July 16, 1968 K. McCONNELL ET AL 3,392,848

PALLET RACK

Filed June 6, 1966 4 Sheets-Sheet 1

Fig. 1.

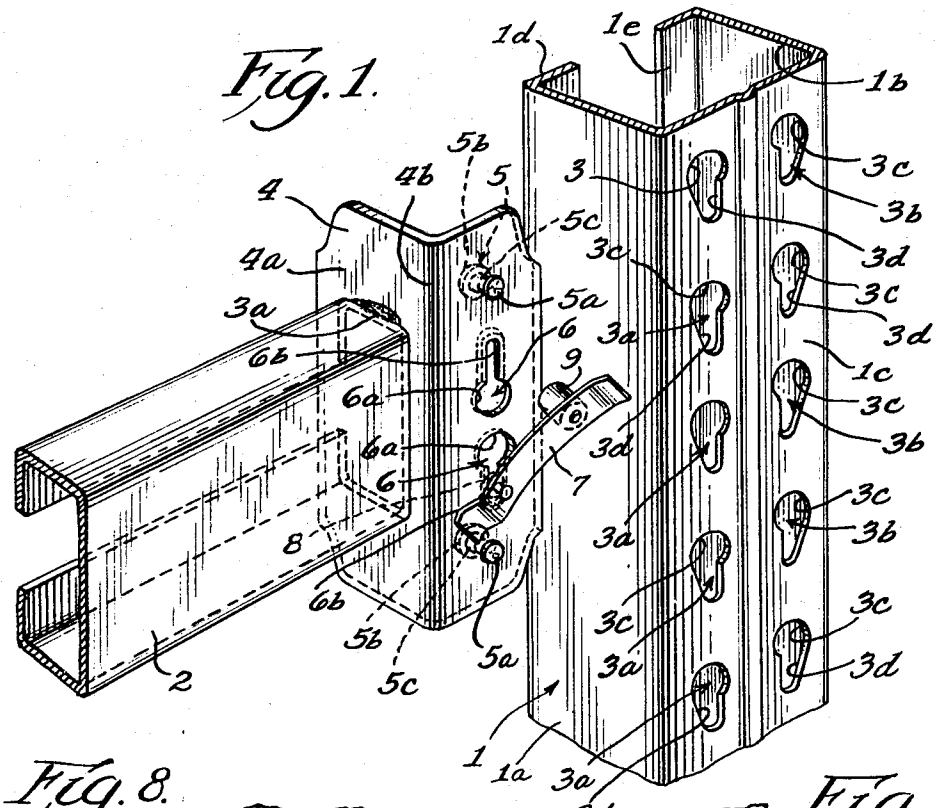

Fig. 8.

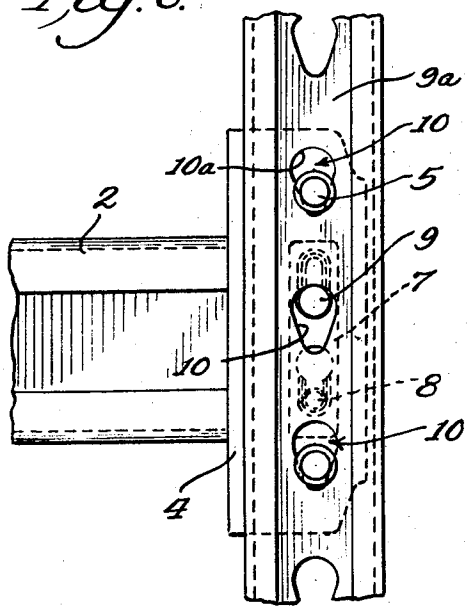

Fig. 9.

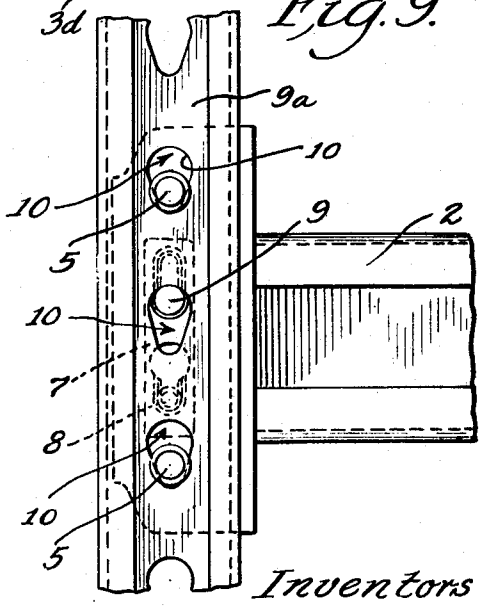

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Fig. 2.

