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(54) A bar connector assembly

(57) A connector assembly for concrete reinforcing bars comprises a seat section 21 and retainer 22 for use with the seat section 21 to connect bars having a semi-circle loop at the ends. The seat section 21 is generally U-shaped and the retainer 22 is generally T-shaped. The seat section is symmetrical, the retainer is not, the bars are of uniform cross-section. A wedging action arises from the asymmetry of the retainer. The seat section has opposed lands in the form of posts 28 and 29, these posts have channels 30 and 31 which take the bar loop sections

(not shown). The retainer has a central wedge 37 which, is operative to eliminate play between the bars and the parts of the connector to effectively form a rigid unit. This is accomplished by reason of the complex wedge action arising from a first wedge region adjacent the front at 38 on opposite sides of the wedge 37 and a second wedge region 39 which comprises a curved continuation of the wedge region 38 and a third wedge region at 40. Thus the first region tends to spread the bars while the second and third wedge regions tend to lift the bars.

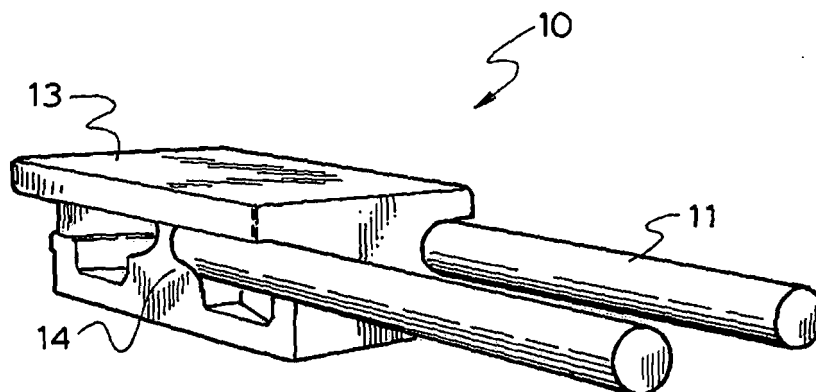


Fig. 1.

Description

FIELD OF THE INVENTION

[0001] This invention relates to a bar connector assembly and in particular but not limited to a bar connector assembly used to couple or connect U-shaped ends of adjacent reinforcing bars and preferably couple them in a common plane.

BACKGROUND TO THE INVENTION

[0002] It is customary to use lap bars projecting from a slab of concrete to connect bars in an adjacent slab. One example is where lap bars are used in a wall rebate to connect a floor to a wall.

[0003] In DE 3634568 (DENNERT KG VEIT) there is described a tensioning element for the frictionally locking connection of prefabricated concrete compound units (prefabricated floor slab) having a basic body and at least one tensioning member which is rotatably mounted in the basic body. As tensioning member, use is made of an eccentric shaft which is laid in a reinforcing loop of the prefabricated concrete compound units and, with its eccentric circumference, acts on the rounded portion of the loop from the inside. The eccentric shaft can rotate relative to the reinforcing loop, as a result of which the tensioning part is produced. The tensioning part of the eccentric shaft is configured as a flat cylindrical eccentric disk.

[0004] In JP10140670 (SUMITOMO CONSTRUCTION CO LTD) there is described a reinforcement connecting structure between precast concrete blocks, so that reinforcements arranged respectively in two precast concrete blocks can be firmly connected to each other. The reinforcement connecting structure comprises U-shapedly bent reinforcements respectively buried in two precast concrete blocks and the U-shaped curved parts are exposed in the vicinity of the joint end of the concrete blocks. Both the blocks are arranged so the curved parts of the reinforcements are arranged in two concrete blocks in confronting relation and a pair of saddle-like lock metal fittings in contact with the inside of the respective curved parts. These lock metal fittings are connected together through bolts and nuts, and are fastened so as to introduce a little tension to the reinforcements on both sides.

[0005] Each of the aforementioned connectors employ mechanisms which actively tension the opposed loops but in each case the connectors do not take into account compression that may occur over time. In addition the application of the connector requires adjustment, in the case of the German patent, the eccentric shafts have to be adjusted, in the case of the Japanese patent the nuts have to be adjusted and this process can be time-consuming where a large number of connectors are being used.

[0006] In the applicant's International Application WO 2004/111362 a connector assembly is used to connect

a U-shaped section of reinforcing bar secured within the connector by a retainer. The connector is symmetrical about so that a corresponding reinforcing bar may be located in the opposite side of the connector. The connector includes a seat section which co-operates with the retainer. The seat section includes opposed D-shaped lands defining thereabout channels into which matching curved sections of the reinforcing bars can be located and positioned. The retainer includes a T-shaped projection that extends transverse straight across the connector and serves to block compressive movement of the bars. The lands inhibit deformation of the U-shaped bars when they are placed under tension. Preferably the retainer bridges across the seat section and its engagement with the seat section serves to apply an outward force to the bars and an inward force to the lands as the retainer is driven into place.

[0007] While this connector overcomes many of the disadvantages of the above German and Japanese connectors the connector assembly does not have universal application and in some cases there is undesirable play between reinforcing bar and connector.

[0008] It is an object of the present invention to alleviate this disadvantage by providing an improved retainer in a connector assembly of the type described in WO 2004/111362.

OUTLINE OF THE INVENTION

[0009] In one preferred aspect there is provided a bar connector assembly whereby at least one bar portion may be connected intimately with the connector assembly, the connector assembly comprising a body surrounding the at least one bar portion, the body having a bar seat section and a bar retainer, the seat section and retainer being moveable relative to each other for assembly together to form the surrounding body whereby during assembly the seat section, retainer and at least one bar portion are progressively wedged together characterised in that the relationship between retainer and seat section comprises a complex wedge having two wedge actions, one wedge action being adapted to force the at least one bar section in a first direction and the second wedge action being adapted to force the at least one bar section in a second direction, the cumulative effect of the complex wedge being to eliminate play between the at least one bar portion, seat section and retainer.

[0010] Preferably, the seat section and retainer section are separate units that are assembled but may be structured as a partially assembled body with two moveable parts where the parts are constrained together for transport purposes and then "snap", clip or slide into operative position without complete separation.

