# United States Patent

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[54] **TIE ROD SECURING MEANS FOR A CONCRETE WALL FORM**
**5 Claims, 13 Drawing Figs.**


[52] **U.S. Cl.** ..... **249/214,** 25/131 T, 249/41, 249/43
[51] **Int. Cl.** ..... **E04g 17/10**
[50] **Field of Search** ..... 25/131 T; 249/41, 43, 46, 214, 40, 190



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**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 so 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.

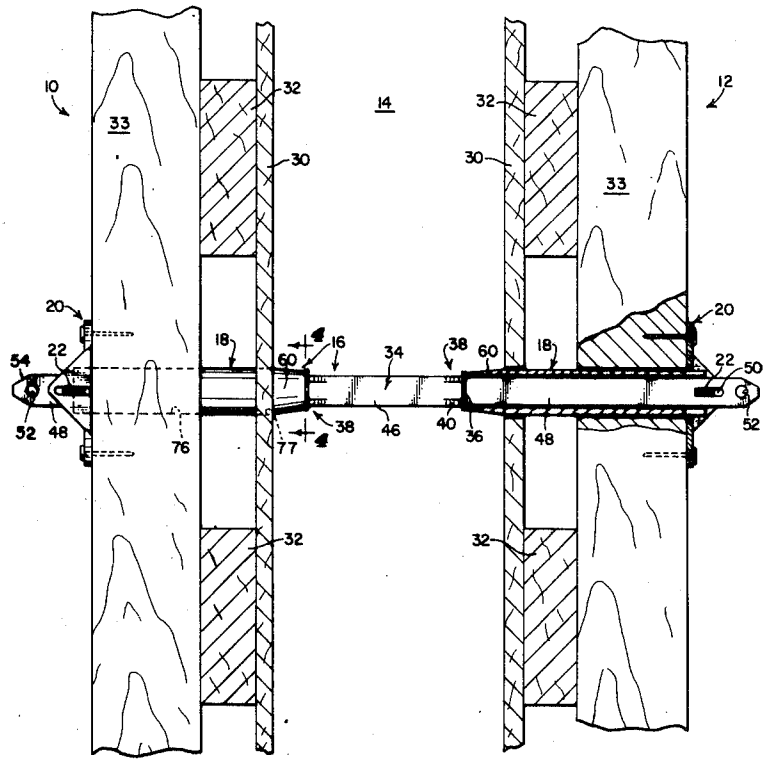
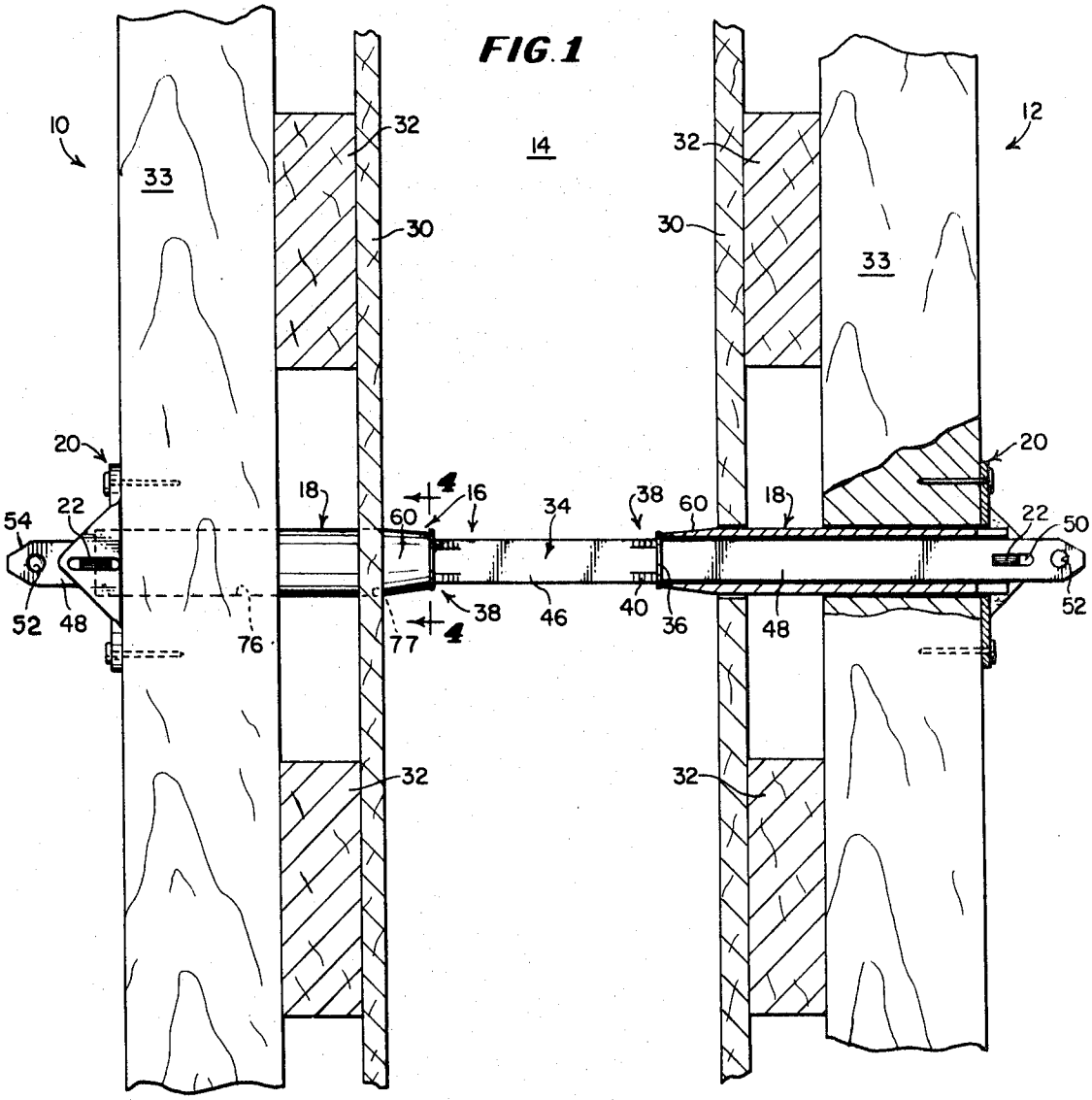
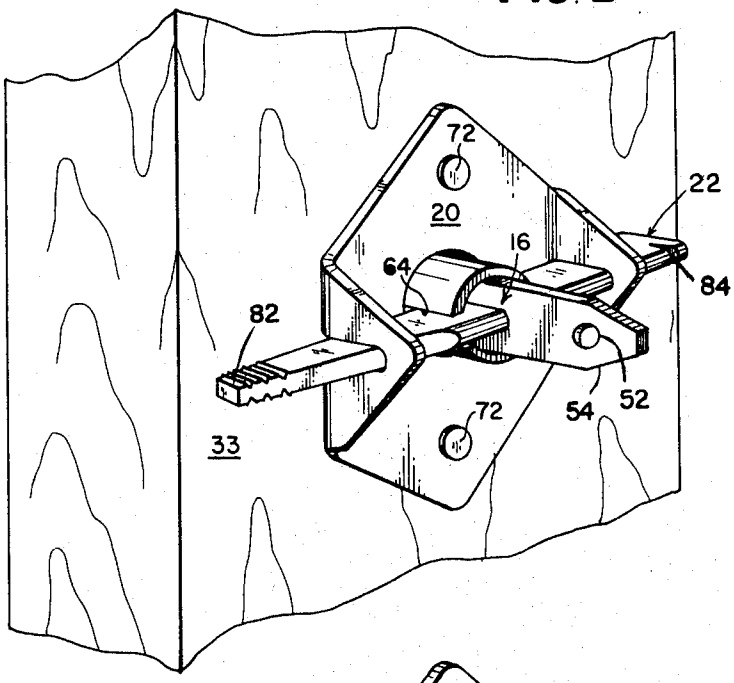



