July 27, 1965 C. A. LORENZ ETAL 3,196,773

BUILDING SYSTEM WITH VENTILATING MEANS

Filed Aug. 6, 1962 3 Sheets-Sheet 1

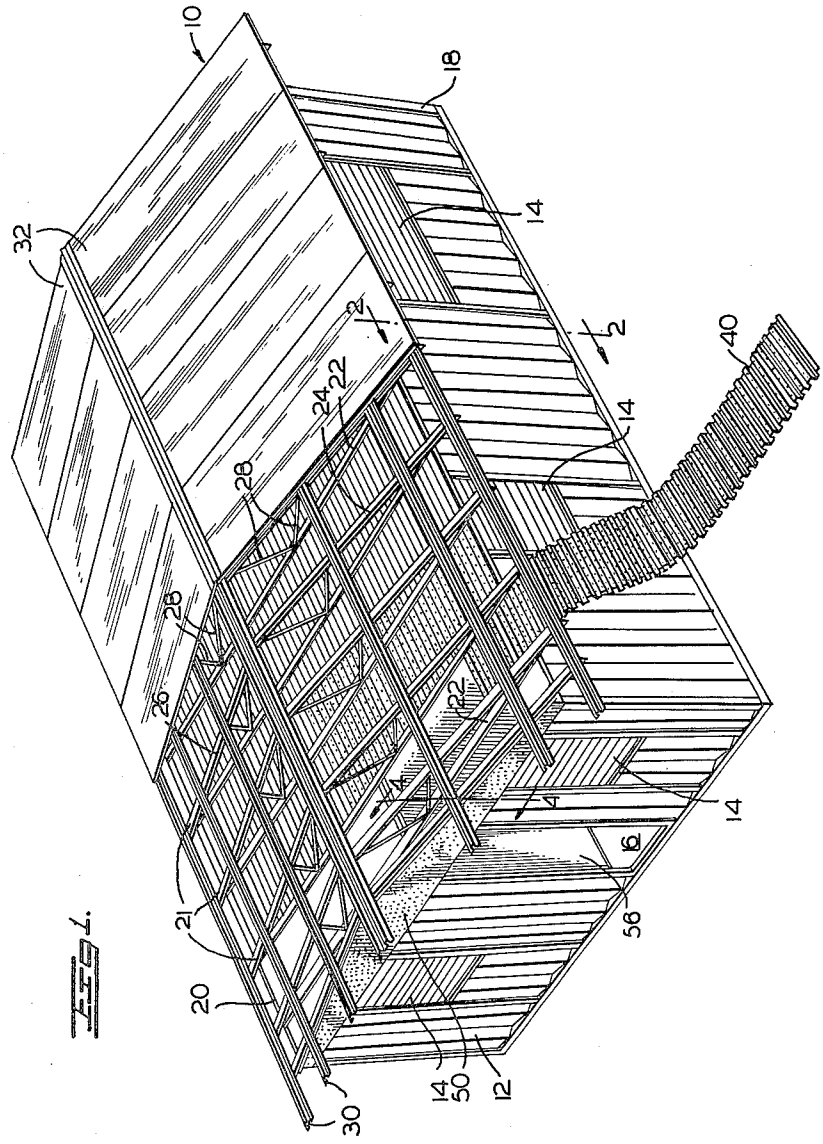

Fig. 1.

