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REBAR CHAIR WITH DEPTH GAUGE

DESCRIPTION

BACKGROUND OF THE INVENTION

[Para 1] This invention relates generally to improvements in so-called rebar chairs for supporting reinforcing steel within a concrete structure such as a concrete shell for a swimming pool or the like. More particularly, this invention relates to a combined rebar chair and depth gauge for supporting reinforcing steel within an open-sided mold or form, with controlled spacing from outboard and inboard sides of a resultant formed concrete shell structure.

[Para 2] In-ground swimming pools and spas are commonly constructed with a steel-reinforced concrete shell structure. In this regard, in accordance with conventional pool/spa construction methods, a suitable hole is excavated to define an open-sided mold or form defining an outboard surface of the to-be-formed concrete shell structure. In a typical construction technique, floor area portions of this open-sided form may be defined directly by the excavated soil, whereas generally vertical wall portions are normally defined by assembled man-made materials such as plywood and the like. An appropriately shaped reinforcing steel cage is constructed from steel bars (rebar) with a size and shape approximating the configuration of the to-be-formed concrete shell structure. Finally, suitable
plumbing and electrical components are assembled in relation to the open-sided form and the reinforcing steel cage.

[Para 3] Building code and structural engineering requirements normally specify a minimum spacing between the reinforcing steel and the associated outboard and inboard surfaces of the finished concrete shell structure. Accordingly, prior to the addition of concrete material to the open-sided form, the reinforcing steel cage is normally positioned and supported relative to the open-sided form to provide a predetermined minimum spacing between the reinforcing steel and the outboard surface of the concrete shell structure. Spacer elements such as so-called dobies and rebar chairs are known for positioning and supporting the reinforcing steel in this manner. Thereafter, concrete material such as gunite or shotcrete is applied to the open-sided form as by spraying under pneumatic pressure from a hose-end nozzle that is manually held and aimed by a nozzle operator. The concrete material is premixed to a consistency for adhering to the steel cage and open-sided form, thereby creating the concrete shell structure of appropriate geometric shape with the reinforcing steel cage embedded therein. After curing, the inboard surface of the resultant concrete shell structure is lined with a suitable waterproof material such as tile and/or plaster and the like.

[Para 4] Dobie-type spacer elements typically comprise a small and relatively inexpensive block constructed from a concrete material and including embedded wires for tie-wrapping about one or more adjacent steel bars. By contrast, rebar chair spacer devices are typically formed from a molded plastic and include a suitably shaped cradle for receiving and supporting one or more adjacent steel
bars. If properly used, these spacer elements assure the requisite minimal spacing between the embedded reinforcing steel and the outboard surface of the concrete shell structure. However, such spacer elements have not provided any means for assuring the requisite minimal spacing between the embedded steel and the inboard side of the concrete shell structure. Instead, the spacing distance between the embedded steel and the inboard side of the concrete shell structure has relied entirely upon the skill and experience of the spray nozzle operator. Specifically, this inboard-side spacing distance has been based entirely upon the nozzle operator’s visual inspection and estimation of the thickness of the spray-applied concrete while standing several feet from the steel cage and manipulating the heavy hose and spray nozzle as the concrete material is jetted therethrough at relatively high velocity.

[Para 5] There exists, therefore, a significant need for further improvements in and to spacer elements of the type used for positioning and supporting reinforcing steel within a concrete mold or form, particularly such as an open-sided form of the type used to construct a concrete shell structure for a swimming pool or the like, wherein an improved spacer element effectively assures a minimum predetermined spacing between embedded reinforcing steel and both of the outboard and inboard sides of the resultant concrete shell structure. The present invention fulfills this need and provides further related advantages.
SUMMARY OF THE INVENTION

[Para 6] In accordance with the invention, a combined rebar chair and depth gauge is provided for supporting reinforcing steel within an open-sided mold or form, with a predetermined minimum spacing from both outboard and inboard sides of a resultant formed concrete shell structure such as a concrete shell for a swimming pool.

[Para 7] In the preferred form, the rebar chair has a broad base defining a relatively large surface area for seating against a closed side of the mold or form, wherein such closed side is defined by excavated soifand/or a form structure defined by plywood or the like. At least one and preferably multiple gussets defining a narrow cross sectional profile project from the base and carry a support member such as an open-sided cradle having a size and shape for snap-fit reception and support of at least one steel reinforcing bar with a predetermined minimum spacing relative to the form. When seated against soil, the broad base defines a footprint of sufficient area to resist significant penetration into the soil. When seated against a form structure of wood or the like, the base includes one or more openings for receiving a fastener such as a nail used to attach the base to the form structure.

