May 26, 1970 J. C. McARDLE 3,514,070

FORM TIE DEVICE

Filed Nov. 15, 1967 2 Sheets-Sheet 1

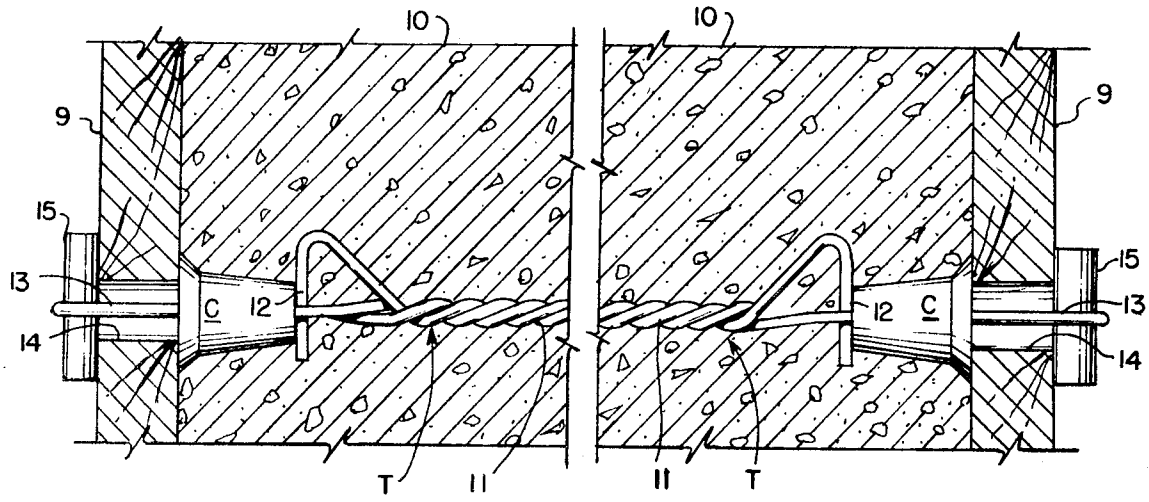


FIG. 1

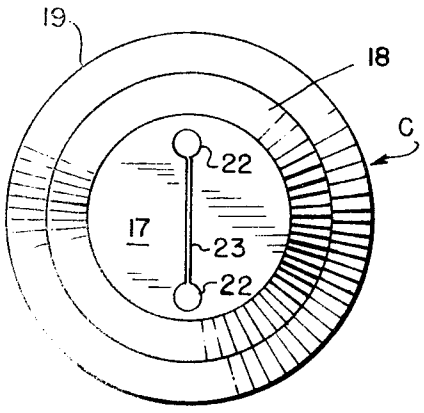


FIG. 2

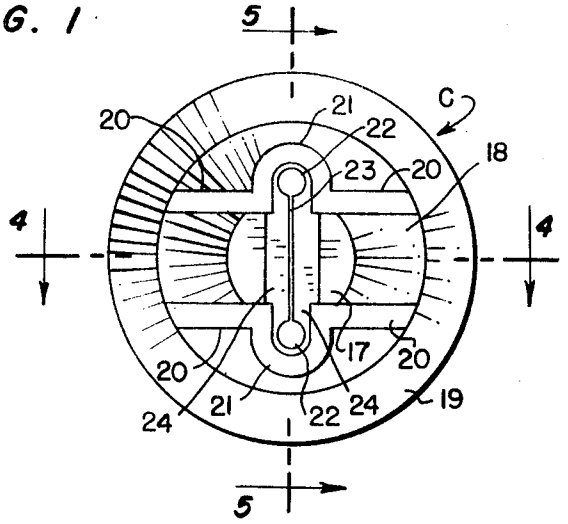


FIG. 3

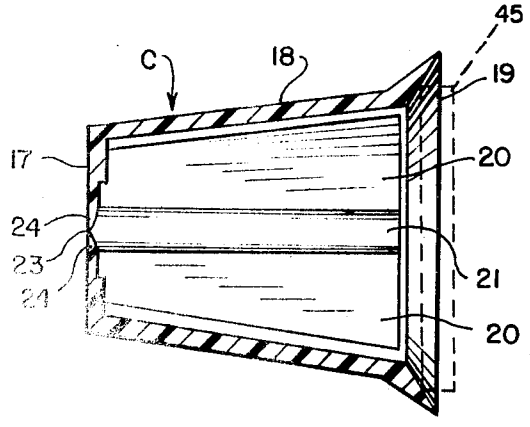


FIG. 4

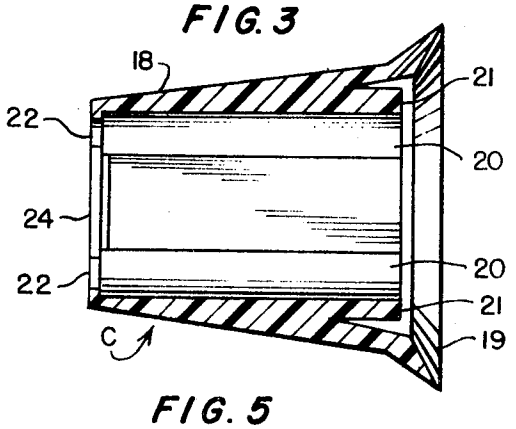


FIG. 5

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FORM TIE DEVICE

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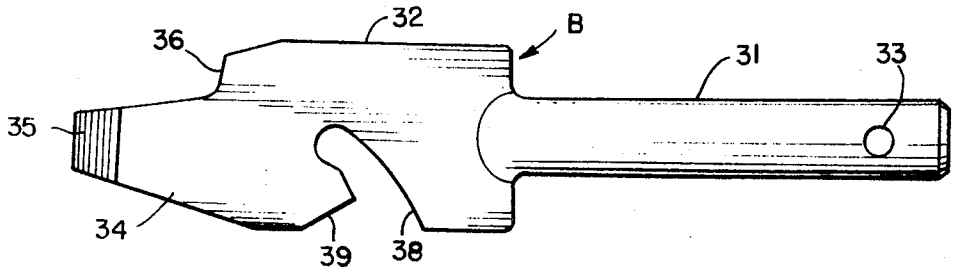


