Jan. 20, 1970 L. O. GATES, JR 3,490,730

COMBINATION FORM TIE GROUT PLUG AND DEFORMABLE SPACER

Filed Oct. 11, 1967

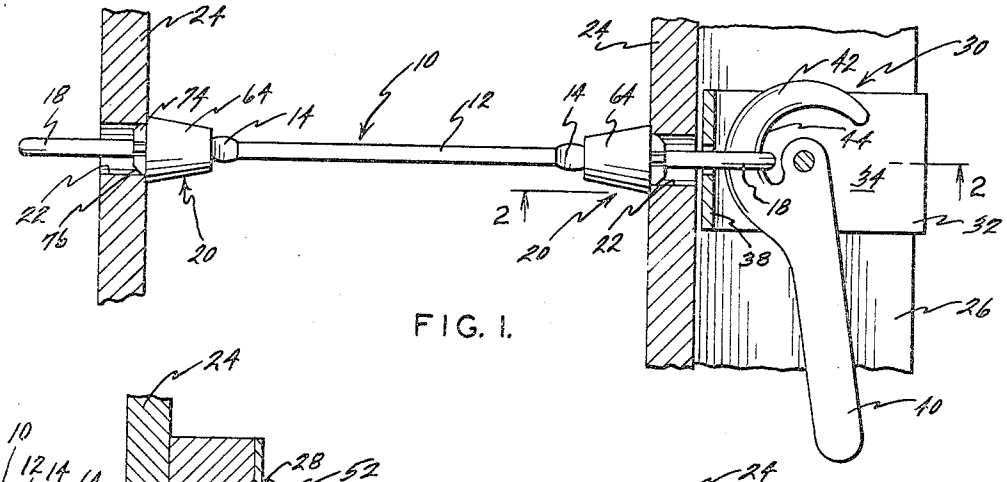


FIG. 1.

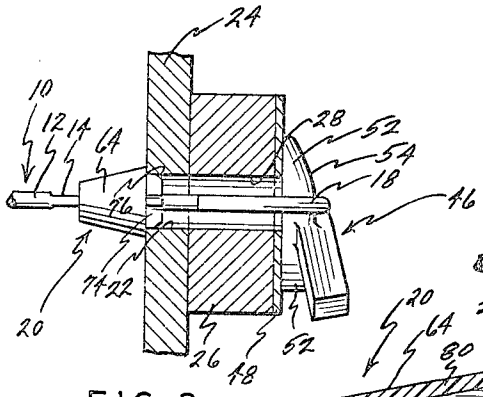


FIG. 3.

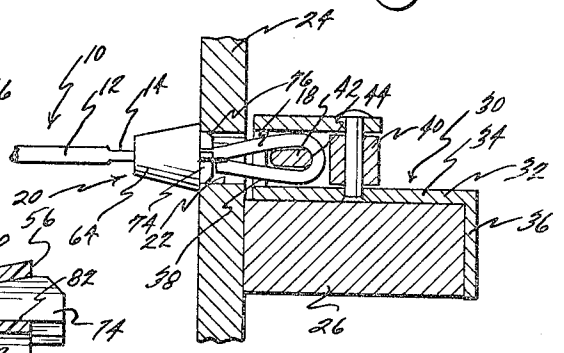


FIG. 2.

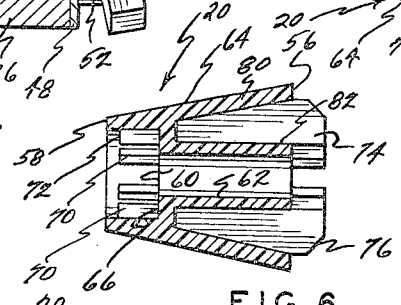


FIG. 6.

