April 8, 1969 H. G. GATES 3,437,306

CONCRETE FORM TIE ASSEMBLY AND PLUG THEREFOR

Filed June 24, 1966

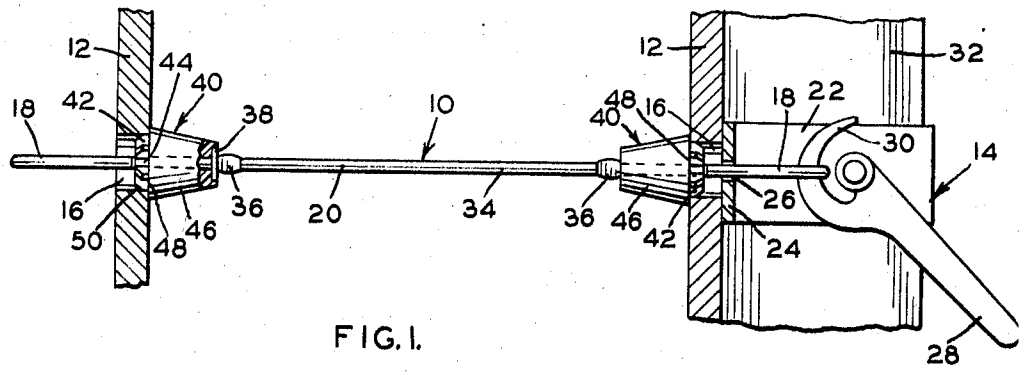

FIG. 1.

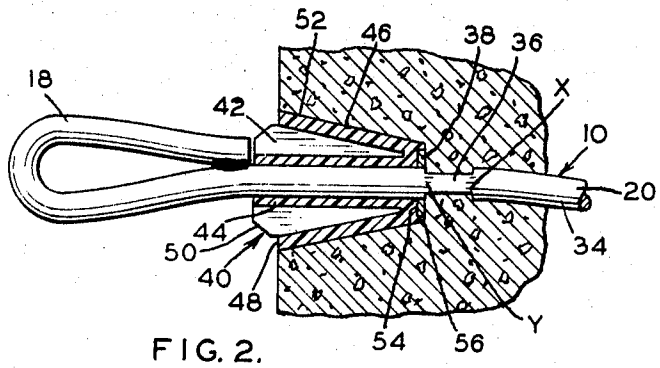

FIG. 2.

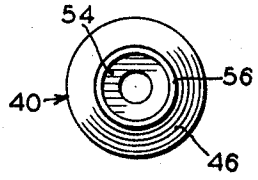

FIG. 4.

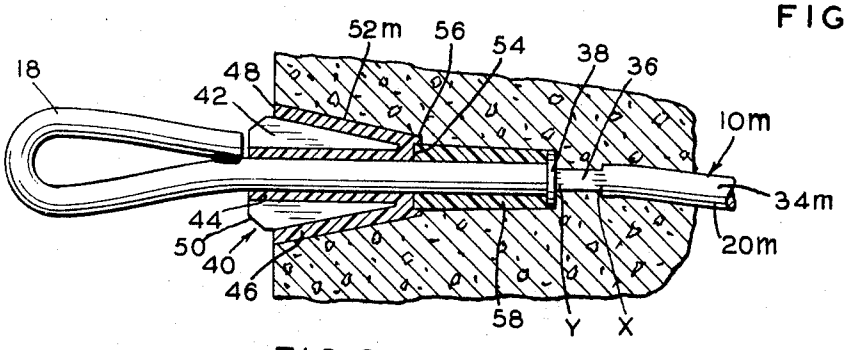

FIG. 3.

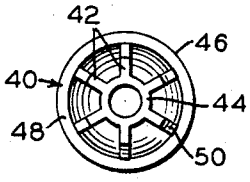

FIG. 5.

