March 4, 1969 C. R. JOHNSON 3,430,913

METAL TIE ROD FOR SPACED WALLS OF WOOD FORM FOR CONCRETE WALL

Filed July 3, 1967 Sheet 1 of 2

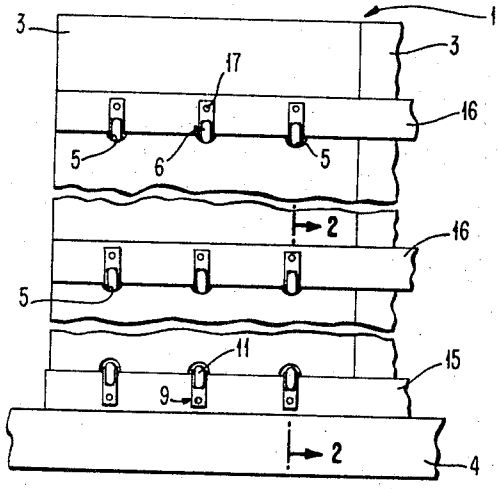


FIG 1

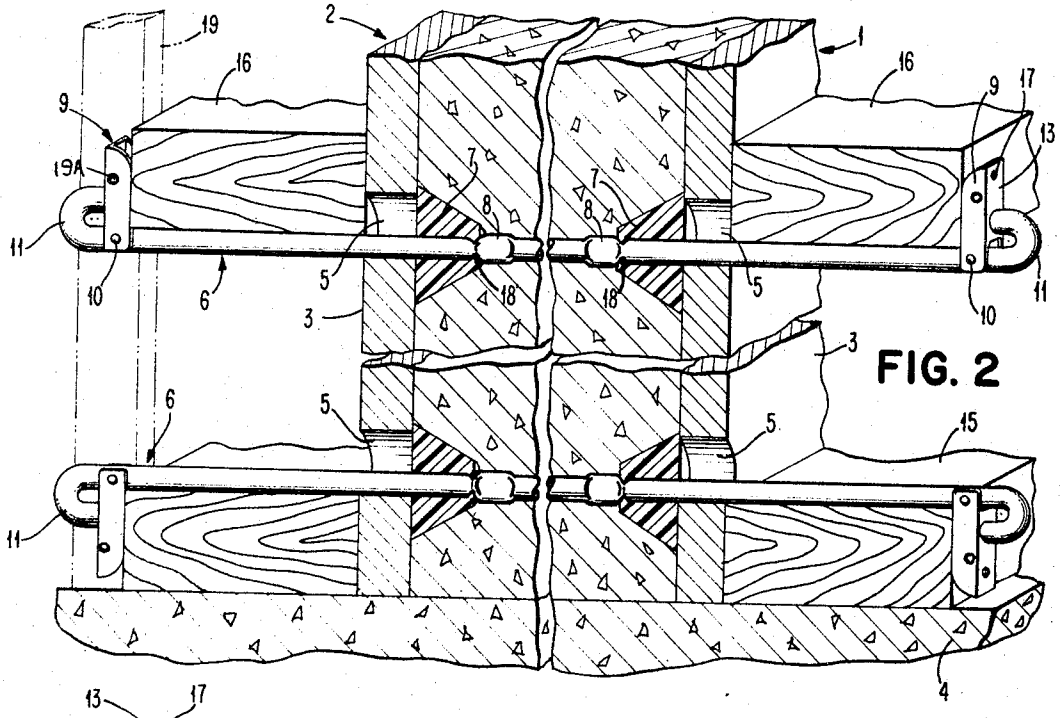


FIG. 2

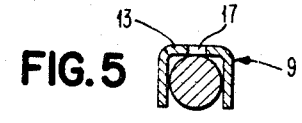


FIG. 5

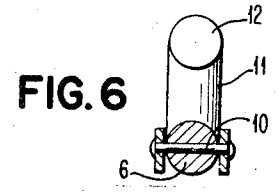


FIG. 6

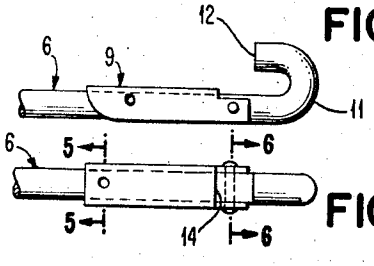


FIG. 3

FIG. 4

INVENTOR.
CALVIN R. JOHNSON

BY Arthur J. Robert

ATTORNEY.

