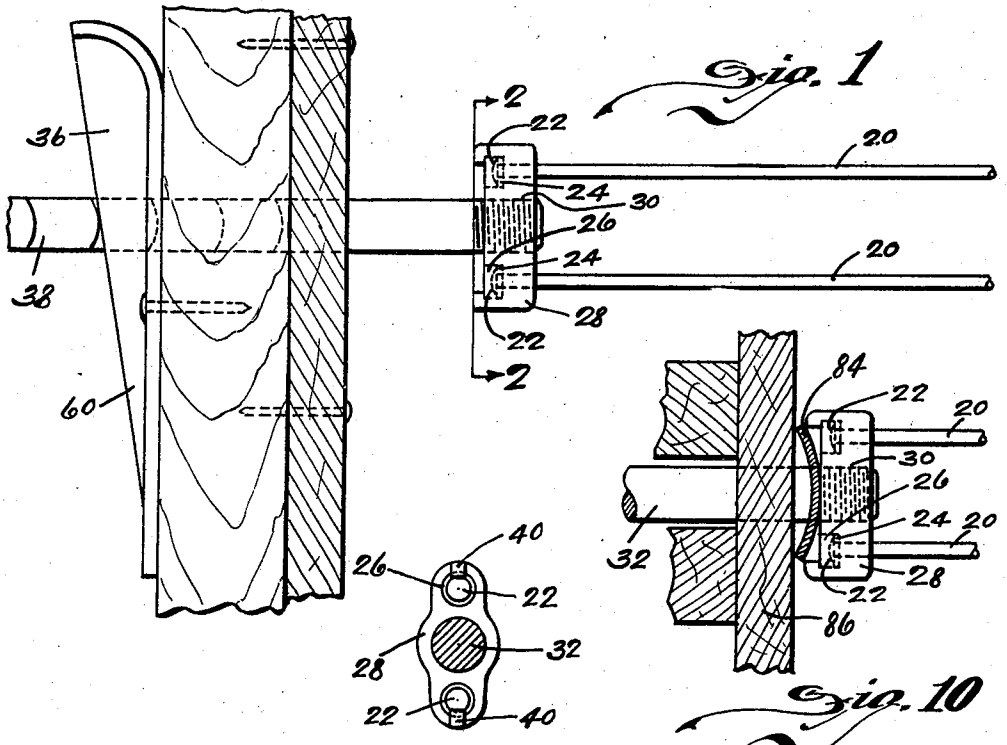
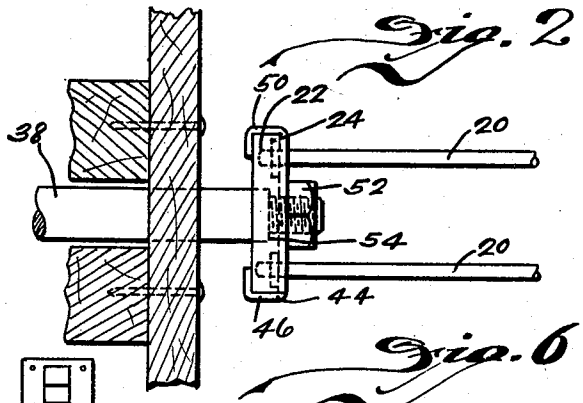
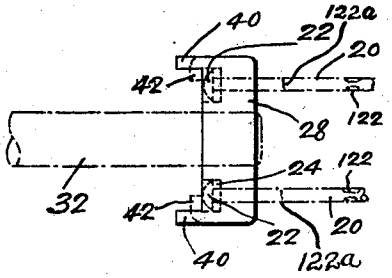
June 17, 1941. C. A. KINNINGER 2,245,559

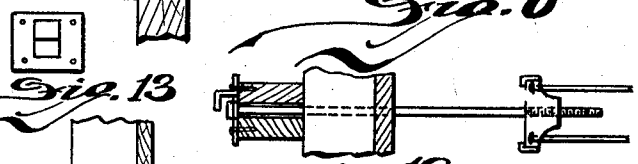
WALL FORM TIE

Filed Nov. 29, 1933 4 Sheets-Sheet 1











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BY

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June 17, 1941. C. A. KINNINGER 2,245,559

WALL FORM TIE

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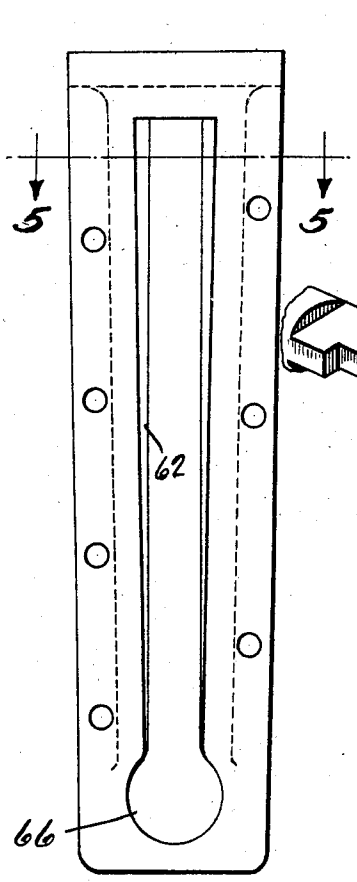


