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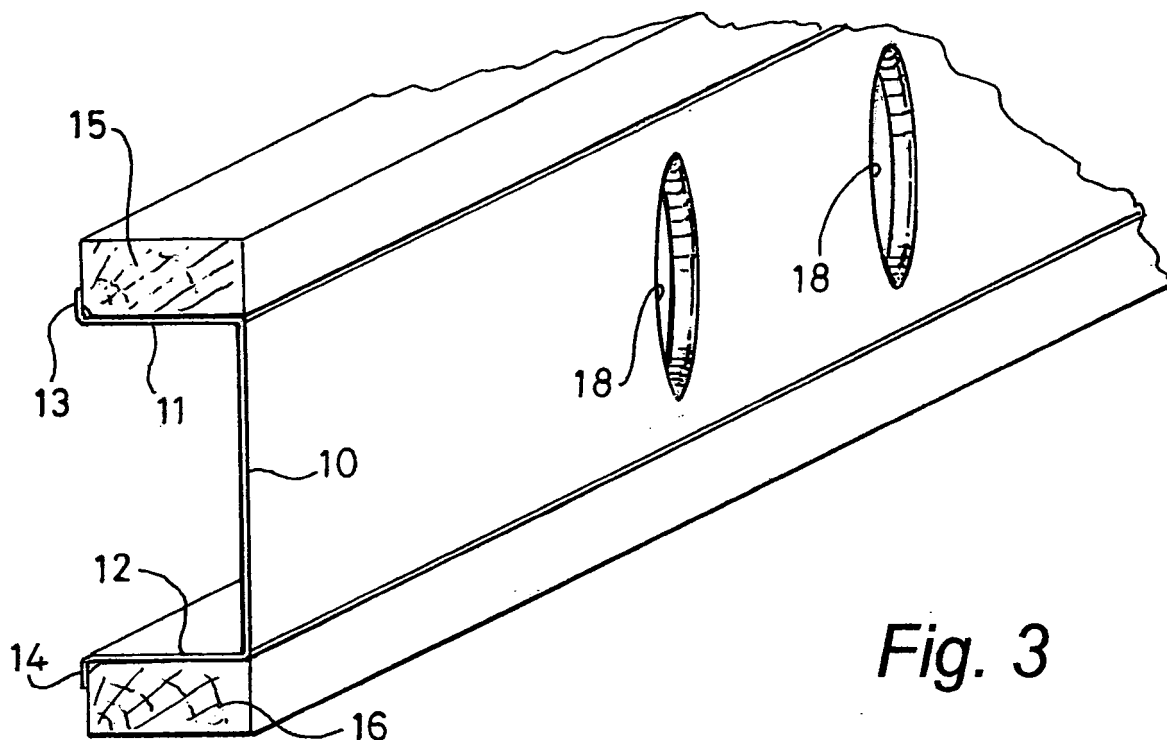
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(54) **Joists**

(57) A joist (7) has a metal member providing a web (10) and having an upper surface (11) bonded by adhesive to an upper timber chord (15) and a lower surface (12) bonded by adhesive to a lower timber chord (16).

The inherent stiffness of the metal web, and the location of the upper and lower chords at distances spaced from the neutral axis of the joist, imparts a substantial resistance to bending.



**Fig. 3**

## Description

### Field of the Invention

**[0001]** This invention relates to joists, a term intended to cover similar structural components such as beams, struts or ties.

### Background to the Invention

**[0002]** Where a building floor incorporates a stairwell, certain supporting joists of the floor must be of a shorter length than the remaining normal length joists spanning spaced walls of the building. The ends of these shorter length joists are attached to a transverse joist which in turn spans the pair of normal length joists defining the ends of the stairwell space. As a consequence, this pair of standard length joists are subjected to higher loads than the remaining joists of normal length, and the invention was devised to provide joists having increased stiffness (i.e. greater resistance to deflection) to serve as the pair of joists defining the ends of a stairwell space (as subsequently explained with reference to Figure 1 of the accompanying drawings) but the invention has application to any joists where increased stiffness and load carrying capacity are required.

### Summary of the Invention

**[0003]** According to the invention a joist has a metal member providing a web and having an upper surface bonded by adhesive to an upper timber chord and a lower surface bonded by adhesive to a lower timber chord. The inherent stiffness of the metal web, and the location of the upper and lower chords at distances spaced from the neutral axis of the joist, imparts a substantial resistance to bending.