March 4, 1969 C. R. JOHNSON 3,430,913

METAL TIE ROD FOR SPACED WALLS OF WOOD FORM FOR CONCRETE WALL

Filed July 3, 1967 Sheet 2 of 2

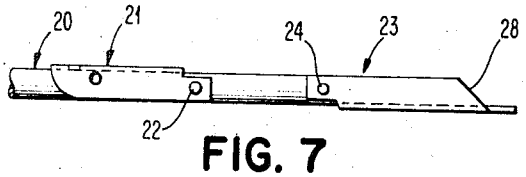


FIG. 7

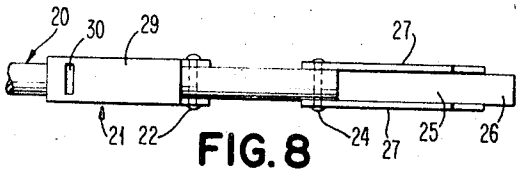


FIG. 8

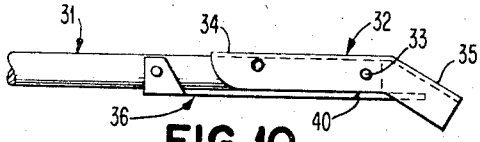


FIG. 10

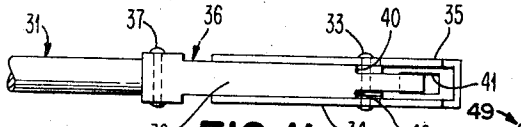


FIG. 11

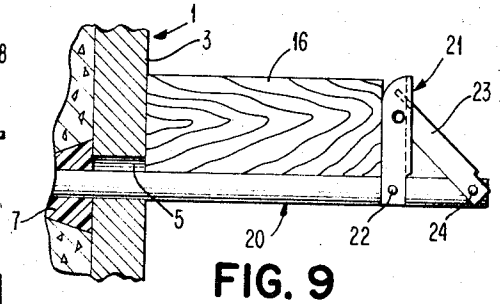


FIG. 9

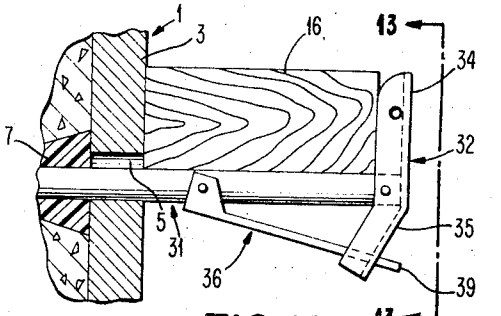


FIG. 12

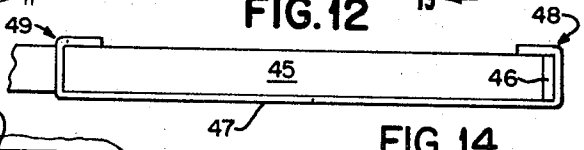


FIG. 14

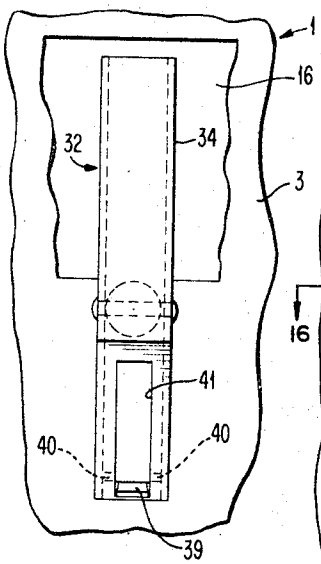


FIG. 13

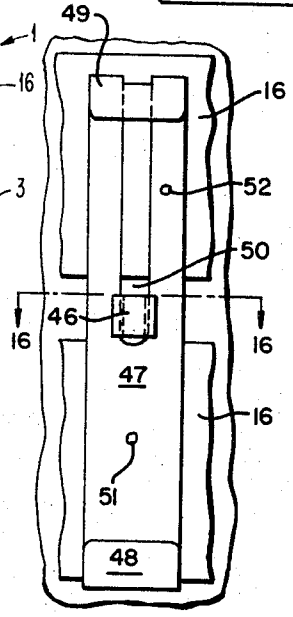


FIG. 15

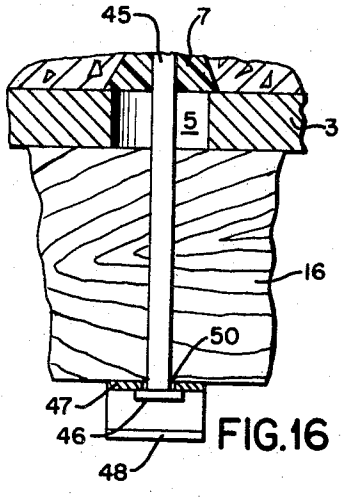


FIG. 16

INVENTOR.
CALVIN R. JOHNSON

BY Arthur Robert

ATTORNEY.

