Aug. 9, 1932. R. F. GREENWOOD 1,871,318

PRECAST CONCRETE STRUCTURAL UNIT

Filed Jan. 30, 1929

Fig. 1.

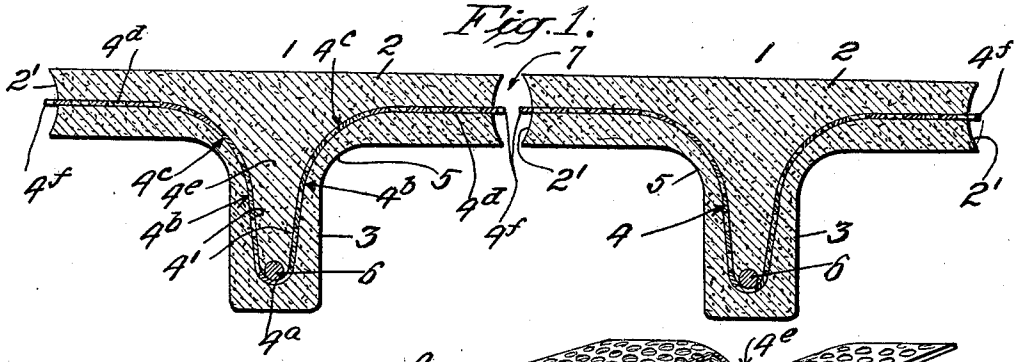

Fig. 2.

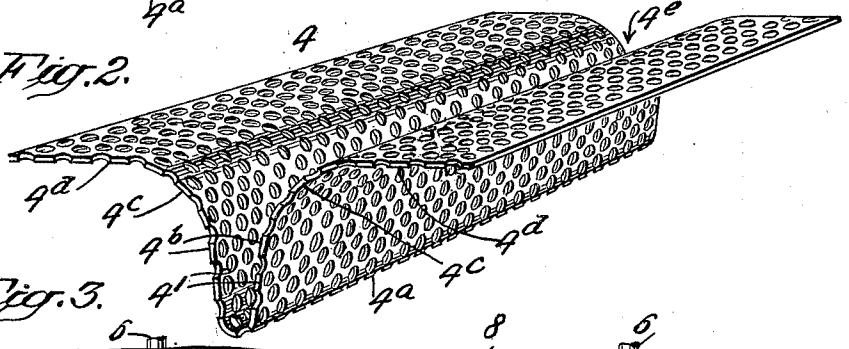

Fig. 3.

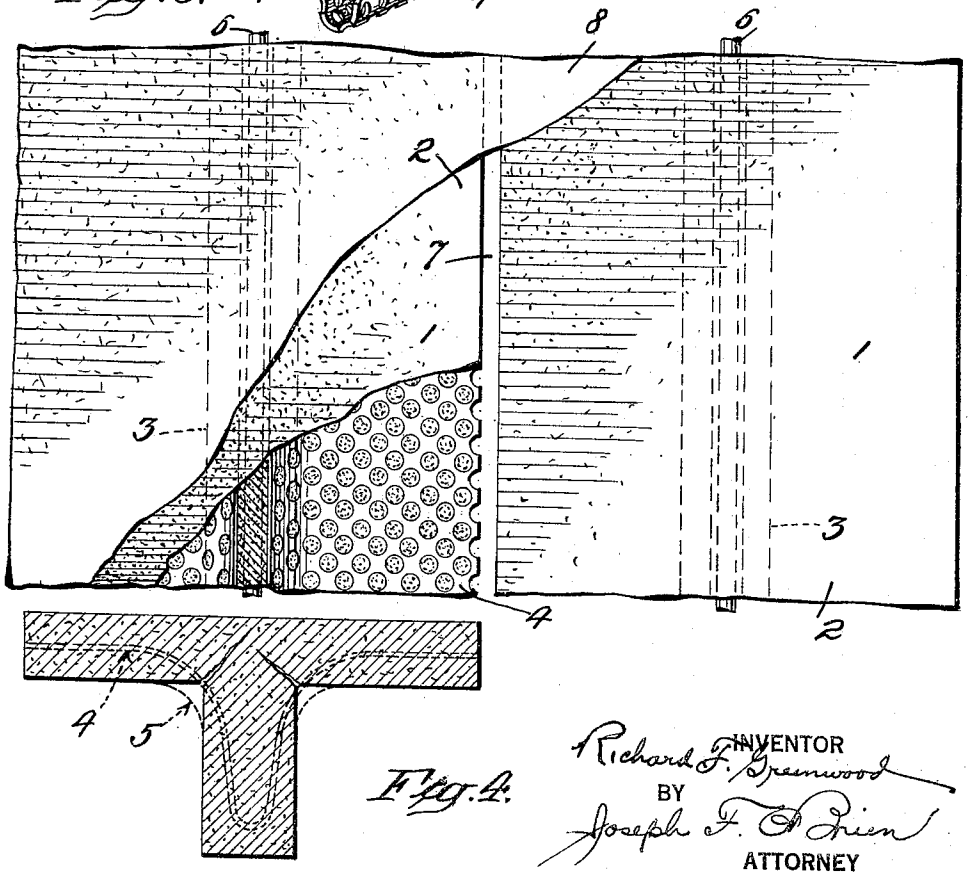

Fig. 4.