INVENTORS
CHARLES A. LORENZ
CORWIN G. HOCKETT

BY Glenn, Palmer & Matthews
ATTORNEYS

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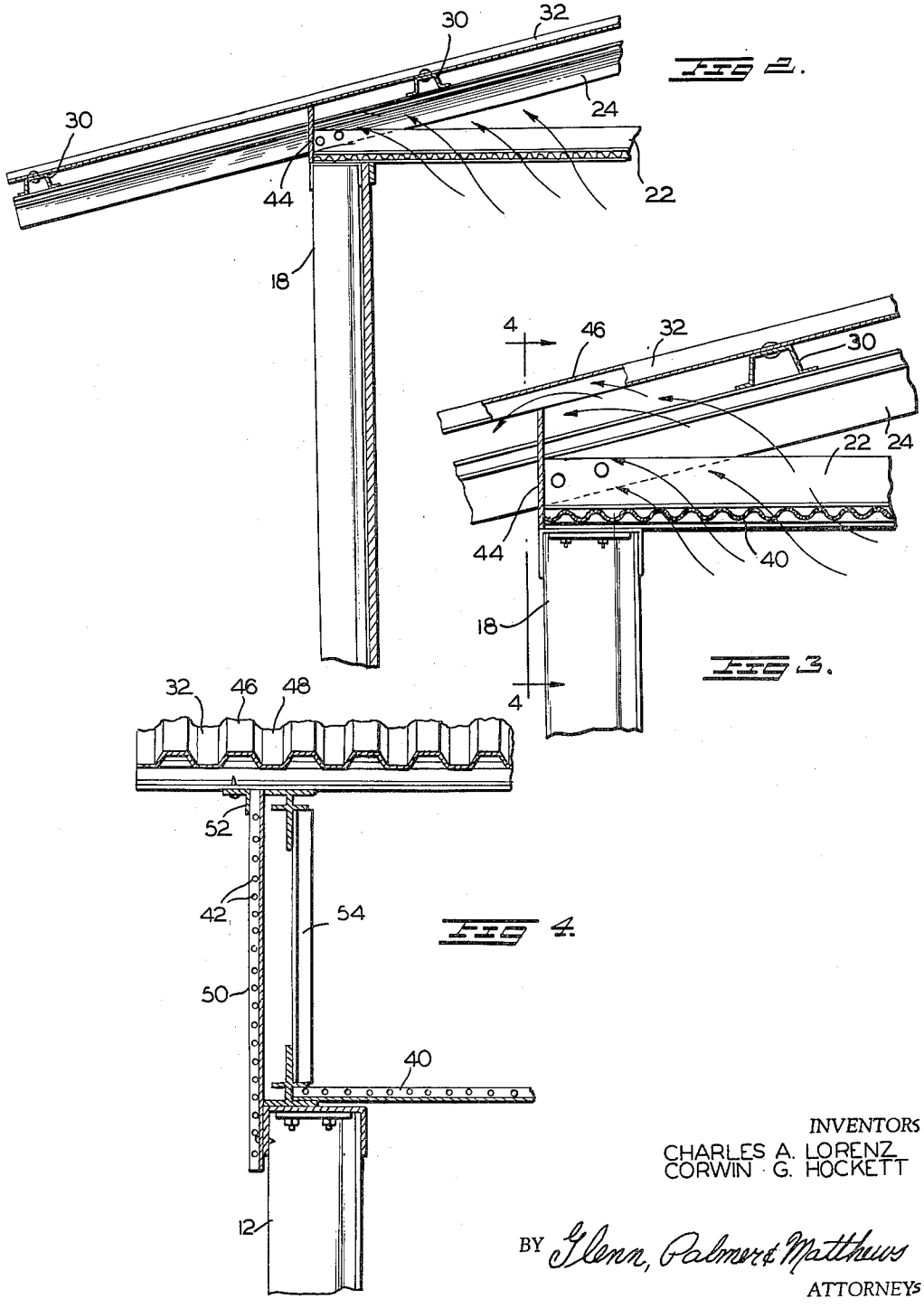

Fig 2.

Fig 3.

Fig 4.

