

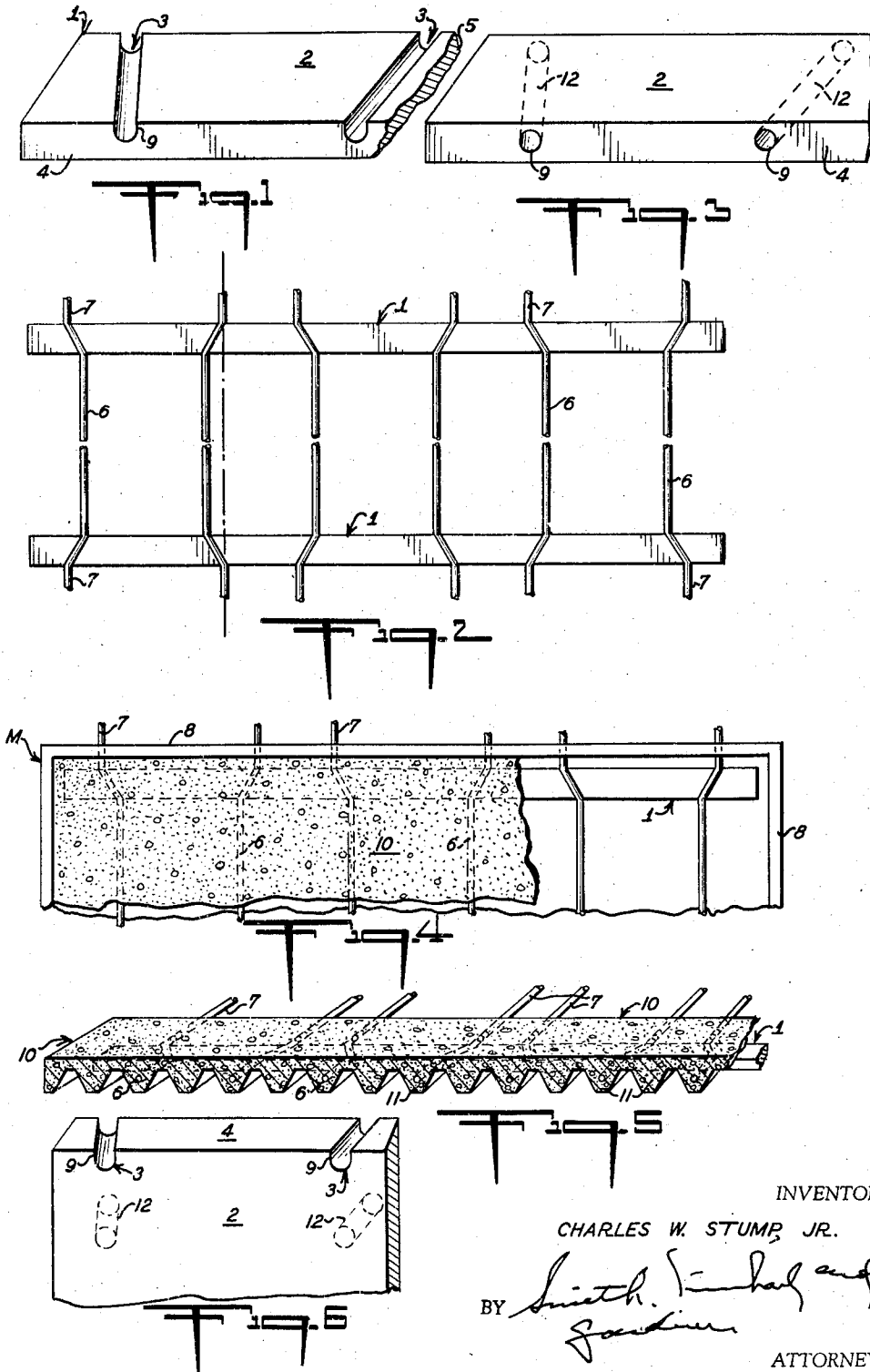
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PRESTRESSED CONCRETE STRUCTURAL ELEMENT

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PRESTRESSED CONCRETE STRUCTURAL ELEMENT

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2 Claims. (Cl. 72—68)

This invention is a load transfer bar for prestressed concrete structural elements, and the method of using the same.