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UNITED STATES PATENT OFFICE

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PRECAST CONCRETE STRUCTURAL UNIT

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This invention relates to improvements in pre-cast concrete structural units.

It is well known that in concrete T-beam construction, the strength against bending moments tortional strain and shearing stresses which may be developed under load depends largely upon the strength of the reinforcement, the arrangement of the same within the T-beam and the strength of the bond between the concrete and the metallic reinforcement.

The principal object of this invention is to produce a pre-cast T-beam or pre-cast ribbed concrete unit for use in building and like construction in which the reinforcement and concrete surrounding the same will be so correlated, arranged and bonded as to provide a combined steel and cement fabrication of great strength along the lines which are usually weakest and where failures or cracks in the concrete usually appear.

Still another object of the invention is to provide a pre-cast concrete structural unit in which the metallic reinforcing member will have sufficient independent strength and rigidity to constitute an independent load-carrying element and at the same time will be relatively light, and will have a thorough interlocking bond connection with the concrete portion of the unit in addition to the usual adherent bond of the concrete and steel.

Still another object of my invention is to provide in a pre-cast T-beam unit a rigid metallic reinforcing element composed of perforated sheet metal traversing the flange or plate portion and having an integral deep channel or stirrup portion extending within the rib, stem or beam section to provide a reinforcing connection between the flange or plate and the beam or rib of the unit.

Still another object of my invention is to bend the walls of the channel portion of said reinforcement within the rib or beam section to cause them to curve or incline outwardly in relation to the center line of the said rib or beam section and to merge with the flange or plate portion in a relatively-wide arcuate section extending closely adjacent to or crossing the intersection of planes coinciding or corresponding to the lower surface of the flange section and the sides of the beam or rib section.

Still another object of my invention is to provide, in a pre-cast T-beam having the continuous perforated sheet metal reinforcement hereinabove described, for further strengthening of the construction and for a symmetrical disposition of the concrete and steel parts thereof by the use of a fillet or web of concrete or like cementitious material arranged at the junctions or corners between the surfaces of the rib and flange, thus producing a symmetrical and homogeneous structural unit.

Still another object of my invention is to provide at the side edges suitable bonding grooves and space between adjacent members or succession of units within which the metallic reinforcement from the respective units project and are bonded together to produce a continuous monolithic construction.

With these and other objects in view, the invention comprises the combination of members and arrangement of parts so combined as to co-act and cooperate with each other in the performance of the functions and the accomplishment of the results herein contemplated, and comprises in one of its adaptations the species or preferred form illustrated in the accompanying drawing, in which:—

Fig. 1 is a cross-section of two T-beams or units arranged adjacent to each other;

Fig. 2 is a view, in perspective, of my reinforcing element separate from the beam;

Fig. 3 is a plan or top view of a plurality of sections bonded together; and

Fig. 4 is a diagrammatic view showing how the placement of my reinforcing element transversely traverses the usual diagonal cracks or failures in T-beams.

Referring now to the drawing, which illustrates a preferred embodiment of my invention, 1 indicates a precast ribbed concrete unit or T-beam embodying a flange or plate portion 2 and a rib or beam portion 3 projecting at substantially right angles therefrom. The unit is reinforced by a continuous metallic reinforcement comprising a perforated metal plate 4 bent intermediate,

its ends to provide an open channel or stirrup portion 4′ preferably reversely, bent or looped at its bottom portion 4^a, having oppositely inclined walls 4^b, 4^b merging by wide arcuate portions 4^c, 4^c with flange portions 4^d, 4^d extending in opposite directions at substantially right angles to the center line of the channel 4^e formed by said channeled portion 4′.

This reinforcing element when bent, as aforesaid, has considerable independent load-carrying strength and rigidity and because of the character of the material will enable a thorough bonding and interlocking between the metal and the concrete to be procured. Furthermore by reason of its continuity, the integrality of its parts and its placement within the concrete T-beam, I am enabled to reinforce and prevent failure at the junctions between the flange or plate and rib or beam sections, which portions of T-beams are weakest and usually fail first under torsional or shearing stresses.