FIG. 6

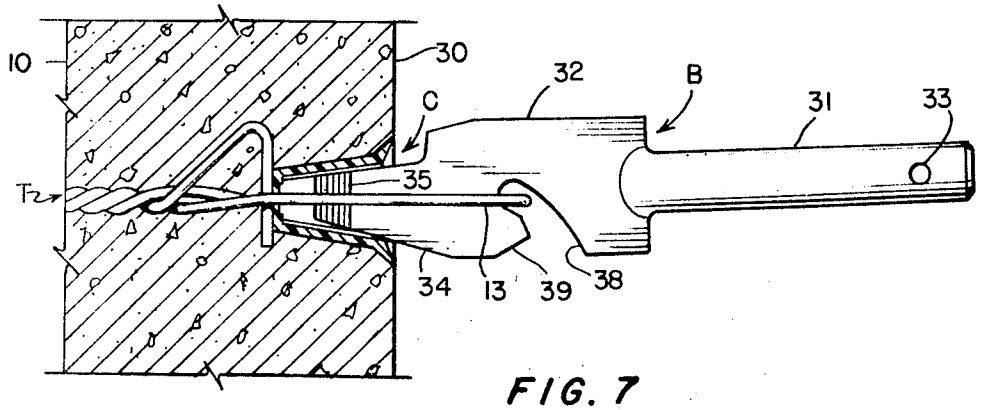


FIG. 7

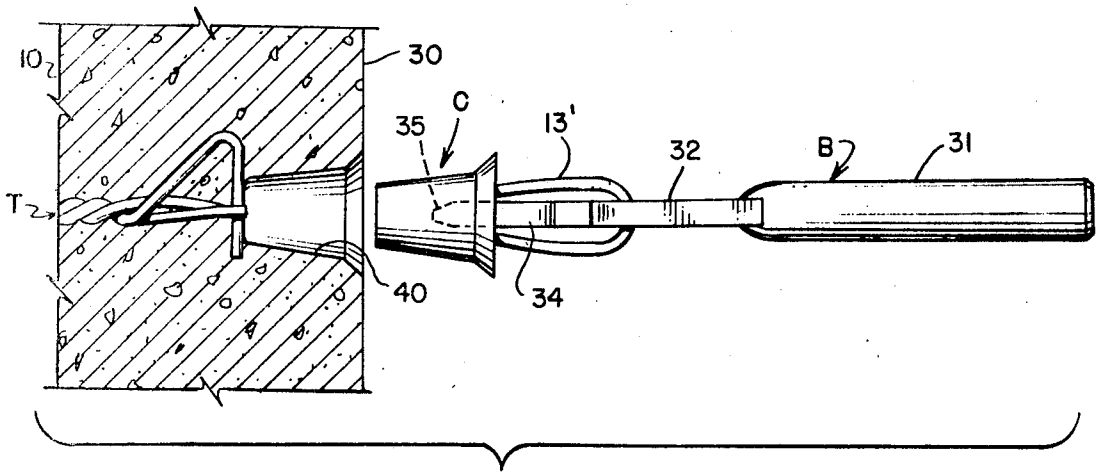


FIG. 8

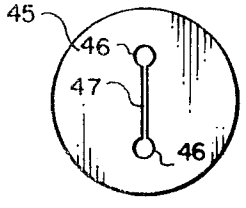


FIG. 9

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United States Patent Office

3,514,070
Patented May 26, 1970

3,514,070

FORM TIE DEVICE

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Filed Nov. 15, 1967, Ser. No. 683,212
Int. Cl. E04g 17/06
U.S. Cl. 249—207 11 Claims

ABSTRACT OF THE DISCLOSURE

A device for use with a terminal looped form tie having a spacing stop, comprising a preferably molded thimble formed for an applied to embracing engagement over and preferably frictional retention on each tie loop, to extend outwardly from each spacing stop, with the base of each thimble not only engaging the spacing stop, but providing a seal around the tie and the outer edge of the thimble, coactable with the inner face of an opposed form wall to seal the form wall hole through which the terminal loop of the tie extends; in its preferred form, said thimble is conical and is provided with an integral interior web and channels correlated with its opposite end conformation to effectuate a structural and functional interrelation of the thimble, the form tie loop and the form wall surface, so that the thimble, as exposed through form wall removal, is receptive to a tool actuable to remove the thimble and detach the associated tie loop from the embedded portion of the tie interiorly of the form finished cast wall surface and retract said freed loop with its associated thimble, thereby producing a wall intrusive recess corresponding to the removed thimble.

The occasion for and the utility of the invention inherent in the practice of reinforced concrete wall construction involving secure consolidation and retention of form walls spaced apart for the reception and shaping of initially plastic concrete therebetween.

The use of form ties engaged through registered holes in and anchored exteriorly of spaced, opposed form walls is an old technique, variously applied in concrete wall constructions. One popular type of form tie is characterized by narrow, elongated terminal loops outstanding beyond fixed spacing stops to obtrude from holes in the form walls for coaction with exterior anchors, in which form the ties permit bleeding of fluids through the unfilled areas of the holes they traverse, are difficult of visual identification for determining the spacing, and produce difficulties in detachment of the protruding portion from the finished wall, during or subsequent to stripping operations.