[0011] Preferably, the seat section, retainer and bar portions are wedged together utilising a complex wedging action whereby wedge forces are applied laterally and outwardly in the direction of the bar portion and then across the bar portion in order to eliminate play between

the bar and the connector assembly.

[0012] The tolerances employed and the length of the wedging action will vary depending on the dimensions of the bar employed. It is preferable to make a connector that is operative for variations in bar tolerances from different manufacturers. Consequently, the wedging action will go slightly further in some cases than others. In some cases where two bars are simultaneously wedged on opposite sides of the retainer by the retainer it is preferable to allow some limited transverse movement of the retainer to accommodate bar variations. In other words the wedge may move sideways as it is being forced into operative position if one bar is slightly bigger than the other.

[0013] In another preferred embodiment the present invention resides in a bar connector assembly comprising a body having a bar seat section and a bar retainer moveable relative to the seat section to enable entry of a bar into the assembly, the seat section being adapted to receive and position a second bar relative to an adjacent bar connected to the assembly, the retainer being moveable between a first position allowing the second bar to be placed on the seat section and a second position to block removal of the second bar from the assembly, the body when assembled about the bars, the bar seat section and retainer surrounds the bars, the parts being so dimensioned and arranged that upon assembly they cooperate to force the bars into intimate relation with the body. The seat section is typically U-shaped while the retainer is typically T-shaped and complementary to the U-shaped seat section. Gaps are provided for U-shaped bar sections so that when assembled play between the body and the U-shaped bar sections is substantially eliminated.

[0014] Preferably, intimacy arises through a complex wedge applied to a U-shaped bar section located on the seat. The complex wedge is typically part of the retainer shape and drives one or where two bars are used drives both the bars into close contact with the seat section by a progressive two or three stage wedging action. The first stage comprises a lateral wedging action giving rise to a substantially lateral force and the second stage comprises the addition of a wedging action across the lateral force to lift the bar relative to the lateral direction of the first applied force. A third stage may further aid lifting of the bars. It will be appreciated that the applied forces may be more complex than this but this is an explanatory reduction of the forces.

[0015] Preferably, the seat section and retainer section are partially assembled and constrained together for transport purposes.

[0016] Preferably, the bar portion is outboard of the wedge sections, the seat section, retainer and bar portion being wedged together, utilising the complex wedging action whereby wedge forces are applied laterally and outwardly in the direction of the bar portion and then across the bar portion in order to eliminate play between the bar portion and the connector assembly.

[0017] Preferably, the wedge sections have a length

sufficient to make a connector that is operative for variations in bar tolerances.

[0018] Preferably, the connector assembly is configured to connect two opposed bar sections, the retainer being configured to allow some limited transverse movement to accommodate differences in the bars being connected.

[0019] Preferably, the connector assembly is configured to connect two opposed bar sections, the retainer being configured to allow some limited transverse movement to accommodate differences in the bars being connected, the retainer wedge section being adapted to move sideways as it is being forced into operative position if one bar is slightly bigger than the other.

[0020] Preferably, the bar retainer is moveable relative to the seat section to enable entry of the said at least one bar into the assembly, the seat section being adapted to receive and automatically position the said at least one bar relative to an adjacent bar already connected to the assembly, the retainer being moveable between a first position allowing the at least one bar to be placed on the seat section and a second position to block removal of the at least one bar from the assembly, the body when assembled about the at least one bar, and the connection to the adjacent bar being such that there is continuity of material between the bars to inhibit compressive movement between the bars when under compression.

[0021] Preferably, the seat section is a U-shaped channel complementary to part of the bar while the retainer is typically T-shaped and also complementary to the bar so the bar is housed between them.

[0022] Preferably, intimacy arises through a complex wedge applied to a U-shaped bar section located on the seat, the complex wedge being provided by the retainer which drives one or in the case of two bars both the bars into close contact with the seat section by a progressive two stage wedging action.

[0023] Preferably, intimacy arises through a complex wedge applied to a U-shaped bar section located on the seat section, the complex wedge being provided by the retainer which drives one or in the case of two bars both the bars simultaneously into close contact with the seat section by a progressive two stage wedging action comprising a first and second stage, the first stage comprises a lateral wedging action giving rise to a substantially lateral force relative to the direction of the retainer and the second stage comprises the addition of a wedging action across the lateral force to lift the bars relative to the lateral direction of the first applied force.

[0024] Preferably, the connector assembly is adapted to connect together opposed reinforcement bars wherein at least one of the bars comprises a loop section, the connector assembly having a seat section and a separate retainer bridging member, the seat section having an opening and the seat section comprises a loop section seat accessible through the opening so that the loop section may be secured to the seat section when positioned on the seat, the bridging member being adapted to bridge

across the opening when it is coupled to the seat section, the other bar being otherwise connected to the seat section opposite the loop section seat, the relative dimensions of the bars, the section and the bridging member being so chosen and arranged that a rigid portion of the assembly is located between the bars to resist compressive forces which may tend to force the bars toward each other and a further rigid section of the assembly is located in the loop section to resist deformation of the loop section when under tension, the body when assembled about the at least one bar from the bar seat section and retainer surrounds the at least one bar, the retainer and seat section being so dimensioned and arranged that upon assembly they co-operate to force the bar into intimate relation with the body.

[0025] Preferably, the bar connector assembly enables connection of bars to the assembly so that bars extend from the connector in opposite directions, the bars having U-shaped ends configured so that the ends may be held captive in the assembly by the retainer.

[0026] Preferably, the seat section comprises a curved channel and an upstanding land, the at least one bar having a curved section defining an inside and outside of the curved section, the curved section of the at least one bar being operatively positioned in the channel, the channel being at a boundary of the upstanding land, the upstanding land filling the inside of the curved section so that upon a load being applied to the bar in tension, the land section aids in retaining the bar in position and inhibits its deformation.

[0027] Preferably, the retainer comprises a solid piece driven in to secure the at least one bar in position, the retainer comprises an edgewise slidable member able to slide into operative position after the at least one bar has been located in operative position in the seat section, the bar in combination with the seat section and the retainer serving to secure the retainer and thereby the bar in position in the seat section, the retainer bridging across opposite sides of the seat section such that the seat section and retainer have the at least one bar located between them.

