March 11, 1969 W. J. KRAJCO 3,432,137

CONCRETE FORM STRUCTURE

Filed Feb. 13, 1967 Sheet 1 of 2

Fig. 1

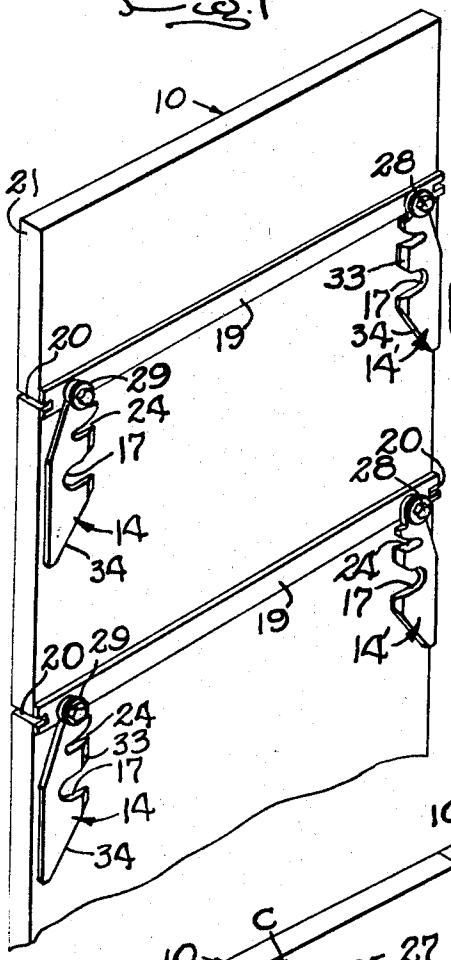


Fig. 2

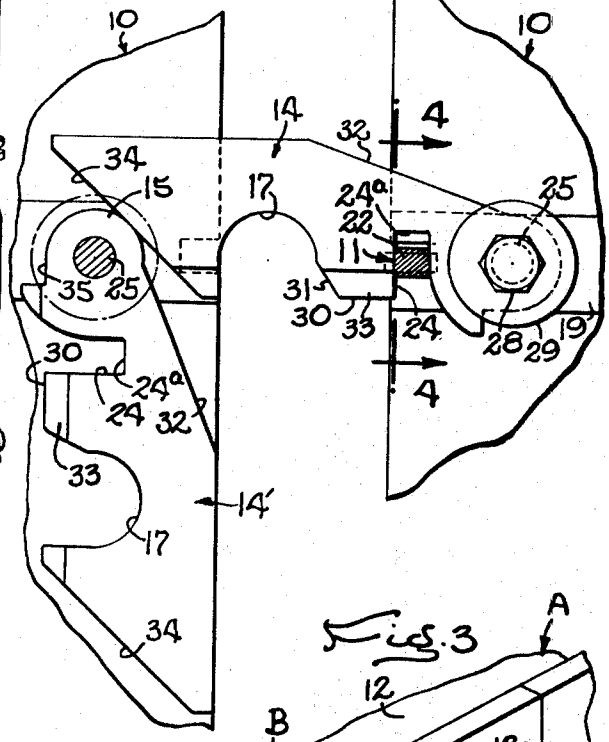
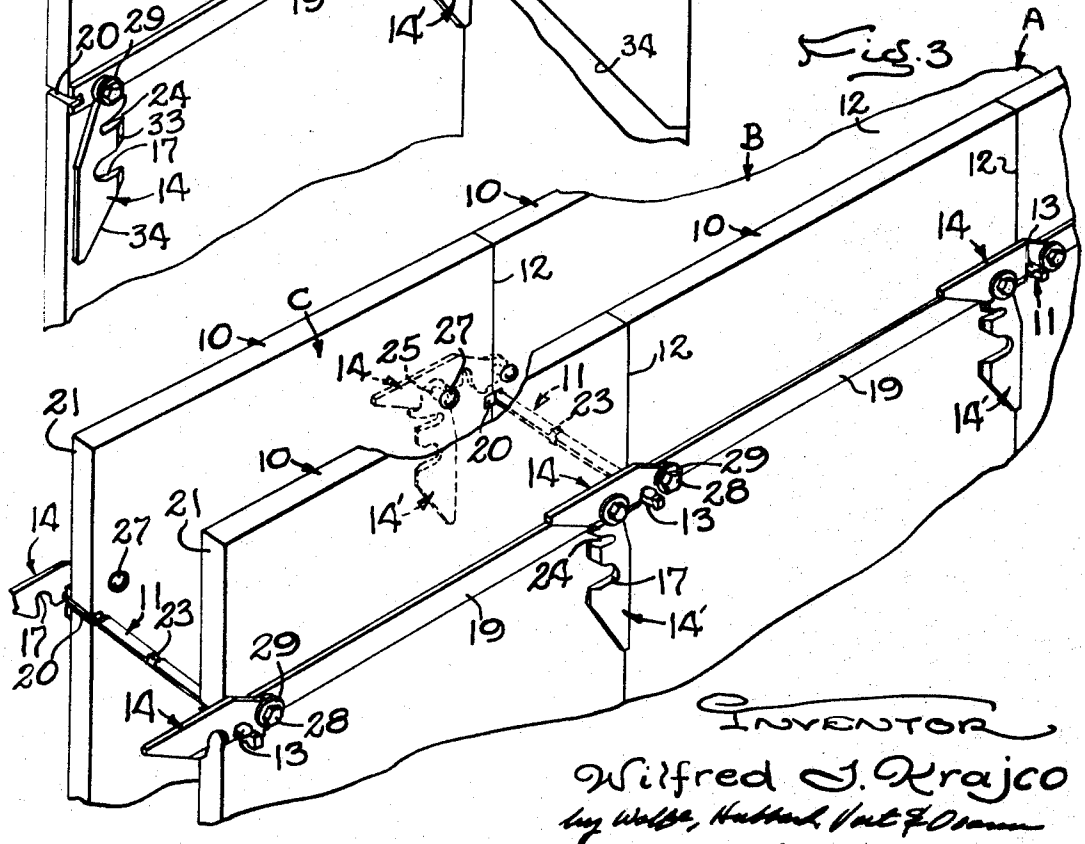


