July 21, 1964 H. G. GATES 3,141,224

COMBINATION FORM WALL REINFORCING MEMBER AND TIE LOCK

Filed Aug. 8, 1962

2 Sheets-Sheet 1

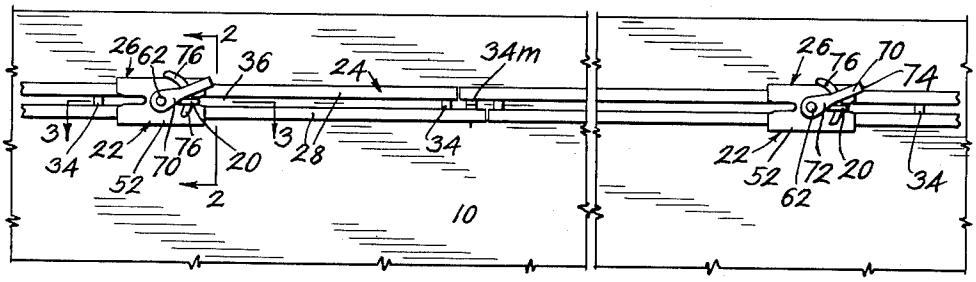


FIG. 1.

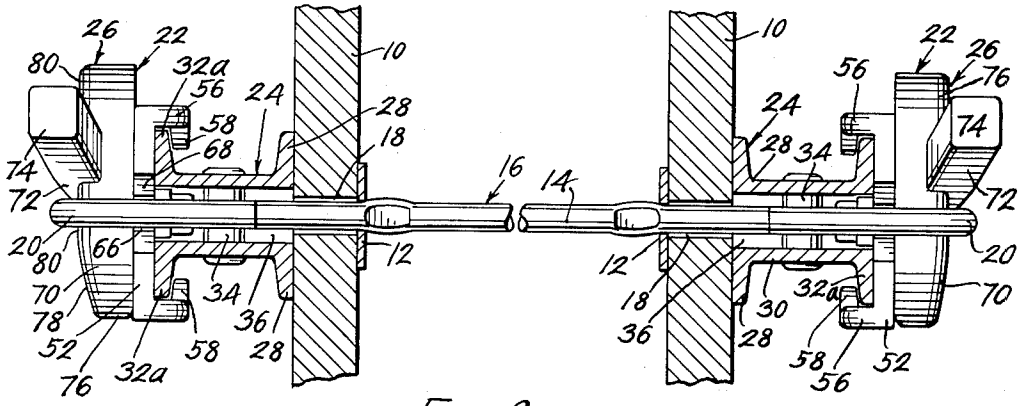


FIG. 2.

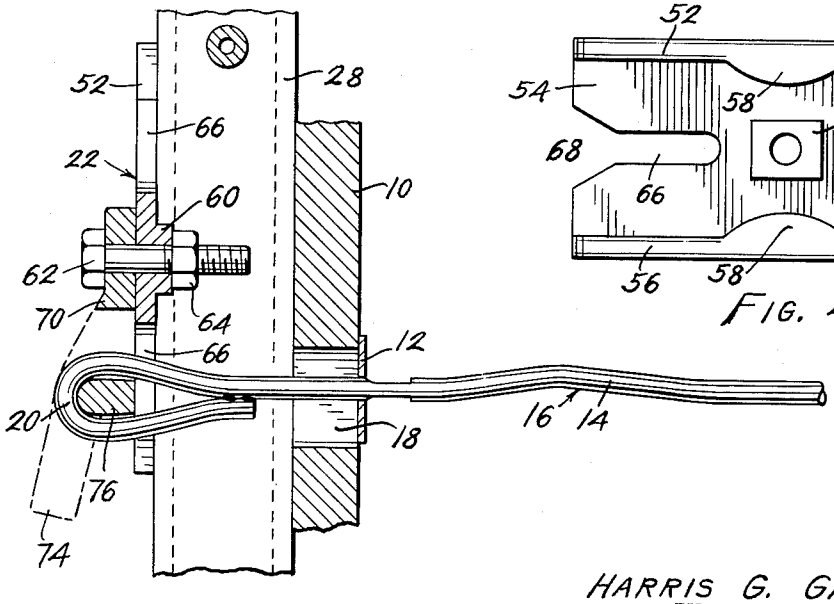


FIG. 3.

