March 25, 1952 F. P. BINGMAN 2,590,227

BUILDING CONSTRUCTION

Filed April 7, 1947 2 SHEETS—SHEET 1

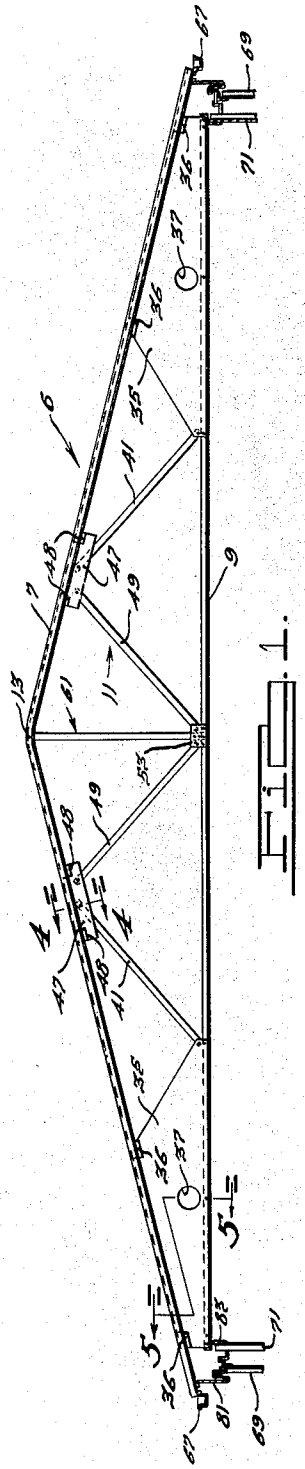


Fig. 1.

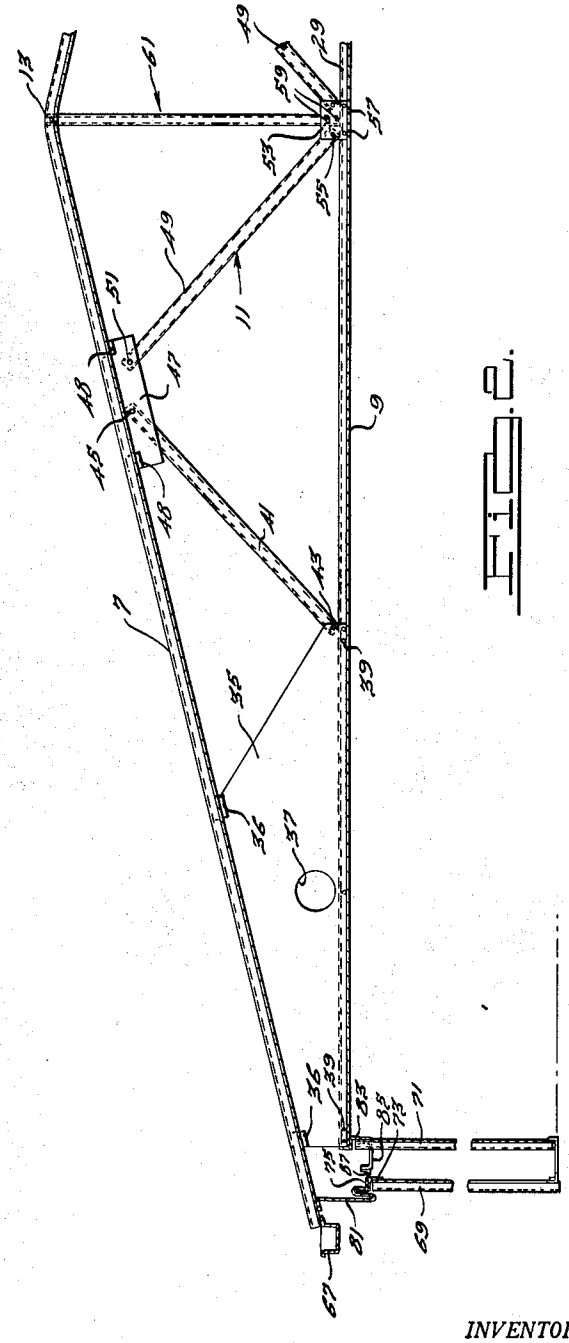


Fig. 2.