Fig. 3



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CONCRETE FORM STRUCTURE

Filed Feb. 13, 1967 Sheet 2 of 2

Fig. 4

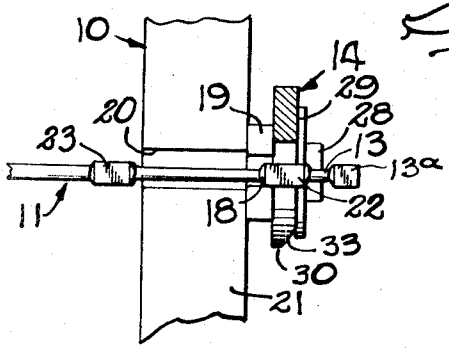


Fig. 5

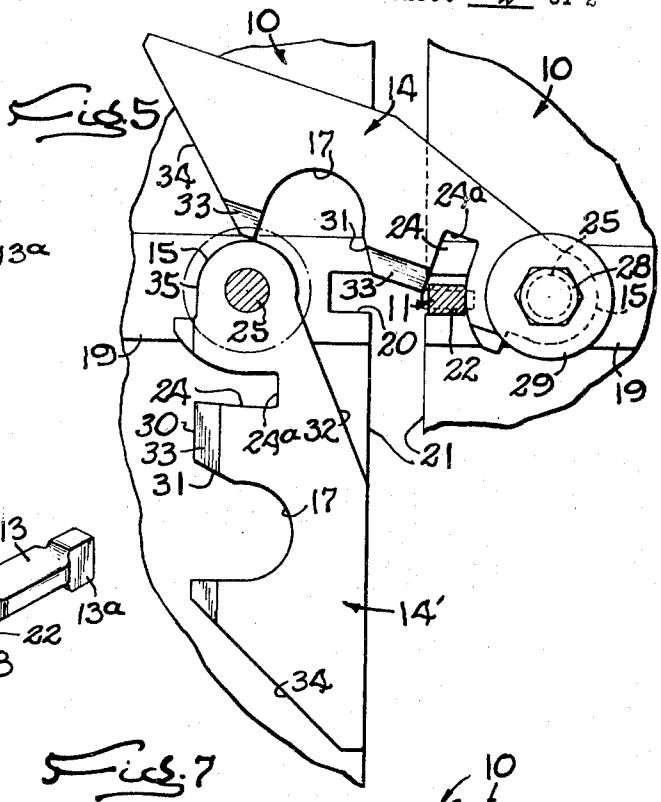


Fig. 6

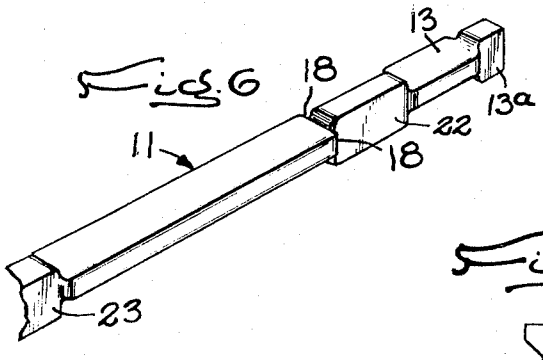


Fig. 7

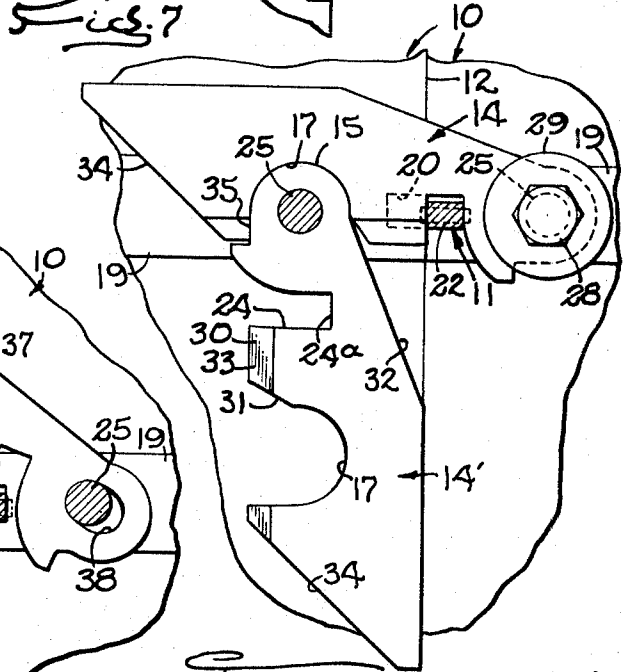
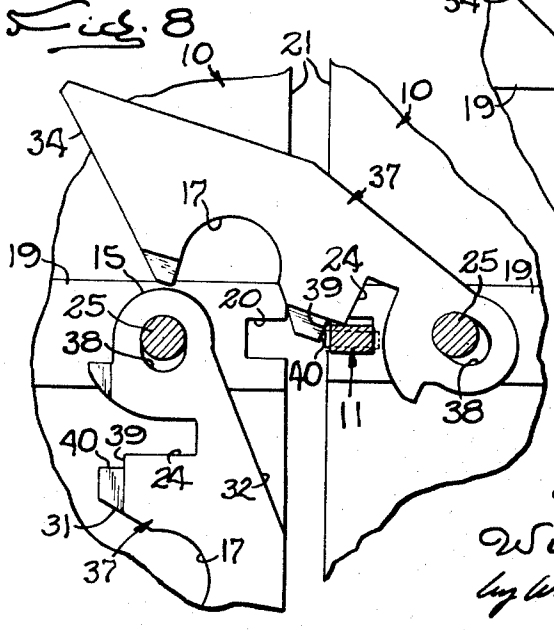


Fig. 8



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3,432,137

CONCRETE FORM STRUCTURE

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Filed Feb. 13, 1967, Ser. No. 615,428
U.S. Cl. 249—45 14 Claims
Int. Cl. E04g 11/10, 17/10

ABSTRACT OF THE DISCLOSURE

A concrete form structure comprising spaced inner and outer walls each made up of a plurality of form sections secured together in abutting edge-to-edge relation. Each form section is a rectangular panel having laterally opening notches in its upright edges for receiving the ends of headed tie wires extending between the walls at the joints between each pair of sections, and locking levers are pivoted on the panels beside the notches and formed with two locking notches in the underside of each lever when the latter is in its locking position overlapping the adjacent section. One locking notch receives the tie wire to secure the wire to the panel before the next section is assembled, and the other notch is shaped to fit over the upper end of a similar lever depending from its pivot on the adjacent section, the free ends of the levers being beveled to be cammed upwardly as the next section is fitted edgewise into place. In a modified form, the levers are longitudinally shiftable relative to the pivots and are formed with tie-wire notches having shoulders engaging the tie wires to hold the levers partially raised during assembly of successive sections. Then the levers are shifted longitudinally to release them for movement into the locking position.

