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(71) Applicant: **Howarth Timber Engineering Limited**
Bury St Edmunds
Suffolk IP32 7QW (GB)

(72) Inventor: **Smith, Roger**
Thurston,
Suffolk IP31 3PB (GB)

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(74) Representative: **Lipscombe, Martin John et al**
Nash Matthews
90-92 Regent Street
Cambridge CB2 1DP (GB)

(54) **Improvements in or relating to joist hangers and the like**

(57) A joist hanger is described which comprises one or more open-topped joist receiving sockets, each socket being defined by two side cheeks and a bridge section which joins the lower ends of the two side cheeks, the joist hanger further comprising one or more flanges by which the hanger can be secured to an abutting face and/or upper edge of a wall or beam, characterised in

that the two side cheeks diverge from the bridge section to the open top of the joist receiving socket, so that the width of the socket is greater at the top than the bottom, such that a joist will fit snugly in the socket between the two side cheeks in the region of the bridge section but the upper portion of the socket is wider to facilitate entry therinto of the joist.

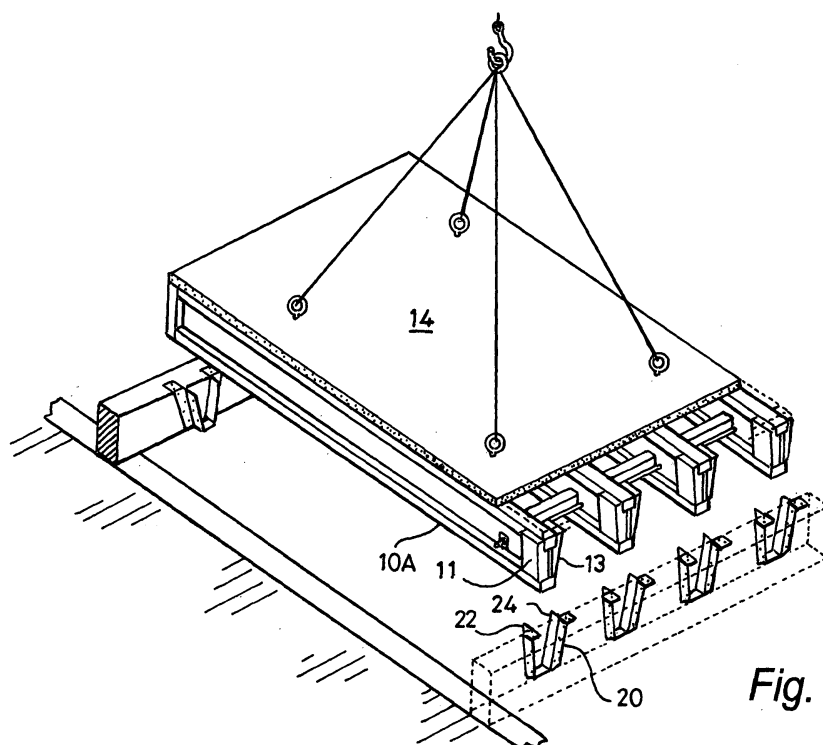


Fig. 2

Description

Field of Invention

[0001] This invention concerns joist hangers and in particular joist hangers which are to be employed in locating pre-fabricated floor panels by engaging and supporting ends of joists forming part of such panels. It is to be understood that a floor panel between floors of a building can also be thought of as a ceiling panel when viewed from below and the expression floor panel employed herein is intended to cover both.

Background to the invention

[0002] It is known to construct floor and ceiling panels off-site and deliver them to where they are required ready to be lifted into position, typically by a crane. Each panel is comprised of a plurality of parallel spaced apart joists below and secured to a decking sheet of wood such as plywood or chipboard or the like. The latter typically includes lifting eyes by which the assembly can be lifted into place by a crane during construction.

[0003] Since the load bearing components of the panel are the joists, it is necessary for at least the ends of the joists to rest on load bearing walls or into the sockets of joist hangers attached to walls or timber beams.

[0004] This method of assembly of the floors and ceilings of a building is especially popular in the case of so-called timber framed buildings, where the load bearing walls are constructed from timber panels which are secured at their ends to form corners or longer runs of walls. Furthermore it is customary for the buildings to be pre-assembled where the wall and floor panels are constructed. In this way the positions of the joists relative to ring beam timbers or upper edges of wall panels or intermediate beams on which they are to be supported, can be determined, and the joist hangers secured to the relevant timber while the floor panels are in position. The floor panels can then be lifted clear of the supporting joist hangers and the pre-assembled building parts dismantled to allow them to be shipped to where the building is to be permanently constructed.

[0005] Since the joist hangers have been positioned exactly where the joists are to be located relative to the rest of the structure, the assembly of floor panels to beams and walls is greatly simplified. The nails or screws used to secure the ends of the joists to the cheeks of the hangers can be inserted after the panel has been lowered into position, since the ends of the joists will be fully supported by the hangers even though they are not secured to the cheeks of the hangers.