INVENTORS
CHARLES A. LORENZ
CORWIN G. HOCKETT

BY Glenn, Palmer & Matthews
ATTORNEYS

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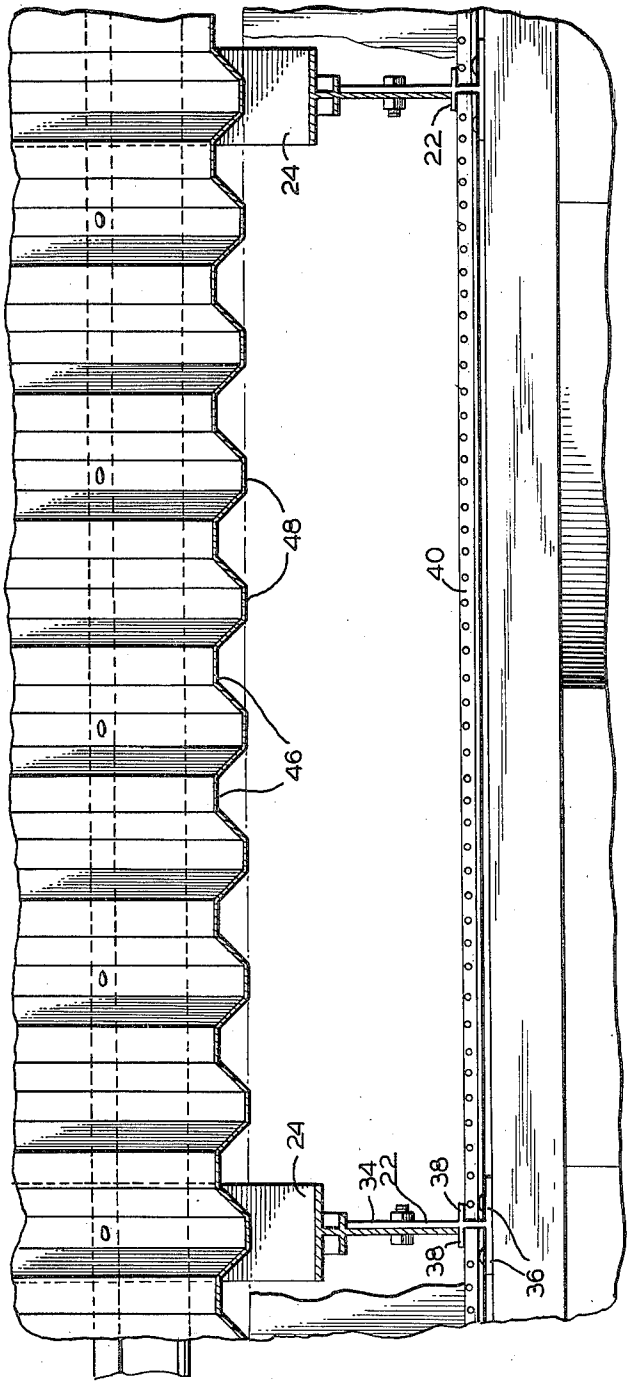

FIG. 5.

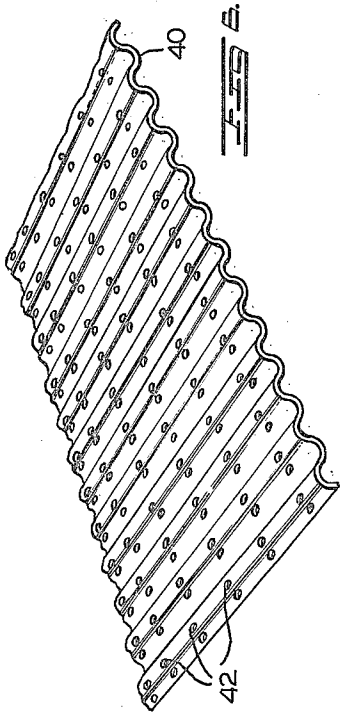

FIG. 6.

INVENTORS
CHARLES A. LORENZ
CORWIN G. HOCKETT

BY Glenn, Palmer & Matthews
ATTORNEYS

United States Patent Office

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BUILDING SYSTEM WITH VENTILATING MEANS

Charles A. Lorenz, Chesterfield County, and Corwin G. Hockett, Henrico County, Va., assignors to Reynolds Metals Company, Richmond, Va., a corporation of Delaware

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8 Claims. (Cl. 98—32)

The present invention relates to building construction and more particularly to a ventilation system for buildings.