[0028] Preferably, the assembly is symmetrical so that two identically shaped curved bars are connected together by the assembly with the bars so connected together occupy a common plane.

[0029] Preferably, the seat section includes a retainer guide way and the retainer has a guide that travels on the guide way, the guide and/or guide way having a slight taper so that the retainer is wedged in position.

[0030] Preferably, the assembly is symmetrical so that two curved bars of circular cross section are connected together by the assembly with the bars so connected together occupying a common plane, the two curved bars being U-shaped and the seat section having D-shaped lands matched to the bars, the retainer having curved wedge surfaces on opposite sides of the retainer, where at least part of the respective wedge surfaces slide under a respective bar to lift the bar against its respective land.

[0031] Preferably, the assembly is symmetrical so that two identically shaped curved bars are connected together by the assembly with the bars so connected together occupying a common plane and any gaps between the bars are filled by the retainer so that compressive movement is blocked, the assembly being symmetrical in terms of force distribution in side view with the seat section resisting tension on one side of the bars and the retainer bridging the seat section on the opposite side of the bars to resist tension so that force applied to the bars is distributed evenly through the assembly.

[0032] Preferably, a second bar is connectable to the assembly, the second bar being curved having a curved section and the retainer being operatively connected across the second bar to the seat section outboard of the second bar and thereby generating a clamping force on the curved section of the second bar with an outward wedge force applied in a direction of tension and an inward force opposite the outward force applied by reason of the connection to the seat section outboard of the second bar. Preferably, the second bar is curved and the retainer is wedged against the at least one bar and the second bar.

[0033] Preferably, the assembly has two opposed seats having curved sections in confronting relation.

[0034] Preferably, the assembly has two opposed seats defined as the inner peripheral portion of opposed lands and having curved sections in confronting relation and the retainer is wedged between bars located in the curved sections applying an outward force to the bars and bridging across the lands applying an inward force to each of the lands tending to prevent separation of the lands when tensioned.

[0035] Preferably, the assembly has two opposed seats defined as the inner peripheral portions of opposed lands, each the land comprises an upstanding post and each seat comprises a curved channel in the upstanding post, the channel extending around part of the post so that a curved section of bar wraps around the post and extends laterally of the post.

[0036] Preferably, the assembly has two opposed seats defined as the inner peripheral portions of opposed lands, each the land comprises an upstanding post and each seat comprises a curved channel in the upstanding post, the channel extending around part of the post so that substantially U-shaped bars may be held in a common plane, the seat section comprises bilateral posts and bilateral channels, the channels being substantially in a common plane.

[0037] Preferably, the assembly has two opposed seats defined as the inner peripheral portions of opposed lands each land being undercut on an outer edge, each undercut forming a guide way at each end for the retainer so the retainer slides sideways onto the lands in order to bridge across the lands.

[0038] Preferably, the assembly has two opposed seats defined as the inner peripheral portions of opposed lands each land being undercut on an outer edge, each

undercut forming a guide way at each end for the retainer so the retainer slides sideways onto the lands in order to bridge across the lands, each guide way being tapered so that the retainer is wedged into the guide way.

[0039] Preferably, the assembly has two opposed seats defined as the inner peripheral portions of opposed lands each land being undercut on an outer edge, each undercut forming a guide way at each end for the retainer so the retainer slides sideways onto the lands in order to bridge across the lands, each guide way being tapered so that the retainer is wedged into the guide way, the retainer having a matching undercut and taper.

[0040] Preferably, the assembly has two opposed seats defined as the inner peripheral portions of opposed lands each land being undercut on an outer edge, each undercut forming a guide way at each end for the retainer so the retainer slides sideways onto the lands in order to bridge across the lands, each guide way being tapered so that the retainer is wedged into the guide way, the retainer having a matching undercut and taper, each guide way extending across the seat section and is tapered from both ends to a central vertex so that the retainer may enter from either end.

[0041] Preferably, the complex wedge comprises at least in part a curved wedge surface. Preferably, the complex wedge action arises from a first wedge region adjacent a front of the retainer on opposite sides of the retainer and a second wedge region which comprises a curved continuation of the first wedge region and a third wedge region adjacent the second wedge region. Preferably, in the case of two opposed bars, the wedge action operates simultaneously on the two bars and the first region tends to spread the bars while the second and third wedge regions tend to lift the bars.

BRIEF DESCRIPTION OF THE DRAWINGS

[0042] In order that the present invention can be more readily understood and put into practical effect, reference will now be made to the accompanying drawings which illustrate a preferred embodiment of the invention and wherein:-

Figure 1 is a perspective view of a connector assembly according to the present invention with a single bar already in place;

Figure 2 is an exploded view of the assembly of Figure 1;

Figure 3 is a perspective view of a seat section of a further embodiment suitable for a connector assembly according to the present invention;

Figure 4 is a perspective view of a retainer for use with the seat section of Figure 3;

Figures 5A through 5D are respective orthographic

views of the seat section of Figure 3;

Figures 6 and 7 are sections through B-B and A-A respectively;

Figures 8A through 8D are respective orthographic views of the retainer of Figure 4;

Figure 9 is a section through A-A of Figure 8B; and

Figures 10A to 10F illustrate a further embodiment.

METHOD OF PERFORMANCE

[0043] Referring to the drawings and initially to Figures 1 and 2, there is illustrated a connector 10 and a U-shaped section of reinforcing bar 11 secured within the connector. It will be appreciated that the reinforcing bar 11 does not constitute part of the present invention. The connector 10 in this case connects together two bar sections configured the same so that a corresponding reinforcing bar 11 may be located in the opposite side of the connector as shown in Figure 2 so that the two sections may be connected together in the same plane. The reinforcing bar has been omitted from the opposite side in each case so that the features of the opposite side of the connector may be seen more clearly.

