Nov. 29, 1966 C. D. TERRY 3,288,428

PREASSEMBLED TIE CONSTRUCTION

Original Filed Jan. 4, 1963 2 Sheets-Sheet 1

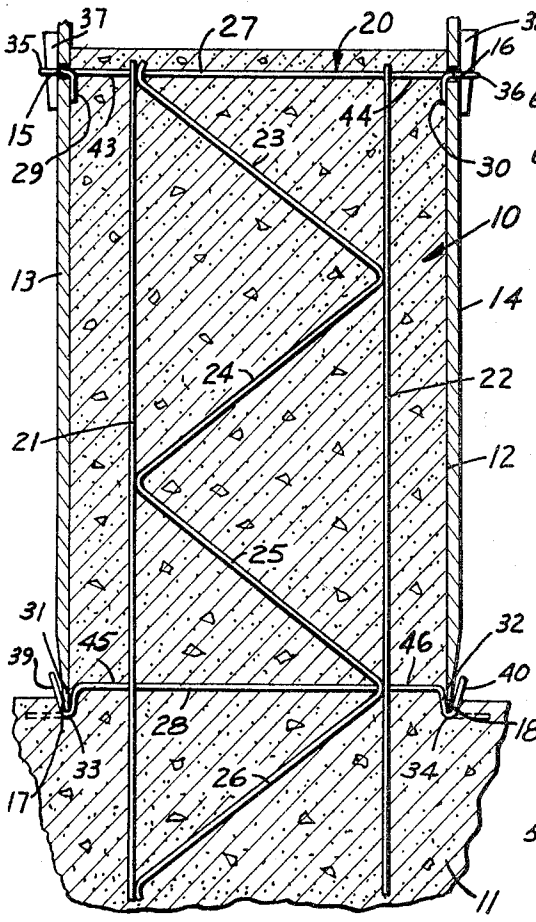


FIG. 1

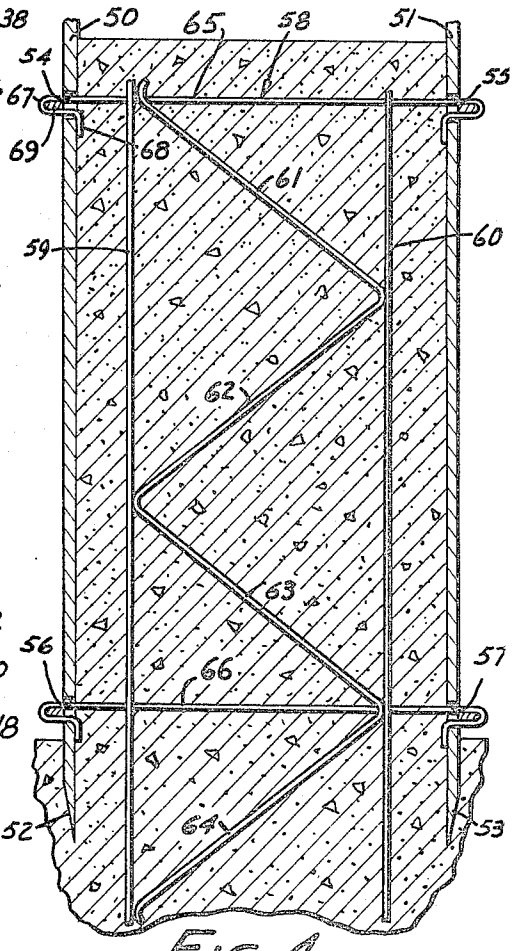


FIG. 4

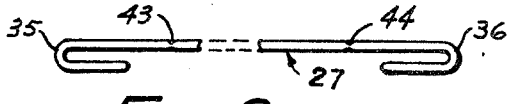


FIG. 2

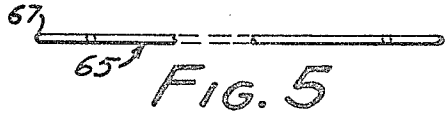


FIG. 5

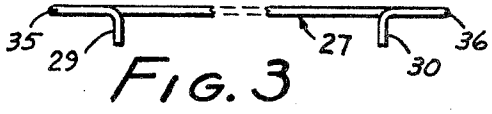


FIG. 3

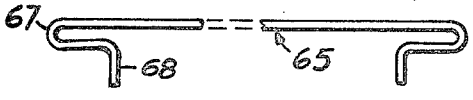


FIG. 6

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PREASSEMBLED TIE CONSTRUCTION

