Dec. 8, 1925. **1,564,981**

D. B. SMITH

CONCRETE FORM TIE AND SPACER

Filed April 4, 1925 3 Sheets-Sheet 1

Fig. 1.

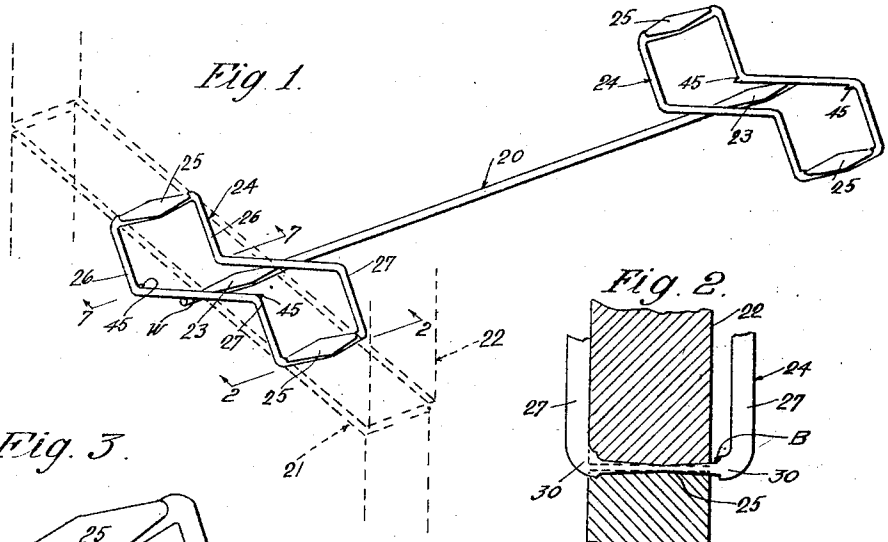


Fig. 2.

Fig. 3.

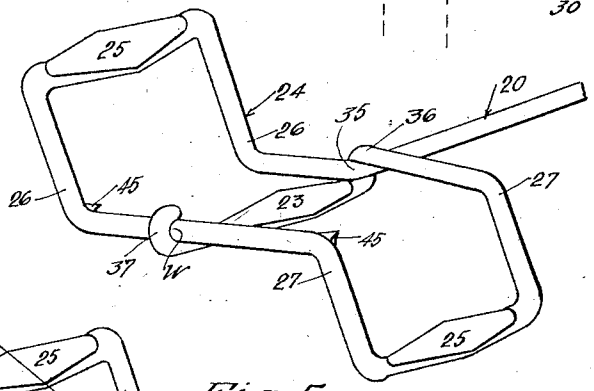


Fig. 4.

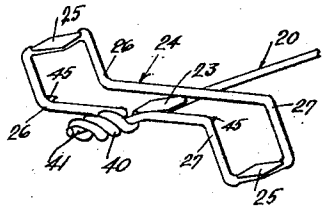


Fig. 5.

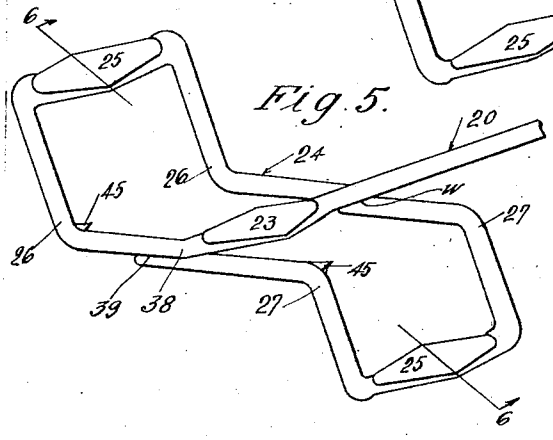


Fig. 7.