[Para 8] The depth gauge comprises an elongated rod projecting a predetermined distance beyond the support member, in a direction opposite to the gussets and base. This gauge rod defines a relatively narrow profile, and terminates with a free end or tip.
In use, the concrete shell structure is formed by spraying concrete material against the open-sided form until the free end or tip of the depth gauge rod is covered. As a result, the combined rebar chair and depth gauge assure a predetermined minimum spacing between both the outboard and inboard sides of the resultant concrete shell structure and the reinforcing steel supported therein.

The combined rebar chair and depth gauge is adapted for economical construction from a lightweight and non-corrosive material such as molded plastic. The device can be color-coded according to different standard sizes, i.e., according to different standard outboard-side and inboard-side spacing dimensions. Alternately, the elongated gauge rod can be provided with distance measure markings along the length thereof, and adapted for suitable length reduction by cutting or breaking to provide the desired inboard-side spacing dimension.

Other features and advantages of the invention will become more apparent from the following detailed description taken in conjunction with the accompanying drawings which illustrate, by way of example, the principles of the invention.

BRIEF DESCRIPTION OF THE DRAWINGS

The accompanying drawings illustrate the invention. In such drawings:

[Para 9]

[Para 10]

[Para 11]
FIGURE 1 is a perspective view depicting installation of a concrete shell structure for a swimming pool or the like, including a plurality of rebar chairs constructed in accordance with the present invention;

FIGURE 2 is an enlarged perspective view of a rebar chair constructed in accordance with the invention;

FIGURE 3 is a top plan view of the rebar chair shown in FIG. 2;

FIGURE 4 is a side elevation view of the rebar chair, and further depicting a length of reinforcing steel supported thereby;

FIGURE 5 is a front elevation view of the rebar chair, taken generally on the line 5-5 of FIG. 4; and

FIGURE 6 is an enlarged and fragmented sectional view taken generally on the line 6-6 of FIG. 1, and illustrating a rebar chair embedded within the concrete shell structure.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

As shown in the exemplary drawings, an improved rebar chair referred to generally by the reference numeral 10 in FIGURE 1 is provided for supporting a grid or cage 12 of reinforcing steel (rebar) in a predetermined position within an open-sided mold or form 14 of the type used, e.g., for constructing a concrete shell structure 6 for a swimming pool or spa or the like. The rebar chair 10 supports the reinforcing steel with a predetermined minimum spacing from a closed side of the form 14, thereby assuring a predetermined minimum concrete wall thickness between the steel and an outboard side of the concrete shell.
structure 16. In addition, and in accordance with a primary feature of the invention, the rebar chair 10 further includes a rod-shaped depth gauge 18 for assuring a predetermined minimum concrete wall thickness between the steel and an inboard side of the concrete shell structure 16.

[Para 20] FIG. 1 generally depicts the open-sided mold or form 14 of a type commonly used in the construction of a swimming pool or spa. As shown, following suitable soil excavation, elongated bars of reinforcing steel are cut, bent, and assembled as by means of wire ties (not shown) or the like to form the reinforcing steel grid or cage 12 having an overall size and configuration for subsequent embedding within concrete material used to form the concrete shell structure 16. The open-sided form 14 is typically defined in part by an adjoining soil surface, particularly such as soil 20 underlying to-be-formed floor surfaces of the concrete shell structure. In addition, the open-sided form 14 is also normally defined in part by assembled concrete form materials such as plywood 22 and/or other forming lumber components, particularly to define generally vertically extending or upright wall surfaces of the to-be-formed concrete shell structure 16. Cooperatively, the soil 20 and forming materials 22 define a closed side of the form 14, for subsequently defining an outboard surface of the to-be-formed concrete shell structure 16.

[Para 21] A plurality of the rebar chairs 10 of the present invention are used to support and retain the reinforcing steel cage 12 in predetermined spaced relation to the open-sided form 14. As shown in FIG. 1, these rebar chairs 10 are designed to space the steel upwardly from the underlying soil 20, and inwardly from the
forming materials 22, thereby effectively suspending the steel cage 12 for subsequent embedding within the concrete shell structure 16 upon application of concrete material to the open-sided form 14. In this regard, concrete material 24 is typically applied to the form 14 by spraying a mixed gunite or shotcrete material through a hose 26 and associated spray nozzle 28 at substantial velocity and pressure. The sprayed concrete material 24 coats and adheres to the open-sided form 14, and is applied by a nozzle operator 30 to produce the concrete shell structure 16 having the desired contour and wall thickness.