INVENTOR.
Frederick P. Bingman.
BY
Harness, Dickey & Pierce
ATTORNEYS.

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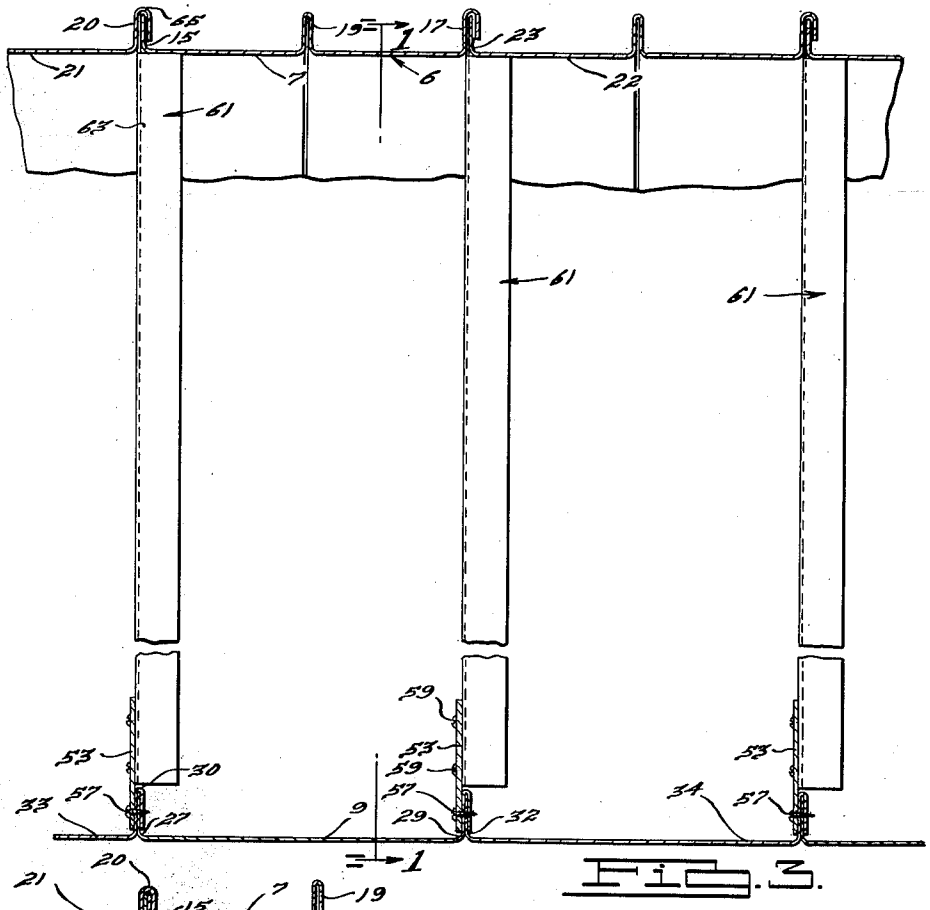


FIG. 3.

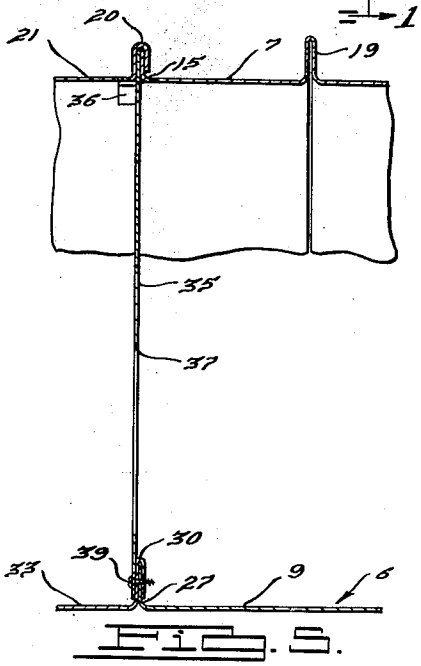


FIG. 5.