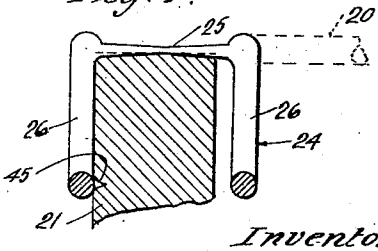
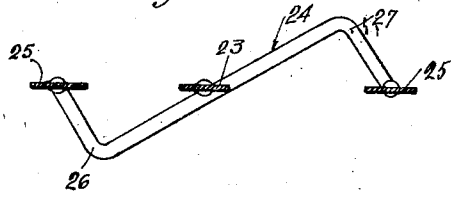


Fig 6.



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Fig. 8.

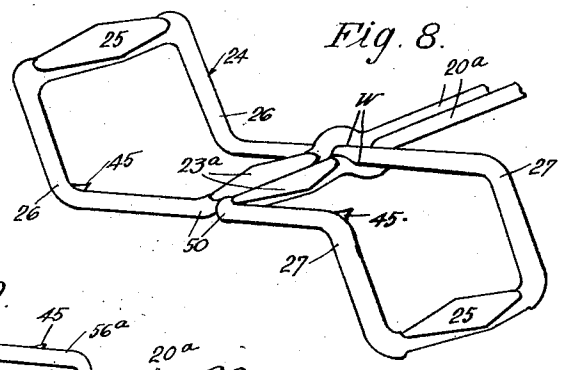


Fig. 9.

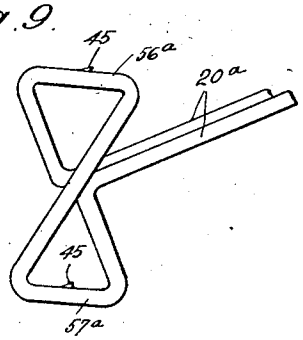


Fig 10.

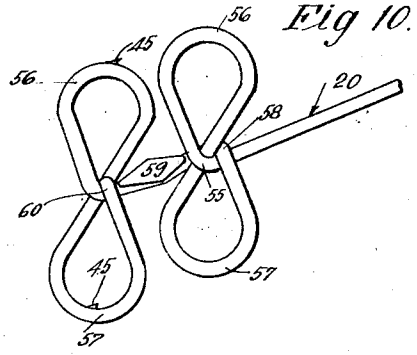
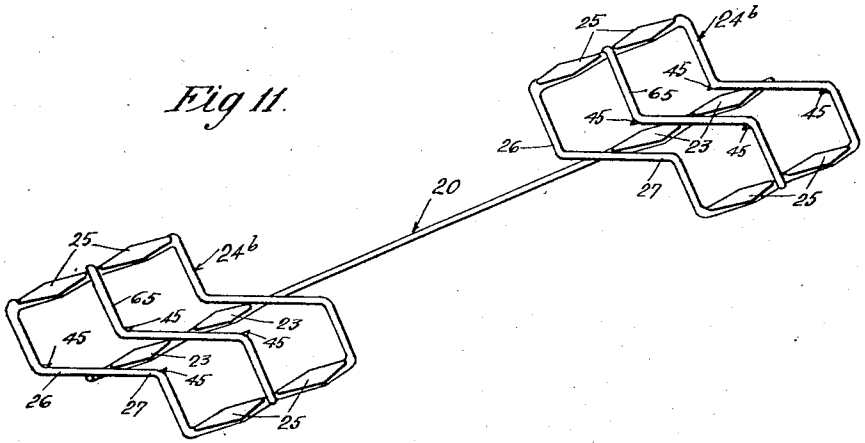


Fig 11.



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Fig. 12.

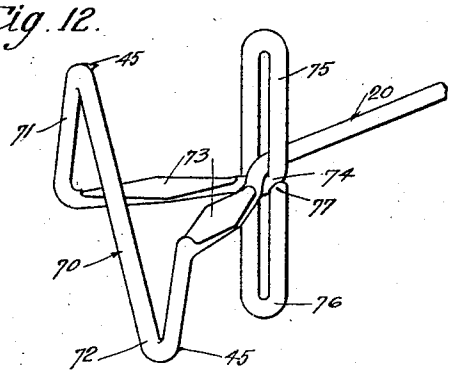


Fig 14.