**[0004]** The adhesive may be a polyurethane adhesive suitable for bonding wood to steel. A moisture curing polyurethane adhesive with a coverage of 400g/m<sup>2</sup> has been found to be particularly suitable.

**[0005]** Preferably, the metal member has an upper flange projecting at 90° from an upper edge of the web, and a lower flange also projecting at 90° from the lower edge of the web, the upper surface then being provided by the upper surface of the upper flange and the lower surface being provided by the lower surface of the lower flange.

**[0006]** The upper surface may also comprise the vertical surface of a continuous lip projecting upwardly from the outer extremity of the upper flange and the lower surface may also comprise the vertical surface of a continuous lip projecting downwardly from the outer extremity of the lower flange. It will be appreciated that the upper and lower metal flanges, and the upper and lower lips when present, also contribute to the enhanced stiffness of the joist.

**[0007]** In the preferred embodiment the upper chord

is rectangular in cross-section, having a horizontal dimension corresponding to the horizontal dimension of the upper flange and the lower chord is similarly rectangular in cross-section having a horizontal dimension corresponding to the horizontal dimension of the lower flange.

**[0008]** The web, the upper flange, the lower flange, the upper lip and the lower lip are preferably formed by bending a single piece of metal, such as galvanised steel, into a substantially u-shaped cross-section, the flanges defining the end limbs of the u-shape.

**[0009]** A portion of the length of the web may have a series of holes for the passage of electrical cables, plumbing pipes or conduits, and these holes may be formed with lips to prevent such cables pipes or ducts snagging on the edges of the holes.

**[0010]** A portion of the length of the joist at one end thereof is preferably devoid of holes so that this length can form an edge of a stairwell, where holes in joists are not required.

**[0011]** A plurality of joists of differing lengths but each in accordance with the invention may be provided so that the user can select joists of appropriate length, trimming one or both ends as necessary.

### Brief Description of the Drawings

**[0012]** The invention will now be further described, by way of example, with reference to the accompanying drawings, in which:

Figure 1 is a plan view of a floor having a stairwell, the ends of the stairwell space being defined by a pair of joists each in accordance with the invention;

Figure 2 is a side elevation of one of the pair of joists;

Figure 3 is a isometric view of one end of the joist of Figure 2, and

Figures 4 and 5 are cross-sectional views respectively taken on the planes defined by the lines IV-IV and V-V in Figure 2.

### Detailed Description of the Drawings

**[0013]** Referring to Figure 1, a domestic building (such as a house of block of flats) has opposed side walls 1 and 2 spanned by conventional joists 3. The joist ends are attached to the walls 1 and 2 either by conventional joist hangers or by the ends of the joists being built into the walls, in conventional fashion. The building has a rectangular stairwell 4 to accommodate a staircase, the stairwell 4 having a length parallel to the wall 1 of 2400mm and width perpendicular to the wall 1 of 1000mm. It can be seen that over the length of the stairwell there are four joists 5 shorter in length than the normal length joists 3 spanning the walls 1 and 2. At their ends remote from

the wall 2, the ends of these shorter joists 5 are connected (e.g. by conventional joist hangers) to a transverse joist 6 defining the stairwell edge parallel to the wall 1. The ends of this transverse joist 6 are in turn connected (e.g. by conventional joist hangers) to the pair of respective joists 7 and 8 defining the ends of the stairwell space.

**[0014]** This pair of joists 7 and 8 must therefore be designed to withstand greater bending moments than the remaining joists, because part of the loading applied to the floor laid over the shorter joists 5 will be transmitted to the pair of joists 7 and 8 through the intermediary of the transverse joist 6. A pair of conventional joists (like the joists 3) have sometimes been placed side by side and screwed together to form a composite joist to serve as each of the joists 7 and 8. The invention provides a joist of special design to serve as each of the joists 7 and 8 and Figures 2 to 5 show one such joist 7.

**[0015]** Referring to Figures 2 to 5, the joist 7 comprises a galvanised steel channel member folded from 1½mm sheet steel so as to have a central vertical web 10 with a height dimension of 218mm and two horizontal flanges 11 and 12 with a width dimension of 72mm from the extremities of which project two out-turned vertical lips 13 and 14 with a height dimension of 15mm.

