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ROOF STRUCTURE FOR USE WITH PREFABRICATED HOUSES

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6 Claims. (Cl. 108—1)

This present application is a divisional application covering a portion of the material disclosed in my co-pending U. S. Patent application Serial No. 675,338 entitled "Prefabricated Packaged House." The subject matter of this present application is limited to those details of structure disclosed in the parent application and which relate specifically to a roof structure with truss supporting means thereof, all of which elements are capable of being prefabricated at a central plant and then folded into a compact package for transportation to the building site. The structure is then particularly adapted to quick and easy erection by a limited crew, and particularly a crew of ordinary workmen, to the end that an economical roof structure is provided; and, because of its being prefabricated in advance, can be erected on the job with a minimum of man-hours of labor.

Persons in this field of endeavor have in the past produced a wide variety of roof structures, the majority of which serve their intended purpose quite satisfactorily. It has been noted, however, in the structures that have been studied that as a rule the home builder is supplied with a confusing array of components which he then has to fabricate into his roof structure on the job. This has made it necessary to employ highly skilled persons for this work and it happens frequently that prefabricated types of houses are erected in far out places, places removed from normal building facilities and naturally removed from centers of population where skilled constructors are readily available. In certain instances that have come under observation, the task of transporting adequately trained personnel to the building site has in many cases made the labor component of a house much higher in money value than the actual house elements themselves. It is to overcome this general deficiency that I have provided my foldable roof structure and it can now be supplied to builders with all the fitting and assembly achieved in the building plant or factory. Further, fullest advantage can thus be taken of technological developments and when the roof structure is sent to the building site the raising requires only a single individual who is versed in this simplified form of building, with the balance of the labor having no requirements for training in this field.

Therefore, the overall cost of a structure of this order erected complete at the building site is believed to be very appreciably less than those other forms of prefabricated housing which have been observed to date.

The principal object of this present invention therefore is to provide a foldable and nestable roof and ceiling structure which can be completely finished at the point of manufacture and can then be folded into a compact shipping package for economical and safe transportation; and when the building site is reached, the roof structure can be raised in its final position by untrained labor for use very quickly.

A further object of this present invention is to provide a packaged roof unit which can be purchased by a builder as a finished package of merchandise, and because it is predicated normally upon the four-foot module plan, these units can be employed to construct the roofs of a wide variety of structures.

A further object of this present invention is to provide a packaged roof unit which can be constructed economically at a factory wherein a length of material and type of material can be selected so that they will each serve their intended purpose, but wherein a very substantial saving can be made by the expedient of employing lower grades of lumber where they will serve their purpose, and where short lengths can be employed thus making it possible to use the lower grades of lumber without detriment to the final structure.

A further object is to provide an improved method of constructing and erecting a prefabricated roof and ceiling structure.

Further objects, advantages and capabilities will be apparent from the description and disclosure in the drawings, or may be comprehended or are inherent in the device.

In the drawings:

Figure 1 is a perspective view showing sequential steps in the erection of a roof built after the teachings of my present invention;

Figure 2 is a perspective view, certain parts of which are broken away, illustrating the truss members making up one of my roof panels;

Figure 3 is an exploded perspective view showing the means employed to secure the foot of the truss-supporting strut and further illustrating the adjustment means employed in the extensible tension member employed in my truss;

Figure 4 is a fragmentary view showing a typical eave with certain parts in section;

Figure 5 is a sectional view taken substantially along line 5—5 of Figure 1;

Figure 6 is a sectional view taken along line 6—6 of Figure 4; and

Figure 7 is a fragmentary perspective view of the roof structural members as joined at the eave.

Referring more particularly to the disclosure in the drawings, my roof consists essentially of
sheeting 10 which forms the base for the type of roofing material it is desired to use. The type of roofing usually influences the type of material used for the sheeting. The most common form is to employ two or more transversely positioned boards which may be laid in edge engagement with each other, or which may be spaced apart so as to give better ventilation for certain types of roofing materials, such as shingles for instance. Under such conditions the sheeting is normally formed of relatively narrow boards to further assure ventilation of the underside of the roof covering. There are certain forms of structure where plywood may be more desirable especially where thin metallic roofing or some of the various patent roofing papers may be employed.