[0044] The connector includes a seat section 13 and a retainer section 14. The reinforcing bars are held captive by reason of the relationship between the seat section 13 and the retainer section 14 which involves a complex wedging action which may be provided by either the shape of the seat section or the retainer section or appropriate shaping of both. However, for simplicity it is preferable to keep the seat section as a simple curved channel and add complexity to the retainer (see Figure 4). The seat section 13 includes opposed D-shaped lands 15 and 16 defining thereabout seats in the form of opposed channels 17 and 18 into which corresponding curved sections 19 of reinforcing bars 11 can be located and positioned. The retainer 14 includes a T-shaped projection 20 that extends transverse straight across the connector. The projection 20 abuts the bars in a wedging action and applies a slight outward force and upward force to drive the bars into intimate relation with the channels, while at the same time inhibits compression that might otherwise cause the bars to move together thereby cracking the concrete. The D-shaped lands act in tension to keep the shape of the loop sections and prevent the loop section closing.

[0045] It should be appreciated that although the assembly is shown as a symmetrical unit only at least one bar need be connected using the teaching of the present invention. The other bar may be connected in any other way. For example a single D-shaped land may be used while at the other end a threaded blind hole may be used so that a single bar may be inserted into the assembly via the threaded hole. Thus two ends of a loop bar may ex-

tend in one direction locked in place by a one sided retainer and a single bar would protrude in the opposite direction as a variation on the two loop version illustrated.

[0046] The seat section and the retainer section are cast iron selected according to appropriate loading as would be desirable in a concrete floor or wall construction or any application where the connector may be used according to engineering specifications.

[0047] Thus, the loops 11 would typically project from a concrete wall construction or floor construction and be connected to reinforcing in an adjacent structure using the connector 10. Since the retainer is located in position by a transverse sliding action the relative dimensions of the body, the retainer and the bar may be selected so that the retainer may be driven into position and it is the complex wedge action which retains the retainer in a secured position against the loop section 19.

[0048] With this general arrangement in mind reference will now be made to the other drawings which describe a preferred seat section and retainer in greater detail.

[0049] Figure 3 illustrates a seat section 21 and Figure 4 illustrates a matching retainer 22 for use with the seat section 21 and reinforcing bars similar to the bars 11 of Figures 1 and 2. That is, the bars have a semicircle loop at the ends. The seat section 21 is generally U-shaped and the retainer 22 is generally T-shaped. The seat section is symmetrical, the retainer is not, the bars are of uniform cross-section. Therefore, in the present case the wedging action arises from the asymmetry of the retainer but could arise from asymmetry in the seat section or they both may be asymmetric giving rise to ultimately the same effect. This all gives rise to the prospect of more than two parts being employed, for example it is conceivable that the same functional effect of surrounding and wedging could be achieved with more than two parts.

[0050] The retainer 22 can only slide onto the seat section in the direction of arrow 23 but may slide on from either side, that is in the direction of arrows 24 and 25 consequently for purposes of description the retainer has a front at 26 and a back at 27.

[0051] The seat section has opposed lands in the form of posts 28 and 29, these posts have channels 30 and 31 which take the bar loop sections (not shown). Each post has a retainer guide way at 32 and 33 which co-operates with retainer guides 34 and 35. Thus having regard to Figures 3 and 4 if one imagines flipping the retainer of Figure 4 over in the direction of arrow 36 the front 26 will be aligned with the seat section and may enter in the direction of arrow 25 with the guides and guide ways co-operating.

[0052] As may be observed in Figure 4 the guides are tapered back to front and are undercut, the guide ways are also tapered and undercut so that the retainer is constrained against transverse movement. In addition the dimensions of the guides, guide ways and the undercut in each case is selected to inhibit separation of the retainer and seat section when the bars are under tension

thus inhibiting any "banana-ring" or curving of the connector. The tapers are chosen so that the guides progressively wedge in the guide ways. The guide ways on the seat section taper bilaterally out from the centre so that the retainer may enter from either side as described.

[0053] When the bars are in position in the channels 30 and 31 the retainer has a central wedge 37 which, in conjunction with the guides and guide ways is operative to eliminate play between the bars and the parts of the connector to effectively form a rigid unit. This is accomplished by reason of the complex wedge action arising from a first wedge region adjacent the front at 38 on opposite sides of the wedge 37 and a second wedge region 39 which comprises a curved continuation of the wedge region 38 and a third wedge region at 40. Thus the first region tends to spread the bars while the second and third wedge regions tend to lift the bars. This means the bars are forced into the channels 30 and 31 and up against the underside walls 41 and 42 of the channels 30 and 31. Since reinforcing bars vary slightly between manufacturers it will be appreciated that the retainer will simply travel further into the seat section for narrower bars so each size connector may cater for a range of bar sizes.

[0054] The embodiment 50 of Figures 10A to 10F differs slightly relative to the earlier drawings in so far as the retainer guide ways 52 and 53 and guides 54 and 55 are parallel albeit still undercut. In addition the guides 54 and 55 are slightly further apart than the guide ways, in the illustrated embodiment there is effectively a 1 mm gap so that as the wedge 56 is being forced into position the wedge may slide sideways up to a mm. Applicant has found this takes into account common variation in bar diameter.

[0055] Whilst the above has been given by way of illustrative example of the present invention many variations and modifications thereto will be apparent to those skilled in the art without departing from the broad ambit and scope of the invention as set out in the accompanying claims.

Claims

1. A bar connector assembly whereby at least one bar portion may be connected intimately with the connector assembly, the connector assembly comprising a body surrounding the at least one arcuate bar portion, the body having a bar seat section and a bar retainer, the seat section and retainer being moveable relative to each other for assembly together to form the surrounding body whereby during assembly the seat section, retainer and at least one arcuate bar portion are progressively wedged together **characterised in that** the relationship between retainer and seat section comprises a complex wedge having two wedge actions, one wedge action being adapted to force the at least one bar portion in a first direction

and the second wedge action being adapted to force the at least one bar portion in a second direction, the cumulative effect of the complex wedge being to eliminate play between the at least one bar portion, seat section and retainer.

