

PATENT SPECIFICATION

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(54) CEILING ASSEMBLY

(71) We, YOSHIDA KOGYO K.K., a Japanese Corporation, located at No. 1, Kanda Izumi-cho, Chiyoda-ku, Tokyo, Japan, do hereby declare the invention, for which 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:-

The present invention relates to a ceiling assembly.

As a conventional means for attaching a ceiling below a slab with a certain distance therefrom, there can be mentioned a method in which a ceiling base such as a ceiling joist composed of steel is constructed by using bolts hung down from the lower face of the slab and ceiling panels are attached to the lower face of the ceiling base by using fitting fixtures or the like. Today, such as section steels and steel plates or band steels formed in a U or W-shape in section, used for construction materials in general, are utilized to provide a device for attaching the ceiling, and such ceiling joist is attached below the slab with a certain distance therefrom by using special fitting fixtures and ceiling panels are attached to the lower face of the attached ceiling joist. Accordingly, processing of such ceiling joist, assembling and attachment operations or drilling operation for formation of screw holes at field (*in situ*) become inevitably complicated and the operation efficiency of the productivity in the manufacture of the joists is extremely low.

According to the present invention there is provided a ceiling assembly comprising a ceiling joist consisting of a molded or extruding frame member having a screw-receiving groove formed on a lower side thereof in the longitudinal direction of the joist, a screw inserted into said screw-receiving groove, a ceiling panel having a groove formed on a side edge thereof and a fixing means inserted into said groove of the ceiling panel, said ceiling panel being disposed along the lower

face of said ceiling joist and fixed thereto through said fixing means supported by said screw.

The invention will be described by way of examples with reference to the accompanying drawings, wherein:-

Figure 1 is a view showing the cross section of the main portion of a first embodiment of the ceiling assembly of the present invention in the state where it is assembled;

Figure 2 is a perspective view showing a J-shaped ceiling joist consisting of an extruded frame member of aluminium;

Figure 3 is a view showing the cross section of a second embodiment of the ceiling assembly of the present invention of the state where it is assembled;

Figure 4 is a view showing the cross section of a third embodiment of the ceiling assembly of the present invention;

Figure 5 is a perspective view showing a molded frame member having a channel section, namely a section having a shape resembling a lipped channel;

Figure 6 is a perspective view showing a plate-like grooved frame member to be inserted in the interior of the molded frame member shown in Figure 5;

Figure 7 is a view showing the cross section of the main portion of a fourth embodiment of the ceiling assembly of the present invention in the state where it is assembled so that upper portions of partition walls are supported; and

Figure 8 is a view showing the section taken along the line VII-VII in Figure 7.

The ceiling joist constituting the main part of each ceiling assembly to be described hereinafter as embodying the present invention is characterized in that it consists of a frame member having generally a channel section, for example a lipped channel section, which is formed by extrusion of aluminium. This frame member can be formed very easily even if it has a special

profile. A groove for a screw for fixing a ceiling supporting fitting fixture is continuously formed on this frame member.

Another characteristic feature of each described ceiling assembly embodying the present invention is that a groove is formed in a side edge of a ceiling panel and an end portion of a fitting fixture is inserted in this groove and the fitting fixture is dismountably attached to the lower face of the ceiling joist very easily by utilizing a screw.

Referring to Figures 1 and 2, a ceiling joist C includes an upper side 1, a longitudinal intermediate side 2 and a lower side 3 and it is extruded or molded to have generally a channel section, and holes 4 are formed on the upper side 1 at certain intervals. These holes 4 are formed for insertion of bolts 5 for attaching the ceiling joist C to the lower end of a slab or other ceiling joist attachment member. The vertical position of the ceiling joist C is determined by positions of nuts 6 and 6' on the bolts 5.

A screw-receiving groove 7 is formed in the central portion of the lower side 3 of the ceiling joist C in the longitudinal direction thereof, and dovetail grooves 9 and 9' are formed one on each side of the screw-receiving groove 7 so that air-tight sealing members 8 and 8' can be inserted therein.

