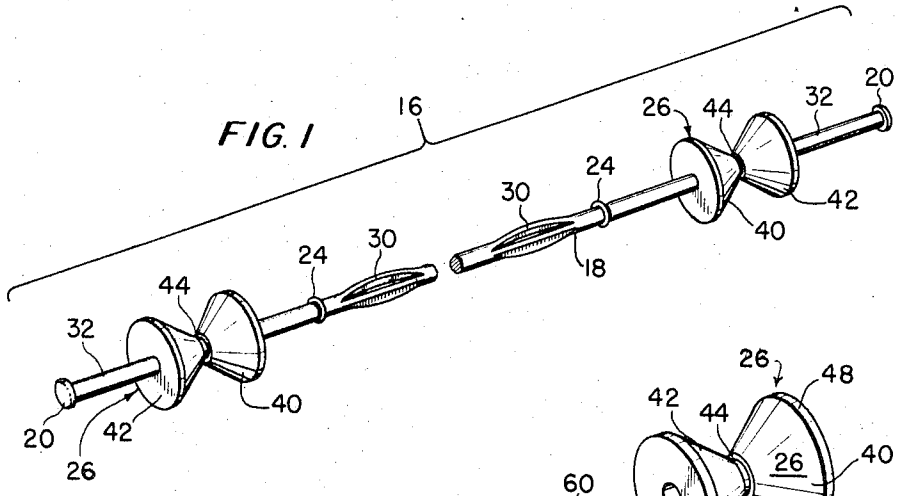
March 4, 1969 R. D. CLASEN ETAL 3,430,914

TIE ROD ASSEMBLY FOR A CONCRETE WALL FORM AND WITH NOVEL SPACER MEMBERS FOR THE FORM SIDES

Filed May 18, 1967 Sheet 1 of 2

FIG. 1



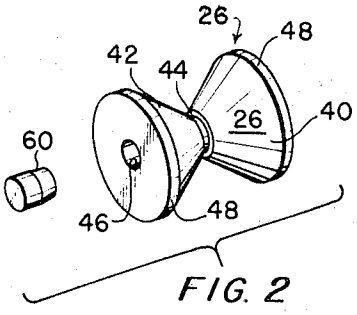




FIG. 2

FIG. 3

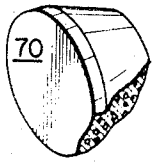



FIG. 4

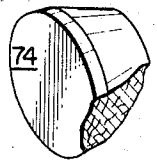
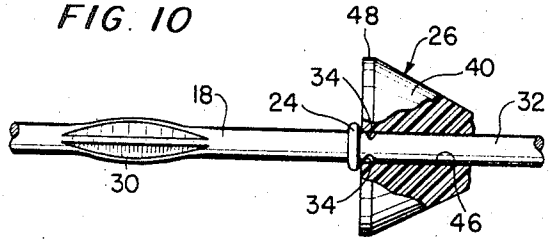



FIG. 10



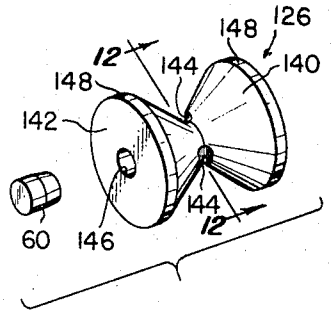
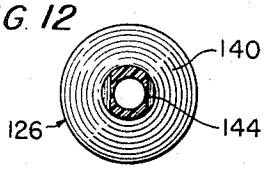




