

PATENT SPECIFICATION

(11)

1 581 945

1 581 945

- (21) Application No. 15109/77 (22) Filed 12 April 1977
 (31) Convention Application No. 51/040450 (32) Filed 10 April 1976 in
 (33) Japan (JP)
 (44) Complete Specification published 31 Dec. 1980
 (51) INT. CL.³ F16B 9/02
 (52) Index at acceptance
 F2M 207 211 225 231 232 233 244 246 248 282 C1
 E1B 33



(54) STRUCTURAL JOINT

(71) We, YOSHIDA KOGYO K.K., a corporation duly organized under the laws of Japan and existing at No. 1, Kanda Izumi-cho, Chiyoda-ku, Tokyo, Japan, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

The present invention relates to a structural joint between a plate member and a tubular member connected endwise to the plate member.

Various structural joints have been proposed in an attempt to assemble metal railings such as tubular aluminum railings for use on balconies, stairs, guard rails and the like. One known connecting arrangement is welding. However, the procedure is time-consuming and expensive though it provides a rugged final structure. Bolts and screws have been used, but they become loose after a period of time to thereby render the railing structure less rigid and make it dangerous. Another type of interlocking device is a fastening connector made up of a plurality of interengaging members which when assembled put the railing bars together. The cost and time involved in installing this fastening assembly, however, has limited its acceptability.

According to the invention there is provided a right angled structural joint, comprising: a first elongate member having a hollow open end; a second member extending substantially perpendicularly to and having a flat surface disposed flat against the said open end, the second member having a through hole; a connector fitted coaxially in the first member at its open end, the connector having a body with an end face held flat against the flat surface of the second member, the body having on its outer periphery a roughened surface held in frictional engagement with the interior

surface of the said hollow open end, there being a bore and a slot in the body, the bore being located substantially along the axis of the body, and the slot communicating between the bore and the outer periphery; and a screw passing through the said hole axially and threadedly into the said connector.

The present invention in its various embodiments seeks to provide a structural joint which is quickly and easily assemblable.

The invention will now be described in greater detail, by way of example, with reference to the drawings, in which:—

Figure 1 is a perspective view of a connector constructed in accordance with the present invention;

Figure 2 is a fragmentary exploded perspective view of a structural joint employing the connector shown in Figure 1;

Figure 3 is an enlarged vertical cross-sectional view of the structural joint that is assembled;

Figure 4 is a cross-sectional view taken along line IV-IV of Figure 3;

Figure 5 is a cross-sectional view taken along line v-v of Figure 3;

Figure 6 is a vertical cross-sectional view of a balustrade incorporating the structural joints shown in Figure 3;

Figure 7 is a top plan view of a modified connector;

Figure 7 is a perspective view of a connector according to another embodiment;

Figure 9 is an exploded perspective view of a balustrade incorporating the structural joints shown in Figure 8;

Figure 10 is a vertical cross-sectional view of the balustrade of Figure 9 that is put together;

Figure 11 is an enlarged cross-sectional view taken along line XI-XI of Figure 10; and

90

Figures 12 to 14 are top plan views of modified connectors.

In Figures 1 and 2, a structural joint generally indicated 10 (in Figure 2) comprises a vertical hollow cylindrical or tubular member 11 having an open end 12, a horizontal plate member 13 extending substantially perpendicularly to the tubular member 11 and having a surface 14 (Figure 3) for being disposed flat against the open end 12 of the tubular member 11, and a connector 15 to be force-fitted in the open end 12 for connecting the tubular member 11 endwise to the plate member 13.