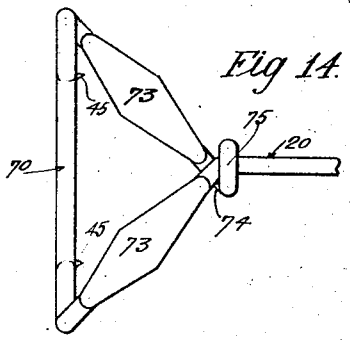


Fig. 13.

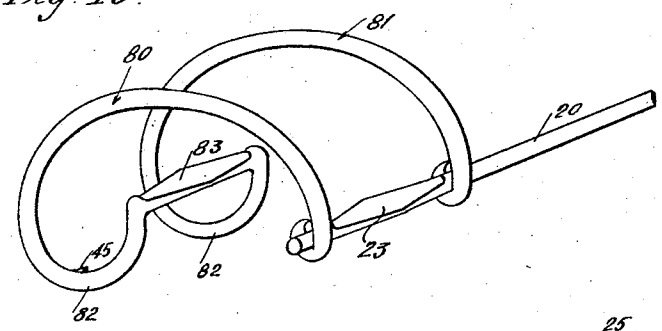
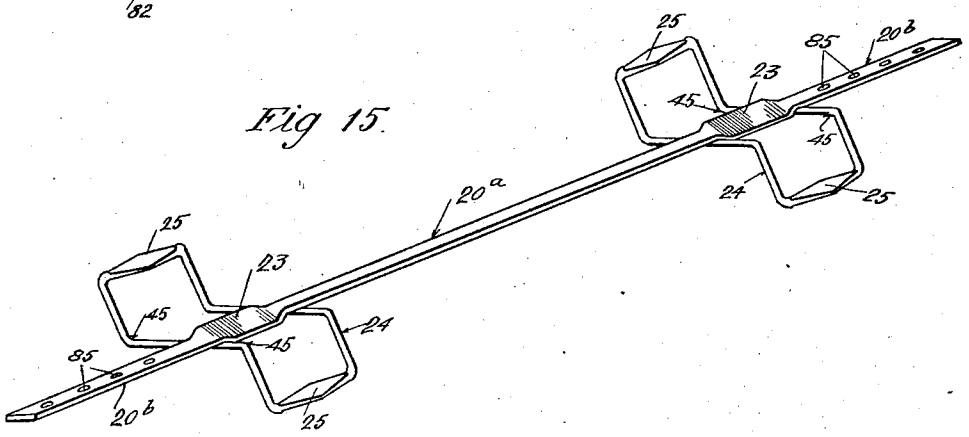


Fig 15.



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Patented Dec. 8, 1925. 1,564,981

UNITED STATES PATENT OFFICE.

DAVID BAKER SMITH, OF LOS ANGELES, CALIFORNIA.

CONCRETE-FORM TIE AND SPACER.

Application filed April 4, 1925. Serial No. 20,756.

To all whom it may concern:

Be it known that I, DAVID BAKER SMITH, a citizen of the United States, residing in Los Angeles, in the county of Los Angeles and State of California, have invented new and useful Improvements in Concrete-Form Ties and Spacers (Case A) of which the following is a detailed specification.

This invention has to do with tie and spacing devices for concrete forms and the like, and it may be stated as a general object of the invention to provide a form or forms of tie, or tie and spacer, that are simple in structure, economical to manufacture and that present the least possible obstruction when in place in the concrete form.

Although the invention in the specific designs shown and described hereinafter has been applied particularly to the holding of forms for poured concrete, and although it will be understood that the invention is not limited to such use, yet the invention itself will be best understood from a detailed explanation of various forms of devices applied to such particular use. Furthermore in the erection and use of concrete forms, although such forms are not always made of wood, nor are they always made of planks or boards laid in edge to edge abutment, yet the invention may be most readily understood by considering its use as applied to that kind of form. Form elements may, of course, be made in various sizes and shapes and of any suitable material; but for the sake of simplicity I may state at the outset that wherein I refer to form boards I do not thereby mean to limit my invention in its applicability to forms that are constructed of wood.