It is indispensable that this screw-receiving groove 7 should have a width sufficient to screw into this groove 7 a self-tapping screw 12 for fixing a strip-like fitting fixture 11 for supporting a ceiling panel 10. When the screw 12 is driven in the screw-inserting groove 7, screw threads are formed on both sides of the groove 7 and the screw 12 is fixed. As is seen from Figure 2, the ceiling joist C is arranged so that the open portion 0 thereof is disposed in the lateral direction and the upper side is suspended by bolts 5. Accordingly, there is a risk of expansion of open portion 0 by the weight of the ceiling panel 10 or the like. However, in order to ensure prevention of expansion of the open portion 0, it is preferred that a holding plate 13 be fitted and fixed between the upper and lower sides 1 and 3.

A groove 14 is formed in the side edge of the ceiling panel 10 so that the strip-like fitting fixture 11 can be fitted therein.

At the time of assembling the ceiling of Figures 1 and 2 *in situ*, bolts 5 are suspended from a slab 20 and the lower ends thereof are inserted into the holes 4 formed on the upper side 1 of ceiling joist C, and the position of the ceiling joist C is set by adjusting nuts 6 and 6'. Before or after this positioning operation, holding plates 13 are fitted at predetermined intervals between the upper side 1 and lower side 3 of the ceiling joist C.

As shown in Figure 1, the ceiling panels 10 are disposed along the lower face of the ceiling joist C, and by rotating the strip-like fit-

ting fixture 11 through 90° inserted through the space between the ceiling panels 10, an end part of the fitting fixture 11 is fitted in the groove 14 formed on the side edge of each ceiling panel 10 and the fitting fixture 11 is fixed by the screw 12. The screw 12 is driven into the groove 7, which has a width smaller than the outer diameter of the screw 12, and the screw 12 is screwed into said groove 7, forming screw threads on both sides of the groove 7.

In the embodiment illustrated in Figure 1, partition walls are disposed in addition to ceiling plates 10. A screw 16 is inserted into a hold of a partition-bordering member 15, and the top end of the screw 16 is driven into the above-mentioned screw-receiving groove 7. Figure 1 is drawn as if the position of the screw 16 were overlapped on that of the screw 12, but practically, the fitting position of the screw 16 is deviated from that of the screw 12 in the longitudinal direction of the screw-receiving groove 7.

After the member 15 is attached to the lower portion of the ceiling joist C in the above-mentioned manner, the partition wall 19 is fixed to this member 15 by a screw 17. Air-tight sealing members 18 and 18' may be disposed on this member 15 according to need. Such air-tight sealing members may be composed of a material customarily used in this field, for example, a rubber, synthetic resin or felt.

Referring to Figure 3, illustrating a second embodiment of the present invention, two projecting ribs 21 are formed at the center of the lower side 3 of the ceiling joist C, with the groove 7 between them, and air-tight sealing members 22 and 22' are disposed on both sides of the projecting ribs 21 so that an air tight seal can be kept between the projection ribs 21 and each ceiling panel 10.

A third embodiment of the present invention will now be described with reference to Figures 4 to 6.

A ceiling joist C₁ consists of a frame member 25 having a downwardly open lip-shaped channel section and a plate-like molded or extruded frame 26. Preferably, both of the frame members 25 and 26 are formed by extrusion of aluminium.

The frame member 25 includes a top plate 27 and side plates 28 and 28' suspended from both sides of the top plate 27. Inwardly projecting supporting portions 29 and 29' are formed on the lower edges of these side plates 28 and 28', respectively. Dovetail grooves 30 and 30' are formed in the respective supporting portions 29 and 29' and air-tight sealing members 31 and 31' are formed in the respective supporting portions 29 and 29' and air-tight sealing members 30 and 30' are fitted in the dovetail grooves 30 and 31' respectively.

Holes 32 are formed at predetermined

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intervals in the upper portion of the frame 25, and bolts 5 projecting from a slab 20 or the like are inserted and fixed in these holes 32.

