June 14, 1966 K. H. MIDDENDORF 3,255,558

METHOD OF AND MEANS FOR PRESTRESSING CONCRETE

Original Filed July 20, 1962

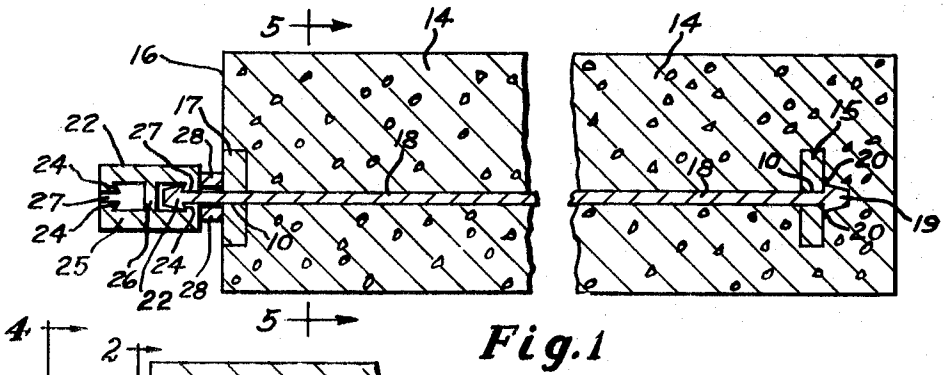


Fig. 1

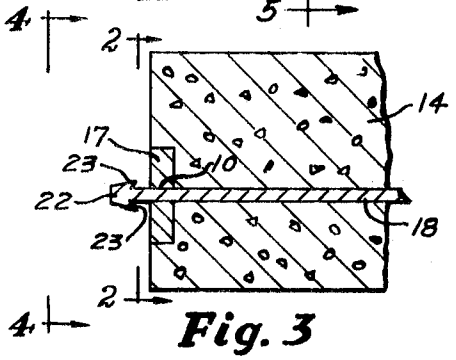


Fig. 3

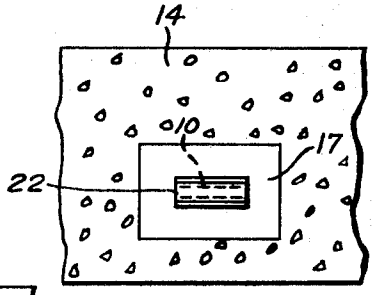


Fig. 4

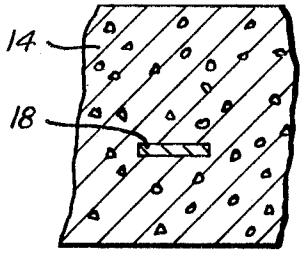


Fig. 5

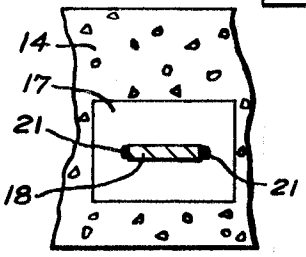


Fig. 2

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METHODS OF AND MEANS FOR PRESTRESSING CONCRETE

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Original application July 20, 1962, Ser. No. 211,191. Divided and this application May 3, 1965, Ser. No. 462,464

6 Claims. (Cl. 52—223)

This is a division of the application of Karl H. Middendorf, Serial No. 211,191, filed July 20, 1962.

The invention relates to methods of and means for prestressing concrete, and more particularly to post-tensioning methods of prestressing concrete and apparatus therefor.

It is a purpose of my invention to provide means for prestressing concrete that is in the form of a flat bar of high tensile strength steel having considerably greater width than thickness. By utilizing a flat bar the advantages of a flat tendon are obtained. Such flat tendons are particularly advantageous in a flat slab concrete construction, as such flat bar tendons make it possible to resist externally induced moments by internally created moments developed by less prestressing force than where a circular in cross section tendon is utilized. This is because a flat tendon can be mounted in a concrete body so as to obtain a longer couple arm than with a round or thick tendon and at the same time maintain the required covering of concrete over the steel prestressing member to protect it against weather and fire.

