March 10, 1964 J. L. BOETTNER 3,123,887

CONCRETE FORMS AND SYSTEM

Filed April 21, 1961 2 Sheets-Sheet 1

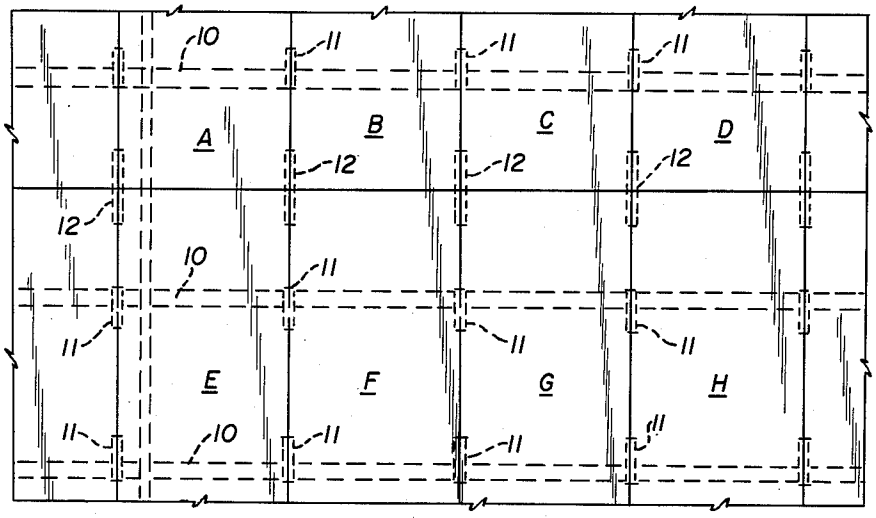


Fig. -1

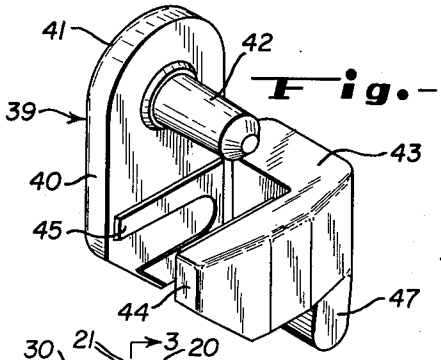


Fig. -2

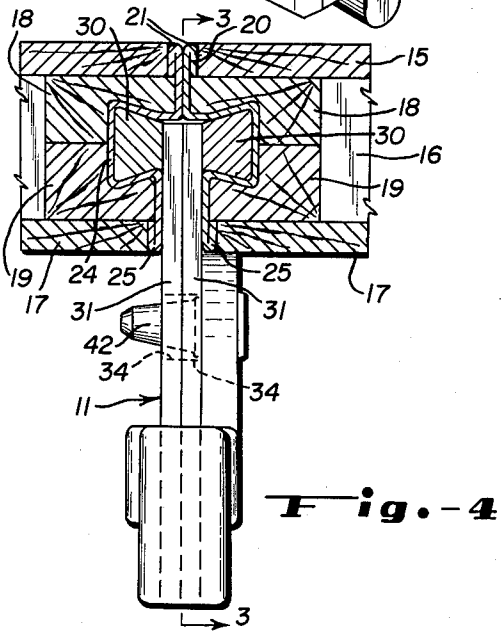


Fig. -4

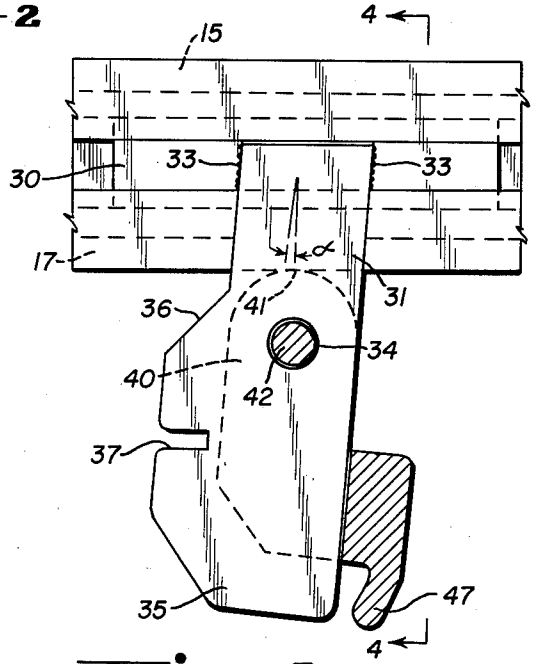


Fig. -3

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CONCRETE FORMS AND SYSTEM

