Nov. 12, 1929. D. B. SMITH 1,735,017

CONCRETE FORM TIE AND SPACER

Filed Nov. 21, 1927

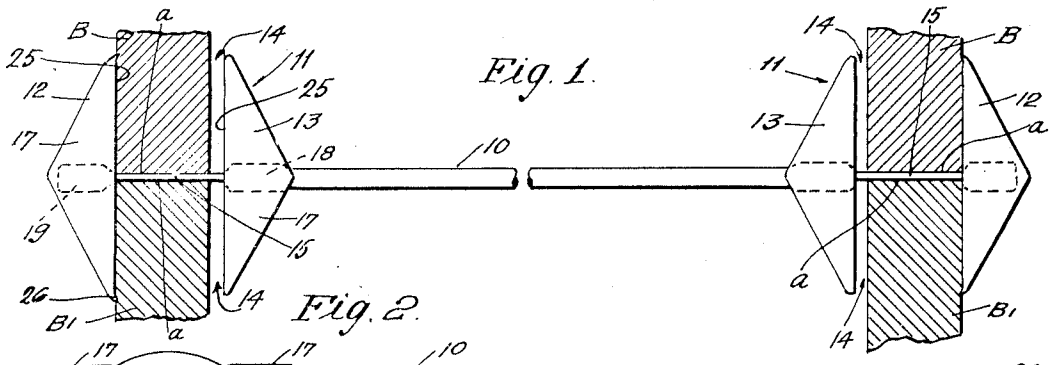



Fig. 1.

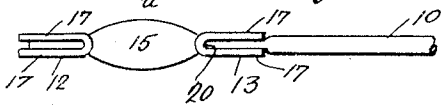



Fig. 2.

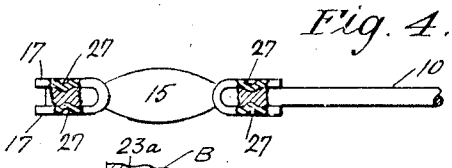



Fig. 4.

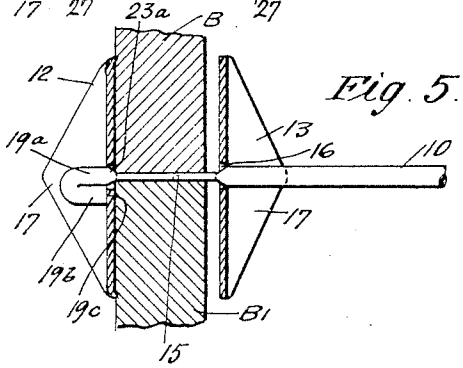



Fig. 5.



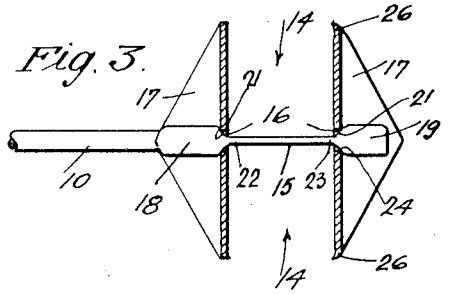




Fig. 3.

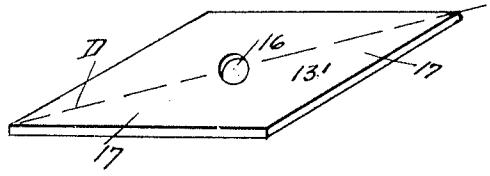



Fig 6.

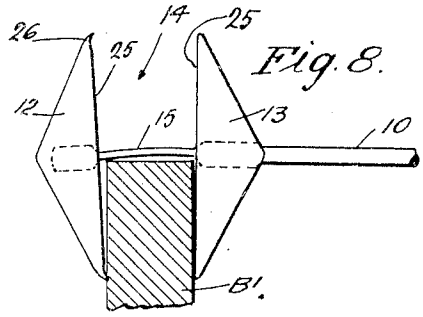



Fig. 8.

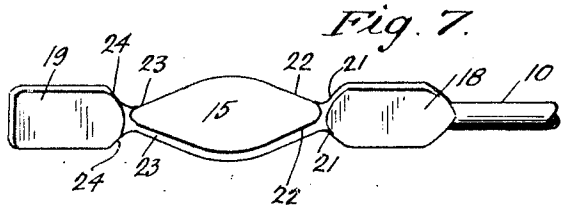



Fig. 7.

