Jan. 22, 1963 G. F. BOWDEN ETAL 3,074,141

TIE ROD FOR CONCRETE WALL FORM PANELS

Filed Feb. 13, 1961

3 Sheets-Sheet 1

Fig. 1.

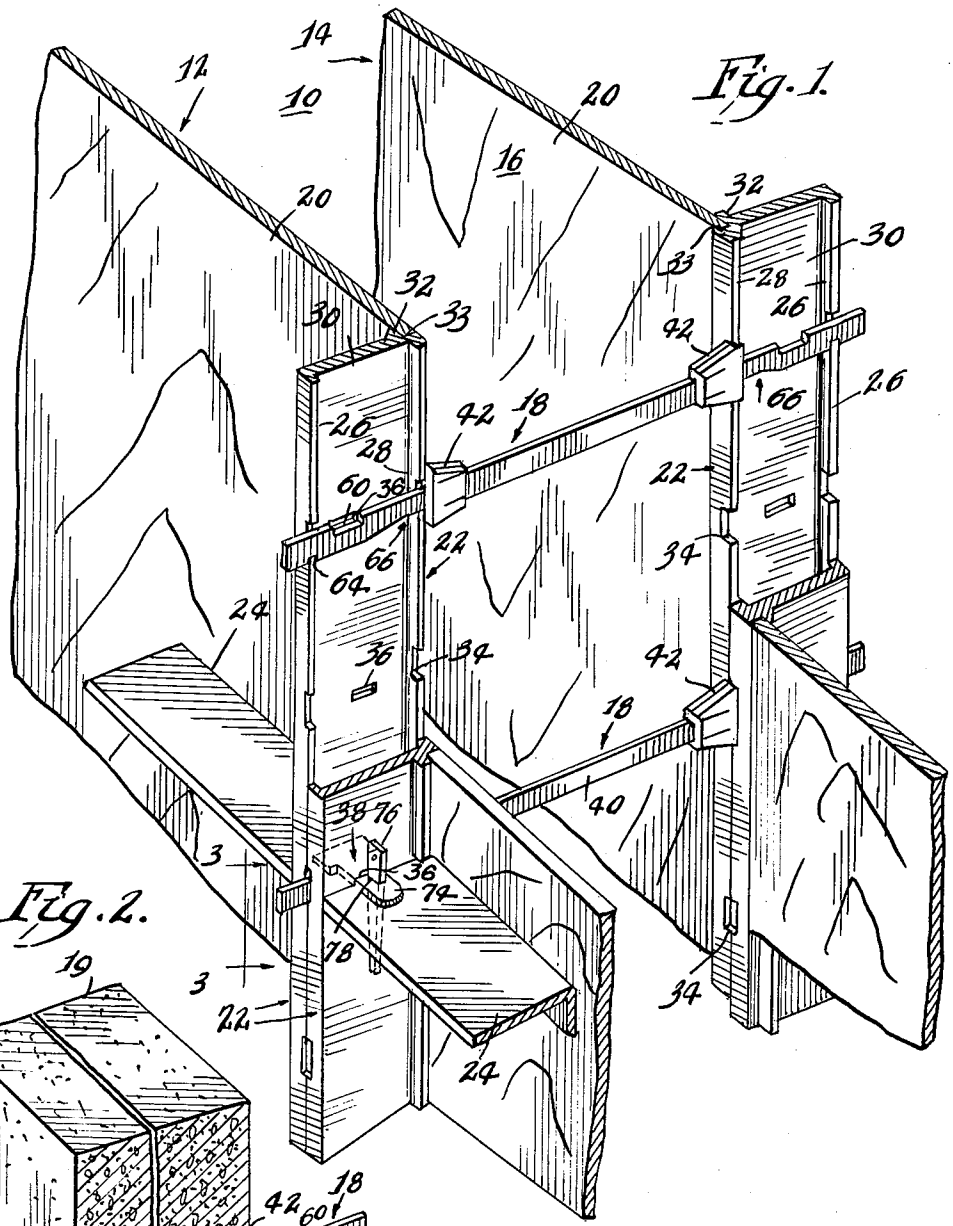


Fig. 2.

