May 7, 1968 E. G. BANCKER 3,381,929

FORM ASSEMBLY WITH ADJUSTABLE RETAINING MEANS FOR VARIABLE SPACING

Original Filed July 24, 1963 2 Sheets-Sheet 1

Fig. 1.

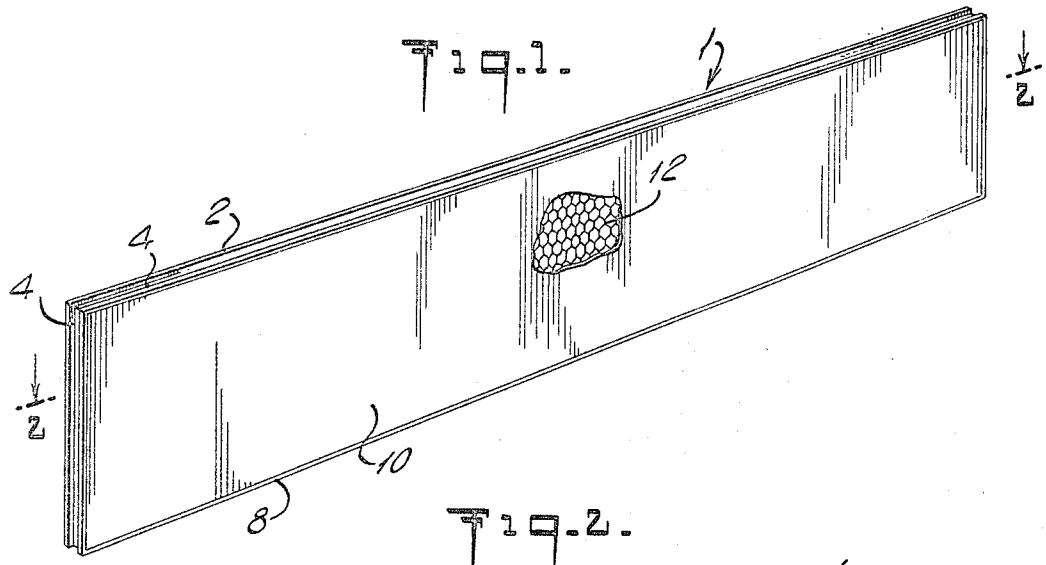


Fig. 2.

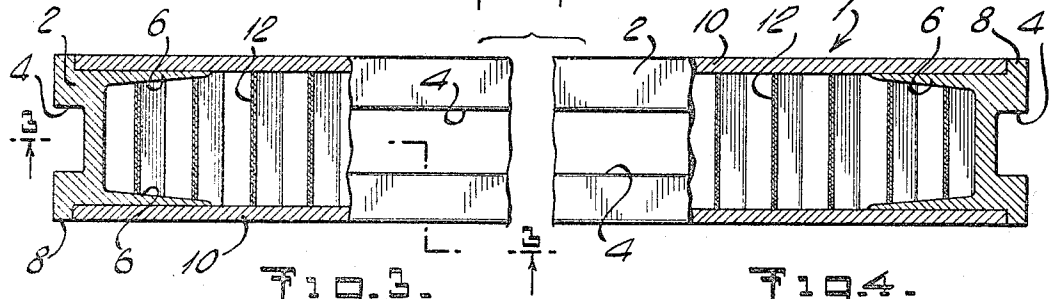


Fig. 3.

