

SPECIFICATION

Joining device

- 5 Subject matter disclosed herein is disclosed and claimed in divisional application 8108591.

This invention relates to a joining device for joining panels.

- 10 The main application of the invention is in joining together at right angles furniture panels made of chipboard, as is very commonly done in the furniture industry, especially in furniture which is sold in the form of pre-prepared and finished panels to be assembled into an item of furniture by the customer.
- 15 Furniture in that form is usually referred to as "knocked-down" and the type of joining device usually employed is therefore frequently referred to as a KD fitting.

- 20 KD fittings often consist of two basic parts, one of which is secured into the edge of one panel and the other of which is fitted into the surface of another panel, and lies substantially flush with the surface. To join the panels at right angles the part projecting from an edge of one panel is secured within the part recessed into the other panel, with the two panels held at right angles.

- 25 In one particular type of KD fitting which has been widely used the part that fits into an edge of a panel is a pin made of plastics material, the pin having a shank which is pushed into a hole drilled into the edge of the panel and a head which, when the pin is fully inserted, projects beyond the edge of the panel so as to be engageable with the other part of the fitting. The shank part of the pin is split and has
- 30 external teeth and a bore runs through the centre of the pin so that after inserting the pin into the hole in the panel a thin steel rod can be driven into the bore in the centre of the pin to spread its shank thus securing the pin in the edge of the panel. In an alternative form the pin is solid and is simply driven into the hole in the panel edge. An example of a fitting of that general kind is shown in British patent specification No. 1,295,470.

- 45 The other part of the fitting, recessed into the other panel, contains a specially formed component having a helicoidal camming surface around it and a screwdriver recess at one end. The camming surface engages with a specially formed head on the pin so that when the component is turned the two parts of the fitting are drawn more tightly together, thus
- 50 tightening the two panels against each other.

- That type of fitting has the advantages that one part of the fitting engages loosely in the other part initially thus providing preliminary location while the fitting is being completely tightened, and it can be
- 55 tightened, using a screwdriver, by applying less than a whole turn to the cammed screw. However, it also has various disadvantages. The plastic pin is of substantial diameter and therefore it has to be rather accurately located near the centre of the panel
- 60 thickness. Otherwise, one side of the pin may be too close to the surface of the board in which case there is a risk of bursting the board. The teeth on the outside of the pin have a tendency to damage chipboard material in such a way that the pin is not
- 65

as securely held within the material as is desirable. Fitting a pin of substantial diameter accurately into the edge of a board is an awkward and expensive operation in mass production. The head end of the pin has to be specially formed to co-operate with the cammed screw, and normally in practice is also cranked relative to the pin shank. Both these factors result in it being necessary for the pin to have a predetermined orientation about its axis when fitted into the panel edge. This increases the expense of fitting the pin into the panel edge. There is also a tendency for the cammed screw to loosen during use, especially if subjected to vibration, which loosens the joint between the panels.

- 80 Despite these disadvantages fittings of that kind have been quite widely used for ten years or so.

An object of the present invention is to provide a joining device, or KD fitting, in which one or more of the above disadvantages is substantially reduced.

- 85 The invention provides a joining device for joining panels at right angles to each other, comprising a pin having a head portion and adapted to be secured into one panel with said head portion projecting from an edge of the panel, a holding member adapted to be fitted in a recess in a major surface of the other panel, the holding member comprising a plug-like body portion having an end face arranged to be exposed at said panel surface, and having an opening extending within it from said end face to receive and surround said head portion, an inward projection within the opening located and dimensioned so that at least a part of said head portion can be moved into the opening and past the projection and engage behind it, and a securing member which
- 90 is located within the body portion, and adjacent to the opening, is operable from said face, and is effective when operated to engage with said head portion from one side to apply directly thereto a force drawing the head portion inwardly relative to the opening to tighten the joint, said inward projection engaging said head portion from the other side, that part of the head portion which is engaged by the securing member and inward projection being substantially symmetrical around the pin axis.

- 100 By means of these features the following advantages are obtained: inherent good pre-location of the joint parts due to the projection and irrespective of the orientation of the pin because of its symmetry; positive retention of the pin head from both sides using only a single securing member, thus resisting deflection of the joint in both directions; by providing the pin with a substantially symmetrical portion with which the securing member can co-operate, the need for any special orientation of the pin about its axis is eliminated and this simplifies and reduces the cost of inserting the pins into panel edges.

