An artificial wall structure (10) comprising a frame of interconnected uprights (12) and cross pieces (14), and detachable panels (16) for facing the frame. The uprights have front (20) and side (24, 25) faces. The cross pieces join between facing side faces (24, 124a, b, 25, 125a, b) of adjacent uprights and the panels connect to the front faces (20) of two uprights connected by the cross pieces. The uprights are constructed from sheet material folded into a tubular construction. Pairs of windows (18) are formed in the front faces, the spacing between adjacent pairs of windows corresponds with the desired spacing between adjacent panels. The panels (16) when connected between the same pair of uprights have overlapping regions (98, 96) to restrict light escaping from between two panels. The panels also have hooks (90) at their edges for insertion and retention in the windows. The arrangement is such that the panel can be removed from the wall without disturbing other panels.
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ARTIFICIAL WALL STRUCTURE

This invention relates to artificial wall structures, and particularly to such structures for use in exhibition systems where walls of different sizes and shapes need to be constructed to form attractive and aesthetically appealing exhibition stands. The invention is particularly concerned with artificial wall structures of the type comprising uprights and cross pieces interconnected to form a frame on which panels are releasably connected to face the wall structure.

Such an arrangement provides a wide variety of different shapes and sizes to be constructed merely by adjusting the height of the various uprights and the shape and numbers of the various cross pieces. The cross pieces normally have some form of connection device enabling the cross pieces to be fixed to the uprights.

Traditionally, uprights comprise extruded aluminium sections where the cross pieces are connected to channel sections of the uprights. Likewise, the panels are also connected to channel sections. The panels are traditionally blow moulded with an upturned lip around their edge so that they have a tray like construction. To parts of the edges along each side of the panel are glued triangular section strips which form barbs on the
edges so that, when inserted into the channels of adjacent uprights, the barbs slide down the channels and lips on the channels engage the barbs and prevent the panel from being withdrawn transversely out of the channels. Thus when two uprights having a height of two or more panel heights are arranged together, the lowermost panel is inserted first, from above, and slid down the channels in the uprights to its bottom position. This is followed by succeeding panels until the last is inserted from above. Each panel has no vertical fixing, but is supported by the panel below. This arrangement is perfectly satisfactory, except that the arrangement does not lend itself to easy adjustment.

It is often the case, that customers of exhibition systems require last minute changes to be made to the appearance of their stand, and this will frequently require the repositioning of panels, some of which may be back illuminated and others may simply carry company logos, names, pictures etc. When this is required, all the panels above the one which is to be removed must be lifted out first and this is time consuming and ultimately incurs the customer with greater costs and inconvenience.

It is an object of the present invention therefore, to provide an artificial wall structure comprising
uprights and cross pieces interconnected to form a frame with panels being releaseably connected to the frame to face the wall structure, wherein panels can be removed and replaced after the wall has been constructed and without requiring other panels to be disturbed.

In accordance with the present invention, there is provided an artificial wall structure comprising a frame of interconnected uprights and cross pieces, and detachable panels for facing the frame, in which the uprights have front and side faces, the cross pieces joining between facing side faces of adjacent uprights and the panels connecting to the front faces of two uprights connected by said cross pieces, characterised in that the uprights are constructed from sheet material folded into a tubular construction, in that pairs of windows are formed in said front faces, the spacing between adjacent pairs corresponding with the desired spacing between adjacent panels, and in that the panels have overlapping regions between adjacent panels connected between the same uprights and have pairs of hooks at their edges for insertion and retention in said windows, the separation between a pair of hooks being the same as the separation of said pairs of said windows.

Preferably the panels comprise injection moulded plastics components having a substantially rectangular
shape, the edges thereof being turned inwardly to give a tray-like structure. Side edges adapted to lie against the front faces are preferably arranged to be perpendicular thereto and to have said hooks extending from and in line with said side edges.

Preferably top and bottom edges of the panels have on one edge an extension and on the other edge a recess to receive the extension of an adjacent panel.