2. A bar connector assembly according to claim 1 wherein, the seat section and retainer section are separate units.
3. A bar connector assembly according to claim 1 wherein, the seat section and retainer section are partially assembled and constrained together for transport purposes.
4. A bar connector assembly according to claim 1 wherein the bar portion is outboard of the wedge, the seat section, retainer and bar portion being wedged together, utilising the complex wedging action whereby wedge forces are applied laterally and outwardly in the direction of the bar portion and then across the bar portion in order to eliminate play between the bar portion and the connector assembly.
5. A bar connector assembly according to claim 1 wherein the wedge has a length sufficient to make a connector that is operative for variations in bar tolerances
6. A bar connector assembly according to claim 1 wherein the connector assembly is configured to connect two opposed bar portion, the retainer being configured to allow some limited transverse movement to accommodate differences in the bars being connected.
7. A bar connector assembly according to claim 1 wherein the connector assembly is configured to connect two opposed bar portion, the retainer being configured to allow some limited transverse movement to accommodate differences in the bars being connected, the retainer wedge being adapted to move sideways as it is being forced into operative position if one bar is slightly bigger than the other.
8. A bar connector assembly according to claim 1 wherein the bar retainer is moveable relative to the seat section to enable entry of the said at least one bar into the assembly, the seat section being adapted to receive and automatically position the said at least one bar relative to an adjacent bar already connected to the assembly, the retainer being moveable between a first position allowing the at least one bar to be placed on the seat section and a second position to block removal of the at least one bar from the assembly, the body when assembled about the at least one bar, and the connection to the adjacent bar being such that there is continuity of material be-

tween the bars to inhibit compressive movement between the bars when under compression.

9. A bar connector assembly according to claim 1 wherein the seat section is a U-shaped channel complementary to part of the bar while the retainer is typically T-shaped and complementary to the bar so the bar is housed between them.
10. A bar connector assembly according to claim 1 wherein intimacy arises through a complex wedge applied to a U-shaped bar section located on the seat, the complex wedge being provided by the retainer which drives the bar at a tangent into close contact with the seat section by a progressive two stage wedging action.
11. A bar connector assembly according to claim 1 wherein intimacy arises through a complex wedge applied to opposed U-shaped bar sections located on the seat section, the complex wedge being provided by the retainer which drives one or both the bars simultaneously into close contact with the seat section by a progressive two stage wedging action comprising a first and second stage, the first stage comprises a lateral wedging action giving rise to a substantially lateral force relative to the direction of the retainer and the second stage comprises the addition of a wedging action across the lateral force to lift the bars relative to the lateral direction of the first applied force.
12. A bar connector assembly according to claim 1 wherein the connector assembly is adapted to connect together opposed reinforcement bars wherein at least one of the bars comprises a loop section, the retainer comprising a bridging member adapted to bridge over the seat section, the seat section having an opening and the seat section comprises a loop section seat accessible through the opening so that the loop section may be positioned on the seat, the bridging member being adapted to bridge across the opening when it is coupled to the seat section, the other one of the said bars being otherwise connected to the seat section opposite the loop section seat, the relative dimensions of the bars, the seat section and the bridging member being so chosen and arranged that a rigid portion of the assembly is located between the bars to resist compressive forces which may tend to force the bars toward each other and a further rigid section of the assembly is located inside the loop section to resist deformation of the loop section when under tension, the body when assembled about the bars from the bar seat section and retainer surrounds the at least one bar and being so dimensioned and arranged that upon assembly they cooperate to force the at least one bar into intimate relation with the body.

13. A bar connector assembly according to claim 1 wherein the bar connector assembly enables connection of bars to the assembly so that bars extend from the connector in opposite directions, the bars having U-shaped ends configured so that the ends may be held captive in the assembly by the retainer
14. A bar connector assembly according to claim 1 wherein the seat section comprises a curved channel and an upstanding land, the at least one bar having a curved section defining an inside and outside of the curved section, the curved section of the at least one bar being operatively positioned in the channel, the channel being at a boundary of the upstanding land, the upstanding land filling the inside of the curved section so that upon a load being applied to the bar in tension, the land section aids in retaining the bar in position and inhibits its deformation.
15. A bar connector assembly according to claim 1 wherein the retainer comprises a solid piece driven in to secure the at least one bar in position, the retainer comprises an edgewise slidable member able to slide into operative position after the at least one bar has been located in operative position in the seat section, the bar in combination with the seat section and the retainer serving to secure the retainer and thereby the bar in position in the seat section, the retainer bridging across opposite sides of the body such that the body and retainer have the at least one bar located between them.
16. A bar connector assembly according to claim 1 wherein the assembly is symmetrical so that two identically shaped curved bars are connected together by the assembly with the bars so connected together occupy a common plane.
17. A bar connector assembly according to claim 1 wherein the seat section includes a retainer guide way and the retainer has a guide that travels on the guide way, the guide and/or guide way having a slight taper so that the retainer is wedged in position.
18. A bar connector assembly according to claim 1 wherein the assembly is symmetrical so that two identically shaped curved bars of circular cross section are connected together by the assembly with the bars so connected together occupying a common plane, the two curved bars being U-shaped and the seat section having D-shaped lands matched to the bars, the retainer having curved wedge surfaces on opposite sides of the retainer, where at least part of the respective wedge surfaces slides under a respective bar to lift the bar against its respective land.
19. A bar connector assembly according to claim 1 wherein the assembly is symmetrical so that two identically shaped curved bars are connected together by the assembly with the bars so connected together occupying a common plane and any gaps between the bars are filled by the retainer so that compressive movement is blocked, the assembly being symmetrical in terms of force distribution in side view with the seat section resisting tension on one side of the bars and the retainer bridging the seat section on the opposite side of the bars to resist tension so that force applied to the bars is distributed evenly through the assembly.
20. A bar connector assembly according to claim 1 wherein a second bar is connectable to the assembly, the second bar being curved having a curved section and the retainer being operatively connected across the second bar to the seat section outboard of the second bar and thereby generating a clamping force on the curved section of the second bar with an outward wedge force applied in a direction of tension and an inward force opposite the outward force applied by reason of the connection to the seat section outboard of the second bar.
21. A bar connector assembly according to claim 1 wherein the assembly is adapted to receive a second bar, the second bar is curved and the retainer is also wedged against the second bar.
22. A bar connector assembly according to claim 1 wherein the assembly has two opposed seats having curved sections in confronting relation.
23. A bar connector assembly according to claim 1 wherein the assembly has two opposed seats defined as the inner peripheral portion of opposed lands and having curved sections in confronting relation and the retainer is wedged between bars located in the curved sections applying an outward force to the bars and bridging across the lands applying an inward force to each of the lands tending to prevent separation of the lands when tensioned.
24. A bar connector assembly according to claim 1 wherein the assembly has two opposed seats defined as the inner peripheral portions of opposed lands, each the land comprises an upstanding post and each seat comprises a curved channel in the upstanding post, the channel extending around part of the post so that a curved section of bar wraps around the post and extends laterally of the post.
25. A bar connector assembly according to claim 1 wherein the assembly has two opposed seats defined as the inner peripheral portions of opposed lands, each the land comprises an upstanding post and each seat comprises a curved channel in the upstanding post, the channel extending around part

of the post so that substantially U-shaped bars may be held in a common plane, the seat section comprises bilateral posts and bilateral channels, the channels being substantially in a common plane.