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TIE ROD FOR CONCRETE WALL FORM PANELS

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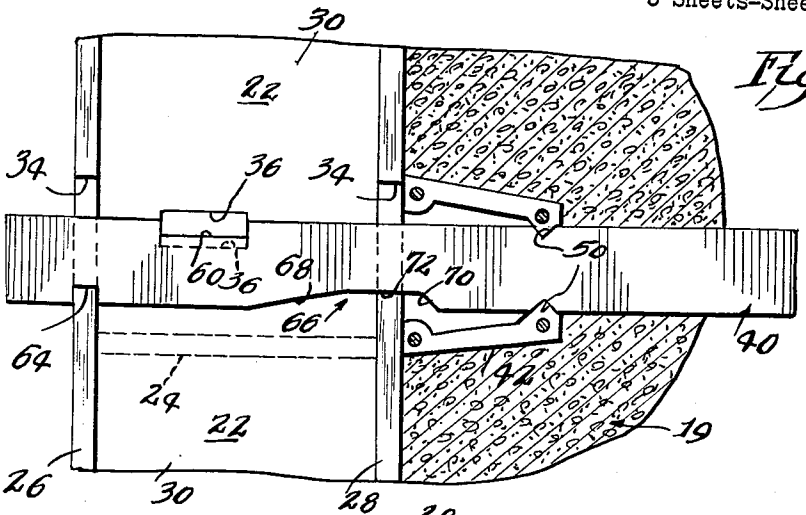


Fig. 5.

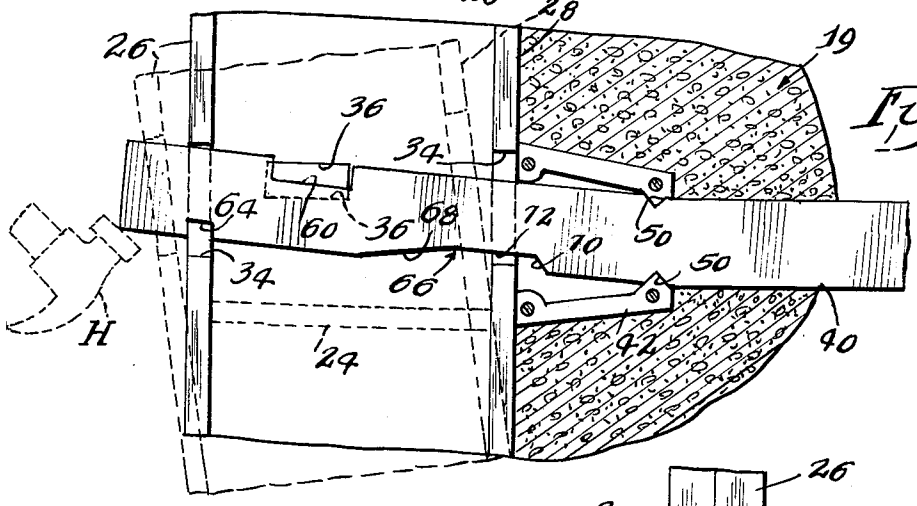


Fig. 6.

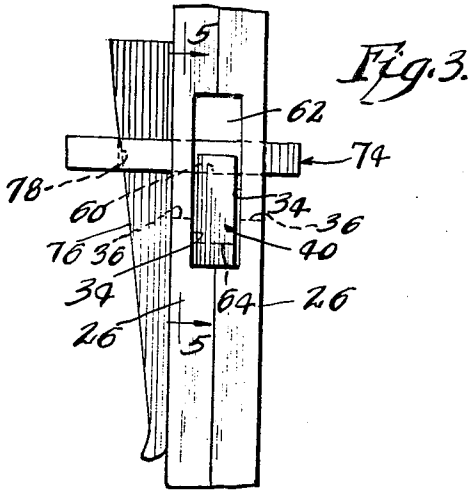


Fig. 3.

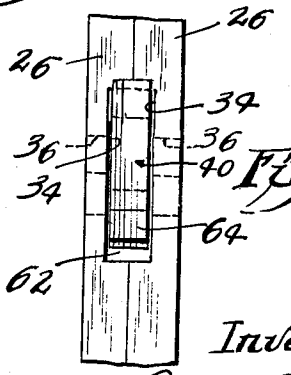


Fig. 4.

