United States Patent

Shoemaker

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[54] **CONCRETE WALL FORM INSTALLATION WITH PARTICULAR TIE ROD SECURING MEANS THEREFOR**

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[22] Filed: **Oct. 8, 1970**

[21] Appl. No.: **79,234**

Related U.S. Application Data

[62] Division of Ser. No. 802,109, Feb. 25, 1969, Pat. No. 3,625,470.

[52] **U.S. Cl.** **249/40,** 249/41, 249/43

[51] **Int. Cl.**.....**E04g 17/08**

[58] **Field of Search**.....25/131 T; 249/41, 43, 46, 40, 249/190, 214, 217

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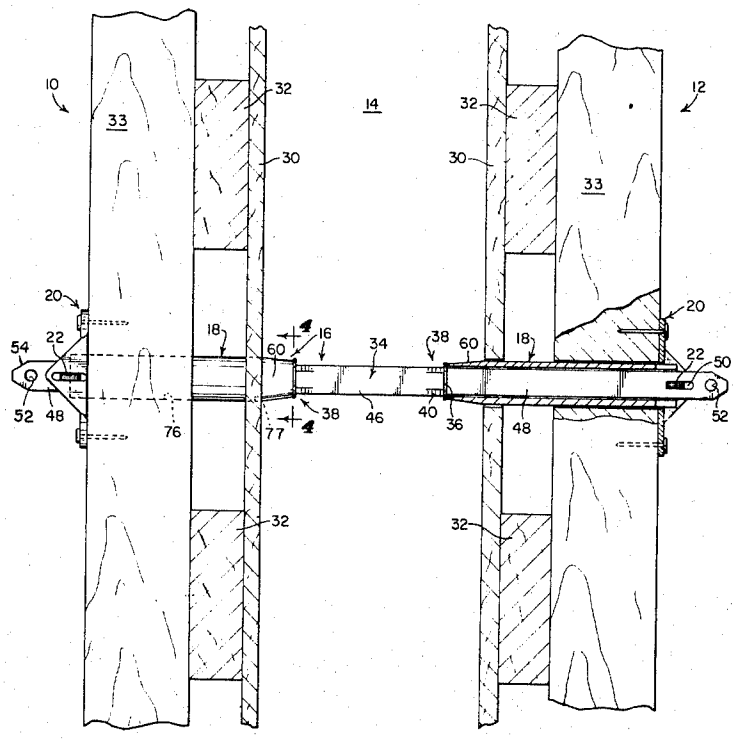
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[57] **ABSTRACT**

Securing means for a concrete wall form including a flat tie rod having means at its end sections for attachment to the form sides so that the medial section of the tie rod spans the form and becomes embedded in the concrete which is poured between the form sides, thus leaving outwardly projecting tie rod end sections. Elongated sleeve cones surround such tie rod end sections and have their inner ends drivingly connected to the same at regions in the immediate vicinity of the tie rod breakbacks, and also have torque-application facilities at their exposed outer ends to that the manual application of torque to the sleeve cones will impart a radial tear or shear effect at the breakbacks to thus free the projecting tie rod end sections.