Fig. 4

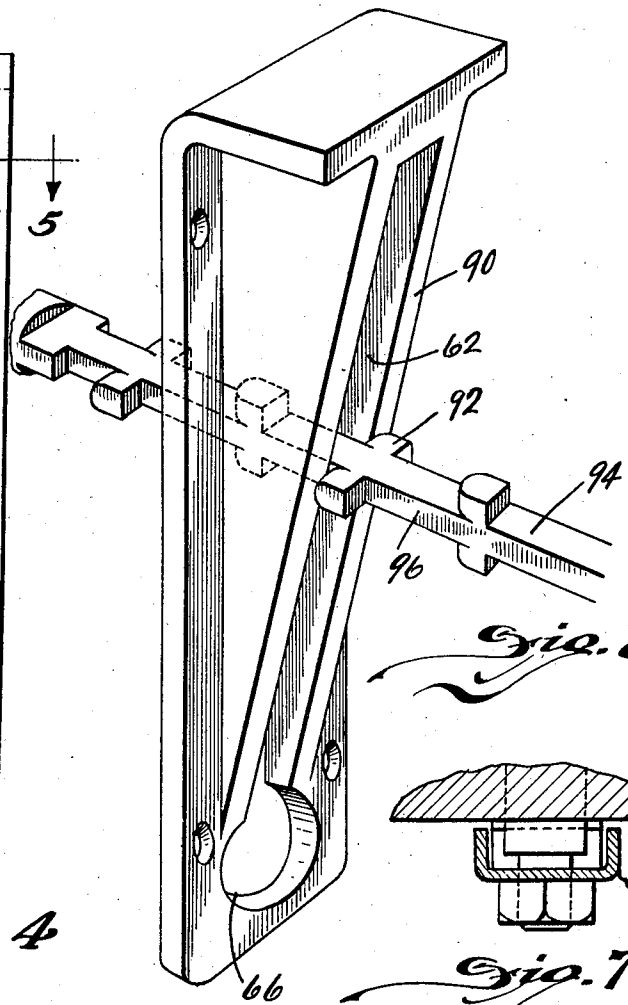


Fig. 8

Fig. 7

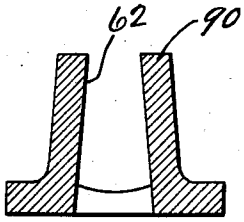


Fig. 5

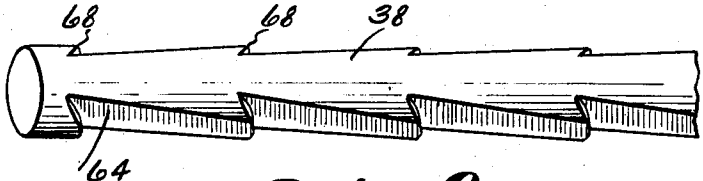


Fig. 9

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WALL FORM TIE

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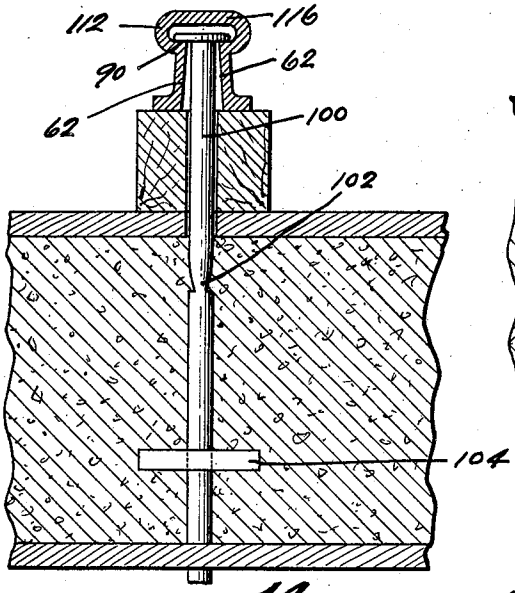


