Jan. 9, 1968 G. F. BOWDEN 3,362,678

TIE ROD WITH SMALL INCREMENT VARIABLE EFFECTIVE LENGTH

Original Filed Sept. 17, 1964 2 Sheets-Sheet 1

Fig. 1

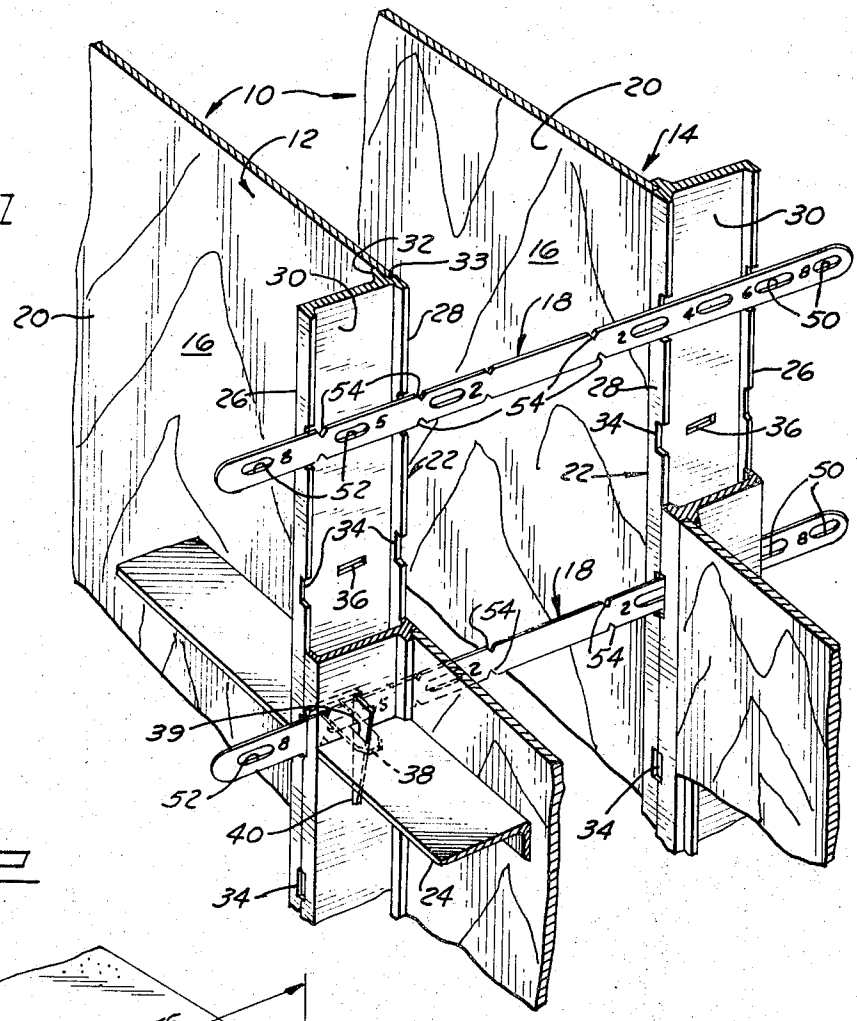
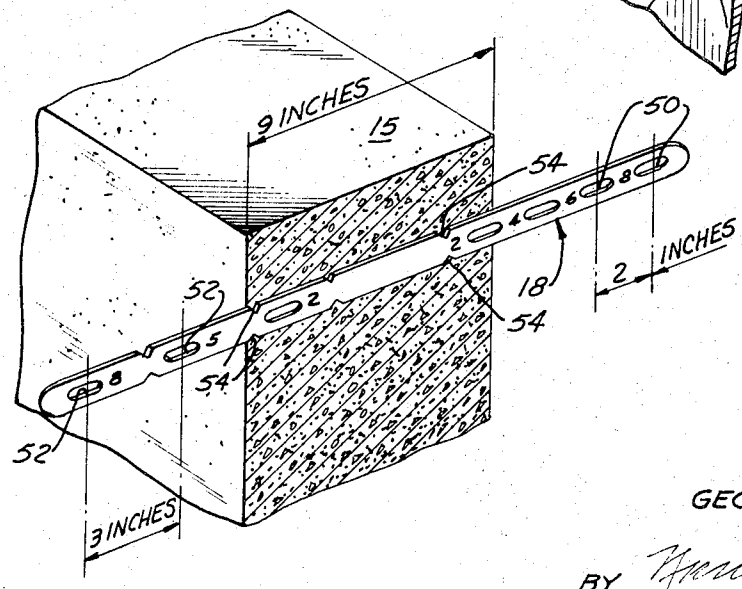