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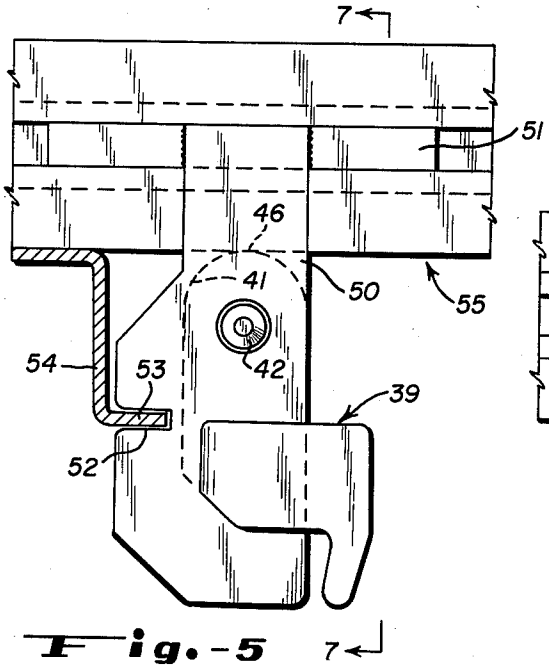


Fig.-5

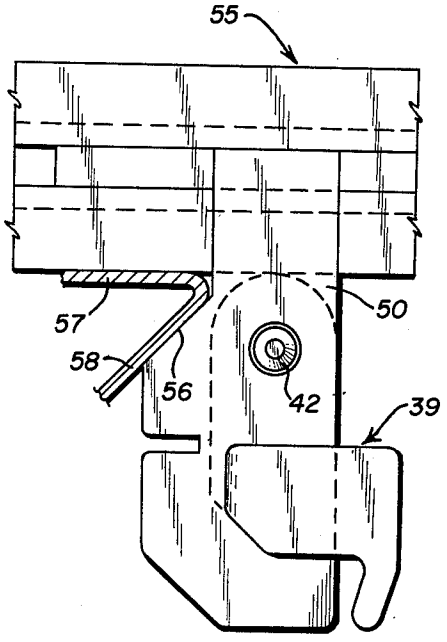


Fig.-6

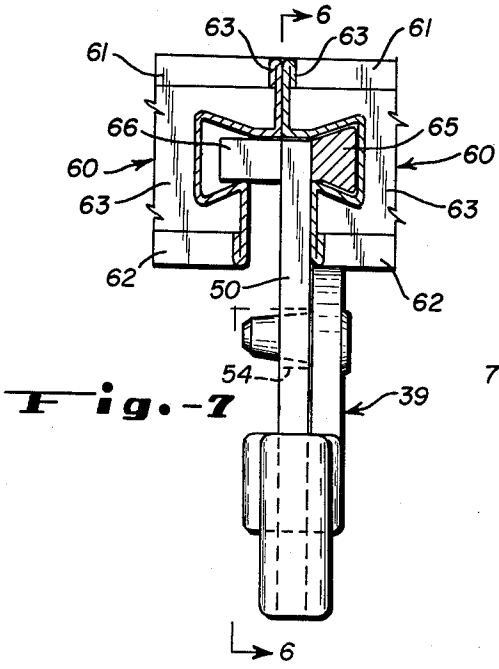


Fig.-7

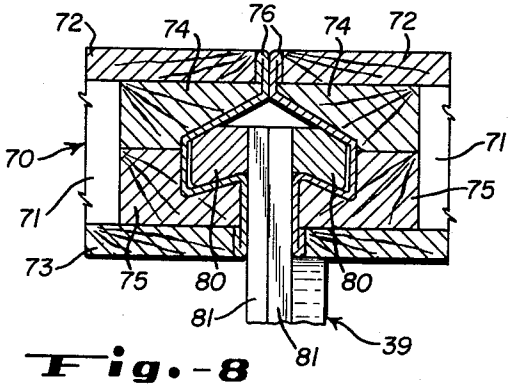


Fig.-8

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CONCRETE FORMS AND SYSTEM

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Filed Apr. 21, 1961, Ser. No. 104,677
6 Claims. (Cl. 25—131)

