March 25, 1958 A. E. A. BLATON 2,827,679

WIRE ANCHORING DEVICE

Original Filed Jan. 23, 1947 2 Sheets-Sheet 1

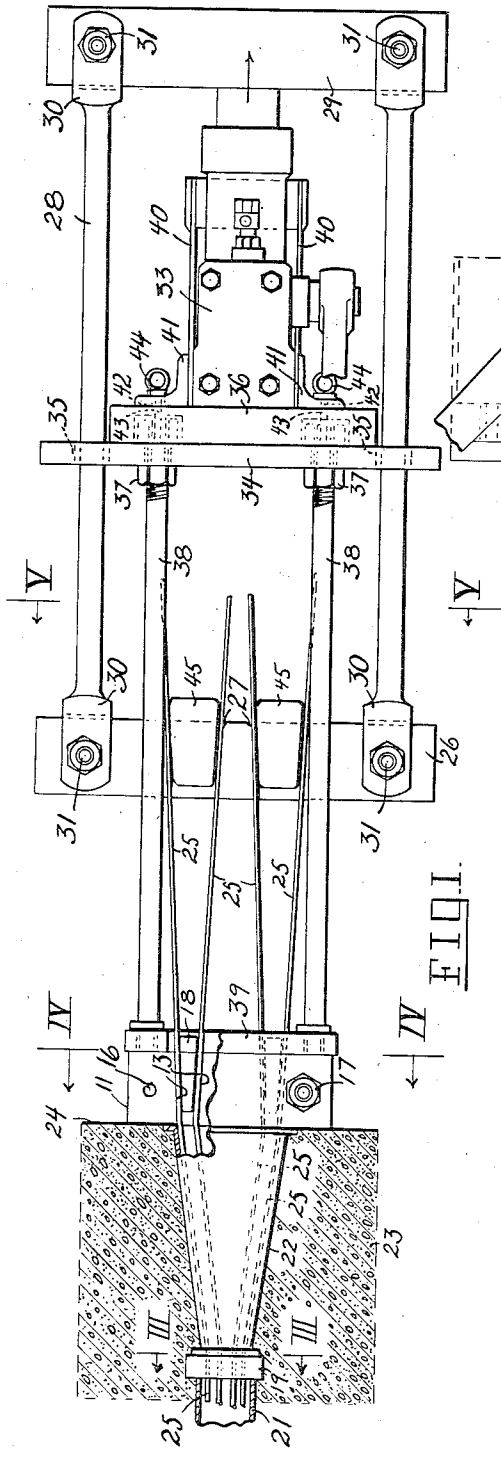


FIG. 1.

