June 28, 1966 G. A. KOENIGSHOF 3,258,282

END-TO-END BEAM JOINT AND CONNECTOR

Filed Nov. 14, 1962

Fig. 1.

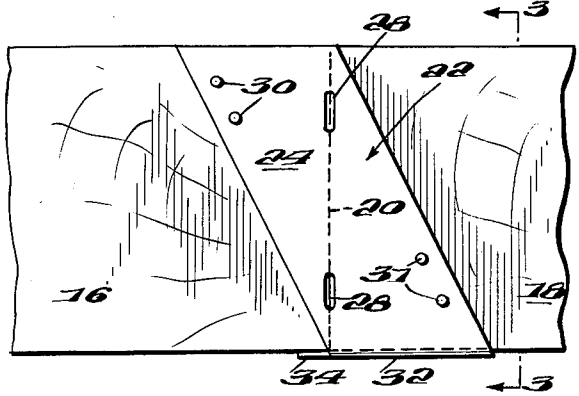


Fig. 3.

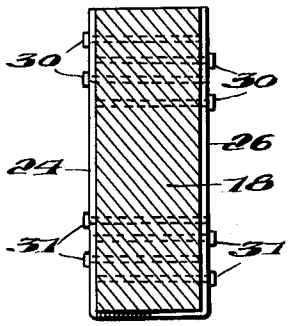


Fig. 2.

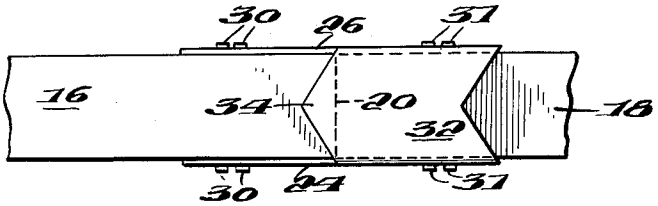


Fig. 4.

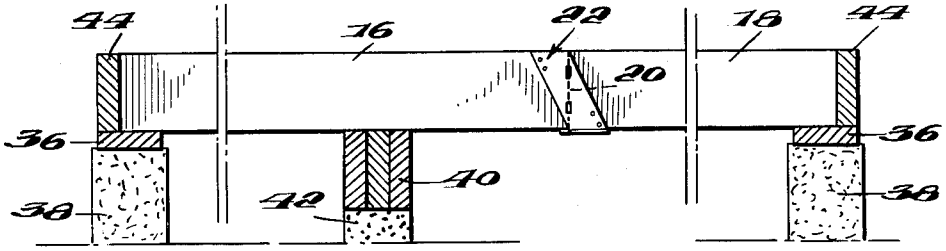
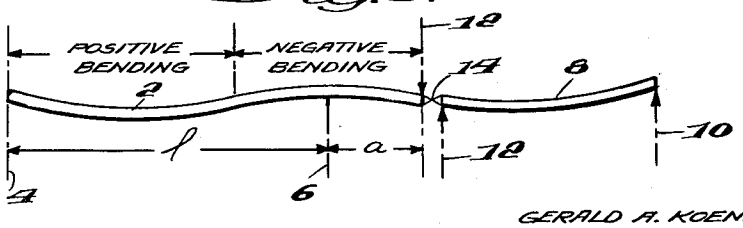


Fig. 5.



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END-TO-END BEAM JOINT AND CONNECTOR

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This invention relates to wooden building construction and, more particularly, to a cantilever joist structure for wooden buildings.

In conventional wooden building construction, a transverse girder is located midway between the outside walls of the foundation and floor joists are supported by the wall and the transverse girder. One end of a joist rests on the wall and the opposite end of the joist rests on the girder. A separate joist extends from the girder to the opposite wall. The joists extending from the opposite walls overlap each other on the girder and bridging is inserted between adjacent pairs of joists.

Although this construction is used widely today, it has several inherent disadvantages. Lumber is supplied in certain standard lengths and unless the outside walls are spaced from the girder at a distance that permits the use of the standard length of lumber, which is extremely rare, the lumber must be cut off to the proper length to permit the prescribed overlap of the joists on the girder. The lumber which is cut off and not used represents a waste of material. Furthermore, if it is necessary to cut standard lengths of lumber to make the joists, there are labor costs involved in measuring the lumber and in cutting the lumber to the proper lengths. In a large building the cost of wasted lumber and the cost of labor for measuring and cutting joists are substantial.