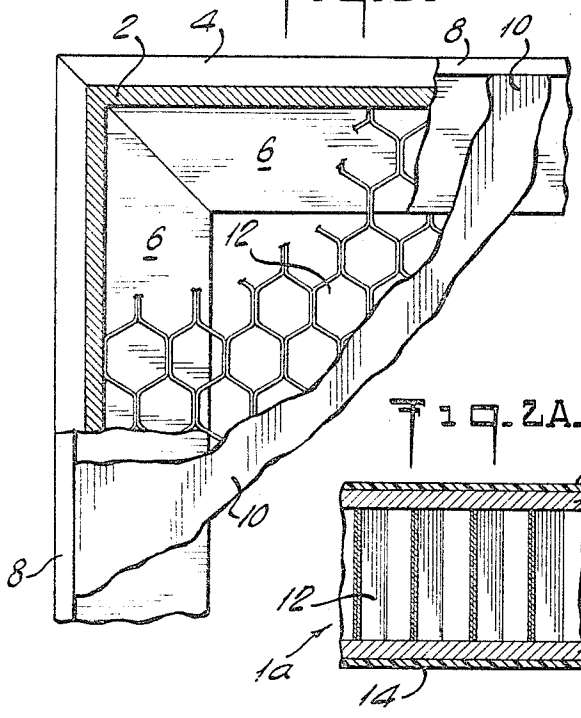


Fig. 4.

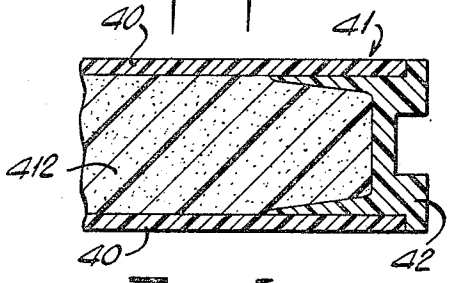


Fig. 5.

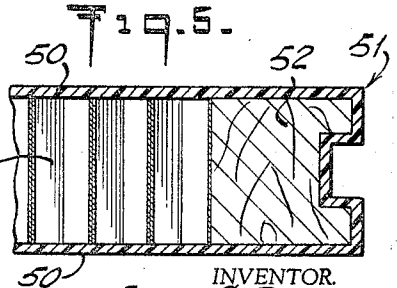


Fig. 2A.

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Fig. 6.

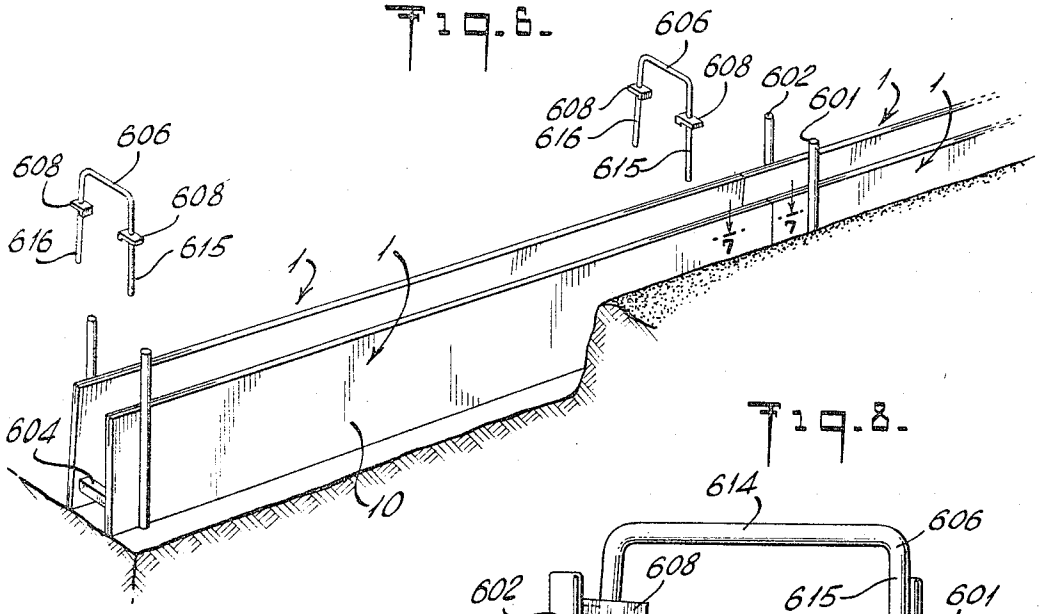


Fig. 8.

