

June 4, 1963

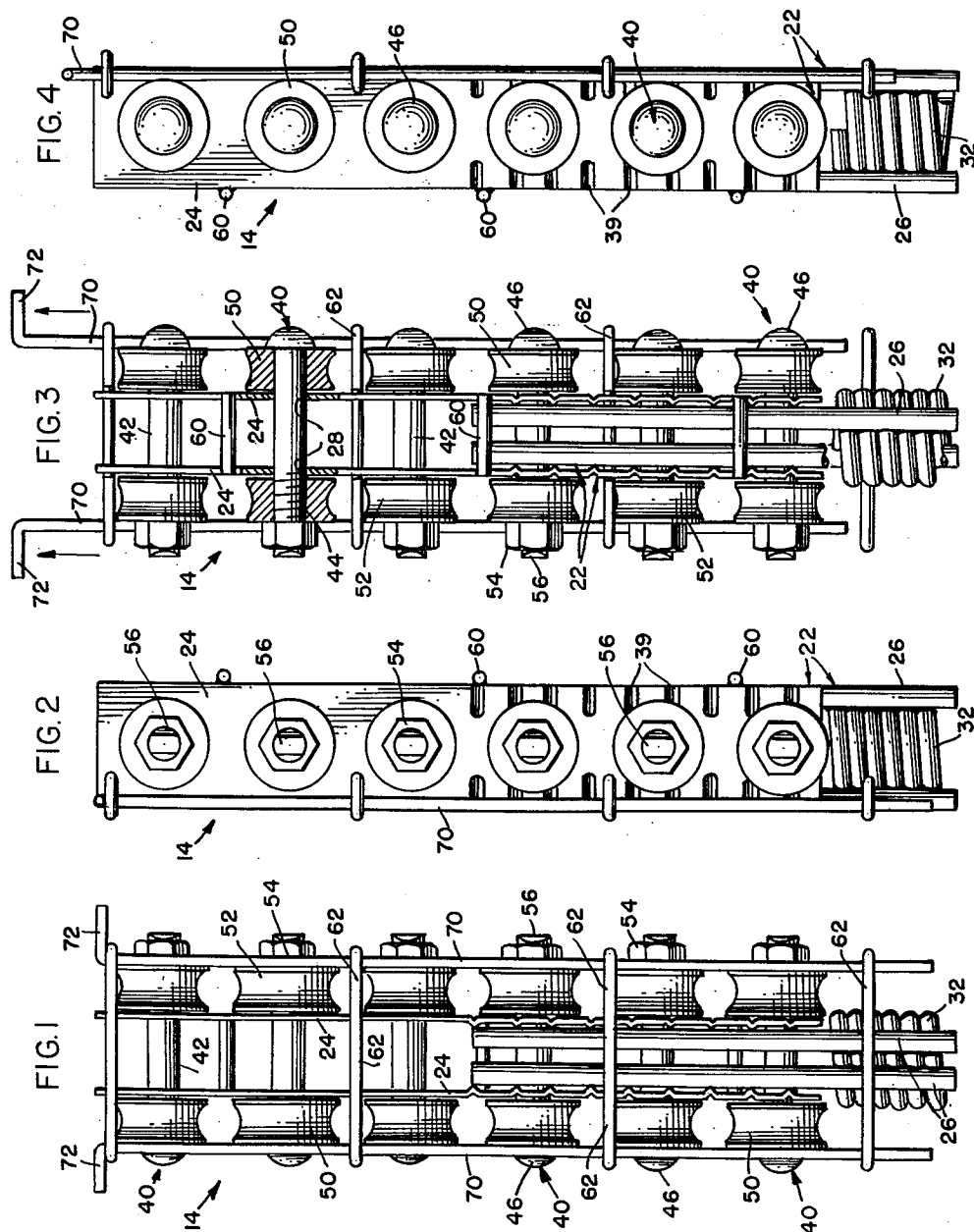
B. HILLBERG

3,091,897

CABLE HOLD-DOWN ANCHOR DEVICE

Filed Aug. 19, 1959

3 Sheets-Sheet 1



INVENTOR:
BROR HILLBERG
BY *Ymman Geddes*
ATT'Y

June 4, 1963

B. HILLBERG
CABLE HOLD-DOWN ANCHOR DEVICE

3,091,897

Filed Aug. 19, 1959

3 Sheets-Sheet 2

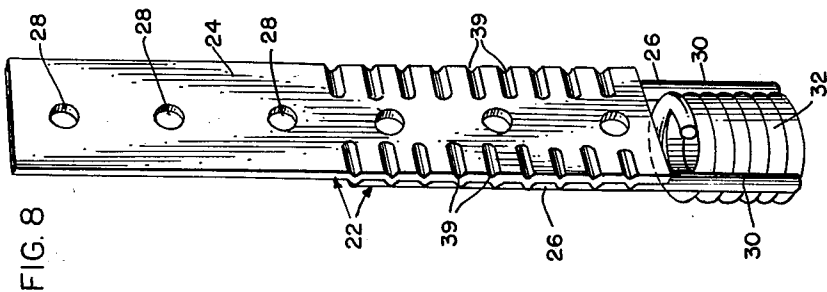


FIG. 8

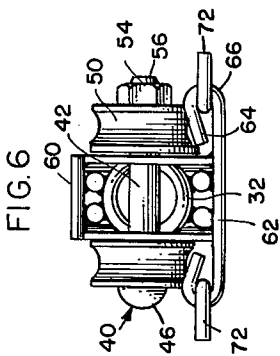


FIG. 6

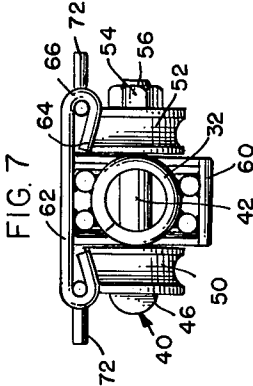


FIG. 7

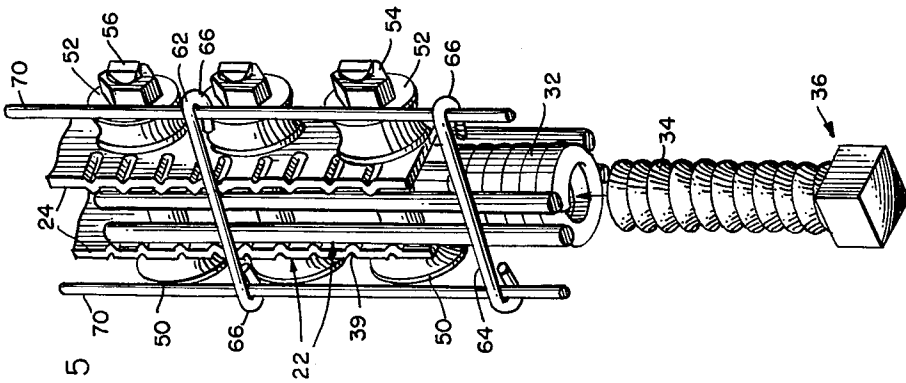


FIG. 5

INVENTOR.
BROR HILLBERG
BY *Ymman Helach*
ATT'Y

June 4, 1963

B. HILLBERG

3,091,897

CABLE HOLD-DOWN ANCHOR DEVICE

Filed Aug. 19, 1959

3 Sheets-Sheet 3

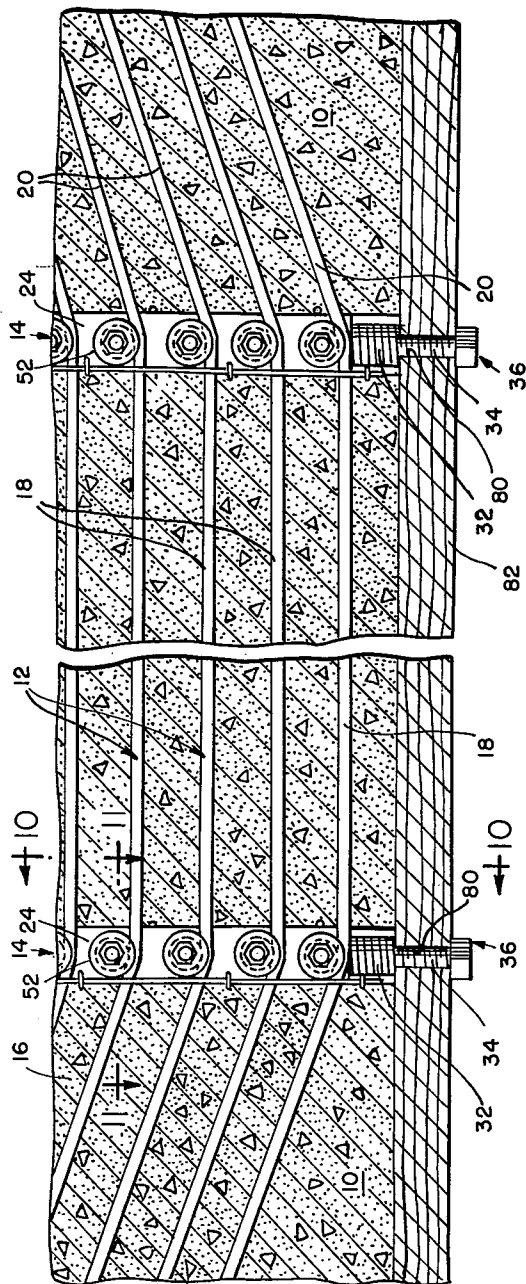


FIG. 9

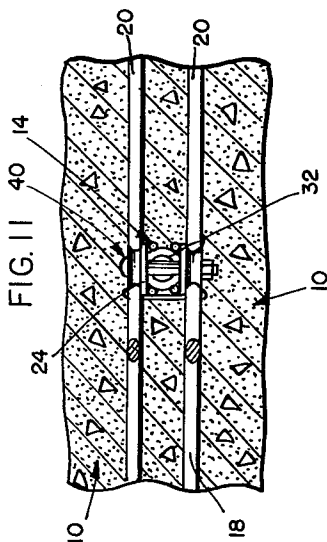


FIG. 11

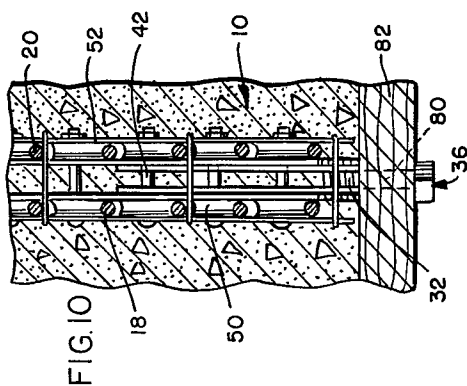


FIG. 10

INVENTOR:
BROR HILLBERG
BY *Wm. L. G. G. G.*
ATT'Y

1

3,091,897

CABLE HOLD-DOWN ANCHOR DEVICE

Bror Hillberg, Franklin Park, Ill., assignor, by mesne assignments, to Superior Concrete Accessories, Inc., a corporation of Delaware

Filed Aug. 19, 1959, Ser. No. 834,827

2 Claims. (Cl. 50-130)

