ABSTRACT OF THE DISCLOSURE

A structural concrete insert or anchor is provided which is intended to be embedded in a concrete mass to be retained therein and to provide a receptacle for a bolt or the like so that attachment or connection can be made to the concrete mass. The insert or anchor is made of struts which straddle a ferrule which opens to the outside of the concrete mass and serves to receive and connect with a bolt. The construction also includes a coil which encircles the struts and is welded to the outside thereof. A fastening device may be provided by which the insert or anchor is affixed to a form into which the concrete is poured. The fastening means may be a nail-like member which is connected to the bolt receptacle, but is capable of being removed therefrom. The ferrule may be used independently of or without the struts under certain circumstances.

OTHER APPLICATIONS

This is a continuation-in-part based on subject matter divided out of our U.S. application Ser. No. 725,410, filed Apr. 30, 1968.

DRAWING

FIG. 1 is a side view of a concrete anchor provided in accordance with a first embodiment of the invention;

FIG. 2 illustrates a variation of a portion of the construction illustrated in FIG. 1;

FIG. 3 illustrates a further embodiment of the invention;

FIG. 4 illustrates a concrete anchor provided in accordance with still another embodiment of the invention;

FIG. 5 illustrates a modification of a bolt receptacle as used in the prior embodiments;

FIG. 6 illustrates the provision of a fastening means in a concrete anchor in accordance with the invention;

FIG. 7 illustrates a variation of the fastening means of FIG. 6;

FIG. 8 illustrates a still further modification of the fastening means;

FIGS. 9 and 10 illustrate two types of ferrule receptacles with fastening devices;

FIGS. 11 and 12 show two modifications of the fastening devices; and

FIGS. 13 and 14 show two further types of receptacles and fasteners.

BACKGROUND

Structural concrete inserts or anchors have long been known and are intended to perform the general function of permitting connections with concrete masses. For this purpose, a structural concrete insert or anchor consists of a device which is cast in the concrete itself. This device must provide for being firmly embedded in the concrete mass without being of such a size therein as to occupy an objectionable amount of space and thus weaken the mass. This is particularly true of low quality concrete or of a mix which contains a relatively small proportion of cement. The device must also provide a receptacle for a connecting means which receptacle will remain accessible from outside the concrete mass and will provide for the connection of a device such as a bolt.

In known constructions, the receptacle and the anchoring portion of the device are formed in two separate sections which are connected by struts. These sections are generally axially spaced and are straddled by two or more struts to which the receptacle and anchoring portion are welded.

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Patent No. 2,788,642 disclosed a concrete anchor consisting of spaced parallel rods with a spiral helix which is formed of a flat strip of metal being secured at its periphery between the rods. The spiral has its convolutions spaced apart to permit the entry of concrete therebetween and the convolutions are of a pitch adapted to engage the threads of a bolt inserted into the helix. A second spiral helix is secured at its periphery between the rods. This helix is also composed of flat strip metal and has its convolutions spaced apart at distances greater than those between the convolutions in the first said helix. The rods which engage the helix may be formed with a bend to dispose of helices at an angle with respect to one another.

Patent No. 2,880,608 discloses a concrete insert also consisting of spaced-apart rods with a spiral helix formed of a coiled metallic rod being mounted between the rods at one end thereof to retain the rods in their spaced relationship. This helix has its convolutions also arranged for threadable engagement with the threads of a bolt or the like which is to be inserted into the same. In addition there is provided a flat annular disc having a diameter which is greater than the distance between the rods which is secured at the ends of the rods and is thereby secured at the end of the helix. This disc is provided with lugs which are welded to the helix along the body of the latter. This construction is provided with a second helix axially spaced from the first and also accommodated between the rods to provide for anchorage in a concrete mass.

Although one of the aforesaid patents illustrates the spaced rods as being of rectilinear form, it is quite conventional in practice that all such rods be preformed or bent. The purpose for this is that the anchorage coil must be made of a greater diameter than the coil which is intended to serve as a bolt receptacle in order to provide for an increased and satisfactory strength of engagement in the concrete mass. This strength of engagement is intended to prevent the undesirable and dangerous possibility of the concrete anchor being pulled free of the mass from which particular circumstance can follow very dangerous and undesirable consequences.