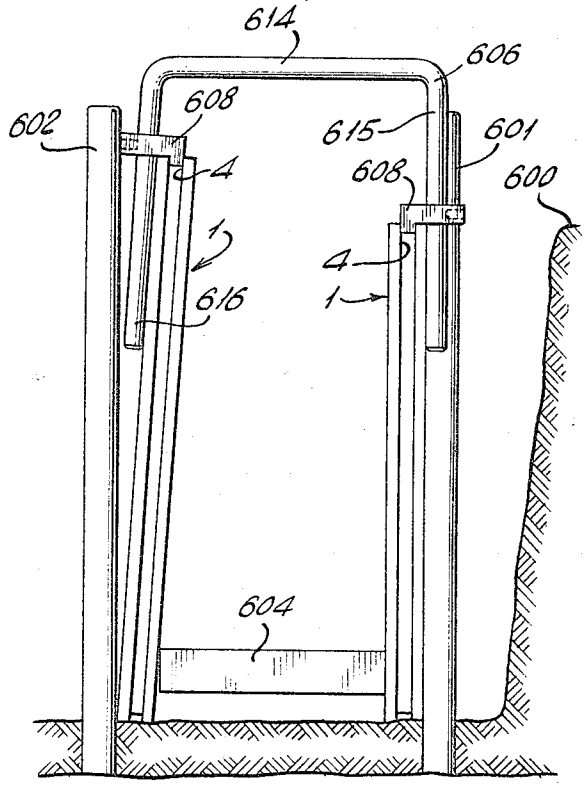


Fig. 7.

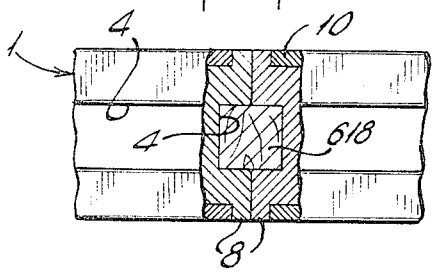
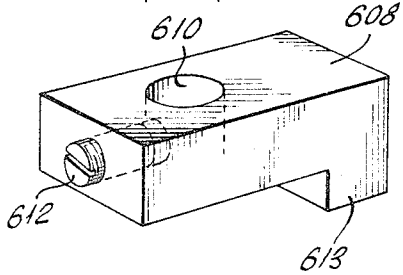


Fig. 9.



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FORM ASSEMBLY WITH ADJUSTABLE RETAINING MEANS FOR VARIABLE SPACING

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Original application July 24, 1963, Ser. No. 297,355. Divided and this application May 20, 1966, Ser. No. 565,368

3 Claims. (Cl. 249—5)

ABSTRACT OF THE DISCLOSURE

A concrete-construction form assembly wherein flat form elements are arranged between upright stakes with spreaders engaging the lower ends of the form elements to hold these lower ends against the stakes. The upper ends of the form elements are situated between U-shaped clamps having diverging depending legs respectively carrying retainers which engage the form elements to retain them at predetermined positions relative to each other. Because of the inclination of these legs it is possible to shift the retaining elements therealong to regulate the distance beween the retaining elements and thus the distance between the top ends of the form elements.

This application is a division of copending application Ser. No. 297,355, filed July 24, 1963, now abandoned, and entitled, Device.

This invention relates to an improved concrete construction form and more particularly to a concrete construction form reusably and permanent in nature.

The forms used in the case of poured concrete constructions are generally made of lumber. In spite of the fact that a low grade lumber is commonly used for this purpose, the practice is expensive since such forms are usually employed only once and must subsequently be scrapped. Other disadvantages of lumber concrete forms include their heavy weight, the tendency of concrete to adhere to the wooden form, lumber deterioration and rotting due to the water in the concrete, natural precipitation, and possible soil moisture, as well as rough surface marks left in the formed concrete because of the poor surface qualities of low grade lumber. Since cured, bonded, or partly bonded concrete tends to stick to lumber, the lumber forms have to be removed after the initial curing or the lumber has to be treated to avoid such sticking. However, the lumber is usually removed after the initial or partial curing, at which time the exposed concrete surface has to be trowelled to smooth the blemishes from the lumber surface. A further disadvantage of lumber is its tendency to warp due to moisture. Lumber is also readily attacked by insects, fungi, or bacteria, and is subject to surface damage due to mechanical influences such as impact or scratching.