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3,430,913

METAL TIE ROD FOR SPACED WALLS OF WOOD FORM FOR CONCRETE WALL

Calvin R. Johnson, P.O. Box 63, Crestwood, Ky. 40014

Filed July 3, 1967, Ser. No. 650,929
U.S. Cl. 249—217 7 Claims
Int. Cl. E04g 17/06, 9/00, 17/00

ABSTRACT OF THE DISCLOSURE

A metal tie rod for waler-backed wall panels which are spaced to receive wall-forming concrete between them. Each tie conventionally has: a central body portion, extending horizontally across the concrete space between panels, and left and right end portions extending through and projecting outwardly from the waler-backed panels; and a pair of spacers, one on each end of its central body portion, to hold the spaced wall panels against relative inward movement and thus prevent a decrease in panel spacing. Each projecting portion of the rod carries an arm mounted on it for movement from a retracted position to an extended position. Retracted, the arm extends along the projecting portion of the tie and cooperates therewith to form an assembly, which is cross-sectionally small enough to pass through a tie-receiving panel opening during the form-erection operation. Extended, the arms extends laterally outward from the tie to hold the adjacent panel and the interposed waler against outward movement relative to other waler-backed panel and thus prevent an increase in panel spacing during a period embracing the concrete pouring and setting operations.

In use, one or more wall panels, on the "right" side of the concrete-receiving space, are erected. Ties, with their lock arms retracted, are inserted "rightwardly" through tie receiving openings of such panels, whereupon their respective locking arms may be extended to receive the walers and to clamp the right panel-waler assembly between the corresponding spacers and locking arms. In the process of erecting the "left" side panels, their tie-receiving holes are "threaded" over the corresponding ties and their retracted locking arms, whereupon their lock arms are extended to receive the walers and to clamp the left panel-waler assembly between the left spacer and locking arms. Now the concrete may be poured and allowed to set. Thereafter the outermost end portion of each end of each tie is twisted to snap the tie at the inner end of its spacer so that the snapped portion and the corresponding waler-backed panels may be stripped from the concrete wall.

BACKGROUND OF THE INVENTION

Field of the invention

This invention relates to improvements in a metal tie rod for holding opposed wood wall panels of a concrete form to a desired spacing while plastic concrete is poured into the form and allowed to set.

Description of the prior art

There are a number of different types of prior art arrangements for locking a pair of spaced waler-backed wall panels to a common tie rod to prevent either inward or outward movement of one panel relative to the other. Some commonly used arrangements provide, for each end of each tie, an inner tie-mounted spacer for holding the adjacent panel against relative inward movement toward the opposed spaced panel and an outer tie-mounted assembly for holding the adjacent panel against relative outward movement away from the opposed panel. One commonly used outer assembly comprises: a stepped (riser-shelf-riser) bracket member providing, at the inner end of the shelf, a vertically depending "riser" or panel-bracket engaging the outer face of the wall panel, and at the outer end of the shelf, an upright "riser" or waler-bracket to engage the outer face of a waler interposed between this waler-bracket and the adjacent wall panel, the shelf acting as a web rigidly interconnecting the upper end of the panel-bracket with the lower end of the outwardly spaced waler bracket; and a rotary cam or wedge member, mounted on the stepped bracket member to engage and use end of the tie rod as a stationary base so that, when the cam is rotated, the cam forces the panel-bracket inwardly against the panel and thence further inward until the panel is clamped tightly between said inner spacer and the panel-bracket of said outer assembly.

Contractors using these tie-based outer assemblies often maintain an inventory of 2,000 to 5,000 of them at a cost approximating $1.50. Their use also involves the cost of removing them from inventory, transporting them to the construction site, using them at the construction site and returning them to the warehouse during the course of which some are lost. Consequently the contractor not only has a substantial financial investment in the equipment but, during each use, is also subject to handling and replacement costs which may be and often are substantial.

In some cases, each waler-backed panel is provided with a number of "stiff-backs" which are studs extending vertically across the outer faces of the successive horizontal walers. To secure "stiff-backs" in place, a series of metal stiff-back cams are provided, one at each intersection of a vertical stiff-back with each horizontal row of walers, each cam being connected to the bracket of the outer assembly to press the stiff-back against the outer face of the adjacent waler.

The use of stiff-back cams involves an additional cost approximating $1.00 per cam and additional handling and replacement costs.

SUMMARY OF THE INVENTION

Objects of the invention

The principal objects of the present invention are: to eliminate the present costly forms of panel-holding brackets and cam-locking assembly and stiff-back cams so as to reduce, in substantial measure, the expense involved in storing, transporting, using and replacing them; and to provide each tie with a simple panel-locking means which is bodily carried by the tie so as to be stored, transported, used and destroyed with the tie which is so inexpensive as to represent but a fraction of the present cost of the eliminated means.