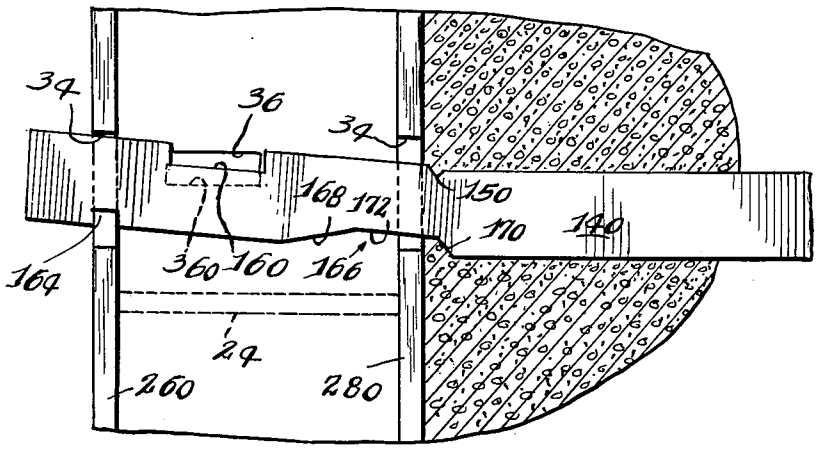
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TIE ROD FOR CONCRETE WALL FORM PANELS

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Fig. 8.



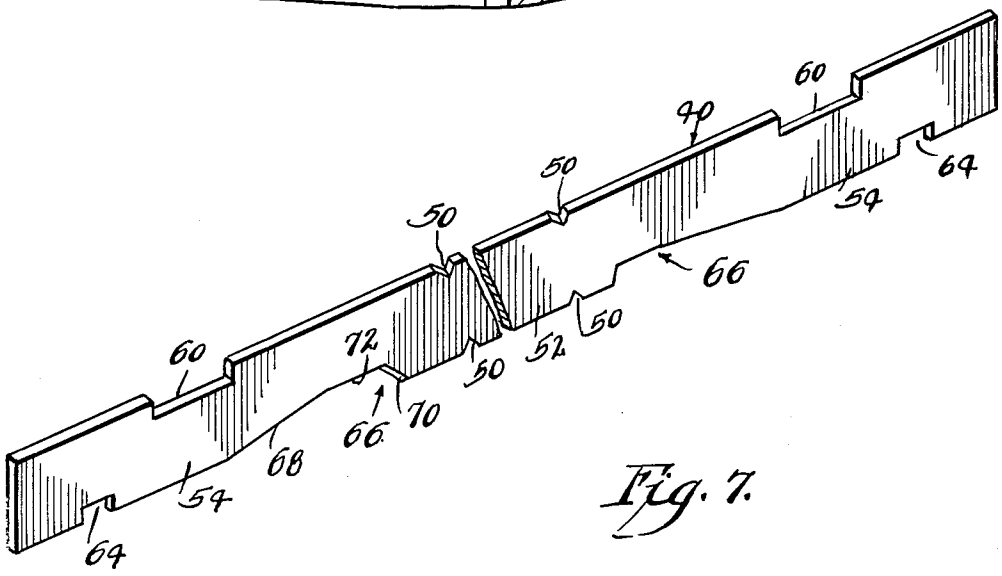


Fig. 7.

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United States Patent Office 3,074,141 Patented Jan. 22, 1963

3,074,141

TIE ROD FOR CONCRETE WALL FORM PANELS

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Filed Feb. 13, 1961, Ser. No. 88,895
3 Claims. (Cl. 25—131)

The improved tie rod comprising the present invention has been designed for use specifically in connection with concrete wall form panels of the type which are commonly referred to as "Steel-Ply" panels and which are disclosed in United States Patent No. 2,640,249, granted on June 2, 1953 to Arthur H. Symons and entitled "Wall Form Panel." A panel of this type comprises a rectangular facing of plywood and a marginal frame of steel. The longitudinal and transverse frame members of the panel frame are provided with outwardly directed ribs along their side edges to the end that these frame members are of shallow channel shape in transverse cross section.

