

PATENT SPECIFICATION (11)

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(54) ROOF STRUCTURE

(71) We, YOSHIDP KOGYO K.K., a Japanese body corporate of 1 Kanda, Izumi-cho, Chiyoda-Ku, Tokyo, Japan, do hereby declare the invention, for which we

we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to a roof structure for a building, and more particularly to a roof structure of a penthouse type for a veranda and like.

For the construction of a roof of a penthouse type, rafters are directly mounted on a horizontal rafter support secured to a structure of a housing or a wall as well as on a horizontal cross beam positioned at a given distance from the rafter support. Then, roof members are placed on the rafters. Accordingly, an inclination of a roof to be constructed is dependent on an inclination of the rafters.

Hitherto, for achieving a desired inclination for a roof, the shape or dimension of a rafter support should be so selected or worked as to accommodate itself to a desired inclination of the roof, in addition to the selection or determination of the level of a cross beam positioned on the opposite side to the rafter support. This results in an expenditure of much time and efforts for constructing a roof having a desired inclination. Meanwhile, for the construction of a roof of a penthouse type, there sometimes arises a need to adjust an inclination of the roof, because of the positional relationship between the roof and other structure of a building. In such a case, it has been a common practice to disassemble or dismantle a roof constructed, and then the rafter support or beam should be worked for modification, and then assembled, thus resulting in difficulties in the adjustment or alternation of an inclination of the roof.

It is accordingly an object of the present invention to provide a roof structure which is easy in assembly and disassembly, high in toughness, and allows adjustment of an inclination of a roof with ease.

According to the present invention, there is provided a roof structure comprising: a horizontal rafter support provided on the wall surface of a structure; a horizontal beam provided at a fixed distance from said rafter support parallel therewith; inclined rafters each placed on and spanning the gap between said rafter support and said beam on top thereof in a manner that a load on the rafters may be borne by said rafter support and said beam; purlins placed on top of said rafters in the direction crosswise thereof; and roof members placed on top of said purlins; and brackets each being of L-shaped cross-section having a base portion secured to said rafter support or said beam and an upright portion extending from one end of said base portion, each bracket having an elongate hole which admits fastening means therein securing said rafters to said brackets adjustably along the length of said elongate hole, so that the inclination of said rafters can be adjusted.

Accordingly, an inclination of rafters may be varied or adjusted without a need to work the rafter support and cross beam for modification, and as a result, there may be provided a roof structure, in which an inclination of a roof may be adjusted or varied with ease.

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

Figure 1 is a longitudinal cross-sectional view of a roof structure according to the present invention;

Figure 2 is a cross-sectional view showing a joint of a rafter to fixing means; and

Figure 3 is another embodiment of a roof structure according to the present invention, which is similar to Figure 1.

Referring now to Figure 1, an angle piece 2 having a substantially "L" shaped cross section is secured to the side wall of a structure 1 of a building. A rafter support 3 is mounted horizontally on an upper portion of the angle piece 2.

The rafter support 3 is made of a section metal of a substantially rectangular shape in cross section, and has top and bottom walls, and two side walls. In this respect, channels 4, 5, 6 of rectangular cross-section with a slot extending longitudinally in one wall are provided on the top and bottom walls, and one of the side walls and are disposed in the interior of the rafter support 3 so as to extend along the length thereof and open outwardly of the support 3. Heads of bolts 7 are loosely fitted in the interior of the channel 5 with the bolt shanks extending through the slot for securing the rafter support 3 to the angle piece 2, and thus the rafter support 3 may be moved along the length thereof, as required. The rafter support 3 may be fastened rigidly by tightening the nuts 7¹ to the bolts 7. The respective end portions of rafters 8 are placed on the rafter support 3 at a given spacing in parallel relation to each other. The end portions or rafters 8 abut a corner edge 3a of the rafter support 3, which is rounded as shown in Figure 1.

Brackets 9 equal in number to the number of the rafters 8 are positioned on the top surface of the rafter support 3.

Each bracket 9 is of a 'L' shaped cross section, including a flat base portion 9a and an upright portion 9b adapted to abut the side of rafter 8. An elongated hole 10 is inclined leftwardly upwards, as viewed in the drawing, and provided in the upright portion 9b. The base portion 9a is secured to the rafter support 3 by means of bolts 11 and nuts 11¹, with the heads of bolts 11 being loosely fitted in the interior of the channel 4 provided in the rafter support 3. Thus, the base portion 9a may be shifted along the channel 4, as required.

At least two posts 12 are provided upright at a given distance from the structure 1. A horizontal cross beam 13 is mounted on tops of the posts 12 substantially in parallel with the rafter support 3.