FIG. 4.

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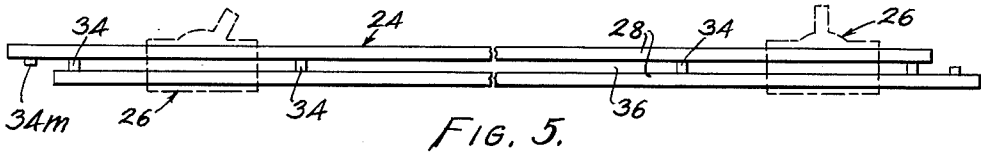


FIG. 5.

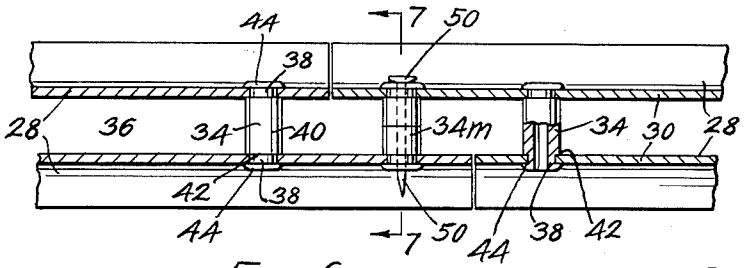


FIG. 6.

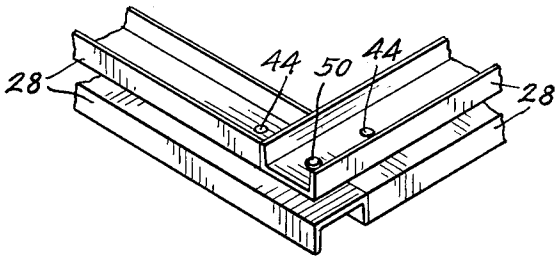


FIG. 8

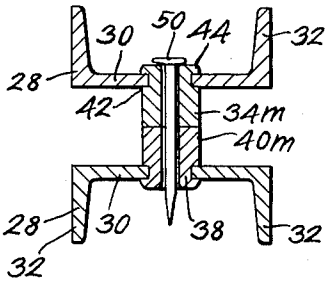


FIG. 7.

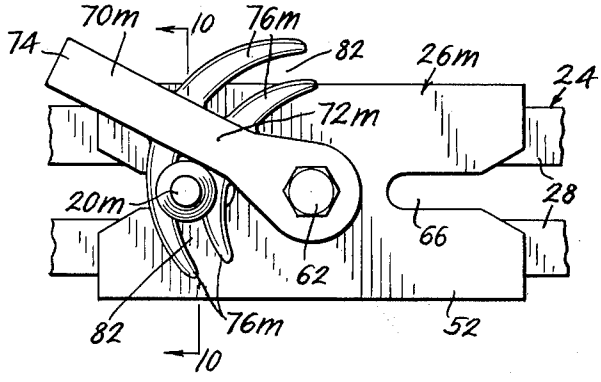


FIG. 9.

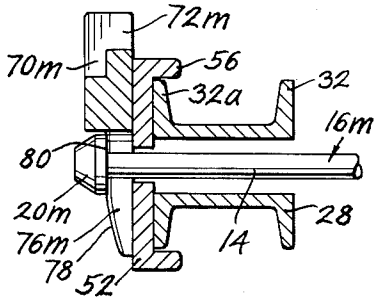


FIG. 10.

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COMBINATION FORM WALL REINFORCING MEMBER AND TIE LOCK

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14 Claims. (Cl. 25—131)

This invention relates to concrete forming apparatus and, more particularly, to reinforcing elements that include means releasably lockable to the projecting form tie ends for the purpose of maintaining the form walls in fixed spaced relation while the concrete is poured therebetween.