5 The extruded frame 26 to be inserted into the extruded frame 25 has a generally plate-like shape as shown in Figure 6. In the under-
10 side of the center of the plate-like frame member 26, a screw-receiving groove 7 is formed along the longitudinal direction
15 thereof between projecting walls 37 and 37', and horizontal supporting portions 33 and 33' for resting in contact with the supporting
20 portions 29 and 29' are formed on both sides of the screw-receiving groove 7. The supporting
25 portions 33 and 33' project laterally from the upper edges respectively of two vertical flanges, see Figures 6 and 7, so that the
30 strength is improved and these supporting portions 33 and 33' and vertical flanges are tightly fitted in and engaged with the
above-mentioned supporting portions 29 and 29', respectively. Dimensions of these supporting portions 29 and 29' and 33 and
35 33' are set so that when the frame members 25 and 26 are combined, the lower ends A of the supporting portions 29 and 29' (see Figure 5) and the lower ends B of the supporting
portions 33 and 33' (see Figure 6) are located in the same plane.

At the assembling operation, the bolt 5 suspended from the slab 20 is inserted into the hole 32 formed on the top plate 27 of the extruded frame member 25 and they are
35 fixed by nuts 6 and 6'. Then, the frame member 26 is inserted into the frame member 25, and a screw 34 is inserted into the screw-receiving groove 7 and a part of the screw 34 is made to project upwardly
40 through a hole 35 formed in the upper portion of the screw-receiving groove 7. When the top end of the screw 34 arrives at the underneath face of the top plate 27 of the frame member 25, the frame member 26 is
45 pressed downwardly by the repulsive force of the top plate 27 and the supporting portions 33 and 33' of the frame member 26 are pressed against the supporting portions 29 and 29' of the frame member 25. Then, ceiling
50 panels 10 are disposed along the lower face of the thus assembled ceiling joist C₁, and the top ends of the fitting fixture 11 are inserted in the grooves 14 formed in the side edges of the panels 10. A screw 36 is inserted into a
55 hole of the fitting fixture 11 and this screw 36 is screwed into the screw-receiving groove 7 of the frame member 26, whereby the ceiling panels 10 are attached to the lower face of the ceiling joist C₁.

60 Figures 7 and 8 illustrate a fourth embodiment of the present invention in which partition walls are disposed.

A projecting rib 37 extends from the central portion of an extruded frame member 26
65 having a screw-receiving groove 7 formed

therein and an air-tight sealing member is disposed on the side face of the projecting rib 37. As in the embodiment shown in Figure 4, the ceiling attachment apparatus is assembled, and then an extruded frame member 39
70 is fixed to the lower portion of the frame member 26 by means of a screw 40 so that the top face of the frame member 39 is closely contacted with the lower face of a ceiling panel 10. A groove 41 is formed in the
75 top face of the frame member 39 and an air-tight sealing member 42 is fitted in this groove 41. Further air-tight sealing members 44 and 44' are disposed in grooves in side plates 43 and 43' of the frame member 39, respectively. The top end of a partition wall
80 46 is supported by a screw 45 by utilizing holes formed in the side plates 43 and 43' and another side plate 43'' formed integrally with or separately from the frame member 39. Thus, assembling of the ceiling attachment
85 apparatus and supporting of the top end of the partition wall have been completed.

As shown in Figure 4, the screw-receiving groove 7 is formed on the frame member 6, and further, the projecting ribs 37 and 37' are formed on this frame member 26 so that a
90 sufficient strength is imparted to not only the frame member 26 but also the entire ceiling joist C₁. However, since these projecting ribs 37 and 37' are in contact with the side faces of the ceiling panels 10, there are formed
95 groove-like clearances in the portions where the projecting walls are present. In this case, if joint fillers 46 are fitted in these clearances, a structure having a good appearance can be obtained.

As will be apparent from the foregoing embodiments of the present invention, since a frame member constituting the ceiling joist
105 is preferably formed by extrusion of aluminium, even a ceiling joist having a peculiar and complicated sectional shape can easily be manufactured at a low cost.