- 110 Preferably the pin is a steel screw, the head portion including means engageable by a rotary driving implement. Such a pin simply screws into the panel edge. This is a very simple manner of fitting the pin and any suitable screw driving equipment can be employed. Since the relevant part of the pin is symmetrical the angular position of the pin about its own axis when driving of the pin is terminated does not matter. When the pin is made of

steel it can be much thinner than a plastics pin of similar performance.

It is further preferred for the head portion of the pin to include a stop portion, for limiting the extent to which the pin can be driven into a panel. By driving the pin in to that extent, the final spacing of the symmetrical part from the panel edge is predetermined.

When the pin is a steel screw, it will preferably have two threads, one between the other, and one of larger outside diameter than the other. Screws having threads of this form are commercially available.

In a preferred embodiment specifically described below, the securing member comprises a rotatable member so engaged with the body portion that rotation of the securing member causes it to travel relative to the body portion to draw on said head portion. In the embodiment illustrated this securing member is in the form of a grub screw. In general, and irrespective of the type of pin employed, this type of securing member, which achieves the tightening effect by travelling bodily, has an advantage as compared with the cam type disclosed in the above-mentioned British patent specification, that the range of tightening movement available can be very much greater and, for practical purposes, unlimited whereas the amount of tightening movement of the cam type is limited to the pitch of the cam. Once that amount of movement has been used, no more is available for further tightening.

The travel of the securing member is preferably in a direction making an acute angle with the pin, when the latter is in its working position relative to the holding member.

In order that the invention may be more clearly understood, an embodiment thereof will now be described, by way of example, with reference to Figures 4 to 7c of the accompanying diagrammatic drawings, in which:

Figure 1 is a perspective view of the holding member of a KD fitting which is not in accordance with the invention but to which the invention may be applied. It will be described to assist in understanding the operation of the embodiment of the invention.

Figure 2 is a cross-section through a complete KD fitting in accordance with *Figure 1* securing two panels together at right angles, the cross-section being taken on the line II-II of *Figure 1*;

Figure 3 is a cross-section through a further type of KD fitting to which the invention may be applied;

Figure 4 is an elevational view of the body portion of an embodiment of the invention;

Figure 5 is a view of the component of *Figure 4* taken in the direction of the arrow A;

Figure 6 is an enlarged view in cross-section taken on the line VI-VI in *Figure 5*;

Figure 7a is a plan view of a screw to be used as securing member within the body portion of *Figures 4* and *5*, taken looking down on its head;

Figure 7b is a side view of the screw from the direction of arrow B; and

Figure 7c is a side view of the screw from the direction of arrow C.

Referring to *Figures 1* and *2*, it can be seen that the joining device or KD fitting comprises a pin 2 which is driven into the edge of one panel 4 with its head portion 6 left protruding from the edge, and a holding member 8 which is firmly fitted into a recess 10 in the face of the other panel 12. A tightening mechanism in the holding member 8 enables the head portion 6 of the pin to be pulled inwardly of the holding member thus tightly securing the two panels into the positions shown in *Figure 2*.

The pin 2 is in the form of a steel screw the head portion 6 of which has three parts namely, a driving head 14 provided with a transverse slot or a cross-shaped recess 15 so that a screw-driver bit can be employed to drive the screw into the panel, an intermediate shank portion 16, and an integral or separate collar or stop portion 18 which is spaced a predetermined distance away from the driving head 14. The collar or stop portion 18 ensures that when the screw is fully driven into the panel 4, up to the collar or stop, the underside of the driving head 14 will always be a predetermined distance away from the edge of the panel 4.

The holding member 8 is shown in more detail in *Figure 1*. It comprises a body portion 20 moulded from plastics material and which includes a cylindrical outer wall 22 formed with external ribs 24 which grip firmly into the wall of the recess 10 when the body portion is pressed into the recess to fix it in panel 12. The holding member 8 is provided with two intersecting bores 62 and 64. Bore 62 receives the head portion 6 of the pin 2 and bore 64 is provided with an internal thread to mate with the external thread of a securing member in the form of a grub screw 66, which has a cross-shaped driving recess 68 provided in its upper end.