[0006] Whilst this method of assembly works well in theory, difficulties can arise in practice especially if there is any appreciable cross wind and/or there are insufficient personnel to position the panels precisely relative to the joist hangers, to enable each panel to drop into the sockets formed by the hangers. The present invention pro-

vides a modified joist hanger and a method of assembly of a building, each of which helps to overcome this problem.

Summary of invention

[0007] According to a first aspect of the invention, there is provided a joist hanger comprising one or more open-topped joist receiving sockets, each socket being defined by two side cheeks and a bridge section which joins the lower ends of the two side cheeks, the joist hanger further comprising one or more flanges by which the hanger can be secured to an abutting face and/or upper edge of a wall or beam, characterised in that the two side cheeks diverge from the bridge section to the open top of the joist receiving socket, so that the width of the socket is greater at the top than the bottom, such that a joist will fit snugly in the socket between the two side cheeks in the region of the bridge section but the upper portion of the socket is wider to facilitate entry thereof of the joist.

[0008] The wider upper end of each socket allows a joist-containing floor panel to be lowered into position without the precision needed if the side cheeks of the joist hanger sockets are parallel, since it is only necessary to position the floor panels so that the lower edges of the joists register with the wider openings in the hanger sockets. Once the lower edges of the joists have entered the upper end of the sockets, the joists and therefore the panel of which they form a part, will be centred as they move downwardly towards the narrower lower end of the socket.

[0009] By providing diverging cheeks in the hangers to facilitate the introduction of the joists into the sockets, the joists will only be gripped between the cheeks at the bottom of each socket. Whilst this may be acceptable it is preferable for each joist end to be held captive over the full depth of the joist and to this end the cross section of at least the end of each joist may preferably be trapezoidal so as to form a wedge, the diverging faces of which diverge with an included angle similar to (but not greater than) that by which cheeks of the hanger socket diverge.

[0010] In a second aspect the invention provides a combination of a joist hanger as defined above, with a joist received in the joist receiving socket of the joist hanger. The joist hanger is typically formed of metal, such as steel, but could be formed from any sufficiently rigid, durable material. The joists used with the joist hanger of the invention are typically formed wholly or predominantly of timber. The joist may conveniently be of rectangular cross-section or I-shaped cross-section along most of its length, but it is also possible that the joist may possess the trapezoidal cross section over its whole length.

[0011] Alternatively means may be provided for locating between the joist ends and the side cheeks of a hanger as aforesaid, to fill the triangular gaps and provide full support for the joist over the whole of the depth.

[0012] Thus in one arrangement triangular cross sec-

tion fillets may be fitted between the faces of the joist and the side cheeks of the hanger to fill the space therebetween.

[0013] The fillets may be secured to the opposite faces of the end of each joist.

[0014] The fillets may for example be of wood or metal or rubber or plastics material and they may be nailed, stapled, screwed or stuck to the joist faces.

[0015] The two fillets may be replaced by a single wedge shaped member having a central slot into which the end of a joist can be fitted. Again such members may be secured to the joist as by nailing, stapling, screwing or by an adhesive or by virtue of interference fit between the sides of the slot and the joist.

[0016] In the case of a timber I-beam cross-section joist the trapezoidal end cross section may be achieved in a similar manner with fillets secured for example to opposite faces of the central web of the I-beam, or by a slotted wedge adapted to receive and be secured to the end of the joist typically to an end of the central web.

[0017] Alternatively the trapezoidal shape may be formed by a metal structure comprising one or two parts adapted to be fitted to the upper and lower rails of the I-beam so as to extend therebetween, the outer faces of the metal structure being spaced from the central web by a greater distance in the region of the upper rail than in the region of the lower rail, so as to form the trapezoidal shape.

[0018] However formed, the included angle between the inclined faces of the fillets or metal structure is substantially the same as, but not greater than, that between the diverging cheeks of a joist hanger constructed in accordance with the one aspect of the invention, to which the joist is to be fitted.

[0019] Preferably the joist hanger top flange or flanges, which are to overlie a wall or beam, extend orthogonally from the plane of the flange or flanges which will in use abut and be secured to the face of the wall or beam, but parallel to the bridging section at the lower ends of the two cheeks. In this way in use the top flange(s) will be square to and lie flat on the upper surface of the wall or beam. In this regard the improved joist hanger proposed by the present invention is significantly different from conventional joist hangers which may on occasions be supplied with the cheeks bent so that they diverge but in order to be fitted to a beam or wall, the cheeks must first be bent so as to be parallel, to enable the top flanges to lie square to the top of the wall or beam on which they are to rest and to which secured. Were a conventional joist hanger to be attached to a beam or wall, so that the cheeks are splayed apart the top flanges of such a hanger would not lie square to and flat on the top of the beam or the wall.