In order to overcome some of the disadvantages presented by concrete forms made of lumber, it has been proposed to use pressed steel reusable forms having rigidifying members, etc. periodically spaced on one side thereof. Such forms have the disadvantage of large weight, high cost, and usefulness on one side only. A further disadvantage of these metal forms resides in their relatively rapid corrosion due to the moisture in the concrete, natural precipitation and the moisture content of the soil.

A variety of difficulties are presented in the assembly of prior art concrete construction form elements. Among such difficulties is the cumbersome manner employed in fastening the elements in place, and to each other.

It is an object of the invention to provide an improved

concrete form element and an improved means and method for assembling such elements for operation.

It is another object of the invention to provide a strong, rigid, durable, reusable, lightweight and inert concrete-construction form element, which may be used on both sides and has a long service life.

It is a further object of the invention to provide a concrete-construction form element having surfaces which are readily separable from cured or bonded concrete.

It is another object of the invention to provide a method and hardware for the simple mounting and assembly of concrete-construction form elements for the pouring of curbs, retaining walls and the like.

It is yet another object of the invention to provide a concrete-construction form element, having all the above mentioned advantages, which may be formed with embossed surfaces to result in a patterned concrete surface.

It is to be understood that as used in the specification and the claims, the term "concrete" is intended to include portland cement, and a great variety of like building materials.

The invention in its broadest aspect comprises a lightweight core within the frame member, and covers for the exposed sides of the lightweight core. In its least expensive form the lightweight core may be a corrugated paper honeycomb, although the honeycomb may be constructed also of plywood, expanded metal, plastic, or the like. Instead of a honeycomb, a hardened plastic foam material, such as Styrofoam (Styrofoam is a closed cell, polystyrene plastic made by inflating cells of polystyrene with air, resulting in a non-permeable, multi-cellular mass that contains in the neighborhood of 97% air by volume), polyurethene foam, or the like.

The frame may be an extruded metal frame, preferably lightweight such as aluminum, or in the alternative may be extruded plastic or a plain wooden frame.

The outer cover, separating the lightweight core from the exterior, may consist, in the least expensive embodiment, of fiberboard siding, or fiberboard covered with a plastic coating to separate the board from exterior moisture and permit easy release from the bonded concrete. In the alternative the fiberboard may be used with a release coating brushed thereon, either permanently or each time before use; but if desired, the outer cover may be made of a coated or non-coated metal, or of a plastic having a high concentration of fiberboard pulp, or like filler. In other embodiments, the outer cover may be a filled or unfilled plastic which may or may not surround the frame around the edges of the core. It is perferred, however, when the frame member is made of wood to surround the frame, at the edges, with an outer plastic cover or separate the wood frame from the exterior by some other means.

The concrete-construction form elements of the invention may be attacked vertically on each other to build a form of any desired height and may also be placed end to end to make a form of any desired length. Preferably, the forms can be interlocked to form joints having a minimum or no surface irregularities to keep the concrete as smooth as possible in the area of the joints. A large variety of known interlocking structures may be used to lock laterally or vertically, adjacent form elements to each other, however, in one embodiment, the form elements may be provided with a peripheral groove, or keyway to permit the interlocking by means of a key or a dowel. The groove or keyway may be formed in the exterior of the frame member itself.