The devices hereinafter explained in detail are use much in the same manner as those described in issued U. S. Letters Patents to Harry A. Orlopp and applicant, No 1,491,413 dated April 22, 1924, and No. 1,468,790 dated September 25 1923, and in the United States Letters Patent issued to Giles, No. 1,524,926, dated February 3, 1925. Such devices as set out in those patents have given eminent satisfaction in actual use, but are open to some objections—their cost of manufacture and also the fact that when in place in an assembled concrete form (particularly where the form has to stand considerable concrete pressure and therefore the ties have to be closely spaced) the ties more or less obstruct the space within the form and, to a slight degree, hinder free pouring or puddling of the concrete. Also there has been the objection that unless the concrete were poured continuously into an assembled form the concrete from a previous pouring would stand on top those ties that were above the pouring level and, standing sometimes over night, that concrete would become set or partially set before the concrete level had been poured up around them. The present invention overcomes all those difficulties and provides a tie, or tie and spacer device, that is very economical to manufacture, light in weight and at the same time capable of taking all stresses that may be imposed upon it.

In speaking of the present invention I may particularly call attention to the fact that the devices may either be merely a tie between opposite walls of concrete form, or they may function both as tie and spacer. The device as hereinafter described comprises a single rod that extends across the form, the rod carrying looped heads to engage the form boards. In a great many cases this rod may function only as a tie rod, and I therefore refer to it as a tension member or tension rod; but at the same time it is in practice made heavy enough and stiff enough to take the compression necessary to hold the form boards apart if there is any tendency for the opposite walls or form boards to move toward each other. Consequently the device is or is capable of being both a tie and spacer, although in the majority of cases it may function only or substantially only as a tie.

For the purpose of making the present invention fully clear to those skilled in this art, I have illustrated in the accompanying drawings various typical and specific forms of devices that embody and are illustrative of the invention; and from consideration of the following detailed descriptions of these various devices the invention itself, as pointed out by the subsequent claims, will be most readily understood; it being understood that I do not go into these specific de-

vices in detail for the purpose of limiting the invention, but merely for the purpose of making the invention clear.

In the accompanying drawings—

Fig. 1 is a perspective illustrating one form of my improved device and indicating how it is applied to form boards;

Fig. 2 is a detailed section taken as indicated by line 2—2 on Fig. 1;

Figs. 3, 4 and 5 are perspectives showing variations in the loop formation at the end of the tension rod;

Fig. 6 is a section taken as indicated by line 6—6 on Fig. 5;

Fig. 7 is a section taken as indicated by line 7—7 on Fig. 1;

Figs. 8, 9 and 10 are perspectives showing variant forms of loop formation;

Fig. 11 is a perspective of a complete device showing how it may be made to suit it to use in walls of different thicknesses;

Figs. 12 and 13 are perspectives showing further variations of loop formation;

Fig. 14 is a plan of the loop formation shown in Fig. 12;

Fig. 15 is a perspective showing a variation of the form of Fig. 1 for instance using a flat tension rod instead of the round rod shown in the other figures.

In the drawings each of the forms illustrated has a tension rod 20 that may be made of any suitable material. In most of the illustrations this tension rod is shown as a round rod or heavy wire, but, as is indicated in Fig. 15 at 20^a, the tension rod may be of flat cross section throughout its length. In fact the cross sectional configuration of the central portion of the tension rod is of no consequence except that the rod should be of such shape as to get both suitable tension and compression strength. A round rod fulfills these requirements very well. At its ends rod 20 is preferably flattened where it passes between adjacent edges of abutting form boards 21 and 22. Although it may not in some cases be necessary to flatten the rod, it is in most cases preferable to do so as rod 20 will in the average device be of a diameter somewhat larger than the permissible separation distance between abutting edges of form boards. Consequently, the rod is flattened as at 23 in that part where it passes across the form board engaging loop (in the form of Figs. 1, etc.) which loop is generally designated by the numeral 24. In the forms shown in Figs. 1 to 7 this form board engaging loop is substantially rectangular as viewed in plan with its sides perpendicular to rod 20 as viewed in plan (that is its longer sides lie in planes that are perpendicular to rod 20) and its ends are preferably parallel to rod 20 and are also flattened as indicated at 25, similarly to the flattening of the rod at 23. Loop 24 is preferably a continuous or closed loop and rod 20 is connected to the two longer sides of the loop where it crosses them. Such connection may be made in any suitable manner; for instance, in the form shown in Fig. 1 it may be made by welding rod 20 to the sides of the loop at the points indicated W in Fig. 1. Viewed endwise (in a direction parallel to rod 20) the loop has a sort of Z shaped form. The flats 23 and 25 lie in one and the same plane—the plane of the abutting edges of boards 21 and 22. The sides of the loop formation are bent so that each side has a part 26 that lies below the plane of flats 23 and 25, and a part 27 that lies above that plane; so that the parts 26 may engage the side surface of lower form board 21 while parts 27 may engage the side surfaces of upper form board 22.