The cross beam 13 is made of a section metal of a substantially rectangular shape in cross section, while two channels 14, 14 of rectangular cross-section with a slot extending longitudinally in one wall are provided in its bottom wall in the interior of the beam 13 so as to open outwardly of the beam 13 and extend along the length of the beam 13 in parallel relation to each other, i.e., in the bottom wall which abuts the top surface of the post 12. Heads of bolts 15, 15 are loosely fitted in the channels 14, 14. The beam 13 may be moved along the length thereof relative to the post 12, as required.

Meanwhile, the beam 13 is secured to the post 12 by means of bolts 15 and nuts 15¹ through the medium of a coupling plate 12a secured to the post 12 by means of screws.

Another slotted channel 16 is provided

on the interior and at the centre of the top wall of the beam 13 in a manner to extend along the length of the beam 13 and open upwards of the beam 13. The top opposite corners 13a, 13a of the beam 13 are rounded. Brackets 17 of the same number as that of the rafters 7 are provided on the top surface of the beam 13.

Like the bracket 9, each bracket 17 includes a flat base portion 17a and an upright portion 17b which is adapted to abut the side of the rafter 8, and is of a 'L' shaped cross section. An elongated hole 18 is provided in the upright portion 17b and inclined at an acute angle to the vertical direction. The base portions 17a of the brackets 17 are secured to the beam 12 by means of the bolts 19, whose heads are loosely fitted in the channel 16, and nuts 19¹, and thus the base portions 17a may be moved along the channel 16, as required.

At least one pair of rafters 8 are mounted on top of the horizontal rafter support 3 and beam 13 in a manner to span same.

The rafters 8 are made of a section metal similar to that used for the rafter support 3. Slotted channels 20, 20 and 21 are provided on the interior of the both side walls and top wall of the rafter 8 in a manner to extend along the length of the rafter 8 and open outwardly thereof. The heads of bolts 22, 22 are loosely fitted in the channel 20 provided in the side wall of the rafter 8. Threaded portions of bolts 22, 22 are inserted into the elongated holes 10, 18 provided in the brackets 9, 17, respectively, while nuts 23, 23 are threaded on the tip portion of threaded portions of the bolts 22, 22 so that the rafter 8 may be rigidly secured to the rafter support 3 and beam 13 through the medium of brackets 9, 17 by the bolts 22 and nuts 23.

Meanwhile, brackets 9, 17 may be positioned on the opposite sides of the rafter 8 as shown in Figure 2. This ensures further rigid joints of these members.

An inclination of the rafter 8 may be finely adjusted without changing the level of beam 13. More particularly, the bolts 22 extend through the elongated holes 10 or 18 provided in the brackets 9 or 17. Thus, even after tightening the nuts 23 to the bolts 22, the level of one end of the rafter 8 may be adjusted or varied, and an inclination of the rafter 8 may be adjusted. After the adjustment, the nuts 23 are again tightened to the bolts 22 so as to provide a desired inclination for the rafters.

In this case, either one of the ends of the rafter 8 is somewhat lifted from the beam 13 or rafter support 3. However, during adjustment, the weight of the roof is still substantially borne by means of brackets 9 or 17 through the medium of bolts 22 and nuts 23.

In case the level of beam 13 is determined

beforehand so as to give a desired inclination to the rafter 8, there may be achieved a desired inclination for the rafters without lifting the rafter 8 from the beam 13 or rafter support 3 as shown in Figure 1, because of the provision of the elongated holes 10, 18. In this respect, even if the level of beam 13 is varied at every roof construction, since the bolt 22 extends through the aforesaid elongated hole 10 in the bracket 9 rather than a circular hole, the rafter 8 will not cause interference with the corner edge 3a of the rafter support 3. As a result, the rafters 8 may be secured in position positively rigidly with ease at a desired inclination.

Two or more purlins 24 are provided on the rafters 8 in the direction crosswise of the latter.

The purlins 24 are made of a section metal similar to the rafter support 3 and rafter 8, while slotted channels 25, 25 and 26 are provided in the interior of the side walls and top wall thereof in a manner to extend along the length of a purlin and open outwardly thereof.

A bracket 31 of a 'L' shaped cross section is secured to one side of the purlin 24, which is secured to the bracket 31 by means of bolts 27 having their heads loosely fitted in the channel 25, and nuts 27¹ threaded thereon. In addition, the bracket 31 is secured to the rafter 8 by means of bolts 28, whose heads are loosely fitted in the channel 21, and nuts 28¹ threaded on the bolts 28.

Roof members 29 are placed on top of the purlins 24, and secured thereto by means of bolts 30, whose heads are loosely fitted in the channel 26, and nuts 30¹ threaded thereon.

Some of the purlins 24 may be placed upside down i.e. with their channels 26 adjacent the rafters 8.