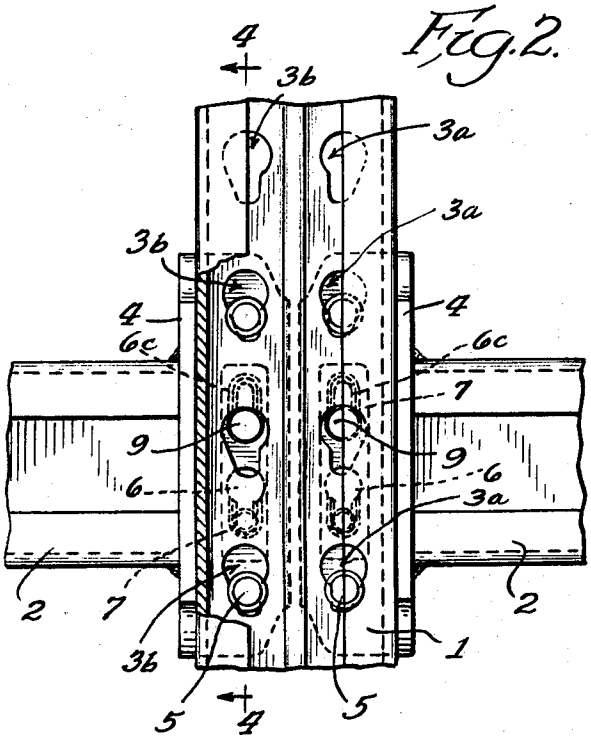


Fig. 3.

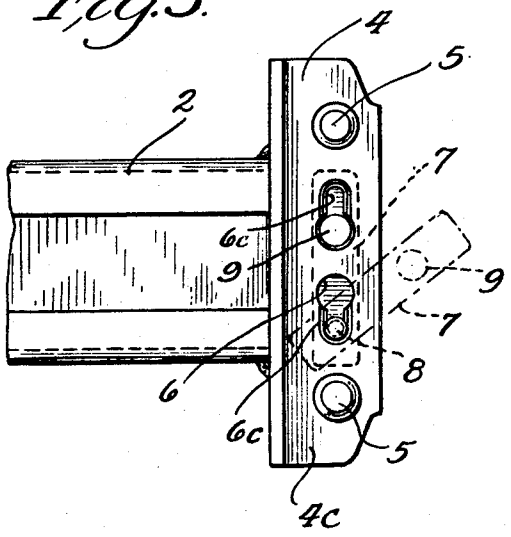
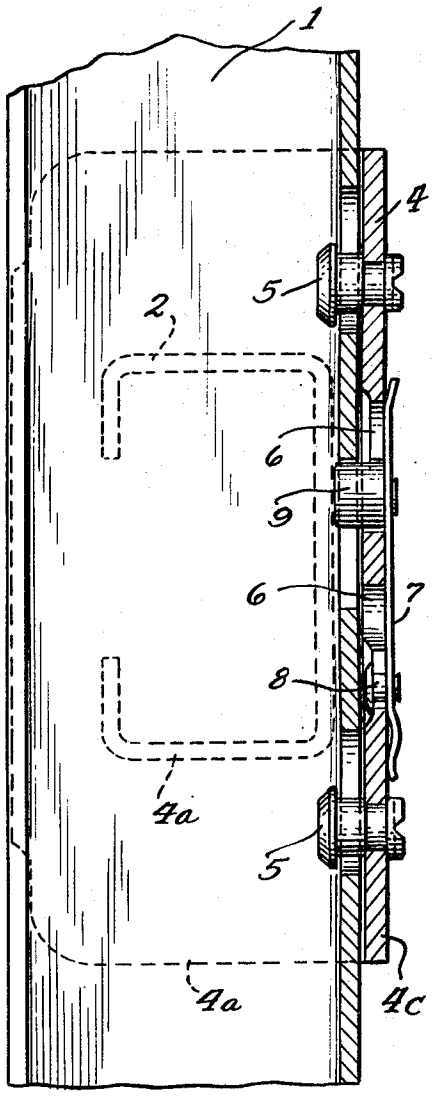


Fig. 4.



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PALLET RACK

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Fig. 5.

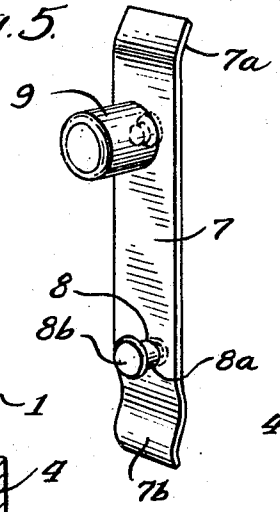


Fig. 6.