This invention relates to concrete forms and a system utilizing such forms for concrete construction, and more particularly to temporarily joinable panels and joining means for making forms for building structures of concrete, including such structures of the reinforced type as walls, slab floors, ceilings, slab roofs, and the like.

Many different systems and associated mechanisms have been proposed and used in the prior art for building forms which support concrete in its wet and slumpable position. Such forms, or generically molds, range from the custom built type wherein a form is built in situ for a particular structure and on disassembly is essentially destroyed, to systems utilizing reusable panels which are secured together by numerous types of hardware. In the latter type of construction, the individual panel sections are generally formed with a plywood face mounted on a rigid steel frame, having reinforcing flanges, which extends perpendicularly a substantial distance from the plywood face itself. The frame, therefore, provides peripheral edges of flanges which may be joined to the flanges of adjacent panels. Such panels are joined together by bolts and the like, the holes through the flanges must, therefore, be accurately placed so as to match the holes of adjacent panels. The panels are bulky with the flanges being several times thicker than the width of the plywood face, increasing storage problems. Even where a steel face is provided in place of the plywood, the flanges must be of substantial thickness to provide sufficient rigidity for supporting the concrete which is placed against it. In all such systems various types of hardware are used for joining the panels together, and for securing the panels to shoring the walers for support and correct alignment. In many of such systems, after the concrete which the system is supporting is hardened, the bolts and pins and hardware are removed for dismantling of the form sections. Such pins and hardware are generally small, substantial numbers are lost and, under ideal conditions, they are still considered expendable items.

According to the present invention, I have provided a simplified panel form which is thin, very strong, and has no extending flanges beyond the two closely spaced faces of the panel. Each panel is provided with at least opposed edge molding members which are arranged to seal together, and are arranged to be held together by means of a key member so that the panels are held in edgewise alignment with their cement contacting faces flush. This positive, flush alignment prevents offset at the joints between the panels. The keys, furthermore, provide means for easily attaching the panels to shoring and waling members. The key members are internal clamping members. Thus, they may be placed at any position along the molding so that the supporting members for the panels need not be accurately spaced apart in relation to the panel fastening means. In addition, the invention provides means for interconnecting not only side-by-side panels, but also end-to-end panels and to provide a load transferring connection for an intersection of four panels, relieving the necessity of having a shoring member directly under the joints between panels.

Included among the objects and advantages of the present invention is a light-weight concrete form panel which is arranged for easy and fast temporary interconnection with adjacent members for providing a mold form for concrete structures. The invention provides thin, essentially rigid panels having edge mounted moldings which cooperate with the moldings of adjacent panels to provide a keyway into which a key may be placed for temporarily holding the panels together in accurate alignment and provide means for temporarily securing the held-together panels to support members. The invention, furthermore, provides means for interlocking four adjacent panels and to provide load-bearing means between said panel members so as to support a concrete load without the necessity of having supporting members directly adjacent the interconnection between adjacent panels. The invention provides means for easily and accurately aligning the concrete contacting surfaces of form panels.

These and other objects and advantages may be readily ascertained by referring to the following description and appended illustrations in which:

FIG. 1 is a top plan view of a series of panels interconnected by panel connecting means according to the invention, mounted on shore members for supporting concrete during setting thereof;

FIG. 2 is a perspective view of a clamping mechanism for use with the panel connecting means according to the invention;

FIG. 3 is a side elevation showing one form of a connecting means for panels according to the invention;

FIG. 4 is an end elevation of a pair of panels and connecting means in partial cross-section, showing a modified key and panel connecting mechanism according to the invention;

FIG. 5 is an end elevation of a connecting means, according to the invention, mounted on a panel and securing the same to a shore member;

FIG. 6 is an end elevation of a modified connector including a modified key member, according to the invention, showing the temporary fastening of the member on a different type of shore member;

FIG. 7 is an end elevation in partial cross-section showing a modified key arrangement; and

FIG. 8 is an end elevation in partial cross-section showing a non-captive key arrangement, according to the invention.