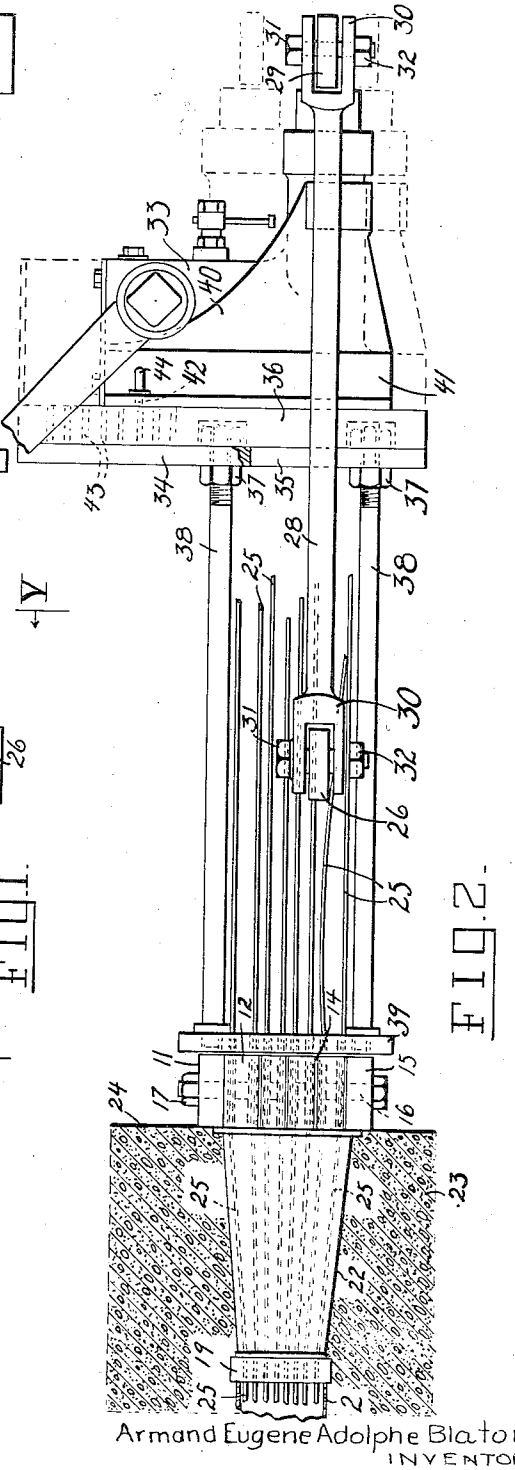


FIG. 2.

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WIRE ANCHORING DEVICE

Original Filed Jan. 23, 1947 2 Sheets-Sheet 2

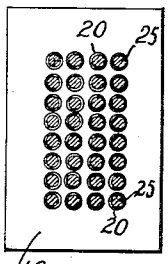


FIG. 3.

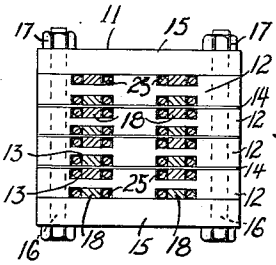


FIG. 4.

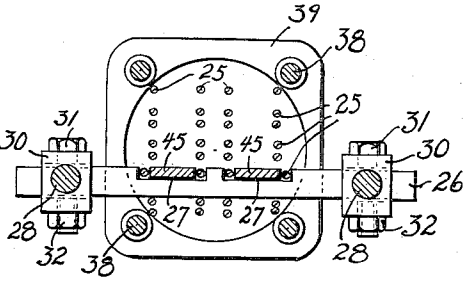


FIG. 5.

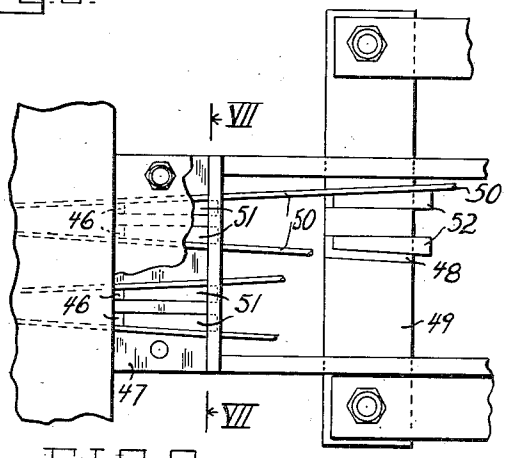


FIG. 6.

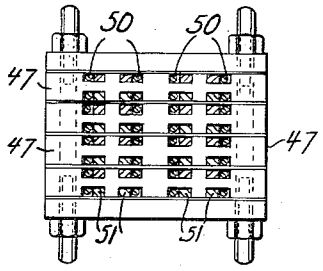


FIG. 7.

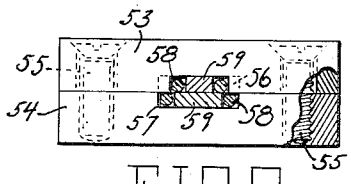


FIG. 9.

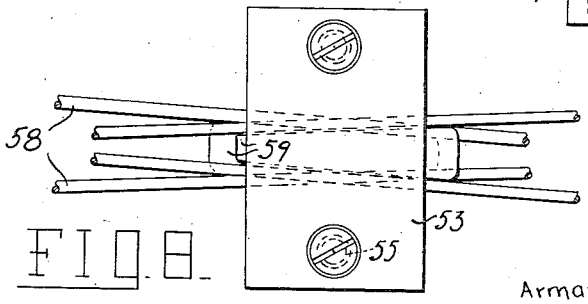


FIG. 8.