The flattened portions 23 and 25 are preferably formed not of the same thickness throughout their lengths but much as is indicated in the drawings. In Fig. 2 it will be seen that these flattened portions are thinner and wider at their centers and thicker and narrower near their outer ends where they approach in thickness the full thickness of the rod or wire of which the parts are formed. However, where, for instance, the flattened end part 25 joins the side part 27 of the loop the wire is first bent at right angles as at 30 (see particularly Fig. 2), and the flattening does not begin at a point flush with the inner edge of side part 27, but at a little distance inside that inner edge; so that at the ends of the parts that pass between the form boards there is a part at the bend 30 that is substantially of the full thickness of the rod or wire of which the loop is formed; and this part of full thickness sinks into the corner of the form board, as is well illustrated in Fig. 2. At the same time the relatively thicker and narrower end portions of the flattened parts 25 may also sink into the edges of the boards. The boards are separated by substantially a distance equal only to the thickness of the flattened part 25 at its thinnest central part. By thus forming these flattened parts so that they bite or sink into the edges of the boards, the devices are held against displacement longitudinally of the boards.

In practice, instead of making the widths of loops 24 just sufficient to take the thickness of a form board, I prefer to make them substantially wider than that, so that when the form boards are engaged by the loops, as shown in Fig. 2, the inner faces of the form boards are a slight distance removed from the inner parts of the loops; and so that when the concrete is poured the inner parts of the loops are covered and are within the concrete. When the forms are removed the end parts of the device are broken or sheared off flush, or substantially flush,

with the surface of the concrete. The natural breaking point will be at the point marked B in Fig. 2—that is at the beginning of the flat 25. Of course the loops may be made narrower so as to take a form board tightly, but in that case the inner portions of the loop would then show at the surface of the finished concrete. Making the loops somewhat loose is in a great many instances no practical disadvantage, as the fluid concrete pressure will press the boards out against the outer parts of the loops to the position shown in Fig. 2, even though the walls of the unfilled concrete form might have a tendency to move back against the inner parts of the loops.

In Fig. 3, a loop formation similar to that of Fig. 1 is shown, except that here the loop proper and rod 20, with its extended flattened part 23, are shown formed of a single piece of wire or rod. This is done by bending the wire or rod at the point 35 and taking it into and through the loop formation and bending it again at 36 to run across the loop, and attaching it in some suitable manner to the outer side of the loop. It may, for instance, be welded as at the point indicated W in Fig. 3 or it may be hooked as indicated at 37, or both methods of fastening may be used.

In Fig. 5 a similar form is shown, but here the rod 20 is run directly into the flattened formation 23 that crosses the loop and is then bent at 38 to pass into and through the loop formation, and its end is then welded or otherwise secured at 39 to form the integral closed loop. In this form a weld or other connection would also be at the point indicated W in Fig. 5.

In Fig. 4 another modification is shown wherein rod 20 extends through the flattened portion 23 right across the loop and at 40 is twisted about itself and also about the final end 41 of the rod or wire of which the whole device is formed.