**[0016]** A strip of timber 15 of rectangular section (72mm wide x 35mm deep) is attached by a polyurethane adhesive to the whole of the upper surface of the upper flange and also to the adjacent surface of the upturned lip 13. The strip of timber 15 has a width corresponding to the width of the flange 11 and forms an upper chord of the joist. A second and identical timber strip 16 of rectangular section (72mm wide x 35mm deep) is attached by the same adhesive to the whole of the lower surface of the lower flange 12 and also to the adjacent surface of the down-turned lip 14. The timber strip 16 has a width corresponding to the width of the lower flange 12 and forms a lower chord of the joist. The adhesive is sufficiently strong to bond the wood to the steel so that the shear forces on this interface are resisted, imparting substantial stiffness to the composite joist.

**[0017]** A series of six circular holes 18 of 80mm diameter are formed in the web 10, the holes 18 being at a regular spacing of 600mm, this distance also being the distance between an end of the joist (the right hand end in Figure 2) and the nearest hole 18. The other end of the joist has a length 19 of 1200mm devoid of holes.

**[0018]** Each hole 18 has a lip 20 which is curved in section as best seen in Figure 5, the lip 20 projecting 10mm from the web 10 on the same side thereof as the upper and lower flanges 11,12. The holes 18 allow for the passage through the joist of cables, pipes or ducting which can be passed through the holes 18 without the risk of snagging on the edges of the holes as a result of the provision of the lips 20. The holes 18 are centred on the neutral axis of the joist so as to minimise loss of stiffness or resistance to bending.

**[0019]** In use, the joist 7 spans the walls 1 and 2 in a position defining one end of the stairwell 4, as shown in

Figure 1. The ends of the joist 7 are supported on the walls 1 and 2 either by joist hangers or by the ends of the joists being built into the walls 1 and 2. In either event, the ends of the joist 7 can be trimmed on site, it being understood that the length 19 of the joist which is devoid of holes is positioned so as to define the edge of the stairwell space and that the flat side of the joist (the right-hand side in Figure 4) faces towards the stairwell 4. Similar considerations apply to the joist 8 which is identical to the joist 7 except that it is "handed" to ensure that the length devoid of holes defines the other side of the stairwell space. The load on the shorter joists 5 is transmitted to the transverse joist 6 the ends of which are attached to the joists 7 and 8 by conventional joist hangers. The joists 7 and 8, being of increased stiffness, are able to take this load without unwanted deflection.

**[0020]** It is envisaged that a plurality of joists, each in accordance with the invention but of differing lengths, should be made available. For example, joist lengths may vary from 3600mm to 5400mm in steps of 600mm, each joist having a length at one end devoid of holes and being trimmable at each end to suit the floor being constructed.

## Claims

1. A joist having a metal member which provides a web and which has an upper surface bonded by adhesive to an upper timber chord and a lower surface bonded by adhesive to a lower timber chord wherein the upper and lower chords are located at distances spaced from the neutral axis of the joist.
2. A joist according to claim 1, in which the adhesive is a polyurethane adhesive suitable for bonding wood to steel.
3. A joist according to claim 2, in which the adhesive is a moisture curing polyurethane adhesive with a coverage of 400g/m<sup>2</sup>.
4. A joist according to any of the preceding claims, in which the metal member has an upper flange projecting at 90° from an upper edge of the web, and a lower flange also projecting at 90° from the lower edge of the web, the upper surface then being provided by the upper surface of the upper flange and the lower surface being provided by the lower surface of the lower flange.
5. A joist according to claim 4, in which the upper surface also comprises the vertical surface of a continuous lip projecting upwardly from the outer extremity of the upper flange and the lower surface also comprises the vertical surface of a continuous lip projecting downwardly from the outer extremity of the lower flange.