One method of using the device according to the invention, for securing a plurality of panels together, to form a bed for supporting a concrete floor or roof during setting of the cement poured thereon is shown in FIG. 1. In this instance, a plurality of rectangular panels labeled A through E, inclusive, are secured together and are placed on supports **10** by means of clamping members **11**, described in detail below. In accordance with the invention these clamping members hold the panels together with the upper concrete contacting surface in planar alignment, and secures the held-together panels onto horizontal shore members **10**. That set of panels is joined, by means of load-transfer members **12**, to another set of panels labeled E through H, inclusively. In a similar manner these panels are secured together and are held on the horizontal support members by means of the clamp members **11**. For conventional forms for floor or ceiling construction, the horizontal shore members **11** must be accurately spaced apart and secured in position by means of vertical shore members which are normally adjustable in height for providing a means for leveling the forms. For the system of the present invention, the shoring members need not be accurately spaced since the clamping devices may be placed in any position along the edge of a panel.

While the drawing of FIG. 1 illustrates the use of the panels supported on the horizontal shores **10**, it is within the concepts of the invention to utilize the panels and the clamping members as vertical forms for forming walls, etc. The horizontal shoring members **10** may be of any convenient type, however, in one embodiment

of the invention the clamping member for the panels is arranged for use with a commercially available shoring member called a "Span-All." The action of the panel clamping member will be, therefore, illustrated in relation to such shoring members, it is to be recognized, however, that the invention is not limited to the particular shoring member but the system is readily adaptable for any type of shoring member.

One form of clamping device for use with panels according to the invention is illustrated in FIGS. 3 and 4, in which a panel (normally rectangular) is made of two face members, one face **15** being a concrete contacting face which is secured to a core member **16**, and an opposite face **17** which is, likewise, secured to a core member. In accordance with applicant's co-pending application, Serial No. 104,676, now Patent 3,047,931, the core material of the panel may be a foamed plastic, honeycomb construction, lattice work of wood, metal or other material, and it is preferred that the face pieces **15** and **17** be secured sandwich-like to the core by means of a high-strength, resinous adhesive for ease of construction and strength and durability of the panel. Other fastening means are, of course, usable. An edging member **18**, which is rabbeted, is secured to the core and to the facing member **15** by means of a high-strength resin adhesive or the like, and an opposing edging member or trimmer piece **19** is, likewise, secured to the core and to the facing **17**, in addition to being secured to the other edging member or trimmer piece **18**. The edging member may be any suitable material, and in one form as illustrated it is a wooden member which is easily worked and readily secured by means of an adhesive to the face and to the core. A metallic molding strip **20**, which has a reverse bend end portion **21**, is mounted on each edge of the panel and it includes a dovetail section **24** which fits into the under-cut rabbeted end members **19** and **18**. The lower end of the molding strip **25** is likewise bent back along itself and secured to the face **17**. The metal molding strip may be secured to the panel by means of high-strength resinous adhesive or by any other convenient means.

The molding strip, when made of relatively thin sheet metal, is relatively inexpensive and is easily formed and provides protection for the edges of the panel. In one form, the molding strip, including the grooves, is extended completely around the peripheral edges of the panel, and since such panels are normally rectangular the edging extends around the four sides. It is noted that the bent-back edge **20** is essentially flush with the surface of the facing member **15**, and it is arranged to seat against an opposing similar member on the opposite panel when secured together by a key. The edging molding may be any type of sheet metal, e.g. steel, aluminum, etc., which is easily formed into shape or it may be a synthetic plastic which is extruded into proper shape and secured to the edges of the panel by means of high-strength resin, or the like. In some instances it may be satisfactory to form the edging members **18** and **19** and the molding **21** as a single piece, as for example by extruding the combined members in the proper shape, providing the dovetail raceway, for attachment along the edge of the panel.

