Dec. 4, 1956 H. P. NEPTUNE 2,772,560

PICK-UP DEVICE FOR PRE-CAST CONCRETE SLABS

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Fig. 1

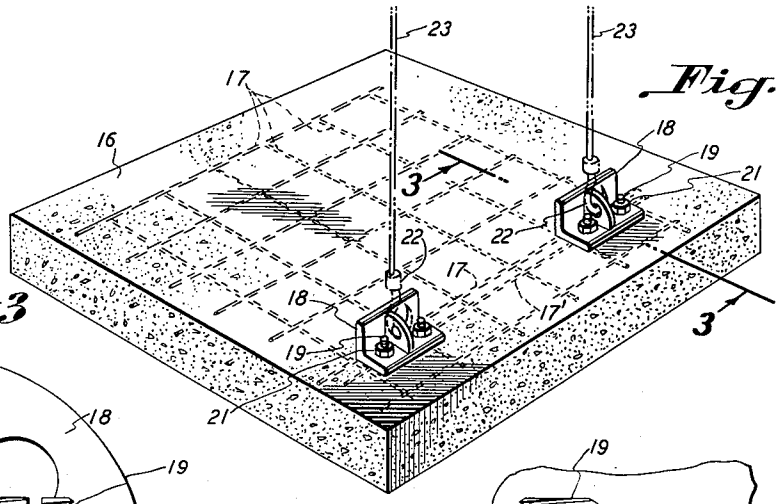


Fig. 3

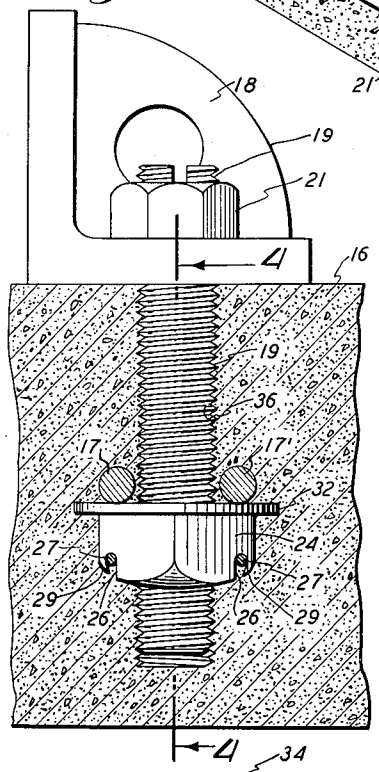


Fig. 4

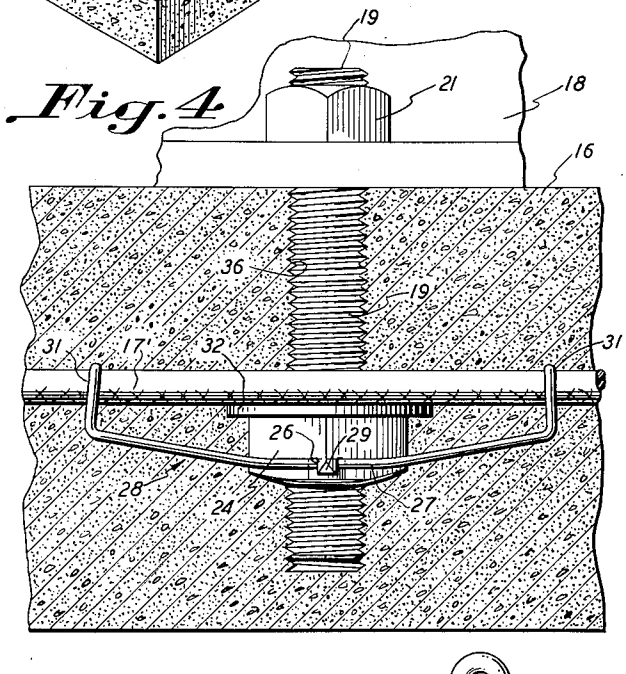


Fig. 2

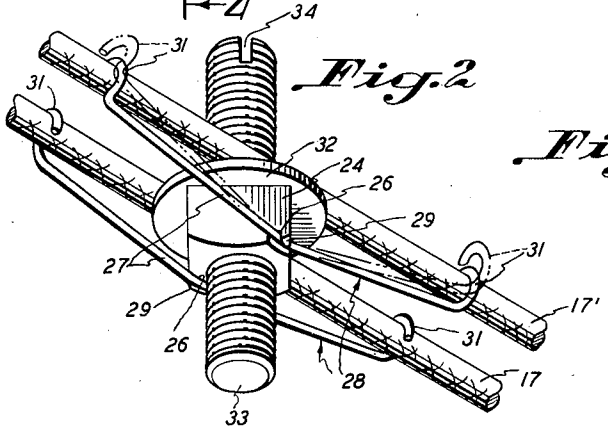
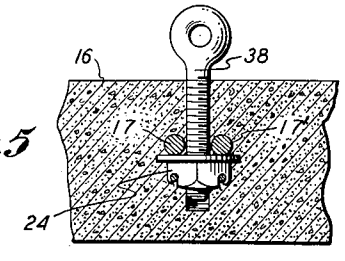


Fig. 5



INVENTOR.
HERMAN P. NEPTUNE.
BY