Thus, after the anchoring devices and then the form walls have been removed, the terminal loops of the ties extend from the concrete wall. If the loops are removed by a cutting tool, which is a time consuming and laborious task, some of the wire of the tie almost always remains, extending from the concrete. When the loops are twisted off, a greater or lesser portion of the concrete is broken out, requiring a patching job of indeterminate extent.

A principal object of the invention is to provide a novel and improved device suited for operative association with a terminal looped form tie

A further object of the invention is to provide an improved device for use with a terminal looped form tie having spacing stops, which device acts as an associated spacing stop.

A further object of the invention is to provide an improved association of initially separate spacing stops in retained, operative relation with a terminal looped form tie.

A further object of the invention is to provide an improved device for a terminal looped form tie having a spacing stop and adapted for sealing coaction with the inner face of a form wall through which the tie extends.

A further object of the invention is to provide an improved device for use with a terminal looped form tie having a spacing stop and facilitating tie rupture interiorly of the cast wall at the inward base of a recess in the concrete.

A further object of the invention is to provide a novel device which is frictionally and retentively coactable with a terminal looped form tie to sealably register over the form wall holes through which the tie terminals extend.

A further object of the invention is to provide a novel and improved device which is frictionally and retentively coactable with a terminal looped form tie for retention thereon during handling and installation.

A further object of the invention is to provide a novel and improved device adapted for operative coaction with a terminal looped form tie, which is expedient of economical production from available, low cost materials, facile of application to retained, operative association with the structure of the form tie, and positive and efficient in attainment of the ends for which designed.