The key, which in the instance of FIGS. 3 and 4 is a captive key, is reciprocably mounted in the raceways of the panels and it includes a dovetail member **30**, which is slidably mounted in the dovetail raceway. A depending arm **31** is secured to the key, as by welding **33** or other means, and this extends outwardly from the panels from dovetail, double raceway between the two adjacent panels. The key **31** FIG. 3 is welded so that it extends at an angle α to a perpendicular to the longitudinal axis of the key itself. This slight angle α provides a means for a positive locking of the clamping device **39** which secures the two arms **31** together and temporarily locks the secured-together arms against the panels themselves. The arms **31** include at hole **34** and a planar portion **35**, which extends beyond the hole. A biased edge surface **36** is arranged adjacent the panel when the key is mounted in the slot, and spaced therefrom is a slot **37**, both of which are arranged to temporarily lock the key device against a shoring member, and thereby temporarily lock the panels to the shoring.

The clamping member includes a body portion **40**, shown in FIG. 2, which has a rounded end **41** arranged for bearing against a panel, and a boss or post **42** extending perpendicularly to the planar body **40**. A clamp member **43** which includes an upper jaw **44** and a lower jaw **45** are arranged to hold the face-to-face mounted arms therebetween, and to essentially temporarily lock the arms together. A removal extension **47** depends outwardly beyond the jaws **44** and **45** and provides means for applying a pry tool for removing the clamping mechanism from the held arms.

In the form shown in FIGS. 5 and 6, the method of attachment of the panels to a horizontal or vertical shore member is illustrated. In this instance an arm **50** which is mounted to a key member **51**, explained in detail below, has a slot or groove **52** which is arranged to seat on a flange **53** shoring member **54**. Thus when the key is mounted in the keyway of the panel, the arm may be attached to the shoring member. By moving the clamp **39** into clamping position, the key is held tightly against the panel **55** and the panel is secured to the shoring **53**. In the application of the device as shown in FIG. 6, the arm **50** is secured with its biased surface **56** held against a shoring member **57** which includes a mating biased flange member **58**, so that when the key is forced against the biased surface **58** the panels will be held against the shoring.

In the form shown in FIG. 7, a panel **60** includes a concrete facing member **61** and an opposed member **62** which sandwich a core **63**. An edging member or molding **63**, which is similar to the molding **20** of FIG. 4, is secured to the edge of the sandwiched panel by means of an adhesive or other convenient fastening members. The facing members **61** and **62** are, likewise, fastened to the core by means of an adhesive resin or other suitable fastening mechanism. The key includes a dovetail member **65**, which is arranged to seat in the dovetail groove of one panel, and an extending bar member **67** which releasably extends into the dovetail groove of the adjacent panel. An arm **50** is secured to the key member **65** and extends outwardly through the opening between the panels. The key **65** is captive in the groove in the one panel while the bar **66** merely provides a positioning means for the panels to maintain the concrete contacting faces **61** flush. A clamp **39** mounted in the hole **54** in the arm **50** seats against the face **62** and secures the key in position against that panel. When the device is then secured against a shoring member, such as is shown in FIGS. 5 and 6 respectively, the device secures the one panel to the shoring member. By placing the keys along the adjacent panels with the keys turned alternately, i.e. the dovetail key in one and then the groove in the adjacent panels, the panels are easily and readily secured to the shoring member. This secures the panels with their concrete contacting surfaces flush forming a smooth surface.

As illustrated in FIG. 5, the upper part of the rounded surface **41** has a flat section **46** for providing a positive seal against the panel and to prevent accidental displacement of the clamp.

Thus it is apparent that the key member of FIGS. 5 through 7 provides a partial, captive key and a partial non-captive key. As explained by reversing the position of the keys from one panel to the next along the same raceway, the panels may be secured to the shoring members.

A non-captive key is illustrated in FIG. 8 wherein the panel sections **70** include a core **71**, a concrete surface

facing **72**, and an opposite facing **73**, secured to the core by any convenient means, and edging members **74** and **75**. The members **74** and **75** are provided with a groove which is partially undercut and a molding **76** is arranged to cover the edge of the panel and maintain the partially undercut groove.

