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METHOD FOR PRESTRESSING

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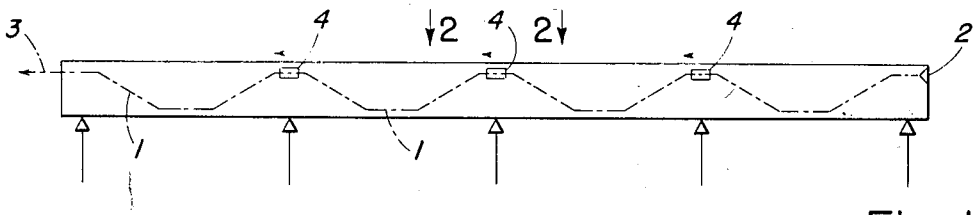


Fig. 1.

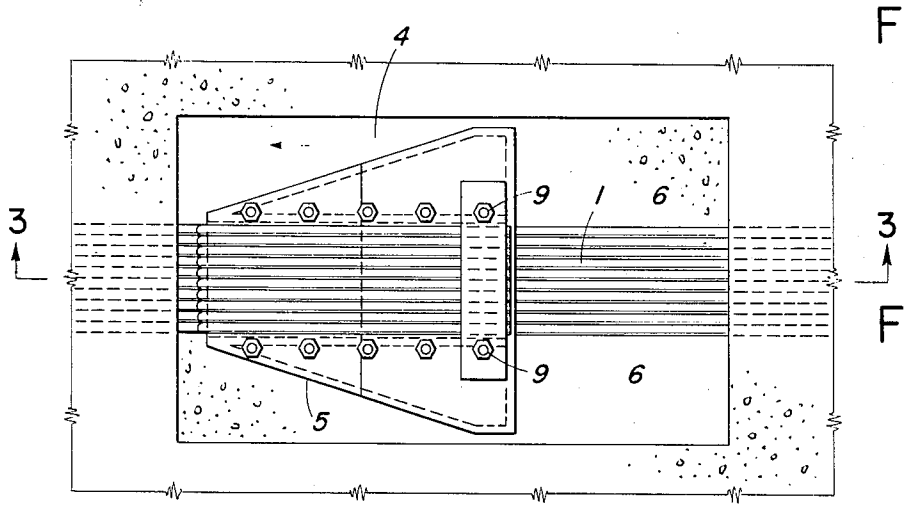


Fig. 2.

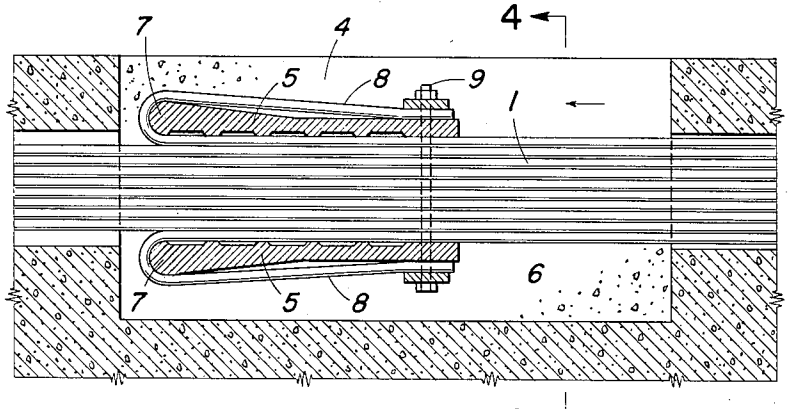


Fig. 3.

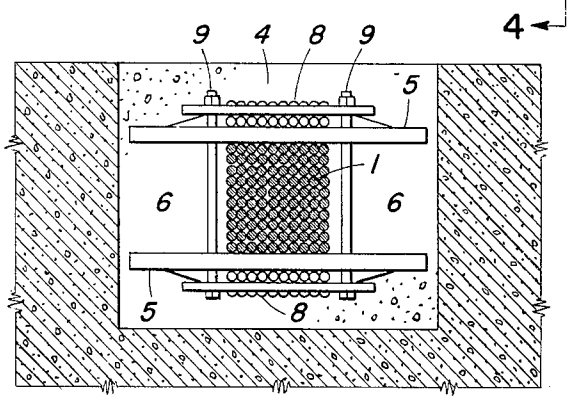


Fig. 4.

INVENTORS
Fritz Leonhardt,
WILLY BAUR.
BY William J. Fox
ATTORNEY

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METHOD FOR PRESTRESSING

Fritz Leonhardt, Stuttgart, and Willy Baur, Stuttgart-Bad Cannstatt, Germany

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1 Claim. (Cl. 29—452)

This invention relates generally to a method for prestressing concrete masses such as girders, beams or the like in which the prestressing units, utilized to prestress such concrete masses, are imbedded or channeled within the mass. In particular, this invention relates to prestressing concrete masses wherein the prestressing unit is composed of multiple elements, as for example a series of wires or cables, and wherein the path of the prestressing unit through the concrete mass is irregular, curved or angular so that the prestressing unit is characterized by a plurality of bends.

Prior to this invention, the prestressing of concrete masses by means of a prestressing unit, located in guide channels either on the inside or outside of the mass, which passed in an irregular, curved or angular fashion through the concrete mass and was thus being characterized by a plurality of bends, has been subject to a serious drawback. Due to the path of the prestressing unit, friction forces are developed at each one of the bends in the prestressing unit. These friction forces tend to decrease the prestressing force of the unit. In the event that the sum total of the bending angles becomes considerable in a construction of this type, which frequently occurs in the case of multiple span girders, the presently known precautionary measures which have been designed to lessen the effect of the friction forces appearing at each of the bends, as well as any temporary exceeding of the calculating stress, have not proved sufficient to insure efficient utilization of the prestressing units.