Figure 3 shows another embodiment of the present invention, in which a rafter support 3¹ is used in place of the rafter support 3, and purlins 24¹ are used in place of purlins 24.

The rafter support 3¹ is made of a section metal of a rectangular cross sectional shape having flanges to be secured to the structure 1, while a slotted channel 4¹ is provided in the interior of and in the top wall of rafter support 3¹ in its center, in a manner to extend along the length of the rafter support 3¹. Loosely fitted in the channel 4¹ are heads of bolts 11 to secure the rafter support 3¹ to a bracket 9.

With the aforesaid arrangement, the rafter support 3¹ may be secured to the structure 1 without using an angle piece 2.

Purlin 24¹ is made of a section metal whose cross-sectional shape has an upper portion of substantially square shape with a pair of leg portions extending from and parallel to two opposite sides of the upper portion, the

leg portions having inwardly directed feet portions resting on the upper surface of the rafter 8, while a slotted channel 25¹ is provided in the interior of and in one side wall of the purlin 24¹ in a manner to extend along the length of the purlin 24¹ and open outwardly thereof. The purlin 24¹ is secured to the rafter 8 by means of a bracket 31¹ similar to the brackets 9, 17. Roof members 29 are secured to the purlins 24¹ by means of J bolts 32.

In this manner, the roof members may be secured to the rafters 8 by means of J bolts.

As is apparent from the foregoing description, the rafters are secured to brackets provided on the rafter support as well as on the beam in a manner that an inclination of the rafter may be adjusted, so that an inclination of the rafters may be selected as desired, depending on the circumstances of a roof to be constructed.

In addition, bolts for use in fastening brackets to rafters extend through elongated holes provided in the brackets. Accordingly, even in case the level of the beam is changed so as to provide a desired inclination to the rafters, the rafters may be positively rigidly secured to the rafter support and beam without modifying the brackets, with the rafters being maintained in contact with the rafter support and beam.

This dispenses with a need to select or modify a rafter support and the like, commensurate to a desired inclination of a roof. In addition, the roof may be constructed with ease rigidly at a desired inclination.

In addition, the brackets are provided in a manner to be moved along the length of the rafter support and beam along the lip channels provided therein, respectively, as required, so that the attaching positions of rafters may be selected, as required.

Still furthermore, in case the rafter support, rafters and purlins are made of the same type section metal, the cost of section metals may be lowered. In addition, the roof may be constructed, without modifying section metals.

WHAT WE CLAIM IS:—

1. A roof structure comprising: a horizontal rafter support provided on the wall surface of a structure; a horizontal beam provided at a fixed distance from said rafter support parallel therewith; inclined rafters each placed on and spanning the gap between said rafter support and said beam on top thereof in a manner that a load on the rafters may be borne by said rafter support and said beam; purlins placed on top of said rafters in the direction crosswise thereof; and roof members placed on top of said purlins; and brackets each being of L-shaped cross-section having a base portion secured to said rafter support or said beam and an upright portion extending from one end of

beforehand so as to give a desired inclination to the rafter 8, there may be achieved a desired inclination for the rafters without lifting the rafter 8 from the beam 13 or rafter support 3 as shown in Figure 1, because of the provision of the elongated holes 10, 18. In this respect, even if the level of beam 13 is varied at every roof construction, since the bolt 22 extends through the aforesaid elongated hole 10 in the bracket 9 rather than a circular hole, the rafter 8 will not cause interference with the corner edge 3a of the rafter support 3. As a result, the rafters 8 may be secured in position positively rigidly with ease at a desired inclination.

Two or more purlins 24 are provided on the rafters 8 in the direction crosswise of the latter.

The purlins 24 are made of a section metal similar to the rafter support 3 and rafter 8, while slotted channels 25, 25 and 26 are provided in the interior of the side walls and top wall thereof in a manner to extend along the length of a purlin and open outwardly thereof.

A bracket 31 of a 'L' shaped cross section is secured to one side of the purlin 24, which is secured to the bracket 31 by means of bolts 27 having their heads loosely fitted in the channel 25, and nuts 27¹ threaded thereon. In addition, the bracket 31 is secured to the rafter 8 by means of bolts 28, whose heads are loosely fitted in the channel 21, and nuts 28¹ threaded on the bolts 28.

Roof members 29 are placed on top of the purlins 24, and secured thereto by means of bolts 30, whose heads are loosely fitted in the channel 26, and nuts 30¹ threaded thereon.

Some of the purlins 24 may be placed upside down i.e. with their channels 26 adjacent the rafters 8.

Figure 3 shows another embodiment of the present invention, in which a rafter support 3¹ is used in place of the rafter support 3, and purlins 24¹ are used in place of purlins 24.