The load transfer members **12** of FIG. 1 are similar to the key of FIG. 4, or where desired of the configuration of FIG. 7 or 8 to fit in the grooves of the panel. For safety factor, the length of the key is desirably somewhat longer than the other members to provide strength. The keys have the arms attached, preferably, for ease of manipulation and for securing the adjacent panels together.

The clamping device includes a key **80** which is shaped to slide sideways into the groove of the panel. In this manner each key with its extending arm **81** may be positioned into the groove at any place along its length. With this arrangement, it is not necessary to have the key enter the groove only at the end as with the captive keys. In a manner similar to that of FIGS. 3, 4, etc., the arm **81** is provided with a hole (not shown) which accommodates the post **42** of the clamp **39**. The post secures the arms together and the clamp, when turned to wedge against the panel, pulls down on the keys and holds them in the partial dovetail groove. Thus, the undercut of the groove holds the partial dovetail and prevents displacement until the clamp **39** is removed. By pulling down on the keys, the panels are moved into flush alignment and held until the clamp is released.

While the invention has been described by reference to specific embodiments, it is apparent other forms may be employed within the spirit and scope of the invention. For example, the groove may be other than dovetailed and still utilize the concept of the clamping key and keyway system. In addition, other clamping means for the extending arms will be obvious to those skilled in the art and it is not intended to limit the invention to the precise details set forth except as defined in the following claims.

I claim:

1. A reusable panel system for making temporary concrete form structures comprising at least two panels arranged to be positioned edgewise adjacent one another in a common plane and to form a concrete containing surface, each panel including a smooth planar concrete containing surface and an outside surface sandwiched over a strengthening core, an edging member mounted on at least the mating edges of said adjacent panels, said edging member extending across each panel and flush with each surface, there being at least one raceway in each said edging member arranged to cooperatively be positioned and form with a similar raceway in the adjacent abutting panel an outwardly opening groove therebetween, the raceway in each panel including at least one undercut portion on the groove-side, a plurality of keys arranged to slidably fit in said mating raceways and each having a portion to secure against the undercut in one of the abutting panels for temporarily holding adjacent panels together, clamp means externally of and adjacent said groove connected with each said key and bearing against at least one of said panels for temporarily clamping the key in said keyway and thereby hold said panels together, and means extending outwardly from said keys in said groove for securing the same to shoring members.

2. A panel system according to claim 1 in which the key is a two piece assembly with each piece including a portion to secure against the undercut of the raceway and said clamp means connecting said key assembly together.

3. A panel system according to claim 1 in which the key is a two piece assembly and each piece includes an extending arm arranged for mating with an adjacent arm and said clamp means is releasably mounted on mating arms for securing said key assembly together and thereby holding said panels together.

4. A reusable panel system for forming concrete form structures comprising a plurality of panels arranged to be positioned edgewise adjacent one another in a common plane and to form a concrete containing surface, each panel including a smooth, planar concrete containing surface and an outside surface sandwiched over a strengthening core, an edging member mounted on the edges of said adjacent panels, there being at least one raceway in each said edging member extending along the length of each member and arranged to be cooperatively positioned with and form with a similar raceway in the adjacent abutting panel an outwardly opening groove therebetween, the raceway in each panel including an undercut, a plurality of keys arranged to slidably fit in said raceways and having a portion to secure against the undercuts of the adjacent panels for temporarily holding adjacent panels together, clamp means externally of and adjacent said groove connected with each said key and bearing against at least one of said panels for clamping said keys in said keyways and thereby maintain said panels together, and means cooperative with means extending from said keys in said keyway and said clamp means for securing the same to shoring members.

5. A panel system according to claim 4 in which the means for clamping the key in said keyways includes a cam means for wedging against the adjacent panel and thereby hold the key in position.

6. A panel system according to claim 4 in which the means extending is an arm connected with each key and extending at a slight angle to the longitudinal axis of the key, whereby the clamping means is secured against accidental displacement.

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