[0020] The invention is of particular benefit when constructing intermediate floors and ceilings of large area buildings, in which each floor is made of two (and more normally a large number of) different panels, and intermediate beams extend across the building to act as sup-

ports for pairs of such panels with joist hangers attached to opposite faces of each intermediate beam, so as to receive and support the ends of the joists of the panel on either side thereof.

[0021] Such beams may be the sole supports for a panel, but where walls are available to support one or more edges of a panel, one or both of the outermost joists may for example rest on the top of a wall and/or a transversely extending timber closure may be secured to the ends of the joists at one end of the panel to enclose that end and in that event it is the closure which will rest on the top of a wall. In such an arrangement the beam carrying the joist hangers will itself rest on walls at each end and its depth will be selected so that the bridge sections of the joist hangers are located at the correct height to support the undersides of the joists and the upper edge of the beam will be below the underside of the decking sheet secured to the upper faces of the joists.

[0022] Where the panel does not include a closure timber at both ends, there is a tendency for the panel to bend when being lifted by a crane. This can not only damage the panel but may also make it more difficult to locate the joists in their respective hangers. To this end one or more elongate members may be secured between the joists near the open end of the panel, so as to resist bending of the panel.

[0023] Preferably the or each elongate member extends across the panel nearer the underside of the joists than the decking sheet.

[0024] In a preferred embodiment a tie rod is fitted across the panel after forming aligned holes in the joists through which it can pass, spacers are located between adjoining joists and the tie bar is tensioned so as to clamp the spacers in place. Tensioning may be achieved by means of nuts screwed onto threads at opposite ends of the tie rod.

[0025] The spacers may comprise tubes for example of metal or plastics material, through which the tie rod passes between the joists, the length of each tube corresponding to the spacing between the joists.

[0026] Alternatively noggins of wood or metal or plastics material may be located in the vicinity of the tie rod between the joists. They may be secured in any convenient way between the joists as by cross nailing or adhesive.

[0027] In the simplest case the noggins are simply a close fit between joists, so that when the tie rod is tensioned the noggins are firmly clamped in place and serve to space the joists apart.

[0028] In the case of I-beam joists the noggins or spacers are a close fit between the I-beam webs, and if noggins are used, their ends will rest on the lower rails of the I-beam cross-section.

[0029] The invention also lies in the combination of a pre-fabricated floor panel comprising a decking sheet supported by and secured to an array of parallel spaced apart joists at least part of at least one end of each of which is trapezoidal in cross section and joist hangers

embodying the invention, the included angle between the diverging joist hanger cheeks being not less than that between the diverging faces of the joist ends.

[0030] The invention also lies in a method of fitting a floor panel as aforesaid to a wall or beam in a building during construction comprising the steps of:-

a) securing to the wall or beam one or more joist hanger each with one or more joist receiving sockets having diverging side cheeks, as aforesaid,

b) using lifting gear to lift the floor panel above the wall or beam and lowering it so that the lower edges of the joist ends register with the wider open ends of the joist receiving sockets formed by the diverging side cheeks and bridging sections of the hangers, so that with further lowering the joists enter the sockets and are guided by the converging cheeks thereof into a final aligned position,

c) detaching the lifting gear from the floor panel, and

d) securing the cheeks to the ends of the joists, for example using nails, screws, staples, pins or any other suitable fixative.

[0031] The method may also include the step of adapting at least part of at least one end of each joist which is to be received in one of those hangers, so as to have a complementary trapezoidal profile the included angle of which is substantially the same as, but not greater than, the included angle between the diverging side cheeks of the hanger.

[0032] The invention will now be described by way of example with reference to the accompanying drawings in which: -

Fig.1 illustrates how a pre-fabricated floor panel is lowered by a crane so that the ends of the joists on its underside can be received in pre-fitted joist hanger sockets;

Fig. 2 illustrates a similar floor panel and set of pre-fitted modified joist hanger sockets which present trapezoidally shaped sockets for receiving the joist ends;

Figs. 3 and 3A show how the end of a conventional rectilinear cross-section joist can be modified for better fit within a joist hanger socket in accordance with the invention;

Figs. 4 and 4A show how the end of an I-beam section joist can be modified for better fit within a joist hanger socket in accordance with the invention;

Figs. 5 and 5A show another way in which the end of an I-beam section joist can be modified for better

fit within a joist hanger socket in accordance with the invention; and

Fig. 6 is a perspective view to an enlarged scale of the pre-fabricated floor panel and cooperating joist hangers shown in Fig. 2.

[0033] In the drawings Fig. 1 shows how conventional joists such as 10 and conventional joist hangers such as 12 need to be precisely aligned before a floor panel such as 14 can be lowered into position, so that the ends of the joists will slide down between the parallel side cheeks 16, 18 of the conventional joist hangers. Any misalignment will prevent the placement of the floor panel, and can damage the side-cheeks of the hangers.