It is a further purpose of my invention to provide a new and improved method of prestressing a concrete structure, which comprises mounting a pair of bearing plates on a high tensile strength steel prestressing member, such as the flat bar above referred to, providing enlargements on the opposite ends of the prestressing member, preferably by a cold upsetting method,, securing one of the enlargements to the one bearing plate and the other enlargement in spaced relation to the other bearing plate, positioning the tendon, comprising said bearing plates and prestressing member provided with said end enlargements, in the concrete body portion so that the bearing plate spaced from an enlarged end of the prestressing member has one face exposed, sliding a coupling member laterally into position in engagement with the enlargement that is spaced from said bearing plate, and after the concrete has been cured sufficiently to reach maximum strength, pulling the coupling member to release the prestressing member from the bearing plate to which it was attached and tension the prestressing member the desired amount, and inserting spacing means between the coupling member and the bearing plate to maintain the tension on the prestressing member.

In carrying out the above referred to method, a coupling member is utilized, which is preferably provided with undercut flanges thereon, similar to those provided on the coupling member disclosed in my co-pending application Serial No. 409,622, filed October 19, 1964, which is a division of my application Serial No. 3,851, filed January 21, 1960, on Method and Apparatus for Post-Tensioning Concrete Prestressing Members now abandoned, and the enlargement on the prestressing member is provided with correspondingly undercut flanges thereon that engage with the undercut flanges of the coupling member, said coupling member being preferably provided with such undercut flanges at opposite ends thereof so that a prestressing member having a similar end enlargement can be engaged therewith so as to connect two such prestressing members together, should this be desirable.

Other objects and advantages of my invention will

appear as the description of the drawings proceeds. I desire to have it understood, however, that I do not intend to limit myself to the particular details shown or described, except as defined by the claims.

In the drawings:

FIG. 1 is a vertical sectional view of a concrete structure showing my improved prestressing means applied thereto, and showing the position of the parts after the prestressing means has been post-tensioned.

FIG. 2 is a fragmentary detail view partly in section, taken on the line 2—2 of FIG. 3.

FIG. 3 is a fragmentary vertical sectional view through the concrete structure shown in FIG. 1 before the prestressing member has been post-tensioned.

FIG. 4 is a fragmentary elevational view taken substantially on the line 4—4 of FIG. 3, and

FIG. 5 is a fragmentary sectional view taken on the line 5—5 of FIG. 1.

Referring in detail to the drawings, in FIG. 1 is shown a body 14 of concrete, such as a slab having a flat bottom face and embedded therein is a bearing plate 15. Mounted in said concrete body portion adjacent one end face 16 thereof, so that one face of said bearing plate will be exposed, is a bearing plate 17. The bearing plate 17 is shown in FIG. 4 as being of greater horizontal than vertical extent, or elongated horizontally, the bearing plate 15 being of the same shape. Each of said bearing plates 15 and 17 is similarly slotted, the slots being indicated at 10 in FIGS. 1 and 4, and extending with their length horizontally.

A flat high tensile strength steel bar 18, which is preferably about five or six times as wide as thick, extends between the bearing plates 15 and 17 and through the slots 10 therein, the slots conforming substantially to the cross sectional shape of the flat bar 18. An enlargement 19, extending the full width of the bar 18, is provided on one end of the bar 18 and engaging the bearing plate 15 on the side thereof remote from the bearing plate 17 and may be fixed thereto by tack welding, as indicated at 20. The bearing plate 17 is secured to the prestressing member 18 by any suitable means, such as by means of tack welds 21, in spaced relation to the enlargement 22, extending the full width of the bar 18 provided on the end of said prestressing member 18 opposite the end having the enlargement 19 to thus space the enlargement 22 from the outer face of the bearing plate 17 for a purpose to be described below. A lubricating coating is applied to the prestressing member 18 before the concrete body 14 is poured to prevent adhesion of the concrete to the metal bar 18. The enlargements 19 and 22 are cold formed under relatively slow pressure of 500,000 p.s.i. or greater.

Said enlargement 22 is preferably provided with undercut grooves 23 therein, which form inclined shoulders extending lengthwise of the enlargement from the flat bar 18 to the outer extremity of said shoulders, said shoulders extending the full width of the bar 18 and being provided for engagement with similarly undercut shoulders 24 on the inturned flanges of the coupling member 25, which is provided with a transverse web portion 26, and undercut shoulders 24 adjacent the opposite ends thereof, there being a passage 27 between the inturned flanges on said coupling member 25 for receiving the portion of the flat bar 18 extending from the enlargement 22.