Additional objects and the novel features of this invention will become apparent from the following description, taken with reference to the accompanying drawings, in which:

FIG. 1 is a condensed vertical section showing a typical concrete wall, form wall and a tie provided at each end with thimbles or cones constructed in accordance with this invention, the intermediate portion of the wall and tie being omitted to conserve space;

FIG. 2 is an end view, on an enlarged scale, of the smaller or inward end of one of the cones or thimbles shown in FIG. 1;

FIG. 3 is an end view, on the same scale as FIG. 2, of the outer end of the cone or thimble, opposite to that shown in FIG. 2;

FIG. 4 is a longitudinal view, taken along line 4—4 of FIG. 3;

FIG. 5 is a longitudinal section, taken along line 5—5 of FIG. 3;

FIG. 6 is a side elevation of a breaker tool adapted to effect removal of the tie loop and associated thimble from the cast wall after form removal;

FIG. 7 is a fragmentary, vertical section, on the same scale as FIG. 1, showing the initial application of the tool of FIG. 6 to one of the cones or thimbles and associated tie loop of FIG. 1;

FIG. 8 is a vertical section, similar to FIG. 7, but illustrating the detachment and separation of the thimble and tie loop occasioned by actuation of the tool initially applied as in FIG. 7; and

FIG. 9 is a plan view of a sealing disc for use with the thimble or cone of FIGS. 2 and 3.

Conforming to accepted general practice in arranging forms for the shaped emplacement of plastic concrete mix, spaced, opposed complementary panels **9** are connected at determined intervals by inextensible ties of diverse particularity, functionally exemplified by the tie T, one of a series which is installed before the concrete **10** is poured. Tie T has a twisted wire central section **11** of a length corresponding to the desired distance between panels **9**, in turn determined by the thickness of the wall to be formed by concrete **10**. Tie T, adjacent each end, is also equipped with a fixed or resilient spacing stop **12**, conveniently angular and normally disposed to abut the interior faces of the opposed panels **9**, together with terminal loops **13** aligned in outward extension from stops **12** for passage through registering holes **14** in the opposed panels for engagement with anchors **15**, such as rods bearing exteriorly against the panels and conveniently through a series of aligned ties, to hold the panels at the interval of separation corresponding to the desired thickness of the concrete wall. In appropriate number and pattern, correlated with whatever waler and other provision may be needful for reinforcement and alignment, the ties effectively resist influences tending to deform the structure comprised by the panels **9**, while the charge of concrete **10** cures as a self-sustained cast wall, after which removal of the anchors **15** frees the panels **9** for removal and exposure of the tie terminals **13** as protrusions subject to detachment from the form shaped surfaces of the cast wall.

Within the general category of known and available form ties having functionally equivalent spacing stops and terminal extensions is that type particularly characterized by narrow, elongated loops **13**, as shown, to extend through the panel holes **14** for engagement with the anchors **15** and accomplish the purposes of the extensions **13** in projection away from the stops **12**. Such loop terminals **13** may complete a tie T of the twisted wire type having the radially directed wire end spacing stops **12**, as shown, or the loop terminals may be those of ties of other types and spacing stop particularity. to any and all of which terminal loop ties the improvements of the present invention are similarly and advantageously applicable.

In accordance with this invention, each spacing stop **12** does not abut the inside of a form wall **9**, but is spaced therefrom by a cone or thimble C, which abuts at its inner end the spacing stop **12** and at its outer end the inside of form wall **9**. Thus, the ties T are modified from the usual previous construction by having, for a given distance between the form walls, a shorted twisted wire section **11** and longer terminal loops **13** to accommodate the cones or thimbles C. Each thimble C engages embracingly and is frictionally retained upon inward reach of the corresponding loop **13**, with its inner end abutting the stop **12**. Conformably sized to the associable feature of a given terminal loop form tie and normally similar in every respect save as to size, the thimble C of the invention is preferably a frusto-conical, integrated part feasibly and expediently molded from one of the synthetic resin materials commonly termed "plastics," with an open greater outer end, a largely hollow interior, and a web **17** transversely closing its lesser base end. Because of its thermoplastic properties and minimal adherent affinity for cement and concrete, high density polyethylene is eminently suited, and is preferred, as material for constitution of the thimble C. Adapted, as shown and explained, to embracingly receive the loop terminal **13** of an associated form tie, the lesser base end of the thimble will require a diameter of its web **17** slightly exceeding the maximum lateral width of the loop **13**, from which controlling dimension a conical wall **18** of the thimble enlarges diametrically in a smooth expansion axially thereof to establish its larger open base end, about and beyond which an integral, conical skirt **19** flares at a

