plate to the channel is removed from the construction by the air currents, and

the sheet bounding the insulating material is formed in overlapping sections with bends in the overlap of the sections curved upwardly within the channel such that air currents are maintained in an upward direction and reverse air flow is avoided when the construction is positioned as a roof and as a wall.

2. A construction as in claim 1 wherein the longitudinal members are projections of the insulating material and wherein the insulating material is formed with upwardly extending curved projections within the channel such that air currents are maintained in an upward direction and reverse air flow is avoided when the construction is positioned as a roof and as a wall.

3. A construction as in claim 1 wherein damper means are connected to the construction to at least one end thereof for selectively opening and closing the channel to the flow of air.

References Cited

UNITED STATES PATENTS

2,514,170	7/1950	Walter	52—618 X
2,553,881	5/1951	Suttles	98—31 X
2,755,728	7/1956	Frisby	98—37
2,767,961	10/1956	Frankland	98—37
2,876,871	3/1959	Coffman	52—618 X
3,115,819	12/1963	Mahlmeister	98—31 X
3,147,336	9/1964	Mathews	52—615

MEYER PERLIN, *Primary Examiner.*