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CONCRETE FORM TIE ASSEMBLY AND PLUG THEREFOR

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U.S. Cl. 249—43 5 Claims

ABSTRACT OF THE DISCLOSURE

This disclosure relates to a removable grout plug for use on the end of a concrete form tie to form a socket that is later grouted with cement following detachment of the tie end. The plug is frusto-conical in shape and has forwardly-projecting chamfered radial webs on the large end thereof that guide said plug into centered relation in the tie-end opening in the form panel. The small end has a shallow socket formed therein designed to accept the form tie stop washer in recessed relation so that it will always come out with the detached end.

Concrete form ties of many different types and designs are customarily employed in the erection of poured concrete wall structures for the purpose of holding the wooden form walls in fixed-spaced relation to one another while the concrete is poured therebetween. In concrete walls that are below grade or will be covered with some type of facing material, it generally makes little difference that holes are left in the faces thereof following removal of the projecting tie ends that were, at one time, attached to the form walls. On the other hand, many poured-concrete structures are being erected at the present time in which one or both of the exposed surfaces comprise the finished wall. In the trade, these are sometimes referred to as "architectural" concrete walls. Obviously, any holes left by removal of the tie ends in this kind of wall seriously detract from its appearance and, for this reason, must be patched in some fashion.

The ordinary hole left after removal of a wire, rod or strap tie is large enough to be quite noticeable, yet, at the same time, so small that they are difficult to repair with ordinary "grouting" techniques. One practical solution to this problem is to mount on the shank of rod-type ties, a generally frusto-conical plastic or metal plug that abuts the inside face of the form walls and functions, in part, as a seal over the tie slots that prevents the wet concrete from escaping therethrough. The other, and more significant, function is to serve as a mold capable of forming a recess of uniform size and shape at the location of the projecting tie ends. Thus, when the tie ends are broken off behind the surface of the wall and removed along with the plugs attached thereto, an oversize recess shaped ideally for patching is left instead of the usual small hole that all too often includes jagged areas around its periphery where some of the "green" concrete has sluffed off when the tie ends were flexed to break them free of the shank. It then becomes possible to go along and fill these cavities formed by the plugs with grout. In fact, a much better and faster procedure is to fill these depressions with precast concrete plugs shaped to fit them. Plugs of this type are ordinarily fastened in place with a good waterproof adhesive. Preferably, the precast plug is formed slightly longer than the opening it is designed to fit so that the excess can be ground off flush with the wall to produce a finished-looking surface.

The foregoing techniques have been in use for many years; however, certain difficulties have arisen in connection therewith that are not easily solved with the available form tie plugs. To begin with, most of the rod-type ties used for forming architectural concrete walls include a "crimped" or otherwise weakened area spaced inwardly of each projecting end portion that serves two functions, namely, to insure the fact that the tie will break-back at the required spots inside the wall and to form a stop adapted to hold a washer in place on the shank of the tie that, in turn, abuts the inner end of the conical plug to hold same in place. To explain more fully, the ends of the tie project into the outside faces of the form walls through generally circular openings provided for this purpose. These projecting ends are then secured by means of rods, clamps, wedges, cams or some other sort of hardware which function to keep the form walls from spreading apart. Provision must be made, however, for preventing the form walls from moving toward one another. This is accomplished with the cones whose larger-diameter outer ends rest against the inside surfaces of the form walls that border the tie slots while the smaller inner ends thereof are retained by the washers and flattened areas aforementioned.

Now, under ideal conditions, the ties are designed to break off inside or beyond both washers so that the projecting tie ends and plugs associated therewith can be removed leaving the shank of the tie and washers cast in place within the wall. Unfortunately, the ties cannot be relied upon to always break off at the desired spot on the shank and, all too often, an end breaks inside the washer. When this occurs, the tie end and plug remain trapped within the wall because the diameter of the washer is larger than the adjacent small end of the plug. Thus, the overhanging lip or peripheral edge of the washer is cast tightly in the wall and swaged portion of the shank lying inside the washer prevents the projecting tie end and cone from being pulled free of the washer.

It has now been found in accordance with the teaching of the instant invention that this objectionable feature of the prior art architectural concrete form tie assemblies can be overcome by increasing the size of the smaller end of the plug to a diameter greater than that of the washer and recessing the latter within the former. When this is done, all but the inside face of the washer is shielded from the bonding action of the concrete and, if the tie should break off behind the washer, it can be removed along with the cone by merely pulling on the severed tie end.