The present invention relates to concrete hardware and has particular reference to a hold-down anchor device by means of which the tensioning cables which are embedded in a prestressed concrete girder or the like may be held taut under tension and in their proper relative positions within the girder form during initial pouring and subsequent hardening or setting of the concrete so that when the tension in the cables is relieved after the concrete has become set and the projecting ends of the cable severed from the ends of the girder, the material of the girder will remain prestressed, thus providing a structure which possesses greater strength than conventional girders which are not prestressed in this manner.

Girders of this type with which the present hold-down anchor device is associated are of the portable type, which is to say, they may be preformed as a composite unit and, thereafter, transported bodily to a scene of installation. Such girders may assume various cross sectional shapes and, for exemplary purposes herein, the hold-down anchor device has been illustrated in connection with the construction of a girder which is generally of I-shape in cross section and which will, for convenience of description, hereinafter be referred to as an I-beam. It will be understood, however, that the present hold-down anchor device may be found useful in the formation of concrete girders having a wide variety of other shapes, such as channels, rectangular beams, and the like. Irrespective, however, of the particular use to which the invention may be put, the essential features thereof are at all times preserved.

The present invention is designed as an improvement over the hold-down anchor device shown and described in my co-pending application Serial No. 832,862, filed on August 10, 1959, now U.S. Patent No. 3,006,114 dated Oct. 31, 1961, and entitled "Hold Down Anchor Device for the Embedded Cables of Prestressed Concrete Girders." In such application, there has been shown a hold-down anchor device which has been illustrated as being applied to a typical girder installation with a full description of the girder being made to facilitate a more complete understanding of the invention. In the present instance, no such detailed illustration or description of the girder assembly is made and reference may be had to the above co-pending application for a full understanding of the specific nature of the girder, it being deemed sufficient herein merely to illustrate the novel hold-down anchor device in its immediate embedded environment within the concrete of the girder.