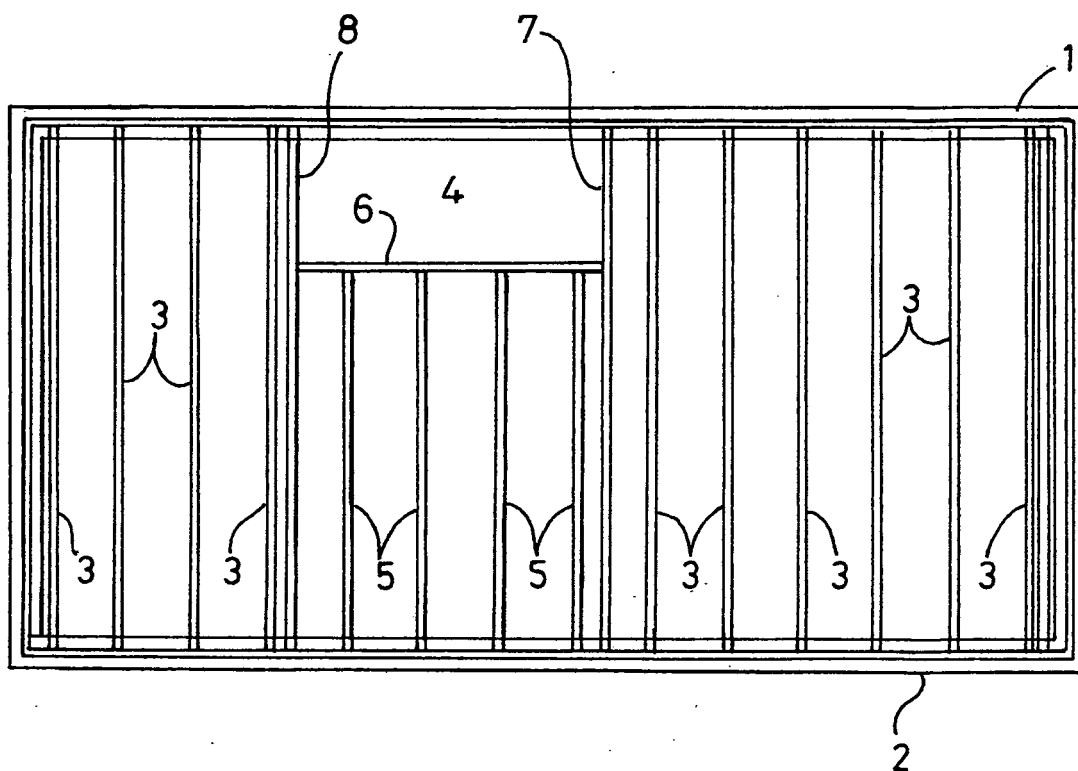
6. A joist according to claim 4 or claim 5, in which the upper chord is rectangular in cross-section, having a horizontal dimension corresponding to the horizontal dimension of the upper flange and the lower chord is similarly rectangular in cross-section having a horizontal dimension corresponding to the horizontal dimension of the lower flange. 5
7. A joist according to claim 5, in which the web, the upper flange, the lower flange, the upper lip and the lower lip are formed by bending a single piece of metal, such as galvanised steel, into a substantially u-shaped cross-section, the flanges defining the end limbs of the u-shape. 10 15
8. A joist according to any of the preceding claims, in which a portion of the length of the web has a series of holes for the passage of electrical cables, plumbing pipes or conduits. 20
9. A joist according to claim 8, in which the holes are formed with lips to prevent such cables pipes or ducts snagging on the edges of the holes. 25
10. A joist according to any of the preceding claims, in which a portion of the length of the joist at one end thereof is devoid of holes so that this length can form an edge of a stairwell, where holes in joists are not required. 30
11. A plurality of joists of differing lengths but each in accordance with any of the preceding claims, wherein the user can select joists of appropriate length, trimming one or both ends as necessary. 35