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WIRE ANCHORING DEVICE

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Original application January 23, 1947, Serial No. 723,718, now Patent No. 2,637,895, dated May 12, 1953. Divided and this application March 24, 1953, Serial No. 344,293. In Belgium March 21, 1942

Section 1, Public Law 690, August 8, 1946
Patent expires March 21, 1962

1 Claim. (Cl. 24—126)

The present invention relates to a wire anchoring device, and more particularly to a device for anchoring a plurality of high tensile strength metal wires cooperating to form a single-unit wire bundle to which a high tension is imparted, for instance, for the purpose of pre-stressing a structural concrete element to this high tension.

My copending United States patent application, Serial No. 723,718, filed January 23, 1947, now Patent No. 2,637,895, of which the present application is a division, describes and claims a preferred method of forming such wire bundles and imparting thereto the desired high tension. This method comprises the steps of arranging a plurality of untensioned high tensile strength wires, which, in combination, form a wire bundle, to extend, throughout the main longitudinal portion of the wire bundle, between two transverse planes located near the respective ends of the bundle, in several closely spaced substantially parallel layers each including a plurality of closely spaced substantially parallel wires in such a manner that, at any cross-section of said main portion of the wire bundle, the wires are substanially uniformly distributed over the entire area of such cross-section, anchoring the wires at one end of the bundle against longitudinal movement in the direction toward the other end of the bundle in relative positions of the several wires with respect to one another the same as in said main portion of the bundle, exerting at the other end of the bundle a predetermined, uniform, longitudinal tensioning stress on a fraction of the total number of wires in the bundle so as to tension a small number of wires of the order from 1 to 4 at a time while maintaining all the wires throughout said main portion of the bundle in their mutually spaced, parallel positions, anchoring each tensioned wire at said opposite end of the bundle against longitudinal movement in the direction toward said first end of the bundle in a relative position of said wire with respect to the other wires the same as in said main portion of the bundle, and repeating the tensioning and anchoring steps with respect to a small number of the order of 1 to 4 at a time of the remaining wires of the bundle until all the wires of the bundle have been uniformly tensioned and anchored.

One object of the present invention is to provide a wire anchoring device which makes it possible to perform this wire tensioning method in a simple and efficient manner.

Another object of the invention is to provide a wire anchoring device which is particularly suitable for use in the wire tensioning method according to my copending application No. 723,718 but which can also be used with favorable results in other wire tensioning methods.

A specific object of the invention is a wire anchoring element in which the wires of a wire bundle can be anchored individually or in pairs as they are stressed to the desired high tension singly or in small groups.

Another specific object of the invention is a wire anchoring device for the wires of a wire bundle, which wires extend throughout the main portion of the bundle in a

plurality of parallel layers, each including a plurality of parallel wires, said wire anchoring device being so designed that it permits of anchoring the individual wires in relative positions with respect to each other the same as in the main portion of the wire bundle.

A further object of the invention is to provide a wire anchoring device which can be manufactured easily and cheaply and in which each individual wire can be accurately positioned in the anchoring plane with respect to, and spaced from each adjacent wire and each wire can be securely anchored in its predetermined position.

A still further object of the invention is to build up a wire anchoring device of the type set forth from a smaller or greater number of standard elements to provide anchorage for a smaller or greater number of wires as may be desired.

Still another object of the invention is to provide a wire anchoring device which is sturdy and efficient to prevent slippage of the highly tensioned wires anchored therein and which is also simple in construction and in operation.

These and other objects which will appear more clearly as the specification proceeds are accomplished according to the present invention by the arrangement and combination of parts set forth in the following detailed description, defined in the appended claims and illustratively exemplified in the accompanying drawings, in which:

Fig. 1 is a top plan view; and

Fig. 2 is a side elevation of one embodiment of a wire anchoring device in accordance with the invention as it is used for anchoring the metal wires of a wire bundle tensioned by the method according to my copending application Serial No. 723,718 referred to above;

Fig. 3 is a section taken on line III—III of Fig. 1;

Fig. 4 is a section on line IV—IV of Fig. 1 showing the anchoring device according to the present invention in front elevation;

Fig. 5 is a section on line V—V of Fig. 1;

Fig. 6 is a top plan view of a second embodiment of an anchoring device according to the present invention in combination with a partially illustrated apparatus for tensioning the wires individually;

Fig. 7 is a section taken on line VII—VII of Fig. 6 and showing the anchoring device according to Fig. 6 in front elevation;

Fig. 8 is a top plan view of still another embodiment of the anchoring device according to the present invention; and

Fig. 9 is an end elevation of the device illustrated in Fig. 8.