It is well-known that the load bearing properties of a concrete structural element may be increased by applying tension to reinforcing elements embedded therein during the course of manufacture. The present invention seeks to provide means whereby several such tensioned reinforcing elements may be individually secured to spaced load transfer bars embedded within the concrete mass so that the tension applied to the several reinforcing elements prior to setting of the concrete is transferred to the load transfer bars after setting and the combined stresses are thus distributed as compression forces uniformly through the mass of the structural element.

One object of the invention is to provide a load transfer bar provided with passages through which reinforcing elements may be passed or threaded, and wherein the nature of the connections between the load transfer bar and the reinforcing elements is such that when tension is applied to the reinforcing elements, they are automatically and individually locked to the load transfer bar.

A further object of the invention is to provide a load transfer bar wherein the reinforcing-element-receiving openings therein are disposed at an angle to the longitudinal axis of the bar so that when tension is applied to the reinforcing elements passing through said openings along lines substantially perpendicular to the bar, the reinforcing elements are deformed or kinked to thereby lock them securely to the load transfer bar.

Another object of the invention is to provide a load transfer bar having spaced reinforcing-element-receiving openings, wherein alternate openings are inclined in substantially equal and opposite directions to the longitudinal axis of the bar. Desirably, the openings may be arranged in pairs, with the openings of each pair being inclined in opposite directions. The openings may be in the form of open slots cut in one face of the bar or may be bores within the body of the bar and extending from one side face to an opposite side face of the bar.

The invention also comprehends the method of locking several reinforcing elements assembled within the openings in the bars, to the bars by applying tension to the reinforcing elements at points beyond the bars to thereby cause locking deformation of the reinforcing elements with respect to the bars.

Another object of the invention is to provide a method whereby an assembled network of reinforcing elements and bars may be disposed within a mold or form with the reinforcing elements extending externally of the form so that tension applying means of any desired form may be associated with the protruding ends of the reinforcing elements.

Another object of the invention is to provide a prestressed concrete structural element wherein reinforcing elements embedded within the body of the member are individually locked to spaced load transfer bars embedded

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within the body of the member and disposed adjacent to opposite edges thereof.

These and other objects of the invention will become apparent from a consideration of the following specification read in the light of the accompanying drawings wherein I have illustrated preferred embodiments of my invention and wherein

Fig. 1 is a fragmental perspective view of one form of load transfer bar.

Fig. 2 is a top or plan view of the network of reinforcing elements operatively associated with a pair of load transfer bars.

Fig. 3 is a fragmental perspective view of a modified form of load transfer bar.

Fig. 4 is a fragmental top plan view showing the network of assembled reinforcing elements and load transfer bars positioned within a mold.

Fig. 5 is a perspective view partly in section of a reinforced concrete structural element made in accordance with the present invention.

Fig. 6 is a fragmental perspective view of a further modified form.

Referring more particular to the accompanying drawings wherein like reference numerals are used to designate like parts throughout, the load transfer bar of the present invention may take the form shown in Fig. 1 wherein the bar 1 is shown as an elongated structural member generally rectangular in cross-section and having provided in its broad upper face 2 a series of slots 3 spaced longitudinally thereof. The slots 3 are designed to receive reinforcing elements (see Fig. 2) and as shown are inclined to the longitudinal axis of the bar 1. The slots 3 are arranged so that the angularity of or the direction of inclination with respect to the longitudinal axis of the bar of alternate slots is substantially equal but in opposite directions. Preferably, slots 3 are arranged in pairs with the inclination of the respective slots of each pair reversed so that the forces set up between the contacting surfaces of the individual reinforcing elements and the bar 1, when tension is applied to the reinforcing elements in a manner hereinafter described, will offset one another and balance out, so that there will be no tendency for the bars 1 to shift lengthwise. The slots 3 as shown, extend from one side face 4 to the opposite side face 5 thereof and open through the top face 2 of the bar so that reinforcing elements 6, as shown in Fig. 2, may readily be entered in or threaded through the slots.