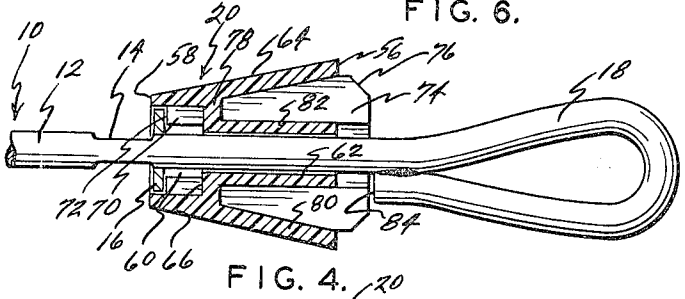


FIG. 4.

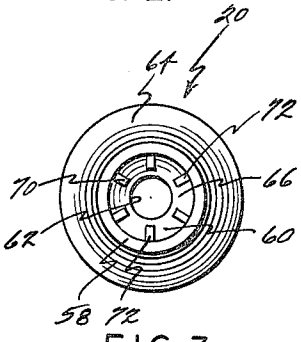


FIG. 7.

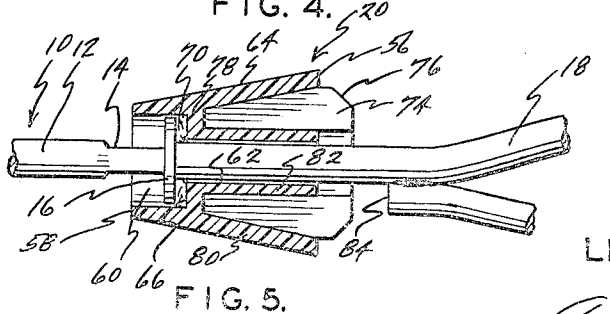


FIG. 5.

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COMBINATION FORM TIE GROUT PLUG AND DEFORMABLE SPACER

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Continuation-in-part of application Ser. No. 560,302, June 24, 1966. This application Oct. 11, 1967, Ser. No. 674,621

Int. Cl. E04g *17/08*

U.S. Cl. 249—43 10 Claims

ABSTRACT OF THE DISCLOSURE

This disclosure relates to concrete form ties, the shank portion of which is equipped with stops, washers and a frusto-conical plastic plug having deformable means in the washer socket thereof adapted to compress slightly in order to accommodate reinforcing timbers of different dimensions.

In United States application Ser. No. 560,302 filed June 24, 1966, now Patent No. 3,437,306, issued Apr. 8, 1969, of which this application is a continuation-in-part, both of which are owned by a common assignee, a novel plastic frusto-conical plug for use on the shank of a concrete form tie to both plug the tie slot in the form panel and mold a socket for subsequent grouting has been illustrated. Two of the main features of this plug are the truncated radial webs that project into the tie slot so as to guide the plug into centered relation therein and a recessed washer socket in the opposite end of the plug that prevents the washer from becoming trapped in the concrete thus preventing removal of the tie-ends.

This tie and plug assembly has proven quite satisfactory so long as the reinforcing timbers, 2 x 4 stiffbacks and walers, remain dimensionally accurate and alike. Unfortunately, the unit will not perform satisfactorily if these timbers are over or undersize. If undersize, a sloppy fit results and the wall formed therewith is uneven. When used with oversize timbers, it can become impossible to fasten the tie-ends into the timber clamps ordinarily used therewith because, while the latch element will usually reach the loops, they cannot be locked.

Up to the present time, this has not been a particularly significant problem for the simple reason that nearly all lumber mills used the same standard dimensions for their 2 x 4's and any dimensional variations were minor, say 1/32 of an inch, and due mainly to a failure on the part of the mill to keep its production within the standard specified limits. Now, however, the situation has changed and become critical due to the fact that the two main associations that set the standards for the softwood lumber industry, namely, The Douglas Fir Association and The Southern Pine Association, have adopted different dimensional standards for their 2 x 4's, which standards have been put into effect by nearly all members of these standard-setting groups. The Douglas Fir Association has adopted the smaller 2 x 4 as its standard with a width of 3½" up to a maximum of 3 9/16". The Southern Pine Association, on the other hand, has shown a preference for the larger 2 x 4 by adopting standards calling for a width of 3 11/16" down to a minimum of 3 5/8". Thus the maximum width Douglas Fir 2 x 4 permitted under Association standards is 1/16" narrower than the minimum width Southern Pine 2 x 4; whereas, the maximum differential permitted between 2 x 4's of these two associations is 9/16". If we add to this additional dimension variations

caused by such things as warpage, swelling or contracting due to various in moisture content, and the mill's failure to hold to the established specifications, it is easy to see how the widths of these 2 x 4's can easily vary as much as ¼ inch.