The rafter support 3¹ is made of a section metal of a rectangular cross sectional shape having flanges to be secured to the structure 1, while a slotted channel 4¹ is provided in the interior of and in the top wall of rafter support 3¹ in its center, in a manner to extend along the length of the rafter support 3¹. Loosely fitted in the channel 4¹ are heads of bolts 11 to secure the rafter support 3¹ to a bracket 9.

With the aforesaid arrangement, the rafter support 3¹ may be secured to the structure 1 without using an angle piece 2.

Purlin 24¹ is made of a section metal whose cross-sectional shape has an upper portion of substantially square shape with a pair of leg portions extending from and parallel to two opposite sides of the upper portion, the

leg portions having inwardly directed feet portions resting on the upper surface of the rafter 8, while a slotted channel 25¹ is provided in the interior of and in one side wall of the purlin 24¹ in a manner to extend along the length of the purlin 24¹ and open outwardly thereof. The purlin 24¹ is secured to the rafter 8 by means of a bracket 31¹ similar to the brackets 9, 17. Roof members 29 are secured to the purlins 24¹ by means of J bolts 32.

In this manner, the roof members may be secured to the rafters 8 by means of J bolts.

As is apparent from the foregoing description, the rafters are secured to brackets provided on the rafter support as well as on the beam in a manner that an inclination of the rafter may be adjusted, so that an inclination of the rafters may be selected as desired, depending on the circumstances of a roof to be constructed.

In addition, bolts for use in fastening brackets to rafters extend through elongated holes provided in the brackets. Accordingly, even in case the level of the beam is changed so as to provide a desired inclination to the rafters, the rafters may be positively rigidly secured to the rafter support and beam without modifying the brackets, with the rafters being maintained in contact with the rafter support and beam.

This dispenses with a need to select or modify a rafter support and the like, commensurate to a desired inclination of a roof. In addition, the roof may be constructed with ease rigidly at a desired inclination.

In addition, the brackets are provided in a manner to be moved along the length of the rafter support and beam along the lip channels provided therein, respectively, as required, so that the attaching positions of rafters may be selected, as required.

Still furthermore, in case the rafter support, rafters and purlins are made of the same type section metal, the cost of section metals may be lowered. In addition, the roof may be constructed, without modifying section metals.

WHAT WE CLAIM IS:—

1. A roof structure comprising: a horizontal rafter support provided on the wall surface of a structure; a horizontal beam provided at a fixed distance from said rafter support parallel therewith; inclined rafters each placed on and spanning the gap between said rafter support and said beam on top thereof in a manner that a load on the rafters may be borne by said rafter support and said beam; purlins placed on top of said rafters in the direction crosswise thereof; and roof members placed on top of said purlins; and brackets each being of L-shaped cross-section having a base portion secured to said rafter support or said beam and an upright portion extending from one end of



5 said base portion, each bracket having an elongate hole which admits fastening means therein securing said rafters to said brackets adjustably along the length of said elongate hole, so that the inclination of said rafters can be adjusted.

10 2. A roof structure as set forth in claim 2, wherein said elongate hole extends at an acute angle to the perpendicular to the base portion of said bracket.

15 3. A roof structure as set forth in Claim 1, wherein said fastening means is a combination of a bolt and a nut; said rafters are made of a section metal of a rectangular cross section; and a channel having inwardly directed lips defining a slot is provided on the side wall of each of said rafters and loosely retains the heads of said bolts therein, said channel extending along the length of said rafter in the interior thereof.

20 4. A roof structure as set forth in Claim 3, wherein said channels are provided on the opposite side walls in the interior of said rafter, which is secured to said rafter support and said beam by means of a respective pair of said brackets provided on said rafter support and said beam, said each pair of brackets being positioned on the opposite sides of each of said rafters.

30 5. A roof structure as set forth in any one of the preceding Claims, wherein said rafters are arranged to be borne by said rafter

support and said beam, during adjustment of the inclination of the rafters, by means of contact between the rafters and a corner edge of each of said rafter support and said beam, irrespective of an inclination selected.

6. A roof structure as set forth in Claim 5, wherein the corner edges of said rafter support and said beam are rounded.

7. A roof structure as set forth in Claim 1, wherein said rafter support and said purlins are made of a section metal of the same shape.

8. A roof structure as set forth in Claim 1 or 7, wherein said purlins and said roof members are fastened by means of bolts extending through said roof members and nuts threaded on the tip portions of said bolts, said bolts having heads which are loosely fitted in a channel having inwardly directed lips defining a slot and provided on said purlin.

9. A roof structure as set forth in Claim 1, 7 or 8, wherein said purlins and said roof members are fastened by means of J bolts.

10. A roof structure as shown in Figures 1 and 2 or Figure 3 appended to the specification.

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