Statement of the invention

The objects of the present invention are accomplished by providing each end of a conventional rod-like tie, having a conventionally mounted inner spacer, with a simple and inexpensive holding or locking member which is firmly (preferably permanently) carried by the tie for movement from a retracted position in which it and the adjacent end of the tie may be passed through a tie-receiving opening of the panel, to an extended position in which it cooperates with the adjacent inner spacer to lock the waler and the panel against outward movement relative to the opposed panel-waler assembly. In the preferred embodiment, the conventional eye-forming closed loop at the outer end of the tie is modified to form an open hook, which provides an abutment, while a locking arm is pivotally secured to the tie for movement from a retracted position, in which it extends closely along the tie, to an extended position, in which it bridges the opening of the hook to abut the free end thereof.

BRIEF DESCRIPTION OF THE DRAWINGS

The invention is illustrated in the accompanying drawings wherein:

FIGS. 1–6 show the preferred embodiment, FIG. 1 being a side elevational view of a portion of a concrete wall form utilizing the ties of the present invention, FIG. 2 a sectional view of a fragmentary portion of the FIG. 1 structure, taken along line 2—2 of FIG. 1, this view showing a portion of the adjacent structure in perspective, FIG. 3 a side elevational view of an end portion of the tie of FIGS. 1 and 2, FIG. 4 a bottom plan view of the tie of FIG. 3, FIG. 5 a sectional view taken along line 5—5 of FIG. 4, and FIG. 6 a sectional view, partly in elevation, taken along line 6—6 of FIG. 4;

FIGS. 7–9 show a 2nd embodiment, FIG. 7 being a side elevational view of a portion of another embodiment of the tie of the present invention, FIG. 8 a top plan view of the tie of FIG. 7, and FIG. 9 a fragmentary sectional view of a portion of a concrete wall form utilizing the tie of FIGS. 7 and 8;

FIGS. 10–13 show a 3rd embodiment, FIG. 10 being a side elevational view of a portion of still another form of the tie of the present invention, FIG. 11 a bottom plan view of the tie of FIG. 10, FIG. 12 a fragmentary sectional view of a portion of a concrete wall form employing the tie of FIGS. 10 and 11, and FIG. 13 an end elevational view of the structure of FIG. 12 and taken along line 13—13 of FIG. 12; and

FIGS. 14–16 show a 4th embodiment, FIG. 14 being a side elevational view showing the device retracted, FIG. 15 an end elevational view showing it extended and FIG. 16 a fragmentary sectional view corresponding to one taken along line 16—16 of FIG. 15.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Conventional structure

FIGS. 1 and 2 show a wood form composed of upright outer and inner walls 1 and 2, which are spaced from each other to provide a concrete-receiving space therebetween into which plastic wall-forming concrete is poured and allowed to set. Each of the walls 1 and 2 usually is formed of a plurality of upright panels 3. Each of the panels 3 is preferably composed of 8′ x 4′ plywood of ¾″ thickness. The lowermost panels 3 of the walls 1 and 2 are supported on a concrete footing 4.

Each of the panels 3 is formed with a plurality of tie-receiving openings 5, which are usually circular. The tie-receiving openings 5 in each wall of the wood form, are usually horizontally and vertically spaced symmetrically on 24″ centers to form vertically spaced horizontal rows and horizontally spaced vertical rows. Furthermore, each tie-receiving opening 5 in wall 1 is horizontally aligned with a corresponding opening 5 in the opposite wall 2.

For each pair of the horizontally aligned openings 5, a tie is provided. As shown in FIG. 2, the tie conventionaly comprises: an elongate ¼″ metal rod 6, having a central body portion bridging the concrete space, right and left panel portions passing through right and left openings 5 and a projecting portion at the outermost end of each panel portion; and a pair of spacers 7, which are preferably plastic, disposed on the right and left ends of the central body portion. Each spacer 7 is preferably of conical shape. Its larger end, which abuts the adjacent wall or panel, has a diameter greater than the diameter of the circular tie-receiving openings 5 in the panels 3.

The body of the rod 6 has a pair of enlarged portions 8, one at the inner end of each spacer 7. Each of the portions 8 acts as a stop preventing the adjacent spacer 7 from moving inwardly along the rod 6. As a result, the spacer 7 cooperates with each other to establish the thickness of the desired concrete-receiving space and to restrict relative inward movement of opposed panels at the established thickness. In other words, the spacers 7 insure that the spacing between the walls or sides 1 and 2 of the concrete form cannot be decreased below the desired thickness of the concrete wall to be formed.

Inventive structure

In accordance with the present invention, at least one end portion of the metal tie rod 6 is arranged to carry a physically attached means for locking the adjacent wall form against outward movement, this means including an arm 9 mounted on the end portion of the rod for movement between a retracted position, in which it extends inwardly along the rod and cooperates with the rod to form a rod assembly, which cross-sectionally is small enough to pass through a tie-receiving opening, and an extended position, in which it extends laterally outward from the rod and is spaced outwardly to permit a waler to be interposed snugly between it and the panel and cooperates with the corresponding inner spacer to lock the waler-backed panel against movement either in the inward direction which would decrease the thickness of the concrete receiving space or in the outward direction which would increase that thickness. When all locking means of the spaced-opposed water-backed panels are extended the plastic wall-forming concrete may be poured into the concrete receiving space between walls 1 and 2 and permitted to set.