In the construction of prestressed concrete girders of the type briefly outlined above, the tensioning cables, of which there may be a relatively large number, are ordinarily "strung" longitudinally through the hollow girder form in different but generally longitudinally extending directions. Certain of the cables may be strung linearly and axially through the girder form in straight-line fashion while others may deviate from such axial alignment at various angles. For example, where prestressed concrete I-beams having an upper head portion, a lower base portion, and a narrow interconnecting web portion, are concerned, certain of the cables are strung through the concrete girder form so that they extend inwardly from the ends of the girder in the head portion thereof and are inclined downwardly so that

2

they pass through the narrow web portion of the girder and enter the base portion thereof, after which they extend longitudinally in straight-line fashion through the base portion of the girder in the medial regions of the latter. The cables are thus caused to make a dip, so to speak, as they pass through the girder from one end to the other so that the end regions of the cables are embedded in the head portion of the girder while the medial regions thereof are embedded in the base portion of the girder. Certain other cables are caused to pass through the base portion of the girder outside the transverse confines of the web portion in straight-line axial fashion. These latter cables require no hold-down anchoring devices since, when they are placed under tension by the hydraulic tensioning mechanism, they assume their straight-line positions. However, those cables which are strung through the form at varying angles require hold-down devices so that when the hydraulic tensioning means is set into operation, the cables will be drawn taut in their predetermined directions of extent through the girder form. Hold-down anchor devices of the type shown in my co-pending application, above referred to, and in the present application are designed to facilitate proper threading of the various cable strands through the girder form with a minimum effort on the part of the operator so that after the threading operation has been completed, it is merely necessary to apply tension to the cables so that they will be drawn taut and assume their respective desired directional extent through the girder form preparatory to concrete pouring operations.

It is among the principal objects of the present invention to provide a hold-down anchor device of the general character set forth above and which is maintained in position within the concrete by means of a conventional coil bolt socket and a cooperating lag screw, the socket being secured in the anchor device assembly in a more expeditious manner than has heretofore been possible, the method of assembly involving projection welding of the various parts with the attainment of closer weld points.

A further object of the invention is to provide a hold-down anchor device of the type shown and described in the above-mentioned co-pending application and which may be constructed in a wide variety of sizes without appreciably increasing the size and weight of the individual components of the assembly.

Yet another object of the invention, in a hold-down anchor device of this sort, is to provide a structure which utilizes lighter gauge materials than has heretofore been employed, yet which affords the same strength and rigidity as devices of corresponding size which are designed for the same purpose.

A still further object of the invention is to provide a hold-down anchor device having associated therewith, novel retaining means for maintaining the various cables to which the device is applied in their proper spaced positions against dislodgment during cable-tightening operations. A similar related object of the invention is to provide such a device wherein the cable-retaining means are in the form of removable keeper devices, which, by their use, eliminate the necessity of threading the cables endwise through the device. By such an arrangement, it is possible to string the cables across the terminal supports therefor and, thereafter, apply the cables to the hold-down anchor device at the medial regions of the cables.

An additional object of the invention is to provide a hold-down anchor device of the type employing spaced side supports, across which there extend a series of traction assemblies for direct assimilation of the cable thrust, together with a series of spacer elements or struts by means of which the side supports are maintained in their

3

proper spaced relationship, certain of the spacer struts also serving the function of affording guideways for the removable keeper devices.

Finally, it is an object of the invention to provide a hold-down anchor assembly wherein a major portion of the components thereof are formed of sheet and rod stock thereby contributing to economy of manufacture.

Other objects and advantages of the invention will become more readily apparent as the following description ensues.

In the accompanying three sheets of drawings forming a part of this specification, a preferred embodiment of the invention has been shown.