In the forms so far described, as also in the forms to be hereinafter described, it is desirable to have some means for holding the device in horizontal position while the concrete form is being assembled. Usually these concrete forms are preferably assembled one wall at a time; and the devices are put in place over the upper edges of the boards of one side of the form as they (the boards) are added to the form, and before the boards at the opposite side of the form are put into place. In order to hold the devices in proper position until the next board is put on top of them, the outer sides of the loop formation may be provided at 45 with small prongs, one of which may be driven or pressed into the side surfaces of the board over whose edge the device is placed. These prongs are preferably placed in two position (as shown in the drawings) on each of the outer sides of the loop so that either prong may be driven into the board regardless of whether the device is used with one side up or the other side up. The engagement of these prongs with the board in the manner shown in Fig. 7 keeps the other end of the device from falling and thus keeps the whole device from being displaced on the form board, rendering it unnecessary to hold the device up while the next board is being placed on top of the device. Then when the boards of the opposite side of the form are assembled the free or outstanding ends of the devices may be easily sprung out of position sufficiently to allow these boards to be placed. In most of the forms of devices herein described and illustrated these prongs perform the function above described and also perform the function of preventing longitudinal displacement of the device along the edge of the board, but they are not called upon to perform the function of keeping the whole device from twisting or turning on rod 20 as an axis, as the engagement of parts 23 and 25 between adjacent boards prevents such twisting or turning. In other words, in most of the forms the device here described the fact that there are two or more spaced parts that pass between adjacent edges of abutting form boards keeps the device in such position that side parts 26 of the loops will always be in position to engage the side of the board below while part 27 of the loop will always be in position to engage the side of the board above. In a somewhat similar and inter-related form of device which is shown in a companion application filed on even date herewith, and bearing Serial No. 20,757 these board engaging prongs 45 not only perform the functions which they perform herein, but also perform the function of keeping the device from turning or twisting on rod 20 as an axis, particularly before the next board above is put into place. It is characteristic of the device of said companion application that there is but a single part of the device that extends through the space between the edges of adjacent form boards; whereas it is generally characteristic, at least of the specific preferred forms, of the present application that there are two or more spaced parts that extend between abutting form boards. However, the dividing line as to claims between this application and said companion application is more along the line that devices of the present application are characterized by having board engaging heads, so to speak, in the form of loops whereas in said companion application the board engaging heads may be of other formations. Accordingly I show in Figs. 9 and 10 typical forms which the looped headed devices may take and have

but a single part extended between adjacent form boards. In Fig. 10 for instance the wire or rod of which the device is formed goes out of tension rod 20 through a bend 55 and then is bent into the form substantially of a figure 8 the upper part 56 of which engages the inner side of an upper board and the lower part 57 engages the inner side of a lower board, and then the wire or rod is bent at 58 to pass into the flattened part 59 that extends across between the form boards; and at the outer end of this flattened part 59, an outer loop formation also of substantially the shape of a figure 8 is formed, the final end 60 of the wire or rod being welded or suitably joined to the other parts. The outer part of the loop formation has the board engaging prongs 45. In such a form as this the flat part 59, held as it is between adjacent form boards, tends to keep the loop formation upright and also prongs 45 perform the same function, and particularly perform this function when the device is put over the upper edge of a board and before the next upper board is put in place upon the device.

In Fig. 9 there is also shown a device with a substantially 8-shaped loop with upper part 56^a and lower part 57^a and with prongs 45 and with a double tension rod 20^a. Such a form of device is illustrative of devices that may be used as ties only, having no function in themselves as spacers.

In Fig. 8 I show a device wherein loop 24 is formed generally as before explained, but wherein the form wire or rod is bent at the center of the outer part of the loop at the two points indicated 50 to pass in double formation across the loop, being flattened at 23^a where they cross the loop, and then extending on inside the loop to form a double rod 20^a. Parts 23^a and 20^a may be simply abutted or they may be welded together if desired: and the parts will also preferably be welded at the points indicated W in Fig. 8.

In Fig. 11 is shown a device having at each end what amounts to a double loop of the general formation shown in Fig. 1. Here the loop 24^b is of double width and is divided into two loop spaces by a rod or wire 65 so that two board receiving loops are formed at each end and the device may thus be adapted to be used without any change upon wall forms of different thicknesses.