Inhabited buildings require ventilation to keep the internal temperature down to satisfactory limits, and to dissipate excessively humid air. Powered air-conditioners or attic fans can be used, but they involve expense and difficulties of installation and maintenance, particularly in remote areas. Windows and doors are satisfactory for admitting outside air to rooms, but some means should be provided for passing at least some of this air through the attic, both to ventilate the rooms and also to help cool the attic. A conventional access opening into the attic will admit some air from below, but this air will not reach all portions of the attic to cool it. In some cases the attic is omitted altogether, so that the air from the rooms of the house all passes directly into the space beneath the roof. This expedient is not entirely satisfactory, however, because the roof is heated by the sun to a temperature above the temperature of the rooms below, and this heat is radiated directly into the rooms below, because there is no intervening attic floor to interrupt this radiation.

In accordance with the present invention an effective but economical ventilation system is achieved by providing an attic space with ventilation openings around its periphery to the outside atmosphere, and by interposing between the attic space and the rooms below a horizontal partition which has numerous and widely distributed small perforations to admit air from the rooms below into the attic space while interposing a reflective barrier to prevent substantial radiation of heat from the roof into the rooms below. The ventilation system of the invention is particularly well adapted to the design of an all metal but nevertheless cool house well suited for tropical conditions, and for erection and use in relatively inaccessible places.

For a better understanding of the invention and its other objects, advantages and details, reference is now made to the present preferred embodiment of the invention which is shown, for purposes of illustration only, in the accompanying drawings. In the drawings:

FIG. 1 is a perspective view of a building employing the invention, with portions of the roof removed and a portion of perforated ceiling sheet partially out of its mounting;

FIG. 2 is an enlarged transverse section taken along the lines 2—2 of FIG. 1, with the lower portion of the wall broken away;

FIG. 3 is a more enlarged view, partially broken away, of the section shown in FIG. 2;

FIG. 4 is a section taken along the lines 4—4 in FIG. 3;

FIG. 5 is a view in side elevation, and partially in section, showing the upper portion of the building including the roof, the truss structure, and the ceiling; and

FIG. 6 is an enlarged and partially broken away diagrammatic view of an individual sheet forming the perforated ceiling of the building.

Referring now more particularly to the drawings, and initially to FIGURE 1, the illustrated building 10 has an end wall 12 with windows 14 and a door 16 therein, and a side wall 18 also having windows 14 therein. The opposite end wall (not shown) and the opposite side wall 20 have windows and doors corresponding to those in

walls 12 and 18, or can have other arrangements of windows and doors as desired. The side walls 18 and 20 extend parallel to each other and support a series of A-frame trusses 21 disposed in parallel spaced vertical planes and each consisting of a horizontal chord member 22, a pair of oppositely slanting upper chord members 24 and 26, and bracing members 28, suitably bolted together. A series of spaced parallel purlins 30 extend across and are bolted to the tops of the respective upper chord members 24 and 26, and corrugated roofing panels 32 are bolted on the purlins 30.

Each of the horizontal truss members 22 has a flat vertical center web 34, a pair of oppositely extending horizontal flanges 36 integral with the bottom of the web 34, and a pair of shorter horizontally extending opposite flanges 38 integral with the web 34 and spaced above the bottom flanges 36 (FIG. 5). The flanges 36 and 38 on each side of the web 34 form a pair of oppositely facing channels which receive the side edges of the corrugated perforated ceiling sheets 40. The sheets 40 can be made of any suitable stiff material, such as metal, plastic or wood, but are preferably made of aluminum or aluminum alloy of the kind conventionally used for soffit purposes. In a typical example, the sheets 40 are prepainted white on one side, are about .019 inch thick, are corrugated in sinusoidal curves having a depth of about ¼ inch and a pitch of about 1¼ inch, and (before corrugation) are perforated with openings 42 of about .094 inch diameter spaced 3/32 inch on centers, so that the total area of the openings through the sheet is about 8% of the total sheet area before corrugation, and in the range of about 8 to 9% after corrugation. While corrugation is desirable, it is not essential, but the relative total area of the openings is important. The relative total area of the openings can be increased or decreased if desired, but preferably should be within the range of about 5% to about 35% of the total area of the ceiling, for the purposes of the invention, because reducing the area of the openings too much reduces air circulation excessively, and increasing the area too much allows the roof to radiate too much heat directly into the rooms below and reduces the ability of the ceiling to reflect back light into the rooms below. If the area of the openings is increased, it is preferable to do so by increasing the number rather than the area of the openings, both for appearance and to block entry of insects.