relatively steeper inclination and in an outward convergence of its annular surfaces to define the ultimate, circular, major end aspect of the thimble as a thin, moderately flexible and pressure yieldable skirt margin opposable in use to an interior face area of a panel **9**. Thus organized, the thimble C may have an overall length, including the skirt **19**, approximately the same as the diameter of the skirt at its free margin.

The otherwise hollow interior of the thimble C, as in FIGS. 2–5, is interrupted by a pair of like, complementary webs **20** which longitudinally traverse the thimble parallel to its axis from conjunction with the end web **17** to its opposite end, terminating in a plane transverse of the thimble and slightly inward of the circular intersection of the skirt **19** and conical wall **18**. Webs **20** are disposed symmetrically relative to the thimble and its axis and are separated a distance slightly less than the open, interior width of the tie loop **13**, thereby defining within the thimble a cunieform cavity extending in a substantial uniform width of opening perpendicular to the webs **20** from the end web **17** of the thimble to open within the circumscription of the skirt **19** at the corresponding ends of said webs **20**. Centrally and longitudinally of the confronting faces of the webs **20**, complementary, counterpart offsets **21**, forming substantially semiannular grooves, are provided to open in opposition diametrically of the thimble interior as parallel boundaries of a slideway centrally of the webs **20** designed to receive and frictionally engage the sides of an associated tie loop **13**, for which purpose the said grooves are sized to slidably accommodate the loop sides with frictional resistance to movement of the loop sides in the slideways. As in FIG. 5, offsets **21** are integral with the conical wall **18** for a major portion of their length. Continuous to abutment against the end web **17** of the thimble C, the groove of each offset **21** registers with a restricted aperture **22** formed in the end web **17**, and as one of a pair coupled by a slit **23** extending across said end web diametrically thereof. Apertures **22** are preferably sized to be enlarged by the wire of the corresponding side of loop **13**, while slit **23** permits the end of a loop **13** to be pushed therethrough, afterward closing to minimize leakage of liquid from the concrete into the thimble. To faciltate insertion of the loop **13** endwise into the thimble C, slit **23** is flanked on each side by a pair of lips **24**, each reduced and tapered in thickness, to provide flaps of enhanced flexibility. It will be noted that the width of slit **23** is exaggerated in FIGS. 2 and 3, for clarity of illustration, since slit **23** is intended to close after placement of a thimble C on a loop **13**.

Application of the thimbles C to the loops **13** is made as an incident of form tie production, with the consequent advantage that supply of the ties in condition for immediate individual use may be maintained at the work site in an assortment of needful and readily identifiable form spacing characteristics. Mounting of a thimble C to use association with a tie loop **13** is facilitated, when the thimbles are of thermoplastic material, by an initial heating of the thimbles sufficiently to permit ready flexing of the lips **24**, whereafter the closed outer end of the loop is applied to spread the slit **23** at the small end of the thimble, to pass between the so deflected lips **24**, to engage and traverse the slideway defined by the offsets **21**, and to emerge as a projection outwardly from and beyond the thimble skirt **19**, as suitably applied pressure urges the thimble inwardly along the loop and to final positioning abutment against the proximate tie stop **12**, in which ultimate relationship the sides of the loop **13** are accommodated in the apertures **22** of the end web **17** and are frictionally retained in the grooves formed by offsets **21**. Also, the lips **24** reconverge to narrow the slit opening **23** and effectively close the lesser, inwardly directed end of the thimble, while the skirt **19** is presented in circumscription with an intermediate portion of the loop for sealing coaction with a form wall area about the hole **14** traversed