5 Claims, 13 Drawing Figures

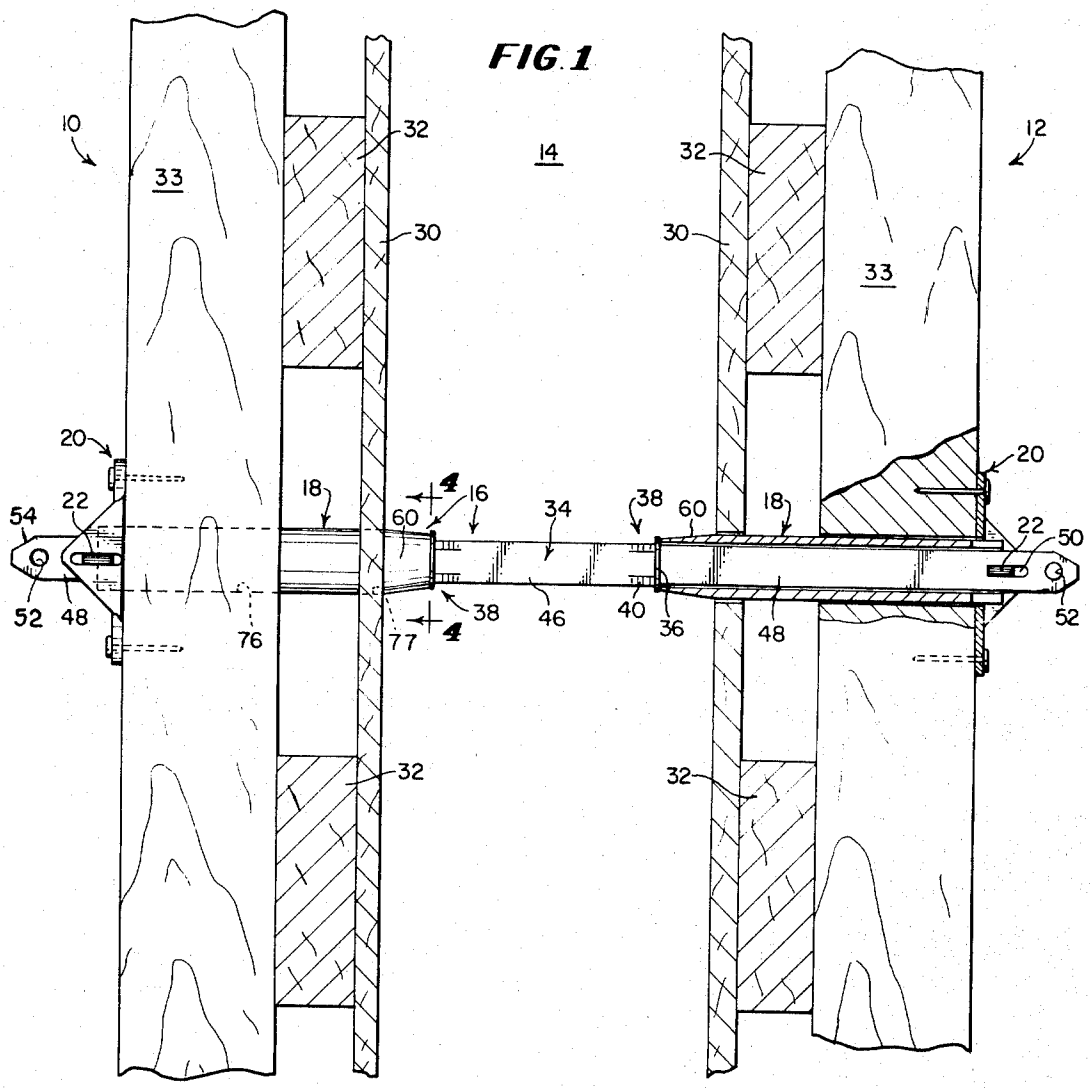


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SHEET 1 OF 4

FIG. 1

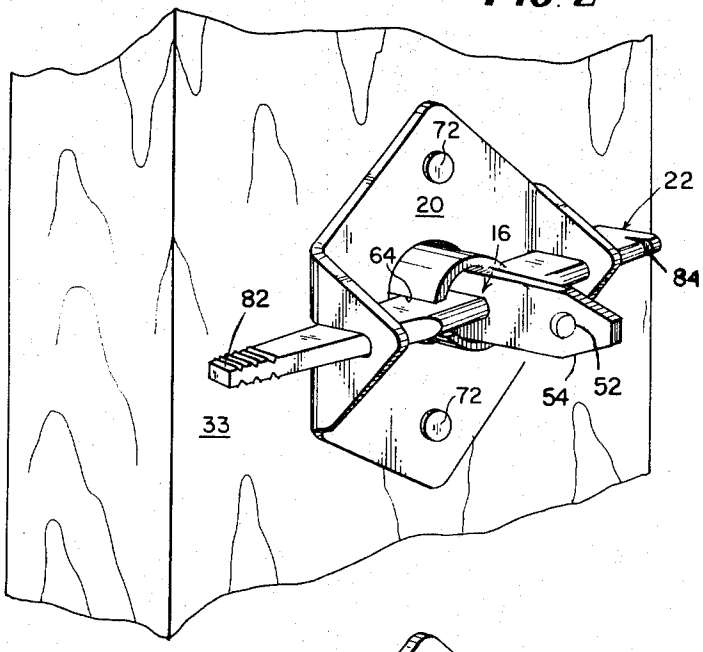


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FIG. 2



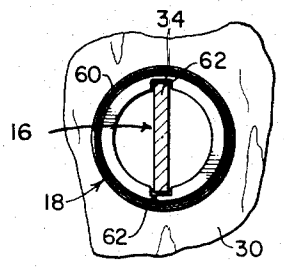
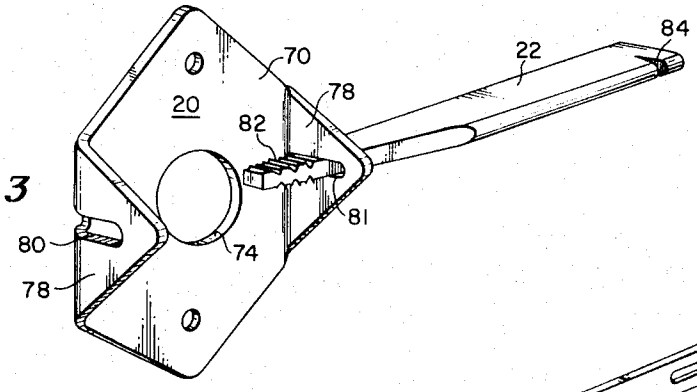


FIG. 4

FIG. 3



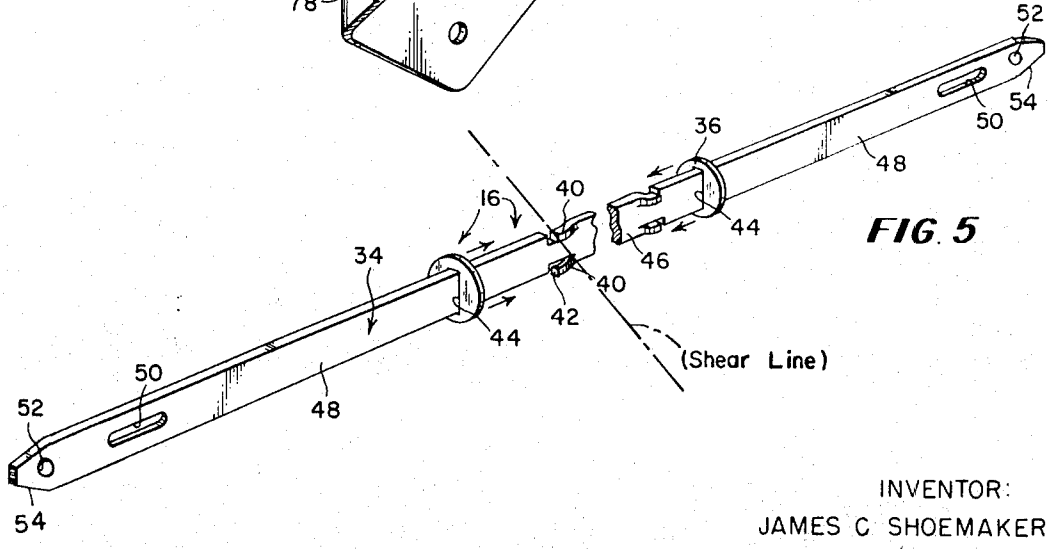


FIG. 5

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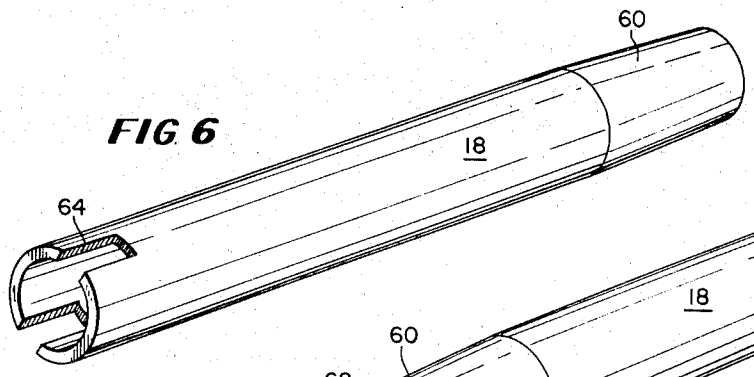