The extension is preferably long enough so that, between adjoining panels, it is possible to lift a lower one to release the hooks from the windows without the adjoining panels contacting one another, so that the lower one can be removed without disturbing the other, and, when both panels are in place the overlap is maintained.

The overlap ensures that when one panel is back illuminated, light does not escape between adjacent panels, which would have a deleterious affect on the aesthetic appearance of the wall.

The hooks are preferably reinforced by a localised internal thickening of the edge at and around the junction between the edge and hook.
Preferably the pairs of hooks and windows each comprise a pair of pairs of hooks and windows respectively. This ensures that should one or two of the hooks break in time, there still remains other hooks to render the panel serviceable.

Thus, the present invention provides an arrangement where, even in a wall structure several panels in height, any one individual panel can be removed without the necessity to disturb the other panels.

The advantages of the present invention can particularly be realised if, in another aspect, it is characterised by slots formed in said side face for receiving and locating said cross pieces, which slots extend into said front face whereby a said cross piece is insertable between two uprights for location in said slots without lateral adjustment of the uprights, and connection means are provided to lock the cross piece in the upright. In this event, the connection means preferably comprises a spring clip in each end of the cross piece and wedge means co-operating with the spring clip to grip against top and bottom side-face lips of the slot on engagement of said wedge with the clip.

The wedge preferably has a screw thread and a nut is captured between slots in the cross piece, the screw
thread co-operating with the nut so that, on rotation of the nut, the wedge is engaged with the spring clip.

Preferably the spring clip is substantially U-shaped with its ends adapted to grip said lips and said screw thread passing through an aperture in the base of said U.

Preferably the cross pieces are tubular having a substantially rectangular cross section and said slots therein are a pair of opposing rectangular windows in the sides of the cross piece, said nut comprising a knurled wheel of diameter no larger than the height of said windows, and thickness no wider than the width of said windows.

Preferably said spring clip is supported by a washer extending through said windows and against which the knurled nut bears.

Where both the panel connection and cross-piece connection aspects of the present invention are employed a particularly convenient system results. Now it is feasible for a customer to say that he wants, for example, a back-illuminated panel with his company logo at any point in a previously constructed wall. The old panel is simply removed, a cross piece with lighting elements connected is inserted (perhaps having previously
removed an ordinary cross piece first), and a translucent panel is inserted. Thus much greater flexibility in the design, without great costs, is made available to the customer.

The invention is further described hereinafter, by way of example, with reference to the accompanying drawings, in which:

Figure 1 is a perspective view of a wall structure in accordance with the present invention, a number of panels being missing therefrom;

Figure 2 is a front view of an upright and cross piece connected thereto;

Figure 3 is a front perspective view of an upright;

Figure 4a, b and c are a plan view, bottom view and side section on the lines C-C in figure 4b of a panel according to the present invention;

Figures 5a, b, c and d are a plan view, a top view, a side view and a section on the line D-D in figure 5b, of a panel according to the present invention.
Figure 6 is a plan view of a wall according to the present invention;

Figures 7a, b and c are respectively a perspective cut-away view of part of an upright of the type employed in figure 6, a cross piece ready for connection thereto, and a front perspective view of the cross piece of figure 7b;

Figure 8 is a cut-away perspective view of a preferred alternative structure of the upright of figure 7;

Figure 9 is a side view of an upright and cross piece ready for connection;

Figures 10a, b and c are respectively a front view, side view and rear view of a wedge element;

Figures 11a, b and c are respectively a side section, end view and side view of a knurled nut;

Figures 12a and b are respectively a front view and end view of a washer;
Figures 13a and b are respectively a side view and a transparent end view in the direction of arrow B in Figure 13a; and

Figures 14a and b are respectively a section on the line XIII-XIII in Figure 13b and an end view in the direction of arrow A in Figure 14b.