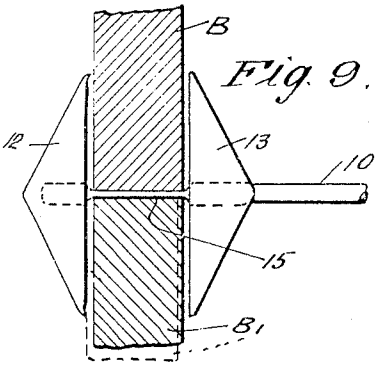



Fig. 9.

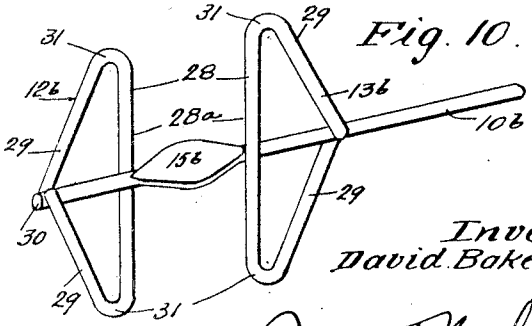



Fig. 10.

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Patented Nov. 12, 1929 1,735,017

# UNITED STATES PATENT OFFICE

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## CONCRETE-FORM TIE AND SPACER

Application filed November 21, 1927. Serial No. 234,587.

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

While the particular embodiments hereinafter shown and described are particularly suited to the holding of forms for poured concrete, it will be understood that the invention is not limited to this particuar use. However, it will lead to a better understanding of the invention to describe it in connection with such a particular use, whereupon it will be obvious to those skilled in the art how it may be put to different uses with equal advantage.

Form elements may, of course, be made in various sizes and shapes and of any suitable material, and though, for the sake of simplicity, I will hereinafter refer to these elements as "boards," I do not thereby limit my invention nor my claims to use only in connection with form elements in the nature of boards.

The present invention is shown embodied in a tie having certain of the general characteristics of the device shown in Patent No. 1,564,982, issued to me December 8, 1925, on concrete form tie and spacer, and all the general advantages of this type of device over those going before are also true of the embodiment here shown. Since these advantages are more or less fully set up in said patent, it will be unnecessary to repeat them here. However, it will be distinctly understood that the present invention is not limited in application to the particular types of tie and spacer shown in the aforesaid patent, the drawings and description being merely illustrative of tie formations and are not to be considered as limitative.

The advance in the art here made may be considered as involving several features, and while certain of these may be discussed to better advantage in the following detailed description, I will here outline some of the more outstanding.

The device embodies a simple rod that extends across a form, the rod carrying near its opposite ends board engaging formations. 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 and safe 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 functioning both as a tie and spacer, and while in the majority of cases it functions only or substantially only as a tie and therefore is hereinafter called a tension member, it will be understood that this terminology is not intended to limit the invention to embodiments where it only functions as a tension member.

The board engaging formations at or near the ends of the rod each embody upright members which extend at substantially right angles to the rod, defining between them a board-taking channel, the bottom of this channel being defined by that portion of the rod which extends between the members.

The present application discloses a novel type of board-engaging head formation, novelty residing both in the nature of the upright board-engaging members and in their mode of attachment to the rod. It is the general purpose of the invention to provide these uprights in such form that they may be manufactured and applied to the rod with expediency, ease, and comparatively low cost. I accomplish all these ends without in any way sacrificing the strength of the tie; in fact, the formation and mode of attach-

ment of the heads to the rod are such that the strains to which they are exposed are resisted with peculiar effectiveness, the uprights, at points spaced from their juncture with the rod being braced against displacing strains. However, the manner in which this is accomplished may be discussed to better advantage in the following detailed specification, wherein other objects and novel features of the invention will be made apparent. Reference will be had to the accompanying drawings, in which:

Fig. 1 illustrates a tie embodying my invention and shown applied to the abutting edges of adjacent form boards;

Fig. 2 is a plan view of the board-engaging head formation shown at the left of Fig. 1, the form boards being omitted;