Original Filed Jan. 4, 1963 2 Sheets-Sheet 2

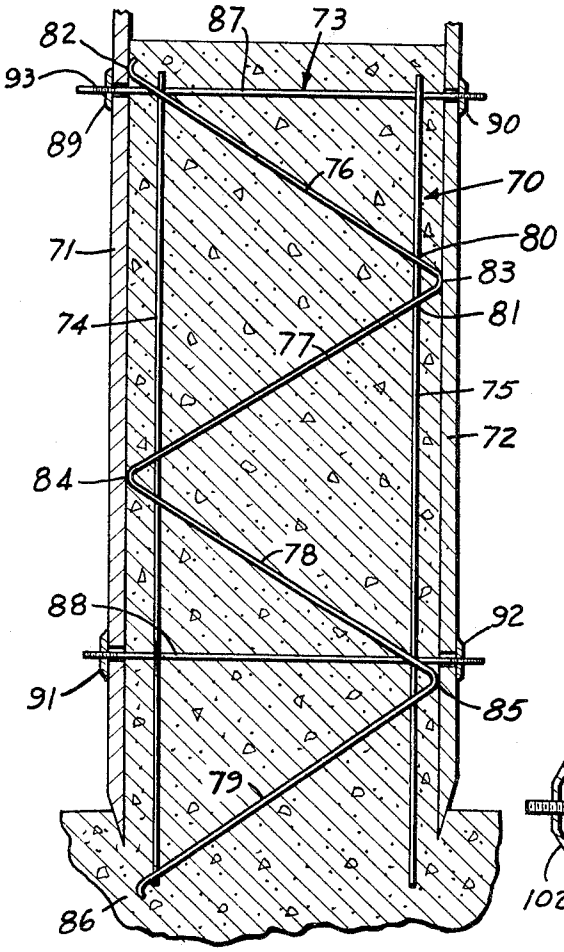


FIG. 7

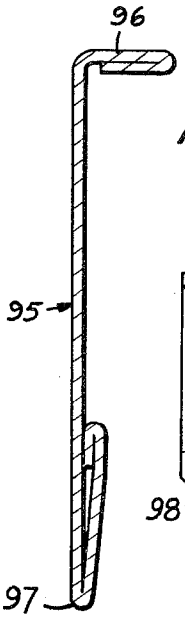


FIG. 8

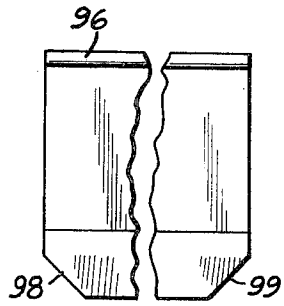


FIG. 9

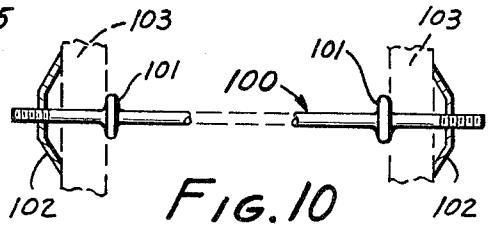


FIG. 10

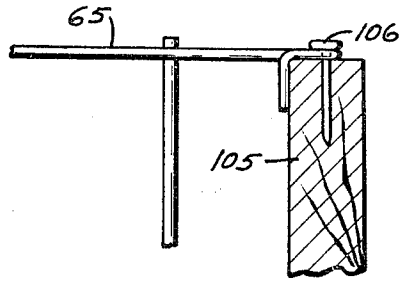


FIG. 11

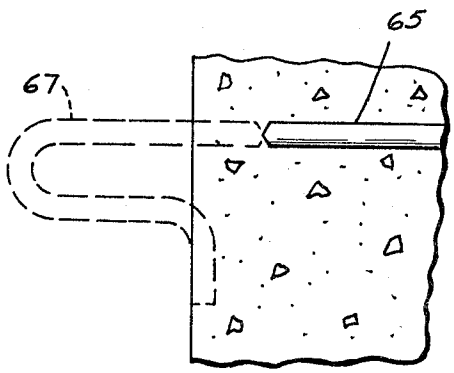


FIG. 12

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3,288,428

PREASSEMBLED TIE CONSTRUCTION

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Continuation of application Ser. No. 249,356, Jan. 4, 1963, now Patent No. 3,199,827, dated Aug. 10, 1965. This application June 8, 1965, Ser. No. 462,383
6 Claims. (Cl. 249—214)

This application comprises a continuation of my co-pending application Serial No. 249,356, filed January 4, 1963, now Patent No. 3,199,827 issued August 10, 1965.