Various systems and associated apparatus are widely known in the concrete-forming art for use in maintaining a pair of form walls in fixed spaced relation to one another while wet concrete is poured into the space therebetween. Basically, all of these systems employ some type of impervious wall structure formed of plywood, metal panels or sheathing that is supported on a previously cast footing while a fixed spaced relation is maintained by a plurality of the elements that span the gap therebetween and are cast into the finished wall structure. These ties are longer than the wall is thick providing projecting end portions which pass through the form walls onto the outside thereof where some type of fastener engages same. Due to the tremendous hydrostatic loads tending to spread apart the form walls, some type of reinforcing elements are ordinarily required which are denominated in the art as "whalers," "stiff backs," etc., but which usually consist of nothing more than elongate 2 x 4 wooden braces that are held or fastened firmly against the outside of the forms. The fasteners for the form ties also take many forms such as, for example, pins, wedges, cleft wedges, rods, 2 x 4's etc., to name but a few.

It has now been found in accordance with the teaching of the instant invention that the forming operation above-described can be considerably simplified and improved upon by combining and reinforcing elements into a single reuseable unitary structure. The reinforcing element replaces the wooden whalers ordinarily used which become damaged, warped and otherwise unfit. The members forming the reinforcing element cooperate to define an elongate slot sized to pass the projecting tie ends, a track adjustably mounting the locking elements, and stops permanently retaining said locking elements. The extremities of the two rail-forming members of the reinforcing element are offset to provide a lap joint with an adjacent reinforcing element thus enabling the resulting assembly to be used at corners and to bridge abutting edges of the form wall panels.

The locking elements slide along the track in position to engage the projecting tie end within the slot wherever it emerges. These locking elements are also double-ended so that they will interlock with a tie on either side thereof. When the reinforcing elements are used in horizontal position, the locking elements tend to remain locked due to gravity acting thereon. Also the arcuate locking fingers of these elements include a cam surface adapted to cooperate with the stop carried on the form tie and wedge the reinforcing element tightly against the form wall.

It is, therefore, the principal object of the present invention to provide a novel and improved combination tie lock and form wall reinforcing assembly for poured concrete wall structures.

A second object is the provision of an assembly of the class described that includes a novel lap joint with a quick-release feature between adjoining reinforcing elements.

Another objective of the invention is to provide as a part of the assembly, reinforcing elements that will not warp or become otherwise damaged during ordinary use and eliminate the need for other types of bracing for the form walls.

Still another object is the provision of a locking element adjustably mounted on the rails formed by the reinforcing elements which are moveable into position to connect with the projecting tie ends yet remain permanently a part of the assembly.

An additional objective of the invention herein described is to provide means ideally suited for use with panel-type concrete pouring forms to prevent same from spreading under the high hydrostatic loads developed by the wet concrete while at the same time requiring fewer ties than many of the less effective prior art forming systems.

Further objects of the invention are the provision of a combined tie-lock and panel reinforcing assembly that is simple and fast to erect, versatile in that it can easily be adapted for use with several different types of ties, one that is compact, rugged and efficient, and a unit of the class described that is adaptable without modification to form walls of various heights, thicknesses, lengths and shapes made up of planar surfaces.

Other objects will be in part apparent and in part pointed out specifically hereinafter in connection with the description of the drawings that follow, and in which:

FIGURE 1 is an elevation partly broken away to conserve space showing the combination tie locking and reinforcing element assembly of the present invention in place on a form wall and connected to the projecting end of looped wire ties;

FIGURE 2 is a fragmentary vertical section greatly enlarged taken along line **2—2** of FIGURE 1 with portions broken away to conserve space;

FIGURE 3 is a fragmentary horizontal section taken along line **3—3** of FIGURE 1 and which is also greatly enlarged;

FIGURE 4 is an inside elevation to an enlarged scale of the slideable track-engaging portion of the locking element;

FIGURE 5 is an inside elevation of the reinforcing element of the assembly showing the locking members in dotted lines, portions having been broken away to conserve space;

FIGURE 6 is an enlarged fragmentary elevation showing the lap joint between a pair of adjoining offset end portions on the reinforcing elements;

FIGURE 7 is a vertical section taken along line **7—7** of FIGURE 6 showing the quick-disconnect feature of the lap joint;

FIGURE 8 is a fragmentary perspective view looking down and to the left on a corner formed with the quick-disconnect feature of the lap joint;

FIGURE 9 is a fragmentary front elevation to an enlarged scale showing a modified form of the locking member in which a two-finger latch is substituted for the single-finger latch of FIGURES 1, 2 and 3 that adapts the assembly for use with button-ended form ties; and,

FIGURE 10 is a section taken along line **10—10** of FIGURE 9.