Fig. 14

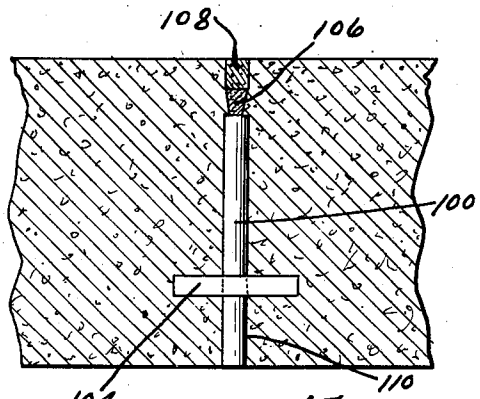


Fig. 15

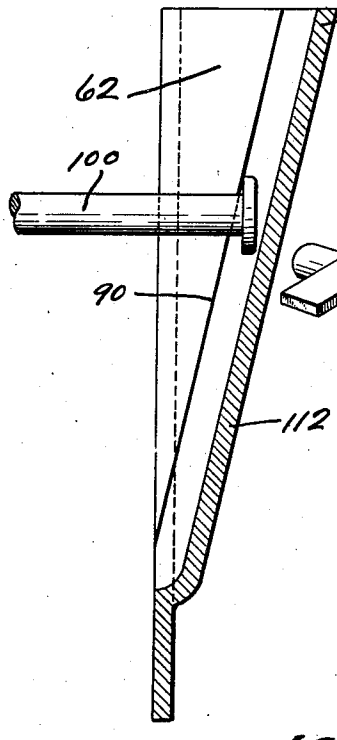


Fig. 16

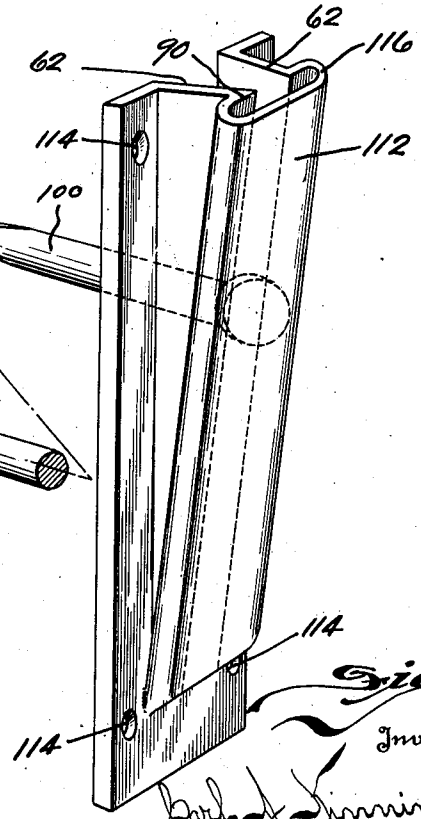


Fig. 17

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WALL FORM TIE

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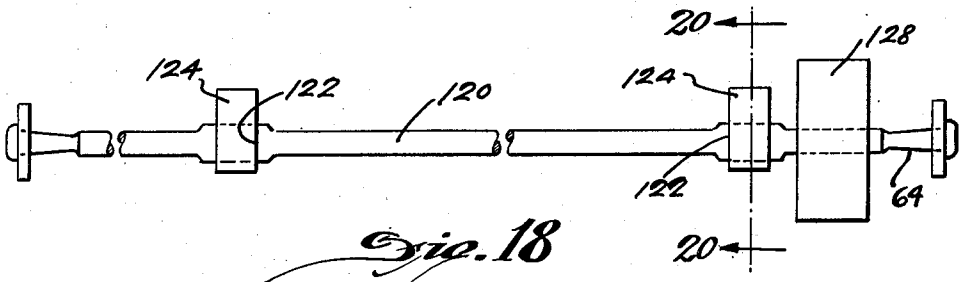
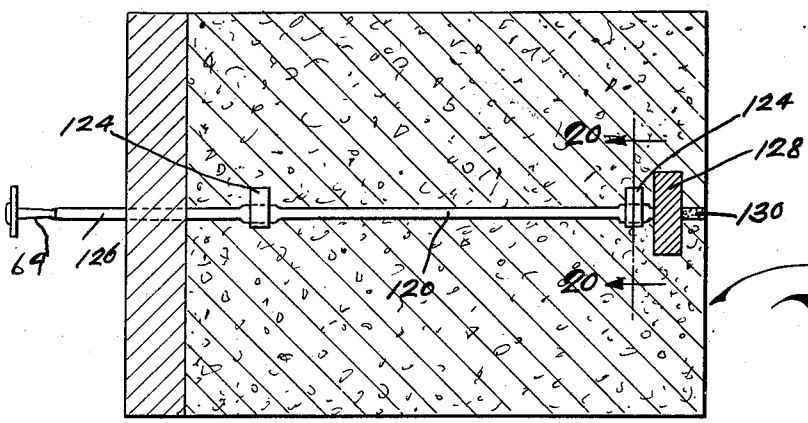


Fig. 18



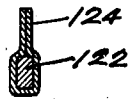


Fig. 20

Fig. 19

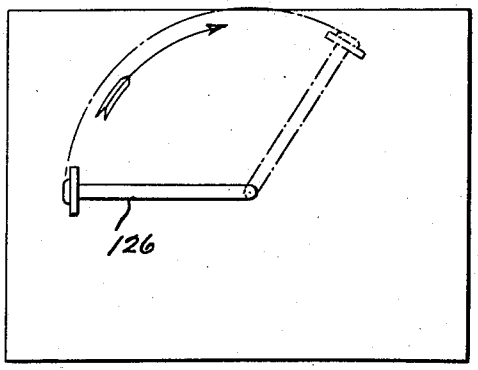


Fig. 21

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Patented June 17, 1941 2,245,559

UNITED STATES PATENT OFFICE

2,245,559

WALL FORM TIE

Carl A. Kinninger, Dayton, Ohio, assignor of one-half to Arthur M. Kinninger, Dayton, Ohio

Application November 29, 1933, Serial No. 700,207

27 Claims. (Cl. 25—131)

This invention relates to wall ties, and more particularly to wall ties for holding the form walls in spaced relation.

An object of this invention is to provide a form wall tie that is economical, convenient to handle, readily assembled, cheap in construction and reliable.

Another object of this invention is to provide a form wall tie that is breakable a considerable distance within the outer surface of a wall built up between opposing form walls.

Another object of this invention is to provide a form wall tie that falls within the subsequently formulated intermediate wall due to torsion.

Another object of the invention is to provide a form wall tie that will not rotate in the intermediately fabricated wall but that may be rotated near the outer surface of the intermediate wall so as to cause the form wall tie to fail intermediate the center of the intermediately fabricated wall and the outside surface thereof.

Another object of the invention is to provide a form wall tie that holds the form walls in spaced relation without the use of spacers intermediate the form walls.

Another object of the invention is to weaken the form wall tie so as to cause it to fail in torsion without materially weakening the tensile strength thereof.

Another object of the invention is to provide means movable with respect to the form wall tie rod that determines the spacing intermediate the form walls.

Another object of the invention is to provide a form wall tie rod of a standard length that may be used for form wall varying in thickness and/or form wall varying in spacing from one another.

Another object of the invention is to provide a seal for the aperture left by the removed end of a tie rod from a wall built up intermediate the form walls.

Another object of the invention is to provide a sealing unit for sealing the aperture vacated by the removed portion of the rod.

With the above primary and other incidental objects in view as will more fully appear in the specification, the invention consists of the features of construction, the parts and combination thereof, and the mode of operation, or their equivalents, as set forth and described in the claims.