Another difficulty with this type of tie assembly is that the tie slots in the form walls must be large enough to pass the loop, hook, upset end or whatever means is provided on the extremities of the tie that is used to provide the releasable connection to the form hardware. This oversize opening tends to "leak" the wet concrete poured between the form walls. The frusto-conical plugs mounted on the shank of the tie are, of course, designed with the purpose in mind of sealing these tie slots from the inside. Here again, the difference in theory and practice is substantial. When the ties are inserted through the tie slots, the shanks thereof immediately drop down and rest in the bottom of the slot instead of remaining centered therein. This, of course, leaves a moon-shaped opening at the top of the slot when the cones fail to cover it. In so doing, one of the prime functions of the plug is left undone.

The instant cone, on the other hand, is designed to obviate this difficulty through the provision of radial fins or webs projecting slightly from the large-diameter end thereof that have chamfered corners adapted to engage the margins of the tie slot and guide the cone along with the tie carried thereby into centered position therein. Thus, a self-centering tie assembly is provided.

The remaining feature of the instant form tie assembly is the provision of a cone extension whereby two dif-

ferent break-back distances can be provided for with a single basic cone. With a deep break-back, say for example 2", a one-piece cone would have to be quite large in diameter to provide the necessary taper required to insure easy removal thereof. With the two-part cone, on the other hand, the extension member can have a lesser taper or even be cylindrical because, in most instances, it can remain in the wall, the outer element providing the desired grout opening.

It is, therefore, the principal object of the present invention to provide a novel and improved concrete form tie assembly.

A second objective is the provision of a device of the type aforementioned that includes means whereby the stop washer may be removed from the wall if the shank of the tie breaks behind same.

Another object of the invention herein disclosed and claimed is the provision of a self-centering plug for architectural concrete form tie assemblies.

Still another objective is the provision of a two-part separable form tie plug for deep break-back applications.

An additional object is to provide an architectural concrete wall plug that leaves a frusto-conical depression in the poured concrete wall which is uniform, smooth-surfaced and otherwise ideally suited for grouting.

Further objects are to provide a wall-plug that is inexpensive, easy to remove, lightweight, rugged, unbreakable, and decorative in appearance.

Other objects will be in part apparent and in part pointed out specifically hereinafter in connection with the description of the drawings that follows, and in which:

FIGURE 1 is a fragmentary horizontal section showing the architectural form tie assembly in place holding a pair of panel-type form walls in fixed-spaced relation, one end being releasably secured by a rotatable cam latch;

FIGURE 2 is a fragmentary diametrical section to an enlarged scale showing the removable projecting looped form tie end, cone, washer and swaged section on the shank of the tie cast in place in the wall after the form panels and associated end hardware have been removed;

FIGURE 3 is a fragmentary diametrical section similar to FIGURE 2 but showing the two-element version of the plug used on a deep break-back tie;

FIGURE 4 is a rear elevation of the cone showing the washer-receiving recess therein; and

FIGURE 5 is a front elevation of the plug revealing the radially-extending centering webs formed integral therewith.

Referring now to the drawings for a detailed description of the present invention and, initially, to FIGURE 1 for this purpose, reference numeral **10** has been employed to designate in a general way an architectural form tie assembly employed to hold a pair of form walls **12** in fixed-spaced relation to one another by means of releasable latch means **14** attached to opposite extremities thereof. The form walls **12** each include circular openings **16** adapted to pass the projecting end portion **18** of the tie **20**. In the particular form illustrated, the ties have welded loops at their opposite extremities although, of course, they may include other end designs such as, for example, upset heads, hooks and other configurations well known in the art.