The sheeting is supported on a plurality of rafters as 12, 14 and 16. These rafters are selected of a size suitable for the particular load-carrying requirements and of course may be arranged to provide any designed roof slope. The rafters, however, are normally used in units of three which are secured together in spaced relationship by the sheeting 10. This form of construction, particularly adapted as it is for prefabricated housing, is usually made on some common module. The most prevalent is four feet apart, which forms the standard plywood panel size and in the arrangement illustrated that would place the rafter members on two foot centers, or 16-inch centers if a second intermediate rafter is used.

There is a further consideration in the selection of the rafters however in that the various roof sections are fitted with their sides abutting in order to make a complete roof. Therefore rafters 12 and 16 substantially abut the outside rafters 12 and 16 of the adjoining roof sections. Consequently it has been found expedient to have these rafters which form the margins of the roof panels, substantially one-half the thickness of the center rafters as 14 and in this way a uniform load-supporting roof is provided without excessive weight or unnecessary wastage of material. For the use to which this form of roof is adapted it is desirable that the roof be self-supporting except for the bearing points at the eaves. This means that the entire load of the roof rests on the eave portions of the finished roof sections and leaves the entire floor space clear so that any desired arrangement of partitions, or even the complete lack of partitions, can be achieved. Such a structure of course to be made in substantial widths and to maintain a reasonably light weight structure definitely requires a truss supporting arrangement and this has been employed.

It will be observed by a study of Figures 1 through 5, that it requires two of these prefabricated combination units to form a complete bent of a building. This arrangement is provided in order to keep the overall size and weight of each prefabricated unit down to a point that will permit of its easy handling and avoid the necessity for a large erection crew.

To insure economical employment of standard size building sheets, such as wall boards, plaster boards, plywood, and the like, I have, for my present construction, adopted a four-foot module, and it has been found that adequate structural strength can be obtained by employing a central truss unit of the dimensions that will adequately carry the roof loading with a given span dimension and to employ on each end of a standard combination unit, members of one-half this thickness, retaining the same depth of all members. It will then be apparent that when the marginal members of one unit are adjoined to the marginal members of an adjoining unit, the resulting truss structure will equal the strength of the central members. Following out this principle, I employ a chord, or ceiling joint members 22, 24 and 26 and at their centrally disposed ends I provide bolt holes, as 28, so that each may be secured with its companion half chord or ceiling member. At the wall end of chord members 24 I provide a spacer 30 secured thereto and these members are hingedly secured, as by bolts 32, to rafter members 14. Pivotally secured substantially at its mid-point to rafter 14, as by another bolt 32, is a compression member 34. At its lower end compression member 34 is provided with a shoe 35 and a rest member 36, which is in turn secured to chord 24. This construction is probably best illustrated in Figures 2 and 3. Owing to the spacer 30, the compression member 34 can swing freely around will, because of its own weight, swing into position where the locking lip 37 is locked behind and under rest 36. This provides the essential compression member of the truss and also provides a means for holding the half-roof sections in position during the erection stage, as is illustrated in Figure 1, where the roof of one combination unit has been raised to its normal position awaiting the raising of its companion building unit so that the two members, or half-roof sections, may be fully joined together to form one bent, as is also illustrated in Figure 1.

At the roof peak end of rafter 14 I provide another spacer, as 38, and pivoted about bolt 39 a tension member 40, much after the teaching of compression member 34, so constructed that, as the roof is raised to its position of use, this member 40, without any attention from the erectors, will expand in length to provide that, in its raised position, it will form the truss tension member which in turn supports compression member 34. In my present showing I provide as one satisfactory form that the tension member 40 be made in two parts, and that one of these parts, as 42, be provided with a longitudinal slot 44 so that bolt 45 may rest in the lower end of the same as viewed, in its folded position, in Figure 1A, during the shipping period; and when raised to the position of use, bolt 45 will come into firm engagement with the upper end of slot 44, and thus be able to assume the tension load it is designed to carry.

At the various load carrying pivot joints I prefer to use a reinforcing bearing device 47, normally referred to as a ring cotter, which is inletted, as at 46, one half in each of the adjacent members. This construction relieves the pivot of all structural load, distributes the load over a large area of the timbers used, and prevents wear during the working of the pivot joint.