Referring to the accompanying drawings, Fig. 1 is a view showing one embodiment of my invention. Fig. 2 is a cross-sectional view taken substantially in line 2—2, Fig. 1. Fig. 3 discloses an enlarged detailed view of a portion of the device shown in Fig. 1. Fig. 4 is an elevation of the wedge member shown in Fig. 1. Fig. 5 shows an enlarged view of the wedge taken on the line 5—5 of Fig. 4. Fig. 6 is a fragmentary enlarged view of a modification of the device shown in Fig. 1. Fig. 7 shows a sectional view of the head disclosed in Fig. 6. Fig. 8 discloses a perspective view of another modification. Fig. 9 is an enlarged fragmentary view showing a modification of the rod disclosed in Figs. 1 and 8. Fig. 10 shows an adaptation of the preferred embodiment shown in Fig. 1. Fig. 11 discloses another modification where form wall spacers have been eliminated. Fig. 12 discloses still another modification wherein form wall spacers have been eliminated. Fig. 13 is an end elevation of the figure disclosed in Fig. 12. Figs. 14, 15, 16, and 17 disclose a modification of a rod and wedge, wherein Fig. 14 discloses a cross-sectional view of the wall with the forms before removal and Fig. 15 after removal, and Figs. 16 and 17 disclose cross-sectional view and perspective view of the wedge respectively. Figs. 18, 19, 20, and 21 disclose another modification of a tie rod, wherein Fig. 18 shows a view of the tie rod, Fig. 19 shows the tie rod embedded in the wall, Fig. 20 a sectional view taken on the line 19—19 of Fig. 18, and Fig. 21 a view showing the process of breaking the rod within the wall.

In building operations it is very desirable to keep the cost thereof to the minimum. Wherever a saving can be effected it should be done in view of the fact that the cost of building has not decreased in proportion with the decrease in cost of many other commodities in daily use. In the construction of concrete walls it is practically necessary to build a temporary building or form, so to speak, that is later removed and discarded. This building or form includes an outer wall and an inner wall which must be held in spaced relation and in fixed relation to one another. Formerly it was the practice to make the form wall spacers on the job by use of wire or other binding members for preventing the separation of the form walls and the use of spacers for preventing the collapse thereof. This is expensive, especially on account of the labor involved. Following this procedure there was a development wherein removable form retaining members were used. The common practice of the very last few years has been the use of temporary form retaining members wherein the member is embedded within the fabricated

intermediate wall, the outer ends being severed or otherwise removed. It has been the common practice to provide spacers on the inside of the form which are located in the surface of the concrete wall when the forms are removed. One type of spacers that has been used has been suggested by the patent to Ewing No. 1,293,391 where cone shaped disks or washers are inserted upon the end of the rod the base of the cone engaging the forms. Such cones are objectionable, however, as the removal of the cones leaves a conical depression in the concrete wall which is later pointed or filled in by concrete or other suitable material. The wall thus constructed is marred as the spaces vacated by the cones are quite conspicuous and a source of trouble. It is almost impossible to get a complete unit between the material used for pointing and the concrete of the wall. This being the case there is a tendency especially during colder weather for moisture accumulating in the crevices between the pointing and the wall which causes the pointing to bulge and finally drop out of its seat. Up to the present time, however, this has been the only solution where it is desirable to present a wall having a comparatively smooth surface. Such cones have been found objectionable in that they increase the cost of the temporary form tie in addition to marring the surface of the finished wall. After the wall is constructed, especially one used as a retaining wall, water seeps through the wall around the form tie remaining therein which is objectionable for two reasons—one the wall is not tight and the other the rust or oxide from the embedded rods streaks the wall, as is well known.

Instead of cone shaped spacers, flat spacers are used for some types of construction which are suitably attached to the tie rod as shown in applicant's co-pending application Serial No. 540,932, filed May 29, 1931. When such spacers are used the problem of pointing is not so great but the concrete wall becomes streaked due to the end of the rod being exposed to the surface.

Each of these objections have been overcome by this invention in that spacers are not used but a wedge engaging the tie rod head is provided which prevents the free movement of the tie rod either away from or toward the wedge so that as the wedge is attached to the temporary form the forms retain a fixed relation to one another. The rod has also been weakened in spaced relation with respect to the forms so that it may be broken within the surface of the intermediate formed wall, the hole vacated by the portion of the tie rod removed being sealed by a suitable sealing unit which will appear more fully later. The tie rod is preferably broken by a twisting movement of the outer end which necessitates the use of means for preventing rotation of the tie rod embedded within the formed wall.

In the construction of form wall ties for small or thin concrete walls, a single rod, having spaced members seated thereon, and suitable wedge engaging heads at each end thereof, has been used with very satisfactory results.

In larger constructions, the tie rods disclosed in my co-pending application, Serial No. 540,932, are not always satisfactory for the reason that the strength of the form wall ties is not sufficiently great and the structure of the parts holding the forms in position is not sufficiently heavy to support heavy timber or material used in the construction of the forms.

A substantial distance in from the outer surface of the concrete wall, as shown in the specification and claims, there is designated the distance from the place where the rod emanates from the concrete whether it be at the surface of the forms at the inner surface of the spacers or at the apices of the cones.

In the preferred embodiment disclosed in Figs. 1, 2 and 3, more tensile strength has been obtained by the use of two or more parallel spaced tie rods **20** extending through the formed wall, each of which is provided with offset heads **22** engaging a suitable washer **24** seated in a recess **26** in the spacer head **28**, which is provided with a threaded hole **30** for receiving a notched bar **32** used in holding the several parts of the form in position by a wedge **36** engaging the notches **38**. The wire rods **20** are preferably made of high carbon content steel in order to get sufficient tensile strength. For this reason it has been found impractical and in some cases impossible to weld the tie rods to the heads or spacers as the high carbon content of the steel when welded causes the steel to become extremely brittle, thereby weakening the rods. By upsetting the ends of the rods disclosed in Figs. 1, 6 and **10**, the tensile strength of the rods is not lost but maintained at its maximum. Washers treated by a cyanide process are placed intermediate the upset head and the seat in the cross head member **28** which prevents the head of the rod stripping therefrom. The use of the high carbon content rods and the cyanide treated washers greatly reduces the required dimensions of the rods and thereby reduces the cost of production, the cost of shipping and the strain upon the forms. In addition to this the light rods with extremely high tensile strength facilitates the construction of the forms as the lighter rods are far more easily handled by the builders. As may best be seen in Fig. 3, the head **28**, before assembly, is provided with a pair of lugs **40** that are turned over, as shown at **42** by the dotted lines to retain the head **22** of the rod **20** within the socket provided therefor. The head **28** is preferably made of either malleable iron or of forged material, as disclosed in Fig. 6.