[0034] By providing modified joist hangers such as 20 as shown in Fig.2, having diverging side-cheeks such as 22, 24, there is less need for precise alignment between the joist ends and the hanger sockets.

[0035] Modified hangers such as shown in Fig. 2 can be used with conventional rectilinear cross-section joists such as shown at 10 in Fig. 1. However there is no lateral support for the upper region of the end of each joist 10A and therefore the cross section of at least the end of each joist 10A may be shaped so as to correspond more precisely to the shape of each joist hanger socket, as shown at 11, 13 in Fig. 2.

[0036] The joists 10A shown in Fig. 2 are of I-beam cross-section and the end shaping arrangements for such joists are described in more detail with reference to Figs. 4 and 5.

[0037] However in the simplest case of a conventional rectilinear cross-section joist 10 (such as shown in Fig. 1) the end shaping can be as shown in Fig. 3. This is achieved by securing two wedge-shaped members 26, 28 on opposite faces of the joist so as to form a trapezoidal cross-section when viewed end-on. The increased width at the widened top of the joist cross-section is made commensurate with the spacing between the upper ends of the side cheeks 22, 24 of the modified hangers 20 shown in Fig. 2. By using wedges which taper to a V-shape, the lower end of the end cross-section will be substantially the same as the thickness of the joist 10, which corresponds to the spacing between the parallel socket cheeks 16, 18 of joist hangers 12 of Fig. 1

[0038] The wedges 26, 28 may be blocks of wood, metal or plastics or rubber or composites thereof and may be solid or hollow.

[0039] Where the joist has an I-beam cross-section as shown in Fig. 2 again two generally wedge-shaped members 30, 32 may be fitted, this time to opposite faces of the web 34 of the I-beam cross-section as shown in Fig. 4. As illustrated the two members 30, 32 are cut-away at their upper ends so as to accommodate the upper rail 36 of the I-beam. The lower ends of 30, 32 rest on the lower I-beam rail 38. As with Fig. 3 the wedge shaped members 30, 32 may be of wood or metal or plastics or rubber or composites thereof and may be solid or hollow.

[0040] In the case of the embodiments illustrated in either Fig. 3 or Fig. 4 the wedges 26, 28 or 30, 32 may be secured in place for example by an adhesive or by nails, staples, screws or pins.

[0041] Although not shown, the wedges 26, 28 or 30, 32 may extend over more of, or even all of the length of a joist, and in the simplest case the joist may have the trapezoidal cross-section over the whole of its length.

[0042] Figs. 5 and 5A show how upper and lower flanges 37, 39, 41, 43 of metal brackets 40, 42, can be fixed as by nails or screws such as 44 to the upper and lower faces of a joist, so as to produce in the end region of the joist a hollow trapezoidal shape which corresponds to that of the diverging side-cheeks 22, 24 of the modified hangers.

Figs. 2 and 6 also show how the floor panel can be modified so as to resist bending as can occur when being lifted and lowered by a crane as indicated in Fig. 2. Referring to Fig. 6 which is to a larger scale than Fig. 2 a tie rod 45 extends across the width of the panel, the rod is threaded at both ends and is secured in place by nuts and washers at each end, such 54, which may be glued or otherwise secured at their ends to the joists, but are put in compression as the tie rod 45 is tensioned by tightening nuts 46, so as to rigidly space apart the joists.