The marginal members of each half or combination unit are provided with half thickness chord members 22 and 26 and half thickness rafter members 12 and 16. These rafter members are pivotally secured to their corresponding chord or ceiling members, as by bolts 45, respectively. These members form part of the marginal trusses for each section, and have compression members 50, which are pivotally connected to their corresponding rafters but at their lower ends, owing to the fact that they can be easily reached by the assembling crew, and the further fact that compression member 34 is ade-
quate to support the roof during its erection period, a simplification of their seat in chord members 22 and 26 is indicated. This I have provided for in my present arrangement by notching the chord members at 52, after the showing particularly of Figure 2.

The tension member for the half-thickness or marginal trusses is provided by tension members 54 and 56, which are pivotally secured to the roof peak end of the rafter members and are secured, as by bolting thereto, to the chord members 22 and 26. It is desired to point out that the compression members as 50 and 54, while shipped pivotally to their corresponding point in the rafter member, are hand assembled in their engagement with the chord members after the roof has been raised, as indicated in Figure 1. It has been found most convenient and practical in erection to have member 50 of full thickness, or in other words, for it to be twice the thickness of the chord members 22 and 26, so that one half of member 50 will lie on each of the chord members which are joined together to form the marginal members of the adjacent units. This has a further desirable characteristic in that the member 50, extending into the cut or dap 52 occurring in both of the chord members, serves to key them together and to prevent longitudinal displacement of the same with respect to each other.

As the roof peak end of the thin or half-thickness rafter members, I provide a separator 58, thus when the adjoining section is brought into position adjacent the section already in place, ample space will be provided for member 50 to be swung into position and, when secured in snug engagement with each other, as by bolts 61 and 63, and possibly through nailing, the half-chord members not only join the adjacent sections together well, but form a properly spaced and adequate securing surface for the ceiling material that is secured underneath the chord members. The ceiling 64 is normally secured to the prefabricated roof unit in the factory, as it can be applied most economically there. A fibrous board may be used or a stiff board or plaster board may be used with insulation secured to the upper surface of the same. The ceiling is shown in Figure 4, indicated by the dashed lines in Figure 5, but has been omitted, for the sake of clarity, in Figure 1.

Normally as the building unit leaves the production plant, it may or may not be provided with the desired type of roofing. It will be apparent, however, that any form of roofing acceptable in the vicinity where the house is to be built, could be substituted therefor. In any event, however, it is necessary to employ roof sheeting as 10. This sheeting serves to tie the various truss members together and to provide a degree of stiffness which is highly desirable in this form of construction. It has been shown in the description of the invention herein to be perfectly satisfactory, and the desired roof, or rafter, is clearly shown in Figure 2. The roof member 70 extends downwardly a sufficient distance to clear the upper margin of the plate members 72 of the wall section.

In order to secure the roof sections to the wall, I have provided each truss member with an angle bracket 74 best shown in Figures 6 and 7. These angle brackets are secured to rafters 12 and 16 by the pivot bolts 49 and to ceiling joist member 24 by pivot bolt 32. The lower horizontal legs of angle brackets 74 are secured to the upper plate 12 of the roof unit. This may be done as desired by as bolts 76 as shown, or by bolts going completely through the plate, or by lag screws.

Erection

The foundation, floor and walls of the building are first completed in any suitable manner. The next step is to raise the rafter assembly after the showing of the left hand side of Figure 1, so that the full strength central compression member 34 can be swung into its locked position on seat 36. This compression member, with its full strength chord member 24 and rafter member 14, have adequate strength to hold the unit in its upright or raised position.

The third step is to raise the right hand combination unit similarly and secure the two units together by bolting or nailing members 66 to each other. The next step is to secure the inward ends of the ceiling or chord members 22, 24 and 26 together. This is accomplished by inserting bolts through previously bored holes in the chord members and an overlaying splice member 74 as will be best understood from a study of Figure 1. When this has been accomplished, the roof truss members have sufficient supporting strength for the next step in erection.

Due to the overall length of the roof unit being greater than the distance between the inside walls, it is most convenient to employ two graduated horses as 78 and 76 so the roof units can be assembled in an inclined position.