FIG. 11

FIG. 12




INVENTORS.
RICHARD D. CLASEN
FRED B. NICHOLS
By Norman Pollack

March 4, 1969 R. D. CLASEN ETAL 3,430,914

TIE ROD ASSEMBLY FOR A CONCRETE WALL FORM AND WITH NOVEL SPACER MEMBERS FOR THE FORM SIDES

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FIG. 5

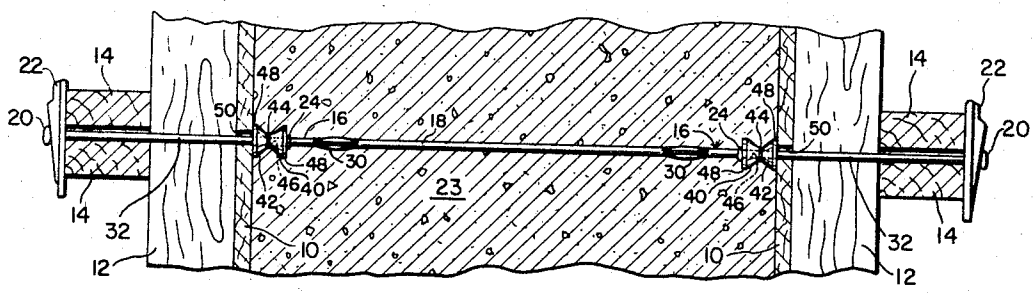



FIG. 6

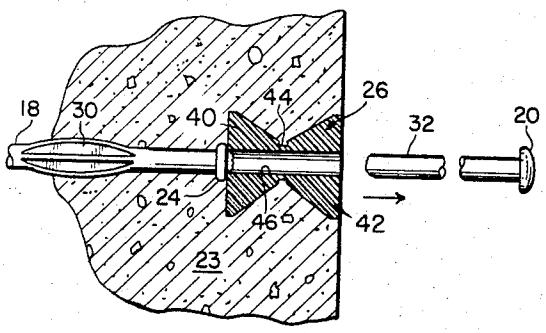



FIG. 7

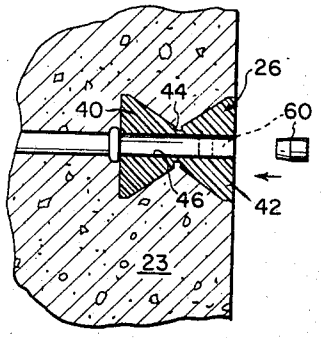



FIG. 8

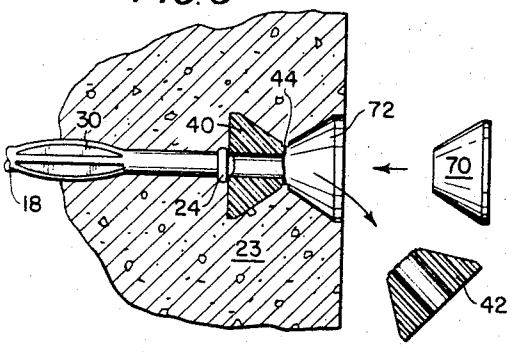
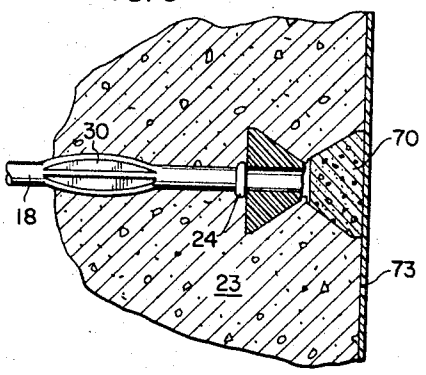



FIG. 9




INVENTORS.

RICHARD D. CLASEN

FRED B. NICHOLS

By Norman Perlach

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# TIE ROD ASSEMBLY FOR A CONCRETE WALL FORM AND WITH NOVEL SPACER MEMBERS FOR THE FORM SIDES

Richard D. Clasen and Fred B. Nichols, Los Angeles, Calif., assignors to Superior Concrete Accessories, Inc., Franklin Park, Ill., a corporation of Delaware

Filed May 18, 1967, Ser. No. 639,393
U.S. 249—217 7 Claims
Int. Cl. E04g 17/08

## ABSTRACT OF THE DISCLOSURE

A tie rod assembly having a spacer member in the form of a molded plastic diabolo which remains embedded in a concrete wall with its outer end face flush with a wall surface, thus obviating the necessity for pointing the void established by a conventional spacer cone when the latter is extracted from the wall surface. The inner section of the diabolo interlocks with the concrete to prevent dislodgment of the spacer member when the concrete shrinks with age. If the wall is to be painted, the outer section of the spacer member may be twisted from the inner member and extracted in the usual manner of cone extraction so that a filler plug having an affinity for paint adherence may be forced into the void left by the extraction.