Referring now to the drawings, and first to Figs. 1 to 5, the reference numeral 11 denotes generally a wire anchoring device according to the present invention. As shown in Figs. 1, 2 and particularly in Fig. 4, the anchoring device 11 comprises a plurality of rigid anchor bars 12 of generally rectangular cross-section (see Fig. 2). Each anchor bar 12 has two opposite flat faces thereof recessed to form a plurality of relatively flat grooves or slots 13. Each slot 13 extends entirely across the face in which it is provided and tapers in width, i. e., as shown specifically in Fig. 1, the side walls of each slot 13 diverge uniformly from each other and from the center line of the slot which extends across the anchor bar 12 at right angles to the longitudinal axis thereof.

The anchor bars 12 are superposed upon one another in such a manner that the recessed faces constitute the top and bottom surfaces of each bar, and recessed faces of adjacent anchor bars 12 are contiguous to and facing each other.

Thin sheet metal plates 14 are interposed between adjacent anchor bars 12 to separate the slots 13 in contiguous faces of adjacent bars 12.

The assembly is completed, at the top and at the bottom, by means of locking bars **15** which are similar to the anchor bars **12** but not provided with any slots in their faces.

The superposed anchor bars **12**, intermediate sheet metal plate **14** and locking bars **15** are removably secured together by bolts **16** and nuts **17** threaded on the ends of the bolts.

Wedge shaped keys **18** are provided, one for each slot **13**, having side surfaces inclined at approximately the same angle as the side walls of the slots **13**. These keys **18** can be inserted into the slots **13** to produce the desired wire locking effect between adjacent inclined side walls of the slots **13** and side edges of the associated keys **18**, respectively.

As shown in Figs. 1 to 5, the anchoring device **11** can be used for anchoring the wires of a wire bundle extending longitudinally in a conduit formed in a structural concrete element and tensioned, for instance, by the method described in my above mentioned copending application Serial No. 723,718.

In Figs. 1 to 5, **19** is a substantially rectangular metal guide plate provided with rows of holes **20** (see Fig. 3). At its left hand side, as shown in Figs. 1 and 2, the guide plate **19** is connected with a metal tube **21**, of more or less rectangular cross-section, and, on its right hand side, it is joined to the smaller base of a sheet metal envelope **22** having the form of a truncated pyramid and terminating at its larger base in an annular flange located in a plane at right angles to the common longitudinal axis of the tube **21** and truncated pyramid **22**. The whole assembly **19**, **21** and **22** is arranged in a concrete beam **23** which is cast around it so that its end face **24** is disposed in the same plane as the front face of the annular flange at the end of the envelope **22**. A plurality of round wires, for example thirty-two steel wires **25** of high elasticity, are anchored at one end (not shown) and form a wire bundle extending axially through the conduit formed in the beam **23** by the metal tube **21**. The individual wires **25** are threaded through the holes **20** in the guide plate **19** and extend through the envelope **22** beyond the end **24** of the beam **23**. In the main portion of the wire bundle, which extends to the left from the guide plate **19**, as shown in Figs. 1 and 2, through the tube **21**, for instance to a similar guide plate (not shown) near the other end of the beam **23**, the wires **25** are disposed in closely adjacent, horizontal, parallel layers, each containing a plurality of closely spaced substantially parallel wires **25** (see particularly Fig. 3). As the wires **25** are arranged and maintained throughout the length of the main portion of the wire bundle in the relative positions indicated in Fig. 3, it follows that at any cross-section of said main portion of the wire bundle the wires **25** are substantially uniformly distributed over the entire area of the cross-section.