It has now been found in accordance with the teaching of the instant invention that this problem can be overcome by the simple, but unobvious expedient of providing the washer socket in the inner end of the cone with a series of radially-extending frangible webs adapted to be crushed so as to accommodate the oversize Southern Pine 2 x 4's. In other words, the cone, tie, washers, stops and other elements of the assembly are manufactured to tolerances matched to the minimum acceptable width of the smaller of the two standard 2 x 4's so that the frangible webs of the washer socket can be employed to accommodate any oversize condition that may exist.

One other improvement has been made in the cone forming the subject matter of assignee's copending application, namely, recessing the center tubular portion back flush with the frusto-conical outer wall of the cone so as to leave the radial webs projecting therebeyond. By so doing, the offset terminal ends of the loops at the extremities of the tie can move into position between the webs without causing the cone to become tilted on the shank. This canting of the cone relative to the shank occurs very rarely; however, when it does, it becomes difficult to center the cone in the tie slot.

Iti s, therefore, the principal object of the present invention to provide a novel and improved combination form tie grout plug and deformable spacer.

Another objective is to provide a unit of the class aforementioned that includes deformable means within the cone capable of being crushed in order to accommodate different width 2 x 4's.

Still another object is to provide a cone subassembly for concrete form ties that has frangible webs in the washer socket.

An additional objective of the invention herein disclosed and claimed is to provide a concrete form tie plug that will admit the offset free end of the loop without canting on the shank.

A further object is to provide a concrete form tie plug and spacer that is inexpensive, versatile, easy to use, rugged, compact 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 horizontal section showing a loop-ended form tie equipped with the improved plugs fastened at one end by a cam-type form tie-end latch, the latter being shown used on an oversize 2 x 4 reinforcing timber;

FIGURE 2 is a section taken along line 2 —2 of FIGURE 1;

FIGURE 3 is a vertical section much like FIGURE 1 except that a different type tie-end latch has been shown which is designed to utilize the broader 4" face of the 2 x 4 rather than the edge thereof;

FIGURE 4 is a fragmentary diametrical section to an enlarged scale showing the cone of the present invention on the tie shank prior to any deformation of the yieldable washer stop webs in the washer socket thereof;

FIGURE 5 is a fragmentary section similar to FIGURE 4 except that the cone has been forced inwardly against the washer thus crushing the webs so as to accommodate an oversize reinforcing timber;

FIGURE 6 is a diametrical section of the plug alone; and

FIGURE 7 is a rear elevation of the plug showing the washer socket and webs therein.

Referring now to the drawings for a detailed description of the present invention and, initially, to FIGURES 1 and 2 for this purpose, reference numeral **10** broadly identifies a concrete form tie of conventional design having a shank portion **12** carrying weakened areas **14** that also serve as stops for washers **16** abutting the outside thereof inwardly of the loops **18** on the ends. Between the loops **18** and the washers **16** are placed frusto-conical plugs that have been broadly identified by reference numeral **20** and which perform a number of functions among which are the plugging of tie-end openings **22** in the form panels **24** and the molding of a socket (not shown) in the face of the concrete that is later grouted in with a concrete plug to produce a finished surface.

The tie-end openings, commonly called "tie slots," are circular and sized to pass the form tie-end loops **18** onto the outside face of the form panels **24** where some type of releasable latch mechanism is connected thereto. The front face of the panels is reinforced by longitudinally-extending braces which, in the form shown, constitute ordinary wooden 2 x 4's **26**. In FIGURES 1 and 2, these 2 x 4's are shown mounted with one of their 2" faces against the panel with a 4" face thus forming a horizontal ledge or shelf running along immediately underneath each row of tie-end openings. FIGURE 3 differs from FIGURE 2 in that the 4" face is placed flush against the form panel directly over the row of tie-end openings and openings **28** are drilled through the timber to pass the tie-end loops.