FIG. 6

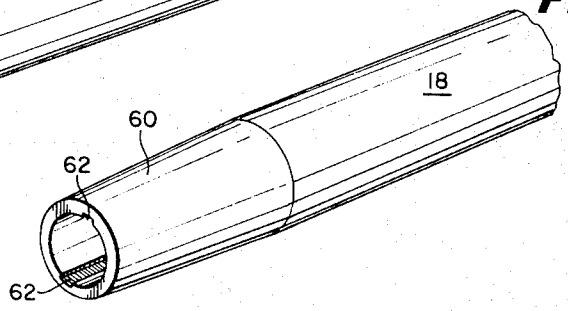


FIG. 7

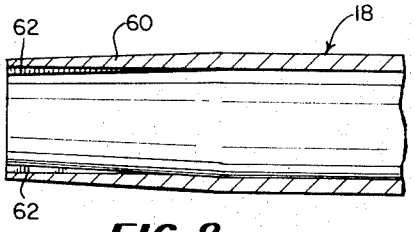


FIG. 8

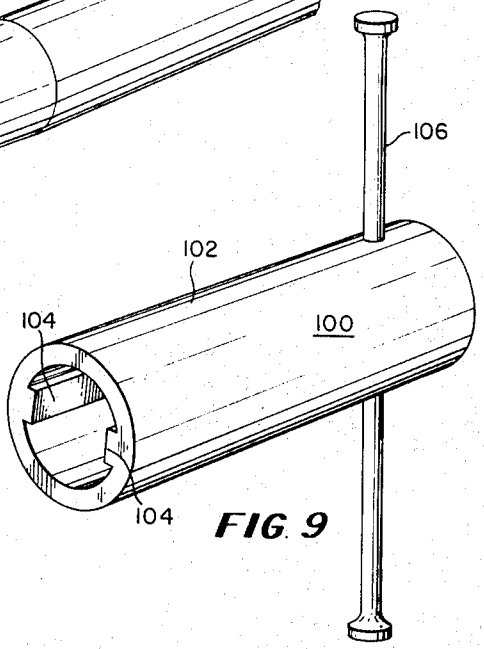


FIG. 9

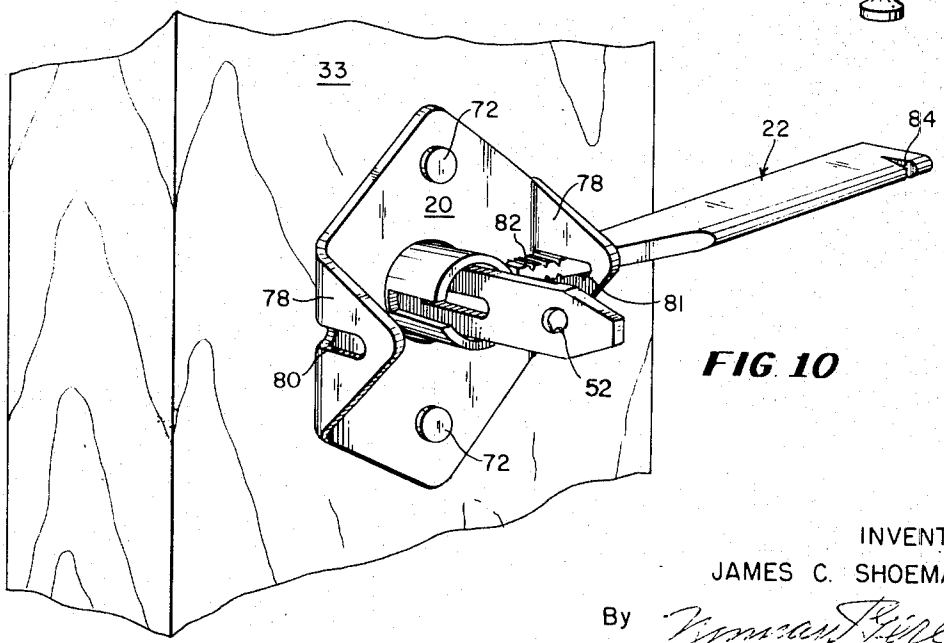


FIG. 10

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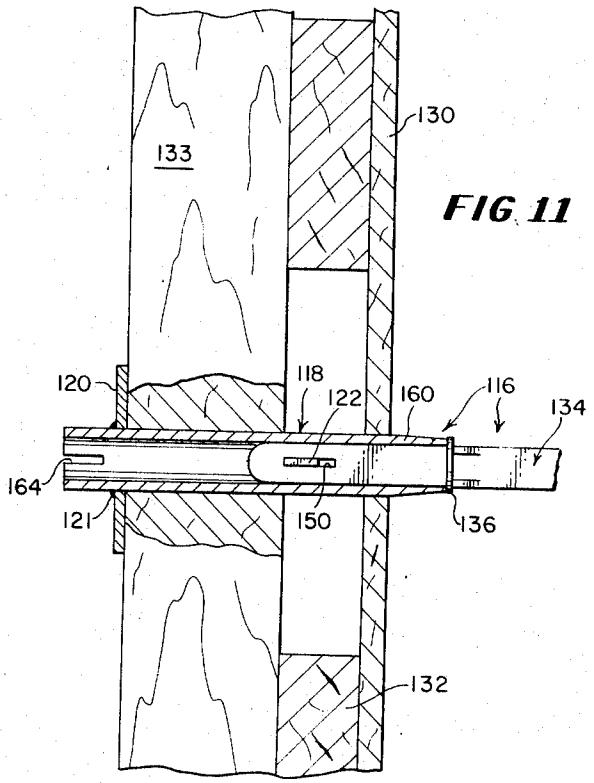


FIG. 11

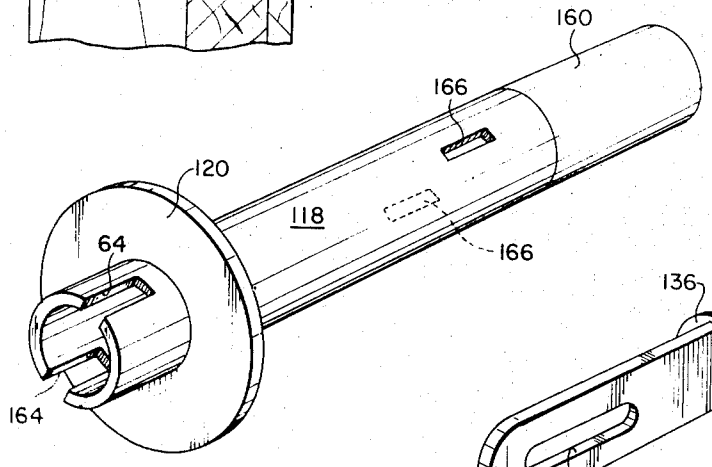


FIG. 12

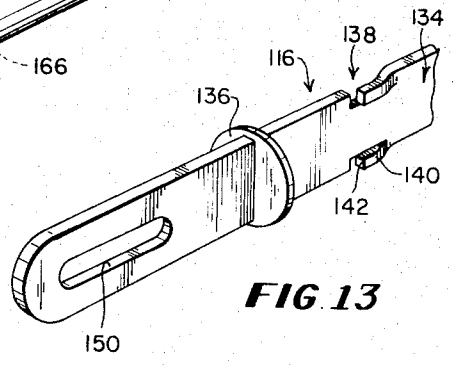


FIG. 13

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CONCRETE WALL FORM INSTALLATION WITH PARTICULAR TIE ROD SECURING MEANS THEREFOR

This patent application is a division of my copending patent application Ser. No. 802,109, filed on Feb. 25, 1969, now U.S. Pat. No. 3,625,470 and entitled "TIE ROD SECURING MEANS FOR A CONCRETE WALL FORM."