The present invention relates generally to tie rod assemblies for use in connection with concrete wall forms and the like and has particular reference to that type of tie rod assembly which is designed for use with similar assemblies in maintaining a pair of opposed and upstanding concrete wall form sides in properly spaced relationship and also in holding such form sides against outward displacement during pouring of wet concrete therebetween. Still more specifically, the invention is concerned with a fracturable or frangible tie rod assembly of the particular type which is illustrated and described in United States Patent No. 2,358,975, granted on Sept. 26, 1944, and entitled, "Wall Form Tie," and wherein the tie rod proper projects completely through the opposed, spaced apart sides of the associated concrete wall form and also the intervening poured concrete between said form sides and has points of weakness or break-off points slightly inwards of the form sides to the end that after hardening of the concrete and removal of the form sides from the side faces of the resulting concrete wall, the free or projecting end portions of the tie rod proper may be bent, twisted, or otherwise worked so as to cause the tie rod proper to break or rupture at the points of weakness and, thus, release or free said projecting tie rod ends from removal from the medial concrete-embedded portion of the tie rod proper. It is currently common practice in connection with the fabrication of a tie rod assembly of the type under consideration to mount on the end portions of the tie rod proper spacer members in the form of outwardly flared truncated cones which embody central longitudinally extending rod-receiving bores therethrough, have the small inner ends thereof in abutment with rod enlargements directly inwards of the aforementioned points of weakness, are adapted to have their large outer ends abut against the inner opposed faces of the opposed sides of the associated concrete wall, serve in conjunction with wedges on the extremities of the tie rod proper temporarily to hold the concrete wall form sides in fixed relation with the end portions of the tie rod proper, and are adapted to remain temporarily embedded in the hardened concrete wall. Such truncated cones are subsequently removed from the sides of the hardened concrete wall, thus leaving cavities or recesses which must



be filled with concrete or other material in order to seal the side faces of the concrete wall. Said removable truncated cones are ordinarily of cast metal, wood, or occasionally of a plastic material. Infrequently, they are in the form of stamped metal cups. The points of weakness of the tie rod proper are usually substantially coincident with the small inner ends of the spacer cones so that the breakage and removal of the projecting end portions of the tie rod proper leaves the cones firmly embedded in the concrete wall.

Heretofore, it has been considered necessary to remove or extract the concrete embedded truncated cones from the sides of the formed concrete wall and fill the resulting recesses with concrete or other filler material because the cones, as heretofore indicated, present their large ends in the direction of the sides of the concrete wall and, hence, even though in most instances they could be left intact within said sides of the concrete wall so as to serve as filler members for the cavities or recesses which they create, they are not stable in the concrete and, after a period time, concrete shrinkage or localized internal shifting of mass tends to force them from their lodged or concrete-embedded positions. The spacer members are specifically made in frusto-conical shape with the view toward easy removal thereof from the hardened concrete. Not only this, but the frusto-conical shape of the spacer members permits such members to be readily extracted before the projecting end portions of the tie rod proper are worked loose from the embedded medial portion of said tie rod portions by sliding them outwardly along the rod end portions and away from the concrete, thus leaving wide angled frusto-conical recesses to allow for working said projecting end portions back and forth until rupture or breakage occurs. Such working of the projecting end portions of the tie rod proper represents a somewhat easier method of rupturing or breaking the end portions of the tie rod proper at the respective points of weakness, especially when a suitable torque-applying tool is not available for the purpose.

Various methods of extracting the concrete embedded cones have been devised. However, heretofore, in each instance, a separate extracting operation and the use of a special tool have been required. Cone breakage during an attempted cone-extracting operation is a not infrequent happening or occurrence and, in such an instance, tedious piecemeal extraction of the broken or fractured cone must be resorted to.

The present invention is designed to overcome the above-noted limitations that are attendant upon the construction and use of conventional truncated cones as the spacer members of a tie rod assembly and, toward this end, the invention contemplates the provision of a novel tie rod assembly which employs on the end portions of the tie rod proper molded plastic spacer members of special configuration, each spacer member being so designed that it forms an interlock with the concrete mass within which it is embedded so that it is incapable of being removed in its entirety from the concrete, and thus, may be left intact in position within the concrete after the adjacent protruding or projecting end of the tie rod proper has been broken away from the adjacent end of the medial portion of the tie rod proper and then bodily removed, and with no danger of its being subsequently forced out of position due to concrete shrinkage as previously described. The particular spacer members of the present invention are furthermore so designed that their large outer end surfaces lie precisely in the same general planes as the adjacent side faces of the concrete wall undergoing formation so that they leave in the concrete no voids or recesses which require filling other than the small longitudinal bores from which the

projecting end portions of the tie rod proper have been axially pulled. These small bores may be conveniently filled and sealed by driving short plastic plugs of generally cylindrical configuration into them. When it is considered that a large concrete building construction may employ thousands of tie rod assemblies, it is clearly manifest that use of the present tie rod assembly results in an appreciable saving in labor costs.