In order to accommodate the tie rods which maintain the two oppositely disposed wall forms in their spaced relationship and also maintain the forms against outward displacement, pairs of transversely aligned notches are formed in the spaced ribs of the various frame members. When the panels are positioned in edge-to-edge relationship to make up the two forms, the ribs of adjacent channel-shaped frame members meet and, as a result, the web parts of the frame members remain slightly spaced from each other. The pairs of notches in the adjacent members, in combination with each other, define rectangular holes or openings which are adapted to receive therethrough the adjacent ends of the tie rods. At the level of the notches, the adjacent webs are provided with aligned holes and these are adapted to receive fastening bolts therethrough, and the bolts are slotted for the reception of wedges, which, when driven into place, lock the adjacent panels together in their edge-to-edge relationship. The proximate ends of the tie rods which extend between adjacent webs are slotted so that the fastening bolts may also pass through the tie rods and thus the bolts serve the dual function of anchoring the tie rod ends in position and of locking adjacent panels together. The tie rod of the present invention is useful only in connection with such steel-ply panels and finds no application in connection with panels having wooden marginal frame members or with frame members which are not channel shaped in cross section.

The tie rod of the present invention is of the same general type that is shown and described in United States Patent No. 2,948,045, granted on August 9, 1960 to John E. Imonetti, and entitled "Tie Rod Assembly for Concrete Wall Forms and Cone Therefor." A tie rod of this character consists essentially of an elongated flat strip of heavy gauge metal stock. It is adapted, when assembled in the form installation, to pass completely through the wall forms and intervening poured concrete, so that after the concrete has hardened and the forms have been removed, the projecting ends of the tie rod may be bent, twisted, or otherwise manipulated or worked in various directions to weaken the metal of the rod at the regions where it enters the concrete and thus enable the projecting ends of the rod to be ruptured or severed and thereafter removed from the concrete mass.

The tie rod of the present invention is designed as an improvement upon the tie rod of the aforementioned patent in that it offers functional advantages which are not attainable in connection with the earlier tie rod. Principal among these functional advantages is the matter of load distribution. The tie rod of the present invention is better able to withstand the tremendous stress exerted

by outward pressure of the panels under the influence of the weight of the poured concrete mass. Whereas, with the earlier or prior tie rod, the rod is subjected to shear stress solely in the vicinity of the fastening bolt which passes through the rod, in the present tie rod, the shear stress is distributed between longitudinally spaced regions along the rod.

A second advantage of the present tie rod resides in a locking effect which is attained when the panels are in their erected or operative positions in the form and against the poured concrete, either in its wet state or after the same has hardened, this locking effect taking place independently of the fastening bolts and their associated wedges. According to the present invention, an interengaging locking connection is effected between the panels and tie rods, and the nature of this connection is such that the panels will remain securely attached to the tie rods even after the bolts which draw the adjacent edges of the panels together are removed. By such an arrangement, it is possible for a workman, when stripping the concrete installation of forms, to remove all of the fastening bolts and, thereafter, take down the panels one at a time and in any selected order of removal.

A third advantage of the present tie rod, in a modified form thereof, resides in the fact that by virtue of the locking effect mentioned above, the necessity of employing spacer cones such as are ordinarily employed for the purpose of effecting a deep breakback operation when removing the tie rod ends, and of affording an inside support for the panels, is completely eliminated.

The provision of a tie rod possessing the advantageous features briefly outlined above being among the principal objects of the invention, various other objects and advantages not at this time enumerated, will become readily apparent as the following description ensues.

In the accompanying three sheets of drawings forming a part of this specification, two illustrative embodiments of the invention have been shown.

In these drawings:

FIG. 1 is a fragmentary perspective view, partly in section, of a concrete wall form installation showing the improved tie rod of the present invention operatively applied thereto;

FIG. 2 is a fragmentary perspective view, partly in section, showing a portion of a concrete wall structure with one of the improved tie rods in position within the hardened concrete of the wall structure preparatory to fracture and removal of the tie rod ends;

FIG. 3 is a fragmentary front elevational view of a limited portion of the structure shown in FIG. 1 with the view being taken from an angle and in the vicinity of the line 3—3;

FIG. 4 is a fragmentary view similar to FIG. 3 showing the tie rod in a stressed position of panel release;

FIG. 5 is a sectional view taken substantially along the line 5—5 of FIG. 3;

FIG. 6 is a sectional view similar to FIG. 5 showing the panel undergoing removal from the concrete installation;

FIG. 7 is an enlarged fragmentary perspective view of the tie rod which is shown in FIGS. 1 to 6, inclusive; and

FIG. 8 is a fragmentary sectional view similar to FIG. 6 but showing a modified form of tie rod.