From the cross-sectional view of the forged head **44**, disclosed in Fig. 7, this head is made from a channel-shaped member having the sides **46** and the end **50** of the base extended at right angles thereto forming a lug holding the end of the rod **20** in position (see Fig. 6). When the channel-shaped member is used, as disclosed in Figs. 6 and 7, it is preferable to provide a nut **52** for the notched bar **38** which is preferably reduced so as to form shoulders **54** against which member **44** is seated. As may best be seen from Figs. 1, 4 and 5, a compound wedge has been used that is provided with the wedging surface **60**, as seen in Fig. 1, and wedging surfaces **62**, seen in Figs. 4 and 5, arranged to engage the inclined surfaces **64** of the ratchet disclosed in Fig. 9. The minimum distance between the surfaces **62** is slightly greater than the minimum distance across the ratchet **38** but smaller than the diameter of the ratchet, so that when the wedge is passed over the end of the notched bar, which is permitted by the enlarged opening of the wedge **60** at **66**, the wedge is limited in its movement on the ratchet **38**, the shoulders **68** preventing movement of the wedge **36** to the left, as disclosed in Fig. 1, and the wedging surfaces **62** engaging the inclined surfaces **64** limiting the movement of the wedge **36** to the right also as viewed in Fig. 1. By tacking this compound wedge to the waler it

holds a form rigid as to inward thrust eliminating spreaders and also outward pressure.

The maximum depth of the wedge 36 is considerably greater than the distance between two succeeding shoulders 68. Such a structure permits the use of the wedge to tighten the forms by moving the forms inwardly along the rods, even a greater distance than that between successive notches in the ratchet 38 if necessary.

In the modification disclosed in Fig. 11, one end of the ratchet 38 is internally threaded at 80 to receive the threaded rod 82. This structure is found desirable where the tensile strength of one rod is sufficient to support the form and where a ratchet is desirable to accommodate various dimensions between the forms.

In the embodiment disclosed in Figs. 1 and 3, the head 28 is located flush with the surface of the concrete wall and may be opposed to the exterior thereof. At times it is necessary to have the head 28 seated or spaced from the outer surface of the wall and spaced from the inner surface of the form. This may be accomplished by using a cone-shaped washer 84, the apex of which engages the head 28 and the base of which engages the form 86, as best seen in Fig. 10. After removing the bar 38 and the forms 86, the cone-shaped washer 84 drops out, and the recess that is left in the wall may be filled so as to present a smooth surface.

For some types of work the compound wedge 36 may be dispensed with and the shouldered bar and the wedge disclosed in Fig. 8 may be used. In this modification the wedge 90 overlaps the adjacent wedge engaging members 92, which lie in planes at right angles to one another. In this modification, the ratchet 94 does not require the inclined surfaces 64 between succeeding shoulders, but has a square cross-sectional area that is substantially uniform in size excepting for the shoulders 92, alternating pairs of which extend at right angles.

In the modification disclosed in Figs. 14, 15 and 16 the tie rod 100 is provided with a reduced portion 102 normally found within the wall and a lug 104 welded or otherwise secured within the rod to prevent rotation of the same when the outer end is twisted to cause the rod to fail at 102. The rod being weakened at 102 permits the failure of the rod at any predetermined distance within the wall so that the outer end may be removed and a hole left thereby suitably plugged.

In the construction of dams, sewage disposal plants and the like it is desirable to plug the hole for the reason that if the hole is not plugged water, sewage and other liquids leak through the foundation or wall along the periphery of the rod and even if the hole left by the rod is cemented the cement does not make a tight union between it and the wall. In order to overcome this difficulty a cork or other suitable plug 106 is driven into the hole so that its outer surface is spaced away from the outer edge of the hole and the cement 108 or other suitable material is used to fill the hole. The cork will of course deteriorate in time but before it does so a union caused by a chemical and electrolytic action is formed between the material of the wall and the rod along the juncture 110 so that when the cork 106 is rotted away a complete union has been effected between the rod and the wall so as to prevent the liquids from leaking through the wall along the outer edge of the rod. In the industry this is known as ironite waterproofing and is considered a very effective method of waterproofing concrete walls.

As shown in Fig. 3 the rods 20 may be weakened at 122 in which event the head 28 may be located on the outside of the concrete wall preferably on the outside of the forms immediate the concrete wall and the rods broken at 122 as will appear more fully later.

Instead of the cross-member 104 being welded to the rod, the rod or tubing may be of an irregular cross-sectional area so as to prevent rotation or it may follow a tortuous path so as to be held in a non-rotatable position after the concrete has been poured and set. By referring to Figs. 16 and 17, a compartment wedge 112 has been provided that in addition to the tapering wall 62 is provided with a cap or head retainer 116 so that when the wedge is driven to its home position it may be secured to the whalers by suitable nails driven through the holes 114. When so fastened in position the shoulders or camming surfaces 90 prevent the head from moving in one direction and the head retainer 116 from moving in the other direction, thereby eliminating the necessity for the spacers that are commonly used in ordinary wall ties now on the market.

The elimination of the spacers decreases the cost of production so as to increase the demand therefor.