N. J. Stevenson
Agent.

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PICK-UP DEVICE FOR PRE-CAST CONCRETE SLABS

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Fig. 6

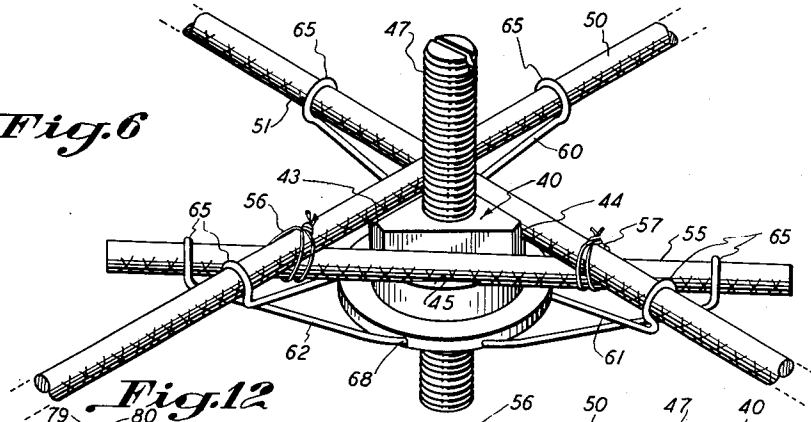


Fig. 12

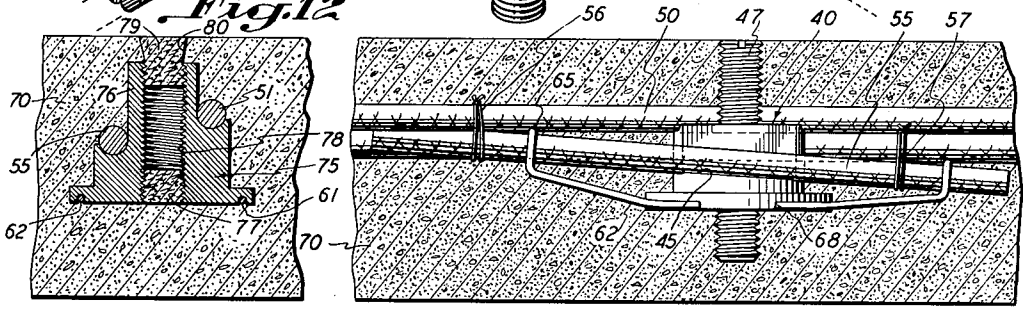


Fig. 9

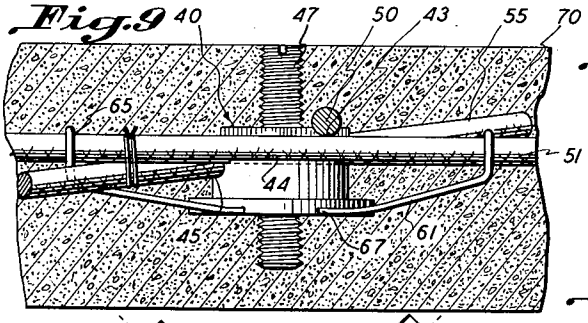


Fig. 8

Fig. 11

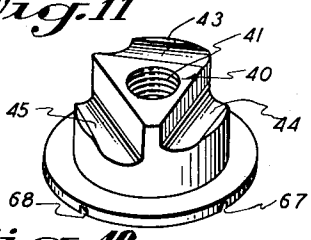
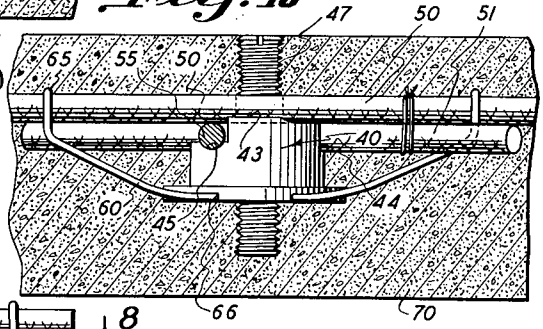