Referring now to the drawings for a detailed description of the invention and in particular, to FIGURES 1, 2 and 3 for this purpose, reference numeral **10** represents a pair of vertically-disposed panels held a fixed minimum distance apart by the spaced form steps **12** provided on the shank portion **14** of a conventional concrete form tie that has been designated broadly by reference numeral **16**. The panels **10** are slotted or otherwise apertured as indi-

cated at **18** to pass the projecting end portions **20** onto the exterior of the form walls. In the particular form shown in FIGURES 2 and 3, end portions **20** are looped; whereas, in the modified form of tie **16***m* of FIGURES 9 and 10, the end portion **20***m* is upset to form a button or head.

Means must be provided on the exterior surfaces of the form walls to engage the projecting ends of the ties and prevent same from spreading apart under the influence of the hydrostatic forces applied thereagainst when the wet concrete is poured into the space left between them. In addition, extra reinforcement is needed on the exterior surfaces of the form panels spanning the gaps between the ties to prevent the panels from bulging and producing an uneven surface on the finished wall. Both of the aforementioned functions are provided by the unitary structure that forms the subject matter of the present invention and which has been designated in its entirety by reference numeral **22**. The assembly **22** comprises in combination a reinforcing member and one or more adjustable tie-locking elements which have been referred to in a general way by reference characters **24** and **26**, respectively. The first element of the assembly that will be considered in detail is reinforcing element **24** which is most clearly revealed in FIGURES 5–8, inclusive, to which reference will now be made.

Reinforcing element **24** includes a pair of elongate channels **28** having web portions **30** and essentially parallel flanges **32** bordering the side edges of the web for the full length thereof. These two channels are arranged in back-to-back spaced relation with the flanges thereof facing outwardly in opposite directions as shown in FIGURE 7. The channels are held in fixed spaced parallel relation by spacers **34** that are located at longitudinally spaced intervals and cooperate with the channels to define a slot **36** through which the projecting tie ends **20** pass into position for attachment, to the locking elements **26** as shown in FIGURE 2.

In the particular form illustrated, these spacers comprise hollow sleeves having sections **38** of reduced diameter at opposite ends of the central cylindrical section **40** and which are separated therefrom by an annular shoulder **42**. The channels are apertured to pass only the sections **38** of reduced diameter so that the web portions rest on the shoulders **42** that provide stops therefor. Once assembled, the projecting end portions **44** of the reduced sections are upset in the manner of a rivet. These spacers also function as stops to retain the locking elements **26** within the confines of the reinforcing element as will be explained presently.

In the preferred construction of the reinforcing element that has been revealed most clearly in FIGURES 6 and 8, the channels are of the same length but are offset longitudinally with respect to one another. The extent to which one channel extends beyond the other is approximately the width of one of the channels so that when one of the reinforcing elements is turned upside down and arranged in right-angular relation to a second reinforcing element in the manner shown in FIGURE 8, a finished square corner is produced. Two channels can also, of course, be arranged in end-to-end lapped relation as shown in FIGURE 6 which has the advantage of bridging any joint between adjacent form panels that may fall at the end of one of the reinforcing elements thus producing a more rigidly braced structure.

The overlapping ends of adjacent reinforcing elements are releasably interconnected together by a modified form of the spacer **34***m* that has been shown in FIGURES 6 and 7. The modification consists merely in cutting the body **40***m* in half so that one section thereof is carried by each of the two reinforcing elements which are to be interconnected. The actual connection is accomplished by slipping a nail **50** or similar headed pin down through the aligned opening in the two halves. It becomes apparent that for the two halves of the spacer **34***m* to match up properly, especially when forming the corner of FIGURE 8, the centerline of the opening in the sleeves must be located on the longitudinal centerline of the channel spaced inwardly from its end a distance equal to one-half of its width.