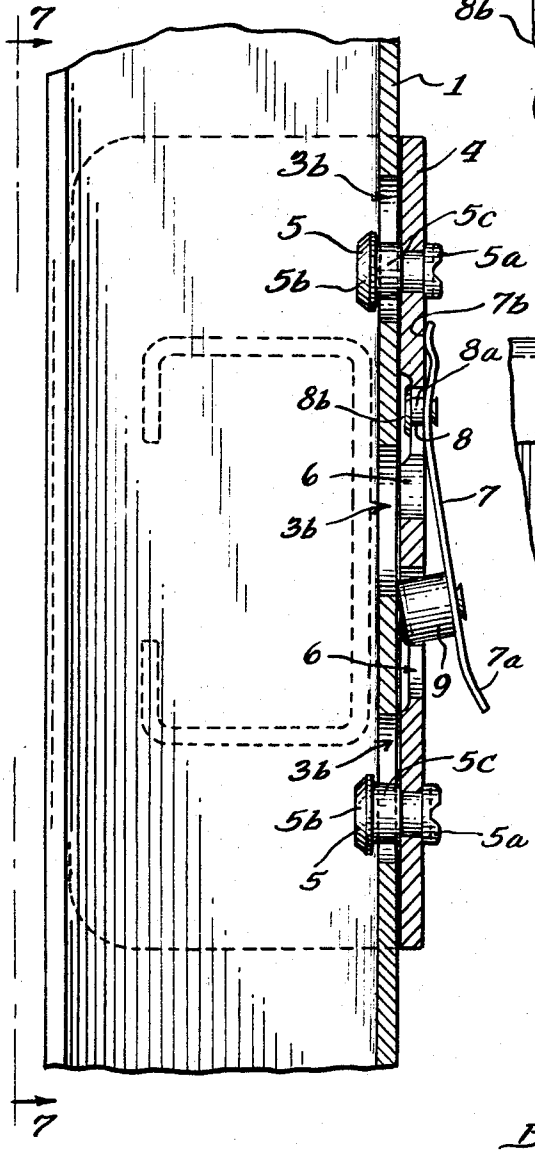
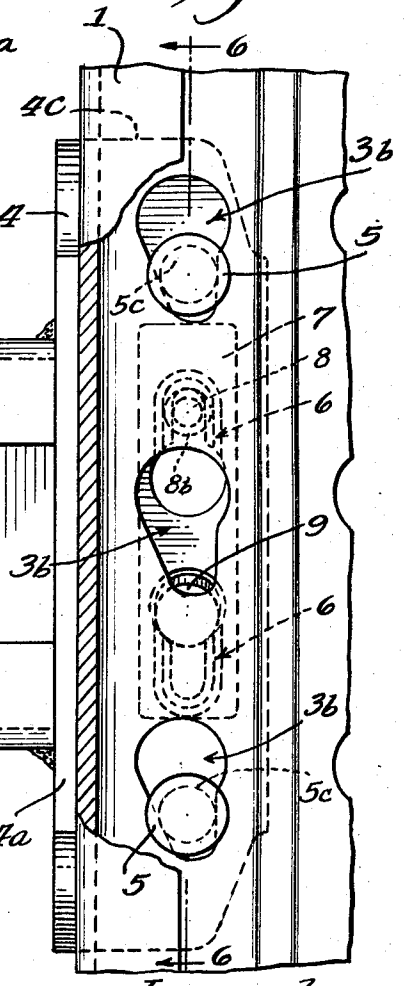


Fig. 7.



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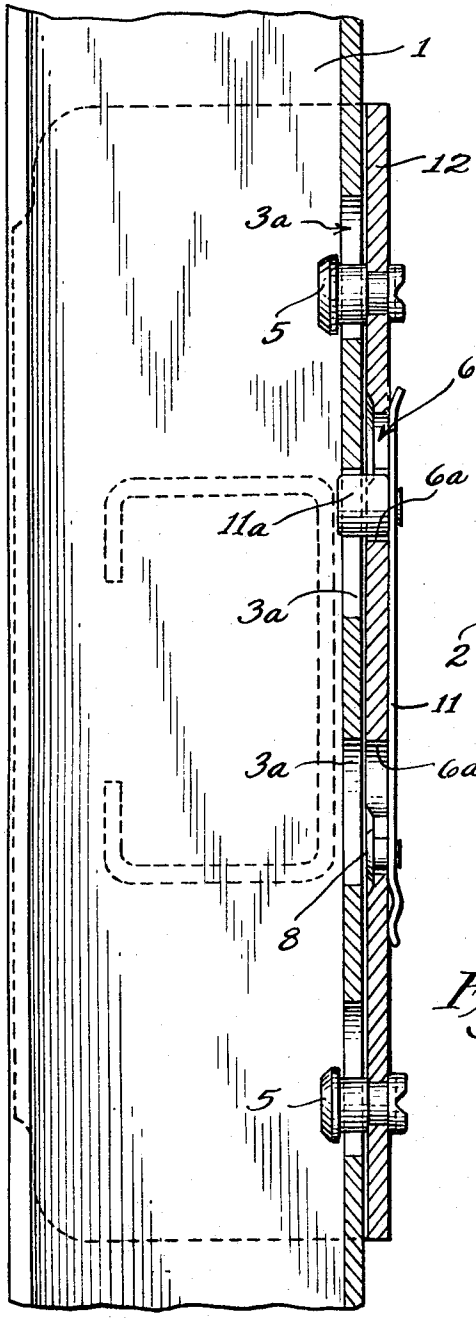

Fig. 10.