Fig. 10



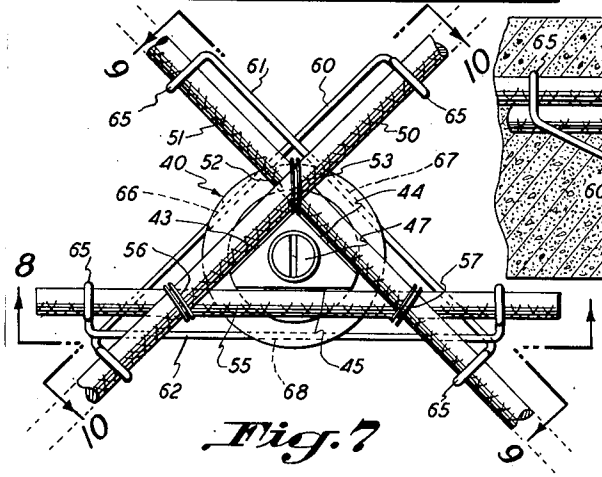


Fig. 7

INVENTOR.
HERMAN P. NEPTUNE.
BY
N. J. Stevenson
Agent.

United States Patent Office

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PICK-UP DEVICE FOR PRE-CAST CONCRETE SLABS

Herman P. Neptune, Los Angeles, Calif.

Application June 28, 1952, Serial No. 296,208

3 Claims. (Cl. 72—105)

This invention relates generally to concrete structures and more particularly to building structures of the so-called pre-cast, "tilt-up" concrete wall panel types. Specifically, the invention is concerned with embedment devices by which pick-up or lifting units can be secured to pre-cast concrete slabs or panels to facilitate tilting the latter from a horizontal position in which the panels are cast, to an erect position to form the walls or other parts of a building.

Concrete building structures are currently erected by what is termed the "tilt-up" panel method. Such a building method consists in pre-casting the structural components, such as large, rectangular wall panels, upon a smooth, coated, horizontal surface, for example a concrete floor, such wall panels being usually reinforced by a network of steel rods embedded in the concrete. After the pre-cast wall panels have cured for a predetermined period of time, they are lifted from the floor by a boom-type crane which sets them in erect position on footings to form the wall, various means being employed for joining the panels together or to columns of the building structure. Such pre-cast wall panels are frequently of large area and their weight may be of the order of approximately twenty tons. Since the panels are lifted by first tilting them upwardly on an edge, it follows that any pick-up unit secured to a panel and to which a crane lifting beam is connected must necessarily be of strong construction and securely fastened to the panel. A pick-up unit most commonly employed for this purpose consists of a lifting angle-plate which is bolted against the upper surface of the pre-cast panel by means of studs projecting from the slab, nuts being screwed onto the outer extremities of the studs and against the plate. The inner ends of the studs are usually screwed into nuts which are welded between the steel reinforcing rods or to separate rods to be embedded in the panel. While such pick-up units are used extensively in the construction field, they are subject to several disadvantages. For example, the welding of the anchoring nuts to the rods is time-consuming and special care must be exercized in spacing them properly in accordance with the spacing of the stud holes in the lifting plate. Another serious disadvantage resides in the fact that welded joints are not thoroughly reliable since they may rupture to release the anchoring nuts which then may pull out from the panel to allow the latter to drop onto the casting surface and crack or break. In an effort to avoid such a serious condition, various expedients have been proposed but in all such cases of which I am aware, the various insert or embedment elements, whether nuts, plates, sleeves or other forms, comprise either an assembly of welded elements or individual parts which are welded directly to the rods of the panel. Consequently, before the advent of my invention no fully satisfactory pick-up unit has been devised for the purpose and the conventional devices referred to above have been tolerated.

It is therefore an important object of this invention to provide an insert or embedment means for attaching lifting plates, angles, eyebolts or other lifting means to pre-cast concrete panels, such embedment being a unitary structure capable of being effectively joined to the reinforcing of a panel without welding.