The reinforcing elements are laid against the exterior face of the panel such that one flange of each channel rests thereagainst as shown in FIGURES 2 and 3 with the projecting tie ends passing through elongate slot **36** and beyond the outboard pair of flanges that individually comprise rails and collectively define a track upon which the locking elements **26** ride. For purposes of differentiating between the set of flanges that rest against the panel in reinforcing relation thereto and the remaining two that constitute the track, the suffix "*a*" has been added to the reference numeral designating the latter.

In connection with the detailed description of the tie locking members **26**, reference will be made initially to FIGURE 4 where the slide block portion **52** thereof has been shown by itself. This slide block includes a generally rectangular plate **54** bordered along both its top and bottom edges by spaced substantially parallel inwardly extending flanges **56** adapted to slide along the free edges of rail-forming flanges **32***a* when the plate is placed in face-to-face contacting relation with the latter. In order to hold the slide block in the track, it is necessary to provide the flanges **56** with retaining lugs **58** that depend from the remote margins of said flanges and ride along behind flanges **32***a* of the reinforcing element. Thus, the slide block is free to slide along the track formed by rail-forming flanges **32***a*.

The rear face of the slide block, in the particular form illustrated, is provided at its centerpoint with a boss **60** which contains a central opening adapted to pass the shank of bolt **62** that is secured on the inside by nut **64** as shown in FIGURE 3. Both side edges of the plate are notched as at **66** midway between the flanges **56** and in position to overlie the gap **36** in the reinforcing element. These slots are elongated and extend inwardly toward one another along the transverse centerline of the plate but, of course, in opposite directions. The function of these slots is to pass the projecting end portion of a tie located on either side of the slide block inwardly toward the center of the plate and, for this reason, the entryway **68** to each slot is preferably widened out as shown in FIGURE 4.

Next, with reference to FIGURES 2 and 3, the latch-forming portion **70** of the tie-locking member **26** will be described in detail. Latch **70** has one extremity thereof mounted on the shank of bolt **62** for pivotal movement, the bolt defining the axis of rotation. Extending radially outward from the axis of pivotal movement is an arm **72**, the free end **74** of which is inclined outwardly relative to the adjacent face of the slide block thus forming a handle. The inclination of the handle is, of course, required to enable the user's fingers to pass between it and the slide block during actuation of the latch.

Intermediate the ends of arm **72** and in position to overlie the notches **66** in the plate **54** of the slide block, a pair of oppositely extending arcuate fingers **76** are provided that curve about the axis of pivotal movement as their center. These fingers preferably taper from their points of attachment to arm **72** down to a blunted point as seen in FIGURE 1. In addition, the outer face thereof is sloped inwardly toward the free blunted end thus defining a cam surface **78** that is best revealed in FIGURE 2 and which cooperates with the looped end **20** of the form tie when inserted therein to pull the locking element **26** and reinforcing element **24** up tight against tie form wall. In other words, the blunted end of the finger is sized to be rather loosely received in the loop, but as the latch is moved into the fully-closed position of FIGURES 2 and 3, the loop rides upon the cam surface **78** drawing the combination tie lock and panel reinforcing assembly of the present invention tight against the form

walls which are held apart by stops **12**. The finger design is further improved by flattening out the cam surface **78** into parallel relation to the face of the slide block as it approaches the connection with arm **72**. Flat **80** on the cam surface **78** that is thus produced, eliminates the tendency for the finger to back out of the loop when under stress and in fully-closed position.

In FIGURE 1, it will be seen that the preferred method of use is to employ the downwardly curving finger to lock into the tie as gravity aids in keeping it closed, it is easier to actuate in this position and there is always the possibility that the end portion **20** of a tie will extend out a bit too far from stop **12** preventing the latch from becoming tightly locked therein if brought up into the loop from the underside. It is apparent that the plate of the slide block could lie notched on only one side and the latch equipped with only one finger located to move downwardly into the loop of a tie within the notch; however, the double-notched and two-fingered configuration affords certain advantages in being able to move into a tie located on either side thereof. In other words, assume two locking elements are provided on each reinforcing element and they are of the single-ended variety. After one has been attached to its tie and it is found that the other lies on the wrong side of a second tie, it is necessary to disconnect the first before both can be brought into correct position, i.e. the unattached locking element can be moved past the second tie onto the proper side thereof for attachment. With the double-ended unit shown, this becomes no problem. Also, the entire assembly has no right-side up and can be reversed end-for-end and still function in exactly the same way. Furthermore, the adjustability of the locking elements along the reinforcing elements adapts the assembly to use with any tie spacing.