Fig. 3 is a fragmentary view similar, in part, to Fig. 1, but showing in section the upright members of the head formation at the right of said figure;

Fig. 4 is a plan view generally similar to Fig. 2 but showing in broken away section a different method of applying the upright to a tension rod having slightly different characteristics;

Fig. 5 is a medial section through the upright members of a tie in which a variational form of tension rod is used;

Fig. 6 is a perspective view of a preferred type of upright member, prior to its being bent into finished form;

Fig. 7 is a fragmentary perspective view showing one manner of forming the tension rod for the reception of one type of board-engaging head;

Figs. 8 and 9 illustrate successive steps which may be taken in applying the tie to form boards; and

Fig. 10 is a perspective view of a variational type of head formation.

At 10 is designated a tension rod, preferably of circular cross-section throughout its major or body portion, having at each end a board-engaging head formation generally designated at 11. Since the two formations may be identical, I will describe but one in detail.

A given head formation 11 may be considered as including two uprights 12 and 13 spaced apart longitudinally along the rod and crossing the rod at substantially right angles, being applied to the rod approximately midway of their length in any suitable manner such as the manners to be described hereinafter, for instance. At each side of rod 10 these members 12, 13, may be considered as defining the sides of a board-taking channel 14, the common bottom of the two channels being defined by that part 15 of rod 10 which extends between the uprights. Part 15 is adapted to pass between the adjacent edges *a* of adjacent form boards B and B′ which are entered in channels 14. While the width of a given channel 14 may be substantially that necessary to take standard form boards, preferably it is somewhat greater than the thickness of such boards so, when the device is in final position, said boards will occupy the relative positions shown in Fig. 1, that is adjacent the outer members 12.

While this is not a feature essential to the present invention, considered in its broader aspects, it is preferable that part 15 be thinner than the major or body portion of the rod, it following that with said body portion of circular cross-section and of a sufficient diameter to give the necessary tensile and compression strength, part 15 is of such relatively thinner cross-section where it engages the abutting edges of adjacent form boards that said edges come into close proximity so there may be no appreciable leakage of concrete therebetween.

This relative thinning of part 15 may be accomplished, for instance, by a flattening or pressing operation which makes part 15 not only thinner but wider than the body portion of rod 10, the cross-sectional area of the flat portion thus being preserved throughout so it substantially equals that of said major portion, with the result that there is no appreciable loss of tensile or compressive strength through the flattening. The engagement of the flattened part 15 with edges "*a*" prevents rotation of rod 10 or the tie, as a whole, with respect to the form boards, a feature of obvious advantage.

While the form of uprights 12, 13 may vary within a wide range and may be fixed to rod 10 in a variety of manners and still lie within the spirit and scope of my broader claims, I will describe with some particularity the form of uprights and their method of attachment as shown in Fig. 1, from a comprehension of which, those skilled in the art will understand how the same principles may be embodied in different physical forms.

Furthermore, while I have illustrated the outer and inner members 12 and 13, respectively, as being substantially identical and as being applied to the rod in substantially the same manner, it will be understood that I contemplate in certain situations that the uprights of a given pair may differ in form and mode of attachment, only one of them agreeing with the following description. In fact, under certain circumstances, only one upright at each end of the rod may be utilized, this one member functioning either as a tie or as a spacer. Accordingly, certain of my claims are drawn to include only one upright on the tension rod.

A preferred, though not limitative, form of upright before it has been applied to the rod is shown in Fig. 6. This element, which I will designate by the numeral 13′, is initially in the form of a symmetrical, four-sided plate, which is centrally apertured as at 16,

the aperture being of a diameter to take the body portion of rod 11. While the exact shape of plate 13′ is not controlling on the invention, I find that if it be shaped as a rhombus or rhomboid, it may be bent to such finished shape that it presents a formation of a character which is particularly effective for the purpose.

Depending upon the chosen order of steps of assembling the uprights with the rod, plate 13′ is bent either before or after it is passed over the rod, the bend being made along its longer diagonal D and thus across the central aperture 16. The plate may be considered as being bent upon itself so side portions 17 which lie at the opposite sides of diagonal D substantially parallel each other in slightly spaced relation.