The problem solved by the plugs **20** of the present invention, as has already been explained in detail, is the accommodation of 2 x 4's having varying widths and thicknesses. The thickness of the timbers in FIGURES 1 and 2 is of no consequence; however, their width may vary as much as ¼ inch and still be within the acceptable dimensional limits prescribed by the two major associations that set lumber specifications for their members. Conversely, the width of the timber in FIGURE 3 is inconsequential, but its thickness is critical and this dimension can easily vary from 2 x 4 to 2 x 4 by ⅛ inch or so.

Reference numeral **30** represents in a general way a tie-end latch subassembly which, in the form shown in FIGURES 1 and 2, includes a generally Z-shaped bracket **32** having its horizontal web **34** resting atop the 2 x 4, the downturned flange **36** (FIGURE 2) abutting the outer edge of the timber **26**, and the upturned flange **38** extending up the face of the form panel. As shown, the horizontal dimension separating the parallel planes defining the inside faces of flanges **36** and **38** is selected such that the latter flange will fit flush against the face of the form panel when a 2 x 4 reinforcing timber is used therewith having the minimum standard width. Thus, as shown, when the 2 x 4 is oversize, the inner flange **38** will lie spaced from the form panel to the extent that the 2 x 4 is wider than the minimum standard.

Pivotally mounted atop web **34** is a latch member **40** which carries an arcuate cam finger **42** positioned to enter the loop of the form tie and draw the form panel and associated structure up tight against the plug with a wedge-like action. The cam surface **44** of finger **42** is so designed that it will enter the loop even when an oversize 2 x 4 timber is used; yet, when a minimum width 2 x 4 is employed, it will still function to wedge the form panel up tight against the cone **20**.

A different type of tie-end latch subassembly **46** has been shown in FIGURE 3. It consists of an apertured plate **48** fastened directly to the face of the reinforcing timber so as to pass the loop **18** through the registering openings therein. A somewhat analogous latch member **50** is pivotally mounted flush on the face of the plate and the arcuate fingers **52** thereof have an inclined plane-type cam surface **54** thereon which enters the tie-end loop **18** and, with a similar wedging action, forces the form panel up tight against the cone **20**. Here again, the cam surface **54** is designed to accommodate the range in variations in the thicknes of the 2 x 4's so as to both enter the tie-end loops and pull the form panel up snug against the cone.

It should, perhaps, be mentioned that the tie-end latch sub-assemblies **30** and **46** are intended as being merely illustrative of several such units in common use. Also, while the ties have been shown provided with loops on the ends thereof, the cones of the present invention are equally well-suited for use on other types of ties such as those having upset end portions, otherwise known in the trade as "button-type" ties.

From the foregoing explanation of FIGURES 1, 2 and 3, it should be apparent that with the 2 x 4 reinforcing timbers essentialy non-compressible under the loads applied thereto by the cam surfaces on the tie-end latches, variations in the dimensions of the reinforcing timbers will appear in the overall assembly as variations in the gap left between the inside face of the form panel and the outside of washer **16** when in abutting relation to stop **14**. In other words, with the loops in the ends of the form ties seated at the base of the arcuate tie-end latch fingers, an oversize 2 x 4 will result in the adjacent form panel moving toward the other by an amount equal to such increase in the 2 x 4's horizontal dimension because the loop must be pulled farther out through the tie-end opening **22** in order to compensate for this dimensional difference.