The need to preform or pre-bend the rods or struts which bracket the two coils of a concrete insert or the equivalent of such coils, however, in turn results in problems which it would be most desirable to avoid. For example, the preforming or pre-bending of such struts results in a stress in the material constituting the same, which reacts most unfavorably to a subsequent welding operation in which the struts are bent in the opposite direction. This initial preforming of the struts, followed by the heat cycle of a welding operation, has been found to result in a slight martensitic formation which has been found more prone to operational failure than in those materials which have not been so processed.

It is therefore seen that while many of the struts of a structural concrete insert with bends by means of pre-forming adds to the strength of engagement of such inserts in a concrete mass by providing for the use of larger anchor coils, this pre-bending operation leads to certain difficulties which it would be desirable to avoid.
In the concrete anchors which are currently available on a commercial scale and which are of the type disclosed in the aforesaid patents, it is usual that the struts embrace or straddle the associated coils and are welded to these coils on the outside of the same. In practice this is found to lead to substantial difficulty due to the nature of currently available welding equipment. It can readily be visualized that in bringing one electrode towards a fixed electrode in a welding apparatus while sandwiching therebetween the coils and struts of a concrete anchor, extreme difficulty will be experienced in keeping the struts aligned with one another and with the related coils. In practice this leads to a skewing of the struts relative to the coils and this constitutes generally an intolerable defect in the finished construction, inasmuch as skewed struts lead to improper stress distribution and to premature failure of the concrete anchors which result from such techniques.

With additional reference to the environment relating to the present invention, it should also be noted that considerable thought has been given to the redesign of known concrete anchor constructions to effect an increase of strength of engagement of these devices in related concrete masses. Within the scope of currently available designs, however, improved strength has not been found achievable by any substantial magnitude and the design improvements have generally related to increasing the diameter of the anchoring coil with the attendant provision of divergent struts, the provision of which results in the difficulties noted hereinabove.

DETAILED DESCRIPTION

This invention relates to structural concrete inserts or anchors and more particularly to the type of structural concrete inserts or anchor involving the use of one or more spirals or helices secured on a plurality of rods, the collective assembly being embedded in a concrete mass to support at the surface of the concrete mass a receptacle for a connecting element such as a bolt or the like.

It is a general object of the invention to provide an improved concrete insert or anchor of such design as to improve the strength of engagement of the same by a substantial magnitude.

It is a further object of the invention to obtain the improved strength of engagement economically and without the use of additional materials or elements which would materially increase the cost thereof.

Another object of the invention is to provide a construction characterized by a substantial strength of engagement in a concrete mass while eliminating preforming operations with the attendant problems of die costs and maintenance as well as set-up and at the same time avoid the need for an inventory of many sizes.

Yet another object of the invention is to provide an improved anchor employing an extended coil portion which is easier to weld and which facilitates increasing production and achieving improved quality.

Yet another object of the invention is to provide a design for an improved concrete anchor which is inherently stronger than known constructions and which avoids the need to utilize preformed struts which might cause undue failure resulting from stress reversals during manufacturing cycles.

Yet another object of the invention is to provide a means for obtaining an improved concrete anchor while avoiding techniques which enhance martensitic formation during welding.

Yet another object of the invention is to provide an improved concrete anchor design which, while using conventional materials and configurations, can be easily altered to meet any practical strength requirement whether in respect of high or low strength concrete.

Another object of the invention is to provide an improved concrete anchor design which enhances strength characteristics by as much as 25% and more without requiring any increase in material.

Other objects of the invention relates to the provision of an improved design which permits a wider spacing of the turns of the coils employed as the anchoring portion of the concrete insert, this being conductive to better anchorage as coarse aggregate can more readily pass between the turns of the coil and engage the interior thereof.

To achieve the above and other of the objectives of the invention, there is provided an improvement over known structures which is surprising in its simplicity. Indeed, by reason of this simplicity, it is most unusual that this development has not heretofore been contemplated by those practicing in the fields involved despite the pressing demands for increased engaging strengths in connection with concrete anchors and inserts.

More particularly, the important and surprising advances of the invention are achieved by the simple steps of removing the anchorage coil from within the straddling embrace of the accompanying struts and positioning such coil in such a manner as to encircle these struts and to be connected or welded to the outwardly facing portions thereof.

Despite the simplicity of the change involved, there are obtained the advantages enumerated above as objects of the invention and the attaining of increases in strength of 25% or more despite the use of corresponding sizes of materials, relative to the constructional designs heretofore available.

Generally speaking, therefore, the invention provides an anchor which comprises, for example, at least two struts with a connector receiving means or receptacle supported by these struts and an anchorage coil encircling the struts and connected to the latter.