The laminated sandwich-type concrete-construction form elements of the invention are strong, rigid, durable and lightweight. They can easily be set in place and removed; both surfaces are usable and provide a clean finished concrete surface, and the molds are unaffected by

ambient circumstances such as temperature, moisture, fungi, bacteria, insects, etc. Under correct handling circumstances the lifetime of the element can be extended to a large multiple of the lifetime of prior art form elements. Due to the preferable release properties of the surface, the elements need little or no cleaning. The elements may be made of material inert to oils, gasoline and solvents of a general nature. The surfaces are tough and impact resistant, and the elements can be stacked in a minimum of space during transportion or storage.

In the case of surface damage or punctures due to improper handling, repairs can be made in the field with a small repair kit containing suitable patching materials and tools.

The standard size elements may be cut into a variety of odd sizes and the cut ends can be patched with a room-temperature setting plastic or the like, which can be furnished with the repair kit.

The invention further provides a novel means to maintain concrete-construction form elements in a desired, spaced relationship in cooperation with the molded edges of the form elements. In the prior art, interior spreaders are used between the form elements at the bottom, intermediate, and top portions thereof to keep the elements apart in the desired spaced relationship.

The displacement of the elements in an outward direction is generally prevented by stakes or other exterior supporting members. Disposing spreaders near the top of the concrete to be poured presents the drawback of having spreaders near the top surface of the concrete, resulting in a weaker structure and surface breakdowns. The device of the present invention comprises a substantially U-shaped clamp member to be disposed exteriorly of the form elements, and an adjustable retaining member mounted on the clamp member. The retaining member grips the form elements by their edges. Thus each form element is prevented from being displaced against the opposing form element.

Further features and advantages of the invention are disclosed in the following detailed specification and claims, with reference to the appended drawing, wherein:

FIG. 1 is a perspective view of a concrete-construction form element according to the invention, with a surface portion broken away;

FIG. 2 is a sectional-elevational view taken along the line 2—2 of FIG. 1;

FIG. 2*a* is a fragmentary view showing another varient of the embodiment of FIG. 2;

FIG. 3 is a plan view of a corner of the element shown in FIG. 1, with parts broken away;

FIG. 4 is a fragmentary cross-sectional view, similar in respect to that shown in FIG. 2, showing another embodiment of the invention;

FIG. 5 is a fragmentary cross-sectional view, similar to that shown in FIG. 4 but showing another embodiment of the invention;

FIG. 6 is a perspective view showing the operative disposition of the concrete form elements according to the invention;

FIG. 7 is a cross-sectional view taken along the line 7—7 of FIG. 6 showing one embodiment of a joint between the form elements according to the invention;

FIG. 8 is an end elevational view as viewed from the left-hand side of FIG. 6;

FIG. 9 is an enlarged perspective view of a retainer member, also shown in FIGS. 6 and 8.

As shown in FIGS. 1 and 2, the concrete-construction form element **1** is formed with a frame **2** defining the peripheral shape of the form element. In the illustrated embodiment, the frame **2** is made of extruded aluminum in a shape defining a peripheral groove **4** and mounting flanges **6** disposed on the side of the frame opposite to the groove **4**. The frame **2** is rectangular in the illustrated preferred embodiment, and the extruded metal members comprising the frame are joined at the corners by any known method, such as a miter joint, or the like. The outer edges of the extruded members comprising the frame **2** are formed with framing flanges **8** defining a rectangular space for cover members **10** disposed within the framing flanges and resting on the mounting flanges **6**. The cover members are bonded to the mounting flanges by suitable adhesives, such as polyester of epoxy resins, complex cement, or resorcinol glue, etc. Disposed within the frame **2** and between the cover members **10** is a lightweight, rigid core **12**, to keep the cover members from bulging inwards towards each other. The cover members may also be bonded to the core.

The core **12** of the illustrated embodiment is a honeycomb structure made of plywood or expanded metal, however, a corrugated structure would be just as suitable.

The cover members **10** are made from fiberboard. In use, the cover member may be coated from time to time with a covering for waterproofing to provide release thereof from the bonding concrete, or in the alternative, the variant shown in FIG. 2*a* may be employed. In the variant, the element **1***a* is similar to the element **1** in most respects, having a core **12** and cover members **10**, but here the latter are covered with a permanent or semi-permanent replaceable plastic layer **14**, adhering to the cover members **10**.