Fig. 2



INVENTOR
GEORGE F. BOWDEN
BY
ATTORNEY

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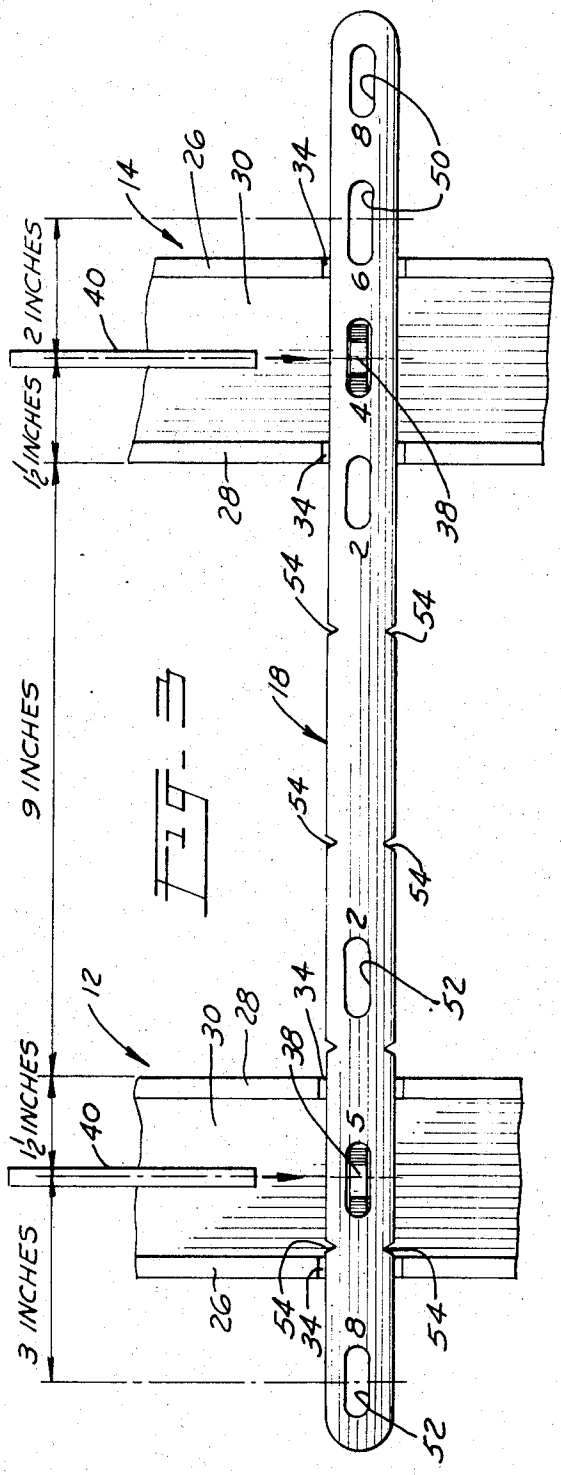