by the loop projection in its extension to engagement with an anchor **15**. Applied to and retained upon the terminal loops of a form tie, as set forth, the oppositely directed, counterpart thimbles C of each tie unit determine by the separation of their skirts **19** the form spacing characteristic of the tie, whence it is manifest that the previous function of the tie stops **12** is appropriated by the skirts **19** when thimbles C are present on the tie and that said stops **12**, when serving only as positioning abutments for the said thimbles, require location on and spacing along the tie such as to effect a determination of form wall spacing characteristic of the tie by the over-all span between the outer skirt margins **19** of the applied thimbles. The nature of the material utilized in the preferred production of the thimbles C facilitates a color coding of the ties equipped with the thimbles that visually translates as immediate recognition of the form wall spacing characteristic of the tie. The resins suited for production of the thimbles are amenable to almost unlimited color variation, selectively applicable according to an established code of color identity or color diversity to qualify the colored thimbles as visual indicators of the spacing characteristic of the tie so particularized.

Conditioned through an appropriate spacing of its tie fixed spacing stops **12** and equipped with counterpart, oppositely directed thimbles C, the terminal looped form tie of the invention is applied in a customary manner, as shown in FIG. 1, to effect a separation of complementary form walls corresponding to the interval between the margins of the skirts **19** of the tie mounted thimbles C and to consolidate said form walls in such spacing through any visual or preferred coaction of the loop protrusions beyond the form walls, as with anchors **15** bearing exteriorly upon said walls, in accordance with accepted practice. A further feature of practical advantage deriving from conventional application and use of the novel tie distinguished by the thimbles C is the inhibition of fluid escape from the concrete through the holes **14** provided to accommodate the tie terminals, since, manifestly, operative placement of the tie effects a sealing closure of each thimble skirt **19** against the inner face of the opposed form wall, over and about the inner end of the tie accommodating hole **14**, to preclude fluid passage to and through said hole, save through the thimble whereof the lesser inner end is closed by the web **17** and its lips **24**.

Of significant practical merit, use of the form tie furnished with the thimbles C, as shown and described, facilitates and improves final conditioning of the cast wall surfaces exposed upon removal of the form walls **9**. Conventional stripping away of the forms through release of the anchors **15** and retraction of the panel **9** away from the cast wall **10** exposes a cast wall surface patterned with an array of protrusions presented by the closed outer ends of the tie loops **13** which require detachment from the wall, desirably by means and in a manner affording ultimate concealment of the embedded portion of the tie and finishing of the contiguous cast wall surface area. Use of the tie equipped with the thimbles C results in a cast wall surface exposure, after form stripping, typified by FIG. 7, wherein a thimble C in maintained coaction with its tie loop **13** is intrusively held within the cast wall in coplanar registration of its skirt **19** margin with the wall surface **30**, wherebeyond the outer closed end portion of the loop terminal **13** projects, but as an aspect to be removed. With the thimble C so retained in the cast wall **10**, the cuneiform cavity defined interiorly of the thimble between the webs **20** thereof opens outwardly of the wall in communication with the bight of the loop terminal **13** projecting from the wall and perpendicular to the plane of said loop in a disposition affording ready access to said cavity by means entered between the sides of said terminal loop. Detachment of the loop protrusion from the embedded portion of the tie is readily effected by application thereto of torsional force capable of rupturing the tie loop sides at or near their convergence adjacent the tie stop **12**, incidental whereto the provision and use of a tool, such as the break back tool B shown in FIGS. 6, 7 and 8. Tool B is disclosed and claimed in the copending application of John C. McArdle and Joseph Rohleder, Ser. No. 684,138, filed Nov. 20, 1967 while the rupture of the loop sides at stop **12** may be facilitated by conventional "break back" notches. The operative engagement of tool B with both the loop protrusion and the associated thimble C facilitates the desired loop protrusion detachment with simultaneous release and extraction of the thimble from the cast wall. Manifestly amenable to some structural variations, with retention of its signficant functional characteristics the tool B is shown as a longitudinally elongated unit having a cylindrical shank **31** and a flat blade **32** fixed to or integral with one end of said shank in aligned extension from one end thereof. Formed of strong, rigid material, such as steel, the shank **31** may be of any approrpiate conformation particularly suiting it to receive and to transmit to the associated blade **32** forces thereto applied for rotation thereof about its axis, such as a carpenter's brace clamped onto the shank **31**. Also, a hole **33** through said shank adjacent its end remote from the blade serves to receive means, not shown, manipulable to forcefully rotate the shank and symbolizing alternative conventional arrangements for the application of torsional forces, powered or manual, to the shank.