Another disadvantage of conventional joist construction is that the joists which span between the girder and the outside walls structurally are beams supported at their opposite ends. Simply supported beams, such as these joists, have lower resistance to deflection and lower load capacities than certain other types of beam structures.

It is an object of this invention to overcome defects in prior joist construction and to provide a joist structure which conserves labor and materials.

It is a further object of this invention to provide a joist structure which may be fabricated and installed rapidly, and with a minimum of labor.

It is a still further object of this invention to provide a joist structure which minimizes the deflection of the joists under load.

It is an other object of this invention to provide a joist structure which has improved load capacities.

These objects are accomplished, in accordance with a preferred embodiment of the invention, by a cantilever joist extending from an outside foundation wall and over a center girder so that a portion of the joist overhangs the girder. A short joist extends from the opposite outside foundation wall and abuts the free end of the overhung joist and a shear loaded connector overlaps the joint between the cantilever joist and the short joist and is secured to both of the joists. The connector is fastened to the cantilever joist first and a portion of the connector supports the short joist while fasteners are being driven into the short joist, thereby facilitating assembly of the joist structure.

This preferred embodiment of the invention is illustrated in the accompanying drawings, in which:

FIG. 1 is a side elevational view of the joists and the connector of this invention;

FIG. 2 is a bottom plan view of the joists and connector of this invention;

FIG. 3 is a cross-sectional view of the joist along the line 3—3 in FIG. 1;

FIG. 4 is a schematic view, partly in section, of the joist structure of this invention; and

FIG. 5 is a diagrammatic view of the joist structure shown in FIG. 4.

A beam which is supported only at its opposite ends is commonly referred to as a simply supported beam. When a simply supported beam is loaded uniformly along its length, it deflects downward, and the bending moments along the length of the beam are positive. An overhung or cantilever beam, however, experiences negative bending in the overhung portion of the beam, which balances a portion of the positive bending which occurs between the supports. This balancing effect reduces the deflection of the beam and, with a given size of lumber, it is possible to span a greater distance than a simply supported beam having the same deflection.

Referring to FIG. 5, an overhung beam **2** rests on supports **4** and **6** and the negative bending which occurs over the support **6** counteracts a portion of the positive bending moments between the supports **4** and **6**. The magnitude of positive bending moments and of deflection in the uniformly loaded overhung beam is, therefore, smaller than in a simply supported beam of the same size and under the same load, extending between the supports **4** and **6**.

At the free end of the overhung beam **2**, the bending moments are zero and a short beam **8** may be simply supported between the end of the beam **2** and a support **10**. The shot beam **8** is essentially a simply supported beam having bending moment and deflection characteristics substantially the same as the portion of the overhung beam **2** which experiences positive bending. The combination of an overhung beam and a simply supported, short beam, therefore, approximates the bending moment and deflection characteristics of two simply supported beams of substantially shorter length than the distance between the supports **4** and **6**, and **6** and **10**.

Since there are no bending moments at the free end of the overhung beam **2**, the connection between the overhung beam **2** and the short beam **8** transmits only shear loading, as represented by arrows **12** and a hinge **14**. Therefore, a connector between the beams **2** and **8** is not required to be capable of transmitting bending moments, but merely to be capable of supporting the weight of the end of the short beam **8**.

The compound joist of this invention includes a cantilever joist corresponding to the continuous beam **2**, a short joist corresponding to the short beam **8**, and a connector corresponding to the arrows **12** and the hinge **14** for securing together the adjacent ends of the joists. A preferred form of connector is illustrated in FIGS. 1 to 4. The continuous beam **2** is in the form of a joist **16** and the short beam **8** is in the form of a joist **18** of the same cross-sectional size as the joist **16**. The joists **16** and **18** have square cut ends and are arranged in abutting relation to form a junction **20**. A connector **22** overlaps the junction **20**. The connector **22** includes on opposite sides of the joists, side panels **24** and **26**, which are substantially identical in shape and are provided with vertically aligned slots **28** for aligning the connector **22** with the junction **20** between the joists **16** and **18**. Nail holes are pre-punched or otherwise marked on the side panels **24** and **26** for locating the position of nails **30** and **31** which extend through the side panels and into the joists **16** and **18** respectively. The positions of the nails in the side panel **24** are offset from the position of the nails in the side panel **26**, so that they do not interfere with each other. The positions of nails **30** and **31** are located with respect to the slots **28** to provide a maximum distance between the nails and the junction **20** of the joists, thereby avoiding splitting of the joists by the nails.