Specifically, the spacer members of the present tie rod assembly are of dual cone or diabolo design, which is to say that they have the general shape of an hourglass, and it is for this reason that they interlock with the concrete in which they are embedded. Still further, the medial or narrowest regions of the specially shaped spacer members are weakened so that it is possible under certain circumstances to twist the outer embedded halves of the members, and thus, break them loose from the inner embedded halves, to the end that the outer halves may be removed from the concrete and then replaced with solid frusto-conical filler plugs of conventional patching material. Such an expedient is resorted to in instances where the side faces of the concrete wall are to be painted or otherwise coated with an oil base type paint or other coating material which will not readily adhere to the plastic material of which the improved spacer members are made, in which case the replacement filler plugs may be in the form of premolded or shaped frusto-conical plugs of concrete, wood, or other material having a marked affinity for the paint or other material to be used for wall-coating purposes.

The provision of a tie rod assembly of the character briefly outlined above constitutes the principal object of the present invention.

Other objects and the various advantages and characteristics of the present invention, not at this time enumerated, will readily suggest themselves as the nature of the invention is better understood from a consideration of the following detailed description.

In the accompanying two 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 perspective view of a tie rod assembly, the spacer members of which embody one form or embodiment of the present invention;

FIG. 2 is an enlarged exploded perspective view of one of the spacer members and its associated bore-sealing plug;

FIG. 3 is a view partly in perspective and partly in section, of a ceramic filler plug that is capable of being employed in connection with the invention;

FIG. 4 is a view similar to FIG. 3 but showing a wooden filler plug;

FIG. 5 is a fragmentary vertical sectional view taken transversely through a conventional or standard concrete wall form in the vicinity of a tie rod assembly like that of FIG. 1, and showing poured concrete in the space between the two opposed sides of the wall form;

FIG. 6 is a fragmentary vertical sectional view similar to the right-hand side of FIG. 5 but showing the right-hand side of the wall form removed, and illustrating, in exploded fashion, the manner in which the right-hand protruding end of the tie rod proper is severed and removed from the concrete-embedded medial portion of the tie rod proper;

FIG. 7 is a fragmentary vertical sectional view similar to FIG. 6 but showing the completed wall and illustrating, in exploded fashion, the manner in which a bore-sealing plug is applied to the concrete-embedded spacer member;

FIG. 8 is a fragmentary vertical sectional view similar to FIG. 7 but illustrating, in schematic fashion, the fracture and removal of the outer half of the concrete-embedded spacer member and the replacement thereof with an auxiliary filler plug like that of FIG. 4 or that of FIG. 5;

FIG. 9 is a sectional view similar to FIG. 8 but showing the auxiliary filler plug in its operative position wherein it serves to fill and seal the frusto-conical cavity or recess which was formed in the concrete wall of the outer half of the spacer member;

FIG. 10 is a fragmentary side elevational view of a portion of the tie rod assembly illustrating in detail the right-hand point of weakness and reaction enlargement of the tie rod proper of the assembly;

FIG. 11 is an exploded perspective view similar to FIG. 2 but showing a slightly modified form of the spacer member and its associated bore-sealing plug; and

FIG. 12 is a sectional view taken on the line **12—12** of FIG. 11 and in the direction of the arrows.

Referring now to the drawings in detail, and in particular to FIG. 5, the opposed, spaced apart, upstanding sides of a conventional or standard concrete wall form are designated by the reference numeral **10** and each side includes, in addition to the usual plywood panels, vertically disposed studs **12** and horizontal walers **14**, the studs and walers being disposed outwards of the panels.

Extending transversely across and through the form is a horizontally disposed tie rod assembly **16** which is illustrated in its free state in FIG. 1 and constitutes the subject matter of the present invention. The assembly **16** comprises a tie rod proper **18** and serves, together with similar assemblies, to hold the form sides **10** in fixed relation while wet concrete is poured therebetween for wall-forming purposes as well understood in the art. The ends of the tie rod proper project beyond the walers **14** and are provided on their extremities with button-type heads **20**. The latter are engaged by tightening wedges **22** which are longitudinally slotted and straddle the end portions of the tie rod proper at locations intermediate the heads **20** and the walers **14**. The tie rod proper **18**, when properly connected to the concrete wall form, resists in tension any tendency for the form sides **10** to separate under the outward thrust of the wet poured concrete **23** which is poured within the confines of the form.