Before leaving the first eight figures of the drawing, it should be mentioned in connection with FIGURE 4 that the bolt **62** is preferably of a length to engage the spacers **34** on either side of the locking element thus maintaining the assembled relation between the latter and its reinforcing element. This saves time for the user as he need not locate the locking elements and place them on the tracks preparatory to each use. It also prevents their becoming separated or lost and most significant, the locking elements will not drop off the end of the rails while the unit is being placed in position to lock into the tie ends.

Finally, brief mention will be made of the modified construction shown in FIGURES 9 and 10. The type of form tie **16***m* has already been mentioned that terminates in upset end portions **20***m* rather than the looped-ends. These ties are commonly referred to as "button" ties and they present special problems in connection with the design of a suitable latch **70***m*. The reinforcing element **74** of the modified assembly **72***m* remains the same as do the slide-blocks **52** and pivot pin **62** of the tie locking element **26***m*. The latch element **70***m* even includes the same handle-forming portion **74**; however, it is necessary to vary arm **72***m* so as to include slotted fingers **76***m* that will accept the shank **14** of the form tie in the arcuate slot **82** provided therein. In this configuration, the fingers **76***m* are wider to accommodate the arcuate slot **82** which splits said fingers down the middle. Of course, the portions of the finger bordering the slot carry the cam surfaces **78** and **80** and move into place under the head **20***m* of the tie. It is now the slot **82** that must be formed on a radius about the axis of pivotal movement of arm **70***m* rather than the fingers which need have no special shape although they have been shown arcuate also.

Having thus described the several useful and novel features of the present invention in connection with the accompanying drawings, it will be apparent that the several worthwhile objectives for which it was developed have been achieved. Although but two specific embodiments of the combination panel reinforcing and tie-locking assembly have been illustrated, I realize that certain changes and modifications therein may well occur to those skilled in the art within the broad teaching hereof; hence, it is my intention that the scope of protection afforded hereby shall be limited only insofar as said limitations are expressly set forth in the appended claims.

What is claimed is:

1. The combination concrete pouring form wall reinforcing member and form tie end lock which comprises, a pair of elongate relatively straight metal channels each having a web bordered on both the front and rear edges thereof by flanges, spacers interconnecting the webs of the channels at longitudinally spaced intervals to define a slot therebetween adapted to pass the ends of concrete form ties projecting beyond the exterior face of a form wall when the inner pair of flanges is placed thereagainst in reinforcing relation, a slide block including a plate covering the slot between the channels and hook-forming means depending from said plate adapted to engage the outer rail-forming flanges of said channels which cooperate to define a track retaining said block for longitudinal slideable movement, said slide block having at least one side edge thereof notched in position to pass the shank portion of a concrete form tie projecting through the slot between the channels, and latch forming means carried by the slide block movable from an unlocked position into a locked position in engagement with the end of a form tie located within the notch.

2. The combination reinforcing member and form tie lock as set forth in claim 1 in which the latch-forming means comprises an arm pivotally attached to the face of the slide block for swinging movement across the notch therein and at least one arcuate finger spaced from the axis of pivotal movement of the arm and curved about the latter as its center, said finger being located to intersect the notch and enter the loop of a loop-ended form tie projecting therethrough.

3. The combination reinforcing member and form tie lock as set forth in claim 1 in which the latch-forming means comprises an arm pivotally attached to the face of the slide block for swinging movement across the notch therein and means carried by said arm having an arcuate slot therein spaced from the axis of said arm and curved about the latter as its center, said arcuate slot being located to intersect the notch in the slide block and adapted to lock in behind the head on the end of a button-type form tie projecting therethrough.