With reference to Figure 1, a wall structure comprises uprights 12 separated by cross pieces 14 to form a frame. Panels 16 are clipped into eyes 18 in front faces 20 of the uprights 12. Cross pieces 14 are received in slots 22 disposed in side faces 24 of the uprights 12.

Figure 2 shows an upright 12 having three pairs of slots 22 into any of which cross pieces 14 can be inserted. The separation of the slots 22 is so as to correspond with panel 16 dimensions. So also do eye-pairs 18 have the same dimensional separations, so that upright 12 in Figure 2 can be seen to be adapted for three panels' height.

Figure 3 shows an upright 12 according to the present invention, which comprises two sheets 112a,b folded in various directions and then connected together for example by spot welding at points 75 along front face.
20 and rear face 21. The length of the upright 12 is equal to the height of a panel 16 to be connected thereto. Should the panel be for two panel heights, then the length will not be quite double the length shown in Figure 3, because there is a slight overlap between panels, one above the other, as mentioned further below.

Turning to Figure 7a, a different embodiment of upright is shown wherein each slot 22 extends around corners 26a, b to front face 20 and an opposing rear face (not visible in the drawings). A cross piece 14 is shown being offered up to either slot 22 in the upright 12.

Figure 8 shows a preferred embodiment, where the upright 12' has a single slot 22' which extends right across side face 24' and around into front face 20' and an opposing rear face (not visible in the drawings).

In Figure 9, upright 12" has a slot 22 of length l. Cross piece 14 is a hollow rectangular tube having a notch 28 formed on its upper and lower surface adjacent each end. The length m of end 30 of the cross piece 14 is slightly less than the length l of the slot 22 so that end 30 fits within the confines of slot 22.

Because the cross piece 14 is hollow, the notches 28 are open above and below. In the sides of the cross
piece 14, are formed windows 32 which are rectangular in shape (only one being visible in Figure 9). A drum shaped knurled nut 34 is received within the windows 32 so that a segment of the nut 34 protrudes through the window 32 on either side of the cross piece 14 (see also Figures 7a and b).

Turning to Figure 14, nut 34 is constructed from plastics material and has a threaded boss 36 received in a throughbore 38. Threaded in the boss 36 is a bolt 40 whose head 42 is captivated in a wedge element 44. The wedge element, shown in more detail in Figure 10, is rectangular in section substantially corresponding with the internal shape of the tubular cross piece 14. It has the throughbore 46 to receive the bolt 40 and a recess 48 to capture the head 42 of the bolt so that the bolt cannot rotate relative to the wedge element 44. The wedge element 44 has chamfered shoulders 50 whose purpose is explained further herein below. However, the wedge element 44, with its captivated bolt 40 is connected to the nut 34 by engagement of the bolt 40 in the boss 36. Thus by rotation of the nut 34, the bolt 40, and hence the wedge element 44, is drawn further into or pushed out of, the end 30 of the cross piece 14.

A U-shaped spring clip 52 is retained within the cross piece 14 between the wedge element 44 and nut 34,
the bolt 40 passing through an aperture 54 in the base of
the clip 52. The base of the clip 52 is supported by a
washer 56 (further details whereof are shown in Figure
12). The washer likewise has an aperture 58 for passage
of the bolt 40 and also a groove 60 which serves to
locate the spring clip 52. Washer 56, like the nut 34,
is insertable in the cross piece 14 through the windows
32, ledges 62 formed opposite the groove 60 serving to
locate inside edges 64 of each window 32, which edges 64
are those closest to the end 30 of the cross piece 14.
Top and bottom edges 66 of the washer 56 are also a close
fit in the windows 32 and serve to maintain the
orientation of the washer 56 within the cross piece 14.

The washer 56 provides a smooth bearing surface 68
against which a front face 70 of the nut 34 slides when
it is rotated.