This invention relates to forms for concrete and for similar initially plastic or fluid materials.

Particularly in the construction field, wherein forms are built up for walls, foundations, roofs, curbs, gutters, and like shapes and structures, there is a requirement for means which can reduce the labor and material costs of erecting the forms. Conventional construction of forms involves the laborious nailing up of planks or sheets, and externally bracing them to hold them against bowing or collapse. Their subsequent removal requires rather violent pounding or stripping operations, so that it is necessary to leave them in place for a considerable time in order that the material will be set hard enough to withstand these operations. This additional hardness, in turn, makes the stripping operation still more difficult, and usually results in the destruction of the panel material, thereby adding the cost of the panels to the job.

An object of this invention is to provide means for making forms including panels which can readily be set up with a minimum of construction operations, which will remain in proper alignment without bulging, and which can gently and readily be stripped from concrete or other material while the material is still relatively freshly set. The panels can then be removed without destroying them or disturbing the pour, and the panels are reusable.

Still another object of the invention is to provide means for making forms wherein panels are held accurately aligned from the inside, and which does not require external side support. Such means also adds its strength as reinforcement to the structure being built, because it remains in the material. These objectives are accomplished by holding the panels from the inside in the space ultimately to be occupied by the poured materiaal.

Still another object of the invention is to provide a tie construction which can be made of wire for holding the panels in alignment. A wire tie can expeditiously be manufactured with conventional spotwelding machinery. A wire tie is small in bulk and light in weight, but still very strong.

Yet another object of this invention is to enable panels to be used of a type which can be left in place after the material has hardened, if desired, where it provides thermal insulation.

In accordance with this invention, a tie is utilized for supporting a pair of spaced-apart panels, the tie including a pair of spaced-apart stringer members, each of which has a dimension of length. These dimensions of length are non-orthogonally oriented. A plurality of diagonal members is attached to and rigidly interconnects the stringer members. Adjacent diagonal members intersect each other substantially at a stringer member. These members are substantially co-planar, in that all lie closely together to form a nearly flat structure.

A plurality of pairs of abutment means are provided on the tie, each pair comprising two elements, one element disposed on each side of the pair of stringer members. The pairs of abutment means are attached to members at different locations along the dimension of length of the stringer members.

Retention means for each abutment means is engaged

to the tie and adapted to stand on the opposite side of a panel from the abutment means, thereby to hold the panel against the abutment means in proper alignment.

According to a preferred but optional feature of the invention, at least some of the abutment means are notched so as to provide a breakaway feature inside the pour for releasing the panels and for thereby leaving a flush concrete surface after the panels are stripped.

Still another preferred but optional feature of the invention resides in providing panels whose lower extremity is tapered so as expeditiously to be removable from concrete in which it may have been set.

The above and other features of this invention will be fully understood from the following detailed description and the accompanying drawings in which:

FIG. 1 is a cross-section of a concrete pour, showing partly in elevation and partly in cross-section the preferred embodiment of the invention;

FIGS. 2 and 3 are top and side views of a portion of FIG. 1;

FIG. 4 is a cross-section view partly in elevation and partly in cross-section of another concrete pour showing still another embodiment of the invention in elevation;

FIGS. 5 and 6 are top and side views of portions of FIG. 4;

FIG. 7 is a cross-section view partly in elevation and partly in cross-section of still another concrete pour showing in elevation yet another embodiment of the invention;

FIG. 8 is a cross-section of an optional embodiment of panel for use with this invention;

FIG. 9 is a right-hand view of FIG. 8;

FIG. 10 is a fragmentary elevation, partly in cut-away cross-section, showing an alternate embodiment of abutment and fastener means according to the invention;

FIG. 11 is a side elevation, partly in cross-section, of still another embodiment of abutment and fastener means according to the invention; and

FIG. 12 illustrates a portion of the concrete pour of FIGS. 1 or 4 after removal of the panels therefrom.