In Fig. 12 a form is shown wherein the loop structure forming the board engaging head for tension rod 20 involves an outside element 70 bent to substantially Z form, having a part 71 that projects above the plane of the abutting form board edges, and a part 72 that projects below that plane, and having two flattened parts 73 that are adapted to pass between abutting edges of adjacent boards. These parts 73 in this form, instead of lying in positions parallel to rod 20, as in some forms previously described, lie at angles to each other, forming with part 70 a triangular formation when viewed in plan as in Fig. 14. A device of this character may be best formed of a single piece of wire or rod, the tension rod 20 extending on into one of the flats 73 and thence into and through the outer member 70, and then back through the other flat 73, where it is then bent as at 74 and extended upwardly into a loop 75, which loop may preferably be closed, or substantially closed, as illustrated, and thence extending down through the loop 75 into the lower part of the loop formation 76 and thence upwardly to the point 77 where it may be welded or otherwise connected at its ends.

In Fig. 13 a form is shown wherein the tension rod 20 has a flattened portion 23 that is adapted to extend between adjacent form boards, and mounted on the end part of tension rod 20 is the board engaging loop formation, whose outside and inside members 80 and 81 may be in this case formed somewhat as spirals, the main part of the spiral curve lying above the plane of the edges of abutting boards and the parts 82 of the spirals lying below that plane. The ends of the spirals are joined by the flattened part 83 that extends between adjacent edges of abutting form boards.

The form shown in Fig. 15 is substantially the same as that shown in Fig. 1, except that here is illustrated the fact that the tension rod 20 or 20^a may be of any suitable cross section. Here it is shown as being flat throughout its length so that it does not have to be especially flattened at 23 where it passes between the form boards. Also in this figure is illustrated the fact that tension rod 20 or 20^a may be extended as at 20^b beyond the outer side of the loop formation. This extension of the tension rod may be used for the purpose of connecting the rod to an exterior stud or similar structure member of the concrete form; and it may be connected to such structural member either by bending it around the member or by nailing it to the member with a nail or nails through holes 85.

I claim:

1. A device of the character described, embodying a tension rod, and a board engaging loop carried at the end of the rod, there being in the loop formation at the end of the rod two spaced portions adapted to pass between adjacent edges of form boards or the like.

2. A device of the character described, embodying a tension rod, and a board engaging loop carried at the end of the rod, the loop having two spaced parts each

adapted to pass between adjacent edges of form boards or the like.

3. A device of the character described, embodying a tension rod, and a board engaging loop carried at the end of the rod, the loop having two spaced parts each adapted to pass between adjacent edges of the form boards or the like, said rod and loop being formed of a single length of metal.

4. A device of the character described, embodying a tension rod, and a board engaging loop carried at the end of the rod, the loop having parts adapted to extend between adjacent edges of form boards or the like and parts adapted to engage the side surfaces of two such adjacent form boards.

5. A device of the character described, embodying a tension rod, and a board engaging loop carried at the end of the rod, the loop having two spaced parts adapted to extend between adjacent edges of form boards or the like and parts adapted to engage the side surfaces of two such adjacent form boards.

6. A device of the character described, embodying a tension rod with a flat end part adapted to pass between adjacent edges of form boards or the like, and a loop carried by the end part of the rod, said loop having a part of flat cross-section adapted likewise to pass between adjacent board edges.

7. A device of the character described, embodying a tension rod with a flat end part adapted to pass between adjacent edges of form boards or the like, and a loop carried by the end part of the rod, said loop having two spaced flat parts likewise adapted to pass between adjacent board edges and parts adapted to engage the sides of adjacent boards.

8. A device of the character described, embodying a tension rod, and a form board engaging loop carried by the end of the rod, the rod being flat adjacent the loop to pass between adjacent edges of form boards, and the loop having parts extending on opposite sides of the plane of the flat to engage the sides of the two boards between which the rod passes.

9. A device of the character described, embodying a tension rod, and a form engaging loop carried by the end of the rod, the loop structure at the end of the rod having two spaced parts adapted to pass between abutting edges of adjacent form boards, and having parts extending on opposite sides of the plane of said spaced parts to engage the sides of such abutting boards.