Another object of the invention is to provide an anchoring means which comprises a threaded element, such as a nut, plate, sleeve, etc., and means for retaining the element against the under surfaces of a pair of the reinforcing or other rods of the concrete panel being pre-cast. In accordance with the invention, the element held in place against the parallel rods includes a nut, which is of sufficient width to extend transversely across said pair of rods, and clamping means engageable between the rods and nut to retain the latter firmly seated against the under surfaces of the rods.

Another object is to provide an embedment, of the character referred to, in which the clamping means comprises a pair of resilient clip elements each of which has a central portion engaging the nut and hook-like end portions adapted to engage around one of the rods. According to the invention, the clip elements are caused to flex or bow as their end portions are hooked around the rods, the tensioned elements then acting to seat the embedment nut firmly in place against the rods and thus retain the nut in position to be embedded in the concrete when the same is poured and tamped into the forms and around the rods. Thus, by this means the embedment nuts are effectively held in place and may be quickly and conveniently installed within the form without welding and without tools of any kind. Moreover, since each embedment nut is yieldingly held in place by the resilient clip elements before the concrete is poured, inadvertent striking of a nut by a workman will not dislodge the nut but rather will merely tilt it, the clip elements yielding to allow such action and then functioning to restore the nut to its original clamped position. In addition, by this mounting means the nuts may be readily shifted on the reinforcing rods to accurately space them in accordance with the spacing of the bolt holes of the angle plate which is to be applied against the upper surface of the cast concrete panel for lifting purposes.

Another object of the invention is to provide a device of the class specified in which the clip elements may be secured to the nuts prior to installation of the embedment nut within the form, each nut and its pair of clips thus providing a pre-assembled unitary structure to facilitate and expedite the placing of the nut in proper position on the rods. In accordance with the present concept, the central portions of the clip elements extend through saw slots at opposite sides of the nut, the metal disposed laterally outwardly of the slots being swayed or forced inwardly to overlie said central portions to retain the latter in the slots.

It is a further object of my invention to provide an embedment which has a relatively large surface for engagement with the reinforcing rods, this object being most practically attained through the use of a washer which may be interposed between the nut and the pair of reinforcing rods.

A further object is to provide means carried by the nut for coring a hole in the concrete slab by which a stud, bolt or like fastening element may be screwed downwardly into the nut. This objective is accomplished by means of a screw which is threaded downwardly through the nut to a point therebelow, the screw being greased or otherwise coated to prevent bonding of the concrete thereto during the casting of the panel and to allow withdrawal of the screw-type core from the panel after the concrete has set or cured. By this provision, a cored hole is provided through which a stud, bolt or the like may be inserted from above and screwed into the embedment nut for the purpose of securing a lifting member against the upper surface of the panel. In some instances, the lifting members may be simply eye-bolts screwed downwardly into the embedment nuts.

A still further object of the invention is to provide an embedment device which is of simple, yet very strong construction and capable of being manufactured at a relatively low cost, one which may be quickly installed to thus minimize the over-all cost of producing the pre-cast concrete panels, and one which does not rely upon weld connections and thus affords greater safety and insurance against dropping of the panel as the latter is tilted on and raised from the casting surface.

Another object is to provide an embedment means in which the nuts may be anchored beneath and extend between one of the reinforcing rods of the panel and a separate rod or rods placed in the form and extending parallel to said reinforcing rod. A related object is to provide such a device which may be employed in connection with precast, unreinforced concrete panels by simply pre-connecting the embedment nuts to steel rods and embedding the assemblies in the concrete.

Another object is to provide an anchoring device in which the anchoring nut may be joined to the reinforcing rods of a concrete panel at crossing points of the rods, in which case a relatively short rod is wired in place to extend diagonally of the crossing rods at a short distance from the intersection to provide a triangular base against which the nut is clamped by three resilient, wire clip elements each engaging a separate rod. In this embodiment of the invention, the anchoring nut is provided with three slots or grooves in its under surface, said grooves receiving the central portions of the clip elements and locating the latter directly beneath the respective rods to which their hooked ends are engaged. Since the rods are necessarily at different levels, the anchoring nuts have grooves of arcuate form and of varying depths in their upper surfaces for receiving the rods, the three clip elements having their hooked end portions or legs of appropriate lengths to extend around the respective rods.