A wide variety of embodiments of the invention will be described hereinafter. However, as a further feature of the present invention, there will be shown a number of fastening means by which the anchors of the invention can be attached to concrete forms into which the concrete is subsequently poured to embed the anchors therein. These fastening means, as will be shown, are applied within or in the vicinity of the connector receiving devices and are provided in such a manner as to be readily detachable therefrom to free the latter for their normal function of receiving threaded bolts by the like.

FIG. 1 illustrates a first embodiment of the invention involving conventional materials and sizes, as well as elements which, however, are rearranged to achieve the various advantages of the invention.

More particularly, in FIG. 1 are shown two spaced and parallel struts which are cut lengths of metal wire or rod having a diameter, for example, of 1/4", there being furthermore provided a bolt receiving device or receptacle and an anchoring or trail coil.

The anchorage or trail coil consists of a plurality of spaced turns. These turns may have a regular pitch or the pitch of these turns may be varied as required. The turns will have a pitch suitable for passing to the interior of the coil the type of aggregate employed in the concrete being poured and cast.

It will be noted that these coils will have a 360° exposure to the concrete mass in which the anchor is embedded. It will also be noted that the struts cannot in any sense shield the exterior of the coil from engagement with the concrete and that for a given spacing of the struts the diameter of the coil will greatly exceed that of a coil which in conventional constructions would be straddled by said struts.

For the above and other reasons which are not yet fully appreciated, the anchor illustrated in FIG. 1 is found to have a substantially greater strength of engagement in a concrete mass than would a similar anchor having the same strut spacing but in which the anchor coil is embraced between the struts. In view of the vast im-
provement obtained in the strength of anchorage, it is believed that other factors besides those mentioned above must contribute to the surprising result. However, the applicants do not wish to be bound by any theoretical explanation since their invention resides in the provision of a particular improvement and not in the theoretical explanation of which such improvement materially insures to the benefit of structural concrete inserts and anchors.

More particularly, in FIG. 1 is illustrated an embodiment of the invention involving the use of spaced and parallel struts 26 and 28, these straddling a receptacle 30 consisting of a ferrule having therein a concentric bore 32 of threaded form.

Axially spaced from the ferrule 30, to which struts 26 and 28 are externally welded, is a tail or anchorage collar 34 having spaced turns and formed of a round metal wire. This collar being in encircling relationship relative to struts 26 and 28 achieves the benefits ascribed to the previous constructions.

The ferrule 30 has an inner end portion 36 and an outer end portion 38, to the latter of which is welded a washer 40 having holes drilled therein and constituting the means by which the illustrated anchor can be fastened to a wooden mold or form into which the concrete is poured.

According to conventional techniques, once the concrete has set, the wood or metal forms are removed and the washers represented by the washer 40 which are exposed, can be either removed or left in place according to the requirements of the job involved.

As illustrated in FIG. 2, the ferrule, in this case the ferrule 42, can be provided with an inset 44 against which the washer 46 will seat, engagement being either by means of friction or by means of a welded connection.

FIG. 3 illustrates a further embodiment of the invention, in which a still further gain in strength is achieved by positioning the struts 48 and 50 in divergent relationship, there being accommodated therebetween a ferrule 52 provided with a receiving bore 54 terminating at the closed end portion 56 of the generally cylindrical body constituting the ferrule.

An anchoring or tail collar 58 fabricated of coiled round wire is welded to the outside of struts 48 and 50, the coil 58 being of truncated conical form in order to accommodate the divergent disposition of the struts 48 and 50.

It should be noted that the provision of threaded form struts is employed only in certain cases, inasmuch as the increase in strength achieved simply by placing the anchoring collar on the outside of the struts is generally sufficient for most practical situations.

FIG. 4 illustrates a further embodiment of the invention involving the use of spaced and parallel struts 60 and 62 straddling a ferrule 64 having a closed end portion 66, terminating the interior bore 68 within which a threaded bolt is received.

In this embodiment of the invention, a truncated conical form is employed for the anchoring collar 70 to impart to the collar an increased strength of engagement with the associated concrete mass. To obtain this form, a wire is employed which is of tapered shape from one end to the other.