Claims

1. A joist hanger comprising one or more open-topped joist receiving sockets, each socket being defined by two side cheeks and a bridge section which joins the lower ends of the two side cheeks, the joist hanger further comprising one or more flanges by which the hanger can be secured to an abutting face and/or upper edge of a wall or beam, **characterised in that** the two side cheeks diverge from the bridge section to the open top of the joist receiving socket, so that the width of the socket is greater at the top than the bottom, such that a joist will fit snugly in the socket between the two side cheeks in the region of the bridge section but the upper portion of the socket is wider to facilitate entry thereto of the joist.
2. A joist hanger as claimed in claim 1 which includes top flanges, which in use overlie the top of a wall or beam and which extend orthogonally from the plane of the flanges which will in use abut and be secured to the face of the wall or beam, but parallel to the bridging section at the lower ends of the two side cheeks, so that in use the top flanges will lie flat on the upper surface of the wall or beam.
3. A combination of joist and a joist hanger as claimed in claim 1 or 2 wherein the cross section of at least the end of the joist is trapezoidal so as to form a wedge, the diverging faces of which diverge with an included angle similar to, but not greater than, that by which side cheeks of the hanger socket diverge.
4. A combination as claimed in claim 3 wherein the trapezoidal cross section extends over the length of the joist.
5. A combination as claimed in claim 3 wherein a gap-filling means is provided for locating between the opposite faces of the end of the joist and the side cheeks of the socket, to fill gaps and provide support for the upper region of the joist within the socket.
6. A combination as claimed in claim 5 wherein the gap-filling means comprise triangular cross section fillets.
7. A combination as claimed in claim 6 wherein the fillets are secured to the opposite faces of the end of the joist.
8. A combination as claimed in any of claim 6 or 7 in which the fillets are of wood, metal, rubber or plastics material.
9. A combination as claimed in any of claims 6 to 8 in which the two fillets are nailed, stapled, screwed or stuck to the joist faces.
10. A combination as claimed in claim 5 wherein the gap-filling means comprises a wedge shaped member having a central slot into which the end of the joist can be fitted.