FIG. 3

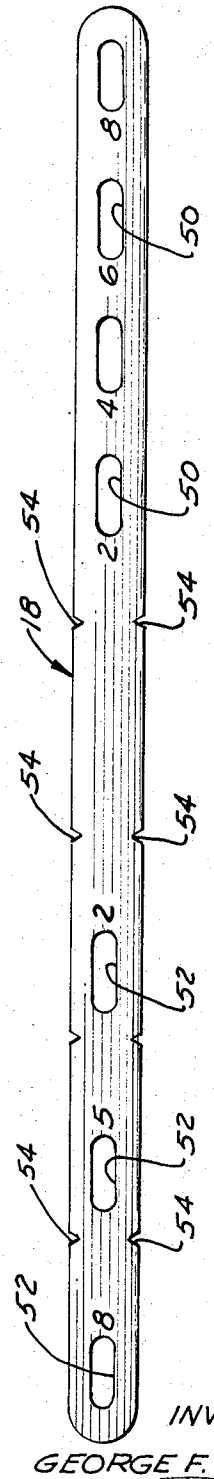


FIG. 4

INVENTOR
GEORGE F. BOWDEN
BY Kenyon & Kenyon
ATTORNEY

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TIE ROD WITH SMALL INCREMENT VARIABLE EFFECTIVE LENGTH

George F. Bowden, Northbrook, Ill., assignor to Symons Mfg. Company, Des Plaines, Ill., a corporation of Delaware

Continuation of application Ser. No. 397,198, Sept. 17, 1964. This application Sept. 30, 1966, Ser. No. 584,625
2 Claims. (Cl. 249—214)

ABSTRACT OF THE DISCLOSURE

A flat tie rod adapted for use with the opposed sides of a concrete wall form and characterized by the fact that it is slotted in such a manner as to accommodate small increments of effective form width by proper selection of slots for attachment of the tie rod to the opposite form sides.

This application for United States Letters Patent is a continuation of application Ser. No. 397,198, filed by me on Sept. 17, 1964, now abandoned, and entitled, "Tie Rod With Small Increment Variable Effective Length."

The present invention relates generally to tie rods for use in connection with concrete wall forms and the like and has particular reference to that type of tie rod which is designed for use in maintaining the opposed spaced apart sides of a standard or conventional concrete wall form in properly spaced relationship and in holding certain of the upstanding edge-to-edge panel units that form the form sides against outward displacement during pouring of wet concrete into the form interior. Still more specifically, the invention is concerned with a frangible tie rod like that which is shown and described in United States Patent No. 2,948,045, granted on Sept. 9, 1960, and entitled, "Tie Rod Assembly for Concrete Wall Forms and Cone Therefor," such a tie rod being in the form of an elongated strip of flat, narrow metal stock and being designed and adapted to project completely through the associated concrete wall form and the poured concrete within the form so that, after hardening of the concrete and removal of the panel units, the projecting ends of the tie rod may be bent, twisted or otherwise "worked" in various directions in order to weaken the metal of the rod at the regions where the rod ends enter the concrete as a preliminary to ultimate rupture or severance of the projecting ends of the rod from the concrete embedded intermediate portion of the rod.

Tie rods of the type and character under consideration are specifically designed for use in connection with a prefabricated concrete wall form wherein the individual panel units are assembled at the factory rather than in the field and consist of rectangular plywood facings and rectangular reinforcing frames around the facings and wherein the vertical and horizontal marginal frame members which are in the form of lengths of metallic channel stock and are shaped, slotted, notched and otherwise fashioned in order properly to receive the edges of the plywood facings, the projecting ends of the tie rods, and the various fastening devices or other concrete form hardware whereby the adjacent panel units may be fastened together in clamped relation. Specifically, the marginal outwardly extending ribs of the vertical frame members of the rectangular reinforcing frames of the panel units are notched at spaced points therealong so that, when adjacent vertical frame members are brought together, pairs of registering notches provide, in effect, openings

which receive therethrough the end regions of the flat tie rods which are employed for maintaining the opposed spaced apart sides of the associated concrete form in their proper spaced relationship. Additionally, the intermediate web portions of the vertical frame members are slotted in the vicinity of the notches in the marginal outwardly extending ribs so that the shanks of T-bolts may be passed through the slots, as well as through slots in the end regions of the flat tie rods as a preliminary to driving wedges through slots in the shanks of the T-bolts in order to draw the adjacent vertical frame members together and lock the panel units and the tie rods in position. Such tie rods, T-bolts and wedges constitute well-known concrete hardware articles which are commonly employed for releasably maintaining the individual panel units of a prefabricated concrete wall form in proper position.