The present invention relates generally to securing means for concrete wall forms and has particular reference to a novel tie rod and fastening means therefor whereby the ends of the tie rod are releasably secured to the opposite sides of the associated concrete wall form so that the medial or intermediate portion of the tie rod extends transversely across the form and bridges the space into which wet concrete is poured and then permitted to harden. The invention is particularly concerned with a flat tie rod, as distinguished from a cylindrical tie rod, one example of a flat tie rod of the type with which the present invention is concerned being shown and described in U.S. Pat. No. 2,948,045, granted on Aug. 9, 1960 and entitled "TIE ROD ASSEMBLY FOR CONCRETE WALL FORMS AND CONE THEREFOR." Flat tie rods are widely used in concrete construction, particularly in connection with concrete wall forms which employ steel studded or reinforced plywood panels, but the present invention contemplates their use in connection with wooden wall form panels which are reinforced by 4 inches × 6 inches or other wooden strongbacks.

A flat tie rod for use in connection with a concrete wall form must satisfy a number of varied requirements. For one thing, it must space apart the sides of the form and hold them in properly aligned relationship while the concrete is poured between the form sides. It must also permit the sides of the form to be readily stripped from the wall after the concrete has hardened. In this connection, it is important that provision be made for readily severing the protruding ends of the tie rod which extend beyond the form sides from the intermediate tie rod portion which remains embedded in the wall after hardening of the concrete. At the same time, it is desirable that as large a portion of the concrete wall form hardware as possible be salvaged for reuse in a future wall form installation. In this connection, the tie rod must be strong enough to assimilate the large stresses which are imposed upon it during pouring of wet concrete into the space between the spaced apart sides of the associated concrete wall form. On the other hand, the tie rod itself should readily break off at the desired point or points and must not be weakened unduly at other points so that it will break at the wrong point or points. The tie rod and its hardware adjuncts should be simple and inexpensive to manufacture and also capable of ease of both assembly and dismantlement.

The present invention satisfies all of these requirements in a novel and effective way, particularly insofar as rupturing the tie rod at the desired breakback points is concerned. A flat tie rod of the character or type under consideration usually has its weakened regions or breakbacks located a sufficient distance from the tie rod ends so that the breakback points are disposed approximately 2 inches within the confines of the concrete wall, measuring from the side surfaces of the

wall. Devices which are commonly known as "cones" surround the tie rod in the vicinity of the breakbacks, and when extracted from the hardened concrete wall, leave small voids or sockets in the side surfaces of the concrete wall leading to the breakbacks. These voids afford clearance regions so that the protruding tie rod ends may be twisted or otherwise worked back and forth until the metal of the tie rod at the breakback points fails and thus releases the tie rod ends for removal from the wall-embedded intermediate portion of the tie rod. The voids are subsequently patched or filled with grout in order that the side surface of the concrete wall are smooth or continuous. Such working of the tie rod ends to release them from the embedded intermediate portion of the tie rod frequently entails considerable manipulation, especially because the application of force or torque to the tie rod at the extreme end regions thereof results in a diminution of this force as it is transmitted through the somewhat flexible tie rod ends to the desired weakened regions or breakback points. This is particularly true where comparatively long tie rod ends are concerned. With short tie rod ends, there is a commensurate reduction in leverage, making it difficult to effect tie rod rupture at the weakened regions or breakback points.

The present invention is directed primarily toward this matter of effecting tie rod rupture at the desired breakback points slightly within the side surfaces of the concrete wall and of permitting ready salvage of substantially all of the wall form hardware exclusive of the tie rod itself. As a matter of fact, the invention is admirably adapted for use in connection with gang form sections where large assembled sections of a concrete wall form installation are handled by an overhead hoist, and the invention, when applied to gang form sections, enables large pre-assembled gang form sections, together with their associated hardware, to be preserved for subsequent reuse intact, in which case there are no expendable items whatsoever other than the tie rods themselves. The invention is, however, by no means limited to use in connection with gang form sections.

The present invention is predicated upon a novel method of effecting tie rod rupture in the vicinity of the prelocated breakbacks by the positive application of torque to the protruding end portions of the flat tie rod in the immediate vicinity of the breakbacks instead of at regions remote from the breakbacks as has heretofore been the practice. Because the torque is applied to the tie rod end portions at the points where they are joined to the wall-embedded intermediate portion of the tie rod, i.e., within the confines of the concrete wall, the torque which is applied is a shearing torque as distinguished from a twisting torque and none of the applied torque is lost by reason of assimilated torsion in the tie rod end portions due to any resiliency which they may possess. To accomplish this, special elongated sleeve-type cones are provided and these sleeve cones substantially completely encompass the protruding tie rod end portions and project outwardly of the sides of the associated concrete wall form. The outer ends of the sleeve cones are thus accessible for the application of manual torque thereto and when such torque is applied to the sleeve cones which are of a rigid nature, it acts on the extreme inner ends of the protruding end

portions of the tie rod to which the inner ends of the sleeve cones are drivingly connected. The result of this is to impart the applied torque to the protruding tie rod end portions at or very close to the breakback points so that the hardened concrete functions as a shear element while the sleeve cones function as cooperating shear elements with the result that a radial shear is applied to the tie rod directly at the breakback points, much in the manner that a mechanic's socket wrench will shear the head from a bolt when too much torque is applied thereto in a tightening direction and the bolt shank is unyielding.

With many previously designed concrete wall forms of a similar nature to that of the present invention, it is necessary to strip the forms from the hardened concrete walls so as completely to expose the protruding end portions of the tie rods before they can be wrested from the wall-embedded intermediate tie rod portions by working them in various directions until tie rod rupture takes place at the breakback points. By the use of the present sleeve cones, shearing of the protruding tie rod end portions from the embedded intermediate portion of the tie rod is effected with the sides of the associated concrete wall form in situ, and the thus sheared tie rod end portions extracted endwise from their environs in the form sides, thus removing what has heretofore proven to be one of the greatest obstacles to easy concrete wall form stripping operations.