In prestressing a concrete structure with the tendons shown in FIGS. 1 to 5, the concrete body portion 14 is poured with the bearing plate 15 so positioned that it and the enlargement 19 will be completely embedded in the concrete, while the bearing plate 17 will be mounted at the end face 16 of the concrete body with just the one face thereof exposed. The enlargement 22

will then be spaced from the concrete body **14** in the manner illustrated in FIG. 3, the spacing of the enlargement **22** being sufficient from the bearing plate **17** that the inturned flanges of the coupling member **25** can be readily slid laterally into position, that is, in a direction lengthwise of the enlargement **22**, or transversely of the prestressing bar **18**, into the position that it will have the undercut shoulders **24** thereof in engagement with the undercut shoulders **23** of the enlargement **22**. When the concrete has been set so as to attain its ultimate strength, a pulling member is connected with the coupling member **25** and the coupling member **25** is pulled to the position thereof shown in FIG. 1. When such pulling takes place, the welds **21** will be broken and the bar **18** will be released from the bearing plate **17** and will be tensioned. When the desired tension has been applied to the bar **18**, suitable spacing members, such as the shims **28**, are inserted between the bearing plate **17** and the coupling member **25**, to maintain the tension on the prestressing member **18**. The pulling means can now be removed and, if desired, another prestressing member **18**, having a similar enlargement **22**, can be applied to the coupling member at the end thereof that is remote from the bearing plate **17**, should this be desired.

What I claim is:

1. The method of prestressing a concrete structure comprising mounting a pair of bearing plates on a high tensile strength steel prestressing member with said prestressing member extending through openings in said bearing plates, cold upsetting the ends of said prestressing member to provide end enlargements thereon, securing one of said enlargements to one of said bearing plates on the side thereof remote from the other bearing plate and the other bearing plate to said prestressing member in spaced relation to said other enlargement, pouring a body of concrete around said prestressing member and bearing plates except for one face of said other bearing plate, said other enlargement and the portion of said prestressing member between said other bearing plate and other enlargement, applying a coupling member to said other enlargement, pulling on said coupling member after said concrete has been cured sufficiently to reach maximum strength to release said prestressing member from said other bearing plate and tension said prestressing member, and inserting spacing means between said coupling member and said other bearing plate to maintain the tension applied to said prestressing member.

2. Means for post-tensioning a concrete structure comprising a pair of bearing plates having openings therein and a high tensile strength steel prestressing member extending between said plates and through said openings, said prestressing member having enlargements on the ends thereof, one of said enlargements engaging the face of one of said bearing plates remote from the other bearing plate and the other bearing plate being secured to said prestressing member in spaced relation from said other enlargement.

3. Means for post-tensioning a concrete structure comprising a pair of rectangular bearing plates having longitudinally extending slots therein and a flat high tensile strength steel bar extending between said plates and through said slots, said bars having transversely elongated enlargements on the ends thereof, one of said enlargements engaging the face of one of said bearing plates remote from the other bearing plate and the other bearing plate being secured to said bar in spaced relation from said other enlargement.

4. In a concrete structure having a flat bottom face, means for putting said structure under compression comprising a smooth surfaced flat high tensile strength steel bar of much greater width than thickness having its width extending parallel to said flat bottom face, a pair of rectangular bearing plates embedded in said concrete structure, said bearing plates being elongated transversely of said bar and each having a longitudinally extending slot therein conforming substantially to the cross sectional shape of said bar, said bearing plates each having a flat face, said bar extending through said slots in said bearing plates and having enlargements on the ends thereof projecting beyond the top and bottom flat faces of said bar and elongated transversely of said bar, one of said enlargements engaging the flat face of one of said bearing plates and spacing means between the other bearing plate and the other enlargement.

5. The concrete structure claimed in claim **4** in which said spacing means comprises a coupling member engaging said enlargement and transversely slidably engaged therewith and shims mounted between said coupling member and said bearing plate.

6. The concrete structure claimed in claim **4** in which said spacing means comprises a coupling member having undercut shoulders thereon and said enlargement has undercut shoulders thereon engaged by said shoulders on said coupling member by sliding movement of said coupling member relative to said enlargement transversely of said bar, said coupling member having a flat face opposite said bearing plate and shims mounted between said coupling member and said bearing plate.

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