Further objects will appear from the following description and from the drawings, which are intended for the purpose of illustration only, and in which:

Fig. 1 is a perspective view of a pre-cast concrete wall panel or slab to which are attached lifting plates or angles by which the panel may be tilted and raised by a crane;

Fig. 2 is a perspective view of one form of my anchoring or embedment device for use in securing a lifting means, such as the lifting angle of Fig. 1, in place against a panel;

Fig. 3 is a cross-sectional view, taken on line 3—3 of Fig. 1;

Fig. 4 is a cross-sectional view, taken on line 4—4 of Fig. 3;

Fig. 5 is a small scale cross-sectional view similar to Fig. 3, showing a lifting eye-bolt secured in place;

Fig. 6 is a perspective view of an alternative form of the anchoring device, showing it applied to use at the crossing point of two of the reinforcing rods of a concrete panel;

Fig. 7 is a plan view of the device illustrated in Fig. 6;

Figs. 8, 9 and 10 are cross-sectional views, taken respectively on lines 8—8, 9—9 and 10—10 of Fig. 7;

Fig. 11 is a perspective view of the modified form of anchoring nut employed in the device of Figs. 6 to 9; and

Fig. 12 is a vertical sectional view through an anchoring device of further modified form.

Referring first to Figs. 1 through 5 of the drawings, the present improved embedment or anchoring device is shown as applied to use, for example, in connection with a pre-cast concrete wall panel or slab 16. In accordance with the usual procedure, the panel 16 is cast in a suitable rectangular form (not shown) which is set up upon a smooth surface, such as a concrete floor. When the wall panel 16 is to be of the reinforced type, a reticulated network of reinforcing rods 17 is suitably supported within the form to be embedded in the panel when the concrete is poured into the form. Upon removal of the form and curing of the concrete for a predetermined period of time, the panel is tilted upwardly on the casting surface, then lifted by a boom type crane and set up in vertical position upon suitable footings to form part of a building wall. As previously pointed out, the panel is lifted at its end which is to form the upper edge portion of the wall and "pick-up" means are provided at this end by which the lifting hooks or harness of the boom cable can be connected to the panel. Many forms of anchoring means, previously referred to, have been employed for detachably connecting various types of pick-up devices to the panels. For example, it is common practice to attach pick-up angles, such as those shown at 18 in Fig. 1, against the upper surface of the panel by means of studs 19 which are inserted downwardly through holes in the angles 18 and in the concrete, the lower ends of the studs being screwed into large anchor nuts pre-welded to and between parallel reinforcing rods 17 of the network. Nuts 21 screwed onto the upper projecting ends of the studs 19 secure the lifting angles 18 in place. The angles 18 have holes through which the hooks 22 of the lifting cables 23 engage during tilting and lifting of the panel. Due to the relatively small effective area of the anchoring nuts embedded in the concrete slab and the fact that they are merely welded at their sides to the reinforcing or separate rods, an insecure attachment of the pick-up devices frequently occurs with the result that the anchoring nuts may break away from the rods to which they are welded, thus allowing them to pull through the overlying cast concrete. Such a deleterious condition may result in dropping of the panel to cause cracking or breaking of the same and in serious injury to the workmen.

It is the aim of my invention to provide an improved means for securing the pick-up devices in place against a panel so as to obviate the serious condition referred to above. Referring to Figs. 2 to 4, the improved anchoring or embedment device includes a large nut 24 which is adapted to be placed in position to underlie a pair of the reinforcing rods 17. Preferably, one of the rods, designated by the numeral 17', may be an extra rod installed alongside a rod 17 and parallel thereto, the nut 24 underlying these rods as shown. The rod 17' may be of sufficient length to serve as a transverse support for several of the anchoring nuts, as illustrated in Fig. 1, or in other instances, relatively short rods, extending longitudinally of the panel 10 may be employed.

The anchoring or embedment nut 24 is provided with a pair of slots or grooves 26 in its under surface, these grooves being formed at opposite corners of the nut. Extending through the slots 26 are the central or intermediate portions 27 of clip elements 28, these portions being retained in the slots by means of ears 29 which form the outer corner portions of the nut, the ears being peened or swaged inwardly (Fig. 3) to reduce the width of the slots for this purpose. The free ends of the clip elements 28 are provided with hooks 31 which are adapted to engage over the rods 17 and 17', so as to hold the nut 24 in place against the under sides of the rods.