The blade **32** of the tool B is expediently relatively wider than the diameter of the shank **31** at its conjunction with the latter and extends thence as a flat plate in generally symmetrical alignment with the blade to an axially disposed, flat, tapered nose **34** having a beveled end **35** and sized for loose reception within the cuneiform cavity of the thimble C established by and between the thimble webs **20**. The nose **34** has a length in extension from a notch **36** greater than the interior axial depth of a thimble C, while the beveled end **35** assists entry through and within the bight of a loop **13** to full depth reception by the cuneiform cavity of the associated thimble C. At a distance from the free end of the blade slightly less that the open, interior length of the loop protrusion subject to detachment by the tool, on the side opposite notch **36** is an arcuate slot **37** intersecting the blade in an inward curvature to just beyond the center line of the shank **31**, thereby serving to locate the closed inner end of slot **37** substantially about the longitudinal median line of the tool. In a size opening such as to loosely receive and freely pass the end of the loop **13** and enlarged at its outer end by a corner chamfer **39**, the slot **37** is disposed to receive the outer end of the loop **13** when the nose **34** is fully entered within the cuneiform cavity of the associated thimble C and to permit the so engaged end of the loop to move to the closed inner end of the slot, incidental to manipulation of the tool B, including insertion of nose **34** into the thimble with chamfer **39** facing loop **13**, then pushing nose **34** into thimble C with chamfer **39** sliding along the end of loop **13** until the end of loop **13** reaches the rear edge of slot **38**, followed by a moderate retraction of the nose **34** from its full penetration of the thimble cavity. This establishes the correlation of features and elements shown in FIG. 7 wherein the loop **13** is hooked to the tool B in alignment with the longitudinal median line of the tool with the nose **34** of the tool partially engaged but against the opposite webs **20** within the cuneiform cavity of the thimble C. The interengagement of the end of the loop **13** with the closed inner end of slot **38** serves to inhibit inadvertent separation of the tool B from its established operative association with the tie loop and thimble C.

Application of the tool B, supplemented by any suitable means, not shown, for rotation thereof through the agency of the shank **31** to the association illustrated in FIG. 7 and described above, is a rapid, simple and obvious

manual exercise which is effective to impose a torsional force, indifferent as to direction, to twist both loop **13** and the associated thimble C. Rotation of the tool B in the operative association represented by FIG. 7, and as above elaborated, applies the angular coaction of the nose **34** with the cavity interiorly of the thimble C to free said thimble from the concrete in which it is embedded and subsequently to rotate the freed thimble in such material, such developments being facilitated by the conical exterior conformation of the thimble and its skirt and the structural interengagement of the thimble slideway with loop sides. Simultaneously with and incidental to such rotation of the tool and thimble, the loop **13** is rotated relative to the embedded portion of the form tie which, supplemented by the twisting influence of the tool blade **32** engaged within the bight of the loop, is concentrated at the convergence of the loop sides at the inner, lesser end of the thimble with consequent prompt rupture of the tie adjacent the inward end of its loop terminal and at the inner, lesser end of the recess conformed as matrix for the thimble. Rotational freeing of the thimble and rupture of the tie accomplished as set forth releases the thimble and its associated tie loop **13'**, as in FIG. 8, for retraction and separation from the cast wall by and in maintained coaction with the tool B. Removal of the thimble produces, at the cast wall surface, an intrusive, conical recess **40**, with the remaining tie material present only at the lesser, inner end of the recess, as shown. The removed tie loop **13'** and thimble C, removed by and in attachment to the tool B, are readily separated from the tool for discard with consequent immediate conditioning of the tool for reuse, while the uniform size, type and conformation of a series of recesses **40** resulting from the described practice of the invention invites and facilitates final dressing of the cast wall in an expedient and sightly manner.

It will be noted that, for the type of tie T shown, the spacing stops **12** may be formed to extend forwardly and angularly, so as to resiliently press against the cone C. Or, such resiliency may be provided in other ways, as by a spring or resilient disc between the stop and the inner end of the cone. Such resiliency, however provided, may be utilized to force the cone lip **19** or other sealing means against the inside of the form wall, thereby reducing the stress on the tie necessary to provide a seal and concomitantly increasing the stress imposed on the tie which represents a force holding the form walls together. As a result, there is less possibility of breaking a tie, as at the weakest point, as a result of excessive preloading normally incurred through the use of uncontrolled wedging forces. Thus, a higher factor of safety is provided for the load ultimately imposed on the form tie when the forms are filled with concrete.