According to other, not illustrated, variants, the cover members may be made from other materials, such as fiberboard-pulp-filled plastic. Plywood sheets may be employed in place of the fiberboard.

Other possible combinations are shown by way of example in FIGS. 4 and 5, the former showing a form element **41** formed with a frame **42** made of extruded plastic members, similar in shape to the elements comprising the frame **2**. Cover members **40** of the element **41** are solid, rigid, or semi-rigid plastic sheets bonded to the frame **42** and a core **412** by adhesive or by heat sealing. The core **412**, made of an expanded plastic foam, fills the interior of the element **41** between the cover members **40**. The foam core may be entirely rigid or should be of at least intermediate rigidity.

A concrete-construction form element **51** as shown in FIG. 5 illustrates another embodiment of this invention.

The form element **51** is reinforced by a frame **52** composed of wooden elements, with a core **512** being disposed within the frame. In the embodiment shown in FIG. 5 the core **512** is a honeycomb, similar to the core **12** shown in FIGS. 1 and 2, however, it is to be understood that a variety of other lightweight, suitably rigid core materials and constructions may be used. In the case of a wooden frame, such as the frame **52**, it is preferred to provide a cover **50** which also surrounds the wooden frame **52** and protects the wood material from the effects of the ambient atmosphere.

If desired, and the size of the form element warrants, additional reinforcing members (not shown), such as diagonal braces may be provided within the form element. In all embodiments the cores are bonded to the frame, however, preferably the covers are also bonded to the core.

It is to be understood, while the embodiments shown are all provided with a peripheral groove similar to the groove **4**, shown in FIGS. 1 and 2, the form elements according to the invention may be provided with other edge-formations (not shown) known in the art for interlocking adjacent and superimposed members of any sort or size.

If so desired, the covers of the various embodiments may be provided with embossed surfaces (not shown) which result in a concrete or cement structure having relief decorations thereon. This is made possible by the increased durability and the inert nature of the form element.

In FIG. 6, by way of exemplary illustration, an arrangement of concrete-construction form elements **1**, according to the invention, is shown adjacent a sidewalk grade **600**.

A row of stakes **601** are driven, spaced apart from each other paralleling the grade **600** into the ground.

A second row of stakes **602** are driven into the ground substantially opposite the stakes **601**. The stakes **601** and **602** are shown substantially vertical, however, as described later, they may also be inclined. The form elements **1** are disposed in spaced, opposing relationship between the stakes **601** and **602**, and spreaders **604** are placed between the form elements near their bottoms to hold the lower parts of the form elements against the stakes. A plurality of U-shaped clamp members **606**, shown exploded in FIG. 6, are placed over the form elements **1**, the depending portions of the clamp members being disposed outside the form elements, as shown in FIG. 8. The longitudinal location of the clamp members **606** over the form elements **1** in relation to the stakes **601** and **602** is immaterial, however, it is desirous that at least one clamp member be located between adjacent pairs of stakes. Each depending leg of the clamp member **606** carries an L-shaped retaining member **608**, shown in detail in FIG. 9. Each retaining member is formed with a mounting bore **610**, the depending legs of the clamp member passing through the mounting bores. Each retaining member is also provided with a set screw **612** to secure the retaining members on the clamp members at any desired location. The shorter, depending leg **613** of the L-shaped retaining member **608** is formed to engage the groove **4** in the top edge of the form elements **1**. By means of this engagement, as shown in FIG. 8, the top edges of the form elements **1** are maintained in the desired, spaced position, while, as indicated, the bottom spacing is maintained by the spreaders **604** against the stakes **601** and **602**.