The provision of a tie rod and sleeve cone combination of the character briefly outlined above, and possessing the stated advantages, constitutes the principal object of the present invention. Additional objects and advantages of the invention, and relating to the manner of releasable attachment of the tie rod end portions to the concrete wall form sides to maintain the latter against outward spreading under the influence of the poured concrete or inward leaning prior to pouring of the wet concrete in the space between the concrete wall form sides, will become readily apparent as the nature of the invention is better understood.

The invention consists in the several novel features which are hereinafter set forth and are more particularly defined by the claims at the conclusion hereof.

In the accompanying four sheets of drawings forming a part of this specification, two illustrative embodiments of the invention are shown.

In these drawings:

FIG. 1 is a fragmentary sectional view taken transversely through an erected concrete wall form employing one form of the improved tie rod construction of the present invention, together with its associated adjuncts, certain parts being broken away in the interests of clarity;

FIG. 2 is a fragmentary outside perspective view of a limited portion of the concrete wall form in the vicinity of a protruding tie rod end portion;

FIG. 3 is a perspective view of a backing plate and its associated captured wedge bolt, these two parts constituting the securing means whereby the tie rod is connected to one of the two sides of the concrete wall form;

FIG. 4 is an enlarged vertical sectional view taken on the line 4—4 of FIG. 1;

FIG. 5 is a perspective view of the tie rod assembly which is employed in connection with the invention;

FIG. 6 is a perspective view of one of the sleeve cones which are employed in connection with the invention;

FIG. 7 is a fragmentary reverse perspective view of the sleeve cone of FIG. 6 and illustrating the nature of the inner end of such cone;

FIG. 8 is a sectional view taken on the inclined plane represented by the line 8—8 of FIG. 7 and in the direction of the arrows;

FIG. 9 is an outside perspective view similar to FIG. 2 but illustrating the manner in which the illustrated concrete wall form side is stripped from the hardened concrete wall;

FIG. 10 is a perspective view of a torque tool by means of which torque is applied to the sleeve cones for tie rod rupture purposes;

FIG. 11 is a fragmentary sectional view similar to FIG. 1, but showing another form of the tie rod construction of the present invention;

FIG. 12 is a fragmentary perspective view similar to FIG. 6 but showing the sleeve cone which is employed in connection with the form of the invention which is illustrated in FIG. 11; and

FIG. 13 is a fragmentary perspective view similar to FIG. 5 but showing the tie rod proper which is employed in connection with the form of the invention which is illustrated in FIG. 11.

Referring now to the drawings in detail and in particular to FIG. 1, the opposed, spaced apart sides 10 and 12 of a concrete wall form 14 are fragmentarily illustrated and are maintained in their spaced relationship by the securing means of the present invention, such securing means consisting essentially of a tie rod assembly 16, a pair of sleeve cones 18 with bracket-type backing plates 20 associated therewith, and a pair of wedge bolts 22. Only one such securing means is illustrated in FIG. 1 and the other views of the drawings, but it will be understood that additional securing means of a similar character will be employed at appropriate regions of the concrete wall form 14.

The wall form sides 10 and 12 are substantially identical insofar as the present disclosure is concerned and thy are of conventional construction except insofar as they have been modified to accommodate the particular securing means of the present invention. Each form side is made up of a number of side-by-side, rectangular panels 30 which may be made of plywood and are reinforced by horizontal members 32 which fit flatly against the outer faces of the panels in vertically spaced relationship, together with vertical load gathering strongbacks 33 which bear against the members 32 on the outer sides of the latter and are arranged in laterally spaced relation. The horizontal members 32 are preferably in the form of lengths of 2 inches × 6 inches lumber while the strongbacks are preferably in the form of lengths of 4 inches × 6 inches lumber, these horizontal and vertical members constituting a wooden frame or studding for the plywood panels 30. Only such portions of the form 10 as are pertinent to the present invention are illustrated in the drawings and it will be understood that the various panels 30 may be shouldered or provided with any suitable interlocking means, while the frame or studding may be braced and held in its proper vertical position in any suitable manner. If the portion of the form which is illustrated in FIG. 1 is regarded is being a fragment of a gang form, it

will be understood that the various gang sections may be interconnected by conventional fastening devices (not shown) which are totally unrelated to the present invention.

The tie rod assembly **16** is best illustrated in FIGS. **1** and **5** and comprises a tie rod proper **34** (hereinafter referred to simply as the tie rod), together with a pair of grout seal washers **36**. The tie rod proper **34** is in the form of a length of flat metal stock having breakbacks **38** in the form of pairs of small metal tongues **40**. The latter are cut and bent out of the general plane of the tie rod and present outwardly facing abutment surfaces **42** against which the washers **36** are adapted to bear when the tie rod is operatively installed in the concrete wall form **14**. The two washers **36** are of circular disk-like construction and embody in their central portions slots **44** for telescopic sliding reception over the tie rod.

It will be observed that the breakbacks **38** are spaced predetermined distances from the end extremities of the tie rod **34** and divide the tie rod into three portions or sections, namely, an intermediate or medial section **46**, and two end sections **48**. The medial section **46**, except for the outstruck tongues **40**, is flat and imperforate and is adapted to remain embedded in the hardened concrete which constitutes the finished wall, while the end sections **48** of the tie rod **34** protrude from the opposite side surfaces of the wall after the form sides **10** and **12** have been stripped therefrom. These protruding end sections **48** are adapted to be sheared from the medial section **46** of the tie rod **34** by a special shearing action which is made possible by the present invention and the nature of which will be set forth in detail presently. The tie rod **34** further embodies a pair of longitudinally extending slots **50** at the outer end regions of the end sections **48** for cooperation with the wedge bolts **22**. Small circular holes **52** are provided in the tie rods **34** near the outer ends thereof and the two extreme outer ends of the tie rods are tapered as indicated at **54**, the holes and tapered ends serving to effect tie rod guiding and tie rod extraction functions which will be described in greater detail subsequently.

Each sleeve cone **18** is in the form of a length of steel tubing and has its inner end (see FIG. **1**) of slightly tapered configuration as indicated at **60** (see also FIG. **7**). The inside diameter of each sleeve cone **18**, except in the tapered inner end region **60**, is slightly greater than the transverse width of the flat tie rod **34**. The tapered end regions **60** of the sleeve cones are internally ground or splined as indicated at **62** in FIGS. **4**, **7** and **8** in order to admit the opposite longitudinal or side edges of the tie rod **34** when the associated end portions **48** are projected through the cones. This projection of the end portions **48** of the tie rod through the sleeve cones **18** is illustrated in FIG. **1** wherein the tie rod edges are shown as being disposed in the opposed longitudinal grooves **62** in the tapered inner end regions **60** of the sleeve cones while the major portion of the end sections **48** project loosely through the cones with the pry heads **52** being disposed exteriorly of the cones. The outer end of each sleeve cone **18** is formed with a pair of diametrically disposed notches **64** and these serve the dual purpose of affording clearance spaces for the associated wedge bolt **22** as will be described presently, and also receiving the application of torque which is applied thereto by a torque tool such as is shown in FIG. **10** for tie rod fracturing purposes as also will be described presently.