In these drawings:

FIG. 1 is a front elevational view of a hold-down anchor device constructed in accordance with the principles of the present invention;

FIG. 2 is a side elevational view of the structure shown in FIG. 1;

FIG. 3 is a rear elevational view of the hold-down anchor device;

FIG. 4 is a side elevational view of the structure shown in FIG. 3;

FIG. 5 is an enlarged fragmentary perspective view of the lower portion of the hold-down anchor device;

FIG. 6 is a top plan view of the hold-down anchor device;

FIG. 7 is a bottom plan view of the hold-down anchor device;

FIG. 8 is a detail perspective view on an enlarged scale of a coil socket and side plate assembly forming a part of the present hold-down anchor device;

FIG. 9 is a fragmentary sectional view taken substantially centrally and longitudinally through a concrete girder form assembly showing the hold-down anchor device operatively installed therein;

FIG. 10 is a sectional view taken substantially along the line 10—10 of FIG. 9; and

FIG. 11 is a sectional view taken substantially along the line 11—11 of FIG. 9.

Referring now to the drawings in detail, and in particular to FIGS. 9 to 11, inclusive, a fragmentary portion of a prestressed concrete girder utilizing a hold-down anchor device constructed in accordance with the principles of the present invention has been designated in its entirety at 10. Although the outline of the girder 10 has not been illustrated herein, it may be assumed for purposes of description of the function of the hold-down anchor of the invention that the girder is in the form of an I-beam through which a plurality of tensioning strands or cables 12 extend longitudinally as shown in FIG. 9, the strands, insofar as each hold-down anchor device is concerned, being arranged in pairs transversely of the girder as shown in FIG. 10, and the various pairs being arranged in superimposed relationship as shown in FIG. 9. For illustrative purposes herein, only one set of superimposed pairs of cables appear in the various views of the drawings, but it will be understood that, utilizing transversely displaced hold-down anchor devices, plural sets of cables may extend through the girder 10.

The complete concrete girder 10 may have embedded therein various accessory inserts such as lifting hooks, stirrups, and the like, as well as linearly straight tensioning cables, as is well known in the art and none of which have been illustrated herein. The invention is primarily concerned with the proper tensioning of the illustrated cables 12, and the cross sectional illustrations of FIGS. 9, 10 and 11 have been taken in the vicinity of such cables to illustrate the application thereto of the hold-down anchor devices of the present invention.

The tensioning strands or cables 12 extend generally in a longitudinal direction completely through the girder 10 from end to end and assume various directional positions within the girder, as will be described presently, these

4

strands being firmly embedded in the surrounding mass of concrete and being initially positioned in the concrete girder or I-beam form by means of a series of hold-down anchor devices, each of which has been designated in its entirety at 14. The anchor devices 14 are in the form of composite anchor assemblies, each assembly being designed to accommodate a plurality of the cables 12.

As shown in FIG. 9, the cables 12 extend from the upper regions of the girder 10 at one end of the latter, inwardly and downwardly on an incline as at 16 through the web portion of the girder and into the base portion thereof where they are engaged by one of the hold-down anchor devices 14, after which these strands extend horizontally as at 18 along the base portion and into engagement with a second hold-down anchor device 14. From the second device 14, the strand extend upwardly on an incline as at 20 toward the other end of the girder and pass through the web portion and into the head portion from whence they emerge from the girder. As best seen in FIG. 10, the cable strands 12 are arranged in two vertical tiers. Additional groups of strands, also held in position by anchor devices, such as those shown at 14, may be provided on either side of the illustrated group of strands, if desired, although only one such group of strands has been disclosed herein.

The specific nature of the previously described prestressed concrete girder assembly forms no part of the present invention and no claim is made herein to any novelty in connection with the girder, the novelty of the present application residing rather in the construction of the various hold-down devices 14 by means of which the cables are initially held in their proper directional orientation within the concrete girder form preparatory to pouring of the concrete.

Referring now to FIGS. 1 to 8, inclusive, wherein one of the hold-down anchor assemblies 14 has been illustrated in detail, each assembly involves in its general organization a pair of composite three-piece side members 22, these side members being of identical construction and each consisting of a generally flat, rectangular plate 24, and two attachment rods 26. The plates 24 are formed of relatively light gauge sheet metal stock and each plate is formed with a plurality of holes 28 there-through, the holes being arranged in a vertical row and serving a purpose which will be made clear presently.