Tie rods of the type that are disclosed in the aforementioned Patent No. 2,948,045 are possessed of limited variable effective length, usually in increments of three inches. Tie rod adjustment to adapt a given tie rod to the erection of two opposed wall form sides that will make it possible to construct concrete walls of different thicknesses is attained by providing plural slots in the opposite end regions of the tie rod and then selectively using the slots for T-bolt receiving purposes. Close spacing of the adjacent slots in the tie rod end regions in an effort to attain small incremental adjustment of the tie rod is precluded because such close spacing does not leave sufficient metal in between adjacent slots to lend the necessary strength to the tie rod when the latter is placed in tension in connection with a concrete pouring operation. The use of conventional "break backs" which are in the form of metal-weakening notches in the side edges of a flat tie rod further limits the minimum spacing distance between adjacent slots in the end regions of the tie rod. Because of the fact that flat tie rods with plural T-bolt receiving slots in their end regions have heretofore been capable of accommodating wall forms for concrete walls which vary in small increments of thickness, for example, one-inch increments, it has been necessary for contractors to maintain a large and costly stockpile of flat tie rods of varying lengths, including tie rods of little-used lengths.

The present invention is designed to overcome the above-noted limitation that is attendant upon the construction and use of conventional flat tie rods with slotted end regions and, towards this end, the invention contemplates the provision of a tie rod which will accommodate the construction of concrete walls, the thicknesses of which may vary in small increments, for example, increments of one inch, throughout a wide range of effective tie rod lengths.

The provision of such a tie rod constitutes the principal object of the invention and it is a further object to provide a tie rod having slots therein for effective length adjustment as well as break backs, yet in which the distance between adjacent slots is well beyond the safe limit for intervening metal so that the tie rod as a whole is possessed of the necessary strength when it is placed in tension in connection with use thereof.

A further object of the invention is to provide a flat tie rod which employs for its attachment to adjacent abutting vertical frame members of the reinforcing frames of the associated edge-to-edge upstanding wall form panel units conventional unmodified T-bolt and wedge assemblies, and which, moreover, requires no additional fastening means or modification of the vertical frame members to which it is attached.

A still further object of the invention is to provide a flat tie rod of the aforementioned type and character and

in which visual means are provided for facilitating selection of the particular slots which are to be employed for T-bolt reception in the erection of a form for a concrete wall of a given thickness, thus eliminating the necessity of measuring the distance between slots in the end regions of the tie rod.

Other objects and advantages of the invention, not at this time enumerated, will readily suggest themselves as the following description ensues.

In the accompanying two sheets of drawings forming a part of this specification, one illustrative embodiment of a tie rod constructed according to the present invention, is shown, such drawings illustrating in detail the manner of installation of the improved tie rod in a concrete wall form.

In these drawings:

FIG. 1 is a fragmentary perspective view, partly in section, of a concrete wall form installation showing two of the improved tie rods operatively installed therein;

FIG. 2 is a fragmentary perspective view, partly in section, showing a portion of the concrete wall structure that is produced by the form of FIG. 1, with one of the improved tie rods in position within the hardened concrete of the wall structure preparatory to fracture and removal of the end regions of the tie rod;

FIG. 3 is an end elevational view of a limited portion of the structure of FIG. 1; and

FIG. 4 is an enlarged side elevational view of a tie rod embodying the invention.

Referring now to the drawings in detail and in particular to FIGS. 1 and 3, a fragmentary portion of a composite concrete wall form of conventional construction is illustrated, such structure being designated in its entirety by the reference numeral **10**. The concrete wall form **10** is made up of two opposed spaced apart sides **12** and **14** in the form of two opposed rectilinear series of rectangular panel units **16** with the units of each series being arranged in upstanding and edge-to-edge relationship. The panel units **16** of the two series are maintained in spaced parallel relationship by means of tie rods **18** which are constructed according to the present invention, two such tie rods being illustrated in FIG. 1 in connection with two adjacent panel units of each of the two concrete wall form sides **12** and **14** in the production or fabrication of a concrete wall **15**.