Returning to Figure 14, the spring clip 52 has
flared ends 72 which bear against chamfered shoulders 50
of the wedge element 44. When the nut 34 is unscrewed
from the bolt 40, and the wedge element 44 is in a left-
most position (as shown in the lower half of Figure 14a)
the ends 72 of the spring clip are brought within the
confines of the dimension m at the end of the cross piece
14. The height of the wedge element 44 is likewise
within the limit m. Thus, as shown in Figure 9, (see

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also Figure 13) the end of the cross piece 14 can be inserted into the slot 22, not only by longitudinal movement of the cross piece 14 with respect to the slot 22, (as would be necessary in Figure 9) but also by transverse movement in and out of the plane of the drawing. Thus with reference to Figure 1, where two pillars 12 are already in position, another cross piece 14 can be added as required simply by transverse insertion from the direction of front faces 20 of each upright, and without the need for any lateral adjustment of the uprights 12. Thus there is no requirement to disturb any upright or indeed any existing cross piece.

When a cross piece has been inserted as shown in Figure 13 into a slot 22, the nut 34 is tightened so that the wedge element 44 is drawn into the cross piece 14. However, there is no corresponding movement of the spring clip 52, so that its ends 72 abut the shoulders 50 and are splayed apart. As the nut 34 is tightened, the ends 72 of the clip 52 engage upper and lower lips 76 of the slot 22 (see also Figure 14). Further tightening clamps the ends 72 and the lips 76 between the wedge element 44 and top and bottom edges 78 of the end of the cross piece 14.

By this arrangement, not only is there secure vertical fixing of the cross piece with respect to the
upright 12" (by virtue both of the spring clip 52 hooking onto leading edge 76 of the opening 22 and by the base of tongues 30 resting on the edge 76) but also there is secure lateral connection given that the ends 72 of the spring element 52 become retained by side walls 20 of the upright just above and below the slot 22. Of course, there is also longitudinal security in that the cross piece 14 cannot be pulled longitudinally out of the slot 22, without first unscrewing the nut 34 to push out the wedge element 44 and permit the spring clip 52 to spring back to its starting position where its ends 72 are within the confines of dimension m of the end 30 of the cross piece 14. In this respect, it is to be noted that the washer 56 serves to support the spring clip 52 so that it flexes at two points 55, one at either end of the washer 56 and across the full width of the spring element. If the washer did not provide this support, the flexing of the clip 52 would be about its centre where it is weakest having the throughbore 54.

Returning to Figure 3, it should be pointed out that the slots 22 in side faces 24 and 25 of the upright 12 do not, strictly speaking, extend around to front face 20 or rear face 21 but rather to transitional faces 20', 21' which nevertheless approximately face in the direction of the front and rear faces 20 and 21 respectively, and in any event, enable transverse insertion of cross pieces 14
as described above. The transitional faces 20', 21' are part of multiple side faces 24, 124a, 124b and 25, 125a, 125b, the purpose of which is explained further below with reference to Figure 6.

However, turning to Figures 4 and 5, two different panel constructions are shown; in Figure 4 a first panel 16a which is essentially flat and, in Figure 5 a panel 16b which is curved. Both panels 16a, b have a large rectangular front surface 80 suitable for the application of names, indicia, company logos etc, such as is commonly found at exhibition stands. Moreover, the panel may be constructed from a translucent material, so that lights disposed behind the panel can illuminate the panel.

Each panel has a top edge 82 and a bottom edge 84 and side edges 86,88. All four edges 82, 84, 86, 88 depend substantially perpendicularly from the surface 80 to form a tray-like construction. Thus side edges 86,88 of the flat panel 16a are parallel, but the side edges of the curved panel 16b are not. The side edges 86,88 of both panels have integral hooks 90 formed thereon. The hooks 90 are twice as thick as the thickness of the rest of the panel 16 to provide extra strength. However, the extra thickness is internal so that the hooks 90 are still flush with the edges 86,88. The hooks are defined by cuts (indents) 92 which are just below the surface of the bottom edge 94 of the edges 86,88. The thickness of
the cuts 92 correspond with the thickness of the material of the uprights 12 where the eyes 18 are formed (ie two thicknesses of the sheet material given the overlap of the edges of the sheets 112a,b).