In order to provide adequate bearing surface area for the nut 24, a large washer 32 is preferably interposed between the nut and the rods, as shown.

When applied to use within the concrete form, each anchoring or embedment device is provided with means for coring a hole in the concrete panel. This core means consists of a relatively long stud 33 which is screw threaded throughout its length to adapt it to pass through the washer 32 and to be screwed into the nut 24 from above, with its lower end projecting below the nut (Fig. 2), the stud having a screw-driver slot 34 in its upper end.

The anchoring device of this invention is a self-contained unit comprising the nut 24, washer 32, clip elements 28 and stud 33, these parts being furnished

to the contractor in assembled condition, ready for use in concrete forms. To install a device of this character in a concrete form, preparatory to pouring the concrete panel **16**, the device is placed in the position shown in Fig. 2, that is, with the upper portion of its stud **33** extending upwardly through the space between the rods **17** and **17'** and with the washer resting against the under sides of these rods.

The free ends of the clip members **28** then are individually forced upwardly, as indicated by the broken lines in Fig. 2, and their hooks **31** are engaged over the rods as shown by the full lines. With the four hooks **31** thus engaged, the clip elements **28** assume an upwardly flexed or bowed contour to become tensioned, the inherent resiliency of the elements maintaining their hooks positively connected to the rods. Due to such resiliency, in the event that the stud **33** is inadvertently struck a lateral blow or stepped upon by a workman, the clip elements **28** may flex downwardly and thereafter assume their bowed condition to restore the nut and washer to original position. By this provision, inadvertent dislodging of the device is effectively prevented.

The required number of the anchoring devices are installed within the form in the manner explained above and when a pair of the devices are to be employed for anchoring each pick-up angle **18** in place, these devices are adjusted along the rods **17** and **17'** to space their studs **33** at a distance which is equal to the spacing of the stud holes of the angle **18**. The studs **33** are then screwed into or from the nuts **24** to locate their upper slotted ends in the plane of the upper edges of the form, that is, the plane of the upper surface of the panel to be produced. The studs **33** then are coated with heavy grease or other bond-inhibiting substance and the anchoring devices are ready for use.

The panel **16** may now be cast in the rectangular form by simply pouring the plastic concrete thereinto and tamping it into place around the rods **17**, **17'** and around the anchoring devices to embed these parts. With the reinforced panel **16** thus cast, it is allowed to set and cure for a predetermined period of time, when the studs **33** are removed by unscrewing them upwardly from the nuts **24** by means of a heavy duty screw-driver engaging in the slots **34**.

Removal of the studs **33** leaves cored holes **36** in the upper portion of the concrete panel **16** for receiving the studs **19** which may now be screwed downwardly into the embedded anchor nuts **24** as shown in Figs. 3 and 4. With the studs **19** thus applied, their upper ends project above the panel **16** and through the stud holes of the pick-up angles **18** which are placed against the panel. The nuts **21** are finally screwed onto the upper ends of the studs **19** to clamp the lifting angles against the panel **16** as shown in Fig. 1.

It is to be particularly noted that the embedded anchoring device, including the rods **17** and **17'**, nut **24**, washer **32** and clip elements **28**, provides a very strong, stable and otherwise efficient means for securing the attaching studs **19** in place and effectively resists any tendency of the nuts **24** to pull from the concrete panel to damage the latter and to allow it to fall as it is being tilted and bodily lifted into place in the wall line of the building structure.

After the panel **16** has been secured in its required position, the cables **23** are disconnected from the lifting angles **18** and the latter are removed from the panel **16** by simply removing the nuts **21**. The studs **19** then are unscrewed from the nuts **24** and the then open cored holes **36** are filled with grout.

In the case of a pre-cast concrete panel of un-reinforced type, the anchoring device may be applied to use by simply installing a pair, or pairs, of the rods **17'** in the form in any suitable manner to provide supports for the devices which then may be embedded by the procedure outlined above.

In the event that the pick-up means consists merely in eye-bolts, such as indicated at **38** in Fig. 5, such bolts are simply screwed into the nuts **24** as shown and are later removed, after the panel has been set up.