FIG. 1




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FIG. 2



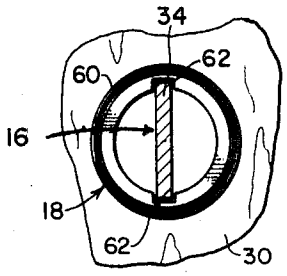




FIG. 4

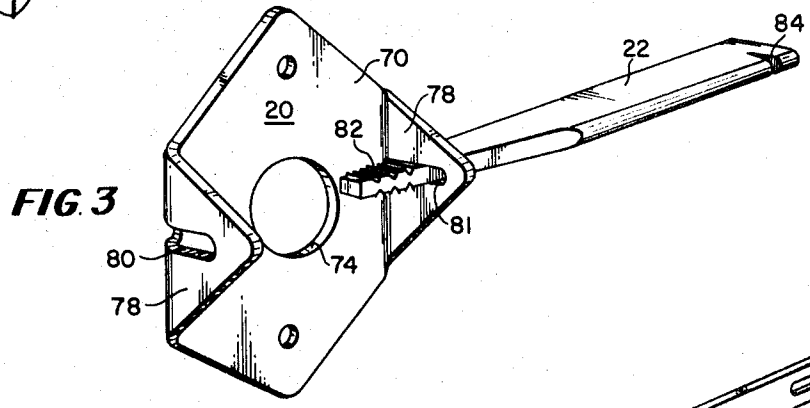



FIG. 3

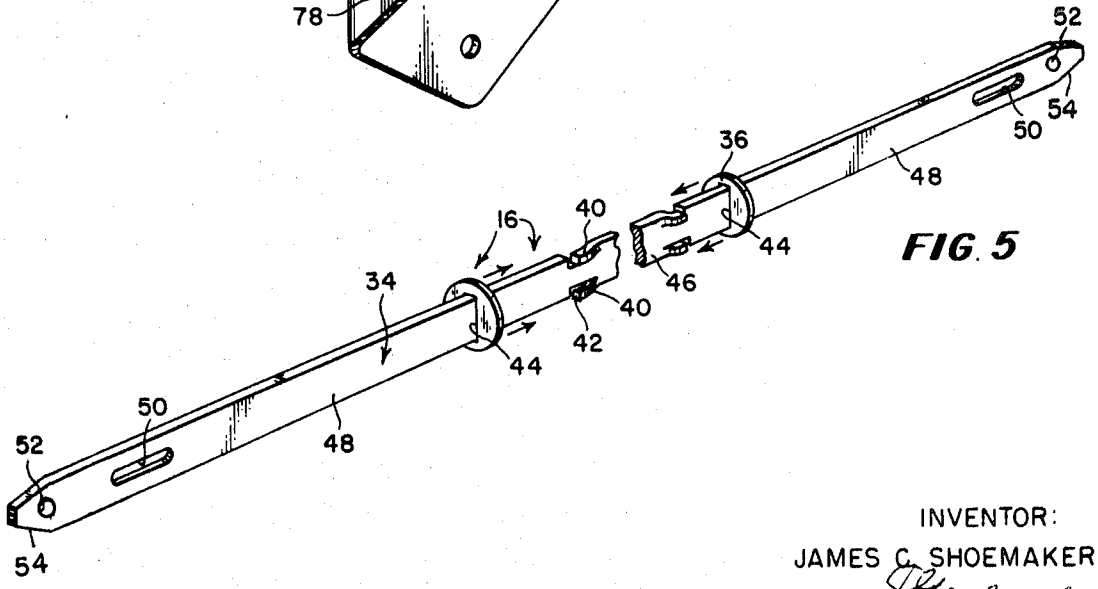



FIG. 5

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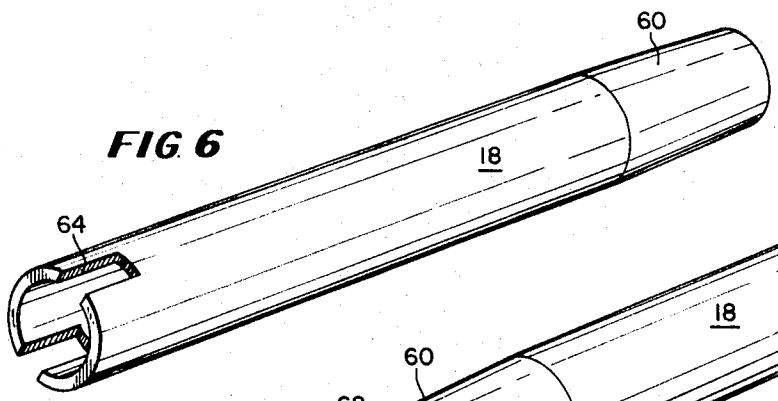