The individual panel units **16** are of the prefabricated type known as "Steel-Ply" panels. Such panels are manufactured and sold by Symons Mfg. Company of Des Plaines, Ill., and consist of a rectangular plywood facing **20** having marginal rectangular reinforcing frames of steel or other suitable metal applied to the outer faces thereof. Such frames consist of vertical and horizontal frame members, only the vertical frame members **22** being illustrated in the drawings. At appropriate levels in the concrete wall form **10**, suitable horizontal crossbars **24** of angle shape design extend across the front faces of the plywood facings and have their ends fixedly connected to the vertical members **22** of the reinforcing frames.

Each vertical frame member **22** is in the form of a structural steel or other metal bar which is generally of shallow U-shape cross section and comprises spaced marginal outwardly extending parallel ribs **26** and **28** and a connecting or intermediate web portion **30**. On their inner faces, the web portions **30** of the vertical frame members **22** are inwardly and longitudinally extending ribs **32** which define shallow angular grooves or recesses **33** for reception therein of the vertical edge regions of the plywood facings **20**. The ends of the horizontal crossbars **24** are welded to the inner faces of the web portions of the vertical frame members **22**. At vertically spaced regions along the vertical frame members **22**, the ribs **26** and **28** are provided with notches **34** to accommodate the slotted end regions of the tie rods **18**, while the web portions **30** of the vertical frame members **22** are formed with horizontally extending rectangular slots **36**. The latter are in horizontal register with the notches **34** and are adapted to receive therethrough the shanks of conventional T-bolts **38**. Such shanks have longitudinally extending slots **39** in their free ends and such slots are adapted to receive vertical wedges **40** which cooperate with the T-bolts **38** in holding the adjacent abutting vertical frame members **22** in clamped relation, all in a manner that will be made clear presently when the nature of the tie rods **18** is better understood. Since both illustrated tie rods are the same, but one will be described and it will be identified by the reference numeral **18**.

As best shown in FIG. 4, the tie rod **18** is in the form of a length of flat steel or other metal stock of rectangular cross section, and it is of a longitudinal extent greater than the overall width of the form **10**. The medial region of the tie rod is imperforate but the opposite end regions thereof are slotted in a novel manner and in accordance with certain considerations pertaining to the desired width of the concrete wall which is to be produced in connection with normal utilization of the two form sides **12** and **14**.

The right-hand end region of the tie rod **18**, as viewed in FIG. 4, is provided with a series of four elongated longitudinally extending slots **50**, while the left-hand end region is provided with a series of three similarly elongated longitudinally extending slots **52**. The spacing between adjacent slots **50** is different from the spacing between adjacent slots **52**, the relative spacings being critical and based upon the desired variable widths which the concrete wall **15** is capable of assuming while utilizing the same tie rod.

According to the present invention, it is desired that the tie rod **18** be employed in constructing concrete walls which vary in width by increments of one inch, ranging from a minimum wall thickness or width of four inches to a maximum thickness of sixteen inches. The over-all length of the tie rod **18**, the axial extent of the slots **50** and **52**, and the positioning of these slots, have been selected specifically to accommodate maximum and minimum wall thicknesses and intermediate incremental thicknesses as stated above.