As shown in FIGURE 1, each ceiling sheet 40 is inserted into the ends of the opposite channels in a pair of adjacent horizontal truss members 22, starting on one side of the house, and is then drawn across to the opposite side of the house. This is repeated until all of the ceiling has been completed (either the whole area within the walls, or any desired part of it). The pre-painted side of each sheet 40 is faced down, and the bare aluminum surface across the top is amply reflective. The corrugations in the ceiling sheet increase its rigidity to help to make it self-supporting between the supporting flanges 36 of the horizontal truss members 22, so that the structure is easily installed and sufficiently rigid in spite of its use of light gauge sheet.

After the sheets 40 have been mounted in place, their ends are closed by vertical plates 44 mounted in the respective spaces bounded by the tops of the side walls, the bottom of the roofing sheets 32, and the sides of the trusses 21. The plates 44 can be perforated to admit air into the attic space enclosed between the ceiling sheets 40 and the roofing panel 32, but this has been found unnecessary in practice, because the roofing sheets 32 have corrugations forming a series of ribs 46 and channels 48 (FIG. 5) extending parallel to the upper truss members 24, and air can pass between the upper edge of the plates 24 and the under surface of the corrugated ribs 46, as shown in FIGURE 3.

Each end of the attic space is vented to the atmosphere through a triangular gable end 50 (FIGS. 1 and 4) mounted across the space between the tops of the respective end walls and the bottoms of the purlins 30 projecting over the end walls. The gable end 50 overlaps the end wall sufficiently to be bolted to it, and the upper end of the gable end 50 is secured between an outside channel member 52 bolted to the purlins 30 and the gable end 50, on the one hand, and the upper truss members 24 and 26 of a truss 54 mounted on the adjacent end wall. Each of the gable ends 50 at the opposite ends of the attic space is preferably made of the same sheet as the ceiling sheet 40, and consequently the perforations 42 through this sheet permit escape of air from the ends of the attic space to the outside atmosphere. Some additional air may pass between the upper edge of the gable ends 50 and the adjacent roofing sheets 32, which are separated from the upper edges of the gable ends 50 by the purlins 30. However, this gap above the edges of the gable ends 50 can be closed, it has been found, without impairing the efficiency of ventilation of the building.

The space in the building 10 below the ceiling sheets 40 can be divided off into any convenient number of rooms, such as by the partition 56 shown in FIGURE 1, without interfering with the ventilating effect of the perforated ceiling sheets 40. Each room formed by the partitions is proportionally ventilated through its ceiling, and the air passing by ordinary thermal convection currents up through the perforations in the ceiling can readily flow out of the attic space all around its periphery through the end gables 50, and through the air spaces provided by the corrugations of the roof along the sides of the house.

While present preferred embodiments of the invention have been illustrated and described, it will be understood that the invention can be otherwise embodied and practiced within the scope of the following claims.

We claim:

1. A ventilated building comprising walls enclosing a space, a horizontal partition made of corrugated metal and extending across the top of said space, a roof forming an attic space over said partition, and means forming ventilating openings to permit escape of air from said attic space to the outside atmosphere, said walls having openings to admit outside air into the space below said partition, and said partition having multiple air passages therethrough each of the order of magnitude of a fraction of an inch in diameter which permit air to pass directly from the space below the partition into the attic space, said air passages being distributed substantially uniformly over a major part of the area of the partition and having a total area of approximately 8 to 9 percent of the total area of the partition.

2. A building according to claim 1 in which the openings venting the attic space to the outside atmosphere are disposed below the roof and extend substantially all around the building.

3. A building according to claim 1 in which the horizontal partition comprises perforated sheet corrugated aluminous metal.