Background of the invention

This invention relates to concrete form structures of the type in which a plurality of form sections are arranged as inner and outer walls between which concrete is to be poured, the sections forming each wall being joined together by levers pivoted on one section and locking over abutments on the adjacent section. To join the two walls together, several headed tie wires or rods span the walls at each of the alined joints between the form sections to project through notches in the sections defining alined pairs of openings at the joints, and are held in place by the locking levers. The levers are formed with notches fitting around the tie wires behind the heads thereon.

After the concrete has been poured and has set, the ends of the tie wires are knocked or twisted off, the levers are unlatched from the adjacent sections, and the form sections are removed for reuse. Different form structures of this type that now are in use commercially include that shown in Patent No. 2,898,659 in which the tie wires serve as the locking abutments for the levers and requiring different sets of sections for the inner and outer walls, and a so-called reversible type shown in Patent No. 3,055,076 in which each lever is formed with alternately usable notches for interlocking with the tie wires, depending upon whether the section is used on the inside wall or on the outside wall. In both of these form structures, the tie wires are held initially in L-shaped "bayonet slots" in the edges of the sections until two sections are together and the locking levers can be manipulated into the locking position to join the sections together.

Summary of the invention

The general object of the present invention is to provide a new and improved concrete form structure of relatively simple and inexpensive construction in which the need for bayonet slots is eliminated and successive

form sections may be assembled in the walls simply by fitting them edgewise into place, the locking of the sections together occurring automatically as an incident to the positioning of the sections. Moreover, the tie wires are held positively in place on the preceding sections during the assembly operation, and the sections are reversible in the sense that they may be used for either inner or outer walls.

In a modified form of the invention, the levers are held in partially raised positions during positioning of succeeding sections and are released manually in a quick and easy operation to shift into the locking position.

Other objects and advantages of the invention will become apparent from the following detailed description taken in connection with the accompanying drawings, in which:

Brief description of the drawings

FIGURE 1 is a fragmentary perspective view of a concrete form section embodying the novel features of the present invention.

FIG. 2 is an enlarged fragmentary side elevation showing the positions of two form sections, the locking levers, and a tie wire preparatory to assembly of the sections in a wall.

FIG. 3 is a fragmentary perspective view taken from the inside of an installation and showing several form sections assembled into partially completed inner and outer walls.

FIG. 4 is a fragmentary cross-sectional view taken substantially along the line **4**—**4** of FIG. 2.

FIG. 5 is a view similar to FIG. 2 showing the positions of the parts as the sections are being moved together.

FIG. 6 is an enlarged fragmentary perspective view of a type of tie wire that may be used with the invention.

FIG. 7 is a view similar to FIG. 5 showing the parts in the assembled positoin.

FIG. 8 is a view similar to FIG. 5 showing a modified form of the invention.

Description of the preferred embodiment

As shown in the drawings for purposes of illustration, the invention is embodied in a concrete form structure in which a plurality of rectangular sections **10** (FIGS. 1 and 3) are arranged edge to edge in two upright rows of alined sections to form spaced inner and outer walls (see FIG. 3) that are connected together by tie wires **11** spanning the two walls and extending through the joints **12** between adjacent sections with heads **13** on the opposite ends of the tie wires disposed outside or beyond the two walls. To secure each two adjacent sections together and hold the tie wires firmly in place, a locking lever **14** is pivoted on one of the sections adjacent each protruding tie wire end to swing about an axis perpendicular to the section into a locking position in which the free end portion of the lever overlaps the adjacent section and interlocks with an abutment **15** thereon while a notch **17** in the underside of the lever fits over the tie wire behind the head thereof.

When the levers **14** at both ends of the tie wires **11** in a given pair of alined joints **12** are latched in place, the form sections **10** on both sides of each joint are securely joined together and the tie wires are locked in place. The heads **13** on the tie wires prevent spreading of the walls, and shoulders **18** on the tie wires behind the locking levers prevent collapsing of the forms toward each other.