Referring now to Figs. 6 through 10 of the drawings, my invention further contemplates the provision of an anchoring device which is designed primarily for use at the crossing points or intersections of the reinforcing rods of a tilt-up concrete panel. This alternative device includes an anchor nut **40** which, as shown best in Fig. 10, is in the form of a cylindrical block having a threaded bore **41**. The nut **40** may have an enlarged lower end providing a peripheral flange **42**. At its upper end, the nut **40** has three upwardly facing, angularly related grooves **43**, **44** and **45**, these grooves being in the form of an isosceles triangle as viewed in plan. It is also to be noted that the grooves are cut at different depths with respect to the upper end of the nut **40**. To be more specific, the groove **43** is relatively shallow while the groove **44** is somewhat deeper. The third groove **45** is still deeper and, as shown best in Figs. 6 and 8, is inclined slightly. The anchor nut **40** is adapted to receive a core-stud **47** which is screwed thereinto as shown.

The anchoring device illustrated in Figs. 6 to 10 is applied to use in connection with reinforcing rods **50** and **51** which cross or intersect each other at right-angles. These rods, which are typical of the many crossing rods of the reticulated reinforcement structure of the concrete panel, are tied together at the intersection **52** by means of a wire **53** (Fig. 7). A third, relatively short, rod **55** is wired at **56** and **57** against the under surfaces of the rods **50** and **51** and extends across the right included angle therebetween at a suitable distance from the intersection **52**. Since the rods **50** and **51** are disposed in different horizontal planes, it is seen that the auxiliary rod **55** must be inclined in order to contact these rods.

The nut **40** is adapted to be disposed within the open triangular area bounded by the rods **50**, **51** and **55**, the grooves **43**, **44** and **45** being so angularly related and of appropriate depth to adapt them to receive the respective rods **50**, **51** and **55**. With the rods thus seated in the grooves, the nut **40** is so disposed that it bears equally against the three rods with the vertical core-stud **47** located at substantially the center of the open triangular area between the rods.

Means are provided for retaining the nut **40** in position against the rods **50**, **51** and **55**. This means comprises clip members **60**, **61** and **62** of substantially the same construction as the clip elements **28** previously described, each element having a central portion and hooks **65** at its ends. The clip elements **60**, **61** and **62** are carried by the nut **40** at the lower end thereof, being held in slots **66**, **67** and **68** formed in the bottom of the flange **42**. The slots **66**, **67** and **68** are located beneath the respective grooves **43**, **44** and **45** and parallel thereto so as to dispose the clip elements **60**, **61** and **62** in line with the respective rods **50**, **51** and **55** to adapt their hooks **65** to engage thereover as shown in the several views, the clip elements crossing one another at different levels as indicated best in Figs. 6 and 7.

The modified anchor device is applied to use in a manner similar to that previously outlined in connection with the device of Figs. 1 through 5, the nut **40** being placed upwardly against the rods **50**, **51** and **55**, with the latter seated in the grooves **43**, **44** and **45**, after which the clip elements **60**, **61** and **62** are flexed upwardly to engage their hooks **65** over the respective rods. By this provision, the nut **40** is held firmly against the rods and is keyed against rotation with respect thereto. After the device has been embedded in the poured concrete **70**, the stud **57** is removed and replaced by a suitable lifting stud or eye-bolt, as desired.

Referring now to Fig. 12, it is within the concept of this invention to provide an anchoring device of the general type disclosed in Figs. 6 through 11 but in which the

anchor nut 75 is made longer than the nut 40. In other respects, the nut 75 is similar, being adapted to be held in place against the under sides of the rods, for example the rods 51 and 55, by means of the respective clip elements 61 and 62. As shown, the nut 75 has an elongate upper portion 76, the extremity of which is disposed slightly below the plane of the upper edge of the form in which the concrete is to be poured.

In applying the alternative nut 75 to use, a first cork plug 77 is inserted and wedged in the lower end of the threaded bore 78 of the nut. A second cork plug 79 is similarly forced into the upper end of the bore 78, this plug being of sufficient length to project above the upper end of the nut to the upper surface of the concrete panel to be cast. The plugs 77 and 79 thus effectively seal the threaded bore 78 to prevent flow of the concrete thereinto. After the concrete has been poured into the form and has set sufficiently, the upper cork insert 79 may be removed to provide an upper cored hole 80 in the concrete which aligns axially with the bore 78. Any suitable threaded stud, eye-bolt or other attaching or pick-up means, such as those previously referred to, then may be screwed down into the nut 75, which is firmly embedded in the concrete. It will be apparent that the nut 75 may be made with its lower end closed, in which case the lower cork plug 77 may be dispensed with.