4. A ventilated building with enclosed side and end walls, a roof truss secured to the top of said side walls and extending therebetween including a horizontal member and an inclined member, the inclined member extending diagonally upwardly from both side walls to an apex adjacent the midpoint between said side walls and in vertical alignment with said horizontal member to form a triangular structure, said members having their opposite end portions secured together adjacent said side walls, said horizontal member having a vertical web and oppositely disposed bottom flanges on said web, other oppositely disposed flanges on said web spaced from said bottom flanges to provide a space for inserting a ceiling member therebetween, a plurality of said triangular structures being spaced from each other the length of said building, elongated corrugated ceiling members extending between said side walls and having their opposite side edges disposed between said bottom and other flanges, said ceiling members being perforated substantially throughout their entire area and forming a ceiling for the building, said triangular truss structures forming an attic space immediately above said ceiling members, a corrugated roof secured to said inclined truss members with the corrugations extending in a direction toward said side walls, the portion of said corrugated roof directly above said side walls being spaced from the top of said side walls, side plate members positioned in the space between said roof and the top of said walls and abutting said side walls and the lower portion of said corrugations so air vents are provided by said corrugations extending substantially the entire length of said side walls, and gable plate members abutting said end walls and extending upwardly toward said roof, said gable plate members having ventilating openings therethrough.

5. A building according to claim 4, in which the gable plate members are made of the same perforated corrugated sheet as the ceiling members.

6. A ventilated building comprising walls enclosing a space, a horizontal partition across the top of said space, a roof forming an attic space over said partition, a series of trusses supporting the roof and resting on the walls, a series of parallel spaced horizontal members forming the lower chords of said trusses and having channels along their sides, means forming ventilating openings to permit escape of air from said attic space to the outside atmosphere, said walls having openings to admit outside air into the space below said partition, said partition having multiple openings therethrough which permit air to pass directly from the space below the partition into the attic space, said partition comprising horizontally extending perforated sheets having their opposite sides received in the channels of said horizontal members and supported by said horizontal members, the perforations of said horizontally extending sheets being distributed over a major part of the area of the partition and having a total area across the partition substantially less than the remaining solid area of the partition.

7. A ventilated building comprising walls enclosing a space, a horizontal partition across the top of said space, a roof forming an attic space over said partition, a series of trusses supporting the roof and resting on the walls, a series of parallel spaced horizontal members forming the lower chords of said trusses and having channels along their sides, means forming ventilating openings to permit escape of air from said attic space to the outside atmosphere, said walls having openings to admit outside air into the space below said partition, said partition having multiple openings therethrough which permit air to pass directly from the space below the partition into the attic space, said partition comprising horizontally extending perforated metal sheets having their opposite sides received in the channels of said horizontal members and supported by said horizontal members, said metal sheets having corrugations which extend transversely between the spaced horizontal supporting members, the perforations of said horizontally extending sheets being distributed over a major part of the area of the partition and having a total area across the partition substantially less than the remaining solid area of the partition.

8. A ventilated building structure comprising side walls enclosing a space, a horizontal partition across the top of said space, inclined roof truss means secured to the top of said side walls, a corrugated roof forming an attic space over said partition and secured to said inclined roof truss means with the longitudinal axis of the corrugations extending toward said side walls, the portion of said corrugated roof directly above said side walls being spaced from the top of said side walls, means forming ventilating openings to permit escape of air from said attic space to the outside atmosphere including side plate members positioned in the space between said roof

and the top of said side walls and abutting said side walls and the lower portion of said corrugations so air vents are provided by said corrugations extending substantially the entire length of said side walls, said walls having openings to admit outside air into the space below said partition, said partition having multiple air passages therethrough each of the order of magnitude of a fraction of an inch in diameter which permit air to pass directly from the space below the partition into the attic space, said air passages in said partition being distributed substantially uniformly over a major part of the area of the partition and having a total area across the partition substantially less than the remaining solid area of the partition.

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ROBERT A. O'LEARY, *Primary Examiner.*

MEYER PERLIN, *Examiner.*