Each end of the rod 6 terminates in an open hook 11. When each of the arms 9 is pivoted to an extended position, in which the arm 9 is disposed substantially perpendicular to the rod 6, it abuts against the end face 12 of the adjacent open hook 11, as shown in FIG. 2. Thus, the end face 12 of the hook 11 serves to limit the pivotal movement of the arm 9 and to retain the extended arm 9 against pivotal movement beyond its extended position. The bight 13 of the arm 9 has its inner end portion cut out at 14 to permit the arm 9 to pivot between its retracted and extended positions.

When the locking arm 9 is in its extended position, it engages against a horizontally disposed support member, which bears against one side of each of the panels 3. The bottom support member 15, which rests on the footing 4, is called a plate while all of the other support members 16, which rest on the rods 6 or are attached thereto beneath the rods 6, are called walers. Each of the support members (the plates 15 and the walers 16) is preferably formed of 2″ x 4″ wood.

The position of each of the arms 9 on the rod 6 is such that the arm 9 will accommodate the panel 3 and the plate 15 (or the waler 16) between the larger outer end of the spacer 7 and the bight of the extended arm 9. This is a tight fit so that the plate 15 or the waler 16 exerts a force inwardly against the panel 3 so as to maintain the walls 1 and 2 of the form against any relative outward movement, which would increase the thickness of the concrete-receiving space between them.

The bight of each arm 9 has an aperture 17 near its free end to permit nailing of the arm 9, if desired, to the plate 15 or the waler 16. The nailing of the arms 9 to the walers 16 is always desirable, particularly when the walers 16 are disposed below the rods 6 rather than being on the top side of the rods 6. It also is desirable to nail the plates 15 to the arms 9.

Each of the tie rods 6 has a weakened portion 18 adjacent each of the enlarged portions 8. This permits breaking or snapping off each end of the rod 6 after the concrete wall has been formed.

In assembling the concrete wall form of FIGS. 1 and 2, the following steps are preferably performed in sequence:

(1) Secure one of the plates 15 to the footing 4 along the outer limit of panels 3, which forms the outer wall 1 of the wooden wall form.

(2) Erect one (or more) of the panels 3 of the outer wall 1 with the lower end of its outer face placed flush against the inner face of the plate 15 and with its bottom end resting on the footing 4 and then nail or otherwise secure the panel 3 to plate 15.

(3) Insert one end of a rod **6** (with its arm **9** retracted) through an opening **5** (in the lowermost horizontal row of openings) from the inside of the panel **3** until the large end of the spacer **7** for the inserted end of the rod **6**, abuts the inner face of the erected panel **3** and then move the arm **9** to an extended position, free of plate **15**. Now rotate rod **6** until the extended arm **9** abuts the outer face of the plate **15** as shown in FIG. 2.

(4) Insert tie rods into the remaining openings of the bottom row and manipulate their respective arms to abut plate **15**.

(5) Pass a nail through the aperture **17** in the arm **9** and drive it into the plate **15**.

(6) Erect the remainder of the lowermost panels **3**, of outer wall **1** by repeating steps 2–5.

(7) Insert the outer ends of the rods **6** (and their retracted arms **9**) outwardly through the remainder of the higher rows of openings **5** in the erected panels **3** of outer wall **1** and then move each arm **9** to its extended waler-receiving position.

(8) Position one of the walers **16**, which should be as long as the plate **15**, on the upper side of the projecting end portions of one horizontal row of rods **6**, and force that waler downwardly into the space between the panels **3** and the extended arms **9**. This locks that waler **16** in place.

(9) If desired, nail arms **9** to waler **16**.

(10) Repeat waler installation and nailing steps 8–9 for the remaining rows of projecting rods **6** and walers **16** along the same outer wall **1**.

(11) If desired, erect stiff-back (one shown in phantom at **19** in FIG. 2) adjacent one of the vertical columns of arms **9**, pass nails through suitable openings **19A** (in the arms **9**) and drive them horizontally into the stiff-back **19**, which should extend the full height of the concrete wall to be formed. If the wall **1** is higher than the height of the panels **3**, then the stiff-back **19** will project above the upper ends of the erected panel **3** at this time.

(12) Erect additional stiff-backs, preferably at every fourth vertical column of the arms **9**.

(13) Thread the openings **5** in the first panel **3** for the inner wall **2** over the inner ends of the rods **6** and then move arms **9** (on this end of the rods **6**) to their extended positions to prevent the panel **3** from unthreading.