11. A combination as claimed in claim 10 wherein the member is secured to the joist as by nailing, stapling or screwing, an adhesive, or by virtue of an interference fit between the slot and the joist.
12. A combination as claimed in any of claims 6 to 11 wherein the joist has an I-beam cross section and the trapezoidal end cross section is achieved by fillets secured to opposite faces of the central web of the I-beam, or by a slotted wedge adapted by the slot to receive, and be secured to, the end of the central web of the joist.
13. A combination as claimed in claim 3 wherein the joist has an I-beam cross section and the trapezoidal shape is formed by a metal structure comprising at least one part adapted to be fitted to the upper and lower rails of the I-beam so as to extend therebetween, outer faces of the metal structure being spaced from the central web by a greater distance in the region of the upper rail than in the region of the lower rail, so as to form the trapezoidal shape.
14. A combination as claimed in any of claims 3 to 13 wherein the included angle between the inclined faces of the wedge or the fillets or metal structure is

substantially the same as, but not greater than, that between the diverging cheeks of the joist hanger to which the joist is to be fitted.

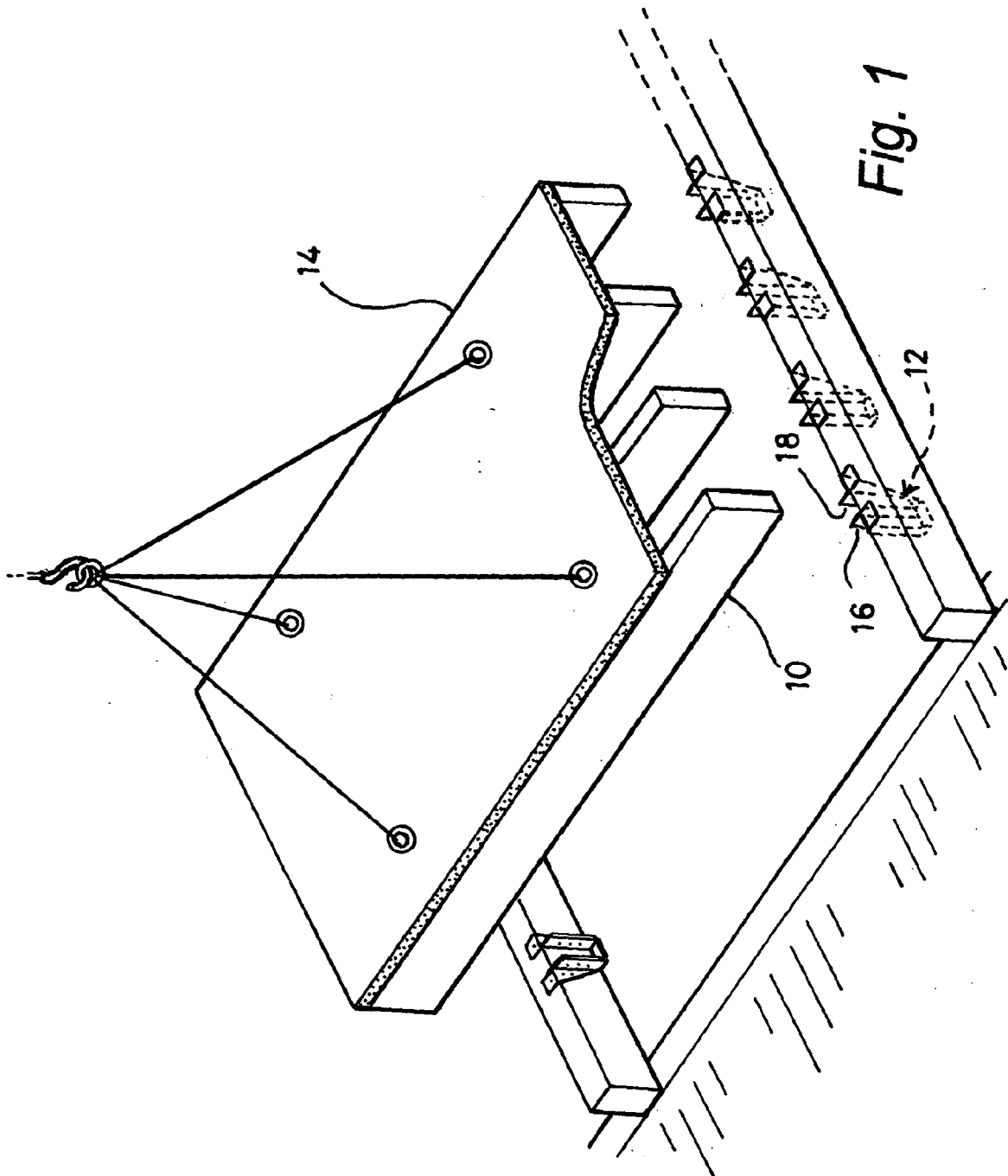
15. A floor panel constructed from a decking sheet secured to a plurality of parallel spaced apart joists when fitted in building with at least some of the joist ends received in joist hangers as claimed in claim 1 or 2. 5
- 10
16. A floor panel as claimed in claim 15 in combination with a second floor panel and a beam carrying joist hangers on opposite faces thereof, wherein in use the joist hangers receive and support the ends of joists of the two panels on either side thereof. 15
17. A method of fitting a floor panel to a hollow beam in a building during construction wherein the floor panel comprises a decking sheet secured to a plurality of parallel spaced apart joists, comprising the steps of:- 20
- a) securing to the wall or beam joist hangers having diverging side cheeks as claimed in claim 1 or 2,
 - b) using lifting gear to lift the floor panel above the wall or beam and lowering it so that the joist ends register with the wider open ends of the joist receiving sockets formed by the diverging side cheeks and bridging sections of the hangers, so that with further lowering the joist ends enter the sockets and are guided by the converging cheeks thereof into a final aligned position, 25
 - c) detaching the lifting gear from the floor panel, and 30
 - d) securing the hanger cheeks to the ends of the joists. 35