In the event that the thimbles or cones C have been in stock for quite some time and lip **19** becomes less flexible, a more effective seal at the inner side of form walls **9** may be provided by utilizing a flexible disc **45**, as shown in side elevation in dotted lines in FIG. 4 and in plan view in FIG. 9. Disc **45** may be formed of rubber and have an outer diameter, as in FIG. 4, slightly less than the outer diameter of lip **19**, so as to be squeezed tightly against the inside of the form boards. For insertion over loop **13** and to the dotted position of FIG. 4, rubber disc **45** may be provided with a spaced pair of holes **46** and a connecting slit **47**, shown with the edges separated but actually formed by a cut, so that the sides of slit **47** will be squeezed together on installation. In order to insure a leak proof seal at the inner end of each cone C, just prior to installation of the cone, a drop of liquid latex or the like may be placed on each side of loop **13** opposite stop **12**, so that when the cone C is slipped onto the loop, the inner end of the cone will engage the latex and it will spread along slit **23** and thereby form a rubber seal within and along the slit.

Although a preferred embodiment of this invention has been illustrated and described, it will be understood that other embodiments may exist and that various changes may be made therein, all without departing from the spirit and scope of this invention.

What is claimed is:

1. A device for use with a form tie having a terminal loop at each end, said loops being adapted to extend through holes in opposed form walls, between which concrete and the like is to be poured, for engagement with anchoring means, said device comprising:

a hollow body disposable about an inner portion of said loop;

means at the inner end of said body permitting passage of the outer end of said loop therethrough and, after such passage, restricting the flow of liquid from said concrete and the like into the interior of said hollow body, said means comprises a web extending across the inner end of said body, a pair of spaced holes in said web through which the sides of said loop may extend, and a slit connecting said holes, said web being flexible at least adjacent said slit; and

means at the outer end of said body for sealingly engaging the inside of a form wall around the hole through which said loop extends.

2. A device as defined in claim **1**, wherein said hollow body has a conical side wall tapering outwardly from the inner end of said body.

3. A device as defined in claim **2**, wherein said means at the outer end of said body comprises an outwardly tapered, annular skirt.

4. A device as defined in claim **2**, wherein said device is formed of a plastic which has a low adherence to cement and concrete of the type characteristic of high density polyethylene.

5. A device as defined in claim **1**, wherein said web, on opposite sides of said slit, is provided with lips tapering in thickness toward said slit.

6. A device as defined in claim **1**, including means within said body for engaging the sides of said loop.

7. A device as defined in claim **6**, wherein said means inside said body for engaging said sides of said loop comprises:

a pair of spaced, opposed, longitudinal webs extending from the inner end of said body to a point adjacent the outer end; and

an outward offset in each said web forming a slideway for the respective side of said loop.

8. A device as defined in claim **6**, wherein:

said body is provided with a conical outer wall which tapers outwardly from the inner end of said body; and

each said web offset is integral with said outer wall for at least a portion of its length.

9. A device as defined in claim **1**, wherein:

said hollow body has a conical side wall tapering outwardly from the inner end of said body;

said means at the outer end of said body comprises an outwardly tapered, annular skirt;

said device is formed of a plastic which has a low adherence to cement and concrete of the type characteristic of high density polyethylene;

said web, on opposite sides of said slit, provided wtih lips tapering in thickness toward said slit;

said means inside said body for engaging said sides of said loop comprises a pair of spaced, opposed, longitudinal webs extending from the inner end of said body to a point adjacent the outer end and an outward offset in each said web forming a slideway for the respective side of said loop, with each said web offset integral with said side wall for at least a portion of its length.

10. A device as defined in claim **9**, wherein said means at the outer end of said body further includes a flexible disc having an outer edge abutting said skirt, a pair of

spaced holes through which the sides of said loop may extend and a slit extending between said holes.

11. A device as defined in claim **1**, including:

means within said body for engaging the sides of said loop; and

means within said body for engaging a tool inserted in said device, whereby after said concrete and the like has set, said tool may be inserted in said device to turn said device and free the same from said concrete and simultaneously cause the sides of said loop to break back adjacent the inner end of said device.

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