The connector 15 is substantially cylindrical and includes a body 16 having an end face 17 to be held flat against the surface 14 of the plate member 13, and a portion in the form of a sleeve 18 at an end of the body 16 opposite to the end face 17, the sleeve 18 being coaxial with the body 16. The connector body 16 has on and around its outer periphery and near the end face 17 a roughened surface 19 such as a knurled surface having a plurality of straight ridges extending lengthwise of the connector 15. The part of the body 16 having the knurled surface 19 thereon is larger in diameter than an interior surface 20 of the tubular member end 12 so that the connector 15 when forcibly inserted in the tubular member 11 can be retained against removal or displacement by the knurled surface 19 held in tight frictional engagement with the interior surface 20. An initial diameter of the body 16 therefore may be such that there is provided a close sliding fit between the interior surface 20 and the body 16 inserted in the tubular member 11 since knurling has a tendency to increase slightly the diameter of the body part knurled. However, to provide the connector 15 with a greater retentive force, a peripheral surface of the body 16 that is to be knurled should be slightly larger in diameter than the remainder. Typically, the peripheral surface to be knurled should initially be raised to the extent that upon knurling valleys between adjacent knurl ridges have their bottoms that describe an imaginary peripheral surface lying substantially flush with the surface of the remainder of the body 16.

The connector body 16 has a through bore 21 located substantially centrally thereof or coaxially therewith and extending axially of the body 16. The bore 21 serves to receive therein a screw, but is not initially tapped before the screw is turned in. The connector body 16 also has therein a slot 22 extending end to end axially thereof and communicating between the bore 21 and the knurled outer periphery 19, the slot 22 providing a pair of legs 23, 24 one on each side thereof. As better shown in Figure 4, the

slot 22 is of a vee cross-section and progressively widened radially outwardly or from the bore 21 toward the outer periphery 19.

The sleeve 18 is slightly tapered toward its distal end remote from the connector body 16 and has in its wall a pair of rectangular splits 25, 26 disposed in diametrically opposed relation (Figure 5). The sleeve 18 also has a slot 27 angularly spaced substantially 90° apart from each of the splits 25, 26. The slot 27 extends axially of the sleeve 18 and is in line and communicates with the slot 22 in the connector body 16. The slots 22, 27 allow the legs 23, 24 to move slightly toward each other under compressive forces.

The plate member 13 has a through hole 28 for the passage therethrough of a screw 29.

For assembly of the T-shaped structural joint 10, the connector 15 is first force-fitted into the tubular member 11 at the end 12 by simply striking the end face 17 with a hammer until the end face 17 is substantially aligned with the end 12. The sleeve 18, being split and tapered, makes it easy to insert the connector 15 partly into the tubular member 11 before hammering. As the connector 15 is forcibly inserted into the tubular member 11, it is squeezed to cause the legs 23, 24 to move closer against their own resiliency. Upon installation, the knurled surface 19 is maintained in tight frictional engagement with the interior surface 20 of the tubular member 11, so that the connector 15 lockingly engages the tubular member 11 against rotation, displacement, and removal. Further, since the legs 23, 24 have a tendency to move apart or spring back under their own resiliency, the peripheral surface of the connector 15 is further pressed against the interior surface 20 of the tubular member 11.

Then, the plate member 13 is placed over the end face 17 of the connector 15 with the hole 28 held in registry with the bore 21. The screw 29 is inserted through the hole 28 and turned into the bore 21 as it forms its own female threads in the wall that defines the bore 21. Thus, the screw 29 has a self-tapping helical thread. As the screw 29 is forcibly threaded in, it slightly widens the bore 21 and hence the slot 22 to thereby urge the legs 23, 24 apart into tighter engagement with the wall 20 of the tubular member 11. When the screw 29 is threaded fully into the connector 15, the T-shaped structural joint 10 is completed as shown in Figure 3.

Figure 6 shows a balustrade 30 incorporating the structural joint 10 thus constructed. The balustrade 30 includes a hollow cylindrical baluster 31 having its

lower end connected to a bottom rail 32 through one connector 10 screwed to the rail 32 and its upper end connected to an adaptor or attachment plate 33 through a second connector 10 screwed to the plate 33 that in turn is fixed to a top rail 34 by means of screws 35.

According to a modified connector 36 illustrated in Figure 7, a vee slot 37 extends diametrically beyond a central bore 38 to give the connector 36 a greater yieldability that provides less resistance when legs 39, 40 are forced together under compressive forces.