In its practical application, as shown in Figs. 1 and 2, the anchoring device **11** is first placed in front of the beam **23** in a position in which the narrow ends of the tapering slots **13** face towards the end **24** of the beam **23**. With all the keys **18** removed from the slots **13**, the wires **25** extending beyond the flanged end of the envelope **22** are then threaded through the anchoring device **11** by passing through each slot **13** a pair of adjacent wires **25** in such a manner that each individual wire is in the same relative position with respect to each other wire as in the main portion of the bundle. Thereafter, the anchoring device **11** is placed firmly against the end face **24** of the beam **23** and the annular flange of envelope **22**, as shown in Figs. 1 and 2, and the wires **25** are pulled straight.

As can be seen from Fig. 4, owing to the design of the anchoring device **11** and the provision of the guide plate **19**, the wires **25** in the envelope **22** are guided toward the anchoring device **11** along diverging lines and, on leaving the anchoring device **11**, they extend in parallel horizontal layers, each of which, in the embodiment of the invention illustrated in Figs. 1 and 2, comprises four wires positioned in pairs in the slots **13** of an anchor bar **12**. Each layer of wires may comprise a greater number of pairs of wires or only two wires. The number of layers depends upon the tensile force to be exerted.

The wires **25** may now be tensioned as described in my copending application Serial No. 723,718, for instance by means of the tensioning device shown in Figs. 1 and 2. This tensioning device comprises a metal cross-piece **26** having in its upper face two recesses **27** of trapezoidal configuration and forming with two rods **28** and a second cross-piece **29** a coupling system through which a desired high tension can be applied to the wires **25**. The rods **28** form at their ends forks **30** which straddle the cross-pieces **26** and **29** and which are connected to these cross-pieces by means of bolts **31** and nuts **32**.

The second cross-piece **29** bears against a hydraulic jack **33** which serves to move the cross-piece **29** in the direction of the arrow.

A metal plate **34** having vertically elongated slots **35** for the passage of the rods **28** serves as seat for a base **36** supporting the jack **33**. The plate **34** in turn is provided with securing members **37** for stays **38** supported on an annular plate **39** which bears against the exposed face of the anchoring member **11**.

The jack **33** is carried by side plates **40** reinforced with angle irons **41**. The angle irons **41** are provided with apertures **42** which may be brought into register with apertures **43** provided in the base **36**. Pins **44** may be introduced into registering apertures **42**, **43** to secure the jack **33** at different heights. The vertically elongated slots **35** permit the rods **28** to follow the up and down adjustments of the jack **33**.

In order to apply tension, for instance to four wires **25** at a time and to maintain this tension for as long as desired, the following procedure may be followed in accordance with the method described in my copending application Serial No. 723,718.

The jack **33** and coupling system **26**, **28**, **29** are adjusted to their lowermost positions in which the apertures **42** in the angle irons **41** register with the bottom row of apertures **43** in the base **36**, and the pins **44** are inserted in the registering apertures **42**, **43** to secure the tensioning device in position. Then the four wires **25** which pass through the two lowermost slots **13** in the anchoring device **11** are positioned in pairs in the two recesses **27** in the cross-piece **26** and are secured in these recesses by means of wedge-shaped keys **45** (see Figs. 1 and 5). The jack **33** is then operated and, by exerting a thrust in the direction of the arrow on the cross-piece **29**, moves the entire coupling system **29**, **28**, **26** to the right, as shown in Figs. 1 and 2, and thus applies to the four wires **25** secured in the cross-piece **26** the desired tension.

When the four wires **25** of the lowermost layer have been tensioned in this manner, they are locked in the slots **13** of the anchoring device **11** by means of the associated tapered keys **18** being driven into the slots **13** from the wider ends thereof between the wires **25**. The jack **33** is then released and the keys **45** are withdrawn so that the anchored wires **25** are freed from the coupling system **26**, **28**, **29**.

Next, the pins **44** are withdrawn and the jack **33** and the coupling system **26**, **28**, **29** are raised until the holes **42** in the angle irons **41** register with the holes **43** in the bar **36** in the row next above the bottom row. The tensioning device **33**, **26**, **28** and **29** is secured in this position by means of the pins **44**, and the four wires **25** of the second layer from the bottom are secured in the slots **27** of the cross-piece **26** by means of the keys **45**. The jack **33** is operated again and the wires of the second layer are tensioned and finally anchored in the anchoring device **11**.