Thus a panel can be inserted between adjacent uprights with hooks 90 inserted in windows 18, the bottom edge of the panel lying flush against front (or rear 21) face 20 of the upright. With an opaque panel, no light could escape between panel and upright. Moreover, another panel can be inserted through the same windows 18 beside an adjacent panel so that edges 86,88 of adjacent panels would lie flat against one another, whether the panels are both curved or flat, or one of each. The width of the windows 18 is thus at least twice the thickness of the hooks 90.

The bottom edge 84 of the panels 16a,b has a recess 97 which extends along the entire length of the panel. Moreover, the top edge 82 has an extension 98, which also extends right across the length of the panel. When two panels 16 are connected between the same pair of uprights 12, one panel 16 above the other, then the extension 98 of one panel is adapted to fit within the confines of the recess 96 of the other, so that there is an overlap between two adjacent panels. No such extension is required at the side, because, behind the junction
between two panels in side by side relationship is an upright 12. Thus, should one of the panels be an opaque panel behind which lighting is arranged, no light can escape around the side of the panel because of the light block provided by the upright 12. This function is achieved by the overlap 98 when panels are disposed one above the other. However, the extension 98 should be sufficiently long that, when the cut outs 92 of the hooks 90 are fully engaged in the eyes 18, at least a part of the extension 98 is within the confines of the recess 96. The overlap cannot however be total, because it is an object of this invention that the panels 16 be removable without disturbing adjacent panels. Therefore, the extension 98 should only partially enter the recess 96 so that, should the panel be required to be removed, it can be lifted so that the extension 98 enters further into the recess 96 while at the same time releasing the cut-outs 92 from their engagement with the eyes 18, and so that the hooks 90 can be withdrawn from the eyes 18. Once released from the eyes 18, the panel 16 can be dropped so that the extension 98 drops out of engagement with the recess 96 and the panel is entirely freed. While it is the top edge 82 which is shown with the extension, and the bottom edge 84 with the recess, it could equally be arranged the other way round.
Finally, turning to Figure 6, the purpose of the multiple side faces 24, 124a, b and 25, 125a, b becomes evident. Their purpose is to permit a single straight cross piece 14 to connect between different of the side faces so that either a curved panel 16b is required, or, if the connection of the cross piece 14 is between side faces 24, 25 then straight panels 16a are employed. Moreover, panels can be attached to either face 20, 21 of the uprights 12, so that the wall can have an aesthetically pleasing appearance from either side. Depending in which direction of curve a wall takes, either a convex or a concave panel is required. Only a concave panel 16b is shown in detail, a convex panel 16c being visible in Figure 6.

The reader's attention is directed to all papers and documents which are filed concurrently with or previous to this specification in connection with this application and which are open to public inspection with this specification, and the contents of all such papers and documents are incorporated herein by reference.

All of the features disclosed in this specification (including any accompanying claims, abstract and drawings), and/or all of the steps of any method or process so disclosed, may be combined in any combination,
except combinations where at least some of such features and/or steps are mutually exclusive.

Each feature disclosed in this specification (including any accompanying claims, abstract and drawings), may be replaced by alternative features serving the same, equivalent or similar purpose, unless expressly stated otherwise. Thus, unless expressly stated otherwise, each feature disclosed is one example only of a generic series of equivalent or similar features.

The invention is not restricted to the details of the foregoing embodiments. The invention extends to any novel one, or any novel combination, of the features disclosed in this specification (including any accompanying claims, abstract and drawings), or to any novel one, or any novel combination, of the steps of any method or process so disclosed.
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CLAIMS

1. An artificial wall structure comprising a frame of interconnected uprights and cross pieces, and detachable panels for facing the frame, in which the uprights have front and side faces, the cross pieces joining between facing side faces of adjacent uprights and the panels connecting to the front faces of two uprights connected by said cross pieces, characterised in that the uprights are constructed from sheet material folded into a tubular construction, in that pairs of windows are formed in said front faces, the spacing between adjacent pairs corresponding with the desired spacing between adjacent panels, and in that the panels have overlapping regions between adjacent panels connected between the same uprights and have pairs of hooks at their edges for insertion and retention in said windows, the separation between a pair of hooks being the same as the separation of said pairs of said windows.