A connector 41 shown in Figure 8 is similar to the connector 15 of Figure 1 except for the provision of a pair of bores 42, 43 in its body 44, the bores 42, 43 extending axially thereof. The bores 42, 43 are located adjacent to the knurled outer periphery 19 and open along their outer sides to thereby provide communication with the outer periphery 19. As best shown in Figure 11, the bores 42, 43 are disposed in diametrically opposed relation and angularly spaced substantially 90° apart from the slot 22.

In Figures 9, 10 and 11, a balustrade 46 utilizes the connector 41 shown in Figure 8. To affix the connector 41 to an adapter plate 47, a pair of self-tapping type screws 48, 49 are additionally used which pass through the plate 47 into the bores 42, 43, respectively. As the screws 48, 49 are turned into the bores 42, 43, they cut their own female threads in the walls that bound the bores 42, 43 and at the same time form female threads partly in the interior surface 50 of a tubular baluster 51.

Thus, the screws 48, 49 positively engage the tubular baluster 51, thereby connecting the plate 47 to the tubular baluster 51 with greater mechanical strength. With this arrangement, the connector 41 can be more effectively prevented from accidental rotation in or removal from the tubular baluster 51 under severe external forces.

A modified connector 52 shown in Figure 12 has a central bore 53 and an outer bore 54 located adjacent to an outer periphery 55 of the connector and having its outer side open. A radial slot 56 extends between these bores 53, 54. According to another connector 57 illustrated in Figure 13, a slot 58 extends diametrically beyond a central bore 59, and a bore 60 with one side open is angularly spaced substantially 90° apart from the slot 58. Figure 14 shows a connector 61 to be fitted in a rectangular hollow member.

WHAT WE CLAIM IS:—

1. A right angled structural joint comprising: a first elongate member having a hollow open end; a second member extending substantially perpendicularly to and having a flat surface disposed flat against the said open end, the second member having a through hole; a connector fitted coaxially in the first member at its open end, the connector having a body with an end face held flat against the flat surface of the second member, the body having on its outer periphery a roughened surface held in frictional engagement with the interior surface of the said hollow open end, there being a bore and a slot in the body, the bore being located substantially along the axis of the said body, and the slot communicating between the bore and the outer periphery; and a screw passing through the said hole axially and threadedly into the said connector.

2. A structural joint according to Claim 1, wherein the screw passing through the said hole extends threadedly into the said bore.

3. A structural joint according to claim 1, said body further including a second bore communicating with said outer periphery, the said screw passing through the said hole in the second member and extending threadedly into the second bore, and having a portion held in self-tapping engagement with the said interior surface.

4. A structural joint according to Claim 3 wherein, the second bore communicates with the said slot.

5. A structural joint according to Claim 3, wherein the second bore is angularly spaced substantially 90° apart from said slot.

6. A structural joint according to any preceding claim, wherein the first member comprises a hollow cylinder and the connector body comprises a cylinder, the slot being of a vee cross-section progressively widened radially outwardly.

7. A structural joint according to Claim 6, wherein the connector includes a sleeve portion at an end of the body opposite to the said end face, the sleeve portion being tapered towards its distal end and having a pair of splits disposed in diametrically opposed relation and there being a second slot in said sleeve that communicates with said first-mentioned slot.

8. A structural joint according to any preceding Claim wherein the roughened surface comprises a knurled surface having a plurality of straight ridges extending

lower end connected to a bottom rail 32 through one connector 10 screwed to the rail 32 and its upper end connected to an adaptor or attachment plate 33 through a second connector 10 screwed to the plate 33 that in turn is fixed to a top rail 34 by means of screws 35.

According to a modified connector 36 illustrated in Figure 7, a vee slot 37 extends diametrically beyond a central bore 38 to give the connector 36 a greater yieldability that provides less resistance when legs 39, 40 are forced together under compressive forces.