As shown in Fig. 2, the reinforcing elements comprise wires or rods 6, the opposite end portions of which are passed through and lie within the slots 3 in spaced bars 1, the arrangement being such that an appreciable length of each reinforcing element extends beyond the respective bars 1, so that, as shown in Fig. 4, the ends 7 of the reinforcing elements may extend through the side wall 8 or a mold or form M and appropriate tension jacks (not shown) applied thereto in a well-known manner. As shown in Fig. 4, a network of reinforcing members comprising the rods 6 and the load transfer bars 1 are assembled and positioned within the mold M so that the bars 1 lie adjacent to opposite edges of the mold. Thus the bars 1 eventually become embedded within the mass of concrete along with the reinforcing rods 6.

The network of reinforcing members 6 and bars 1 is positioned within the mold M as shown in Fig. 4 with the ends of the reinforcing members 6 passing through holes in the side wall of the form M. If desired, the bars 1—1 may conveniently be supported at a proper height within the mold by conventional mounts (not shown), in order to properly assemble the rods to bars 1 prior to applying tension to the rods 6. Tension is applied to the individual reinforcing elements 6 in any convenient man-

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ner, such as by attaching tension-jack devices (not shown) to the protruding ends 7 of the rods 6. Tension is preferably applied to all of these members 6 simultaneously or at least in pairs as described, so that there is no tendency for the bars 1 to shift lengthwise within the mold. As previously described, due to the equal and opposite inclination of each pair of the passages 3, the forces tending to cause the bars 1 to shift, are balanced out or equalized. The tension is applied to the reinforcing rods 6 along lines generally perpendicular to the bars 1 so as to cause deformation or kinking of the reinforcing elements at the points of contact thereof with the bars where they pass through the inclined passages 3 with the result that the rods are kinked in a manner to lock them individually to the bars 1. It will be understood that the line of the tension force applied to each of the rod ends 6 is offset with respect to that portion of the rods extending between the bars 1, and this causes deformation of the rods, with the result that the rods are locked to the bars against movement longitudinally of the rods. The biting action of the edges 9 of the slot walls and the surface of the rods, enhances this locking action. After the several reinforcing rods 6 have been tensioned in this manner and as a result thereof locked individually to the bars 1, the raw plastic concrete mix 10 may be deposited within the mold and allowed to harden, the tension on the rods 6 being maintained until the concrete is thoroughly set and hardened. The tension devices may then be removed, with the result that the forces within the several rods 6 tending to restore the rods to normal, due to the locking engagement between these rods 6 and the bars 1—1, are transferred to these bars and the bars thus distribute these forces substantially uniformly to the mass of set and hardened concrete, as compression forces.

In Fig. 5 there is shown a preferred form of reinforced concrete structural element or slab formed in accordance with the present invention and wherein the rods 6 are shown embedded in substantially V-shaped ribs 11 projecting from the under face of the slab. It will be understood, of course, that the invention is not restricted in its use to slabs having reinforcing ribs 11 such as shown in Fig. 5 and that a slab or block of any desired configuration or cross-section may be made in an appropriate form and in accordance with the method herein described. In that form of bar shown in Fig. 1, it is desirable to support the bars 1 temporarily within the mold until tension has been applied to the reinforcing elements in order to assure proper positioning of the bars with respect to the completed structural elements.

In Fig. 3 I have shown a modified form of load transfer bar wherein the reinforcing-element-receiving openings are in the form of inclined bores 12. The bores 12 are arranged in pairs in equally and in oppositely inclined relation, similar to the open slots 3 as shown in the bar of Fig. 1 but in this instance, no means are required to support the bars within the forms prior to the time tension is applied thereto, since the bars 1 are supported by the reinforcing elements, passing through the openings.

Although the load transfer bars have been shown as imperforate, if desired, the bars of either form as shown in Figs. 1 and 5, may be provided with perforations (not shown) or may be roughened conventionally to enhance the bond between the bars and the body of the concrete.

It should be noted that while the bar 1 as shown in Figs. 1 and 3 is designed with the reinforcing-rod-receiving openings lying in a plane generally parallel to the broad upper face 2 of the bar, with the edge 4 of the bar lying generally perpendicular to the plane of the reinforcing elements and acting as the compression face thereof to transmit the forces from the rods 6 to the body of concrete, the invention also contemplates the use of the bars in a position such that the broad faces of the bar are disposed generally perpendicular to the general plane of the reinforcing elements so as to act as the compression

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faces of the bar. A bar having the reinforcing-rod-receiving openings 3 or 12 arranged for use in this manner is shown in Fig. 6.