10. A device of the character described, embodying a tension rod, and a form board engaging loop carried by the end of the rod, the rod being flat adjacent the loop to pass between adjacent edges of form boards, the loop having parts extending on opposite sides of the plane of the flat to engage the sides of the two boards between which the rod passes and board piercing projections on said extending parts of the loop.

11. A device of the character described, embodying a tension rod, and a form board engaging loop carried by the end of the rod, the loop structure at the end of the rod having two spaced parts adapted to pass between abutting edges of adjacent form boards, and having parts extending on opposite sides of the plane of said spaced parts to engage the sides of such abutting boards, and board piercing projections on said extending parts of the loop.

12. A device of the character described, embodying a tension rod with an end part adapted to extend between adjacent edges of abutting form boards, a closed loop carried on the end of the rod, the loop being substantially rectangular in plane with two sides lying in planes at right angles to the rod, and the other two sides being parallel to the rod and adapted also to extend between adjacent edges of abutting form boards, the end part of the rod crossing the loop from side to side.

13. A device of the character described, embodying a tension rod with an end part adapted to extend between adjacent edges of abutting form boards, a closed loop carried on the end of the rod, the loop being substantially rectangular in plane with two sides lying in planes at right angles to the rod, and the other two sides being parallel to the rod and adapted also to extend between adjacent edges of abutting form boards, the end part of the rod crossing the loop from side to side, that part of the rod which lies within the loop being flattened and the sides of the loop which are parallel to the rod also being flattened, said flats being all in the same plane.

14. A device of the character described, embodying a tension rod with an end part adapted to extend between adjacent edges of abutting form boards, a closed loop carried on the end of the rod, the loop being substantially rectangular in plane with two sides lying in planes at right angles to the rod, and the other two sides being parallel to the rod and adapted also to extend between adjacent edges of abutting form boards, the end part of the rod crossing the loop from side to side, sides of the loop which lie in planes at right angles to the rod being bent in that plane so as to have parts that project above and below the plane of the other two sides of the loop.

15. A device of the character described, embodying a tension rod with an end part adapted to extend between adjacent edges of abutting form boards, a closed loop carried on the end of the rod, the loop being substantially rectangular in plane with two

sides lying in planes at right angles to the rod, and the other two sides being parallel to the rod and adapted also to extend between adjacent edges of abutting form boards, the end part of the rod crossing the loop from side to side, that part of the rod which lies within the loop being flattened and the sides of the loop which are parallel to the rod also being flattened, said flats being all in the same plane, those sides of the loop that lie in planes perpendicular to the rod being bent in those planes so as to have parts that lie above and below the said plane of said flattened parts.

16. A device of the character described, embodying a tension rod with an end part adapted to extend between adjacent edges of abutting form boards, a closed loop carried on the end of the rod, the loop being substantially rectangular in plane with two sides lying in planes at right angles to the rod, and the other two sides being parallel to the rod and adapted also to extend between adjacent edges of abutting form boards, the end part of the rod crossing the loop from side to side, that part of the rod which lies within the loop being flattened and the sides of the loop which are parallel to the rod also being flattened, said flats being all in the same plane, those sides of the loop that lie in planes perpendicular to the rod being bent in those planes so as to have parts that lie above and below the said plane of said flattened parts, and said parts that project above and below the plane of the flats having inwardly extending board piercing projections as described.

17. A device of the character described, embodying a tension rod adapted to pass between adjacent edges of edgewise abutting form boards, and a form board engaging loop carried by the end of the rod, the loop being relatively stiff to take the thrust of form boards, and the loop having parts extending in a plane substantially at right angles to the rod and extending on opposite sides of the rod to engage the surfaces of two edgewise abutting form boards.

18. A device of the character described, embodying a single tension rod adapted to pass between adjacent edges of edgewise abutting form boards, and a form board engaging loop formed of the rod at its end, the loop being relatively stiff to take the thrust of form boards, and the loop having parts extending in a plane substantially at right angles to the rod and extending on opposite sides of the rod to engage the surfaces of two edgewise abutting form boards.

In witness that I claim the foregoing I have hereunto subscribed my name.

DAVID BAKER SMITH.