Once the head of the pin 2 has been loosely positioned in the bore 62, the grub screw 66 is screwed into the bore 64 so that its leading end contacts the underside of the driving head 14 of the screw 2 and then continued rotation of grub screw 66 draws the head tightly into the body portion and hence tightens the joint. The leading end of the grub screw is provided with a recess indicated in broken lines at 70 so as to spread the contact pressure between the grub screw 66 and the driving head 14 of screw 2 over a greater area.

Grub screw 66 is shown as having a fairly fine thread, but in an alternative version shown in *Figure 3* it may be provided with a very coarse pitched thread, for example a thread making only two turns along the whole length of the screw, the thread shown having a double-start version of the thread used on pin 2. A matching thread is provided on the inside of the bore 64. With this modified arrangement the screw 66 would move through its whole length in response to two rotations thus simplifying tightening of the joint. The ribs of the thread could be on the wall of bore 64 and the matching grooves on the outside of screw 66.

The thread may have only one turn in the whole length of the screw. Generally, it is desirable for the thread to have four or less, and preferably two or less, turns, when the length of the screw is approximately equal to the diameter of its body (excluding

threads). If the screw does not have such relative dimensions, nevertheless a similar range of thread angles is desirable.

It should be appreciated that the arrangements shown can have a greater range of tightening movement than can a cam arrangement as employed in the prior art. They also are more resistant to vibration than a non-detented cam and can exert a stronger force on the head of the pin than can a cam. In combination with the improved holding force obtained by using a steel screw as the pin, this results in a stronger and more rigid joint than is obtainable with the prior art device described hereinbefore.

Referring now to the further embodiment shown in Figures 4 to 7c, this has many features in common with the previous constructions, and to that extent the same reference numerals have again been used. Such common features will not be described in detail again.

The body member 20 shown in Figures 4 and 5 is a plastics moulding comprising two halves as indicated, linked by a thin plastics bridge or hinge 71, so that by folding the two halves about the hinge 71 and upwardly out of the paper relative to Figure 4, or vertically in the plane of the paper relative to Figure 5, a plug-like body portion generally similar to that shown in Figure 1 is formed. In that condition, the flat surfaces 72a and 72b abut each other, as do the flat surfaces 74a, 74b and flat surfaces 76a, 76b, these surfaces all lying on the dividing line between the two halves.

It can be seen that the bore 62 is split axially, with one half lying in one of the body halves, and the other half lying in the other body half. Within the bore 62 an inward radial projection is moulded, again in two matching halves 78a, 78b. The projection is generally arcuate, tapering away towards its two ends as best seen in Figure 5. The projection 78a, 78b, together with an end wall portion 80a, 80b, forms a converging pocket between the two, into which the symmetrical head 14 of the screw 2 (all components of the screw being shown in broken lines in Figure 4) is forced when the joint is tightened. It has been found that this makes for a firmer joint. Additionally, the projection 78a, 78b, provides a physical cushion or reinforcement which helps to resist breakage of the cylindrical wall of the body portion if the joint is greatly overtightened and also projection portion 78a provides a body of material within which a socket 82 can be moulded, this socket receiving and retainingly fitting a pin 84 when the body portion 20 is folded into its plug-like form. The pin 84 is moulded onto the surface of projection part 78b which is presented at the dividing line of the body portion halves as shown on the right in Figures 4 and 5.

A further feature which can be seen from Figures 5 and 7 is that between the peripheral gripping ribs 24 deep recesses or slots 86 are moulded, which give the ribs a degree of resilience which has been found to be useful since they can deflect a little when the body portion is being pushed into its recess in a board, thus making this insertion easier, and then resume their original position where, it has been

found, their gripping effect is not significantly weakened. It can be seen from Figure 6 that the edges of the gripping ribs 24 have a non-symmetrical form, the direction of insertion of the body portion into its recess being downwards in relation to Figure 6. The recesses 86 also offer an economical advantage in reducing the amount of material needed to mould the body portion.

The bore 64 is also axially divided between the two halves of the body portion and the thread within it is formed by two thread groove portions 88a and 90a in the left-hand half and two groove portions 88b and 90b in the right-hand portion. In broken lines in Figure 4, the positions which groove portions 88b and 90b would occupy when the body portion is closed are shown on the left-hand side and on the right-hand side the relative positions which groove portions 88a and 90a would occupy are similarly shown in broken lines.