FIG. 1 illustrates a concrete pour **10** incorporating the preferred embodiment of the invention. The pour is a typical foundation which includes a footing **11** and a stem wall **12**. The object of the invention is to provide a form for a stem wall atop which a slab or conventional flooring can be erected. The pour is generally made in two steps, the footing first, and thereafter the stem wall.

The invention includes a pair of panels **13**, **14**, which in the embodiment of FIG. 1 are identical. The panels in all embodiments are of indefinite length and height, these dimensions being selected to suit the job. Also, the dimensions of the ties are similarly selected. Panels **13** and **14** have upper holes **15**, **16**, respectively, and lower tapered edges **17**, **18**.

The presently preferred embodiment of tie **20** is shown in FIG. 1, this tie having a pair of stringer members **21**, **22**, which have dimensions of length extending vertically in FIG. 1. These stringer members are non-orthogonally related, and in the preferred embodiment are parallel. The ties are spaced apart along the pour as needed for strength.

Diagonal members **23**, **24**, **25**, **26** are attached to the stringer members preferably by butt welds formed at their intersections therewith. It will be observed that this forms a plurality of contiguous three-link systems, which resist shear and bending movement within the tie, and holds the panels correctly and rigidly aligned by exerting restraint on relative shear and bending movements.

Cross-members **27**, **28** are attached to the stringers, such as by spotwelding, and extend beyond opposite sides of the pair of stringers. A pair of abutment means stands on opposite sides of the pair of stringer members and

comprises a pair of tabs **29, 30**. A second pair of abutment means **31, 32** comprises a first arm of a U-shaped bend **33, 34** on cross-member **28**.

Retention means are provided for each abutment means and are engaged to the tie. In the illustrated embodiment, they are integral with the cross-members. The retention means associated with cross-member **27** comprises a pair of U-shaped bends **35, 36** (see FIGS. 2 and 3), which U-shaped bends are adapted to pass through holes **15** and **16** in the panels and to stand on the opposite side of the respective panel from the stringer members. Fastener means comprise wedges **37, 38**, which are adapted to be placed in bends **35** and **36** to force the panel against the abutment means.

The retention means associated with cross-member **28** comprises second arms **39, 40** integral with cross-member **28**. Initially, the second arms have the structure shown in dotted lines, which are subsequently bent up to form the second arms as shown in solid line in FIG. 1. This enables the panels to be expeditiously put in position by spindling them first on the upper retention means and then bending the wire of cross-member **28** up to the U-shaped bends **33, 34**, as illustrated in FIG. 1.

In the preferred embodiment, notches **43, 44, 45, 46** are provided in the cross-members between the abutment means and the stringer members where the cross-members will readily torque off at the time for removing the panel. The result of this torque-off is shown in detail in FIG. 12.

The embodiment of FIG. 4 utilizes panels **50, 51**, which have even more sharply tapered edges **52, 53** than panels **13** and **14**. The purpose of illustrating different panels in FIGS. 1 and 4 is to illustrate that the taper can be varied at the lower edges of the panels. Furthermore, panels **50** and **51** include both upper holes **54, 55** and lower holes **56, 57**. Should the panel be intended to remain in place, the lower edge need not be tapered.

Tie **58** includes stringer elements **59, 60**, and diagonal elements **61, 62, 63** and **64** as in the embodiment of FIG. 1.

A slightly different type of cross-member is illustrated in FIG. 4, both cross-members **65, 66** being identical. They differ from the cross-members in FIG 1 in that the U-shaped bend **67** forming retention means lies in the plane of the sheet rather than perpendicular to it as in FIG. 1. Tab **68** is on the free end of the bend. Wedges **69** are passed through the bends to hold the panel against the abutment means as in FIG. 1.

The embodiment of FIG. 7 is shown in combination with a pour **70**, and includes a pair of panels **71, 72**, each having tapered lower edges, and holes as in the embodiment of FIG. 4.