[Para 22] The improved rebar chair 10 of the present invention beneficially provides the dual functions of assuring a predetermined minimum concrete wall thickness between the embedded reinforcing steel cage 12 and both the outboard and inboard sides of the completed concrete shell structure 16. In this regard, local building codes and structural engineering requirements specify minimum wall thickness dimensions between the embedded reinforcing steel and the outboard side of the concrete shell structure 16 as defined by the open-sided form 14. In addition, such building codes and structural engineering requirements also specify minimum wall thickness dimensions between the embedded steel and an inboard side of the concrete shell structure 16. However, since the inboard side of the form 14 is open for receiving the spray-applied concrete material 24, the wall thickness of the concrete shell structure 16 at the inboard side of the reinforcing steel cage 12 has relied upon the subjective skill and experience of the nozzle operator 30. Alternately stated, there has been no effective and reliable way to assure that the proper minimum wall thickness dimension at the inboard
side of the steel cage 12 has been achieved. The improved rebar chair 10 of the present invention, incorporating the depth gauge 18, resolves this problem.

[Para 23] The improved rebar chair 10 is shown in detail in FIGS. 2-5. As shown, the rebar chair 10 comprises a spacer block having a base 32 defining a relatively broad surface area for stable seating upon underlying soil 20. In the preferred form as shown, the base 32 has an enlarged generally circular or disk-like shape, with a low profile or narrow thickness dimension, but other base configurations such as a square shape may be used. Fastening holes or slots 34 are formed in the base 32, preferably at diametrically opposed locations as shown, for receiving suitable fasteners such as nails 35 or the like (FIG. 1) used to secure the rebar chair 10 to forming material 22.

[Para 24] At least one and preferably multiple gussets 36 project upwardly from the base 32 and are joined at upper ends thereof with a support member 38 for receiving and supporting a length or bar of reinforcing steel 40 (FIGS. 4-6). As shown, these gussets 36 are configured as a pair of intersecting and relatively thin-walled triangular structures each protruding upwardly from a perimeter of the base 32 and terminating at a substantially centered upper apex end at the support member 38 disposed generally in predetermined spaced relation above the base 32. One or more of these gussets 36 may include stiffening ribs 42. The support member 38 is shown in the illustrative drawings in the form of an upwardly open cradle having a narrowed inlet throat 43 for downward, pressed and snap-fit reception and retention of a steel bar 40 within a range of standard rebar sizes.
In a typical installation, the rebar chairs 10 are employed throughout the open-sided form 14 with steel bars 40 retained within the respective support members 38, whereby the rebar chairs 10 support the steel cage 12 in a predetermined spaced relation to the form 14, thereby assuring the requisite minimum wall thickness between the reinforcing steel and the outboard side of the to-be-formed concrete shell structure 16. FIG. 1 shows multiple rebar chairs 10 arranged throughout the floor and wall surfaces of the open-sided form 14 at a relative maximum inter-chair spacing of about 3 feet, although the spacing may vary. In some locations, the gussets 36 may be sized for supporting the reinforcing steel within the respective support members 38 by a minimum spacing of 3 inches from the form 14. In other applications, or at different locations within a common structure, different spacing dimensions such as 4 inches may be required. To accommodate different required spacings, rebar chairs 10 of different gusset sizes can be visibly marked and preferably color coded so that the array of rebar chairs in any given installation can be visually verified quickly and easily prior to spray-addition of the concrete material 24.

The depth gauge 18 comprises an elongated element preferably such as an elongated rod extending upwardly from the rebar chair 10 beyond the support member 38 by a predetermined distance. In this regard, FIGS. 2-6 show the depth gauge rod 18 joined at a lower end to one side of the support member cradle 38 and projecting upwardly therefrom. This depth gauge rod 18 also has a narrow profile and may be constructed with length markings or serrations 19 (FIG. 2) thereon to facilitate trimming or break-away shortening of the rod to the
desired length at the job site. In either case, a free end or tip 44 of the rod 18 terminates at a location spaced a predetermined distance or dimension beyond the rebar 40 carried by the associated support member 38, whereby the rod tip 44 defines the requisite minimum wall thickness for the concrete material at the inboard side of the steel cage 12.