The cone subassembly **20** of the present invention provides the means by which these dimensional variations are compensated for and reference will now be made to FIGURES 4–7, inclusive, for a detailed description thereof. The cone is essentially frusto-conical in shape with the base or larger-diameter end thereof **56** facing outwardly and the truncated or smaller diameter end **58** facing inwardly. The base **56** has a diameter slightly greater than that of circular tie-end opening **22** so that it will effectively plug the latter against the escape of concrete therethrough while, at the same time, abutting the inner surface of the form panel surrounding same. The truncated end **58** is, likewise, larger than the diameter of washer **16** and is provided with a generally cylindrical socket **60** sized to receive the latter. An axial opening **62** extends all the way through the cone sized to receive that portion of the form tie shank **12** lying between washer **16** and loop **18**.

Now, the overall height of the frusto-conical surface **64** measured from the base to the truncated surface along the axial centerline thereof is selected to be at least equal to the space left between opposing surfaces of the washer **16** and form panel **24** when a 2 x 4 reinforcing member of minimum standard horizontal dimension (either width or thickness) is used therewith. In the preferred embodiment illustrated herein, the height of said frusto-conical surface **64** exceeds that of the aforementioned washer-to-form panel gap by an amount approximately equal to the thickness of washer **16** so that the latter will always be recessed in socket **60** as shown in FIGURE 4 where the wet concrete cannot get to the edge thereof and cause it to end up cast in the wall such that the loop could not be removed after being broken off at weakened stop-forming area **14**.

The depth of washer socket **60** measured from the truncated end **58** to socket bottom **66** is at least equal to the maximum variation in horizontal dimension between acceptable standard 2 x 4 wooden reinforcing timbers. As previously mentioned, this dimensional variation can run as high as 3/16 " on 2 x 4's laid with their 4" width horizontal. Actually, the depth of the socket should be at least ¼" to accommodate a 1/16" thick washer and, preferably, 5/16" so that some space will be left at the bottom of the socket to accept the material

squeezed therein when webs **70**, to be described presently, are crushed therein as shown in FIGURE 5. Thus, from a practical standpoint, socket **60** should have an overall depth of about 5/16" so as to accommodate the maximum differences in width of standard 2 x 4's.

Next, and most important, the socket 60 is provided with two or more inwardly-extending radial webs **70** formed integrally with the wall of the cone and arranged in angularly-spaced relation around the form tie shank. As illustrated, six such webs are used spaced 60° apart. The outer free edges **72** thereof define ledges upon which the washer is supported within the washer socket **60** as shown in FIGURE 4. If, as aforementioned, the overall depth of the socket is about 5/16" and the washer is 1/16" thick, then the length of the webs should be about 1/4" to allow a 1/16" recess for said washer. When used with a 2 x 4 of minimum standard horizontal dimension, the washer will be pulled up tight against the edges **72** of webs **70** and yet not crush same. These webs are of a thickness such that when used together to support washer **16**, they will not deform under the static loads present in the forming system. Of course, once the concrete is poured between the form walls, the hydrostatic load tends to force them apart and the load, if any, tending to crush the webs **70** is reduced or relieved altogether. On the other hand, the strength of webs **70** as determined by their number, thickness and material out of which the cone is fabricated is selected such that they will crush to the extent necessary to accommodate the dimensional variations in an oversize 2 x 4 when subjected to the compression load exerted thereon by the cam latch members already described in connection with FIGURES 1, 2 and 3. Thus, when an oversize 2 x 4 is used, actuation of the latch member forces the cone inwardly over the washer as in FIGURE 5 to the exact degree necessary to compensate for the increase in horizontal 2 x 4 dimension above the minimum standard.

In the particular form shown, cone **20** also has radial webs **74** projecting beyond the base thereof whose outer corners are bias cut as at **76** to guide and center same within the tie-end opening **22** which they are sized to fit into. While the base end of the cone may be solid and have webs **74** projecting therebeyond, in the preferred form shown, they extend all the way back to annular partition wall **78** that forms the bottom of washer socket **60**. Thus, webs **74** bridge the tapered annular space left between conical wall **80** and tubular wall **82**. By having tubular wall **82** terminate flush with conical wall **80** as shown in FIGURES 4, 5 and 6, the terminal end **84** of the loop **18** can, if necessary, pass down between the webs **74** in case there is insufficient space left between end **84** and washer **16** to accommodate the cone.