In the modification disclosed in Figs. 18, 19, 20 and 21 another form of the present invention has been disclosed. The rod 120 is flattened at 122 and member 124 is provided with a bight that surrounds and grips the flattened portion 122 so that as the outer end 126 of the rod is twisted as shown in Fig. 21 the rod fails in tortion adjacent to the retaining member 124 which prevents rotation of the rod beyond the break. Member 124 need not necessarily be welded in position as its shape is such that it engages the rod 120 so as to prevent its rotation.

Instead of using the cork 106 to plug the aperture vacated by the removed portion of the rod, a sealing unit 128, provided with a suitable aperture through which the outer end of the rod 120 passes, is embedded in the concrete in such a manner that as the outer end of the rod 120 is removed the hole vacated by the rod extending through the receiving unit 128 is closed. A flexible rubber pierced for the reception of the rod 120, closes when the rod is removed. Instead of a rubber sealing unit 128 any other suitable sealing unit, wherein the aperture vacated by the rod is closed so as to prevent water or other liquids from seeping therethrough, may be used. By referring to Fig. 19 it may be seen that the sealing unit 128 prevents seepage through the concrete wall between the rod 120 and the wall. The other end of the aperture vacated by the rod may be subsequently filled with concrete or any other suitable filler 130 so as to present a surface flush with the outer surface of the wall, thereby concealing the use of the retaining rods.

As disclosed in Fig. 3, the modification using two or more tie rods may be weakened at 122 in which event the head 28 is preferably located outside of the forms and not within the wall as above described. After the concrete has been poured and set, the tie rods may be cut at 122—*a*, the stubs intermediate 122—*a* and the outer surface of the wall bent and twisted so as to cause each rod to fail at 122 which is preferably embedded within the concrete wall. The hole vacated by the removed portion of the rod may be sealed and filled with concrete.

From the above description it will be apparent that there is thus provided a device of the character described possessing the particular features of advantage before enumerated as desirable, but which obviously is susceptible of modification in its form, proportions, detail construction and arrangement of parts without departing from the principle involved or sacrificing any of its advantages.

While in order to comply with the statute, the invention has been described in language more or less specific as to structural features, it is to be understood that the invention is not limited to the specific features shown, but that the means and construction herein disclosed comprise the preferred form of several modes of putting the invention into effect, and the invention is therefore claimed in any of its forms or modifications within the legitimate and valid scope of the appended claims.

Having thus described my invention I claim:

1. In the construction of a concrete wall formed intermediate spaced forms held in spaced relation by tie rods, the method of construction including embedding a sealing unit within the concrete wall through which the rod passes, and removing a portion of the rod extending through the sealing unit so as to permit the sealing unit to seal the aperture vacated by the rod extending therethrough.

2. In a construction of the class described including a rod, a sealing unit carried by said rod, said sealing unit being of expansible and contractable material so that as the rod is removed therefrom the material expands and the aperture vacated by said rod is sealed.

3. A tie rod structure for forms used in casting a concrete wall and adapted to be partially embedded in the concrete wall, comprising a tie rod having a weakened portion spaced from the end of the rod and positioned to be embedded in the concrete wall whereby the rod will fail at the weakened portion thereof on twisting after the concrete wall is formed to thereby permit removal of the end portion of the rod up to the weakened portion thereof, sealing means normally carried by the removable end portion of the rod a sufficient distance from the outermost extremity thereof as to be embedded in the formed concrete wall, said sealing means being of a nature to seal the aperture in the concrete vacated by the removable end portion of the rod upon removal of said end portion from the wall.

4. In a tie assembly for forms used in casting and including a wall, a tie rod extensible through the form wall and a wedge member cooperating with the tie rod for adjustment of the form wall longitudinally of the tie rod, said wedge including a pair of tapering surfaces bounding an elongated slot through which the tie rod extends, the walls of the slot diverging from one of said first named pair of surfaces toward the other, and said tie rod including successive pairs of opposite diverging surfaces disposed along the end of the tie rod engageable with the wedge member, each pair of diverging surfaces terminating in a wedge engaging shoulder, the taper of the walls of the slot in the wedge member substantially coinciding with the angularity of the diverging surfaces on the tie rod to lock the wedge member against bodily movement other than transversely of the tie rod.

5. In a tie assembly for forms used in casting and including a wall, a tie rod extensible through the form wall and a wedge member cooperating with the tie rod for adjustment of the form wall longitudinally of the tie rod, said wedge including a pair of tapering surfaces bounding an elongated slot through which the tie rod extends, the walls of the slot diverging from one of said first named pair of surfaces toward the other and diverging from one end of the wedge member toward the other end thereof and complemental tapering surfaces on the rod cooperating with the pair of surfaces on the wedge to lock the wedge against bodily movement other than transversely of the rod.

6. A tie assembly for spaced form walls used in casting, and wherein a tie rod is extensible through the form walls and has a portion of its length disposed within the area of the casting and ultimately embedded therein, the rod being secured to the spaced form walls in a manner to resist separation movement thereof by forces resultant of the casting operation, characterized by the tie rod having substantially the same resistance to tensile stress throughout all portions of its length, and shaped at predetermined points within the length of the rod ultimately embedded in the casting to reduce resistance of the tie rod to torsion stresses so that certain predetermined length sections of the tie rod may be separated from the remainder of the rod by twisting and then removed from the casting, and a sealing means carried by the portion of the rod to be removed from the casting and located within the length of the rod embedded in the casting, said sealing means remaining in the casting to seal the opening left by removal of a portion of the rod.