I will now describe a preferred method of forming rod 10 to take the uprights in a particularly efficient manner, Fig. 7 showing this preferred formation, though it will be understood that the flattened portions shown in this figure are formed as the assembly of the uprights therewith progresses; that is, rod 10 does not reach the finished form of Fig. 7 until the assembly of the tie is complete, though the uprights are omitted from this figure in order more clearly to disclose the rod formation. It will be seen, at the outset, that flat 15 is spaced from the outer end of the rod, and it will be later made apparent that the uprights 12, 13, are joined to rod 10 at points adjacent but preferably not on flat 15.

At opposite sides of flat 15 are provided flat portions 18 and 19, these portions preferably, though not necessarily, being thinner and wider than the major or body portion of rod 10, though of substantially the same cross-section area. Flats 18 and 19 lie in planes at substantially right angles to the plane of flat 15, that is, substantially in the vertical axial plane of rod 10, assuming that the tie be in its normal position of application to the form boards.

While the order of procedure in assembling the tie may vary to suit conditions, a typical order of procedure will be set out. Assume first that flat 18 be formed in rod 10 at a point well spaced from its end, and that plate 13′ be bent substantially to the shape shown at 13 in Figs. 1 and 2, though preferably the side portions 17 of the plate are spread sufficiently far apart to take flat 18 between them easily. The bent plate is then slipped over the end of the rod, aperture 16 being of a size to permit this even after the plate is bent, until the inner face 20 of the plate bend engages the shoulders 21 formed at the end of the flat. Flat 15 is then formed in rod 10, the shoulders 22 thereof serving to hold uprights 13 against shoulders 21 and thus positioning the upright on the rod. However, the side portions of the uprights are preferably pressed tightly against the side faces of flat 18 and then welded or otherwise joined thereto so the upright is rigidly held in position.

Upright 12 in the unfolded condition of plate 13′ in Fig. 6, is then slipped over the round terminal of rod 10 which now extends from flat 15, the plate being moved over against the shoulders 23 formed by flat 15. The flat 19 is then formed in rod 10, shoulders 24 thereof engaging the outer face of the plate to hold said plate against shoulders 23 and thus position the upright on the rod. The plate is then bent to the form shown in Figs. 1 and 2, the inner faces of the bent-over portions firmly engaging the sides of flat 19 and preferably being joined thereto as by welding or the like. Of course, in some situations it may be desirable to bend upright 12 partially before it is applied to the rod and then, by one pressing operation, squeeze the side portions of the head or upright against rod 10 and flatten said rod to provide flat 19. It is obvious that the facial engagement of the side portions of the head plates with the flats hold head members 12 and 13 against rotation with respect to rod 10, whether or not said members are welded to the rod. Furthermore, the flat faces of the rod and uprights which are in engagement are of appreciably great extent whereby the welding may be performed with particular effectiveness, as will be readily understood.

With the tie thus assembled, it will be seen that each upright 12, 13, presents a shoulder 25 which extends angularly from rod 10, each shoulder preferably being of arcuate cross-section, as taken in plan, and having its vertically extending central portion lying substantially in the vertical axial plane of rod 10. As a consequence of these conditions the compression and tensile strains placed upon the rod 10 through the uprights are imposed directly in line with the rod axis, to obvious advantage; and even though the form boards be at other than right angles with the rod, as viewed in plan, these strains are not transmitted angularly with respect to the axis of said rods. Consequently these strains are not apt to fracture the rod at its weakest points, that is, at points lying within the flats or at their junction with other portions of the rod.

It will be seen that both upright shoulders 25 face toward flat 15, and that the rearwardly extending, triangular sides 17 of the uprights, are joined to rod 10 at points appreciably spaced from flat 15 and from the junction of shoulders 25 with the rod, thence extending directly to shoulders 25 at points spaced from flat 15. The triangular side portions thus serve as diagonal braces for said shoulders, lateral strains imposed on the shoulders, the form boards at points spaced from the rod being transmitted to the rod at

points located horizontally rearwardly of shoulders 25.

In certain cases, I prefer to provide board-piercing projections on the shoulders 25 of uprights 12, which projections extend towards uprights 13 so as to hold the form-boards in the position of Fig. 1. The purpose of this provision will be obvious to those skilled in the art and is fully set up in the aforementioned patent granted to me. These projections may be conveniently formed by pressing the upper and lower ends of uprights 12 into the form of relatively sharp lips 26 which extend from the planes of shoulders 25 toward companion uprights 13.