Referring now to the drawings in detail, and in particular to FIGS. 1 and 2, a fragmentary portion of a composite wall form of conventional construction has been designated in its entirety at 10 and is made up of two series 12 and 14 of rectangular panels with the panels of each series being arranged in edge-to-edge relationship. The panels of the two series are designated by the reference numeral 16 and are maintained in spaced, parallel relationship by means of tie rod assemblies 18 which in-

corporate the novel tie rods proper of the present invention and will be described in detail hereinafter. Two of the tie rod assemblies 18 have been shown in FIG. 1 as being associated with two adjacent panels 16 of each series 12 and 14 in the production of a concrete wall such as has been fragmentarily shown at 19 in FIG. 2.

The panels 16 are of conventional design and no claim is made herein to any novelty associated with the same per se, although they cooperate in a novel manner with the improved tie rods of the present invention. Such panels are commonly known as "Steel-Ply" panels and are manufactured and sold by Symons Clamp & Mfg. Co. of Chicago, Illinois. These panels 16 are of the prefabricated type and consist of rectangular plywood facings 20 and steel marginal rectangular reinforcing frames around the facings. The frames consist of vertical and horizontal frame members, only the vertical frame members 22 being illustrated herein. At appropriate levels in the form structure, suitable horizontal frame struts or bars 24 of angle shape design may extend across the panels between the opposed vertical frame members 22.

The vertical frame members 22 are specifically in the form of lengths of specially shaped structural steel channel stock of shallow channel configuration so that the members 22 present spaced parallel outside and inside marginal ribs 26 and 28, respectively, and a connecting base or web 30. On the side of the web 30 opposite to the ribs 26 and 28, a longitudinally extending rib 32 defines an angular groove or recess 33 for reception therein of the extreme vertical edge region of the plywood panel facing 20. The horizontal frame bars 24 are welded to the inside faces of the vertical frame members 22. At vertically spaced regions along the vertical frame members 22, the ribs 26 and 28 are notched as at 34 to accommodate the tie rods proper of the tie rod assemblies 18, while the webs 30 of the members 22 are formed with rectangular openings 36 in horizontal registry with the notches 34 for reception therethrough of conventional connecting bolt and wedge assemblies 38 by means of which adjacent panels are fastened together, all in a manner that will become apparent as the following description ensues.

As best seen in FIGS. 2, 5, 6 and 7, each tie rod assembly 18 is comprised of a tie rod proper 40 of novel design and a pair of composite spacer cones 42. The spacer cones 42 may be identical with the cones which are shown and described in aforementioned Patent No. 2,948,045 and constitute the subject matter of such patent. They are each in the form of two-piece plastic trapezoidal hexahedrons having six faces, four of which are trapezoidal. Although they do not present a truly conical appearance, they function in the form assembly in the manner of conventional spacer devices which have become known in the art as tie rod "cones" and, for this reason, they will be referred to as such throughout this specification. For a full understanding of the nature and function of the spacer cones 42, reference may be had to the above-mentioned patent.

The tie rod proper 40 is in the form of a length of flat sheet metal stock of relatively heavy gauge and of a longitudinal extent appreciably greater than the over-all width of the spaced series 12 and 14 of the wall form panels 16. At regions which are spaced inwardly from the opposite ends of the tie rod 40, the metal of the tie rod is relieved to provide respective pairs of transversely opposed notches 50, thus weakening the metal of the rod in these regions. In the hardened concrete wall structure 19, the notches 50 lie within the confines of the concrete mass and constitute "breakbacks" or points of weakness by means of which the protruding end regions of the tie rod may be wrested from the medial region of the rod and the latter region allowed to remain embedded in the concrete. The notches 50 thus divide the tie rod into three sections, namely, a medial section 52 which remains in the concrete, and two removable end sections or regions 54.

The cones 42 are adapted to be applied to the tie rods either at the factory or in the field prior to setting up of the concrete wall forms and, when in position on the tie rod 40, they span the longitudinal extent from the adjacent pairs of notches to the regions where the rod sections 54 emerge from the surfaces of the concrete wall structure. These cones serve the dual functions of providing outwardly facing shoulders which engage the opposed wall form panels and limit their inward movement during erection of the forms, and of creating voids in the concrete, which, after the forms have been removed but prior to extraction of the pliable or deformable cones, afford clearance pockets for "working" of the rod sections 54 in various directions so that the metal of the rod may be fractured along lines of cleavage preparatory to removal of these rod sections 54.