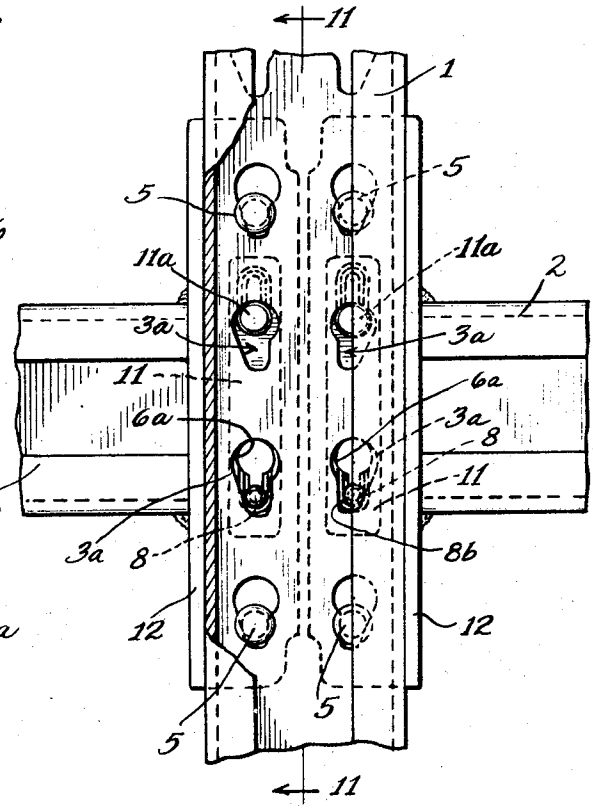

Fig. 11.

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3,392,848

PALLET RACK

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Filed June 6, 1966, Ser. No. 555,351
18 Claims. (Cl. 211—176)

ABSTRACT OF THE DISCLOSURE

A connection between a beam and an upright having stud and keyhole connectors which can be reversed to provide interchangeable use of identical parts for both right and left hand connections.

This invention relates to the art of support structures commonly referred to as pallet racks and the connections between certain basic components of the pallet rack.

In U.S. Patent 3,070,237 issued Dec. 25, 1962 to Thomas J. Fullerton et al. is shown the basic type of pallet rack structure of which this invention is an improvement. In that patent is shown the type of pallet rack which employs vertical upright members spaced from each other by means of horizontal beams which join the upright members together. The horizontal beams are provided with studs at their ends which engage keyholes extending in vertical rows along the upright members for purposes of connecting the beams to the upright members. In addition, that patent shows a releasable locking means which, when engaged, prevents accidental displacement of a beam relative to the upright members. The locking means is an integral part of the beam and is one which is used today on heavy duty pallet rack and the locking member serves as a bearing means as well as a locking device.

For the sake of economy and when heavy duty applications are not involved, the locking means is commonly of a different type than that shown by the U.S. Patent 3,070,237. Instead, the locking pin is employed which is connected to one end of a leaf spring arm which has its other end either permanently secured or detachably mounted on the ends of the beam. The advantage of the detachable mounting is that it permits the locking pin arm to be removed and replaced readily if broken, without removal of the beam from the pallet rack. When the arm is riveted or otherwise more permanently secured to the beam, removal of the beam from the pallet rack is usually required for repair.

Even with the detachable type of locking pin, there have been certain difficulties. These locking pins are ordinarily located on an end plate welded to the beam end. Because the beam connections to the upright must be made along both sides of the upright, each beam must be capable of both left-hand and right-hand connections to the upright. Although prior devices permitted such mounting, they oftentimes have required the use of two different end plates, one for a right-hand connection and the other for a left-hand connection. This increases the manufacturing problems and requires a double inventory of similar parts. It is one of the important objects of this invention to provide a connection between a beam member and an upright member which employs a single end plate construction which can be used for either left-hand or right-hand connections.

In prior devices, it has been possible to invert the beam and connect it to an upright with the connecting studs in place, or substantially so, but with the locking pin improperly placed, although its outward appearance indicates that the locking pin is properly assembled. It is another object of this invention to provide a locking pin end plate construction which provides a visual indicator when the beam is inverted and the locking pin is improperly positioned. Further, provision is also made for permitting the locking pin to be easily reversed into position to correct the condition.

In order to accomplish the above objective, an end plate construction is provided which has two symmetrically positioned keyholes for accommodating the locking pin supporting arm in two different positions inverted relative to each other.

It is another object of the invention to provide keyholes for connecting the locking pin arm to the end plates, which keyholes have a recessed portion which permit the arms to be mounted in a non-protruding manner relative to the inside surface of the end plate so that there is no interference between the connecting portions of the arm with portions of an upright when the beam is connected to the upright. This affords the advantage of permitting a convenient location of the keyholes for the locking pin arm without requiring accommodation of these keyholes to the location of non-interfering parts of the upright. On prior devices, with the connecting means of the locking pin arm protruding, it was necessary to have alignment of the locking means with a recess or opening in the upright.