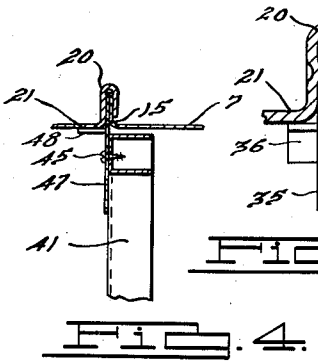


FIG. 4.

FIG. 6.

INVENTOR.
Frederick P. Bingman.
BY
Harness, Dickey & Pierce
ATTORNEYS.

Patented Mar. 25, 1952

2,590,227

UNITED STATES PATENT OFFICE

2,590,227

BUILDING CONSTRUCTION

Frederick P. Bingman, Birmingham, Mich., assignor to The R. C. Mahon Company

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6 Claims. (Cl. 108—23)

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This invention relates to building structures, and more particularly to a building roof structure, the principal object of which is the provision of a roof structure in which a roof skin and ceiling skin form the upper and lower chords, respectively, of the roof truss.

Other objects of this invention include the provision in a roof section of a continuous unbroken roof skin and ceiling skin which form the finished roof and ceiling for a building; the provision of a prefabricated roof section in which a plurality of braces for interconnecting the roof and ceiling skins can be folded together to make a compact package for shipment; the provision of a roof section which is exceptionally rugged in construction and inexpensive to manufacture; the provision of standardized sections for a building which may be quickly and easily assembled together to form the entire roof and ceiling structures for a building; the provision of combined roof and ceiling sections for a building which can be easily and speedily assembled and mounted on any type of wall structure of a building; and the provision of a roof section which has no beams, purlins, or rafters therein, thereby saving material and reducing costs.

These and other objects of this invention will become more apparent from the following detailed description taken in conjunction with the accompanying drawings, in which:

Fig. 1 is a sectional view taken along the line 1—1 of Fig. 3 showing an assembled roof and ceiling structure mounted on side walls of an all metal building;

Fig. 2 is an enlarged view of a portion of the structure illustrated in Fig. 1;

Fig. 3 is a vertical transverse sectional view of a plurality of interconnected roof sections taken substantially at the center thereof;

Fig. 4 is an enlarged fragmentary thin sectional view taken on the line 4—4 of Fig. 1 looking in the direction indicated by the arrows;

Fig. 5 is an enlarged fragmentary thin sectional view taken along the line 5—5 of Fig. 1 looking in the direction indicated by the arrows; and

Fig. 6 is an enlarged fragmentary sectional view illustrating how the flanged marginal side edges of the roof sections are assembled with the vertical bracing and interlocked in the finished structure.

Referring now to the drawings, and more particularly to Figs. 1 and 3, a truss structure generally indicated at 6 comprises three main elements, namely a roof skin 7 continuous from end to end, a continuous ceiling skin 9, and a

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conventional web and brace system, generally indicated at 11, interconnecting the roof skin 7 and the ceiling skin 9. The roof and ceiling skins are formed from a plurality of relatively long, narrow sheet metal strips having integrally formed flanges along their opposite side edges which interfit with similar flanges on the next adjacent strips thereby permitting a structure of any desired dimension to be fabricated. The roof section may be of any conventional shape and type, but is preferably, as illustrated in Fig. 1, constructed of the form of a gable type roof section which is adapted to be mounted upon and span the space between vertical building walls.

In the example illustrated, the side walls are also of flanged sheet metal strips interlocked along their side edges, but it is to be understood that my improved roof and ceiling structure is equally well adapted for mounting upon any type of side wall, whether it be masonry, wood, metal, or otherwise.

Each strip of roof skin 7 of the section 6 is made preferably of a single steel sheet and is bent at its center, as at 13, to form downwardly sloping portions on either side thereof, i. e., a gable roof. Each strip of skin 7 is provided along one longitudinal side edge thereof with an integrally formed, male flange 15 disposed at substantially right angles to the plane of the sheet or strip. The opposite longitudinal side edge of the strip 7 is provided with a similarly disposed, reversely looped, integrally formed, female flange 17, which is formed and adapted to embrace the male flange 15 of a next adjacent strip, as well as a vertical brace, as illustrated in Fig. 6. Intermediate these two flanges 15 and 17, a similarly extending, longitudinally stiffening flange 19 is formed on the roof skin for strengthening and adding rigidity to the entire skin.