The two rods 26 are in the form of short lengths of rod stock and they are welded along portions of their extent to one face of the plate 24 in the vicinity of the opposite longitudinal edges of the plate in such a manner as to overlap the plate and extend an appreciable distance below the lower edge of the plate. The portions of the rods 26 which overhang the plates 24 are designated at 30 and such portions constitute anchoring fingers by means of which the entire plate assembly 22 as a whole may be welded to a short length 32 of closely wound helical coil stock, the various convolutions of which provide a series of internal coil threads adapted to receive therein the threaded end 34 of a lag screw 36 by means of which the anchor device as a whole may be affixed in position on the base member of the concrete girder form, as will be described subsequently. The helical coil thus serves to maintain the lower adjacent ends of the two side plate assemblies 22 in their proper spaced relationship.

In order to enhance the welded bond between the various rods 26 and the faces of the plates 24 to which they are attached, the two plates are ribbed or corrugated as at 39 along their marginal edges, as best seen in FIG. 8. Such corrugations in the plates 24 enable the various parts to be secured together by projection welding as distinguished from arc welding since the various ribs make for closer weld areas than could otherwise be obtained.

The hold-down anchor device illustrated herein has, purely for illustrative purposes, been designed to accommodate the anchoring of six tiers of paired, vertically

5

disposed cable strands 12 and, accordingly, the side plates proper 24 are each formed with six of the vertically aligned holes 28, the various holes in the two plates being transversely aligned in pairs across the anchor assembly, as best seen in FIG. 3. Each pair of transversely aligned holes 28 receives therethrough a traction pin 40. The pins 40 may be in the form of conventional rivets, the shank portions 42 of which have been threaded as at 44 adjacent their distal ends. The pins 40 project loosely through the holes 28 and are freely rotatable therein. Interposed between the enlarged head portion 46 of each pin 40 and the adjacent side plate 24 and freely rotatable on each pin is a roller 50. On the other side of the assembly exteriorly of the plate 24, the shank portion 42 of each pin carries a second roller 52. A nut 54 is threadedly received on the threaded end 44 of the pin and serves to prevent removal of the roller 52 from the pin. The extreme end of the threaded portion 44 is peened or otherwise deformed as at 56 to prevent removal of the nut 54. The nut 54 is not tightened on the threaded portion of the pin, but is left free to rotate or float, so to speak, on this portion. Thus, at no time will either of the two rollers 50 or 52 bind against the side plates 24 and the two rollers will always be free to rotate during cable tensioning operations.

In order to maintain the medial and distal or upper end regions of the side plates 24 properly spaced from each other and in parallelism, a series of vertically spaced short struts 60 (FIGS. 2, 3 and 4) are welded at their ends to the adjacent edges of the plates 24 on one side of the device. On the other side of the device, a similar series of struts 62 having looped ends 66 (see also FIGS. 6 and 7) are welded to the adjacent edges of the plates 24.

As best seen in FIGS. 9, 10 and 11, the various rollers 50 and 52 are adapted to receive therebeneath the cable strands 12 in any given concrete form installation and, accordingly, in order to bias the cable strands within the confines of the various rollers, the rollers are of the grooved type as shown in FIGS. 1 and 3. In order to retain the cable strands in position beneath the rollers and prevent slipping of the cable strands sideways from the rollers during cable tensioning operations, a pair of keeper rods 70, one for each side of the structure, are provided. These keeper rods are in the form of elongated lengths of rod stock having short laterally turned end portions 72. The keeper rods are threaded through the looped ends 66 of the struts 62 on opposite sides of the assembly, these looped ends being in vertical alignment for reception of the rods. The keeper rods 70 are loosely disposed within the loops 66 and the upper laterally turned ends 72 of the rods are adapted to be loosely supported on the uppermost loops 66 in the series. Each keeper rod 70, in combination with the adjacent side plate 24, serves to confine the cable strand within narrow transverse limits and to retain the cable strand in vertical register with the roller which is immediately thereabove.

In the installation and use of the herein described hold-down anchor device or assembly 14, holes such as have been shown at 80 in FIG. 9 are formed in the bottom or base member 82 of the concrete girder form in the regions where it is desired to install the various devices 14. The lag screws 36 are passed upwardly through the holes 80 and are threadedly received in the helical coil members or sockets 32. When the lag screws 36 are tightened, the four lower ends of the rods 26 rest squarely on the base or bottom member 82 so that the anchor device 14 as a whole extends vertically and is rigidly secured within the empty concrete form between the form side walls.