Accordingly, the axial extent or length of each slot **50** and **52** is seven-eighths of an inch. The slots **50** are spaced apart on two-inch centers, while the slots **52** are spaced apart on three-inch centers. Each of the slots **52** has associated therewith a pair of opposed break back notches **54**, such notches being formed in the side edges of the tie rod and being spaced inwardly from their respective slots toward the central region of the tie rod a predetermined distance. These pairs of break back notches **54** weaken the tie rod at various break-off points which are adapted to lie within the confines of the completed concrete wall **15** and facilitate the breaking-off of the left-hand projecting tie rod end in a manner well known in the art. The slots **50**, with the exception of the innermost slot **50**, have no break back notches associated with them. Whereas, the break-off points afforded by the notches **54** lie substantially centrally of the intervening regions of the tie rod between adjacent slots **52**, similar break-off points, if provided for the slots **50**, would entail the creation of notches in close proximity to adjacent slots **50** and would thus impair the tensional characteristics of the tie rod beyond the danger point.

The tie rod **18** is useable in the manner of a conventional flat-slotted tie rod by selecting one of the slots **50** and one of the slots **52** for reception therethrough of the shanks of two of the T-bolts **38**. The panel units **16** of the wall form sides **12** and **14** are erected in their edge-to-edge relationship and the tie rods **18** are positioned in the various horizontally aligned notches **34** as shown in FIG. 1. The shanks of the T-bolts **38** are then passed through the slots **36** in the web portions **30** of the vertical frame members **22** and the selected slots **50** and **52** in the end regions of the tie rods **18**, and thereafter,

the wedges **40** are projected through the slots **39** in the free ends of the shanks of the T-bolts and driven to a home position to clamp adjacent panel units of the wall form sides **12** and **14** in position in the usual manner of erecting such a concrete wall form.

According to the present invention, the width of the completed concrete wall **15** is determined by the two particular slots which are selected for T-bolt reception. As best seen in FIGS. 3 and 4, the slots **50** are labeled **2, 4, 6** and **8**, reading from left to right, while the slots **52** are labeled **2, 5** and **8**, reading from right to left. The labeling may be effected by stamping the numerals directly on the body of the tie rod **18** in the vicinity of the related slots. The slots are so positioned and spaced apart that the sum of the numerals represented by the labeling when one slot **52** and one slot **50** are selected for T-bolt reception, represents the width in inches of the particular concrete wall which will be formed. For example, if the tie rod **18** is operatively installed in the wall form **10**, utilizing the two slots **52** and **50** labeled **8**, then the resultant concrete wall width will be sixteen inches. For an eleven-inch wall, the slot **52** labeled **5** and the slot **50** labeled **6** will be selected for T-bolt reception. Similarly for a nine-inch width wall, the slot **52** labeled **5** and the slot **50** labeled **4** will be selected, this being the thickness dimension of the concrete wall **15** shown in FIG. 2.

To attain these ends, tie rod length, slot elongation, adjacent slot spacing, and the extent of the imperforate medial region of the tie rod **18** are critical. Reference to FIG. 3 will reveal that in a conventional "Steel-Ply" panel unit, the distance between the center of any given slot **36** and the plane of the plywood facing **20** is on the order of one and one-half inches. Thus, if the center-to-center distance between the slot **52** labeled **5** and the slot **50** labeled **4** is twelve inches, use of these two slots for T-bolt receiving purposes will result in a spacing of nine inches between the respective planes of the two opposed panel facings **20**. Similarly, the center-to-center distance between any two given slots in the two series of slots **50** and **52** is three inches greater than the sum of the labeling applied to such slots. Therefore, the longitudinal extent of the imperforate medial region of the tie rod between the two innermost slots **50** and **52** labeled **2** is seven inches less the length of one slot or, specifically, seven inches less seven-eighths of an inch or, namely, six and one-eighth inches.

It is to be noted that the region of break-off that is established by any pair of notches **54** will, regardless of which slot **52** is selected for T-bolt reception, lie just inwards of the confines of the wall form side **12** so that it will become embedded in the wall-forming concrete when the concrete is poured. This break-off region will lie near the adjacent side surfaces of the wall **15** after the concrete has hardened. The use of break back notches in connection with three of the four slots **50** is not necessary or desirable inasmuch as when any one of these slots is selected for T-bolt reception, the effective plane of the adjacent panel unit facing **20** will intersect the next adjacent slot inwardly of the tie rod. Only the innermost slot **50** labeled **2** need be provided with break back notches **54** and they are located a slight distance inwards of the inner end of the innermost slot **50**. The intersection of the effective plane of the associated plywood facing **20** with a given notch **50** weakens the tie rod at the region of intersection, and thus, in effect, establishes a break back.