Referring to Fig. 3, it will be seen how a plurality of roof section strips 6 may be interconnected with identically constructed strips on each side thereof, so that a complete roof structure can be formed. This is accomplished by positioning the reversely looped female flange 20 of an adjacent roof strip 21 over the upstanding male flange 15 of the strip 7. At the opposite side of the section 6, another adjacent roof strip 22 is connected thereto by positioning the flange 17 of the strip 7 over the male flange 23 on the adjacent strip 22. This interconnecting of roof strips continues until the entire roof of the building is formed. It will be noted that the complementary connected flanges of the skins are se-

cured together such as by dimpling, as illustrated in Fig. 6, after the web and brace system 11 is positioned to interconnect the roof and ceiling skins.

The ceiling skin 9 is also preferably made from a plurality of sheet steel strips formed with a slight longitudinal camber to compensate for loads thereon, and is horizontally disposed with respect to the vertical walls of the building structure. Each strip of the ceiling skin 9 is provided with flanges integrally formed along their opposite side edges in a similar manner to the roof skin 7, that is, on one side edge of the strip, a male flange 27 is formed at right angles to the plane of the sheet, and on the opposite edge a reversely looped female flange 29 is similarly formed, both of which extend the entire length of the strip.

It will be noted, by referring to Fig. 3, that the male flange 27 of the ceiling skin 9 is vertically aligned with the male flange 15 on the roof skin 7 and, likewise, the female flange 29 of the ceiling skin 9 is vertically aligned with the female flange 17 of the roof skin 7. However, the ceiling skin 9 is not provided with a stiffening flange intermediate the flanges 27 and 29 on its opposite edges. As this member is under tension at all times, there is no need for a flange similar to the flange 19 on the roof skin, which is a compression member. It will be noted by referring to Figs. 1 and 2 that the skin 7 overhangs the ceiling skin in the particular structure illustrated, but such detail is not essential to my invention, as the amount of overhang, if any, will vary with different designs of buildings.

The flanges 27 and 29, formed on the ceiling skin 9 are adapted to be connected to complementary flanges formed on adjacent ceiling strips 33 and 34. The reversely looped flange 30 of the strip 33 embraces the upstanding flange 27 of the skin strip 9, and the flange 32 of the ceiling skin strip 33 is adapted to be embraced by the reversely looped flange 29 of the skin strip 9.

In order to interconnect the roof skin 7 and the ceiling skin 9, the web and brace system 11 is provided. It will be noted, by referring to Fig. 1, that each half of this system is identical, and, therefore, only the portion of the web and brace system 11 shown in Fig. 2 will be described. A vertical sheet metal gusset plate 35 is positioned between the roof skin 7 and ceiling skin 9 adjacent their converging ends, and is provided with an aperture 37 therein to allow any necessary wiring, plumbing, heating ducts or the like to pass therethrough.

By referring to Fig. 5, it will be seen that the upper marginal edge of the gusset plate 35 is embraced by the reversely looped female flange 20 of the adjacent roof strip 21 when the roof sections are assembled. These interconnected flanges may then be dimpled together, as illustrated in Fig. 6, to rigidly secure the gusset plate to the roof strip 7 and the adjacent strip 21. Means are provided for accurately positioning the roof strips so as to align them in a plane, and comprise tabs 36 cut from the top marginal edge of the gusset plate 35, and bent at right angles to form seats for supporting the roof strips during assembly and until their respective flanges are locked together. The lower marginal edge of the gusset plate 35 is positioned against the outer face of the reversely looped flange 30 of the ceiling strip 33 and the gusset plate and flanges are secured together by a plurality of self-threading metal screws 39, although it is obvious that other suitable means, such as stove bolts with nuts, may be used.

An inclined brace 41 of channel-shaped cross section, is connected to the gusset plate 35 adjacent the lower and inner end thereof by means of a screw 43. The upper end of the brace 41 is secured adjacent the roof skin 7, by means of a screw 45, to a vertical plate 47, which, as illustrated in Fig. 4, has its upper marginal edge embraced by the reversely looped flange 20 of the adjacent section 21 when the sections are assembled. When the strip 7 is secured to the adjacent roof strip 21 and the interconnected flanges thereon dimpled, as illustrated in Fig. 6, the plate 47 will be fixedly secured between the roof skins.