Immediately prior to application of the various cable strands 12 to the hold-down anchor devices within the concrete form, the two keeper rods 70 are withdrawn from the various aligned looped ends 66 of the spacer struts 62 and the medial regions of the untensioned cable strands 12 are "hooked," so to speak, beneath the various

6

rollers as shown in FIG. 10, after which the keeper rods 70 may be replaced by threading them through the aligned looped ends 66 of the struts 62. Thereafter, the cables 16 may be drawn taut by the usual hydraulic tensioning mechanism so that the medial regions of the cables will underlie and bear upwardly tractionally against the respective rollers immediately thereabove. The cables will then assume the positions wherein they are shown in FIG. 9 preparatory to pouring of the concrete into the girder form.

After the concrete has been poured and allowed to become set, the lag screws 36 may be unthreaded from the various coil anchors or sockets 32 and withdrawn from the form assembly. Finally, the form assembly may be knocked down and the projecting or protruding ends of the various cable strands severed flush with the ends of the girder.

While one specific and preferred form of hold-down anchor device by means of which the principles of the invention may be carried out has been illustrated and described herein, it will be understood that this form of the device does not by any means indicate the only form contemplated. The form illustrated herein is only one which has been developed for commercial application of the invention and, therefore, the invention is not to be limited to the details described since these may be modified within the scope of the appended claims without departing from the spirit of the invention.

Having thus described the invention what I claim as new and desire to secure by Letters Patent is:

1. A hold-down anchor device for positioning the tensioning cables of a prestressed concrete girder within a girder form preparatory to concrete pouring operations, said hold-down anchor device comprising, in combination, a pair of spaced, generally parallel, side members, each side member including a vertically elongated flat plate of sheet metal stock and a pair of transversely spaced parallel vertical supporting rods extending along the marginal edge regions of the plate and overhanging the lower edge of the plate so as to present portions which depend below the plate, said rods being secured to the same side of the plate by welding a closely-wound helical coil of rod stock interposed between the depending portions of the rods of each plate and secured by welding thereto along axial lines of tangency, said coil being formed with an internally threaded bore adapted to receive therein the threaded end of a lag bolt whereby the side members may be secured to the base support of the girder form within the confines of the form, said side plates being formed with a series of opposed pairs of holes therein with the various pairs being spaced progressively along the side plates upwardly from said coil, a traction pin received through each pair of opposed holes and having its opposite ends projecting outwardly beyond the remote sides of said side plates, cable-engaging rollers in substantial vertical alignment mounted on the projecting portions of each end of the traction pins and adapted to overlie and tractionally engage a plurality of the tensioning cables so as to receive the upward thrust thereof and space the same from said base support at the points of contact therewith when the cables are drawn taut, a plurality of vertically spaced elongated struts, each disposed transversely of the adjacent vertical side edges of said plates and terminating at each of its ends in looped portions in substantial vertical alignment, said portions lying substantially in a plane common with the outer vertical faces of the cable-engaging rollers, said struts being secured to said plates and, in combination with said coil, serving to maintain the side members in their spaced parallel relationship, and a keeper rod extending through the aligned looped portions on each end of the struts and removably seated therein, said keeper rods, in combination with the adjacent side plates being adapted to confine therebetween the various cables so as to maintain the same in vertical register with said rollers.

2. A hold-down device as set forth in claim 1 and wherein each cable-engaging roller is rotatably mounted on its respective traction pin and wherein each traction pin is rotatable in the respective opposed holes within which it is mounted.

References Cited in the file of this patent

UNITED STATES PATENTS

871,017	Witte	Nov. 12, 1907	10
875,396	White	Dec. 31, 1907	
1,520,840	Murray	Dec. 30, 1924	
2,100,614	Schenk	Nov. 30, 1937	
2,504,313	Fearon et al.	Apr. 18, 1950	

FOREIGN PATENTS

485,552	Italy	Oct. 14, 1953
561,555	Italy	Apr. 23, 1957

OTHER REFERENCES

Richmond Catalogue, published 1943 by Richmond Screw Anchor Co. Inc., Brooklyn, N.Y., page 15, item: F. M-Flange Hanger.

"Concrete," page 60, September 1957.

"Construction Methods and Equipment," pp. 102; 103 and 104; May 1958.

Publication: Holddown Anchors for Pretensioned-Pre-stressed Concrete by Superior Concrete Accessories, Inc., Franklin Park, Ill., dated Dec. 2, 1957.