Such forms have found their widest application in the forming of foundation or basement walls, but also have other uses well known to those skilled in the art. Special pieces are used for making corners and for other special purposes, but the present invention is concerned primarily

with the general form structure in which each section **10** is a rectangular panel composed of plywood or other suitable material typically two feet wide, eight feet high, and ¾ to 1⅛ inch thick. While the levers could be pivoted directly on these panels, they preferably are mounted on flat reinforcing bars **19** secured to the front sides of the panels and extending horizontally across the full width of the latter as shown in FIGS. 1 and 3. To admit the tie wires through the joints **12**, notches **20** are formed in the vertical edges **21** of the panels and extend through the ends of the reinforcing bars, these notches being only slightly larger than the cross-sectional size of the tie wires. A set of such notches is formed in each vertical edge **21** of each section **10**.

Thus, the metal bars **19**, the locking levers **14** and the tie wires **11** constitute an interconnected metal framework for the form structure. A standard tie wire, shown most clearly in FIGS. 3 and 6, is an elongated rod that has a flattened portion **22** adjacent each end for receiving the locking lever inside the head **13**, the flattened portion forming the locking abutments at the head and also the shoulders **18** for preventing collapsing tilting of the walls toward each other. Additional flats **23** disposed between the two form walls assist in anchoring the tie wires in the concrete. It will be seen that the ends **13a** beyond the heads are rectangular in cross-section so that the heads may be twisted off with a suitable tool (not shown) after the concrete has set.

In accordance with the primary aspect of the present invention, two sets of identical locking levers **14**, **14'** are mounted along the vertical edges **21** of each form section **10** with one lever adjacent each laterally opening notch **20**, and each lever is formed with a tie-wire notch **24** spaced from the lever axis a distance less than the spacing of the axis from the adjacent vertical edge so that the sidewalls of the lever notch straddle the associated notch **20** in the same form section to lock a tie wire **11** in this notch before the next succeeding form section is positioned. After a tie wire is in place, the two levers **14** for holding the wires are swung into and maintained in laterally projecting positions locking the wire in place so that the two alined sections become a free standing unit while preparations are made for assembling successive sections.

In addition, the locking abutments **15** on the next pair of form sections **10** are formed by the upper ends of the sets of levers **14'** mounted along the adjacent edges **21** of the next sections, and the free ends of the active levers **14** and the upper end portions of the inactive levers **14'** are formed as opposed cam surfaces for lifting the active levers over the abutments and dropping them into interlocking relation automatically as an incident to the edgewise movement of the next sections into abutting relation with the already-positioned sections. Accordingly, the need for bayonet slots or the like is eliminated and the assembly of successive form sections is reduced to a relatively simple operation requiring little or no manipulation of the levers after the tie wires are swung into the locking positions.

In this instance, each locking lever **14**, **14'** is an elongated piece of flat metal on the order of ¼ inch thick and is pivoted adjacent one end on a stud **25** extending loosely through a hole in the lever and on through the associated reinforcing bar **19** and the form panel with a riveted inner end **27** (FIG. 3) cooperating with a head **28** on the outer end of the stud to form the lever pivot. Washers **29** are fitted on the pivot studs outside the levers.

Formed in the underside **30** of each lever **14**, **14'** is the tie-wire notch **24** which preferably is arcuately curved about the axis of rotation of the lever and is spaced from this axis a distance equal to the spacing of the associated panel notch **20** from the axis to overlie the panel notch when the lever is positioned as shown on the right section **10** in FIG. 2. The width of the notches **24** is somewhat greater than the width of the tie wires at the flattened portions **22** to fit freely over the wires, but is less than the width of the heads **13** and the shoulders **18**. To facilitate movement of the levers into locking relation with the tie wires, the width of each notch preferably increases toward its open end to a width somewhat greater than the width of the flattened portions **22**.

Radially or longitudinally outwardly from the tie-wire notch **24** is the second notch **17** which is shaped and positioned to fit over the locking abutment **15** on the next form section **10**, herein the pivoted or upper end of an inactive lever **14'** on that section. As will be seen in the drawings, each of these second notches is shaped like a wide inverted U and the upper ends of the levers (in the inactive positions) are rounded to the same shape to fit snugly into the notches and lock the form sections together. The notches **17** and the rounded upper ends **15**, of course, are spaced the same distance from the joints **12** when the two sections are together and the levers **14** are in the locking positions. Stated another way, the notches **17** are spaced from the lever axes farther than the notches **24** to overlie the next form section and, more specifically, are spaced beyond the joint or edge of the section a distance equal to the spacing of the pivots **25** from the edges of the sections.