FIG. 5 illustrates how certain of the advantages of the invention can be achieved with respect to the receptacle element. As was noted hereinabove, one of the benefits of the invention is that in positioning the anchor collar on the outside of the associated struts, substantial improvements are secured in the avoiding of certain limitations inherent in currently available welding techniques. One of these improvements consists of the avoiding of critical martensitic formations, and another of these improvements relates to the avoiding of the skewing of the struts, which in turn has been found to lead to structural failures at reduced loads.

FIG. 5 illustrates an end view of struts 98 and 100 in spaced parallel relationship and the provision of a receptacle 90 provided with extended portions 94 and 96 which reach around and embrace the struts yet permit the receptacle to have an inner diameter D which is less than the spacing S between the struts. Since the diameter D is less than the spacing S between the struts, the inside surface of the receptacle can serve as a threaded element for engaging a threaded bolt inserted into the same. At the same time the extending of portions 94 and 96 around the outside parts of struts 98 and 100 permits the receptacle to be welded to the outside portions of such struts, thereby avoiding the need for reverse stresses in the struts, which in turn avoids the critical formation of internal martensitic regions of weakness. The anchor collar will be welded to the outside of the struts, as has been hereinabove indicated with respect to FIGS. 1–4.

It has been mentioned hereinabove that a feature of the invention is provided for fastening the anchors of the improved construction to forms or molds for the concrete which is to be poured. A cross-section of such a mold or form is indicated at 102 in FIG. 6, wherein is also shown the ferrule or receptacle 104 of one of the embodiments of the invention discussed hereinabove. The ferrule 104 is of the type including a closed end portion 106 and the ferrule 104 is moreover straddled by struts of an associated anchor (not shown) to which an anchoring or tail is welded.

Passing through the bore 108 of ferrule 104 and in concentric relationship with the cylindrical body constituting such ferrule, is a rod or nail-like member 110 having a pointed end 112 fastened at a base 114 to the closed end portion 106. The rod or elongated member 110 is provided with a portion of reduced cross-section indicated at 116 and constituting the break point by means of which the rod 110 can be detached from the ferrule.

In practice the anchor is fastened to the form 102 by driving the nail-like member 110 through the form, whereupon the anchor is fixed in position and firmly held in this position while the concrete is poured. After the concrete has set, the form 102 is removed, thereby exposing the interior of the bore 108, whereupon the elongated member 110 can be removed by the use of pliers or the like, the elongated member 110 being given a torsional force which will twist the same from the base 114.

FIG. 7 illustrates a further feature of the invention involving the use of a ferrule 118 to the outside of which are welded two nail-like members 120 and 122, these being in offset relationship to the struts 124 and preferably displaced 90° rotationally from the latter.

In practice, the nail-like members 120 and 122 are forced through form 126, thereby holding the associated anchor in place until the concrete has been poured and has set. Thereafter the extremities of the nail-like members 120 and 122 may be pounded against the set concrete or may twisted off by the application of a rotational force.

FIG. 8 illustrates a further variation of the fastening means previously discussed with respect to FIGS. 6 and 7, this embodiment involving the use of a ferrule 130 having an open outwardly facing end 132 and an open interior end 134. In this case there is provided an end obturating member 136 which engages on the end of the ferrule 132 disposed inwardly of the form 138 a nail-like member 140 extending through the element 136 and being forced through the form 138.

In this embodiment of the invention the end cap 136 is formed of a plastic or of a relatively soft metal so that after the concrete has been poured and set, the nail-like rode 140 can be removed simply by pulling the same through the member 136, from which the nail-like member is readily removed.

Thus there is provided in accordance with a feature of the invention, a means for readily fastening anchors
to wood or metal forms and the like. In connection with such a fastening means, it will be understood that the nail-like member can be replaced by a threaded screw-like member or the like and that other types of fastening elements can be applied in the manner which has been generally described.

The basic improvement of the invention, however, resides in the provision of an externally located coil having an encircling relationship to the structure related therewith, there resulting therefrom a surprising increase of strength of engagement in the associated concrete mass. Generally, the struts employed will be parallel, but convergent or divergent struts may also be used. The anchoring coil may consist of spaced turns which are regularly spaced or are spaced with a varying pitch. The receptacle employed in structures of the invention may consist of a round coil or of a ferrule having a closed or open interior end. The anchor coil may be of circular shape or of a flattened oval shape and may be generally of cylindrical form or of truncated conical form.

The method of the invention is a method of substantially strengthening the design of a concrete anchor which generally includes struts welded to a bolt receiving member. This method will include basically encircling the struts with a coil and welding the coil to outwardly facing portions of the related struts.