It will be understood that the term "cone" with reference to each elongated sleeve-like member **18** does not represent a geometrical definition of the member. Rather, it represents a designation which has long been applied to any socket-forming member which surrounds an end portion of a tie rod and establishes a socket-like void in the adjacent surface of the completed concrete wall for allowing freedom of twisting or swinging movement of the protruding tie rod end so that this protruding end may be worked loose fractured from the embedded medial portion or section of the tie rod. Conventional cones for this purpose usually are of true frusto-conical configuration and they are made of wood or plastic material. However, a large number of special cones which do not present frusto-conical surfaces are referred to as "-cones" as evidenced by aforementioned U.S. Pat. No. 2,948,045. The present sleeve cones **18** do, however, exhibit frusto-conical surfaces in their inner end regions **60** for the production of frusto-conical sockets in the side surfaces of the hardened concrete wall which is formed by way of the form **14**. The cones **18** of the present invention also have a further function in that they transmit torque to the tie rod for fracture purposes as previously described.

The previously described backing plates **20** are provided for the purpose of affording reaction anchor means for connection of the tie rod end sections **48** to the two form sides **10** and **12**. As clearly shown in FIGS. **2** and **3**, each bracket-type backing plate is in the form of a plate metal stamping having a flat rectangular plate portion **70** which is secured by fastening devices **72** to the outer side of the adjacent strongback **33**, preferably at a region where the strongback spans the distance between a pair of adjacent horizontal members **32**. The plate portion **70** of each backing plate is arranged so that two opposed corner portions are at the top and bottom and the other two opposed corner portions are at its sides, and it is provided with a central circular hole **74** which registers with a preformed bore or hole **76** in the adjacent strongback **33**, as well as a hole **77** which is preformed in the adjacent panel **30**. The side corner portions of the plate portion **70** are turned laterally outwardly of the form to provide a pair of spaced apart triangular attachment ears **78**. The latter have horizontal slots **80** and **81** which register horizontally with the notches **64** in the outer end of the adjacent sleeve cone **18** and also with the adjacent outer slot **50** in the adjacent end section **48** of the tie rod **34**. The wedge bolts **22** pass through all of these registering slots and notches (see FIG. **2**) and serve securely to connect the end sections of the tie rod to the form sides **10** and **12**. The wedge bolts **22** are generally of tapered configuration, and when driven into position through the slots **80** and **81**, the notches **64**, and the slots **50**, hold the tie rod **34** against endwise movement with respect to the bracket-type backing plates **20**. The notches **64** in the outer ends of the sleeve cones **18** afford clearances for passage of the wedge bolts **22** through the slots **50**, **80** and **81** and their primary purpose is one of torque application during form-stripping operations as previously indicated.

Reference to FIG. 3 will reveal the fact that each backing plate 20 and the associated wedge bolt 22 constitute an inseparable two-part assembly wherein the wedge bolt is captured and retained at all times in connected relation with the backing plate. Enlargements 82 on the small ends of the wedge bolts 22 may be formed by a swaging operation and permit such ends of the bolts to pass freely through the slots 80 but not through the slots 81 which are of smaller dimensions in a transverse direction than the slots 80. Similarly, swaged or punched enlargements 84 at the large ends of the wedge bolts 22 prevent such ends from passing inwards through the slots 81.

If it is assumed that the form sides 10 and 12 are gang form sections, it will be understood that the various bracket-type backing plates 20 will be permanently applied to the adjacent strongbacks 33 at the proper locations and with their central holes 74 in registry with the holes 76 in the strongbacks and the holes 77 on the panels 30. After a given pair of opposed gang form sections have been set up as components of the two form sides 10 and 12 as shown in FIG. 1, a tie rod assembly 16 may be applied to the form 14 by first telescoping one of the two sleeve cones 18 over one end section 48 of the tie rod 34 so that the adjacent loose washer 36 is forced toward the abutment surfaces 42 (see FIG. 5) on the adjacent pair of outstruck tongues 40. With one sleeve cone 18, say, for example, the right-hand sleeve cone as viewed in FIG. 1, thus assembled on the right-hand end section of the tie rod 34, the outer end region of the left-hand end section 48 is inserted through the central hole 74 in the right-hand backing plate 20 which is attached to the form side 12 and then the rod assembly 16 is initially shifted or pushed bodily to the left so as to cause the left-hand end section 48 of the tie rod 34 to pass through the hole 76 in the right-hand strongback 33 and the right-hand panel 30. When the left-hand end section of the tie rod approaches the hole 77 in the panel 30 of the form side 10, the left-hand tapered end portion 54 of the tie rod 34 facilitates so-called "fishing" to effect initial entry of the tie rod into the panel 30 for projection therethrough. When said hole has been located, the tie rod is then shifted or pushed further to the left as viewed in FIG. 1 so that the applied right-hand sleeve cone follows or passes through the three holes 74, 76 and 77 in the form side 12, while the left-hand end section 84 of the tie rod 34 is caused to project through the holes 77, 76 and 74 in the form side 10 in the order named. With the tie rod 34 in this position, the other sleeve cone 18 is then telescoped over the left-hand tie rod section 48 (now in position within the form side 10) and the three parts or elements 18, 18, 34 assume the positions in which they are shown in FIG. 1 with the notched outer ends of the sleeve cones 18 being exposed within the confines of the two backing plates 20 as shown in FIG. 9, and with the outer extremities of the tie rod 34 projecting outwardly beyond the outer ends of the sleeve cones.

It is to be noted from an inspection of FIG. 10 that at this time the wedge bolts 22 are maintained in an out-of-the-way position at one side of the backing plates 20. As soon as the tie rod 38 and the two sleeve cones 18 have been manipulated, the wedge bolts 22 are slid in the proper direction in order that they project through the slots 50 in the end sections 48 of the tie rod 34, the ends thereof are confined in the slots 80 and 81, the notches 64 in the outer ends of the sleeve cones 18 affording clearance for the wedge bolts so that they may thus be slid into its locking position (see FIG. 2). When both of the wedge bolts 22 are in place, the tie rod 34 will be firmly secured to the opposed sides 10 and 12 of the form 14 and said sides will be held in their proper vertical spaced apart position, while at the same time the washers 36 will close the adjacent ends of the sleeve cones 18 for grout-sealing purposes.