The plate 47 is also provided with cut and bent tabs 48 to form seats for the strip, similar to and for the same purpose as described with respect to the tabs 36 of the gusset plate 35.

Adjacent the point of connection of the brace 41 to the plate 47, a second inclined brace 49 also of channel-shaped cross section, is connected to the plate 47 by means of a screw 51. The brace 49 is downwardly and inwardly inclined and has its lower end connected to a flat, vertical plate 53 by means of a screw 55. The plate 53 overlaps and lies alongside of the reversely looped flange 29 of the ceiling skin 9 and is secured thereto by means of screws 57 which pass through the plate 53, the flange 29 and the flange 32 on the adjacent ceiling strip 34. Extending vertically upwardly from the plate 53 and connected thereto by a pair of screws 59 is a channel-shaped member or post generally indicated at 61. As illustrated in Fig. 3, at the upper end of the channel-shaped member 61, the web portion 63 thereof, which is parallel to the above-described flanges formed on the roof and ceiling strips, extends upwardly and the end portion 65 thereof is embraced by the female flange of the roof strip and secured thereto in the same manner as is the upper marginal edge of the above-described gusset plate 35. The web and brace system on the opposite side of the roof structure is identical with that previously described, and like numbers are given to like parts therein.

Referring now to Figs. 1 and 2, it will be seen that an eave trough 67 may be secured to the outer marginal portion of the above eave on each side of the roof strip 7 for carrying off the water which drains from the roof skin. It will also be appreciated that condensation water collecting on the inner surface of the roof skin may drain downwardly along the roof skin to a point beyond the hereinafter mentioned outer wall 69.

Any desired number of these sections may be connected together as above described to form a roof structure of any desired length and the resulting structure may be supported on any desired wall structure as above mentioned. For illustrative purposes, the roof structure is shown supported at its opposite sides on spaced outer and inner vertical walls 69 and 71. The outer wall 69 is connected to the roof skin 7 by means of an angle iron 73 which extends longitudinally of and is welded, bolted or otherwise suitably secured to the upper marginal edge of the wall 69. A second similarly extending angle iron 75 is carried by the angle iron 73 and disposed with one flange extending vertically upwardly and embraced in a female member 81 welded or otherwise suitably secured to the roof skin 7. The lower marginal portion of the female member 81 is reversely folded to receive the upwardly ex-

tending flange of the angle iron 75. The inner wall 71 carries an angle iron 83 which extends longitudinally of the upper marginal edge thereof and is welded, bolted or otherwise suitably secured thereto. The angle iron 83 engages the under surface of the ceiling skin 9 adjacent the outer edges thereof and transmits a part of the load of the roof structure to the inner wall 71. The upper ends of the walls 69 and 71 may be secured in the desired spaced relation by brackets 85 and 87 which are carried on the inner and outer walls. These brackets extend to abutting relation and may be welded or otherwise suitably secured together.

It will thus be seen that when it is desired to transport the parts involved in forming the roof structure, the brace system comprising the inclined braces 41 and 49, the vertical post 61, and the mounting plates 53 and 47, can be folded into a small, compact unit. Handling may also be facilitated by shipping separately large numbers of the gusset plates 35, the roof strips 7, and the ceiling strips 9. When these packages are received at the place of construction, it is then possible to connect the web and brace system to the skins and assemble the various sections so as to lock the web and brace system firmly in place. It will be noted that a similar web and brace system, corresponding to the web and brace system 11 of the roof section 6, is furnished for each of the other adjacent sections.

From the foregoing, it will be seen that a prefabricated roofing structure is provided which is especially strong in construction and inexpensive to manufacture and in which the entire roof skin acts as the upper chord and carries the compression load of the roof structure while the ceiling skin acts as the lower chord and carries the tension load for the roof section. In this way, heavy beams, purlins and rafters, commonly employed in roof structures, are eliminated with consequent saving of material and reduction of cost.