When the two body portion halves are folded together, the groove portions 88a, 88b, 90a, 90b together form a single thread which makes two complete revolutions and which is terminated by an abutment surface portion at each end. It can be seen from the right-hand side of Figure 4 that the upper end of groove portion 88b, indicated at 88c is moulded open, but when the halves are folded together the surface portion indicated at 88d on the left of Figure 4 closes the end of this groove and consequently forms one of the thread end abutment surfaces. Surface portion 90d on the right half of Figure 4 co-operates similarly with the open end 90c of groove portion 90a on the left of Figure 4, to form an abutment surface terminating the other end of the thread when the two portions are closed.

Figures 7a, 7b and 7c show a screw particularly designed to co-operate with the body portion described with reference to Figures 4 to 6. It is a one-piece moulding or casting in suitable strong plastics material or metal.

As in the previous constructions, the screw has a driving recess 68 in its top end and a rounded recess 70 in its bottom end. It has a single thread 92 of substantially rectangular cross-section which extends 360° or a little less around the body of the screw and which terminates at each end in a substantially flat abutment surface, these being shown at 94 and 96. When the screw is positioned in the body portion, co-operating with the thread which has already been described, it can move through one whole turn between the outermost abutment position where surface 94 on the screw contacts surface portion 90d and the innermost position where surface 96 on the screw contacts surface portion 88d.

The innermost stop has been found to be desirable because this embodiment works so well that a strong individual can tighten the joint sufficiently to cause damage. To prevent this, the stop is positioned such that, with a device manufactured to the exact middle of the design tolerances, the intended fully-tightened position is reached when the screw still has one-eighth more of a turn to go before hitting the inner stop. If it is over-tightened through this amount and up to the stop, no damage is caused. The outer stop is provided so that once the

device has been assembled with the screw inside it, the screw cannot be extracted by unscrewing it.

The particular screw design shown in Figures 7a to 7c has the interesting and economical characteristic that it can be moulded or cast using a die having two parts which separate from each other in a direction along the screw axis and along a parting line indicated by the heavy chain-dotted line in Figure 7b, which goes around the periphery of the single turn of the thread and is completed by a parting line portion which links the adjacent corners of the end surfaces 94, 96 and goes along the surface of the main body of the screw.

It is preferred to mould or cast the screw with deliberate flash left along this portion of the parting line as indicated in broken lines at 98 in Figure 7c. Then, on assembly, the screw can be positioned in its bore with this flash against the surface portion indicated at 100 on the left of Figure 4 and the flash will become trapped between surface portion 100 and the mating surface portion on the other side of the body portion 20 when the body portion halves are closed together. This ensures that the screw cannot rotate in its bore through vibration or rough handling during transit, which does occur in the securing devices employed in many prior art types of KD fitting, so that the screw will necessarily always be in the correct position for free insertion of the pin into the body portion, followed by tightening of the screw, which tightening will cause the flash to break away.

The body portion 20 is also formed with two slot portions 100a and 100b which in the fully assembled body portion form one continuous slot extending across the surface of the body portion that lies flush with the surface of the panel. The purpose of the slot is to receive a tongue or pegs on a special co-operating fitting which may be employed when the device of the present invention is used to secure a rail between two end panels, one device being employed at each end of the rail. In these circumstances, of course, there is the possibility of the rail twisting, and the engagement of the special tongue or pegs in the groove 100a, 110b resists this.

The screw of Figures 7a and 7b may have its body diameter slightly greater on one side of the single thread than on the other, and the diameter of the bore in which it fits may have a corresponding stepped diameter. This ensures that the screw can only be fitted into the body portion, and the latter be fully closed, if the screw has been placed the right way round.