With the parts in position just described, erection of the concrete wall form 14 is complete insofar as the present tie rod securing means is concerned, it being understood, of course, that ancillary form bracing and securing means such as panel interlocking and bracing devices will be properly applied to the form in accordance with known form erection procedures. At this time, wet concrete may be poured between the two form sides 10 and 11 and allowed to harden, thus embedding the medial section 46 of the tie rod 34, the two washers 36 and the inwardly projecting frusto-conical end portions 60 of the two sleeve cones 18.

After the poured concrete has hardened or set, stripping of the forms is accomplished by knocking the wedge bolts 22 to their out-of-the-way positions wherein they are withdrawn from the slots 80 and 50 and the notches 64 (see FIG. 2), thus freeing the tie rod end sections 48 which protrude outwardly from the side surfaces of the hardened concrete wall, so that they are not restrained from the rotative effect of the torsional force which is necessary, and which subsequently is applied thereto, for tie rod fracture purposes.

Whereas, in connection with conventional concrete wall form stripping operations, it has been the necessary practice to remove the gang form sections from the hardened concrete wall at this point, so as to afford the necessary clearance for working the tie rod end sections back and forth, for twisting them, or otherwise causing their rupture from the embedded medial section of the tie rod, the present invention makes it possible to rupture the end sections 48 at the regions of the breakbacks 38 with the gang form sections remaining in place on the wall. Accordingly, with the various parts of the securing means assuming the positions in which they are illustrated in FIG. 9 on both sides of the form 14, a torque tool 100 such as is shown in FIG. 10 is employed for rotating or turning the tie rod end sections 48 in either direction for tie rod fracture purposes. The tool 100 comprises a cylindrical tubular body 102 having opposed or diametrically opposite internal ribs 104. When the body 102 is telescopically received over the notched outer end of either sleeve cone 18, these ribs 104 will enter the notches 64 and interlock therewith. The radial extent or thickness of the ribs 104 of the tool 100 is such that the ribs project radially inwardly through the notches 64 but do not necessarily engage the adjacent tie rod end section 48. A handle 106 on the body 102 enables good leverage to be applied to the tool for sleeve cone turning purposes.

It is to be noted at this point that upon rotation of either sleeve cone 18 in one direction or the other, the driving connection between the cone and the adjacent end section 48 of the tie rod, that is, the connection that is established by the internal grooves 62 (see FIG.

8) and the longitudinal or side edges of the tie rod, serves to effect a sharp and definite shear of the tie rod directly at the breakback **38**, the shear taking place along a transverse line which is shown in broken lines in FIG. **5** and labelled "shear line." In effecting this shear, the bottom wall of the wall socket which is created by the projection of the frusto-conical inner end **60** of the sleeve cone **18**, in combination with the lateral edges of the grooves **62**, cooperate with each other and, in effect, provide relatively rotatable sharp shear edges which sever the tie rod end section **48** from the medial section **46** directly at the breakback **38**. In this manner, there are no torsional forces which must be assimilated by the body of the tie rod before the desired tie rod rupture or fracture takes place. The involved action is a true shearing action whereas with conventional tie rods there are no positive shear edges and the fracture takes place only as a result of a twisting of the rod beyond the amount of twisting which it will withstand.

After the end section **48** of the tie rod **34** have been sheared loose from the concrete-embedded section **46**, these loosened end sections will be contained within the surrounding sleeve cone **18** by means of which the shearing thereof was effected. When a given sleeve cone is pulled from the form side within which it was installed, the fractured end section will remain within the cone with its outer end protruding from the slotted end of the cone. Frequently, the end section of the tie rod will remain fast within the cone due to grout seepage and hardening of the grout. Extraction of the thus captured and confined tie rod end section **48** from the interior of the sleeve cone **18** ordinarily can be effected by thrusting the protruding portion of the end section hard against a suitable reaction surface of object, the impact serving to loosen the end section **48** from its bond within the sleeve cone. Invariably this will serve to drive the end section further into the sleeve cone and project the other end outwardly therefrom where it may be manually engaged so that the end section can be easily pulled axially from the cone. Occasionally, however, repeated impact on the end section **48**, first on one end and then on the other, will fail to loosen the same sufficiently that manual force can remove it. In such an instance, a nail or other object may be passed through the small hole **52** in the end of the tie rod end section **48** so that a greater leverage may be attained for pulling purposes. Rarely is it necessary to drive the captured tie rod end section from its surrounding sleeve cone by forcing the same endwise from the cone with another length of tie rod stock.

When all of the tie rod end sections **48** have thus been removed, the entire gang section on each side of the form is completely free from the hardened concrete wall and may be hoisted from the installation. These gang sections with their attached backing plates **20** remain intact for subsequent reuse in a successive installation.

In FIGS. **11**, **12** and **13**, a modified form of tie rod construction or assembly embodying the principles of the present invention is shown. In FIG. **11**, this modified form of tie rod assembly is shown as being operatively installed in a concrete wall form of the type which is shown in FIG. **1** and, therefore, in order to avoid needless repetition of description, similar reference numerals but of a higher order have been applied to the corresponding parts as between the disclosures of FIGS. **11**, **12** and **13** and FIGS. **1**, **6** and **5**.

In the form of the invention which is shown in FIGS. **11**, **12** and **13**, in order to obtain a positive spreading action on the two form sides, the use of the outside brackets **20** has been eliminated while the sleeve cones **118** and the tie rod assembly **116** have been modified so that they cooperate with one another to produce this spreading effect. In FIG. **11**, only one side of the concrete wall form is shown, together with the particular end region of the tie rod proper **134** which is associated therewith. It will be understood, however, that the tie rod proper **134** is symmetrical in that both end regions thereof are identical and cooperate with their respective wall form sides in an identical manner.

The tie rod **134** is somewhat shorter than the tie rod **34** so that, in the illustration of FIG. **11**, its outer end falls within the longitudinal confines of the sleeve cone **118**. A short distance inwards from each end of the tie rod **134**, a slot **150** is provided for reception of a transversely extending wedge bolt **122** which also passes through a pair of diametrically opposed slots **166** in the sleeve cone **118**. The slot **150** in the tie rod **134** and the slots **166** in the sleeve cone **118** are so disposed that the wedge bolt **122** which passes through these slots may bear outwardly against the inside face of the adjacent vertical strongback **133**. A load-gathering reaction washer or disk **120** is welded as indicated at **121** to the sleeve cone **118** a slight distance inwardly from its outer rim or end and bears against the outside face of the strongback **133**, thus locating the slots **166** so that they fall in the vicinity of the inside face of the strongback. Otherwise, both the sleeve cone **118** and the tie rod assembly **116** remain substantially the same as the cone **18** and tie rod assembly **16** of the form of the invention which is shown in FIGS. **1**, **5**, **6**, **7** and **8**.