2. A structure as claimed in Claim 1, in which the panels comprise injection moulded plastics components having a substantially rectangular shape, the edges thereof being turned inwardly to give a tray-like structure.
3. A structure as claimed in Claim 2, wherein side ones of the edges are adapted to lie against the front faces of the upright and are arranged to be perpendicular thereto and to have said hooks extending from and in line with said sides edges.

4. A structure as claimed in Claim 2 or 3, in which top and bottom ones of the edges of the panels have on one edge an extension and on the other edge a recess to receive the extension of an adjacent panel.

5. A structure as claimed in Claim 4 in which the extension is long enough so that, between adjoining panels, it is possible to lift a lower one to release the hooks from the windows without the top and bottom edges of adjoining panels contacting one another, so that the lower one can be removed without disturbing the other, and, when both panels are in place the overlap is maintained.

6. A structure as claimed in any of Claims 2 to 5, in which the hooks are reinforced by a localised thickening of the edge at and around the junction between the edge and hook.
7. A structure as claimed in any preceding Claim, in which the pairs of hooks and windows each comprise a pair of pairs of hooks and windows respectively.

8. An artificial wall structure comprising a frame of interconnected uprights and cross pieces, and detachable panels for facing the frame, in which the uprights have front and side faces, the cross pieces joining between facing side faces of adjacent uprights and the panels connecting to the front faces of two uprights connected by said cross pieces, characterised in that slots are formed in said side face for receiving and locating said cross pieces, which slots extend into said front face whereby a said cross piece is insertable between two uprights for location in said slots without lateral adjustment of the uprights, and connection means are provided to lock the cross piece in the upright.

9. A structure as claimed in Claim 8, in which the connection means comprises a spring clip in each end of the cross piece and wedge means co-operating with the spring clip to grip against top and bottom side-face lips of the slot on engagement of said wedge with the clip.
10. A structure as claimed in Claim 9, in which the wedge has a screw thread and a nut is captured between slots in the cross piece, the screw thread co-operating with the nut so that, on rotation of the nut, the wedge is engaged with the spring clip.

11. A structure as claimed in Claim 10 in which the spring clip is substantially U-shaped with its ends adapted to grip said lips and said screw thread passing through an aperture in the base of said U.

12. A wall structure as claimed in Claims 10 or 11 in which the cross pieces are tubular having a substantially rectangular cross section and said slots therein are a pair of opposing rectangular windows in the sides of the cross piece, said nut comprising a knurled wheel of diameter no larger than the height of said windows, and thickness no wider than the width of said windows.

13. A structure as claimed in Claim 12, in which said spring clip is supported by a washer extending through said windows and against which the knurled nut bears.

14. A structure as claimed in any of Claims 8 to 13 when dependent on any of Claims 1 to 7.
15. A wall structure substantially as hereinbefore described with reference to any of the accompanying drawings.
## INTERNATIONAL SEARCH REPORT

### A. CLASSIFICATION OF SUBJECT MATTER

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According to International Patent Classification (IPC) or to both national classification and IPC

### B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

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Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

### C. DOCUMENTS CONSIDERED TO BE RELEVANT

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<td>US RE32890 E (DEFOUW) 21 March 1989 see the whole document</td>
<td>1-7,15</td>
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☐ Further documents are listed in the continuation of box C.

☐ Patent family members are listed in annex.

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"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

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"O" document referring to an oral disclosure or use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

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"Y" document of particular relevance: the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Z" document of particular relevance: the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

Document member of the same patent family

Date of the actual completion of the international search: 9 June 1998

Date of mailing of the international search report: 17/06/1998

Name and mailing address of the ISA

European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016

Authorized officer: Vrugt, S
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