4. The combination reinforcing member and form tie lock as set forth in claim 1 in which, both sides of the slide block are notched to receive the shank of a loop-ended form tie from either direction, and in which the latch-forming means comprises an arm pivotally attached to the face of the slide block between the notches therein and a pair of arcuate fingers spaced from the axis of pivotal movement of said arm curved about the latter as their common center, said fingers projecting from said arm in opposite directions in position to intersect either notch and enter the loop of the form tie projecting therethrough.

5. The combination reinforcing member and form tie lock as set forth in claim 1 in which, both sides of the slide block are notched to receive the shank of a button-type form tie from either direction, and in which the latch forming means comprises an arm pivotally attached to the face of the slide block between the notches therein and means carried by said arm having a pair of arcuate slots spaced from the axis of pivotal movement of said arm and curving in opposite directions from one another about the latter as their common center, said slots being positioned to receive the shank portion of a tie projecting through either slot and adapted to lock in behind the head on the end thereof.

6. The combination reinforcing member and form tie lock as set forth in claim 1 in which, the two channels are identical and interconnected by the spacers in longitudinally offset relation, one channel overhanging the other at the end a distance approximately equal to the width of a single channel measured across the web.

7. The combination reinforcing member and form tie lock as set forth in claim 1 in which, the two channels are identical, said channels are interconnected by the spacers in longitudinally offset relation to provide an overhang of approximately the width of a single channel measured across the web, in which the overhanging portion of each end is apertured at a point located midway between the flanges and spaced inwardly from the end a distance equal to approximately one-half the width of a single channel, and in which a sleeve is mounted on each overhanging portion registering with the aperture therein, said sleeves being of a height equal to approximately one-half the height of the slot between the channels, said sleeves cooperating with one another to define a spacer adapted to receive a locking pin when two reinforcing elements are placed in end-to-end overlapping relation.

8. The combination reinforcing member and form tie lock as set forth in claim 1 in which the latch-forming means comprises a radial arm pivotally attached adjacent one end to the exposed face of the slide block directly over the slot between the channels, the free end of said radial arm being offset from said exposed face of the slide block to form an operating handle, and means including at least one arcuate cam surface depending from said radial arm between its axis of pivotal movement and the handle-forming portion thereof, said cam surface being curved about said axis of pivotal movement as its center in radially spaced relation thereto so as to intersect the notch in the slide block, and said cam surface including an inclined portion adapted to wedge behind the end of a form tie projecting through said notch pulling the reinforcing member in tight against the adjacent form wall when moved into latched position.

9. The combination reinforcing member and form tie lock as set forth in claim 8 in which the cam surface also includes a flattened portion located at the end of the inclined portion thereof upon which the form tie end rides in fully-latched position, said flattened portion being adapted to prevent accidental release of the latch-forming element upon the application of hydrostatic loads to the tie acting in the direction of its shank.

10. The combination reinforcing member and form tie lock as set forth in claim 8 in which the means carrying the cam surface comprises an arcuate finger adapted to enter the loop of a loop-ended form tie projecting through the notch in the edge of the slide block.

11. The combination reinforcing member and tie lock as set forth in claim 8 in which the cam surface forms at least one edge defining an arcuate slot formed in the means depending from the radial arm, said slot being curved about the pivot axis of said arm as a center and spaced from the latter to intersect the notch.

12. The combination reinforcing member and tie lock as set forth in claim 8 in which the pivotal connection between the radial arm and slide block comprises a pin projecting into the slot between the channels a distance adapted to engage the spacers holding the latter in spaced relation, said pin and spacers cooperating to maintain the tie lock and reinforcing element in assembled relation.

13. The combination reinforcing member and tie lock as set forth in claim 10 in which the latch-forming means has two arcuate fingers depending from the radial arm that extend in opposite directions from a common point of attachment, the pivotal connection of the radial arm with the slide block is located midway between the side edges thereof, and both sides of the slide block are notched to receive the tie ends.

14. The combination reinforcing member and tie lock as set forth in claim 11 in which the means depending from the radial arm is provided with two arcuate slots extending from approximately the same point on said radial arm in opposite directions therefrom, the pivotal connection of the radial arm with the slide block is located midway between the side edges thereof, and both sides of the slide block are notched to receive the tie ends.

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