This operation is repeated for each layer of wires, Fig.

2 showing the device in a position in which the third layer of wires from the bottom is being tensioned.

It is thus possible to obtain with comparatively small operating devices and little risk of breakage of the individual wires a total tensile force of any desired magnitude.

When all the wires **25** of the bundle have been placed under tension, the jack **33** and the coupling system **26, 28, 29** are removed together with the support members **34, 36, 37, 38** and **39**, but the tensile force is maintained in the wires **25** as long as the tapered keys **18** are left in position in the slots **13** of the anchoring device **11**.

Should it be desired to release the tensile stress in the wires **25**, the coupling system **26, 28, 29** and the members **34, 36, 37, 38, 39** together with the jack **33** are again placed in position and a further pull is exerted on each group of four wires **25** until the keys **18** can be readily withdrawn. The jack **33** is then released, the keys **45** are removed and the wires **25** are then no longer under tension.

The embodiment of the invention shown in Figs. 1 to 5 may also be used, if desired, for anchoring wires **25** which are tensioned in pairs.

It may, however, be desired to tension and anchor wires of a wire bundle one at a time. This can be done by modifying the slots **13** in the anchoring bars **12** and the recesses **27** in the cross-piece **26**, and also the shape of the tapered keys **18** and **45**, as illustrated in Figs. 6 and 7.

In these figures, the tapering slots **46** in the anchoring bars **47** and the recesses **48** in the cross-piece **49** have each one surface extending parallel to the direction of movement of the jack, i. e., of the tension applied to the wires and thus normal to the edge of the bar **47**, while the other surface is obliquely inclined to the edge, and each wire **50** is locked against the inclined surface of the slot **47** or recess **48**, respectively, by a correspondingly shaped key **51** or **52**.

Figs. 8 and 9 illustrate an embodiment of the invention in which two anchoring bars **53** and **54** are removably secured together face to face by threaded bolts **55**. Each of the contiguous faces of the two bars **53** and **54** is provided with a tapering slot **56, 57** similar to slots **13** in the anchoring bars **12** of Figs. 1 to 5, but in the embodiment according to Figs. 8 and 9, the slotted surfaces of the adjacent anchoring bars **53, 54** are in direct contact with each other and the slots **56** and **57** overlap one another and taper in opposite directions so as to form wire-receiving slots diverging in opposite directions. The wires **58** are locked in the slots **56** and **57** by tapered keys **59** in a manner similar to that previously described with reference to slots **13** and keys **18**.

With the anchoring device according to Figs. 8 and 9, the slot **56** in one of the bars **53** may be used for the anchoring of two outgoing wires **58** while the other slot **57** and bar **54** receives two incoming wires **58**, and the wires are tensioned in pairs first at one end and then at the other end. This anchoring device is particularly suitable for the anchoring of wires which extend in a circular fashion, for instance around a cylindrical tank. Alternatively, it may be used for joining the ends of two cables, each composed of a pair of wires which extend rectilinearly from the opposite sides of the anchoring device.

What I claim is:

An anchoring device for maintaining tension in a group of wires, said wires, intermediate their ends, being arranged in a plurality of closely spaced substantially parallel rows and columns to form a bundle of wires wherein each wire is individually tensioned to impart a predetermined total tension to said bundle, said anchoring device comprising several pairs of parallel elongated substantially rectangular anchor bars disposed in stacked relationship with aligned edges and confronting faces, each of said bars having at least one open-ended transverse slot formed in at least one face thereof and extending between opposite ends of said stacked bars, each of said slots having an inclined face for engagement with one of said wires, at least one of said wires being received in and extending continuously beyond both ends of each of said slots, said slots being disposed to retain said wires positioned in the same mutual relationship as in said bundle, wedge means in each slot and accessible from one side of said stacked plates for holding at least one of said wires under tension by forcing the same against said inclined face, said forcing being augmented by said tension, and means securing said anchor members together to form a unitary rigid body for maintaining said bundle under tension.

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