Within the confines of the form sides **10**, the tie rod proper **18** is provided with annular reaction enlargements **24** (see FIG. 10). The assembly **16** also comprises two one-piece spacer members **26** which are mounted on the tie rod proper directly outwards of the reaction enlargements **24**. These spacer members, together with the enlargements **24**, limit or restrict movement of the form sides **10** toward each other before concrete-pouring operations are instituted and serve to maintain said form sides in their correct predetermined spaced apart relationship.

At regions spaced inwardly from the enlargements **24**, the tie rod proper **18** is formed with flattened portions **30** which serve as torque-reaction wings to prevent turning of the intermediate or medial portion of the tie rod proper **18** about its longitudinal axis within the hardened concrete when the protruding or projecting end portions **32** of said tie rod proper are twisted for cleavage and removal purposes as is customary in the concrete construction art. At regions spaced slightly outwardly from the enlargements **24** and directly inwards of the enlargements **24**, the tie rod proper **18** is provided with pairs of opposed notches **34** (see FIG. 10) which establish points of weakness whereby, upon twisting or turning of the projecting end portions of the tie rod proper after wrecking the forms, said tie rod proper will fail and fracture just within the inner ends of the spacer members **26**, thus freeing the projecting rod end portions **32** for withdrawal from the concrete, and leaving the medial portion of the tie rod proper permanently embedded in the concrete wall.

The general arrangement of parts thus far described, with the exception of the specific construction of the two spacer members **26**, is purely conventional and no claim is made herein to any novelty associated therewith, the novelty of the present invention residing rather in the

character of the spacer members whereby they become interlocked with the hardened concrete for permanent retention therein in a manner and for a purpose that will be described in detail presently.

Referring now particularly to FIGS. 1, 2 and 10, each spacer member **26** of the tie rod assembly **16** has a diabolo or dual cone configuration, which is to say that it assumes the general form of an hourglass and consists of an inner truncated cone section **40** and an outer truncated cone section **42**, the two sections being arranged in tandem relationship and with the small bases or ends thereof coincident or connected together. Preferably, the spacer members **26** are of a molded plastic material which may be either thermoplastic or thermosetting, although other materials are contemplated, such, for example, as wood or impregnated fibrous material. Each spacer member **26** is provided at the juncture region between its two cone sections **40** and **42** with any suitable means for weakening said juncture region, one such means being shown in FIGS. 1 and 2 and consisting of an external annular groove **44** between the two sections. This weakening of each spacer member is resorted to for purposes of fracture and separation of the two cone sections in a manner and for a purpose that will be explained presently.

Each spacer member **26** is provided with a full length central axial bore **46** in order to enable it to be strung or threaded onto the tie rod proper **18**, such bore having a diameter slightly greater than the diameter of the rod stock from which the tie rod proper is made. The tie rod assembly **16** is possessed of two of the spacer members **26** as heretofore pointed out, such members being loosely or slidably disposed on those portions of the tie rod proper which extend between the button-type heads **20** and the reaction enlargements **24**, and being thus confined or captured on the tie rod proper against removal. In manufacturing the tie rod assembly **16**, there is employed a special jig involving a cylindrical chute for a stack of the diabolo spacer members and, therefore, in order to avoid binding of the spacer members within the chute by reason of flash or other irregularities on the peripheral edges of the large bases of the cone sections of the spacer members, these edges are flattened to provide annular band regions **48**. After the spacer members **26** have been strung upon the end portions of the tie rod proper during manufacture of the assembly **16**, the button heads **20** are formed, thus capturing the two spacer members **26**.

In the erection of the concrete wall form which is shown in FIG. 1, the plywood panels and the vertical studs **12** of the form sides **10** are erected in the usual manner and are then manipulated so that the end portions **32** of the tie rod proper **18** extend through openings **50** in the panels of the form sides. Thereafter, the walers **14** and the wedges **22** are applied in the usual manner of concrete wall form erection so as to draw the spacer members tightly between the reaction enlargements **24** and the inside faces of the panels of the form sides **10**. With the form thus erected, wet concrete is poured into the space between the form sides in order ultimately to produce the concrete mass **23** within the form.