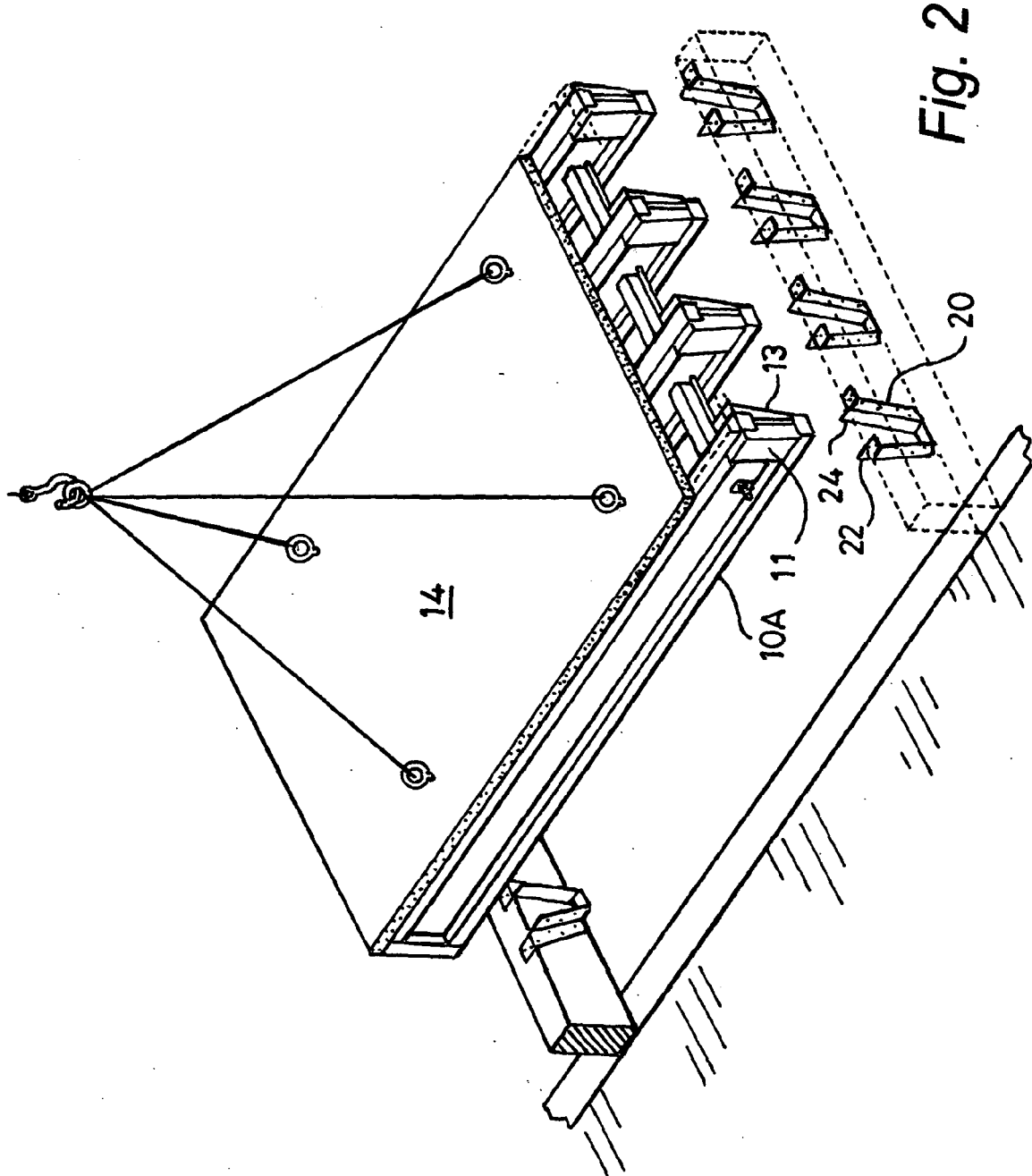
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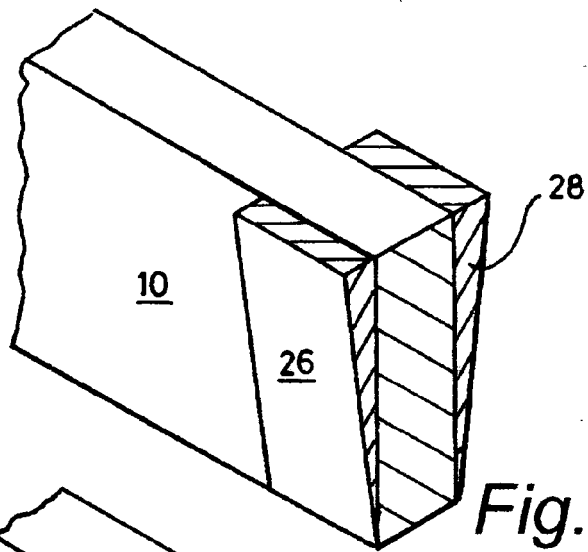