In Figs. 8 and 9 I have shown one method of applying the tie to form boards, which method has certain peculiar advantages. Due to the cross-sectional characteristics of portion 15 it is flexible and more readily bendable than is the major portion of the rod. Thus flat 15 may be readily bent from its horizontal plane to assume the arcuate or bow shape shown in Fig. 8, thus throwing one of the uprights (for instance, outer head 12) into such a position that its shoulder 25 extends angularly with respect to the shoulder 25 of the companion upright. The center of flat 15 is then spaced above the upper edge of board B', while the lower ends of uprights 12 and 13 converge toward one another into frictional gripping relation with the side faces of the board, thus holding the tie against accidental displacement therefrom. This bending also widens the board-taking channel 14 above flat 15 so upper board B may be more easily entered therein. When the upper board B is thus entered and thrust downwardly against the convex side of the bend, it straightens the flat 15 between the abutting edges of the board, again swinging shoulder 25 of upright 12 into substantially parallel relation with the corresponding shoulder of upright 13. The form boards may then be thrust over into the position of Fig. 1, or, when the concrete is poured, the hydro-static-head of the fluid mass may be adapted so to thrust them.

Thus, though the board-taking channels are of such width and shape that with boards of given thickness it is assured that the inner uprights 13 will be completely covered by the poured concrete, the final clearance between the boards and uprights 13 necessary to accomplish the embedding of the inner uprights is initially taken up by bending flat 15 so the shoulder members may frictionally grip an underlying form board, all to obvious advantage.

In Fig. 4 I have shown a slightly variational manner of applying the uprights to the rod. In this variation, the rod 10 at each side of flat 15 is left of full circular cross-section, and the side portions of the uprights are either directly welded to these circular portions of the rod or they may be joined thereto by such an expedient as pressing portions 27 bodily thereinto.

In Fig. 5 is shown a variation wherein the side portions of the inner head 13 are directly welded to the circular portion of rod 10, while the end $19^a$ of the rod is left of full circular cross-section but bent upon itself as at $19^b$ to increase the vertical extent of the rod within the side portions 17 of outer upright 12. With this increase in vertical extent, said upright may be held against rotation with respect to the rod without or prior to a welding operation. The upright is held by end face $19^c$ against end shoulders $23^a$ of flat 15. Bend $19^b$ also provides additional area for the welding of the side portions 17 to the rod terminal.

In Fig. 10 is shown another variational type of tie, wherein rod $10^b$ has a flat $15^b$ corresponding to flat 15 in the other figures, and uprights $12^b$ and $13^b$ are made of skeleton or frame construction, rather than in the solid form of the other uprights 12 and 13. In this variation a given upright consists of a vertical bar 28 welded or otherwise suitably affixed at a point substantially midway of its length to rod 10 adjacent flat $15^b$ and of portions 29 which extend angularly from the outer ends of the bar to the opposite sides of the terminal portion 30 of rod 10. Portions 29 are welded or otherwise suitably secured to said terminal at points appreciably spaced from flat $15^b$ and from bar 28, which latter provides the board-engaging shoulder $28^a$. It will be seen that portions 29 serve to brace the bar 28, especially near its outer end, against displacement strains, the upright thus having the general characteristics ascribed to uprights 12 and 13. Though this is not essential, portions 29 may be integral with bar 28, being bent therefrom as at 31.

It will be understood the drawings and description are to be considered merely as illustrative of and not restrictive on the broader claims appended hereto, for various changes in design, structure and arrangements may be made without departing from the spirit and scope of said claims.

I claim:

1. A device of the character described, embodying a rod adapted to extend across a concrete form and having a part adapted to pass between adjacent edges of abutting form boards, and a board engaging head formation embodying a member in a plane at substantially right angles to the rod and located on the rod near an end of said part, said member presenting an arcuate shoulder extending angularly from said rod and substantially in the vertical axial plane thereof and comprising portions extending longitudinally an appreciable distance along the opposite sides of the rod from said shoulder away from said part.