The rods 6 may vary in diameter according to the design of the slab or block, and may run between $\frac{1}{4}$ " and 3" in diameter. The slots or openings 3 in the bars may be dimensioned to receive the rods somewhat loosely, there being no necessity for a tight or even snug fit between the rods and the bar openings, the deformation of the rods and the biting action between the corresponding edges 9 of the openings and the rods being ample to securely lock the rods to the bars, even though a relatively high order of tension is applied to the rods. As is well known, these tension forces vary between 8,000# and 150,000# per square inch.

It will be understood that the bars 1 are assembled as shown in Fig. 2, with the corresponding pairs of openings 3 in bars 1 in alignment, but with the angles of inclination reversed so that the opposite ends 7—7 of the rods 6 will be in substantial alignment, generally perpendicular to the longitudinal axes of the bars. Thus when tension is applied to the opposite ends of the rods, the line of applied tension is offset to the body of the bar lying between the bars and this causes the locking deformation of the rods with respect to the bars, as described.

While I have referred to applying tension to the rods 6 before the concrete mix is deposited in the form M, it will be understood that this is a preferred manner of operation only and if desired, the net work of reinforcing elements such as shown in Fig. 2, may be properly positioned within the form M, and the concrete mix deposited thereon before any appreciable tension is applied to the rods 6. The important factor is to apply tension to the rods before the concrete has set, and to maintain such tension until after the concrete has set.

Having thus described my invention, it is apparent that I provide means in the form of a load transfer bar through which a plurality of reinforcing rods or bars may be passed in a manner such that when tension is applied to the reinforcing rods they are deformed or kinked in a manner to securely lock them to the load transfer bar. By thus securing the individual reinforcing rods to the load transfer bars and maintaining the rods under tension until after the concrete has set, these tension forces set up in the rods are transferred to the bars at the time the tension jacks are released, and the bars thus uniformly distribute these forces to the concrete within the body of the structural element, as compression forces. Those skilled in the art will realize that various changes in size and proportions of parts may be made without departing from the spirit of the invention which is set forth more particularly in the appended claims.

What I claim as new is:

1. A prestressed reinforced concrete structural element having embedded therein a reinforcing network including a pair of elongated load transfer bars arranged in spaced substantially parallel relation, each of said bars being provided with a pair of inclined openings passing transversely therethrough and with the axes of the openings of each pair being symmetrically disposed and oppositely inclined with respect to a common axis passing transversely through the bars substantially perpendicular to the longitudinal axes thereof, both pairs of openings being disposed in substantially coplanar relation with respect to each other and to the common axis thereof with the axes of the openings of respective pairs converging in opposite directions towards said common axis, and a pair of longitudinally prestressed reinforcing rods, one of the rods lying within one opening of each of said pairs of openings and the other of the rods lying within the other opening of each of said pairs of openings, each of said reinforcing rods passing completely through said bars and being interlocked with both of said bars at points of intersection therewith by reversely bent portions of said reinforcing rods which lie within and conform

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to the reverse inclination of openings in the respective bars through which they pass.

2. A prestressed reinforced concrete structural element having embedded therein a reinforcing network including a pair of elongated load transfer bars arranged in spaced substantially parallel relation, each of said bars being provided with a pair of openings passing transversely therethrough and symmetrically disposed with respect to a common axis passing transversely through the bars substantially perpendicular to the longitudinal axes thereof, both pairs of openings being disposed in substantially coplanar relation with respect to each other and to the common axis thereof, plural longitudinally prestressed reinforcing rods, one of said rods lying within one opening of each of said pairs of openings and another of said rods lying within the other opening of each of said pairs of openings, said rods passing completely through said bars with portions of said rods lying on opposite sides of the respective load transfer bars being out of longitudinal alignment with respect to each other but sub-

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stantially perpendicular to the longitudinal axes of the respective bars, to thereby interlock the reinforcing rods with both of said load transfer bars at points of intersection therewith, thus securing the same against relative movement with respect to said bars.

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