Fig. 3

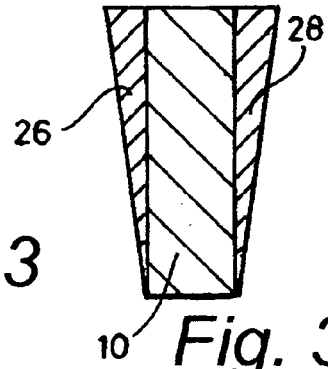


Fig. 3A

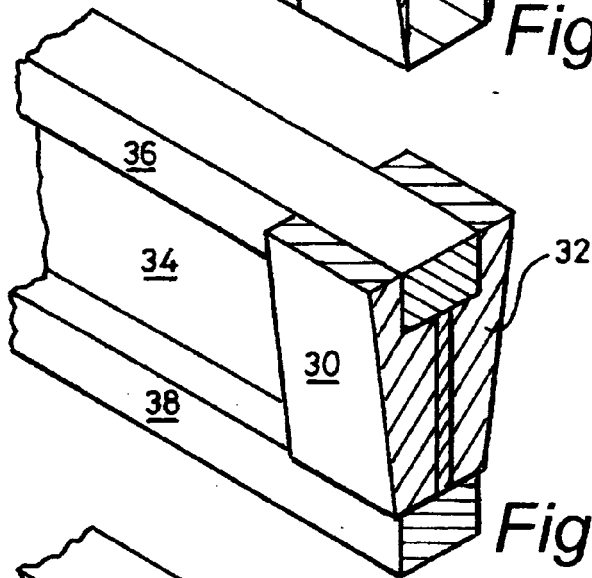


Fig. 4

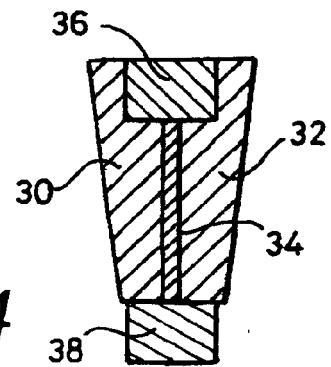


Fig. 4A

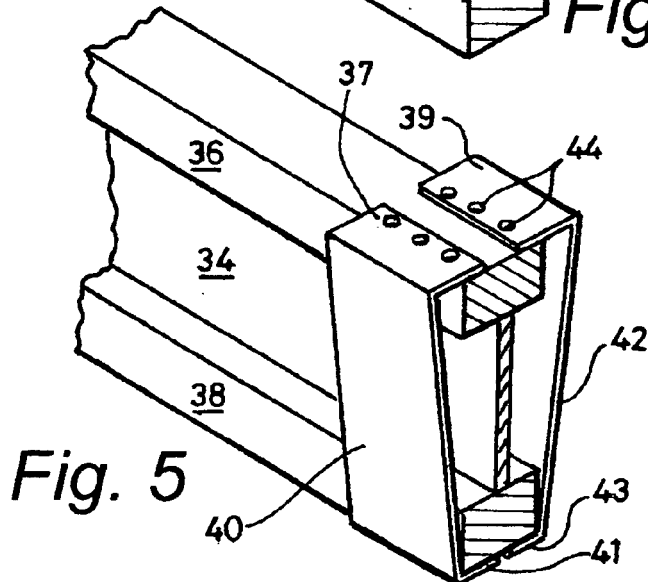


Fig. 5

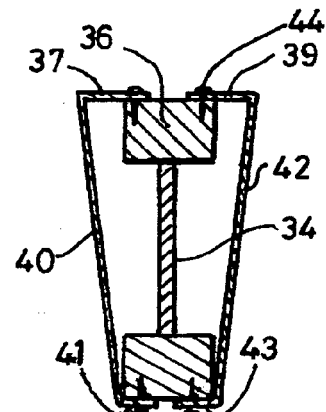


Fig. 5A

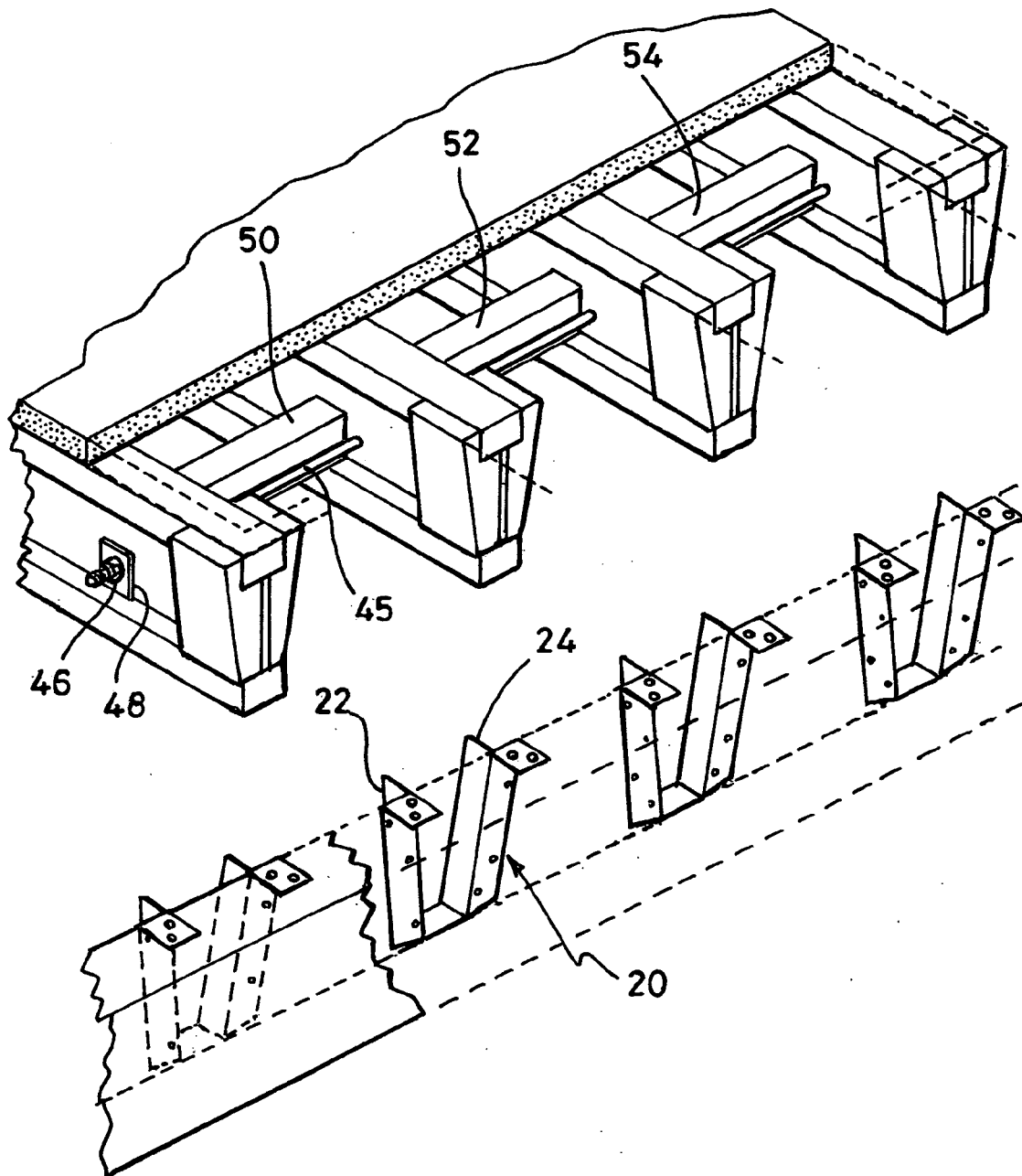


Fig. 6