7. A tie assembly for a form used in casting concrete structures and held in position by a wedge abutting a waler associated with the form, including a tie rod having an upset end engaged by the wedge and a reduced portion arranged in spaced relation from the other end of the rod so as to lie a substantial distance within a concrete structure cast within the form, said reduced portion decreasing the torsional strength of the rod without affecting the tensile strength which remains substantially uniform throughout the length thereof, so that as the outer end of the rod is twisted it fails at the reduced portion, and a transversely extending member carried by the portion of the rod ultimately embedded in a cast concrete structure and spaced from the outer end of the rod for cooperation with the cast concrete structure to prevent rotation of the rod extending from the reduced portion thereof further within the cast concrete structure.

8. A tie assembly for a form used in casting concrete structures and held in position by a wedge engaging a waler associated with the form, including a tie rod having an upset end engaged by the wedge and a weakened portion arranged in spaced relation from the outer end of the rod so as to lie a substantial distance within a concrete structure cast within the form, said weakened portion decreasing the torsional strength of the rod without affecting the tensile strength which remains substantially uniform throughout the length thereof, so that as the outer end of the rod is twisted it fails at the reduced portion, and a peripheral extension on that portion of the rod ultimately embedded in a cast concrete structure and spaced from the outer end of the rod for cooperation with the cast concrete structure to prevent rotation of the rod extending from the weakened portion thereof further within the cast concrete structure.

9. In a tie assembly wherein a form used in casting concrete structures are held in position by a wedge engaging a waler, a rod extending across the area defined by the form, the rod having an upset head engageable by the wedge and a flattened portion arranged in spaced relation from the outer end of the rod so as to lie a substantial distance inwardly from the outer surface of a concrete structure cast within the form, said flattened portion decreasing the torsional strength of the rod without affecting the tensile strength which remains substantially uniform throughout the entire length of the rod, so that as the outer end of the rod is twisted it fails at the flattened portion, and a member carried by the rod and non-rotatable with respect thereto, and constructed and arranged to cooperate with the cast concrete structure to prevent rotation of that portion of the rod within the cast concrete structure and beyond the flattened portion thereof and embedded in the cast concrete structure.

10. The combination of a sealing unit with a tie assembly for holding concrete wall forms in spaced relation including a rod extending across the area defined by the forms, said rod having a weakened portion a substantial distance from the end thereof so as to be located within a concrete wall erected within the forms, so that when the outer end of the rod is twisted it fails in torsion at said weakened portion and permits removal of the outer end thereof, leaving an aperture in the cast concrete wall, said sealing unit being normally associated with the outer end of the tie rod and located within the area occupied by the formed concrete wall, and being effective to seal the aperture vacated by the removed portion of the rod.

11. In a tie assembly for a form used in casting walls, a tie rod having a portion thereof extending through a form and having its ends spaced from the inner and outer surfaces of the form, a wedge member engageable with the rod in advance of the outer surface of the form and movable transversely of the rod to adjust the form longitudinally of the rod, complemental angular surfaces on the wedge member and rod restricting the wedge member to movement transversely of the rod, a flattened portion on the rod spaced from the inner surface of the form to lie within a cast wall and at which the rod fails on twisting to permit removal of a part of the rod from the cast wall, a member having a bight around the flattened portion of the rod and extending laterally thereof into the cast wall to lock that portion of the rod beyond the flattened portion and within such cast wall against rotation, and a sealing unit carried by the rod in spaced relation with the inner surface of the form and normally associated with the removable part of the rod lying within the cast wall and adapted to seal the aperture in such cast wall by removal of the removable part of the rod.

12. In a tie assembly for a form used in casting concrete structures, a tie rod having an end outside the form which includes successive pairs of diverging surfaces forming spaced shoulders, a wedge associated with the rod and providing a backing for the form, the wedge engaging a selected shoulder and being movable relatively to the rod to produce lateral adjustment of the form along the rod, and having rod contacting surfaces complemental to the diverging surfaces of the rod, the complemental surfaces on the rod and the wedge locking the wedge against bodily movement other than transversely of the rod for form adjustment purposes while permitting unrestricted transverse movement thereof.

13. In a tie assembly for a form used in casting concrete structures, a tie rod having an end outside the form which includes a pair of diverging surfaces forming a shoulder, a wedge associated with the rod and providing a backing for a form, the wedge engaging the shoulder on the rod and being movable relatively to the rod to produce lateral adjustment of the form along the rod, and having rod contacting surfaces complemental to the diverging surfaces on the rod to lock the wedge against bodily movement other than transversely of the rod for form adjustment purposes, while permitting unrestricted transverse movement thereof, there being a plurality of like pairs of diverging surfaces spaced equidistantly along the length of the rod to permit positioning of the wedge member at selected points along the rod length.

14. In a tie assembly for a form used in casting concrete structures, a tie rod having an end outside the form which includes a pair of surfaces disposed angularly to the longitudinal axis of the rod and forming a shoulder, a wedge associated with the rod and providing a backing for the forms, the wedge engaging the shoulder on the rod and being movable relatively to the rod to produce lateral adjustment of the form along the rod, and having rod contacting surfaces complemental to the pair of angularly disposed surfaces on the rod for locking the wedge against bodily movement other than transversely of the rod while permitting unrestricted transverse movement thereof for form adjustment purposes.

15. A wall tie assembly for a form used in casting concrete structures, including a rod extending across the area defined by the form and protruding through the form, a wedge providing a backing for the form and associated with the protruding end of the rod, the wedge being movable relative to the rod for adjustment of the form along the rod, and complemental coacting angular surfaces on the protruding end of the rod and the wedge locking the wedge against bodily movement other than transversely of the rod while permitting unrestricted transverse movement thereof for form adjustment purposes.