The bottom panel **32** connects the side panels **24** and **26** and supports the end of the short joist **18**. A portion of the bottom panel **32** is in the form of a tab **34** which extends across the junction **20**. The tab **34** is shown in an angular configuration, but it may also have a circular, irregular or other shape. The purpose of the tab **34** is to locate the position of the connector **22** vertically relative to the joist **16** before the joist **18** is lodged in the connector **22**.

Referring to FIG. 4, sills **36** are conventionally provided on foundation walls **38** and a girder **40** is supported on a pier **42**. The girder **40** is customarily positioned approximately equidistant from the foundation walls **38**. The overhung joist **16** is supported at one end on one of the sills **36** and extends across the center support girder **40**. The short joist **18** is supported on the opposite sill **36** and is arranged in abutting relation with the end of the overhung joist **16**. The connector **22**, which extends in overlapping relation with the junction **20** between the joists **16** and **18**, supports the end of the joist **18**. Band joists **44** extend across the ends of the joists.

The position of the junction **20** can be determined theoretically on the basis of bending moments and deflection limitations on the particular sizes of joists **16** and **18**. It has been determined that if the distance *a* is measured from the center support **6** to the free end of the overhung joist **2**, as shown in FIG. 5, and *l* is one-half the distance between the interior edges of the sills **36**, then the ratio of *a* to *l* which produces a minimum of deflection in the overhung beam **16** due to positive bending is a ratio of *a* to *l* of 0.172. On the basis of practical experience, however, it has been determined that values of the ratio between 0.156 and 0.195 are satisfactory. The practical application of this theoretical analysis is that by taking into account the distance between the interior edges of the sills **36** and interior side of the band joists **44**, the length of the overhung joist **16** and of the short joist **18** can be selected to give a ratio of *a* to *l* close to 0.172, with one of the joists **16** and **18** being of a standard length. Accordingly, one of the joists may be installed without the time and effort of cutting it to length.

For example, if the distance between the exterior edges of the sills **36** is 20 feet and the width of the sills **36** is 3⅝ inches, then the distance *l* equals 9 feet 8⅜ inches and if the value of *a* is selected as close to 0.172 as possible, but between the limits of 0.195 and 0.156 of *l*, a length of 1 foot 10⅜ inches is obtained, giving a ratio of 0.192. The length of *a* plus *l* is then 11 feet 6¾ inches and allowing 2 inches for mounting the end of the joist **16** on the sill **36**, the length of the overhung joist **16** is 11 feet 8¾ inches and the length of the short joist is equal to *l* minus *a* plus 2 inches, or 9 feet 8¾ inches minus 1 foot 10⅜ inches plus 2 inches, which equals 8 feet 0 inches. Thus, the short joist has a standard length of 8 feet.

As another example, assume that the span distance is 34 feet 0 inches. The length *l* is then 17 feet minus 3⅝ inches, which equals 16 feet 8⅜ inches and selecting a value for *a* of 2 feet 10⅜ inches to give a ratio of *a*/*l* of 0.172 the length of *a* plus *l* plus 2 inches which is the length of the overhung joist **16** is 19 feet 8¾ inches and the length of the short joist is 14 feet 0 inches. Thus, the short joist is a standard length.

In both examples the short joist **18** is a standard length, but the overhung joist **16** may be a standard length instead of the short joist **18**, if the ratio of *a*/*l* is closer to 0.172.