(14) Install the next two or three panels **3** of the inner wall **2** in the same manner as described in step 13.

(15) Position one of the walers **16** on the upper side of the projecting inner-end portions of one horizontal row of rods **6**, about half way up the height of the panels **3**, and force that waler **16** downwardly into the space between the extended arms **9** and the panel **3**.

(16) If desired, nail the locking arms **9** to the walers **16** although this is not a requisite unless the waler **16** is disposed on the underside of the rods **6**.

(17) Dispose the remaining of the inner wall walers **16** and the plate **15** between the extended arms **9** and the erected panels **3** of the inner wall **2**.

(18) Erect the remainder of the lowermost panels **3** of inner wall **2** by repeating steps 13–17.

(19) Apply the stiff-backs **19** as necessary in the same manner as described in steps 11–12.

(20) Erect additional rows of upper panels **3** above the lowermost panels **3** of the outer wall **1** if the wall **1** is to be higher than the height of one of the panels **3**. Then, erect upper panels **3** for the inner wall **2** if the height of the form is to be greater than the height of one of the panels **3**.

(21) Pour concrete into the space between the walls **1** and **2** and permit to set.

(22) Remove the nails, which connect the arms **9** to the plates **15** and any of the walers **16**, and the nails connecting the stiff-backs **19** to the locking arms **9**.

(23) Remove the walers **16**.

(24) Break or snap off the rods **6** at their weakened positions **18** by fitting a tool over the hook **11** and the arm **9** in its retracted position and turning the tool approximately 90°.

(25) Remove the snapped portions of the tie rods, panels **3**, and the walers **16** including plates **15**.

(26) Fill or putty the holes left in the formed concrete wall due to snapping or breaking the removal of the snapped portions of the tie-rods **6** and spacers **7**.

Now it may be noted that one tie conventionally constructed to comprise a rod **6** having a pair of plastic spacers **7**, flattened enlargements **8**, weakened snapping off points **18**, and closed end loops instead of open hooks **11**, presently costs approximately 12 to 13 cents. A second tie identically constructed except for the provision of open hooks **11** at its opposite end and the addition of pivotal locking arms **9**, is estimated to cost 15 to 16 cents. Thus, at an estimated cost increase of 3 cents, each tie, made in accordance with my invention, not only eliminates the cost of making or purchasing two outer tie-mountable assemblies (each composed of a metal bracket and a cam or wedge member) but also eliminates the cost of the labor and overhead expense involved in storing, transporting and using them and the cost of replacing those that are lost. As an indication of the amount involved, it should suffice to note that one present form of tie-mountable assembly (i.e. one bracket and one associated wedging cam) presently cost $1.50.

My arrangement as above described also substitutes one inexpensive nail for each stiff-back cam, one widely-used form of which presently costs approximately $1.00.

DESCRIPTION OF MODIFICATION OF FIGS. 7–9

FIGS. 7–9 show a portion of another form of the tie of the present invention. The tie includes an elongated rod **20** having a locking arm **21**, which is preferably channel-shaped, pivotally connected thereto by a pin **22**, located on the projecting portion of the rod **20**. When the arm **21** is in its retracted position of FIGS. 7 and 8, it rests on the rod **20**. The combined cross section of the rod **20** and the arm **21** is less than the size of the opening **5** in the panel **3** so that the rod **20** with the locking arm **21** in its retracted position may pass through the opening **5**.

A second (retaining) arm **23**, which is preferably channel shaped, is pivotally connected by a pin **24** to the rod **20** adjacent its outermost end. The retaining arm **23** is movable between its retracted FIGS. 7–8 positions and its extended FIG. 9 position. When the retaining arm **23** is in its retracted position of FIGS. 7 and 8, it increases the cross sectional size of the rod **20** only slightly so that the combined cross sectional size of the rod **20** and the retaining arm **23** is also less than the size of the opening **5** whereby the arm **23** and the rod **20** may pass through the opening **5**.

The retaining arm **23** has a bight **25**. The inner end of bight **25**, which is nearest the pivot **24**, engages the adjacent end of the rod **20** to prevent the arm **23** from swinging past its retracted position. The other end of arm **23** is cut away so that bight **25** provides a projection or tongue **26** extending beyond the end of sides **27** of the arm **23**. The sides **27** have their ends **28** beveled.

As the locking arm **21** is moved to approach its extended FIG. 9 position, wherein it is substantially perpendicular to the rod **20**, the retaining arm **23** may be moved to an extended position wherein its beveled ends **28** of the sides **27** abut against bight **29** of the arm **21** as shown in FIG. 9. In order to insure that the retaining arm **23** retains the locking arm **21** in the extended position, the arms **21** and **23** are manipulated so that the tongue **26** of arms **23** enters a slot or opening **30** in the bight **29** of the arm **21**.