16. In a wall tie assembly for a form used in casting concrete structures, a rod extending across the area defined by the form and having a toothed end outside the form, and a wedge engaging the toothed end of the rod and providing a backing for the form, said wedge being movable transversely of the rod for adjustment of the form along the rod, and complemental angular surfaces on the wedge and rod for locking the wedge against bodily movement other than transversely of the rod while permitting unrestricted transverse movement thereof for form adjustment purposes.

17. A form tie including a tie rod having a reduced portion arranged in spaced relation from the outer end of the rod so as to lie a substantial distance from the outer surface of a structure erected within the form, so that as the outer end of the rod is twisted it fails within the erected structure, said reduced portion decreasing the torsional strength of the rod without affecting the tensile strength of the rod which remains substantially uniform throughout the entire length thereof, and means carried by the portion of the rod spaced further from the outer end of the rod than the reduced portion and embedded in the erected structure for preventing rotation

of such rod portion, said means including a member surrounding the reduced portion of the rod with a bight and extending laterally of the rod into the erected structure.

18. A form tie including a tie rod having a flattened portion arranged in spaced relation from the outer end of the rod so as to lie a substantial distance from the outer surface of a cast structure erected within the form, so that as the outer end of the rod is twisted it fails within the cast structure, said flattened portion decreasing the torsional strength of the rod without affecting the tensile strength of the rod which remains substantially uniform throughout the entire length thereof, and means carried by the portion of the rod embedded in the cast structure for cooperation therewith to prevent rotation of such rod portion, said means including a member surrounding the flattened portion of the rod with a bight and extending laterally into the cast structure.

19. A form tie assembly for use in casting concrete structures including a tie rod extensible across the interior of the form, said tie rod being weakened within the area defined by the form and thereby within the area of a concrete structure cast within the form whereby the rod fails on twisting to permit removal of a part thereof from such cast concrete structure, and sealing means associated with the removable portion of the rod and located within the area occupied by the cast concrete structure before failure of the rod for cooperation with the cast concrete structure to seal the aperture vacated by the removed portion of the rod.

20. A form tie comprising a one-piece continuous rod, enlarged heads at the opposite ends of the rod, a distorted portion of the rod in such relatively spaced relation with at least one of the heads as to lie a substantial distance within the confines of a body of concrete molded in a form reinforced by the tie, wherein the rod is embedded in rotation resisting relation, said distorted portion being of substantially equal cross-sectional area and approximately uniform tensile strength with the cross-sectional area and tensile strength of the remainder of the rod but of decreased resistance to torsional strain, the construction and arrangement being such that upon twisting of a headed end of the rod protruding beyond the face of the concrete body the rod will fail and separate at such distorted portion a substantial distance within the confines of the molded concrete body, leaving a portion of the rod permanently embedded therein.

21. A form tie comprising a one-piece continuous, rod, enlarged terminal heads at the opposite ends thereof, a portion of the rod indented without removal of any substantial portion of material therefrom and embodying substantially the maximum cross-sectional area of the rod disposed in such relatively spaced relation with at least one of the terminal heads as to lie a substantial distance from the outer face of and within a body of concrete molded in a form reinforced by the tie, wherein the rod is embedded in rotation resisting relation, the construction and arrangement being such that upon twisting a headed end of the rod protruding beyond the face of the concrete body the rod will fail and separate at such distorted portion a substantial distance within the concrete body, leaving a portion of the rod permanently embedded therein.

22. A form tie comprising a one-piece continuous rod, enlarged terminal heads at opposite ends thereof, and a weakened breakoff portion of decreased resistance to torsional strain but of approximate maximum tensile strength of the rod disposed in such spaced relation with at least one of the headed terminals as to lie a substantial distance within a body of concrete material molded in a form reinforced by the tie, wherein the rod is embedded in rotation resisting relation, the construction and arrangement being such that upon twisting motion of a protruding terminal portion of the rod the latter will fail and break at such breakoff portion a substantial distance inwardly from the face of the molded concrete body, leaving a portion of the rod permanently embedded therein.

23. A tie for concrete forms comprising a rod having a plurality of spaced heads adjacent one end thereof and a wedge constructed and arranged to coact with any one of said heads to tighten the rod, the oppositely facing parts of adjacent heads being spaced apart a less distance than the maximum take-up of the wedge.

24. In combination, a tie rod having a plurality of spaced heads adjacent one end thereof and a wedge channeled in cross section to receive one head as the wedge is coacting with the next outer head and having a slot in its outer surface to receive the rod and having spaced bearing faces at its inner surface, the channel between said inner and outer surfaces being dimensioned to receive said head.

25. A tie for concrete forms comprising a rod having a plurality of spaced heads adjacent one end thereof, and a wedge constructed and arranged to coact with any one of said heads to tighten the rod, said heads being spaced apart a less distance than the maximum take-up of the wedge, said rod having a flattened portion and said wedge having an opening to receive and fit said flattened portion of the rod.

26. A tie for concrete forms comprising a rod having a plurality of spaced heads adjacent one end and a wedge having bearing surfaces angularly inclined in relation to each other, one surface comprising bearing faces spaced from each other a distance at least as great as the width of said heads, and the wedge having a longitudinal channel to receive one of the inner heads as the other wedge surface coacts with the adjacent outer head.

27. A tie for concrete forms comprising a rod having a plurality of spaced heads adjacent one end thereof and a wedge constructed and arranged to coact with any one of said heads to tighten the rod, the inner, wedge engageable surfaces of adjacent heads being spaced apart a less distance than the maximum take-up of the wedge.

CARL A. KINNINGER.

CERTIFICATE OF CORRECTION.

Patent No. 2,245,559. June 17, 1941.

CARL. A. KINNINGER.

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows: Page 4, second column, line 41, claim 7, for the word "other" read --outer--; and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 29th day of July, A. D. 1941.

(Seal)

Henry Van Arsdale,
Acting Commissioner of Patents.