CLAIMS

1. A joining device for joining panels at right angles to each other, comprising a pin having a head portion and adapted to be secured into one panel with said head portion projecting from an edge of the panel, a holding member adapted to be fitted in a recess in a major surface of the other panel, the holding member comprising a plug-like body portion having an end face arranged to be exposed at said panel surface, and having an opening extending within it from said end face to receive and surround

said head portion, an inward projection within the opening located and dimensioned so that at least a part of said head portion can be moved into the opening and past the projection and engage behind it, and a securing member which is located within the body portion, and adjacent to the opening, is operable from said face, and is effective when operated to engage with said head portion from one side to apply directly thereto a force drawing the head portion inwardly relative to the opening to tighten the joint, said inward projection engaging said head portion from the other side, that part of the head portion which is engaged by the securing member and inward projection being substantially symmetrical around the pin axis.

2. A joining device as claimed in claim 1, wherein said projection includes an inclined head-engaging surface portion.

3. A joining device as claimed in claim 1, wherein said opening has an end wall portion, which together with said inward projection forms a converging pocket into which a part of said head portion is forced upon tightening.

4. A joining device as claimed in any one of claims 1 to 3, wherein said body portion is a plastics moulding comprising two halves, and the halves are such that said opening in the body portion, and said inward projection therein, lie partly in one half and partly in the other.

5. A joining device as claimed in claim 4, wherein a peg and mating socket are formed respectively on and in the respective parts of said inward projection to retainingly mate with each other and hold the body portion halves together.

6. A joining device as claimed in any preceding claim, wherein said pin is a steel screw, the head portion including means engageable by a rotary driving implement.

7. A joining device as claimed in claim 6, wherein the engageable means is a driving slot or recess.

8. A joining device as claimed in claim 6 or claim 7, wherein the head portion of the screw includes a stop portion for limiting the extent to which the screw can be driven into a panel.

9. A joining device as claimed in claim 8, wherein the stop portion is a collar freely rotatable on the screw.

10. A joining device as claimed in claim 6, wherein the screw has two threads, one between the other, and one of larger outside diameter than the other.

11. A joining device as claimed in any preceding claim, wherein said body portion is a plastics moulding having peripheral gripping ribs and with recesses moulded between gripping ribs.

12. A joining device as claimed in any preceding claim, wherein said body portion is a plastics moulding comprising two halves.

13. A joining device as claimed in any preceding claim, wherein the securing member comprises a rotatable member so engaged with the body portion that rotation of the securing member causes it to travel relative to the body portion to draw on said head portion.

14. A joining device as claimed in claim 13,



device has been assembled with the screw inside it, the screw cannot be extracted by unscrewing it.

The particular screw design shown in Figures 7a to 7c has the interesting and economical characteristic that it can be moulded or cast using a die having two parts which separate from each other in a direction along the screw axis and along a parting line indicated by the heavy chain-dotted line in Figure 7b, which goes around the periphery of the single turn of the thread and is completed by a parting line portion which links the adjacent corners of the end surfaces 94, 96 and goes along the surface of the main body of the screw.

It is preferred to mould or cast the screw with deliberate flash left along this portion of the parting line as indicated in broken lines at 98 in Figure 7c. Then, on assembly, the screw can be positioned in its bore with this flash against the surface portion indicated at 100 on the left of Figure 4 and the flash will become trapped between surface portion 100 and the mating surface portion on the other side of the body portion 20 when the body portion halves are closed together. This ensures that the screw cannot rotate in its bore through vibration or rough handling during transit, which does occur in the securing devices employed in many prior art types of KD fitting, so that the screw will necessarily always be in the correct position for free insertion of the pin into the body portion, followed by tightening of the screw, which tightening will cause the flash to break away.

The body portion 20 is also formed with two slot portions 100a and 100b which in the fully assembled body portion form one continuous slot extending across the surface of the body portion that lies flush with the surface of the panel. The purpose of the slot is to receive a tongue or pegs on a special co-operating fitting which may be employed when the device of the present invention is used to secure a rail between two end panels, one device being employed at each end of the rail. In these circumstances, of course, there is the possibility of the rail twisting, and the engagement of the special tongue or pegs in the groove 100a, 110b resists this.

The screw of Figures 7a and 7b may have its body diameter slightly greater on one side of the single thread than on the other, and the diameter of the bore in which it fits may have a corresponding stepped diameter. This ensures that the screw can only be fitted into the body portion, and the latter be fully closed, if the screw has been placed the right way round.