The particular tie end latch assembly **14** shown releasably secured within the looped end on the right-hand extremity of the tie **20** includes a bracket **22** having an upstanding portion **24** with a slot **26** therein that aligns with the opening **16** in the form wall and passes said loop. Latch element **28** is pivotally mounted on the base of the bracket **22** and includes an arcuate cam-forming finger **30** that passes into the tie end loop. Latch assembly **14** is, of course, intended as being merely representative of many such releasable end connectors in common use in the concrete-forming industry. A reinforcing waler **32** is shown clamped in place against the form panel by the end latch assembly.

The tie assembly **10** consists of a conventional loop-ended form tie **20** having a shank portion **34**, flattened areas **36** on said shank that weaken the latter and enable the ends **18** to be removed therefrom, washers **38** on the outside of the flattened area utilizing same as stops, and the cones forming the subject matter of the instant invention which have been designated in a general way by reference numeral **40**. These cones bridge the gap between the washers **38** and the inside surface of the form walls and function in cooperation with the latter and with the flattened areas **36** to maintain a minimum fixed-spaced relation therebetween. The maximum spread between the form walls is, of course, determined by the tie and latch assemblies coacting with the looped-ends to pull said form walls up snug against the cones. In FIGURE 1, it will be seen that when this occurs, the radially-extending integrally-formed webs **42** that bridge the gap left between the tubular shank-receiving portion **44** of the plug and the flared skirt **46** thereof coact with the circular opening **16** in the form wall to guide the tie assembly into centered position therein. The free edge **48** of the annular flared skirt **46** is larger in diameter than opening **16** and thus abuts the inside form wall surface. The tubular portion **44** of the plug, on the other hand, is smaller than opening **16** and projects into the latter part way, it being somewhat longer than the skirt **46**. The webs **42** interconnect the free edges of both tubular portion **44** and skirt **46** and, for this reason, also project slightly into the opening **16** in the form wall.

The maximum radial distance these webs **42** extend outwardly from the tubular portion **44** is no greater than equal to the radius of opening **16** so that these webs may enter the latter a distance which will permit the free edge **48** of the skirt to move up snug against the form wall. Now, to guide the plug **40** and associated elements of the tie assembly into centered relation within opening **16**, the corners of the webs **42** are cut off and inclined toward said opening thus producing cam surfaces **50**. In the particular form illustrated, six such webs are provided arranged in equi-angularly-spaced relation to one another. As few as three webs can be used although more are preferred because they provide a degree of structural rigidity to the skirt that is helpful in resisting the compressive forces exerted on the plug by the wet concrete.

Next, with reference to FIGURES 2, 4 and 5, it will be noted that the tubular portion **44** and the flared annular skirt-forming portions of the plug **40** are joined together at the truncated end of the latter while they remain free of one another at the large end except for the radial connecting webs. Thus, the plug takes on a generally frusto-conical exterior appearance ideally suited to the molding of a socket **52** in the concrete wall **54** that can be grouted or otherwise patched.

Now, the truncated end of the plug is slightly larger in diameter than washer **38** and is recessed as shown at **54** to provide a socket for the latter. The rim **56** that borders this recess **54** envelops the edge of the washer and prevents the wet concrete from adhering thereto except on the rear or inner face thereof where it makes no difference. With this construction, if the form tie should break at point X rather than at point Y where it should break, the end portion **18** with the washer and plug attached can still removed from the wall. In the prior art constructions, the washer is larger than the truncated end of the cone and, for this reason, prevents removal of the tie end and plug if the shank breaks at any point behind the midpoint of swaged portion **36**. On the other hand, if the tie breaks off where it should, namely, in the proximity of point Y, the tie end and plug can be pulled free of the hole in the washer.

Finally, with reference to FIGURE 3 wherein a modified form of tie assembly **10***m* has been shown, it will be seen that the flattened area **36** has been moved inwardly on the shank **34***m* of tie **20***m* a considerable distance. Here, the same basic conical plug **40** is employed to mold

the grout socket and seal the tie slot **16** but, instead of the washer **38** fitting into recess **54** in the truncated end of said plug, an extension member **58** does so. This extension member is essentially tubular and fits over the shank of the tie extending from the recess of the plug back to the inwardly-displaced washer. As shown, the extension member is no smaller in diameter than the washer so that the entire assembly of elements outboard of point X can be removed as a unit should the tie break-back at this point. If the tie should break back at point Y, the end portion **18** and plug can be removed easily leaving both the washer and extension in the wall. The socket **52***m* is the same size and shape as before assuming the extension remains in the wall, otherwise, it would be deepened by the length of the extension but need not be grouted to its full depth. By making the exterior surface of the extension cylindrical or only slightly tapered as shown, the concrete surrounding same will probably hold it in the wall, yet, it could be removed if, for same reason, it become necessary to do so.