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*Fig. 1*

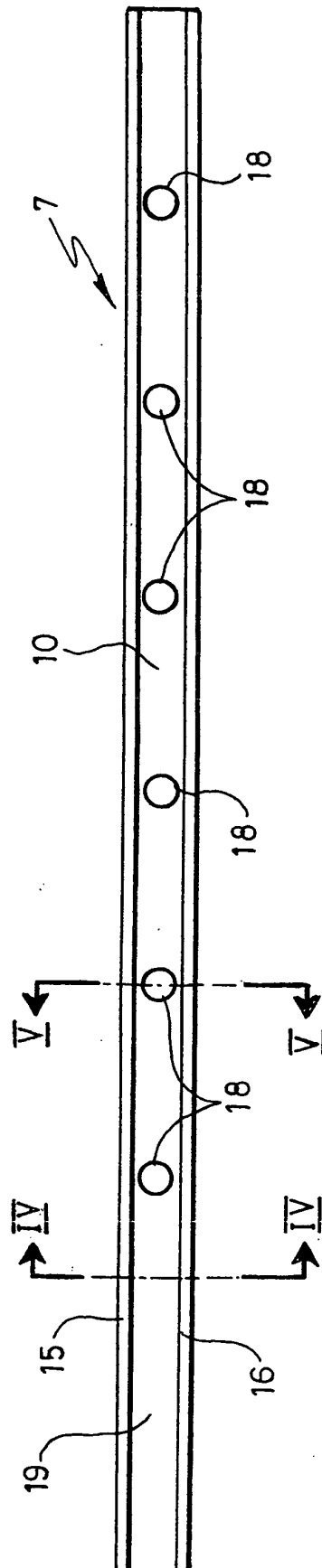
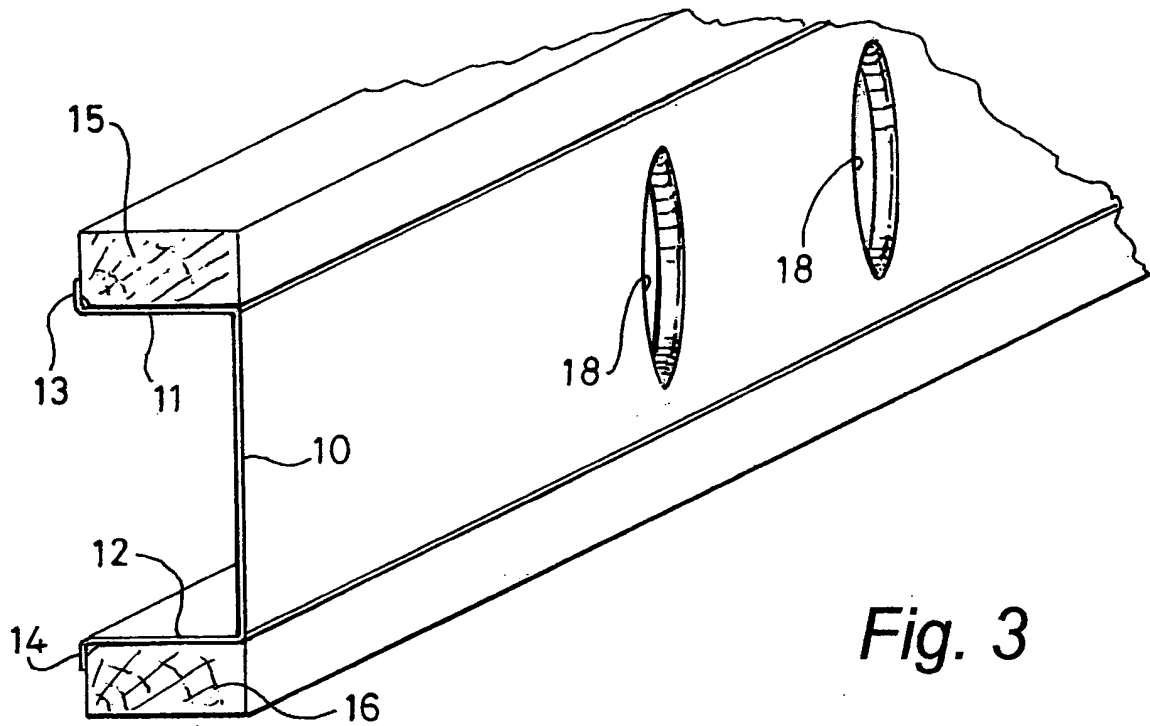
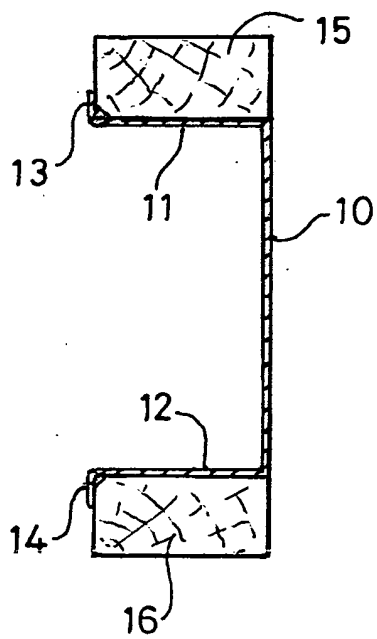


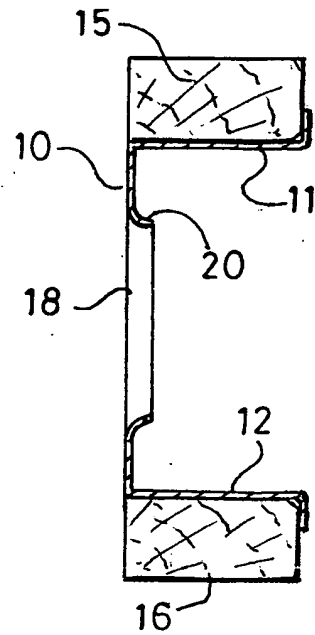
Fig. 2



*Fig. 3*



*Fig. 4*



*Fig. 5*