CLAIMS

1. A joining device for joining panels at right angles to each other, comprising a pin having a head portion and adapted to be secured into one panel with said head portion projecting from an edge of the panel, a holding member adapted to be fitted in a recess in a major surface of the other panel, the holding member comprising a plug-like body portion having an end face arranged to be exposed at said panel surface, and having an opening extending within it from said end face to receive and surround

said head portion, an inward projection within the opening located and dimensioned so that at least a part of said head portion can be moved into the opening and past the projection and engage behind it, and a securing member which is located within the body portion, and adjacent to the opening, is operable from said face, and is effective when operated to engage with said head portion from one side to apply directly thereto a force drawing the head portion inwardly relative to the opening to tighten the joint, said inward projection engaging said head portion from the other side, that part of the head portion which is engaged by the securing member and inward projection being substantially symmetrical around the pin axis.

2. A joining device as claimed in claim 1, wherein said projection includes an inclined head-engaging surface portion.

3. A joining device as claimed in claim 1, wherein said opening has an end wall portion, which together with said inward projection forms a converging pocket into which a part of said head portion is forced upon tightening.

4. A joining device as claimed in any one of claims 1 to 3, wherein said body portion is a plastics moulding comprising two halves, and the halves are such that said opening in the body portion, and said inward projection therein, lie partly in one half and partly in the other.

5. A joining device as claimed in claim 4, wherein a peg and mating socket are formed respectively on and in the respective parts of said inward projection to retainingly mate with each other and hold the body portion halves together.

6. A joining device as claimed in any preceding claim, wherein said pin is a steel screw, the head portion including means engageable by a rotary driving implement.

7. A joining device as claimed in claim 6, wherein the engageable means is a driving slot or recess.

8. A joining device as claimed in claim 6 or claim 7, wherein the head portion of the screw includes a stop portion for limiting the extent to which the screw can be driven into a panel.

9. A joining device as claimed in claim 8, wherein the stop portion is a collar freely rotatable on the screw.

10. A joining device as claimed in claim 6, wherein the screw has two threads, one between the other, and one of larger outside diameter than the other.

11. A joining device as claimed in any preceding claim, wherein said body portion is a plastics moulding having peripheral gripping ribs and with recesses moulded between gripping ribs.

12. A joining device as claimed in any preceding claim, wherein said body portion is a plastics moulding comprising two halves.

13. A joining device as claimed in any preceding claim, wherein the securing member comprises a rotatable member so engaged with the body portion that rotation of the securing member causes it to travel relative to the body portion to draw on said head portion.

14. A joining device as claimed in claim 13,



wherein the travel of the securing member is in a direction making an acute angle with the element, when the element is in its working position relative to the holding member.

- 5 15. A joining device as claimed in claim 13 or claim 14, wherein the securing member has an external thread and is threadedly mounted in said body portion.

- 10 16. A joining device as claimed in claim 15, wherein the ratio of diameter to thread pitch of the thread on the securing member is less than four.

17. A joining device as claimed in claim 16, wherein the ratio of diameter to thread pitch of the thread on the securing member is less than two.

- 15 18. A joining device as claimed in claim 16, wherein the ratio of diameter to thread pitch of the thread on the securing member is about one.

19. A joining device as claimed in any one of claims 13 to 18, wherein said body portion is a plastics moulding comprising two halves, and has an internal thread formation for threadedly receiving the securing member, said thread formation being divided axially such that part lies in one body half and another part lies in the other body half, at least the axially innermost end of the thread formation being terminated by an abutment surface portion which lies on the opposite body half at the axial division line.

20. A joining device as claimed in claim 19, wherein the other end of the internal thread formation is similarly terminated.

21. A joining device as claimed in claim 19 or claim 20, wherein the external thread of the securing member has at at least one end an abutment surface for contacting a said abutment surface.

22. A joining device as claimed in any one of claims 13 to 21, wherein the securing member has a single thread which extends 360° or less around it.

23. A joining device as claimed in any one of claims 13 to 22, wherein the thread has a substantially rectangular cross-section.

24. A joining device as claimed in claim 22, wherein the securing member is moulded or cast with a continuous parting line extending round the periphery of the single thread and linking the two ends of said thread.

25. A joining device as claimed in claim 24, wherein the securing member is moulded with some flash on the parting line portion which links the two ends of the thread.

26. A joining device for joining panels, substantially as hereinbefore described with reference to the accompanying drawings.