26. A bar connector assembly according to claim 1 wherein the assembly has two opposed seats defined as the inner peripheral portions of opposed lands each land being undercut on an outer edge, each undercut forming a guide way at each end for the retainer so the retainer slides sideways onto the lands in order to bridge across the lands.
27. A bar connector assembly according to claim 1 wherein the assembly has two opposed seats defined as the inner peripheral portions of opposed lands each land being undercut on an outer edge, each undercut forming a guide way at each end for the retainer so the retainer slides sideways onto the lands in order to bridge across the lands, each guide way being tapered so that the retainer is wedged into the guide way.
28. A bar connector assembly according to claim 1 wherein the assembly has two opposed seats defined as the inner peripheral portions of opposed lands each land being undercut on an outer edge, each undercut forming a guide way at each end for the retainer so the retainer slides sideways onto the lands in order to bridge across the lands, each guide way being tapered so that the retainer is wedged into the guide way, the retainer having a matching undercut and taper.
29. A bar connector assembly according to claim 1 wherein the assembly has two opposed seats defined as the inner peripheral portions of opposed lands each land being undercut on an outer edge, each undercut forming a guide way at each end for the retainer so the retainer slides sideways onto the lands in order to bridge across the lands, each guide way being tapered so that the retainer is wedged into the guide way, the retainer having a matching undercut and taper, each guide way extending across the seat section and is tapered from both ends to a central vertex so that the retainer may enter from either end.
30. A bar connector assembly according to claim 1 wherein the complex wedge comprises at least in part a curved wedge surface.
31. A bar connector assembly according to claim 1 wherein the complex wedge action arises from a first wedge region adjacent a front of the retainer on opposite sides of the retainer and a second wedge region which comprises a curved continuation of the first wedge region and a third wedge region adjacent

the second wedge region.

32. A bar connector assembly according to claim 1 wherein the complex wedge action arises from a first wedge region adjacent a front of the retainer on opposite sides of the retainer and a second wedge region which comprises a curved continuation of the first wedge region and a third wedge region adjacent the second wedge region and the assembly is adapted to connect two opposed bars, the wedge action operating simultaneously on the two bars and the first wedge region tends to spread the bars while the second and third wedge regions tend to lift the bars.

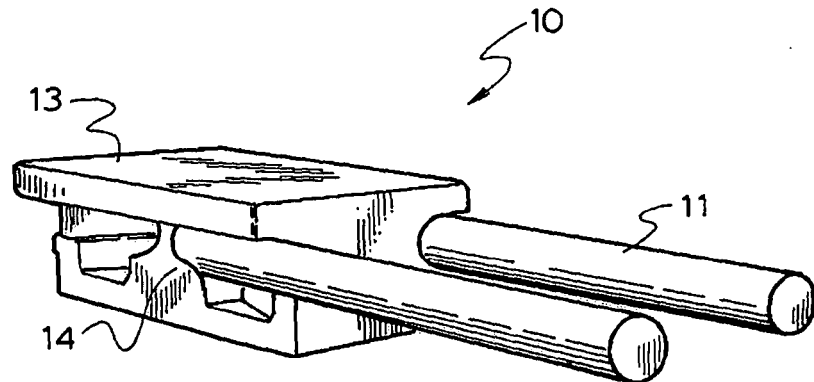


Fig. 1.

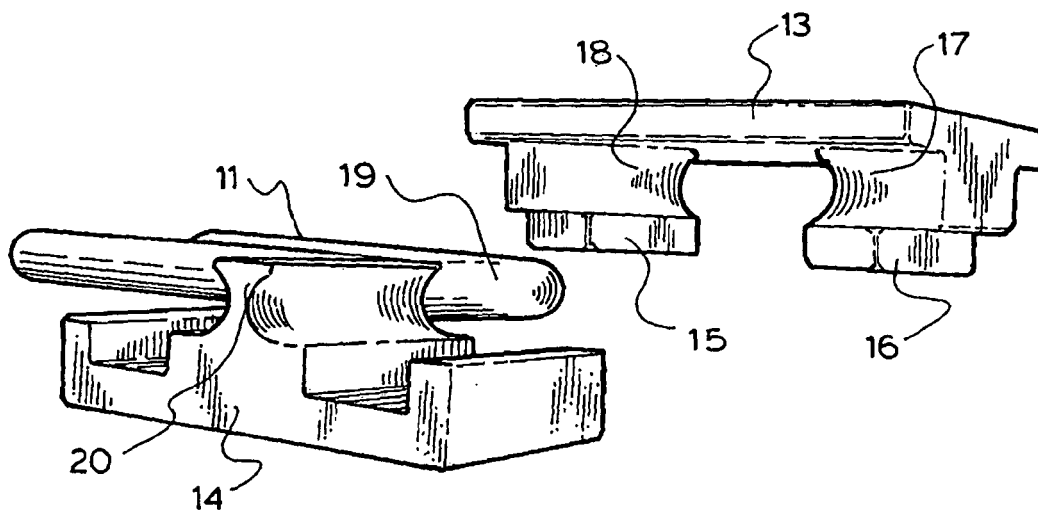


Fig. 2.