Other objects and advantages of the invention should become apparent upon reference to the accompanying drawings in which:

FIG. 1 shows a perspective view of a portion of an upright and an end portion of a beam in preparation for connecting the two members together;

FIG. 2 is a rear elevation partially cutaway showing an upright member with beam portions connected from it extending in opposite directions;

FIG. 3 shows a beam portion of the same construction as shown on the left in FIG. 2;

FIG. 4 shows an enlarged sectional view along the lines 4—4 of FIG. 2;

FIG. 5 shows a perspective view of the locking pin lever employed in the connections of the beams to the upright;

FIG. 6 shows an enlarged sectional view similar to FIG. 4 with the locking pin arm improperly positioned;

FIG. 7 shows an enlarged view corresponding to the left-hand portion of FIG. 2, except with the locking pin lever mispositioned as shown in FIG. 6;

FIG. 8 shows a left-hand connection of a beam and an upright having only a single row of keyholes;

FIG. 9 shows a right-hand connection of a beam to an upright having a single row of keyholes;

FIG. 10 is a rear elevation partially cutaway showing an upright member with beam portions connected from it in opposite directions similar to FIG. 2, except that an alternate beam portion construction is illustrated and;

FIG. 11 shows a sectional view along the lines **11—11** of FIG. 10.

As viewed in FIG. 1, the basis components of pallet rack are indiacted. They consist of an upright member or column **1** and a horizontal beam **2**, Both the column **1** and the beam **2** are C-shaped in cross-section and are substantially hollow tubes. The particular structure shown is by way of example and many other cross-sectional shapes are possible. The upright member is provided with two side walls **1***a* and **1***b* and a front wall **1***c*. Two flange walls **1***d* and **1***e* connect to the side walls **1***a* and **1***b*, respectively. These three walls and the two flanges provide the C-shape of the upright member **1**.

Along the front wall **1***c* are provided a plurality of first keyholes **3***a* and **3***b* arranged in two vertically extending parallel rows, the keyholes **3***a* being canted in

one direction and the keyholes 3*b* being canted in the opposite direction. Each of the keyholes 3*a* and 3*b* is provided with an enlarged upper portion 3*c* connected to a downwardly extending elongated and convergent narrower portion 3*d*, each large portion 3*c* and a corresponding narrow portion 3*d* forming the keyhole shape.

The beam 2 is welded at its end 2*a* to an L-shaped wall 4*a* of an end plate 4. The wall 4*a* is connected along a corner 4*b* to another wall 4*c* at a right angle to it to provide the L-shape for the end plate 4. The wall 4*c* is provided with two head studs or connectors 5, one adjacent the top of the end plate and the other adjacent the bottom of it and they are of a rivet type which are secured to the wall 4*c* by means fo their narrow ends 5*a* being passed through openings in the wall 4*c* and peened over. These could just as well be welded or otherwise secured to the wall 4*c*.

The formation of the heads on the studs is by means of radially extended flanges 5*b* which extend at a radius greater than the narrow main body portions 5*c* of the studs. The end plate 4 is connected to the upright 1 by inserting the heads 5*b* of the studs 5 through enlarged portions 3*c* of the first keyholes 3*a* with the heads 5*b* protruding behind the front wall 1*c* of upright member 1. The beam and its end plate 4 are then moved downward vertically to allow the body portions 5*c* of the studs to travel along the narrow portions 3*d* of the first keyholes 3*a*. The size of the enlarged portions 3*c* are such that the flanged heads 5*b* of the studs readily pass through them and the widths of the narrow portions 3*d* of the first keyholes are approximately the same dimension as the body portions 5*c* of the studs. As the studs 5 are lowered with the end plate 4, the flanged heads 5*b* are located behind the front wall 1*c* along the regions of the lower portions 3*d* so that the end plate is thereby connected to the upright 1.

With the narrow portions 3*d* sloped or canted in the direction as indicated in FIG. 1, the studs 5, as they travel downwardly along the narrow portions 3*d*, draw the end plate 4 in a direction toward the side wall 1*a* of the upright member 1. In this way, a snug fit of the end plate 4 against the upright 1 is insured.

The end plate 4 has its wall 4*c* also provided with two second keyholes 6 which have enlarged portions 6*a* connected to narrower portions 6*b*. The second keyholes 6 accommodate a locking pin arm or lever 7 which is particularly shown in FIG. 5. This locking pin lever 7 consists of a strip of flat springy metal, such as spring steel, which has an outwardly turned upper end 7*a* which is used for facilitating manipulation of it. Its lower end is irregularly curved to provide a smooth bearing surface 7*b* which is hereinafter more fully described. Adjacent this portion 7*b* is a pin 8 which has a narrow body portion 8*a* connected by riveting or otherwise secured to the arm 7 and it has an enlarged head portion 8*b* formed by a radially extending flange larger in diameter than the body portion 8*a*. Adjacent the upper end 7*a* is a somewhat larger locking pin 9 which is likewise riveted or otherwise fastened to the arm 7. When the arm 7 is assembled to the end plate 4, the pin 8 is inserted through the enlarged portion 6*a* of a second keyhole 6 and the narrow body portion 8*a* of the pin 8 is guided along the narrow portion 6*b* of the second keyhole 6. This positioning of the pin 8 along the narrow portion 6*b* retains the arm 7 attached to the end plate 4 because the enlarged portion of the pin backs against the inner surface of the wall 4*c* in the regions along the narrow surface portion 6*a*. The bearing surface 7*b* is located so that it bears against the front surface of the wall 4*c* when the pin 8 is located in one of the second keyholes 6. The distance between the second keyholes 6 as related to the distance the locking pin 9 is located from the pin 8 is such that the locking pin 9 will align and pass through the enlarged portion 6*a* of the second keyhole opposite to the one in which the pin 8 is located when the pin 8 is bottomed in the end of the narrow portion 6*b*. Since the second keyholes 6 are identical but oppositely positioned and located, the pin 8 can be removed from one and positioned in the other as desired so that the locking pin 9 can protrude in either enlarged portion 6*a* of either second keyhole 6.