It is accordingly an object of the present invention to provide a novel method for prestressing concrete masses which will overcome this serious drawback.

It is a further object of the present invention to provide a method for prestressing concrete masses of the type referred to above which will function more efficiently to lessen the effect of the friction forces developed at each of the bends than any method and apparatus heretofor available.

Other and further objects of the present invention will become readily apparent from a detailed consideration of the following description when taken in conjunction with the drawing in which:

Figure 1 is a schematic representation showing a continuous beam of concrete having imbedded therein a prestressing unit which follows an irregular path through the beam;

Figure 2 is a view in plan showing the method and apparatus of the present invention;

Figure 3 is a view in vertical section of Figure 2 taken along the longitudinal axis; and

Figure 4 is a view in vertical section of Figure 2 taken along the transverse axis.

One feature of the present invention resides in the provision of connecting the prestressing unit to a means to add to the prestressing forces of the unit the forces that would otherwise be lost due to the friction forces developed at the bends of the unit. These means are located at spaced intermediate points along the length of the concrete beam and serve to stress additionally at these intermediate points the prestressing unit so that a fairly uniform stress will be obtained over the whole length of the unit. For smaller prestressing units, a stressing shoe can be clamped thereon, while in the case of larger units the prestressing element is embraced by the stressing shoe which is provided with shearing surfaces at the inside, the inner hollow spaces being filled with concrete, casting metal or materials acting in similar fashion, so that the resistance offered to slippage thus produced between the shoe and the unit makes it possible to transfer the differential force to the prestressing unit by means of hydraulic jacks or the like. The jacks are brought to bear upon the stressing shoe and the structural element respectively. In the case of continuous beams, the support area is a suitable place for that purpose. Any other point, however, may be chosen in this respect. The same arrangement may be used for stepping the cross section of the prestressing units, which is desirable with continuous girders of different span lengths. In this case, one portion of the prestressing wires or strands is bent over and anchored in the prestressing shoe. Before removing the jacks, the prestressing shoe is made to bear against the structural element either directly or indirectly in such a manner that the force of the prestressing unit anchored in the stressing shoe can be transmitted directly to the structural member.

Referring now to the drawings, Figure 1 shows a continuous beam of concrete or the like wherein a prestressing unit **1** is anchored at one end **2** of the beam and traces an irregular path longitudinally through the beam to emerge at the other end **3**. The prestressing unit **1** is stressed or tensioned in the direction of the arrow shown at the end **3**. Recesses are provided at intermediate spaced points **4** along the length of the beam. Additional prestressing forces are applied to the prestressing unit **1** in these recesses **4** in the following manner.

Referring now particularly to Figures 2, 3 and 4, there is shown the prestressing unit **1** in greater detail. The prestressing unit **1** is composed of a plurality of wires or cables **8** (note Figure 4). A stressing shoe **5** is fitted around the prestressing unit **1** and the parts of the shoe **5** are bolted together as indicated by the numeral **9** in Figure 3. The stressing shoe **5** on its inside is provided with a serrated surface which acts to grip firmly the prestressing unit **1**. The stressing shoe **5** is also provided with laterally extending portions so that jacks **6** can be applied between the beam and the laterally extending portions for applying a stressing force to the unit **1**. These portions are cantilever supported from the main body of the shoe **5**. As will be noted with particular reference to Figure 3, the stressing shoe **5** is characterized by roll-shaped thickened portions **7** which enable portions of the prestressing unit **1**, namely, the wires **8** to be bent over the shoe **5** and securely anchored to the shoe **5**. The anchorage for the portion of the prestressing unit **1** to be anchored are the same parts which serve to hold the shoe **5** together. These parts are identified in Figure 3 by the numeral **9**. Figure 4 illustrates more clearly the lateral positioning of the jacks **6** and shows how they act upon the stressing shoe **5**.

Thus with the present arrangement, as above described, the friction forces which would normally appear at the bends in the prestressing unit **1** tending to decrease the prestressing force of the unit **1** are compensated for by the application to the prestressing unit **1** at these same points of an added stressing force by means of the jacks **6** acting through stressing shoe **5**. Further, the provision of anchoring one or more of the elements **8** constituting the prestressing unit at intermediate points along the length of the beam permits the cross section of the prestressing unit **1** to be stepped. This is de-

sirable in constructions employing continuous girders of different span lengths.

Although the present invention has been described in a specific embodiment, nevertheless, various changes and modifications obvious to one skilled in the art are within the spirit and scope of the present invention.

We claim:

A method of compensating for the prestressing force lost by friction at a bend of a bent stressed unit acting to prestress a mass that comprises forming a mass with a bent stressable unit therein in a plurality of bends, stressing the unit throughout its length, anchoring the ends of the unit to retain the stress, and applying a supplementary stress at each of a plurality of bends with at least one recess at each bend by bending at least one section of the unit around parts of a stressing shoe, bolting said parts together and applying a stress to said shoe by means of a jack.

References Cited in the file of this patent

UNITED STATES PATENTS

2,413,990	Muntz	Jan. 7, 1947
2,510,958	Coff	June 13, 1950
2,579,183	Freyssinet	Dec. 18, 1951

FOREIGN PATENTS

273,004	Switzerland	Apr. 16, 1951