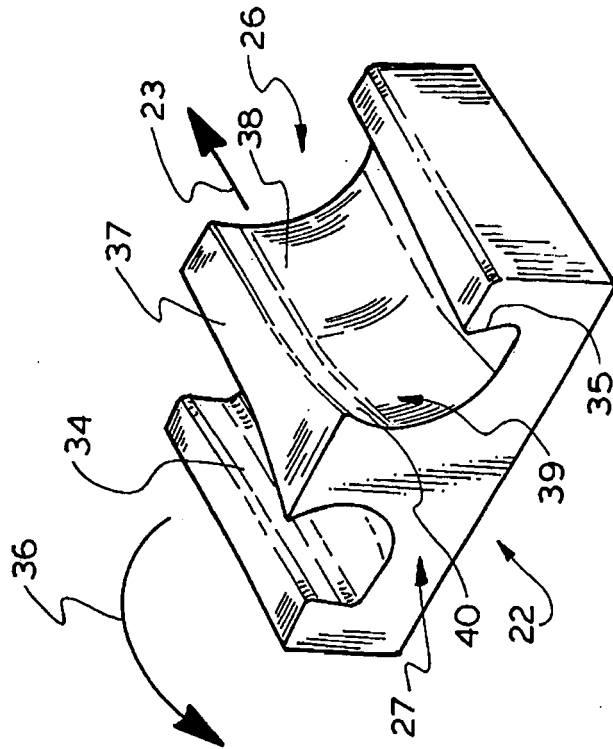


Fig. 4.

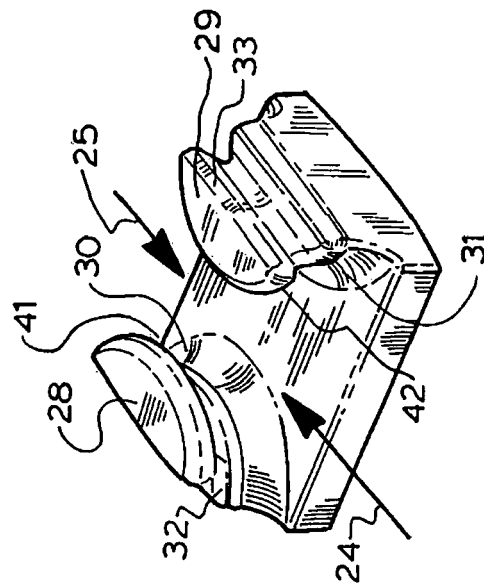


Fig. 3.

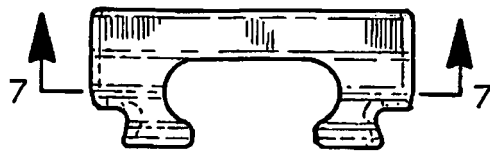


Fig. 5A.

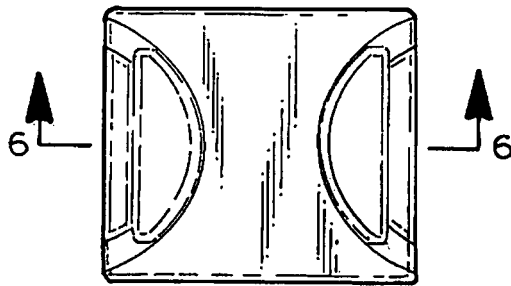


Fig. 5B.



Fig. 5D.

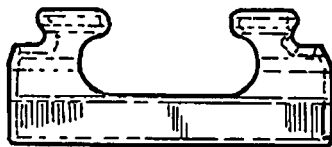


Fig. 5C.

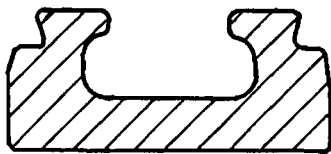


Fig. 6.

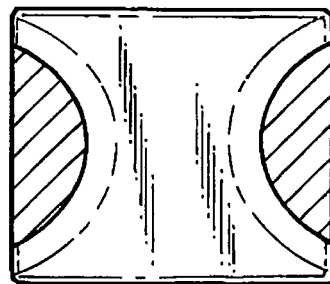


Fig. 7.

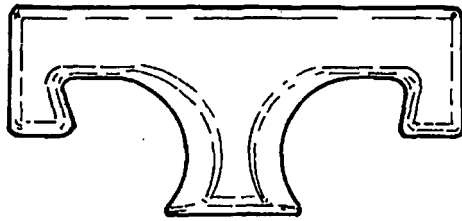


Fig. 8A.

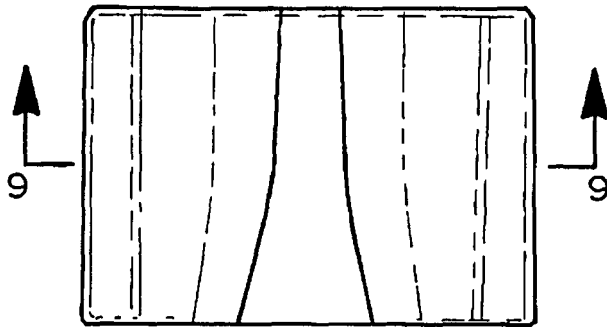


Fig. 8B.

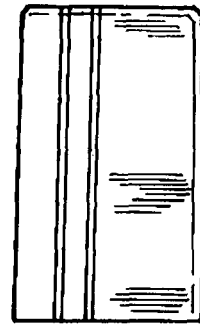


Fig. 8D.

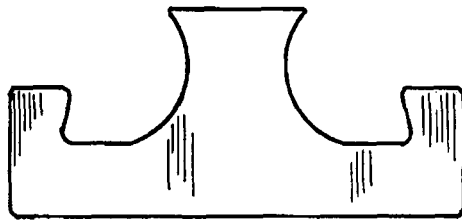


Fig. 8C.

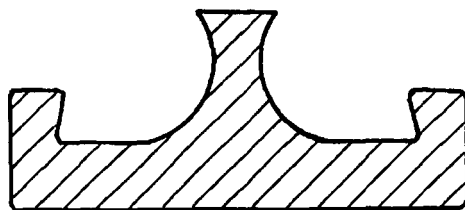


Fig. 9.