As illustrated this reinforcing element is so placed and embedded within the concrete as to cause the metallic flange portions 4^d, 4^d to extend substantially parallel to the center line of the plate or flange section 2, the integral open-looped stirrup or channel portion 4′ to be arranged centrally within the rib or beam sections 3 with the bottom 4^a of the channeled portion extending to a plane adjacent to the outer edge of said rib or beam section, the opposite walls 4^b of the channel inclining outwardly to opposite sides of the center line of the rib or beam section and the arcuate portions 4^c, 4^c of the reinforcement extending to a plane closely adjacent to or crossing the intersection of planes coinciding with the lower surface of the flange and the opposite faces of the rib and thus passing in a substantially transverse direction over diagonal lines extending from said intersection which is the weakest portion of the unit and along which cracks or failures caused by the contraction of the cement while setting or curing from the inundated stage to the final setting stage, usually occur.

Furthermore, I preferably strengthen the bond between said rib and plate or flange portions of the unit by applying at the junctions therebetween a fillet or binding web 5 of cementitious material. The thickness of this concrete fillet 5 outside the arcuate portion of the metallic reinforcement at such corners is at least equal to the depth or thickness of the concrete adjacent to the straight flange portions at the same side of the said reinforcement.

The above will be clear from an examination of Fig. 4 in which I have shown in full lines an ordinary T-beam with cracks at the junction between the flange and rib members and have illustrated in dotted lines the positioning of my reinforcing element in a transverse direction across these cracks and have also illustrated in dotted lines the addition of my fillet which combined with my reinforcing element provides a symmetrical construction of great strength.

In the embodiment shown in Figs. 1 to 3 the flange portion is provided with a bonding groove 2′ and the reinforcing element 4 has a marginal portion 4^f projecting into said groove. When units are assembled, as shown in Fig. 3, they are spaced apart as illustrated at 7 and the bond thus connects the adjacent reinforcements as well as the concrete parts. After bonding together, a top layer 8 may be applied as shown in said Fig. 3.

I also embed in the concrete within the groove or channel 4′ a reinforcing rod 6 extending longitudinally of the said channel 4 and of the rib portion 3.

Having described my invention, I claim:—

1. A pre-cast concrete structural unit comprising a beam substantially T-shaped in cross section and composed of concrete flange and rib sections and a rigid continuous perforated metallic reinforcing element composed of sheet metal and having independent load-carrying strength and provided at opposite ends with flange portions embedded in the said concrete flange portions of the beam, and a channel portion substantially V-shaped in cross section formed integrally with said flange portions and extending into and embedded within the said rib portion.

2. A pre-cast concrete structural unit comprising a beam substantially T-shaped in cross section and composed of concrete flange and rib sections and a rigid continuous perforated metallic reinforcing element composed of sheet metal and having independent load-carrying strength and provided at opposite ends with flange portions embedded in the said concrete flange portions of the beam, a channel portion substantially V-shaped in cross section formed integrally with said flange portions and extending into and embedded within the said rib portion, the intermediate channel and flange portions of said reinforcing element merging by arcuate web portions branching in opposite directions, and extending across the junctions formed between the rib and flange portions.

3. A pre-cast concrete structural unit comprising a beam substantially T-shaped in cross section and composed of concrete flange and rib sections and a rigid continuous perforated metallic reinforcing element composed of sheet metal and having independent load-carrying strength and provided at opposite ends with flange portions embedded in the said concrete flange portions of the beam, and a channel portion substantially V-shaped in cross section formed integrally with said flange portions and extending into and embedded within the said rib portion, the said intermediate channel portion having walls

inclining outwardly away from the center line of the concrete rib and merging with the flange portions by an arcuate web portion extending closely adjacent to the line of intersection of planes which coincide with the bottom surfaces of the flange portions and with the side surfaces of the rib.

4. A pre-cast concrete structural unit comprising a beam substantially T-shaped in cross section and composed of concrete flange and rib sections and a rigid continuous perforated metallic reinforcing element composed of sheet metal and having independent load-carrying strength and provided at opposite ends with flange portions embedded in the said concrete flange portions of the beam, a channel portion substantially V-shaped in cross section formed integrally with said flange portions and extending into and embedded within the said rib portion, the said intermediate channel portion having walls inclining outwardly away from the center line of the concrete rib and merging with the flange portions by an arcuate web portion extending closely adjacent to the line of intersection of planes which coincide with the bottom surfaces of the flange portions and with the side surfaces of the rib, and a concrete fillet arranged adjacent to said arcuate metallic web and filling space at the junction of said flanges with the sides of said rib.

5. A pre-cast concrete structural unit comprising a concrete beam substantially T-shaped in cross section and composed of concrete flange and rib sections, and a continuous rigid plate of perforated sheet metal bent to provide at opposite ends flange sections embedded in the concrete flange sections of the T-beam and an intermediate integral channel portion, substantially V-shaped in cross-section, embedded centrally in the rib portion of said unit, each of said flange portions having bonding grooves along the side edges thereof and said metallic reinforcement having a marginal portion projecting outside the concrete flange and into said groove to provide an interlock between units.

In witness whereof, I have signed my name to the foregoing specification.

RICHARD F. GREENWOOD.