In addition to eliminating the above-described conventional roof elements, it will be noted that the ceiling skin forms the finished ceiling for the building. That is, no plaster, lath or the like is required, and the lower surface of the ceiling skin may be painted for decorative purposes as desired. The roof skin likewise forms the finished roof for the building, and may be painted or otherwise treated to protect the surface from the elements.

While only one embodiment of this invention has been illustrated and described, it is to be understood that it is not to be limited thereto, and that it is intended to cover all modifications thereof which would be apparent to one skilled in the art, and which come within the spirit and scope of the appended claims.

I claim:

1. A truss structure comprising a continuous lower sheet forming the tension chord of the truss structure, a continuous upper sheet forming the upper chords of the truss structure, said sheets having their longitudinal side edges deformed to provide male and female flanges respectively whereby a plurality of such truss structures may be interconnected by connecting the male flange of one such truss structure with the female flange of an adjacent structure, a plurality of braces for interconnecting said upper and lower sheets, and means interconnecting said braces and including plate means adapted to be gripped between one of said first-named flanges and a cooperating flange on an adjacent truss structure.

2. A building structure comprising first and second truss structures each including continuous upper and lower sheets affording upper and lower chords of said truss, said truss structures being disposed in adjacent parallel relation and the sheets of each of said first and second truss structures having interfitting male and female flanges respectively along their adjacent edges, a plurality of braces for interconnecting said upper and lower sheets, means interconnecting said braces including plates having portions received between and registering with portions of said flanges, said registering portions of said plates and flanges being secured against relative movement.

3. A building structure comprising first and second truss structures each including continuous upper and lower sheets affording upper and lower chords of said truss, said truss structures being disposed in adjacent parallel relation and the sheets of each of said first and second truss structures having interfitting male and female flanges respectively along their adjacent edges, a plurality of braces for interconnecting said upper and lower sheets, means interconnecting said braces including plates having portions received between and registering with portions of said flanges, said registering portions of said plates and flanges being dimpled to secure said plates and flanges against relative movement.

4. A building structure adapted to be supported on and span the space between associated wall structures, said building structure comprising a ceiling sheet forming the lower tension chord of a truss structure and continuous from one wall structure to the other, a roof sheet continuous from one wall structure to the other and forming the upper compression chords of the truss structure, a plurality of braces interconnecting said sheets, each of said sheets having one marginal side portion deformed to provide a male flange portion disposed at right angles to said sheet, and each of said sheets having its opposite marginal side portion deformed to provide a complementary female flange portion disposed at right angles to said sheet.

5. A building structure adapted to be supported on and span the space between associated wall structures, said building structure comprising a ceiling sheet forming the lower tension chord of a truss structure and continuous from one wall structure to the other, a roof sheet continuous from one wall structure to the other and forming the upper compression chords of the truss structure, a plurality of braces interconnecting said sheets, each of said sheets having one marginal side portion deformed to provide a male flange portion disposed at right angles to said sheet, and each of said sheets having its opposite marginal side portion deformed to provide a complementary female flange portion disposed at right angles to said sheet, said roof sheet also having other flange means formed thereon intermediate said male and female flanges to add rigidity to said roof sheet.

6. A building structure adapted to be supported on and span the space between associated wall structures; said building structure comprising a plurality of truss structures each including a ceiling sheet forming the lower tension chord of a truss structure and continuous from one wall structure to the other, a roof sheet continuous from one wall structure to the other and form-

ing the upper compression chords of the truss structure, a plurality of braces interconnecting said sheets, each of said sheets having one marginal side portion deformed to provide a male flange portion disposed at right angles to said sheet, and each of said sheets having its opposite marginal side portion deformed to provide a complementary female flange portion disposed at right angles to said sheet; said truss structures being disposed with adjacent truss structures interconnected by interfitting male and female flanges; and means for connecting said braces to said sheets, said means being secured to said braces and registering with a portion of said male flanges and being embraced in said female flanges.

FREDERICK P. BINGMAN.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
2,325,747	Dailey	Aug. 3, 1943
2,365,579	Mulligan	Dec. 19, 1944
2,371,421	Blaski	Mar. 13, 1945
2,386,077	Van Norman	Oct. 2, 1945
2,427,021	Rapp	Sept. 9, 1947