Accordingly, the rod **20** may be easily inserted through the opening **5** in the panel **3** when the arms **21** and **23** are in the positions of FIGS. 7 and 8. Thereafter, during

assembly of the concrete wall form in the same manner as described for the tie of FIGS. 1–6, the arm **21** is moved to its extended position by pivoting about the pin **22** whereby the arm **21** locks the plate **15** or the waler **16** between the arm **21** and the panel **3**. The arm **23** is then pivoted about its pin **24** to engage the tongue **26** within the slot or opening **30** in the locking arm **21** to maintain the arm **21** in its extended or locking position. This retains the waler **16** or the plate **15** in the position between the panel **3** and the locking arm **21** to prevent movement between the two walls or sides **1** and **2** of the concrete wall form when concrete is poured into the space between the two walls of the concrete form and sets.

It should be understood that the rod **20** has a similar assembly of arms **21** and **23** on its other end. Likewise, the rod **20** is similar to the rod **6** in that it has the enlarged portions **8** to prevent movement of the spacers **7** and the weakened portions **18** to permit snapping or breaking of the rods **20** after the concrete wall has been formed due to setting of the concrete.

If the stiff-backs should be required, then aligned openings for a nail would be provided in the sides **27** of the arm **23**. Likewise, the bight **29** of the arm **21** may have a nail aperture therein to permit nailing of the arm **21** to the walers **16** and the plates **15** in the manner described for the rod **6** of FIGS. 1–6.

DESCRIPTION OF MODIFICATION OF FIGS. 10–13

FIGS. 10–13 show another form of the tie of the present invention. The tie includes an elongated rod **31** having a locking arm **32**, which is preferably channel shaped, pivotally connected thereto by a pin **33** adjacent the end of the rod **31**. The arm **32** includes a first portion **34**, which lies over the rod **31** in its retracted position, and a second portion **35** extending at an angle to the first portion **34**.

The cross section of the rod **31** and the portion **34** of the arm **32** is less than the size of the opening **5** in the panel **3** so that the rod **31** and the portion **34** of the arm **32** may pass through the opening **5** when the arm is in its retracted position. The angular projection of the second portion **35** of the arm **32** from the first portion **34** is such that it also will pass through the opening **5** when the arm **32** is in its retracted position.

A retaining member **36** is pivotally connected to the rod **31** by a pin **37**. The pin **37** is disposed inwardly of the pin **33**. Thus, the pivotal connection of the arm **32** and the retaining member **36** to the rod **31** is opposite to that for the tie **20** of FIGS. 7–9.

The retaining member **36** comprises a strip **38**, which has a width less than the distance between the sides of the arm **32** so that the strip **38** may be disposed therebetween. The strip **38** terminates in a tongue **39** of smaller width than the remainder of the strip **38**. The strip **38** has beveled ends **40** (see FIG. 10) for co-operation with the portion **35** of the arm **32** when the arm **32** is in its extended position.

In assembling the concrete wall form when using the rod **31**, the rod **31** is inserted through one of the openings **5** in the panels **3** with the arm **32** in the retracted position of FIGS. 10 and 11 and the retaining member **36** in the position of FIGS. 10 and 11. The retaining member **36** is held in this position by the assembler grasping the bottom of the strip **38** as the rod **31** passes through the opening **5**.

Then, the arm **32** is pivoted to the position of FIG. 12 wherein the first portion **34**, which engages the waler **16** or the plate **15**, is disposed substantially perpendicular to the rod **31**. As the arm **32** is pivoted clockwise (as viewed in FIG. 12) about the pin **33**, the retaining member **36** is held so that the tongue **39** enters a slot **41** in the second portion **35** of the arm **32**. Thus, as the arm **32** is pivoted about the pin **33**, the tongue **39** moves down the slot **41**. When the arm **32** reaches the position of FIG. 12 in which the first portion **34** is substantially perpendicular to the rod **31**, the beveled ends **40** of the strip **38** engage against the central part of the second portion **35** of the arm **32** to retain the arm **32** in the extended or locking position of FIG. 12.

The assembly of the walers **16** and the plates **15** is the same as that described for the rod **6** of FIGS. 1–6. Thus, each of the plates **15** and the walers **16** is held between one of the panels **3** and the arms **32** to maintain the walls **1** and **2** of the concrete wall form at the selected, spaced distance when concrete is poured into the space between the walls **1** and **2** of the concrete form and sets therein.

It should be understood that the rod **31** has a similar assembly of retainer arm **36** and locking arm **32** on its other end. Likewise, the rod **31** has the two spacers **7**, the enlarged portions **8**, and the weakened portions **18**.

If it is desired to nail any of the arms **32** to the plates **15** or the walers **16**, nail holes may be provided in the bights thereof. If stiff-backs also are to be employed, aligned nail holes may be provided in the arm **32**.