FIG. 6

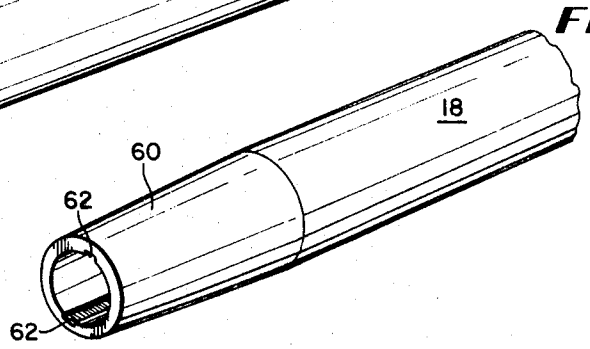



FIG. 7

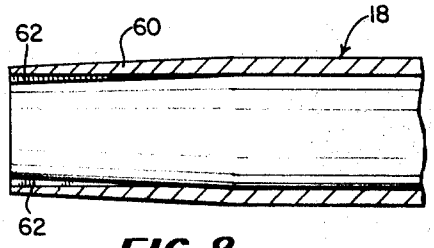



FIG. 8

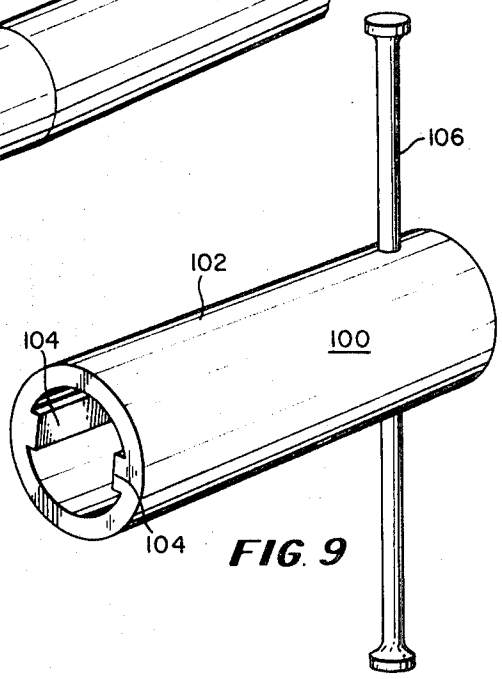



FIG. 9

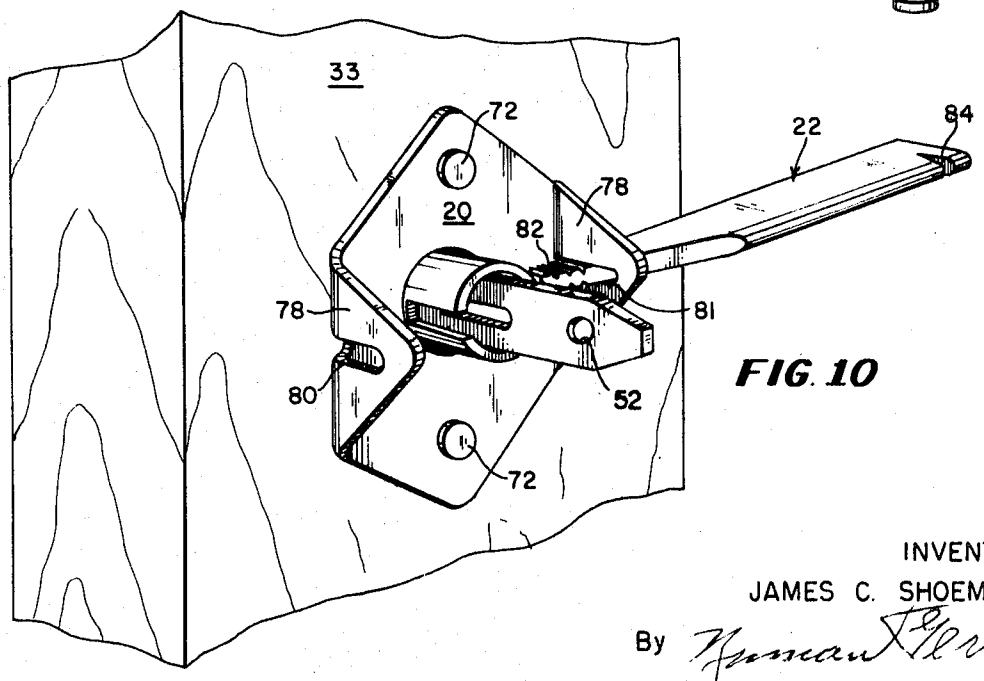



FIG. 10

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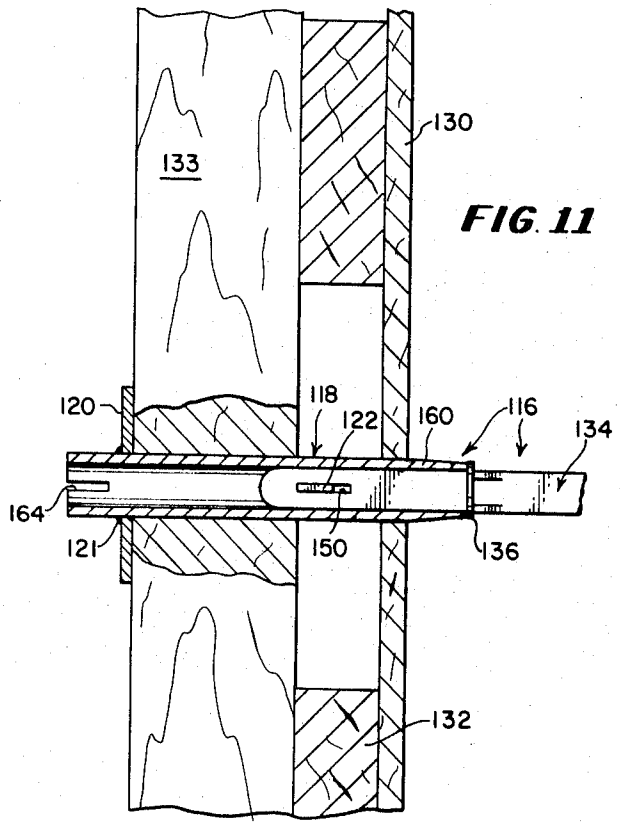



FIG. 11

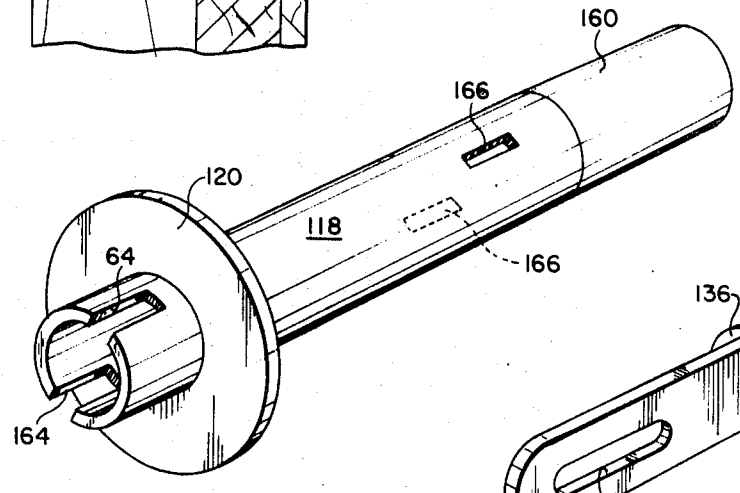



FIG. 12

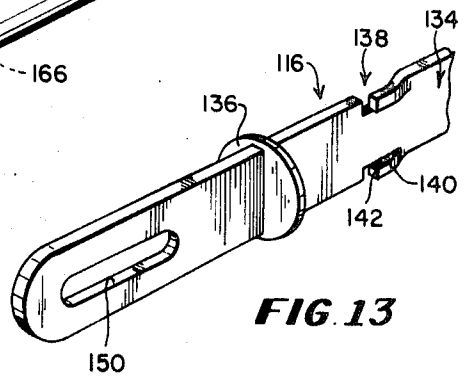



FIG. 13

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# 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"×6" 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 preassembled 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 longitudinal sectional view of the sleeve cone of FIG. 7;