The joist is assembled, after the lengths of the overhung joist **16** and the short joist **18** are determined and cut, if necessary. The overhung joist **16** is set in place first on the sill **36** and girder **40**. The connector **22** may be fastened to the joist **16** either before the joist **16** is set in position, or after. The position of the connector with respect to the end of the joist **16** is located by aligning

the slots **28** in the connector with the end of the joist **16**. The vertical position of the connector is adjusted by means of the tab **34**, so that the interior side of the bottom panel **32** is coextensive with the bottom edge of the joist **16** to form a socket between the end of the joist **16**, the bottom panel **32** and the lower portions of the side panels **24** and **26**. After the connector has been fastened to the joist **16** by nails **30**, and after the joist **16** is set in place on the girder **40**, the short joist **18** is placed in position on the sill **36** and lodged in the socket formed by the connector **22** and the end of the joist **16**. It is important that the abutting ends of the joists **16** and **18** be square and in contact with each other when placed in position and held by the connector **22**. Accordingly, the band joists **44** are not installed until after the joists **18** are in place.

The important advantages of this invention are that the joists **16** and **18** are arranged in alignment and abutting relation, rather than in overlapping relation as in conventional construction, thereby conserving the cost of the lumber. Furthermore, one of the joists **16** and **18** has a standard length, thereby reducing labor and material costs in measuring and cutting both joists. The joist construction of this invention has improved load bearing characteristics and will support a load with less deflection than would a simply supported beam of the same length. The connector itself facilitates assembly of the joists by providing support for the short joist before nailing, means for locating accurately the position of the connector with respect to the junction between the joists and for locating the nail holes at the optimum positions to prevent splitting and provide maximum holding strength.

While this invention has been illustrated and described in one embodiment, it is recognized that variations and changes may be made therein without departing from the invention as set forth in the claims.

I claim:

1. A connector for securing together the joint between the abutting ends of aligned joists comprising a bottom panel, said panel having two substantially parallel opposite edges, a first side panel secured along one parallel edge of the bottom panel and extending upright therefrom, a second side panel secured along the opposite edge and extending substantially parallel to the first side panel, said side panels being nonrectangular and having opposite edges parallel, one of said side panels having a slot extending along a line intersecting the closer opposite corners thereof for locating the joists, said bottom panel having a tab extending beyond said corners intersecting line for positioning the connector relative to the joist whereby the joists are joined together by positioning the ends of the joists between the side panels with the joint at said corners intersecting line.

2. A connector for securing together the joint between the abutting ends of aligned joists comprising a bottom panel, said panel having substantially parallel opposite edges, a first side panel secured along one of said parallel edges and extending upright from said bottom panel, a second side panel secured along the other of said opposite edges and extending parallel to the first side panel, said side panels being non-rectangular and having opposite edges parallel, said bottom panel having a tab portion substantially in the plane of said bottom panel, said tab portion extending beyond a line intersecting the closer opposite corners of said side panels, whereby the joists are joined together by positioning the ends of the joists between the side panels with the joint at said corners intersecting line.

3. In wood building construction, first and second joists arranged in aligned end-to-end abutting relation at a point of substantially zero bending moments and secured together by a connector, said connector comprising a bottom panel, said panel having substantially parallel opposite edges, a first side panel secured along one of

said parallel edges and extending upright from said bottom panel, a second side panel secured along the other of said opposite edges and extending parallel to the first side panel, said side panels being non-rectangular and having opposite edges parallel, said bottom panel having a tab portion substantially in the plane of said bottom panel, said tab portion extending beyond a line intersecting the closer opposite corners of said side panels, said joists extending between said side panels with the ends of said joists positioned substantially at said corners intersecting line and fasteners extending through said side panels and into said first and second joists whereby the joists are joined together by said connector.

4. In wood building construction first and second joists arranged in aligned end-to-end abutting relation at a point substantially zero bending moments and secured together by a connector, said connector comprising a bottom panel, said panel having two substantially parallel opposite edges, a first side panel secured along one parallel edge of the bottom panel and extending upright therefrom, a second side panel secured along the opposite edge and extending substantially parallel to the first side panel, said side panels being non-rectangular and having opposite edges parallel, one of said side panels having a slot extending along a line intersection the closer opposite corners thereof for locating the joists, said bottom panel having a tab substantially in the plane of said bottom panel, said tab extending beyond said corners intersecting line, said joists extending between said side panels with the ends of said poists positioned substantially at said corners intersecting line and fasteners extending through said side panels and into said first and second joists, whereby the joists are jointed together by said connector.

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