When the end plate 4 is attached to the upright 1 by means of the two headed studs 5, their space from each other is the same as the spacing of every third first keyhole 3*a* or 3*b* so that there is a first keyhole 3*a* in between the two keyholes 3*a* engaged by the headed studs 5. The spacing of the second keyholes 6 with respect to this in-between first keyhole 3*a* is such that the enlarged portion 6*a* of one of the second keyholes aligns with the enlarged portion 3*c* of a first keyhole 3*a* when the end plate 4 is fully attached to the upright 1 by means of the studs 5. With this arrangement, the locking pin 9 can protrude simultaneously through the enlarged portion 6*a* of the one of the second keyholes 6 and the enlarged portion 3*c* of the first keyhole 3 with which it aligns.

As indicated in FIGS. 1, 2 and 4, the locking pin 9 aligns with the enlarged portion 6*a* of the upper second keyholes 6 in the enlarged portion 3*c* of a first keyhole 3*a* when the pin 8 is located in the lower of the second keyholes 6.

The purpose of the locking pin 9 is to prevent inadvertent elevation of the beam 2 relative to the upright 1 which might happen by accidental movement of the forks of a lift truck or collision with other moving vehicles, or otherwise.

It should be noted that when the enlarged portion 6*a* of the upper of the second keyholes 6 aligns with the portion 3*c* of a first keyhole 3*a*, the enlarged portion 6*a* of the other of the second keyholes does not align with the enlarged portion 3*c* of any of the first keyholes 3*a*. This indicates that the arm 7 can be assembled properly in only one way. If it is improperly inverted, it will assume a position as shown in FIGS. 6 and 7 whereby the locking pin 9 will pass through an enlarged portion 6*a* of a keyhole 6, but it will not pass through an enlarged portion 3*c* of a first keyhole 3*a* because there will be no enlarged portion 3*c* in alignment with it. This condition is corrected by inverting the arm 7.

The significance of this is that the arm 7 will noticeably extend from the front surface of the wall 4*c* of the end plate 4 to provide a visual indicator that the arm 7 is improperly placed. The operator can then immediately determine the error and correct it. On other devices, it is possible to assemble a beam to an upright with a similar type of locking pin arrangement without any indication that there is an improper assembly. The result in such a situation is that the locking pin 9, or its counterpart, is then ineffective as the intended safety feature.

The other advantage of the arrangement shown by having the arm 7 reversible and symmetrical placement of the second keyholes 6 as shown, is that it permits the use of a single construction for the end plate 4 which can be inverted to provide a connection of this same end plate to either the left-hand or right-hand sides of the upright 1. In FIG. 2 is indicated how two beams are connected, one on either side of the upright 1. In FIG. 2 is indicated how two beams are connected, one on either side of the upright 1. In each case the arm 7 has its locking pin in the up position. However, both of the beams can be removed from the sides to which they are connected and inverted and interchanged with each other. When doing this, in order to get the benefit of the locking pin 9, it is only necessary to also invert the arm 7 relative to its particular end plate 4.

In this manner, there is provided a very simple means for interchangeability and versatility of parts because a single design of end plate 4 is used and the removable arm 7 is employed. If an arm 7 is damaged or broken, it can readily be replaced with another. On prior art devices,

the arms of this type are not necessarily removable, but are riveted or otherwise secured to the beam member.

As indicated in FIGS. 1 and 3, the arm **7** can be pivoted on the pin **8** to move the locking pin **9** clear of an enlarged portion **6***a* of a second keyhole **6**.

As also shown in FIGS. 3 and 4, each of the second keyholes **6** have a coined or recessed portion **6***c* surrounding the narrow portion **6***b*. This recessed portion **6***c* is depressed relative to the surface of the wall **4***c* by a dimension of at least the thickness of the flanged head **8***b* of the pin **8**. In this way, the flanged head **8***b* can be mounted on the wall **4***c* in a non-protruding manner. With this arrangement, no special cutouts must be provided in the upright **1** to accommodate the travel of the pin **8** nor, in the alternative, is it necessary to insure that the pin **8** always aligns with at least a portion of a first keyhole **3***a* or **3***b* in order to prevent interference of the pin **8** with portions of the upright **1** during assembly of the beam to the upright.

The first keyholes **3***a* have been distinguished from the first keyholes **3***b* only because of their difference in slope. Actually, the significance is that they are mirror images of each other and the first keyholes **3***a* accommodate beams connected on one side of the upright **1** while the keyholes **3***b* accommodate beams connected on the opposite side of the upright **1**.