Referring now to FIGS. 3 to 7, inclusive, the opposite end regions 54 of the tie rod 40 are substantially identical in their configuration, as also is the manner in which these end regions cooperate with the form panels 16 so that a description relating to one end region of the tie rod will suffice for both end regions. Each end region 54 of the tie rod 40 is formed with a shallow rectangular notch 60 in the upper longitudinal edge thereof and this notch is adapted to become aligned in horizontal transverse registry with a pair of the opposed rectangular bolt-receiving openings 36 in the webs 30 of adjacent vertical frame members 22 when the end region of the rod is projected into the narrow space 62 (FIGS. 3 and 4) existing between said webs of adjacent frame members. The lower longitudinal edge of the rod is formed with a shallow notch 64 of a width equal to the thickness or width of one of the ribs 26. When the rod 40 is operatively assembled with respect to the panels 16, the notch 64 is adapted to straddle the lower edge of the adjacent rectangular opening which is created when the two notches 34 of the contiguous ribs 26 of adjacent vertical frame members 26 are brought together as best seen in FIGS. 3 and 5.

The lower edge of the end region 54 of the rod 40 is formed with a second and wide notch 66 presenting an inclined edge portion 68 of small slant angle, a second inclined edge portion 70 of steep slant angle, and an intervening horizontal straight portion 72. The notch constitutes a clearance void which 66 is adapted to straddle the lower edge of the rectangular opening which is created when the two notches 34 of contiguous ribs 28 are brought together. The thickness of the metal stock from which the rod 40 is formed is such that, when the rod is assembled upon adjacent panels 16, the lower edge of the rod is supported partly on the ribs 26 and 28 of both panels, as shown in FIG. 3. With the notch 64 straddling the lower edges of adjacent notches 34 in the ribs 26, the edge surface 72 of the notch 66 seats upon the lower edges of the adjacent notches in the ribs 28.

When the tie rod 40 has been assembled in the manner described above on a pair of adjacent panels 16 with the rectangular notch 60 in register with the adjacent aligned rectangular openings 36 in the webs 30, a conventional T-bolt 74, which constitutes one of the two elements of the connecting bolt and wedge assembly 38, is passed through the openings 36 and notch 60, and a wedge 76, which constitutes the other element of the assembly 38, is passed through the usual slot 78 provided in the shank of the T-bolt and driven home to draw the edges of the two panels 16 hard against each other. The T-bolt 74 engages the bottom edge of the notch 60 and serves to force the end region 54 of the tie rod downwardly so as to cause the bottom edge of the notch 64 to seat firmly upon the lower edges of the notches 34 provided in the adjacent ribs 26. At the same time, the horizontal edge 72 of the wide notch 66 is forced downwardly against the lower edges of the notches 34 provided in the adjacent ribs 28. The interlocking engagement which exists between the ribs 26 and notch 64 securely holds

the panels 16 against either outward or inward displacement prior to concrete pouring operations. After the concrete has been poured and has become hardened, the interlocking connection between the ribs 26 and notch 64 prevents outward displacement of the panels even after the connecting bolt and wedge assemblies 38 have been removed. Thus, it is possible for a workman to remove all of the connecting bolt and wedge assemblies associated with a given installation and thereafter to remove the panels 16 at will and in any desired order of removal.

To effect removal of a panel after the connecting bolt and wedge assemblies 36 associated therewith have been removed, it is merely necessary to strike the underneath edge of the projecting portion 54 of the tie rod 40 with a suitable impact tool, such as the hammer head H shown in dotted lines in FIG. 6, so that the end region 54 will be displaced upwardly as shown in this view and the notch 64 caused to clear the lower edges of the notches 34 of the ribs 26. At this time, the edge portion 68 of the wide notch 66 will assume a substantially horizontal position so that the panel 16 may be pulled outwardly as shown in dotted lines in this view and thus removed from the concrete wall 19. After the panel 16 has been removed, the end region 54 of the tie rod 40 may be worked by swinging the same back and forth or by twisting the same until cleavage takes place in the vicinity of the breakback notches 50.