Again, to facilitate entry of the abutments **15** into the notches **17**, the latter are wider at their open ends than the width of the abutments. Herein, the lower edges of the levers are cut away at **31** to accommodate the inclined portion **32** on the upper sides of the levers (see FIG. 7). In addition, the lower edge portions are tapered at **33** to fit easily in between the bars **19** and the washers **29** during latching.

The camming action providing automatic latching as an incident to the positioning of successive sections **10** in edge-to-edge relation is achieved by beveling the free ends of the levers at **34** to form cam surfaces inclined downwardly from the tips of the levers and back toward the pivoted ends. It will be seen in FIG. 3 that the tie wires abut against the closed upper ends **24a** of the notches **24** and thus hold the levers in laterally projecting positions in which the beveled ends **34** are level with the upper end portions of the inactive levers **14'** on the next form section. Accordingly, edgewise movement of the new form section from the position shown on the left in FIG. 2, to the right through the position shown in FIG. 5 and into the position shown in FIG. 7, causes the active levers on the stationary section to be raised upwardly (FIG. 5) to permit the abutments **15** to pass under the levers **14** into alinement with the notches **17** (FIG. 7).

It should be noted that the tie wires **11** remain locked in the notches **20** when the lever **14** is raised high enough for the abutments **15** to become alined with the notches **17**. This is accomplished by extending the lower portion of the lever well past the level of the tie wires when the levers are in the locking position shown in FIG. 7. In this way, the sidewalls of the notches **24** remain in straddling relation with the tie wires when the levers are partially raised, and the tie wires thus are positively held in place on the form sections as the new sections are latched in place. Accordingly, the notches may be simply U-shaped in cross-section as shown herein, and are formed by simple grooves extending across the edges of each panel and through the ends of the bars **19**.

The procedure for setting up a form structure with the foregoing form sections **10** should be apparent from the description of the structure. After the first two sections are in place in spaced side-by-side relation, as illustrated at A on the right in FIG. 3, tie wires **11** are placed in the alined pairs of notches **20** spaced along the left edges **21** of the sections and the levers **14** adjacent the left edges are swung into generally horizontal positions extending to the left beyond the initial two sections, thereby locking the tie wires in place and securing the first two sections together in spaced parallel relation.

Then the next two sections **10** are moved edgewise into abutting relation with the first two sections as illustrated at B in FIG. 3. During this step, the inactive levers **14'** along the right edges of the new sections are allowed to hang down or depend from their pivots **25** so that the upper end portions of the levers are alined with and engage the beveled ends **34** of the levers **14** on the first two sections. Accordingly, the levers **14** are cammed upwardly (FIG. 5) and the upper ends **15** of the inactive levers **14'** slip under them to become alined with the notches **17**. Then the active levers drop into place to complete the assembly. A slight tap sometimes may be desirable to seat the levers **14** over the abutments **15**. Each successive pair of form sections is assembled in the manner shown at C until the inner and outer walls are complete and ready to receive the concrete for the foundation.

After the concrete has set, the form structure is disassembled simply by unlatching the levers **14** and removing the form sections **10**. The protruding ends of the tie wires may be broken off in the usual manner, and the levers **14** may be unlatched by striking the underside of each lever with a hammer. Also, the inactive levers **14'** may be rotated clockwise as viewed in FIG. 7 to lift the active lever out of the locking position, the straight left side **35** of the upper end portion producing the lifting action.

Description of the modified form

In the modified form of the invention shown in FIG. 8, the levers **37, 37'** are of generally the same shape as the levers **14, 14'** and are formed with similarly positioned notches **17** and **24** in their undersides, and with curved upper end portions **15** forming the abutments for interlocking with levers on the adjacent form sections **10**. Other basic parts of the structure similar to parts of the preferred form are indicated by the same reference numbers.

The hole **38** in each lever receiving the pivot stud **25**, however, is elongated longitudinally of the lever to form a lost-motion connection, and the tie-wire notch **24** is formed with a downwardly facing shoulder **39** along its radially outer side, the side farthest from the lever axis, for abutting against the top of a tie wire **11** when the lever is partially raised and retracted to the right as permitted by the elongation of the hole **38**. A lug **40** beside the notch and beyond the shoulder still retains the tie wire in the panel notch **20** by covering the side of the notch when the lever is in this partially raised and retracted position.