Having thus described the several useful and novel features of the combination form tie grout plug and deformable spacer of the instant invention, it will be apparent that the many worthwhile objects for which it was designed have been achieved. Although but a single specific embodiment has been illustrated, I realize that certain changes and modifications therein may well occur to those skilled in the art within the broad teaching hereof; hence, it is my intention 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 having upstanding form panels arranged in spaced parallel relation that include horizontal rows of transversely-aligned tie-end openings, horizontal wooden reinforcing timbers fastened to the outside faces of the form panels adjacent the rows of tie-end openings, form ties bridging the space between the form panels with their opposite end portions projecting through aligned pairs of tie-end openings, said opposite end portions including latch receiving means, said ties having stops formed on the shank portions thereof spaced inwardly of each form panel and washers abutting said stops on the outside thereof, and cam-type tie-end latches carried by the reinforcing timbers operative upon actuation to releasably lock onto said latch receiving means of the adjacent projecting tie-end, the improved combination grout plug and deformable spacer which comprises: a frusto-conical member having an axial opening therethrough sized to slidably receive the shank portion of the form tie outwardly of the washer, the larger-diameter base thereof being sized to plug the tie-end opening and abut the inside face of the form panel surrounding same, the truncated smaller-diameter end thereof being of larger diameter than the washer and including a socket adapted to recess same, the overall depth of said socket being such as to accommodate a narrowing of the space left between said washer and adjacent form panel occasioned by the use of an oversize reinforcing timber on the outside of the latter, and yieldable abutment-forming means located within said socket adapted to deform to the extent necessary to accommodate dimensional variations in the reinforcing timber adjacent thereto under the influence of substantial compression loads directed toward forcing the washer thereagainst.

2. The combination grout plug and deformable spacer as set forth in claim **1** in which: the yieldable abutment-forming means comprises at least two integrally-formed frangible webs projecting inward radially in angularly-spaced relation to one another from the wall of the recess.

3. The combination grout plug and deformable spacer as set forth in claim **1** in which: the overall length of the frusto-conical member is at least equal to the maximum gap left between the washer and the adjacent form panel surface when using a reinforcing timber adjacent thereto of predetermined minimum transverse horizontal dimension.

4. The combination grout plug and deformable spacer as set forth in claim **1** in which: the longitudinal dimension of the frusto-conical element measured between the form panel abutting surface of the base and the bottom of the washer socket is no greater than the minimum space left between the washer and adjacent form panel surface when using a reinforcing timber adjacent thereto of predetermined maximum transverse horizontal dimension.

5. The combination grout plug and deformable spacer as set forth in claim **1** in which: the frusto-conical element includes an outer frusto-conical wall extending from end-to-end thereof, an inner tubular wall containing the axial opening extending outwardly from the bottom of the washer socket in spaced relation inside the frusto-conical wall, and a plurality of integrally-formed radial webs interconnecting the tubular and frusto-conical walls in angularly-spaced relation to one another.

6. The combination grout plug and deformable spacer as set forth in claim **2** in which: the washer socket has an overall depth of not less than approximately one-fourth inch and the washer-engaging ends of the frangible webs are recessed in the washer socket a distance no less than the thickness of the washer.

7. The combination grout plug and deformable spacer as set forth in claim **5** in which: the radial webs interconnecting the frusto-conical and tubular walls project outwardly therebeyond and are sized to enter the tie-end openings.

8. The combination grout plug and deformable spacer as set forth in claim **5** in which: the outer ends of the frusto-conical and tubular walls are substantially coplanar with the webs projecting therebeyond.

9. The combination grout plug and deformable spacer as set forth in claim **7** in which: the outside corners of the webs are cut on the bias to form cam surfaces adapted to guide said webs into centered position within the tie-end opening.

10. The combination grout plug and deformable spacer as set forth in claim **6** in which: the washer socket has an overall depth of approximately five-sixteenths inch, the

webs project from the bottom of the socket toward the open end thereof a distance of approximately one-fourth inch leaving a one-sixteenth inch recess to receive the washer.

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