In FIGS. 8 and 9 another embodiment of the invention is shown. Although identical beams and end plates as already described are employed, a different upright **9***a* is used. It has a single row of keyholes **10** which have enlarged upper portions **10***a* and narrower lower portions **10***b*, but they are not sloped one way or the other. With this arrangement, a beam can be connected from either side of the upright **9***a* by means of the single row of keyholes **10**. In the first embodiment described, two rows of keyholes are employed on the upright **1** and, with that construction, it is necessary to employ one row for connection from one side of the upright and the other row for connection on the other side. The main reason for two rows is to provide the tightening action obtained by having the second keyholes **3***a* and **3***b* oppositely sloped or canted. With the construction shown in FIGS. 8 and 9, the keyholes **10** do not provide this tightening action in either direction. If such an action is required, it is necessary to slope the holes in one direction or the other, but this may limit the ability to properly attach beams with the tightening action from both sides of the upright **9***a*.

Still another embodiment of the invention is shown in FIGS. 10 and 11. Whereas the previous embodiments shown indicate structures wherein the pin **9** was accommodated through aligned first and second keyholes where only a single second keyhole on the beam portion aligned with a single first keyhole on the upright **1**, the structure shown in FIGS. 10 and 11 indicate an arrangement whereby there can be simultaneous alignment of two pairs of first and second keyholes. The advantage of this arrangement is that the locking pin arm **11** can be employed in either the position shown in FIGS. 10 and 11 or in and end-to-end inverted position. In either case the locking pin **11***a* on it can pass through a second keyhole **6** aligned with a first keyhole **3***a*. As a practical matter, this construction is completely foolproof because the locking pin **11***a* will always fit properly in a manner to be functional as a locking pin which prevents relative movement between the upright member **1** and a beam member **2**.

The reason that there is alignment of two pairs of first and second keyholes is because the headed studs **5** are spaced from each other by a distance equal to the spacing of every fourth first keyhole **3***a* along the upright **1**. Further, the spacing of the second keyholes from each other is such that their enlarged portions **6***a* are approximately equal to the increment of spacing between adjacent first keyholes **3***a*. Because the spacing of the second keyholes **6** is different than on the previous embodiments shown, the length of the locking pin arm **11** is longer than the locking pin arm **7**, and the spacing of the pin **8** from the locking pin **11***a* is also different. Otherwise, the construction is substantially the same as for the other embodiments. Further, it is apparent that the same end plate **12** can be used for either left-hand or right-hand connections to an upright **1** so that a beam **2** can be inverted and reconnected with either of its ends connected by either a left-hand or right-hand connection. With this arrangement, the same locking pin arm **11** can be employed and it makes no difference in which end-to-end position the locking pin arm **11** is connected.

Although the invention has been shown in all of its embodiments with horizontally positioned beams connected to vertical uprights, it is clear that the connections shown can be made between beams and upright members which are positioned at different angles and what is shown as an upright could just as well be a horizontal member and what is shown as the horizontal beam could be positioned as a vertical member. Further, even though the beam members are indicated as having connectors at both ends, they can just as well be cantilever type members with connectors at one end only. Also, they need not be actual beam members. Instead, they might just as well be relatively short supports in many different forms.

Although only certain embodiments of the invention have been shown and described, it should be understood that the invention can be made in many different ways without departing from the true scope of the invention as defined by the appended claims.

We claim:

1. In a connection between a beam and an upright comprising, a first row of substantially equally spaced first keyholes extending along the upright, a pair of headed studs secured to a plate portion on the end of the beam and spaced from each other by the same spacing as the distance between every third keyhole of said first row of keyholes, a pair of second keyholes in said plate portion along said end of the beam, each keyhole being shaped with an enlarged portion connected to a narrow portion, the spacing of the pair of second keyholes being such that the enlarged portion of one of the second keyholes aligns with the enlarged portion of one of the first keyholes when the pair of headed studs engage the narrow portions of two of the first keyholes.

2. In a connection between a beam and an upright as defined by claim **1** characterized by, the spacing of the pair of second keyholes permitting the beam to be inverted and have its headed studs engaging the narrow portions of two keyholes of a second row of first keyholes extending along the upright with the enlarged portion of the other of said pair of second keyholes aligned with the enlarged portion of one of the first keyholes of the second row.

3. In a connection between a beam and an upright as defined by claim **1** characterized by, said beam carrying a locking pin on the plate portion which extends through the aligned enlarged portion of said one of the second keyholes and the enlarged portion of said one of the first keyholes.

4. In a connection between a beam and an upright as defined by claim **2** characterized by, said beam carrying a locking pin on the plate portion which can be repositioned on the beam to extend through either of said pair of second keyholes.

5. In a connection between a beam and an upright as defined by claim **3** characterided by, said locking pin being connected to an elongated arm, said arm being connected to the plate portion on the beam by detachable means.

6. In a connection between a beam and an upright as defined by claim **4** characterized by, said locking pin being connected to an elongated arm, said arm being connected

to the plate portion on the beam by detachable means.

7. In a connection between a beam and an upright as defined by claim 5 characterized by, said detachable means comprising a shouldered pin engaging either of the narrow portions of the pair of second keyholes so that the elongated arm can be reversed in position end to end.

8. In a connection between a beam and an upright as defined by claim 6 characterized by, said detachable means comprising a shouldered pin removably engaging either of the pair of second keyholes so that the elongated arm can be repositioned end to end.