FIG. 9 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. 10 is an outside perspective view similar to FIG. 2 but illustrating the manner in which the associated concrete wall form side is stripped from the hardened concrete wall;

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 they 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 flat 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"×6 lumber while the strongbacks are preferably in the form of lengths of 4"×6" 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 as 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 disklike 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 paid 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 rod **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 grooved 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 side 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 holes **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. **9** for tie rod fracturing purposes as also will be described presently.

It will be understood that the term "cone" with reference to each elongated sleevelike 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 socketlike 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 frustoconical configuration and are made of wood or plastic material. However, a large number of special cones which do not present frustoconical 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 frustoconical surfaces in their inner end regions 60 for the production of frustoconical 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 swagging operation and permit such ends of the bolts to pass freely through the slots 81 but not through the slots 80 which are of smaller dimensions in a transverse direction than the slots 81. Similarly, swaged or punched enlargements 84 at the large ends of the wedge bolts 22 prevent such ends from passing inwards through the slots 80.

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 has 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 48 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. 10, 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 34 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 their 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 the 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 frustoconical 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 the, 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. 9 is employed for rotating or turning the tie rod end sections 48 in either direction for tie rod fracture purposes. The tool 100 comprised 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 labeled "shear line." In effecting this shear, the bottom wall of the wall socket which is created by the projection of the frustoconical 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 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 sections 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 or 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.

I claim:

1. Securing means for the opposed sides of a concrete wall form and comprising an elongated narrow flat tie rod of uniform width and having breakbacks adapted to lie inwardly from the inside faces of the form sides and dividing the tie rod into a medial section for fixed embedment in the hardened concrete, and end sections adapted to project outwardly through holes which are provided in the form sides, a rigid open-ended tubular torque-transmitting sleeve cone slidably and telescopically receivable over each end section and when fully received thereon extending outwards from the adjacent breakback, the wall of said tubular sleeve cone being substantially of uniform radial thickness throughout its entire length and the inner end region of such sleeve cone being tapered so as to present a frustoconical inner end region of small slant angle, each tapered inner end region being formed with a pair of diametrically disposed longitudinally extending spline grooves which are coextensive with the length of the associated inner end region and the bottom walls of which, in effect, constitute extensions of the inside cylindrical surface of the wall of said sleeve cone, said spline grooves serving to receive therein the opposite longitudinal edges of the tie rod, each tie rod end section being formed with a slot therein for reception of a wedge bolt which engages an exterior surface of the adjacent form side, and means on the outer end of each sleeve cone for facilitating the application of torque to the sleeve cone, said diametrically disposed spline grooves, in combination with the adjacent longitudinal edges of the tie rod, serving to establish a driving connection between the sleeve cone and the adjacent end section when torque is applied to said sleeve cone in order to effect severance of said end section from the medial section of the tie rod.

2. Securing means as set forth in claim 1 and wherein the exposed outer end region of each end section of the tie rod projects outwardly beyond the outer end of the associated sleeve cone when the latter is fully received over such end section and is provided with an opening therein which is disposed exteriorly of the associated sleeve cone and is designed for projection therethrough of a tension-applying tool by means of which the severed end section of the tie rod may be extracted from said associated sleeve cone.

3. Securing means as set forth in claim 1 and wherein each breakback comprises at least one outstruck tongue which extends laterally outwardly from the metal stock of the tie rod, and there is a circular washer slidable on each end section of the tie rod and engageable with the adjacent tongue to limit the extent of telescopic reception of the associated sleeve cone over such end section.

4. Securing means as set forth in claim 1 and wherein said tie rod is provided with generally pointed end extremities to facilitate locating of the holes which are provided in the form sides during installation of the tie rod therein.

5. Securing means as set forth in claim 1 and wherein a circular grout seal washer having an opening therein is telescopically and slidably received over each end section of the tie rod and is adapted to be effectively clamped between the adjacent breakback and the adjacent sleeve cone.

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