As the tie wires are placed in the notches **20** in a pair of side-by-side form sections **10**, the levers **37** are positioned as shown in FIG. 8 preparatory to the positioning of the next form sections. It will be seen that the next sections may be placed against the first sections without contact between the active levers **37** and the inactive levers **37'** on the new sections. When the latter are in place, the active levers are pulled and extended to the left until the shoulders **39** clear the tie wires, and then are dropped into the locking position similar to that shown in FIG. 7, the notches **17** being alined with the abutments **15** in the extended positions of the levers. Thus, the modified form provides semi-automatic latching of the forms.

From the foregoing, it will be seen that the present invention provides a novel type of concrete form section **10** which may be used interchangeably in either inside or outside form walls and which holds the tie wires **11** positively in the simple notches **20** in the edges of the sections prior to and during assembly of the next abutting sections without need for the bayonet slots that have been used in prior form structures of this general type. Moreover, the locking levers are of relatively simple and inexpensive construction, and may be smaller in size than the reversible levers in commercial use, thereby offsetting at least part of the expense of providing two sets of levers on each section, and the preferred levers have the additional advantage of latching the sections together automatically as an incident to the positioning of each pair of new sections of the form walls.

I claim as my invention:

1. A concrete form section of the type adapted to be joined in an upright position to similar sections disposed in edge-to-edge relation to form two walls joined together by tie wires, said form section comprising a rectangular panel adapted to stand in an upright position and having two sets of laterally opening notches spaced along the upright edges of the panel, each notch in one of said edges being vertically alined with a notch in the other edge, and two sets of locking levers spaced along said edges, each lever being pivoted on said panel adjacent one of said notches for swinging about an axis perpendicular to the panel and spaced a preselected distance from the adjacent panel notch, and being swingable into an inactive position hanging below the lever axis and also into a locking position extending laterally beyond the panel edge to overlap another form section disposed in alined edge-to-edge relation with said panel, said levers having first and second locking notches formed in the longitudinal edges of the levers facing downwardly in said locking positions, each of said first notches being spaced said preselected distance from the lever axis and having sidewalls straddling the associated laterally opening notch in said panel when the lever is disposed in said locking position, and each of said second notches being spaced beyond the edge of the panel in said locking position a distance equal to the spacing of the lever axis from the edge of the panel and shaped to fit over the upper end of a similar lever disposed in an inactive position on the next form section.

2. A concrete form section as defined in claim **1** in which the free end of each lever is beveled to form a cam surface inclined downwardly and back toward the lever axis from the tip of the lever for engagement with the upper end portion of an alined lever on the next form section as the latter is moved edgewise into alined abutting engagement with said panel, and further including means on each lever for holding the latter in a preselected laterally projecting position for engagement with the alined lever during movement of the latter toward said panel.

3. A concrete form section as defined in claim **2** in which said holding means include a surface in each lever at the closed end of said first notch positioned to overlie the upper edge of the associated laterally opening notch in said panel when the lever is in said preselected position.

4. A concrete form section as defined in claim **3** in which said sidewalls are dimensioned and positioned to straddle said laterally opening notches in said preselected laterally projecting position, said locking position, and also in a preselected partially raised position of the lever thereby to maintain tie wires in said laterally opening positions when the lever is in said partially raised position.

5. A concrete form structure as defined in claim **1** in which each of said levers is mounted on said panel with a lost-motion connection permitting limited longitudinal shifting of the lever between extended and retracted positions, said lever having a downwardly facing shoulder on the sidewall of said first notch farthest from the lever axis overlying said laterally opening notch when the lever is in said retracted position and is partially raised and disposed a preselected distance above said locking position, said shoulder being shiftable away from said laterally opening notch as the lever is shifted longitudinally to said extended position.

6. A concrete form structure as defined in claim **5** further including a lug on the underside of each lever extending downwardly beyond said shoulders to cover the sides of the laterally opening notches when said levers are partially raised and in said retracted positions.