In the embodiments illustrated in Figures 110 1 to 3, since the frame member constituting the ceiling joist C has a channel section and an open portion 0 is formed in the lateral direction, attachment of this ceiling joist C by means of bolts 5 can be remarkably facilitated.
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Moreover, since the holding plate 13 is disposed in this open portion 0, deformation of the open portion 0 of the ceiling joist C can be completely prevented.
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Still further, since two projecting ribs 21 (37 and 37' in Figure 7) are formed at the central portion of the lower plate 3 of the ceiling joist C and the screw-receiving groove 7 is formed between these projecting ribs, the strength of not only the lower plate 3 but also the entire ceiling joist C can be remarkably improved. Still in addition, since the screw-receiving groove 7 is formed in the longitudinal direction of the ceiling joist C
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and the ceiling panel 10 can be supported by screwing a screw into this groove 7 anywhere therealong, the fitting fixture 11 to be fitted in the groove 14 formed on the side edge of the ceiling panel can be fixed at an optional position.

In the embodiments shown in Figures 1 to 3, grooves 9 and 9' for attachment of air-tight sealing members may be formed in the lower face of the lower plate 3 of the ceiling joist C, and by fixing air-tight sealing members 8 and 8' into these grooves, good air-tightness can be maintained between the ceiling joist C and the ceiling panels 10. Furthermore, since the side portion of the ceiling joist C is open, the height of the ceiling joist C can easily be adjusted.

In the embodiments illustrated in Figures 4 to 8, the ceiling joist C₁ consists of two extruded frame members 25 and 26, and at first, the upper frame member 25 having a section having a shape resembling a lipped channel can be fixed to the supporting portion, for example, the lower face of the slab 20 by means of bolts and nuts. After fixing the lipped channel section frame member 25 and the ceiling panel 10 is fixed through the screw and fitting fixture 11 by utilizing the screw-receiving groove 7 formed on the frame member 26. Accordingly, the ceiling panel 10 can be attached and fixed very easily.

Since the screw-receiving groove 7 is formed in the longitudinal direction of the ceiling joist C or C₁, a liner 15 or frame 39 for attachment of a partition wall can be fixed very easily by utilizing this screw-receiving groove 7.

WHAT WE CLAIM IS:-

1. A ceiling assembly comprising a ceiling joist consisting of a molded or extruded frame member having a screw-receiving groove formed on a lower side thereof in the longitudinal direction of the joist, a screw inserted into said screw-receiving groove, a ceiling panel having a groove formed on a side edge thereof and a fixing means inserted into said groove of the ceiling panel, said ceiling panel being disposed along the lower face of said ceiling joist and fixed thereto through said fixing means supported by said screw.

2. A ceiling assembly as recited in claim 1 wherein said ceiling joist comprises a molded or extruded frame member having an upper side, a longitudinal intermediate side and a lower side and holding plates extending over both the upper and lower sides of said molded or extruded frame member and holding the free edges thereof, said holding plates being mutually spaced apart.

3. A ceiling assembly as recited in claim 1, wherein said ceiling joist comprises a molded or extruded frame member having a

shape in cross section resembling a downwardly open lipped channel and another molded frame member with its sides supported by the lips of the first mentioned molded frame member and having a screw-receiving groove formed on the lower side thereof in the longitudinal direction.

4. A ceiling assembly as recited in claim 1, wherein an air-tight sealing member is attached to the lower side of said ceiling joist so that said air-tight member is interposed between said lower side and said ceiling panel.

5. A ceiling assembly as recited in claim 2 or 3, wherein a screw for supporting a partition wall is driven into said screw-receiving groove formed on the lower side of said ceiling joist.

6. A ceiling assembly as recited in claim 2 or 3, wherein a suspension bolt is fixed to the upper side of said ceiling joist.

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2. A ceiling assembly as recited in claim 1 wherein said ceiling joist comprises a molded or extruded frame member having an upper side, a longitudinal intermediate side and a lower side and holding plates extending over both the upper and lower sides of said molded or extruded frame member and holding the free edges thereof, said holding plates being mutually spaced apart.

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