The ferrules which have been described hereinabove have been associated with elongated struts. It is to be understood, however, that the ferrules can be used independently of or without the struts as well as without the anchoring coils, in connection with circumstances wherein the load to be supported thereby is very light. FIGS. 9-14 illustrate additional ferrules which may be so employed, it being understood however that struts may be attached to these ferrules along with anchoring or tail coils in the manner set forth in detail hereinabove.

FIG. 9 in particular illustrates a ferrule 150 having an uneven outer surface 152 and being provided with an internal bore 154 from which extends an opening 156 which is coaxial with the bore 154. The ferrule thus has an open end 158 and a closed end 160. Extending through the ferrule and located chiefly within the bore is a fastening device 162, this being constituted by an elongated body having a pointed end 164 and a head 166. The fastener 162 is thus in fact a nail or nail-like member, the head 166 of which is located adjacent the closed end 160 of the ferrule and is welded thereto.

In use the nail will be driven through a wooden form 168 or the like, wherefore the concrete is poured into the form. After the concrete has set the form is readily removed from the fastener 162 and the fastener is detached by twisting which will fracture the fastening member adjacent the head 166 which, due to the welding process, will have undergone a metallic change which will facilitate such detachment.

FIG. 10 illustrates a similar ferrule 170 with a fastener 172 which is also provided with a pointed extremity as indicated at 174. In this embodiment of the invention the portion 176 adjacent the pointed extremity is threaded in order to accommodate a wooden nut 178 or an equivalent member which operates to sandwich a form 180 against the ferrule 170.

In both of the aforesaid embodiments of the invention there is provided an internal thread indicated at 182 in FIG. 9, and at 184 in FIG. 10. The purpose of this internal thread located within the bore is to accommodate a connection in the manner which has been referred to hereinabove.

Although the use of a threaded element such as a wing nut has been indicated with respect to FIG. 10, there are other techniques for locking the ferrule to a form. Some of these are illustrated in FIGS. 11 and 12 which show the outer extremities of fasteners 186 and 188 respectively. In these two modifications of the invention, there are provided "speed nuts" indicated at 190 and at 192 in FIGS. 11 and 12 respectively, these being press fit over the fasteners 182 and 188 in a manner which is well known. For this purpose the speed nuts are provided with one or more cantilever-like protrusions extending into a central opening, these protrusions constituting tongues which press up against the inside of the fasteners.

FIG. 13 illustrates still a further embodiment of the invention in which a ferrule 194 is fabricated in the manner which has been indicated above. In this embodiment of the invention there is employed a fastener 196 including a pointed extremity 198 on a portion 200 which bends over at almost a right angle to the main body portion of the fastener. This hook-like extremity 200 will be spaced from the form 202 to which the ferrule is to be attached, there being further provided a separate clip 204 including a handle 206 and a right angled extension 208 intended to fit between the portion 200 and the form 202 to lock the ferrule 194 to the form.

FIG. 14 illustrates another embodiment of the invention employing a ferrule 210 in which a fastener 212 has threaded connections as indicated at 214, the fastener 212 including a threaded portion 216 on which will be engaged a nut 218 or the like.

The fastener 212 has a hooked extremity 220 enabling leverage to be obtained in unfastening the threaded connection indicated at 214 after the concrete has been set and it is desired to install a bolt within the threaded bore of the ferrule.

It will be noted in the last embodiment of the invention that there is a limit to which the nuts 218 can move along the fastener 212 by virtue of termination of the threading thereon. The distance between the threading engagement at 214 and the nut 218 will be sufficient to accommodate a form 222 between the open end of the ferrule 210 and the nut 218.

There will now be obvious to those skilled in the art many modifications and variations of the constructions and methods set forth hereinabove. These modifications and variations will not depart from the scope of the invention if defined by the following claim.

What is claimed is:

1. A bolt receiving device adapted for being retained in a mass of concrete and comprising a ferrule provided with an internal bore and having an at least substantially closed end and an open end, said ferrule having an internal thread in said bore and having an uneven outer surface with uniform irregularities extending at least substantially between said ends, and a fastener connected to the ferrule at said closed end and being located partly in said bore and extending outwardly at said open end, said closed end being provided with an opening extending from the bore, said fastener including an elongated rod extending through said opening and with two ends and including a head on one end overlying the opening and a pointed extremity at the other end, said head being rigidly fastened to the exterior of the ferrule, said rod being adapted for being broken adjacent said head.

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