For the erection I prefer to use gin poles 60 which are suitably secured in position. In actual raising, to insure that no side stresses are placed upon the structure, I have found it expedient to use spreaders as 82 having hooks descending downwardly and engaging the marginal chord members so that the two roof units can be raised as a unit to form a single roof bent of the house. The actual raising can best be accomplished by the use of the common locking winches 84. If only one man is available for the operation, he can take a turn or two successively on the winch on each end of the bent and thus raise the entire section itself. It is of course necessary to raise one end higher than the other in order that the eave portions will not engage the inside of the walls.

It is believed that it will be clearly apparent from the above description and the disclosure in the drawings that the invention comprehends a novel construction of a roof structure for use with prefabricated houses.

Having thus disclosed the invention, I claim:

1. A prefabricated roof and ceiling section providing, together with an identifying section on the opposite side of the gable, a bent of the roof and ceiling portions of a building, comprising: a half-strength side rafter on each side of said section and a full-strength intermediate rafter; roof sheeting running transversely of said rafters and tying the same together; a half-strength side ceiling joist on each side of said section and full-strength intermediate ceiling joist; the eave ends of said rafters and joists being positioned side by side with side rafters adjacent corresponding side joists and the intermediate rafter adjacent the intermediate joist, and connecting
means pivotally securing said eave ends of adjacent rafters and joists together, by which means the rafters and joists may be brought together in an inter-fingered relationship forming a compact unit for handling and transportation; a full-strength intermediate tension link pivotally connected at one end to the gable end of said intermediate rafter and pivotally connected at the other end to the central portion of said intermediate joist, said intermediate tension link being formed of two members and having slot and key means therebetween connecting said members together permitting telescoping of said intermediate link when the gable ends of said rafters and joists are separated; a full-strength intermediate compression member pivotally connected at its upper end to the central portion of said intermediate rafter and connecting shoe means on the lower end of said intermediate compression member and on the central portion of said intermediate joist, providing means for securing the lower end of said intermediate compression member to said intermediate joist to accept a compressive load when the gable ends of said rafters and joists are separated; half-strength side tension links pivotally connected at their upper ends to the gable ends of said side rafters, and connecting means at the lower ends of said side tension links and at the central portion of said side joists for securing the same together when the gable ends of said rafters and joists have been separated; and a full-strength side compression member having its upper end pivotally connected to the central portion of one of said side rafters and the central portion of said side joist having aligned recesses for accepting the lower end of said side compression member to hold it in position to accept a compressive force.

2. A prefabricated roof and ceiling section providing, together with an identical section on the opposite side of the gable, a bent of the roof and ceiling portions of a building, comprising: a side rafter on each side of said section and an intermediate rafter; roof sheathing running transversely of said rafters and tying the same together; a side ceiling joist on each side of said section and an intermediate ceiling joist; the eave ends of said rafters and joists being positioned side by side with said rafters adjacent corresponding side joists and the intermediate rafter adjacent the intermediate joist, and connecting means pivotally securing said eave ends of adjacent rafters and joists together, by which means the rafters and joists may be brought together in an inter-fingered relationship forming a compact unit for handling and transportation; an intermediate tension link pivotally connected at one end to the gable end of said intermediate rafter and pivotally connected at the other end to the central portion of said intermediate joist, said intermediate tension link being formed of two members and having slot and key means therebetween connecting said members together permitting telescoping of said intermediate link when the gable ends of the rafters and joists are brought together and providing automatic positioning of said intermediate link when the gable ends of the rafters and joists are separated; a full-strength intermediate compression member pivotally connected at its upper end to the central portion of said intermediate rafter and connecting shoe means on the lower end of said intermediate compression member to hold it in position to accept a compressive force.

3. A prefabricated roof and ceiling section providing, together with an identical section on the opposite side of the gable, a bent of the roof and ceiling portions of a building, comprising: a half-strength side rafter on each side of said section and an intermediate rafter to accept a compressive load when the gable ends of said rafters and joists are separated; half-strength side tension links pivotally connected at their upper ends to the gable ends of said side rafters, and connecting means at the lower ends of said side tension links and at the central portion of said side joists for securing the same together; a half-strength ceiling joist on each side of said section and a full-strength intermediate ceiling joist; the eave ends of said rafters and joists being positioned side by side with said rafters adjacent corresponding side joists and the intermediate rafter adjacent the intermediate joist, and connecting means pivotally securing said eave ends of adjacent rafters and joists together, by which means the rafters and joists may be brought together in an inter-fingered relationship forming a compact box-shaped unit for handling and transportation; an intermediate tension link connected at one end to the gable end of said intermediate rafter and connected at the other end to the central portion of said intermediate joist, said tension link being collapsible so said rafters and joists can be brought together in said inter-fingered relationship; a rigid intermediate compression member pivotally connected at its upper end to the central portion of said intermediate rafter and interlocking means between the lower end of said intermediate compression member and the central portion of said intermediate joist whereby said compression member can be positioned parallel to said rafters when said rafters and joists are brought together in said inter-fingered relationship and said compression member will swing down into position to engage said intermediate joist when said rafters are raised; and securing means connected to the free end of said ceiling unit for securing it to the ceiling unit of the opposite section.