2. A device of the character described, embodying a rod adapted to extend across a concrete form and having a flattened part thinner and wider than the body of the rod and adapted to pass between adjacent edges of abutting form boards, and a board engaging head formation embodying a member in a plane at substantially right angles to the rod and located on the rod near an end of said part, said rod having a second flattened part adjacent the first-mentioned flattened part but lying in a plane at substantially right angles thereto, said member presenting a board engaging shoulder extending angularly from said rod and having a portion extending along said second flattened part.

3. A device of the character described, embodying a rod adapted to extend across a concrete form and having a flattened part thinner and wider than the body of the rod and adapted to pass between adjacent edges of abutting form boards, and a board engaging head formation embodying a member in a plane at substantially right angles to the rod and located on the rod near an end of said part, said rod having a second flattened part adjacent the first-mentioned flattened part but lying in a plane at substantially right angles thereto, said member presenting a board engaging shoulder extending angularly from said rod and having a portion extending along and joined to said second flattened part.

4. A device of the character described, embodying a rod adapted to extend across a concrete form and having a flattened part thinner and wider than the body of the rod and adapted to pass between adjacent edges of abutting form boards, and a board engaging head formation embodying a member in a plane at substantially right angles to the rod and located on the rod near an end of said part, said rod having a second flattened part adjacent the first-mentioned flattened part but lying in a plane at substantially right angles thereto, said member presenting a board engaging shoulder extending angularly from said rod and having portions extending along and joined to opposite sides of said second flattened part.

5. A device of the character described, embodying a rod adapted to extend across a concrete form and having a part adapted to pass between adjacent edges of abutting form boards, and a board engaging head formation embodying a member in a plane at substantially right angles to the rod and located on the rod near an end of said part, said member being characterized as an apertured plate bent upon itself across the aperture, the rod extending through the aperture and being taken between the bent-together portions of the plate.

6. A device of the character described, embodying a rod adapted to extend across a concrete form and having a part adapted to pass between adjacent edges of abutting form boards, and a board engaging head formation embodying a member in a plane at substantially right angles to the rod and located on the rod near an end of said part, said member being characterized as a four sided, centrally apertured plate bent diagonally upon itself across the aperture, the rod extending through the aperture and being taken between the bent-together portions of the plate.

7. A device of the character described, embodying a rod adapted to extend across a concrete form and having a part adapted to pass between adjacent edges of abutting form boards, and a board engaging head formation embodying a member in a plane at substantially right angles to the rod and located on the rod near an end of said part, said member being characterized as an apertured plate bent upon itself across the aperture, the rod extending through the aperture and being taken between the bent-together portions of the plate, and means joining said plate portions to the rod.

8. A device of the character described, embodying a rod adapted to extend across a concrete form and having a part adapted to pass between adjacent edges of abutting form boards, and a board engaging head formation embodying a member in a plane at substantially right angles to the rod and located on the rod near an end of said part, said member being characterized as an apertured plate bent upon itself across the aperture, the rod extending through the aperture and being taken between the bent-together portions of the plate, said rod being flattened where it is taken between said plate portions, and said plate portions firmly engaging the opposite sides of said flattened portion of the rod.

9. A device of the character described, embodying a rod adapted to extend across a concrete form and having a part adapted to pass between adjacent edges of abutting form boards, and a board engaging head formation embodying a member in a plane at substantially right angles to the rod and located on the rod near an end of said part, said member being characterized as an apertured plate bent upon itself across the aperture, the rod extending through the aperture and being taken between the bent-together portions of the plate, said rod being flattened where it is taken between said plate portions, and said plate portions being joined to the opposite sides of said flattened portion of the rod.

10. A device of the character described, embodying a rod adapted to extend across a concrete form and having a part thinner than the body portion thereof adapted to pass between adjacent edges of abutting form boards, and a board engaging head formation embodying two members extending angularly

from the rod and located on the rod near opposite ends of said part, said part being preformed with a bend in it and thus initially holding said members in angular relation with each other, said part being flexible and thus being adapted to be straightened out to bring said members into substantially parallel relation when a form board is pressed against the convex side of the bend.

In witness that I claim the foregoing I have hereunto subscribed my name this 1st day of November, 1927.

DAVID BAKER SMITH.