Tie **73** includes a pair of stringer members **74, 75** and diagonal members **76, 77, 78, 79**. The adjacent diagonal members of this embodiment, instead of intersecting the stringer members at a single coincident point, meet the stringers at substantially a point-intersection, but actually at spaced-apart locations **80, 81** (with respect to diagonals **76** and **77**, which relationship applies to the other diagonals). However, this spacing apart is negligible in effect when compared to the effects of the other dimensional relationships, and for practical purposes, points **80** and **81** are spoken of as coincident. The spacing between them does, however, enable the diagonals to be continued beyond the stringer members so as to form abutment means **82, 83, 84, 85, 86**. While the regions bounded by a stringer and a pair of diagonals are not strictly three-link systems, still the projection of the abutment means beyond the stringer means is not particularly great, perhaps of the order of ¾ inch, and itself forms a three-link system which lends a certain amount of rigidity to the device, so that the amount of shear movement between the stringers is restricted to a very small amount, which is scarcely noticeable, and certainly not enough to permit any significant malalignments of panels to occur.

Cross-members **87, 88** comprise wire pieces welded to the stringer members. Fastener means **89, 90, 91, 92** comprise speed nuts or other similar devices adapted to engage notches or threads, such as threads **93** on cross-member **87**.

FIG. 8 shows a panel construction which is particularly suitable for use with this invention because it may be made of light metal such as aluminum. It has a face section **95**, an upper flange **96** for rigidity, and a lower tapered edge **97** formed by a double fold in the lower edge of the material. For most convenient use, chamfers **98, 99** are provided on the lower edges, as best shown in FIG. 9.

FIG. 10 shows an alternate embodiment of cross-member **100**, which may be utilized in place of cross-members of other embodiments, if desired, for use with panels wherein a hole is provided. In this device, enlargements **101** are provided on the cross-member for abutment means. Fastener means **102** can bear against a panel **103** by virtue of engagement with threads **104**, to hold a panel in position.

FIG. 11 shows an alternate use of the cross-member shown in FIG. 3. It is particularly suitable when an insulating type of material is used for the panel which is to remain in place. In this embodiment, panel **105** may be made out of bagasse waste, cellulose, wood or the like, and a nail **106** may be driven into the panel through the bend to hold the tie in place.

It is preferable for the stringer and diagonal members to be butt-welded, because then they lie in the same plane, and reduce the thickness of a stack of a given number of ties. This accomplishes a saving in shipping costs. In the embodiment of FIG. 7, the members and elements are substantially coplanar, but actually lie in a pair of parallel planes spaced apart by the thickness of the material. All tie embodiments are essentially flat, and the diagonal and stringer members are therefore spoken of as being co-planar in all embodiments.

The use of all of the embodiments should be evident from the foregoing. In the preferred technique, the ties (of which there are a number for each panel) and panels are assembled. Then the lower portion of the assembly is pressed into the footing while the footing is still soft. The ties preferably, but not necessarily, project below the lower edges of the panels, and aid in supporting the assembly by virtue of their insertion into the footing material. The lower edges of the panels are not ordinarily pressed more than about an inch into the footing. This alone firmly supports the assembly, and the pour can then be made.

Another erection technique is first to place the ties in the soft footing, and then assemble the panels to them, but this involves taking care with dimensions, and is much slower. The use of this technique would be rare.

After the assembly is put in place, the stem wall is poured. After the initial set, ordinarily on the order of a 3–4 hours' delay, the wedges or other fastener means may be removed. Then in the embodiments of FIGS. 1 and 4, and also of FIG. 7, if it is desired to torque off the projecting portions of the cross-members, the end of the cross-member is twisted so that it torques off at the notches. These notches are disposed well inside the concrete pour so that a flush concrete surface results. The panel can then be removed. When a slab floor is to be poured instead of a foundation wall for a conventional foundation, the inside panel is often left in place even after the slab is poured. The outside panel is not stripped off until after the slab itself is poured, because it ordinarily extends above the elevation of the inside panel so as to establish the elevation of the slab itself and to form the upper outside edge of the slab.

As can best be seen in FIG. 12, the turning of the tab end inside the face of the concrete will create a small depressed arc on the surface. However, this is not considered deterimental and, furthermore, it is easy to accomplish, because the concrete is still not finally set. The

result is an entire concrete surface without any projecting metallic elements which might tend to rust and stain the surface.