A connector 41 shown in Figure 8 is similar to the connector 15 of Figure 1 except for the provision of a pair of bores 42, 43 in its body 44, the bores 42, 43 extending axially thereof. The bores 42, 43 are located adjacent to the knurled outer periphery 19 and open along their outer sides to thereby provide communication with the outer periphery 19. As best shown in Figure 11, the bores 42, 43 are disposed in diametrically opposed relation and angularly spaced substantially 90° apart from the slot 22.

In Figures 9, 10 and 11, a balustrade 46 utilizes the connector 41 shown in Figure 8. To affix the connector 41 to an adapter plate 47, a pair of self-tapping type screws 48, 49 are additionally used which pass through the plate 47 into the bores 42, 43, respectively. As the screws 48, 49 are turned into the bores 42, 43, they cut their own female threads in the walls that bound the bores 42, 43 and at the same time form female threads partly in the interior surface 50 of a tubular baluster 51.

Thus, the screws 48, 49 positively engage the tubular baluster 51, thereby connecting the plate 47 to the tubular baluster 51 with greater mechanical strength. With this arrangement, the connector 41 can be more effectively prevented from accidental rotation in or removal from the tubular baluster 51 under severe external forces.

A modified connector 52 shown in Figure 12 has a central bore 53 and an outer bore 54 located adjacent to an outer periphery 55 of the connector and having its outer side open. A radial slot 56 extends between these bores 53, 54. According to another connector 57 illustrated in Figure 13, a slot 58 extends diametrically beyond a central bore 59, and a bore 60 with one side open is angularly spaced substantially 90° apart from the slot 58. Figure 14 shows a connector 61 to be fitted in a rectangular hollow member.

WHAT WE CLAIM IS:—

1. A right angled structural joint comprising: a first elongate member having a hollow open end; a second member extending substantially perpendicularly to and having a flat surface disposed flat against the said open end, the second member having a through hole; a connector fitted coaxially in the first member at its open end, the connector having a body with an end face held flat against the flat surface of the second member, the body having on its outer periphery a roughened surface held in frictional engagement with the interior surface of the said hollow open end, there being a bore and a slot in the body, the bore being located substantially along the axis of the said body, and the slot communicating between the bore and the outer periphery; and a screw passing through the said hole axially and threadedly into the said connector.

2. A structural joint according to Claim 1, wherein the screw passing through the said hole extends threadedly into the said bore.

3. A structural joint according to claim 1, said body further including a second bore communicating with said outer periphery, the said screw passing through the said hole in the second member and extending threadedly into the second bore, and having a portion held in self-tapping engagement with the said interior surface.

4. A structural joint according to Claim 3 wherein, the second bore communicates with the said slot.

5. A structural joint according to Claim 3, wherein the second bore is angularly spaced substantially 90° apart from said slot.

6. A structural joint according to any preceding claim, wherein the first member comprises a hollow cylinder and the connector body comprises a cylinder, the slot being of a vee cross-section progressively widened radially outwardly.

7. A structural joint according to Claim 6, wherein the connector includes a sleeve portion at an end of the body opposite to the said end face, the sleeve portion being tapered towards its distal end and having a pair of splits disposed in diametrically opposed relation and there being a second slot in said sleeve that communicates with said first-mentioned slot.

8. A structural joint according to any preceding Claim wherein the roughened surface comprises a knurled surface having a plurality of straight ridges extending



(13)

4.

1 581 945

4

lengthwise of the connector, the knurled surface being larger in diameter than the interior surface of the hollow open end of the first member.

as described herein with reference to the drawings.

10

5 9. A structural joint substantially as herein described with reference to the drawings.

10. An attachment device substantially

For the Applicants:
J. F. WILLIAMS & CO.,
Chartered Patent Agents,
34 Tavistock Street,
London WC2.

Printed for Her Majesty's Stationery Office by The Tweeddale Press Ltd., Berwick-upon-Tweed, 1980.
Published at the Patent Office, 25 Southampton Buildings, London, WC2A 1AY, from which copies may be obtained.



* C L M S *