Accordingly, when utilizing any of the simple and inexpensive ties of the present invention, there is no requirement for any extra clamping or locking equipment such as the metal brackets, their associated wedging cams and stiff-back cams. Thus, an important advantage of this invention is that it eliminates the normally required large inventory of such parts and their attendant costs.

DESCRIPTION OF MODIFICATION OF FIGS. 14–16

This modification is similar to the preceding structures in that it includes: an elongate metal rod; and a pair of panel holding means, one for each end of the rod, each panel holding means interconnecting the adjacent end portion of the rod with the adjacent wall panel **3** to hold the adjacent panel **3** against outward movement relative to the other panel **3**, and each comprising an arm mounted on the adjacent portion of the rod for movement between retracted and extended positions, wherein the retracted arm extends along said adjacent end portion and cooperates therewith to form an assembly which is cross-sectionally small enough to pass through a tie-receiving panel opening **5**, while the extended arm extends outwardly from the rod to block relative outward movement of the adjacent panel.

The elongate metal rod, which is designated **45**, is flattened at each end to provide a head or abutment **46**.

The panel holding means, at opposite ends of rod **45**, preferably are identical; hence, only one holding means will be described. It comprises an arm **47** in the form of an elongate shallow C having a straight back, which terminates at its outer end in a re-entrantly turned hook portion composed of two successive 90° turns forming an inwardly open hook **48** that is dimensioned large enough to receive the adjacent head **46** of rod **45** as seen in FIG. 14. The inner end of arm **47** preferably is also re-entrantly turned to form an identical hook **49**. The inner half of arm **47** is cut away along its axis to provide a slot **50** extending from about the center of the arm **47** to the end thereof through the first turn of the hook **49**, this end of the slot being closed by the second turn of the hook **49**. The rod **45** extends through slot **50** and its end abutment **46** is large enoguh to prevent its removal from arm **47** or vice versa.

With this arrangement, the retracted arm **47**, as seen in FIG. 14, may be thrust through a tie-receiving opening **5** of the outer wall panel **3** to position the arm **47** on the outer side of the wall panel. Thereupon the arm **47** may be moved to the extended position shown in FIGS. 15–16 wherein the inner slotted end portion of the arm extends vertically, either up (as shown in FIG. 15) or down. A pair of (upper and lower) walers **16** are now inserted between the arm **47** and the adjacent panel **3** so that both walers **16** and the panel **3** are clamped (as a unit) between spacer **7** on the inner side of the waler-panel unit and arm **47** on the outer side of that unit. In FIGS. 15–16, the

upper waler **16** is shown between the upwardly extending slotted end portion of the arm **47** and the panel while the lower waler **16** is shown between the downwardly extending portion of the arm **47** and the panel **3**. Nail holes **51** and **52** are provided for nailing arm **47** to the walers.

Having described my invention, I claim:

1. An improvement in concrete wall-forming equipment, comprising:

(A) an elongate metal tie rod, having

(1) a mid-portion to extend across the space between spaced upright waler-backed wall-panels of a wood-form for a concrete wall and

(2) opposite end portion to extend through horizontally-aligned tie-receiving openings in the wall-panels and project outwardly therefrom; and

(B) panel-holding means for interconnecting one end portion of said tie rod with an adjacent wall-panel for the purpose of holding the adjacent wall-panel against outward movement relative to the other wall-panel, said means including

(1) an arm mounted on said one end portion of the tie rod for movement between

(a) a retracted position, in which it extends along said one end portion and cooperates therewith to form an assembly, which is cross-sectionally small enough to pass through a tie-receiving panel opening, and

(b) an extended position in which it extends outwardly from the rod to block relative outward movement of the adjacent panel, and

(2) retaining means, mounted on said one end portion, to retain said arm in its extended position.

2. The improvement of claim **1**, wherein:

(A) said arm is pivotally mounted to said one end portion.

3. The improvement of claim **2**, wherein:

(A) said retaining means can be passed through the tie-receiving opening.

4. The improvement of claim **3**, wherein:

(A) said retaining means comprises a lateral abutment rigidly connected to said one end portion.

5. The improvement of claim **4**, wherein:

(A) said lateral abutment comprises a hook formed at the extreme end of said one end portion to extend laterally from the rod.

6. The improvement of claim **1** wherein:

(A) said arm is in the form of an elongate shallow U

(1) having inner and outer halves, each characterized by a substantially straight back and a turned free end,

(a) said inner half being provided with a slot extending lengthwise through its back and its turned end; and

(B) said rod extending through said slot.

7. The improvement of claim **6** wherein:

(A) said retaining means prevents said one end portion of the rod from being removed endwise through the slot.

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WILLIAM J. STEPHENSON, *Primary Examiner.*

D. W. JONES, *Assistant Examiner.*

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