It will be observed from the foregoing that the present invention provides a simple, inexpensive and highly practical anchoring device for use particularly with pick-up devices used in connection with pre-cast concrete tilt-up construction panels. As an important feature, the embedment or anchoring means is retained within the concrete form, to be embedded therein, by simple, flexible, clip elements or retainers which engage the reinforcing rods of the concrete panel to retain the anchoring nut in place without the necessity for welding the nut to the rods. By this means, therefore, the anchoring means is positively held in its embedded position and the possibility of the nut working loose or pulling out from the concrete panel, as the latter is lifted, is wholly avoided. Consequently, the present anchoring device constitutes an important improvement over the welded types previously employed for the same purpose, which occasionally become separated from the reinforcing rods to cause dropping of the panels. As another feature, the improved anchoring device is adapted for use in connection with pre-cast panels of either the reinforced or un-reinforced types. In the latter case, the device is applied to use by simply connecting the anchoring nut to relatively short pieces of rod to provide an assembly which then may be placed in the concrete form and embedded in the concrete poured therearound. In this respect, it is also pointed out that the anchoring devices may also be utilized for analogous purposes, such as embedding anchoring nuts in the floor or a concrete foundation upon which a machine is to set up, the embedded nuts being spaced to receive bolts employed to fasten the machine base to the floor or foundation. Another advantage of the invention resides in the fact that the anchoring device may be used in connection with either two parallel rods, or two crossing rods when it is desired to locate the lifting means at intersections of the reinforcing rods. In either case, the clip members or clamping wires are pre-assembled on the anchoring nut so that such assembling of the components at the construction site is unnecessary. Thus, the procedure of pre-casting the concrete panels is greatly expedited to minimize the over-all cost of the concrete structure. In addition, when the embedment or anchoring device is connected to the reinforcing rods of a panel the use of saddles or chairs for holding the device in proper vertical position within the form is unnecessary. In view of these various features, it is apparent that the present invention provides an important advancement in the art to which it pertains.

Considering the present invention in its broadest aspect, the anchoring means consists generally in an anchor nut which is retained in place against the under side of any suitable embedment means to be embedded in the concrete. For example, it is within the present concept to position the nut against the under side of the usual reinforcing rods of a concrete panel, against the under side of one or more of the reinforcing rods and one or more auxiliary rods installed for this specific purpose, or against the under side of separate rods. In the later case, the entire assembly of the rods, nut, stud and retainer elements is supported in proper position by means of conventional saddles or chairs. It is also within the purview of this invention to embed the anchor nut beneath one or more rods and a plate or entirely beneath a plate, mesh or other embedment member, having a relatively large bearing surface and capable of retaining the nut firmly embedded in the concrete.

In accordance with the provisions of the patent statutes, I have described the principle of application of the improved embedment or anchoring device, together with the constructions which I now consider to represent the best embodiments of the device, but I wish it to be understood that other modifications might be made without departing from the spirit of the invention. Consequently, I do not wish to limit myself in this respect, but desire to be afforded the full scope of the appended claims.

I claim as my invention:

1. In a concrete slab having a plurality of reinforcing rods therein, said rods having a space therebetween, an anchoring device comprising a nut having spaced first and second faces, an axially threaded bore in the nut passing through said faces, the first face of said nut bearing against a plurality of said rods with the threaded bore being accessible through the space therebetween, said second face having a plurality of elongated wire retaining elements secured thereto, said retaining elements having means at the ends thereof engaging said rods at points thereon spaced from said nut and clampingly securing said first face against said rods.

2. A reinforced slab as recited in claim 1 wherein said rods are disposed in spaced parallel relation, said nut having spaced grooves on said second face and said wire elements being disposed within said grooves and fastened therein, the means at the ends of the wire elements comprising hooks, the individual hooks being disposed in planes substantially normal to the axes of the rods.

3. A reinforced slab as recited in claim 1 wherein at least three rods intersect in substantially co-planar angular relation, said space between the rods being located at the intersection thereof, said first face of said nut having a plurality of substantially semicircular grooves thereon disposed in angular relation, each of said rods being disposed in a respective groove, said second face of said nut having a plurality of angularly positioned seating grooves therein, a wire retaining element occupying each of said seating grooves, the means at the ends of the wire retaining elements comprising hooks, and each of said hooks being disposed in a plane substantially normal to the axis of the rod engaged thereby.

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