9. In a connection between a beam and an upright comprising, a first row and a second row of substantially equally spaced first keyholes extending parallel to each other in a vertical direction along the upright, a pair of studs secured to a plate portion on the end of the beam and spaced from each other by the distance between every third keyhole of the first and second row, a pair of second keyholes in the plate portion on the end of the beam between the pair of studs, each of the first keyholes and the second keyholes being shaped with an enlarged portion connected to a narrow portion, the spacing of the pair of second keyholes from each other being less than the spacing of the enlarged portions of two adjacent first keyholes in a single row so that only a first of the pair of second keyholes can concentrically align with one of the first keyholes when the end of the beam is connected to the upright with the pair of studs engaged with two of the first keyholes along said first row, and a locking pin on the plate portion extending through said aligned keyholes.

10. In a connection between a beam and an upright as defined by claim 9 characterized by, the second of said pair of second keyholes being positioned relative to the pair of studs so that it can concentrically align with one of the first keyholes of said second row to accommodate said locking pin when the beam is inverted and connected to the upright with the pair of studs engaged with two of the first keyholes along said second row, thereby permitting both right hand and left hand stud and locking pin connections of the beam to the upright with the same beam end.

11. In a connection between a beam and an upright as defined by claim 3 characterized by, said locking pin being supported on an elongated arm having pin means for selectively detachably securing the arm in either of the pair of second keyholes, said locking pin being secured to the elongated arm at a location from the pin means sufficient to permit the locking pin to concentrically align with the enlarged portion of the one of the pair of second keyholes which is not engaged by the pin means.

12. In a connection between a beam and an upright as defined by claim 11 characterized by, said pin means having a headed flange at its free end which is larger than the narrow portions of the second keyholes so that the elongated arm is detachably secured in either of the second keyholes by means of the headed flange bearing against the regions of the rear face of the beam end immediately surrounding the second keyholes.

13. In a connection between a beam and an upright as defined by claim 12 characterized by, said regions being recessed relative to the general rear face of the beam by an amount at least equal to the thickness of the headed flange on the pin means to thereby permit non-protruding mounting of the pin means in either of the second keyholes relative to the general rear face of the beam.

14. An end flange construction for use in connecting a beam member to an elongated member having at least one row of substantially equally spaced first keyholes, the end flange being connected to one end of a beam member, comprising, a stud secured to the flange, a pair of second keyholes in the flange, each of the first keyholes and the second keyholes being shaped with an enlarged portion connected to a narrow portion, the spacing of the second keyholes from each other being less than the spacing of the enlarged portions of two adjacent first keyholes so that only a first of the pair of second keyholes can concentrically align with one of the first keyholes when the end flange is connected to the elongated member with said stud engaged with one of the first keyholes, said aligned keyholes accommodating a locking pin.

15. An end flange construction as defined by claim 14 characterized by, the second of said pair of second keyholes being positioned relative to the stud so that said second keyhole can concentrically align with one of the first keyholes to accommodate the locking pin when the beam is inverted and connected to the elongated member with the stud reengaged with another first keyhole, thereby permitting both right hand and left hand stud and locking pin connections of the beam to the elongated member while employing the same flange.

16. A connection between a beam member and an elongated member having at least one row of substantially equally spaced first keyholes, comprising, a connector secured to a plate portion on the beam member, a pair of second keyholes in the plate portion on the beam member adjacent the connector, the first keyholes and the second keyholes each being shaped with an enlarged portion through which a locking pin fits, the spacing of the second keyholes from each other being less than the spacing of the enlarged portions of two adjacent first keyholes so that only a first of the pair of second keyholes is concentrically aligned with one of the first keyholes when the connector on the plate portion on the beam member is connected to another of the first keyholes on the elongated member, said aligned keyholes accommodating a locking pin.

17. A connection between a beam member and an elongated member having at least one row of substantially equally spaced first keyholes, comprising, a connector secured to a plate portion on the beam member, a pair of second keyholes in the plate portion on the beam member adjacent the connector, the first keyholes and the second keyholes each being shaped with an enlarged portion through which a locking pin fits, the spacing of the second keyholes from each other relative to the spacing of the first keyholes from each other being such that at least one of the enlarged portions of the pair of second keyholes is concentrically aligned with one of the first keyholes when the connector on the plate portion on the beam member is connected to one of the first keyholes on the elongated member, said aligned keyholes accommodating a locking pin.

18. A connection between a beam member and an elongated member having at least one row of substantially equally spaced first keyholes comprising, a connector secured to a plate portion on the beam member, a pair of second keyholes in the plate portion on the beam member adjacent the connector, the first keyholes and the second keyholes each being shaped with an enlarged portion through which a locking pin fits, the spacing of the enlarged portions of the second keyholes from each other being substantially equal to the spacing of the enlarged portions of the first keyholes so that each enlarged portion of the second keyholes align with respective enlarged portions of first keyholes when the connector on the plate portion on the beam member is connected to one of the first keyholes on the elongated member, each pair of aligned keyholes accommodating a locking pin.

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