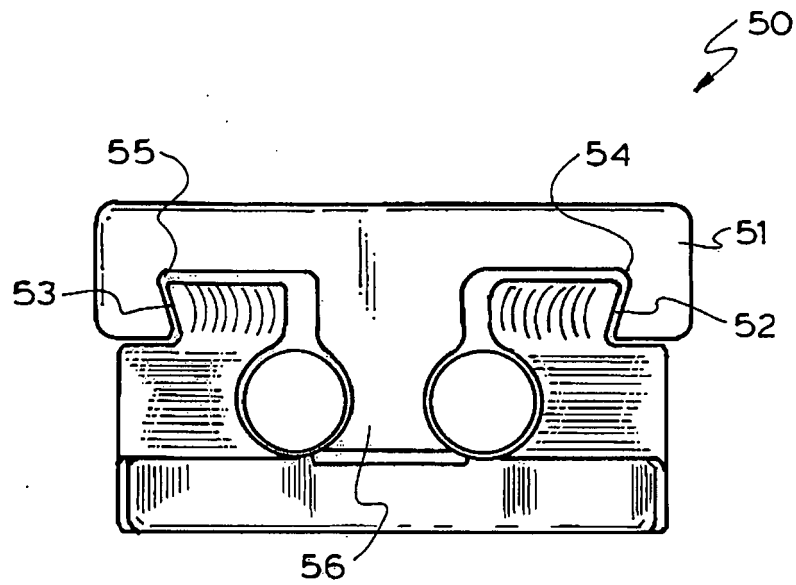


Fig. 10A.

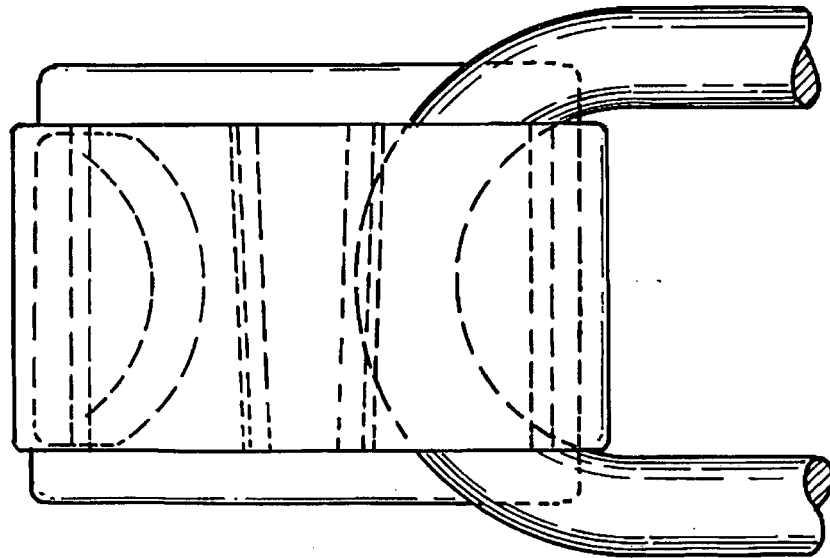


Fig. 10B.

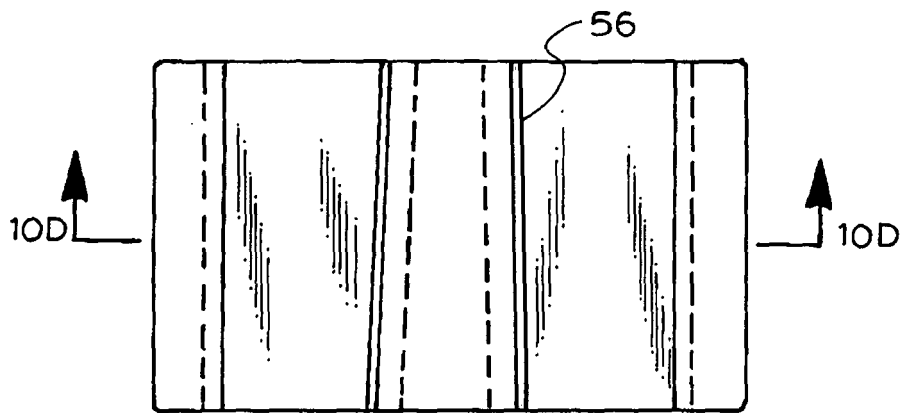


Fig. 10C.

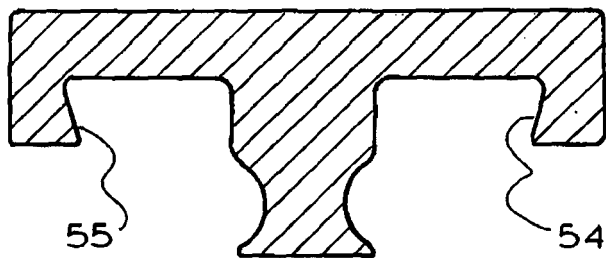


Fig. 10D.

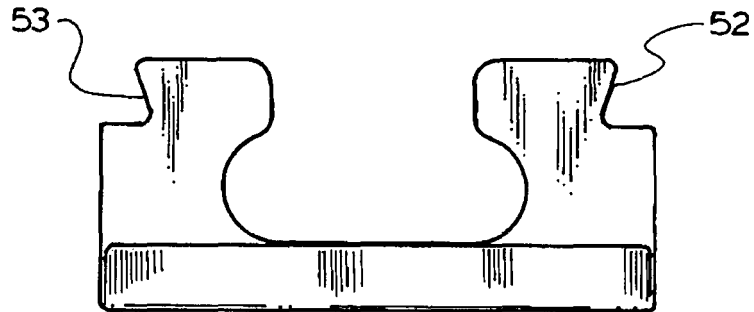


Fig. 10E.

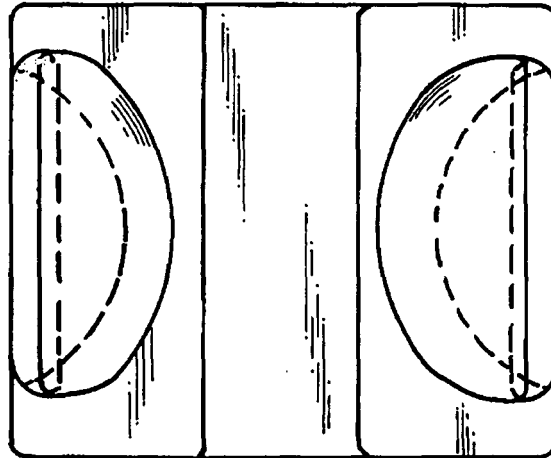


Fig. 10F.

REFERENCES CITED IN THE DESCRIPTION

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