In connection with wrecking of the form, the wedges **22** are first removed in order to release the walers **14**, the studs **12** and the panels of the two form sides **10**. Thereafter, such parts of the form sides are stripped from the hardened concrete mass **23** which then constitutes the desired wall. After the stripping operation, the spacer members **26** of the tie rod assembly **16** will remain embedded within the concrete with their outer circular end faces lying flush with the side surfaces of the concrete wall and being thus exposed. The spacer members will, by reason of their diabolo or dual cone configuration and the fact the frusto-conical side surfaces of the inner sections **40** thereof constitute outwardly facing restraining shoulders, be firmly interlocked with the concrete mass and no amount of concrete shrinkage or internal shifting of the concrete mass can dislodge them so that for all intents and purposes they become a functional part of the concrete wall.

The protruding or projecting end portions **32** of the tie rod proper **18** are worked loose from the medial concrete-embedded portion of said tie rod proper by twisting or turning them within the bores **46** in the two spacer members **26** until the tie rod proper becomes fractured at the aforementioned points of weakness. After fracture of the tie rod proper **18**, these protruding end portions **32** are pulled axially outwardly as indicated at the right-hand side of FIG. 6. Following removal of said protruding or projecting end portions **32** of the tie rod proper, small filler plugs **60** which preferably are formed of the same plastic material as that of the spacer members **26** themselves, may be pushed or driven into the exposed ends of the bores **46** as shown in FIG. 7 in order to seal the same and present smooth outer end faces in coplanar relation with the side faces of the concrete wall.

From the above description, it will be apparent that inasmuch as both diabolo-shaped spacer members **26** remain intact within the concrete wall, the usual cone or insert extraction procedure which is prevalent in connection with a conventional tie rod assembly is dispensed with. Additionally, pointing operations where grout is required to be packed into the voids or recesses which are left after cone or insert removal are eliminated.

Inasmuch as the spacer members **26** are formed of moldable plastic material which has very little affinity for oil base commercial paint for application to concrete wall and other surfaces, the aforementioned annular grooves **44** at the junctures between the small bases of the two cone sections **40** and **42** of the spacer members **26** make it possible to separate and remove the outer cone sections **42** from the inner cone sections **40** and then replace said outer cone sections by concrete filler plugs **70** which are of similar frusto-conical configuration and are formed of a material which does have an affinity for such paint or other coating composition. By utilizing a screw extractor of the type which is widely known in the carpenters' trade as an "easy-out," the pointed end of such extractor may be introduced into the outer end of the bores **46** and then turned in the direction of thread pitch so that the outer cone sections **42** may be twisted from the inner cone sections **40** and then discarded as shown in FIG. 8. Thereafter, filler plugs **70** of a ceramic nature may be tapped into position within the generally frusto-conical voids **72** which are left by reason of the extraction of the outer cone sections **42**. The filler plugs **70** are solid and fill at least a substantial volume of the voids **72** as shown in FIG. 9. In addition, they present smooth unbroken continuations of the side faces of the concrete wall to the end that said side faces may be painted or otherwise coated with impunity since the paint **73** (see FIG. 9) will adhere to the outer end surfaces of the plugs **70** as well as to the concrete wall faces.

In FIG. 4, a filler plug **74** which may be turned down from wooden stock is disclosed as an alternate form of filler plug possessing good adhering properties as far as paint and other coating compositions are concerned.

Referring again to FIG. 2, it will be appreciated that the annular grooves **44** which are provided at the interfacial planes between the inner and outer cone sections **40** and **42** of the spacer members **26** should be sufficiently deep as materially to weaken the central portions of the spacer members for fracture purposes when the outer cone sections **40** are rotated or turned relatively to the inner cone sections **42** as previously described. Inasmuch as when the diabolo-shaped spacer members are embedded in the concrete wall as shown in FIG. 6, considerably larger interfacial friction areas exist between the concrete and the inner cone sections **40** than between the concrete and the outer cone sections **42**, a greater restraint against turning movement is placed upon the inner cone sections than on the outer cone sections. Therefore, in manufactur-

ing the spacer members **16**, the depth of the grooves **44** is determined so that during normal handling operations, the members are stable and will not fracture, but during twisting of the outer cone sections **42** for extraction purposes as heretofore described, the members are not stable and fracture of the same will take place in the vicinity of the grooves **44**.