Having thus described the several useful and novel features of the concrete form tie plug of the present invention, it will be apparent that the many worthwhile objectives for which it was developed have been realized. Although but two specific embodiments of the plug have been illustrated, we realize that certain changes and modifications therein may well occur to those skilled in the art within the broad teaching hereof; hence, it is our intension that the scope of protection afforded hereby shall be limited only insofar as said limitations are expressly set forth in the appended claims.

What is claimed is:

1. In a poured-concrete wall-forming assembly of the type including a pair of upstanding form panels arranged in spaced-parallel relation to one another and including a plurality of transversely-aligned tie-and-receiving apertures, form ties bridging the space between the form panels with their end portions projecting through the apertures in the latter, said ties having their intermediate shank portions provided with stop forming weakened areas spaced inwardly of the adjacent form panel surfaces, washers slidably mounted on the shank portions outwardly of the stop forming areas in abutting relation thereto, and releasable latch means removably fastened to the projecting tie ends and cooperating therewith to maintain a maximum fixed-spaced relation between the form panels, the improved means for molding a groutable socket in the concrete wall surfaces at the points where the tie ends emerge therefrom which comprises: a generally frusto-conical plug having an axial opening therethrough adapted to slidably receive the shank of the form tie, the smaller-diameter truncated end thereof being of larger diameter than that of the washer and provided with a recess sized to receive the latter, the larger-diameter end being larger than the tie-end-receiving aperture in the form panel and adapted to cover same so as to prevent the wet concrete from escaping therethrough, an integrally-formed chamfered portion projecting beyond the large-diameter end sized and adapted to enter said tie-and-receiving aperture and center said plug therein, and the length of said plug measured from the bottom of the washer recess to the large-diameter end behind the chamfered projecting portion being such as to bridge the space between the washer and the adjacent inside surface of the form wall so as to cooperate with said washer recessed within the truncated end thereof, the stop forming weakened area and the tie and latch means to maintain a minimum fixed-spaced relation between said form walls.

2. The improved means for molding a groutable socket in a poured-concrete wall surface as set forth in claim **1** in which: the truncated end of the plug includes a continuous annular rim bordering the recess therein and adapted to encircle the peripheral edge of the washer; and, said recess is of a depth substantially equal to the thickness of the washer so that the latter lies essentially flush with the small-diameter end thereof.

3. The improved means for molding a groutable socket in a poured-concrete wall surface as set forth in claim **1** in which: said plug includes an inner tubular portion containing the axial opening, a flared conical skirt-forming portion joined to the tubular portion at the truncated end, and at least three radially-extending integrally-formed webs extending between the outer cylindrical surface of the tubular portion and the inner conical surface of the skirt-forming portion arranged in equi-angularly-spaced relation to one another.

4. The improved means for molding a groutable socket in a poured-concrete wall surface as set forth in claim **3** in which: the tubular portion projects beyond the skirt-forming portion, the webs project from the inside conical surface of the skirt-forming portion to the end of the tubular portion, the radius of each web is substantially equal to the radius of the tie-end-receiving aperture, and the outside corners of each web that project beyond the free edge of the skirt-forming portion are cut on the bias to form cam surfaces adapted to center said plug and tie within said aperture.

5. The improved means for molding a groutable socket in a poured-concrete wall surface as set forth in claim **1** in which: the integrally-formed chamfered portion comprises at least three equi-angularly-spaced radially-extending webs projecting beyond the large-diameter end of the plug with the outside corners thereof cut on the bias so as to guide the latter into centered position within the aperture.

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