In FIG. 8, a slightly modified form of tie rod 140 has been illustrated as being applied to the wall form installation 10 of FIG. 1. In this form of the invention, the tie rod remains, to a large extent, identical with the tie rod 40 and, therefore, to avoid needless repetition of description, similar reference numerals, but of a higher order, have been applied to the corresponding parts as between FIGS. 6 and 8.

The tie rod 140 shown in FIG. 8 is designed for use without employing the cones 42 and, accordingly, the two opposed breakback notches 50 which cooperate with the cone 42 in effecting a deep breakback in the case of the tie rod 40, have been omitted and in their stead, there has been substituted a single notch 150 in the upper edge of the rod and at a region not far removed from the outer face of the concrete wall 119 when the rod is operatively embedded in the latter. The notch 150 is preferably transversely opposed to the juncture region between the two edge portions 170 and 172 of the wide notch 166 which is formed in the lower edge of the tie rod. This juncture region, in effect, constitutes a second breakback relief notch. Omission of the cones 142 is made possible by virtue of the locking effect which obtains between the notch 164 and the lower edge of the rectangular opening afforded by the juxtapositioning of two adjacent notches 34 in the ribs 26 of adjacent panels. The inside edge of the notch 164, in effect, constitutes a shoulder which limits the inward movement of the panel 16.

It is to be noted that in connection with either form of tie rod described above, the notches or other relief areas which are provided in the lower edge of the tie rod are staggered transversely from the notches or other relief areas provided in the upper edge of the tie rod. An appreciable thickness of metal transversely of the rod thus exists at all longitudinal regions therealong so that the rod is capable of withstanding an appreciable amount of longitudinal pull or rod tensioning when the weight of the poured concrete is applied to the panels which are supported by the rod.

The invention is not to be limited to the exact arrangement of parts shown in the accompanying drawings or described in this specification as various changes in the details of construction may be resorted to without departing from the spirit of the invention. Therefore, only insofar as the invention has particularly been pointed out in the accompanying claims is the same to be limited.

Having thus described the invention what we claim as new and desire to secure by Letters Patent is:

1. A tie rod for holding a pair of upstanding wall forms in spaced relationship in a concrete wall form installation, each wall form being comprised of a series of vertical panels arranged in edge-to-edge relationship and including coplanar panel facings and vertical marginal steel frame members which are of shallow channel shape cross section thus providing spaced parallel inside and outside ribs and interconnecting webs, adjacent panels in each series being disposed with adjacent marginal frame members in contiguity so that the ribs thereof abut each other while the webs remain slightly spaced apart, the abutting ribs of adjacent panels being formed with registering notches defining rectangular openings therebetween, said tie rod being adapted in connection with normal use to extend horizontally and comprising an elongated one-piece strip of flat metal stock presenting straight upper and lower parallel longitudinally extending side edges, at least one of said edges being formed with a breakback spaced inwardly from each end of the rod, thus dividing the rod into a medial region adapted to remain embedded in the hardened concrete of the wall installation and two end regions adapted to project between the spaced webs of adjacent frame members, through said rectangular openings, and outwardly beyond the opposite faces respectively of the wall installation, the upper edge of each end region being formed with a shallow notch designed for reception therethrough of a fastening bolt which extends through registering holes in the spaced webs of adjacent frame members, the lower edge of each end region being formed with a shallow narrow notch the bottom edge of which is adapted to seat upon the lower edge of the rectangular opening defined by the abutting outside ribs, the lower edge of each end region also being formed with a shallow wide notch the bottom edge of which is adapted to seat upon the lower edge of the rectangular opening defined by the abutting inside ribs said shallow wide notch affording a clearance region to permit the adjacent panel to be moved laterally away from its opposed panel when the outer end of the end section is elevated to an extent sufficient to move the shallow narrow notch out of register with the lower edge of its associated rectangular notch.

2. A tie rod as set forth in claim 1 and wherein the wide notch is disposed within the vicinity of said breakback and itself constitutes a breakback for the tie rod.

3. A tie rod as set forth in claim 1 and wherein the wide notch is provided with a flat bottom adapted to seat upon the lower edge of the rectangular opening defined by the abutting inside ribs, and with an inclined side edge of small slant angle on the end thereof adjacent to the narrow notch.

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