The application of one of the tie rod and cone assemblies **116**, **118** to the concrete wall form is similar to that of the tie rod and cone assembly **16**, **18** of the previously described form of the invention. The application is made by first telescoping one of the two sleeve cones **118** over one end section **134** of the tie rod so that the adjacent loose washer **136** is forced toward the abutment surfaces **142** on the adjacent outstruck tongues **140**, after which the assembly is projected through the hole **176** in the strongback **133** and then through the hole **177** in the concrete wall form panel **130** as heretofore described in connection with the tie rod and cone assembly of FIG. **1**. As soon as the slots **166** in the sleeve cone **118** and the slot **150** in the tie rod **134** become available on the inner side of the vertical strongback **133**, the wedge bolt **122** may be inserted therethrough and driven into its wedging position, thus binding the strongback between the washer or disk **120** and wedge bolt **122** so that the load exerted by the concrete which is subsequently to be poured is transferred from the front face of the strongback **133** to the disk **120** and from thence through the sleeve cone **118** and the wedge bolt **122** to the tie rod.

Stripping of the form is accomplished by removing the wedge bolt **122** and applying the torque tool **100** to the exposed outer end region of the sleeve cone **118** in the manner previously described, the inwardly projecting ribs **104** of the tool cooperating with the slots **164** in the extreme outer end of the sleeve cone **118** and the

cone serving to transfer the applied torque directly to the region of the breakback **138**. After the tie rod **134** has been thus severed, the form sides are free for removal from the hardened concrete.

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, whereas the longitudinal grooves **62** and **162** at the tapered inner ends **60** of the sleeve cones **18** and **118** are shown as extending only through the tapered inner ends of the cones, it is within the purview of the invention to effect a driving connection between the cones and tie rod at regions further removed from the breakbacks **38** and **138** if desired. Furthermore, although the invention is shown in connection with wall form sections having vertical load gathering members through which the tie rod and cones project, it is obvious that the tie rod and its adjuncts may be projected through any appropriate portion of the panel studding or reinforcement. Still further, in connection with the form of the invention shown in FIG. **1**, the use of backing plates **20** precisely as shaped herein is not essential since other backing plates or attachment brackets may be devised which will serve the functions of fixedly connecting the end sections of the tie rod to the wooden or other studding during concrete pouring operations and of affording a quick release of the tie rod end sections after the concrete has hardened and it is desired to strip the form from the hardened concrete wall. Finally, it is within the purview of the invention to apply the principles thereof to the fracturing of a cylindrical tie rod at its breakback regions, the only criterion being the provision of sleeve cones which present inner ends capable of drivingly engaging the protruding end sections of the tie rod at or near the breakback points, and presenting outer ends which are exposed for torque-application purposes. Therefore, only insofar as the invention is particularly 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 concrete wall form installation comprising, in combination, a form embodying a pair of opposed, vertically disposed, spaced apart sides between which wet concrete is adapted to be poured, each form side including an inside panel and outside panel-reinforcing members, and securing means adapted to maintain said form sides in spaced apart relationship and consisting of an elongated flat tie rod formed of flat metal stock, extending horizontally between and through said form sides, and having breakbacks disposed directly inwards of the inside faces of the panels of the form sides and dividing the tie rod into a medial section for embedment in the poured concrete and end sections which project outwardly through and beyond the form sides, a rigid, open-ended, tubular, torque-transmitting sleeve cone slidably and telescopically received over each end section of the tie rod, and extending outwards from the adjacent breakback through and beyond the associated form side, the wall of each tubular sleeve cone being substantially of uniform radial thickness throughout its entire length and the inner region of said sleeve cone being tapered so as to present a frusto-conical inner end region of small slant angle, each tapered inner end region being formed with a pair of diametrically opposite, longitudinally extending, internal spline grooves which are coextensive therewith, have the bottom walls thereof forming extensions of the inside cylindrical surface of the wall of the medial portion of the sleeve cone, are arranged so that they receive therein the opposite longitudinal edges of the adjacent tie rod end section and, in combination with said longitudinal edges, serve to establish a driving connection between the sleeve cone and said adjacent tie rod end section when torque is applied to said sleeve cone in order to effect severance of said adjacent end section of the tie rod from the medial section of the tie rod, and releasable means for fixedly securing the tie rod end sections to the reinforcing members of the form sides.

2. A concrete wall form installation as set forth in claim **1** and wherein the outer regions of the end sections of the tie rod have longitudinal slots directly outwards of the outside faces of the reinforcing members of the form sides, the outer open rims of the sleeve cones have pairs of diametrically opposite notches in register with said slots in the outer regions of the tie rod end sections for torque tool-receiving purposes, and the means for releasably securing the tie rod end sections to the reinforcing members of the form sides consists of (a) backing plates which are attached to the outside faces of the reinforcing members, have central holes through which the outer end regions of the end sections of the tie rods extend, and are provided at the side portions thereof with pairs of outwardly extending, spaced apart ears having formed therein slots disposed in register with the aforementioned notches, and (b) wedge bolts which extend through the slots in the outer regions of the tie rod end sections, the notches in the outer open rims of the sleeve cones, and the slots in the ears of said backing plates.

3. A concrete wall form installation as set forth in claim **2** and wherein the slots in the ears of the backing plates are of different width and the wedge bolts have a certain of their ends enlargements which are incapable of passing through the narrower ones of the last-mentioned slots in order that the wedge bolts are captured by the backing plates.

4. A concrete wall form installation as set forth in claim **1** and wherein the end sections of the tie rod have formed therein longitudinal slots adjacent to the inside faces of the outside reinforcing members of the form sides, the medial portions of the sleeve cones have formed therein pairs of diametrically opposite, longitudinally extending slots in register with the slots in the tie rod end sections, and the means for releasably securing the tie rod end sections to the reinforcing members of the form sides consist of (a) reaction disks mounted on and fixedly connected to the outer end regions of the sleeve cones and engaging the outside faces of said reinforcing members, and (b) wedges extending through the registering slots in the tie rod end sections and the medial portions of the sleeve cones and engaging the inside faces of the reinforcing members of the form sides.

5. A concrete wall form installation as set forth in claim **4** and wherein the outer open rims of the sleeve cones have pairs of diametrically opposite notches for torque tool-receiving purposes.

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