The panels are very readily stripped while the pour is still in its initially set condition. Because no strong forces or vibrations are needed to accomplish this stripping operation, the pour is not disturbed, and the panels may thereafter be reused. The ties remain inside the pour where they serve to reinforce the same.

It will be noted that the devices provide a tie construction in which shear forces in the plane of the tie are resisted between the stringer elements and which thereby hold the panels in alignment. Some relative shear motion may result between the panels due to flexibility of those portions of the cross-members which project beyond the stringer members. However, this length of projection is not ordinarily more than one inch and the amount of flexibility is therefore quite small. It has been found that this is less than ordinarily results from the use of plank or plywood forms, and that the resulting construction is very much more accurate.

Fairly stiff wire is used to resist bending and shear movement. However, the ties could be stamped or poured, and could be of plastic, metal, or other suitable material as desired.

The construction is quick and expedient, it being necessary only for the workmen to press the ties and panels directly into the footing while still soft, thereby enabling accurate and quick alignment to be attained.

This invention provides a carefully controlled volumetric use of concrete, particularly in slab construction, because both sides of the pour, instead of merely one, are under form control. In conventional practice, often only one form panel is provided (the outside), and a randomly formed ditch edge is filled in with concrete when the slab is poured, costing as much as three cubic yards of extra concrete in an average tract home. In this invention, panels can be left in place, such as in FIG. 11, and the random ditch edge can be filled with earth or sand before pouring the upper slab surface, thereby saving this wasted concrete.

When an insulting material such as shown in FIG. 11 is used, and left in place, particularly on the inside face of the stem wall, a very large improvement is attained which is useful in cold regions such as Alaska, where insulation against lateral movement of cold is extremely desirable. The additional K factor provided to the foundation is of significant value in cold-weather housing. Furthermore, in any installation, it is useful as a termite and vapor barrier should the wall crack. The panel may be treated for vermin resistance, if desired, such as the "Ferrox" treatment by the Celotex Corporation.

It will be appreciated that various combinations of the cross-members and abutment members are possible in combination with the stringer and diagonal members, all of which lie within the scope of the invention.

This invention is not to be limited by the embodiments shown in the drawings and described in the description which are given by way of illustration and not of limitation, but only in accordance with the scope of the appended claims.

I claim:

1. A tie construction preassembled as a unit and adapted to be put in place as an assembly prior to placing form panels thereon for releasably holding a pair of form panels in parallel, spaced relationship, comprising:

a pair of parallel, spaced stringer members; a pair of parallel, spaced wire cross-members extending substantially in the plane of said stringer members for maintaining the parallel alignment of the stringer members, said cross-members having a length greater than the spacing between said stringer members and extending perpendicularly thereto to define a mid-portion extending between said stringer members, opposite end portions extending laterally outwardly from said stringer members, and connecting portions between said mid-portion and said end portions; means for rigidly securing said connecting portions to said stringer members to provide a rigid tie assembly; said end portions defining abutment means on the cross-members for aligning and locating said panels in parallel, spaced relationship spaced outwardly of said stringer members; said end portions defining retaining means on the cross-members for holding the panels against said abutment means, said wire cross-members and stringers being constructed to maintain the abutment and the retaining means adjacent one of said stringer members aligned with respect to each other and rigidly spaced from the abutment means and retaining means adjacent the other of said stringer members, and separation means on said end portions inwardly of said abutment means and said retaining means providing facilitated removal of said abutment means and the retaining means from said tie to permit removal of said form panels from said tie.

2. The tie of claim 1 wherein said retaining means comprise integral turned extensions of said end portions of the cross-members.

3. The tie of claim 1 wherein said separation means comprise notches in said end portions providing a fracture-inducement upon application of torque to said holding means.

4. The tie of claim 1 wherein said securing means comprises spotweld means.

5. The tie of claim 1 wherein said retaining means includes means integral with said end portions of said cross-members defining a shoulder spaced from said stringer members and adapted to bear against the form panels to maintain the form panels spaced outwardly of the stringer members.

6. The tie of claim 1 wherein said retaining means includes means integral with said end portions of said cross-members defining a shoulder spaced from said stringer members and adapted to bear against the form panels to maintain the form panels spaced outwardly of the stringer members, said retaining means comprising distal ends of said cross-member end portions turned in said plane of the stringer members.

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