In FIGS. 11 and 12, there is illustrated a spacer member **126** having alternative means for weakening its medial region. The spacer member **126** of these two views has substantially the same outline as the previously described spacer members **16** and, therefore, in order to avoid needless repetition of description, similar reference characters but of a higher order have been applied to the corresponding parts as between the disclosure of FIGS. 11 and 12. Instead of providing a continuous annular groove around the spacer member in the medial region thereof, two diametrically opposite notches **144** are provided at the interfacial plane between the inner cone section **140** and the outer cone section **142**. Otherwise, the spacer member **126** is identical to the spacer members **26** and its manipulation for extraction of the outer cone section **142** from the hardened concrete remains the same. By utilizing two diametrically opposite notches **144** instead of an annular groove, there is such an interlock as positively to hold the inner cone section of the spacer member **126** against turning in the concrete.

From the foregoing description, it is believed that the construction and use of the present tie rod assembly will be readily apparent and that various modifications thereof which will accomplish substantially the same functions may readily be anticipated. For example, the method of providing weakened areas by utilizing the notches **34** may be modified to employ any of many well-known means for attaining the desired fracture when one part of the tie rod proper is twisted relatively to the other adjacent part. These notches afford a convenient means of weakening the tie rod proper, but heat treating to produce brittle spots will accomplish the same purpose. Similarly, in the case of the spacer members either oppositely positioned notches or single annular grooves are adequate to attain the desired weakening of the medial regions of the diabolo-shaped spacer members, however, other means such as the drilling of radial holes is contemplated.

The invention, therefore, it 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. 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 we claim as new and desire to secure by Letters Patent is:

**1.** A tie rod assembly for holding the upstanding sides of a concrete wall form in spaced relationship, said assembly comprising a tie rod proper, a fracture point on said tie rod proper thus dividing the tie rod proper into a fixed inner portion adapted to remain at least in part embedded in the concrete body resulting from pouring of concrete between said form sides, and a free outer end portion adapted to project at least in part outwardly from one face of the concrete body and be wrested from the fixed portion by twisting or turning it with respect to said fixed portion, a stop on said tie rod proper on the inner side of the fracture point, and a one-piece spacer member formed of rigid material mounted on the tie rod, enclosing the fracture point and adapted to abut against the outer side of the stop, said spacer member being provided with a radial planar outer end face adapted to abut against the inside face of the adjacent form side when said free outer section of the tie rod proper is placed under tension whereby the spacer member is clamped between said stop and said adjacent form side and becomes embedded in the concrete body with said end face extending in coplanar relationship with the adjacent outer face of the concrete body, and an integral outwardly facing shoulder on said spacer member designed for interlocking engagement with the concrete body and serving positively to maintain the spacer member against dislodgment from its embedded position within the concrete body.

**2.** A tie rod assembly as set forth in claim **1** and wherein said spacer member consists of an inner section and an outer section, the outer section being of frusto-conical configuration and having its small base joined to the inner section along a plane of cleavage whereby the outer section is retractable from the concrete body by twisting the same with respect to the inner section, and said outwardly facing shoulder is formed on the inner section.

**3.** A tie rod assembly as set forth in claim **2** and wherein said spaced member is in the form of a diabolo and the frusto-conical surface of the inner section of the spacer member constitutes said outwardly facing shoulder.

**4.** The tie rod assembly as set forth in claim **3** and wherein the spacer member is provided with a longitudinally extending, full length, centrally disposed bore for receiving the free outer end portion of the tie rod proper, and the outer section of said spacer member has associated with it a small filler plug for filling and sealing the outer end of the bore when said outer section of the spacer member remains in the concrete body.

**5.** A tie rod assembly as set forth in claim **3** and wherein the juncture region between the two cone sections is provided with a relief void for fracture purposes when the outer section is rotated forcibly with respect to the inner section and then removed from the latter.

**6.** A tie rod assembly as set forth in claim **5** and including, additionally, a separately formed frusto-conical filler plug of a size and configuration substantially commensurate with the size and configuration of said outer section of the diabolo-shaped spacer member, said filler plug being designed for forcible entry into the void established in the concrete body by removal of the outer section from the inner section.

**7.** A tie rod assembly as set forth in claim **6** and wherein said filler plug is formed of a ceramic material having an affinity to commercial concrete wall paint.

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WILLIAM J. STEPHENSON, *Primary Examiner.*

D. W. JONES, *Assistant Examiner.*