4. A prefabricated roof and ceiling section providing, together with an identical section on the opposite side of the gable, a bent of the roof and ceiling portions of a building, comprising: a side rafter on each side of said section and an intermediate rafter; roof sheathing running transversely of said rafters and tying the same together; a side ceiling joist on each side of said section and an intermediate ceiling joist; the eave ends of said rafters and joists being positioned side by side with said rafters adjacent corresponding side joists and the intermediate rafter adjacent the intermediate joist, and connecting means pivotally securing said eave ends of adjacent rafters and joists together, by which means
the rafters and joists may be brought together in an interfingered relationship forming a compact box-shaped unit for handling and transportation; an intermediate tension link connected at one end to the gable end of said intermediate rafter and connected at the other end to the central portion of said intermediate joist, said tension link being collapsible so said rafters and joists can be brought together in said interfingered relationship; a rigid intermediate compression member pivotally connected at its upper end to the central portion of said intermediate rafter and interengaging means between the lower end of said intermediate compression member and the central portion of said intermediate joist whereby said compression member can be positioned parallel to said rafters when said rafters and joists are brought together in said interfingered relationship and said compression member will swing down into position to engage said intermediate joist when said rafters are raised; and securing means connected to the free end of said ceiling unit for securing it to the ceiling unit of the opposite section.

5. A prefabricated roof and ceiling section providing, together with an identical section on the opposite side of the gable, a bent of the roof and ceiling portions of a building, comprising: a rectangular roof unit running from an eave to the gable; a rectangular ceiling unit running from an eave halfway to the opposite eave, said ceiling unit being of substantially equal width to said roof unit; connecting means pivotally securing the eave end of said roof unit to the eave end of said ceiling unit; a tension link pivotally connected at one end to the gable end of said roof unit and pivotally connected at the other end to the central portion of said ceiling unit, said tension link being formed of two members and having a slot and key means therebetween connecting said members together permitting telescoping of said link when the gable end of said roof unit and the free end of said ceiling unit are brought together and providing automatic positioning of said intermediate link when the gable end of said roof unit is raised from said ceiling unit; a compression member pivotally connected at its upper end to the central portion of said roof unit and connecting shoe means on the lower end of said compression member and on the central portion of said ceiling unit providing means for securing the lower end of said intermediate compression member to said ceiling unit to accept a compressive load; and securing means connected to the free end of said ceiling unit for securing it to the ceiling unit of the opposite section.

6. A prefabricated assembly providing a bent of the roof and ceiling portions of a building, comprising: two rectangular roof units of equal widths, each running from an eave to the gable on opposite sides of the gable; two rectangular ceiling units of equal widths, each running from an eave halfway to the opposite eave, said ceiling units being of substantially equal widths to said roof units; connecting means pivotally securing in pairs the eave end of each of said roof units to the eave end of one of said ceiling units; a tension link for each roof unit, said tension link being connected at one end to the gable end of the roof unit and being connected at the other end to the central portion of the paired ceiling unit, said tension link being collapsible so that the paired roof and ceiling units may be brought together forming a compact unit for handling and transportation; a rigid compression member for each roof unit, said compression member being pivotally connected at one end to the central portion of the roof unit and interengaging means between the lower end of said compression member and the central portion of the paired ceiling unit whereby the paired roof and ceiling units may be brought together by positioning the compression member parallel to the roof unit and said compression member will swing down into position to engage said ceiling unit when said roof unit is raised; securing means for connecting together the free ends of the two ceiling units when the roof units are raised; and securing means for connecting together the gable ends of said roof units.

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