7. A concrete form structure having, in combination, spaced inner and outer walls each comprising first and second wall sections disposed in abutting edge-to-edge relation in an upright plane and defining a joint between adjacent sections, said joints and said first and second sections in said outer wall being alined with the corresponding parts of said inner wall, laterally opening notches in

the abutting edges of said first sections defining pairs of alined openings at said joints, elongated tie wires spanning said walls and each having opposite end portions projecting through and beyond a pair of said alined openings, elongated locking levers pivoted on said first sections for swinging about axes spaced a preselected distance from said notches and having free end portions swingable into laterally extending locking positions in which the levers extend across the joints and overlap said second sections, a first notch in each of said levers opening downwardly when the lever is in said locking position and spaced said preselected distance from the lever axis to receive the projecting end of a tie wire in the adjacent laterally opening notch, a second downwardly opening notch in each of said levers spaced radially from the lever axis a distance greater than the spacing of said joints from said axes to overlie said second sections, abutments on said second sections interlocking with said second notches when the levers are in said locking positions, said first notches being shaped and positioned to fit over said projecting ends and hold the latter in said laterally opening notches while said levers are in said locking positions and also while the free ends of the levers are raised a preselected amount sufficient to release said abutments, and means for holding each of said levers generally in said locking positions after insertion of said tie wires in said laterally opening notches and before the addition of said second sections, said abutments and the free ends of said levers being formed as opposed cam elements for raising said free ends by said preselected amount to clear the abutments as an incident to lateral movement of said second sections into edge-to-edge relation with said first sections and then releasing the levers to drop into interlocking relation with the abutments.

8. A concrete form structure as defined in claim **7** in which said holding means are opposed surfaces on said levers and said tie wires.

9. A concrete form structure as defined in claim **7** in which the free end of each lever is a cam surface inclined downwardly and toward the pivoted end from the tip of the lever to lift the latter as the associated abutment on said second section engages the cam surface and moves laterally toward said first section.

10. A concrete form structure having, in combination, spaced inner and outer walls each comprising first and second wall sections disposed in abutting edge-to-edge relation in an upright plane and defining a joint between adjacent sections, said joint and said first and second sections in said outer wall being alined with the corresponding parts of said inner wall, laterally opening notches in the abutting edges of said first sections defining pairs of alined openings at said joints, elongated tie wires spanning said walls and each having opposite end portions projecting through and beyond a pair of said openings, a set of elongated locking levers pivoted on said first sections adjacent said abutting edges for swinging about axes spaced a preselected distance from said notches and having free end portions swingable into locking positions in which the levers extend across the joints and overlap said second sections, a first notch in each of said levers opening downwardly when the lever is in said locking position and spaced said preselected distance from the lever axis to receive the projecting end of the tie wire in the adjacent laterally opening notch, a second downwardly opening notch in each of said levers spaced radially from the lever axis a distance greater than said preselected distance to overlie said second sections in said locking positions, and abutments on said second sections interlocking with said second notches in said locking positions whereby said levers hold said tie wires and said sections in position to form said walls.

11. A concrete form structure as defined in claim **10** in which second sets of locking levers similar to the first sets are pivoted on said second sections adjacent said abutting edges for swinging about axes spaced the same distance from said joints as the pivots of said first set and alined therewith, the levers of said second set hanging downwardly from their pivots and having upper end portions shaped to interlock with said second notches in the levers of said first set, thereby forming said abutments.

12. A concrete form structure as defined in claim **10** in which each of said sections has two sets of notches spaced apart along the upright edges of the section and two sets of similar locking levers each pivoted on the section said preselected distance from one of said notches whereby an active set of levers serves to lock the tie wires in the notches along one edge of the section while the other set is inactive, the upper end portions of said other set being shaped to interlock with said second notches in the levers of the adjacent section, thereby forming said abutments.

13. A concrete form structure as defined in claim **12** in which said tie wires and said first notches in the active set of levers coact to hold the latter in laterally projecting positions prior to positioning of the abutting section, and the free ends of said levers are formed with cam surfaces engageable with the inactive set of levers during edgewise movement of the abutting section into alined edge-to-edge relation and operable to raise the levers to pass over the abutments and bring said second notches into alignment with the abutments.

14. A concrete form structure as defined in claim **10** in which said levers are mounted on said first sections with lost-motion connections permitting limited longitudinal shifting between extended and retracted positions, said first notches having internal shoulders alined with and resting on said tie wires in said retracted positions and holding the levers partially raised for movement of said abutments of said second panels under the levers, said shoulders moving out of alinement with said tie wires upon shifting of the levers endwise to said extended positions whereby the levers may be pivoted downwardly to interlock with said abutments after said second sections are positioned against said first sections.

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