The provision of a conventional break back, i.e., one which is created by the formation of opposed notches **54** in the side edges of the tie rod **18**, is illustrated at the left-hand side of FIG. 2 wherein one pair of notches **54** lies just inside the confines of the concrete wall **15** and is embedded therein so that the left-hand projecting portion or end region of the tie rod containing the two slots **52** labeled **8** and **5** may be bent, twisted or otherwise worked so as to effect a break-off in the vicinity of said one pair of notches **54**. At the right-hand side of FIG. 2, no such notches **54** are apparent but the outer end of the innermost slot **50** labeled **2** is intersected by the plane of adjacent side face of the concrete wall **15** so that when the right-hand projecting portion or end region of the tie rod **18** containing the slots **50** labeled **4, 6** and **8** is similarly twisted or otherwise worked and this portion or end region of the tie rod breaks off in the vicinity of the slot **50** labeled **2** where the metal of the tie rod is weakened. Whichever of the three slots **50** labeled **4, 6** and **8** is employed for T-bolt receiving purposes, the next adjacent notch in the inward direction of the tie rod will be intersected by the plane of the adjacent side face of the concrete wall **15** after the wall has been stripped of the panel units. The innermost slot **50** labeled **2**, having no adjacent inside slot, requires associated break back notches **54** which become effective for break-off purposes only when the slot labeled **2** is employed for T-bolt receiving purposes.

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 or scope of the invention. For example, the dimensions specified herein and certain of which have been applied to the drawings by labeling are predicated upon the construction of concrete walls, the thicknesses of which vary in increments of one inch and between a minimum wall thickness of four inches and a maximum wall thickness of sixteen inches. Obviously, if wall thicknesses are to be varied by increments expressed in units other than inches, for example, in the metric system of measurement, different and appropriate slot spacing will be resorted to. 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 I claim as new and desire to secure by Letters Patent is:

1. A slotted tie rod for holding a pair of opposed upstanding concrete wall form panel units in spaced relationship, said panels being of the type including a rectangular plywood facing with marginal metal studding having anchor slots therein designed for register with selected tie rod slots and in which the centers of said anchor slots are spaced from the effective plane of the plywood facing by a distance on the order of one and one-half inches, said tie rod comprising a narrow one-piece strip of flat metal stock presenting straight parallel longitudinally extending side edges, one end region of said strip being provided with a first longitudinally extending row of longitudinal slots which are no less than three in number are spaced apart on three-inch centers, all of the slots being of equal longitudinal extent and on the order of seven-eighths of an inch in length, said side edges at regions spaced inwardly of each slot being provided with a pair of opposed notches the existence of which weakens the metal of the tie rod and establishes a break back, each break back being spaced from the center of its respective slot by a distance on the order of one and three-fourths of an inch, the other end region of said strip being provided with a second longitudinally extending row of longitudinal slots which are no less than four in number, are spaced apart on two-inch centers, and likewise are of equal extent and on the order of seventh-eighths of an inch in length, said side edges at a region spaced inwardly of the innermost slot in the second row of slots being provided with a pair of opposed notches which likewise establish a break back, said latter break back being spaced from the center of said innermost slot by a distance on the order of one and three-fourths of an inch.

2. A slotted tie rod as set forth in claim **1** and wherein the center-to-center distance between the innermost slots of the two rows of slots is on the order of seven inches,

and wherein the slots of the first row are progressively labelled with numerical designations having an arithmetical progression of three while the slots of the second row are similarly labelled with numerical designations having an arithmetical progression of two, the innermost slot of each row being labelled with the numerical desig- labelled with numerical designations having an arith-meti-

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J. SPENCER OVERHOLSER, *Primary Examiner.*
R. D. BALDWIN, *Assistant Examiner.*