One of the depending legs **615** of the clamp member **606** adjacent stake **601** is disposed perpendicular to the horizontal crosspiece-portion **614** of the clamp. The other depending leg **616**, the one adjacent the stake **602** is disposed at an oblique angle to the horizontal crosspiece. This divergent leg feature permits the use of a single clamp member **606** for a variety of form element spacings, since the elements may be accommodated at the various spacings by the adjustment of the retaining member **608** along the length of the depending legs. The clamp, according to the invention provides for a versatility of application by allowing the use of dissimilar height or width form elements, as shown in FIG. 8, where the top edge of the element adjacent the stakes **601** is lower than the top edge of the element adjacent the stakes **602**. This feature is advantageous because it is not necessary to accurately select identical size form elements and carefully level them in place. In addition, the form element adjacent the grade **600** may be selected to be level with the grade and thus determine the level of the concrete body to be formed, while the form element adjacent the stakes **602** may be higher to provide a convenient retaining wall portion above the level of the concrete to facilitate the troweling of the surface after the concrete has been poured. When it is desirable to use the same available dissimilar width form elements with the same clamp **606**, but at a different element spacing, the crosspiece of the clamp may be disposed closer to or further above the top edges of the form elements. Of course, the clamp may be constructed so that both depending legs may be disposed at oblique angles relative to the crosspiece.

If a standardized form element spacing is used in certain types of constructions, both depending legs of the clamp **606** may be perpendicular to the crosspiece.

A variety of form element-clamp-stake arrangements may be used (not shown), which may be suitable for particular applications. However, according to applicant's novel arrangement the stakes **601** and **602** may be very short and merely serve to limit the outward displacement of the bottom of the form elements **1**, in which case the clamp member **606** and positioning of the retainers **608** thereon determine the spacing of the upper edges of the form elements. If the thickness and the outward pressure of the concrete is contemplated to be relatively large, the stakes **601** and **602** may of course be used also, to provide additional restraint against the outward movement of the form elements.

As shown in FIG. 7, the adjacent form elements **1** can be interlocked by means of a dowel or key **618** positioned in the grooves or keyways **4** in the opposing vertical edges of the adjacent form elements. As indicated in the preceding, various other known interlocking provisions may be made; for instance, the dowel **618** may be made integral with an edge of a form element, so that along that edge no groove but rather a halfway protruding dowel or tongue is presented (not shown), and adapted to interlock with a groove **4** of an adjacent element.

I have described what I believe to be the best embodiments of my invention. I do not wish, however, to be confined to the embodiments shown, but what I desire to cover by Letters Patent is set forth in the following claims:

1. A form comprising a pair of form elements each comprising a frame for providing structural rigidity to the element, surface cover means for presenting a molding surface to material to be poured adjacent to said surface cover means, and core means disposed within said frame for supporting said surface cover means in an operative position against the material surface, said form elements being disposed in a spaced relationship, means exterior said form elements for providing a retaining support for at least the lower parts of said form elements from being displaced in a direction away from each other, a substantially U-shaped clamp member spaced from said means exterior said form elements and having a substantially horizontal connecting portion disposed across and above said form elements, and two legs, depending at each extremity of said connecting portion, at least one of said depending legs being disposed at an oblique angle relative said horizontal connecting portion, and means for maintaining the upper edges of said form elements in a desired spaced relationship carried by said depending legs, said maintaining means including an adjustable retaining member carried by at least one of said depending legs.

2. A form according to claim **1**, wherein said form elements each are formed with a groove in said frame about the edges of said elements, and said retaining member comprising a first portion having a bore therein for connection to a depending leg of said clamp member, and a second portion integral with and disposed at an angle relative to said first portion for cooperating with the groove in the upper edge of an adjacent form element.

3. A form, comprising a pair of concrete construction form elements disposed in a spaced relationship, a substantially U-shaped clamp having a crosspiece and two depending legs integral with said crosspiece, at least one of said depending legs being disposed at an oblique angle relative to said crosspiece, and retaining members adjustably carried by each one of said depending legs, providing an adjustable retaining means for variable spacing of said form elements.

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