[Para 27] The entire rebar chair 10 including the depth gauge 18 is conveniently and economically constructed from lightweight molded plastic, preferably as a one-piece or unitary construction. When the rebar chair 10 is placed with the base 32 thereof seated on the form 14 defined by the soil 20, the base 32 provides sufficient surface area to support the steel cage 12 which resisting or preventing undesired sinking into the underlying soil 20. When the rebar chair 10 is mounted onto generally upright forming material 22, the base 32 is quickly and easily secured thereto by means of the fasteners 35 passed through the slots or holes 34. In either position, the rebar chair 10 provides an extremely narrow profile projecting into the to-be-formed concrete shell structure 16, wherein the rebar chair 10 avoids any significant interference with or compromise to the structural integrity of the shell structure.

[Para 28] In use, as viewed in FIG. 1, the concrete material 24 is spray-applied against the open side of the form 14 to form the concrete shell structure 16. The open-sided form thus defines the outboard surface of the shell structure, with the gussets 36 of each rebar chair 10 retaining the steel cage 12 in a position with the desired minimum wall thickness between the steel and the outboard surface of the shell structure. As the spray-applied concrete material 24 covers the steel cage
12, the depth gauge rods 18 of the rebar chairs 10 remain at least partially exposed until sufficient concrete material 24 is applied to cover or conceal the rod tips 44. When these rod tips 44 are no longer visible to the nozzle operator 30, then further application of concrete material 24 can be halted with confidence that the requisite minimum wall thickness between the steel and the inboard side of the concrete shell structure 16 has been achieved.

[Para 29] Persons skilled in the art will appreciate that, following curing of the concrete shell structure 16, appropriate plumbing and electrical connections are completed, and the inboard surface of the concrete shell structure 16 is faced with a suitable waterproof material such as plaster and/or tile before filling with water.

[Para 30] A variety of further modifications and improvements in and to the improved rebar chair 10 of the present invention will be apparent to those persons skilled in the art. Accordingly, no limitation on the invention is intended by way of the foregoing description and accompanying drawings, except as set forth in the appended claims.
What is claimed is:

[Claim 1] In a rebar chair having a chair base of relatively large surface area for contacting a closed mold side, at least one gusset projecting from the base, and a support member carried by the gusset in predetermined spaced relation to the base, said support member being adapted to receive and support a reinforcing bar, the improvement comprising:

a depth gauge carried by said chair and projecting in a direction away from said chair base and terminating at a free end disposed beyond and in predetermined spaced relation with said support member.

[Claim 2] The improvement of claim 1 wherein said depth gauge comprises an elongated rod.

[Claim 3] The improvement of claim 2 wherein said rod has a plurality of length markings formed along the length thereof.

[Claim 4] The improvement of claim 1 wherein said chair base has an enlarged and generally circular shape.

[Claim 5] The improvement of claim 4 further including at least one fastener-receiving hole formed in said chair base.

[Claim 6] The improvement of claim 1 wherein said at least one gusset has a relatively narrow cross sectional profile shape.

[Claim 7] The improvement of claim 1 wherein said at least one gusset comprises a pair of intersecting, generally triangular gussets extending from said base in a first direction.
[Claim 8] The improvement of claim 1 wherein said support member comprises a cradle-shaped element carried by said at least one gusset.

[Claim 9] The improvement of claim 1 wherein said depth gauge is carried by said support member.

[Claim 10] The improvement of claim 1 wherein said rebar chair including said depth gauge comprises an integrally molded plastic element.

[Claim 11] A rebar chair, comprising:

- a chair base having a relatively broad surface area adapted for seated placement against a closed side of an open-sided form;
- at least one gusset projecting from said base in a first direction, said at least one gusset defining a relatively narrow cross sectional shape profile;
- a support member carried by said gusset in predetermined spaced relation to said base, said support member being adapted to receive and support a reinforcing bar; and
- an elongated depth gauge projecting in said first direction beyond said support member and terminating in a free end disposed in predetermined spaced relation with said support member.

[Claim 12] The rebar chair of claim 11 wherein said depth gauge comprises an elongated rod.

[Claim 13] The rebar chair of claim 12 wherein said rod has a plurality of length markings formed along the length thereof.

[Claim 14] The rebar chair of claim 11 wherein said depth gauge is carried by said support member.
[Claim 15] The rebar chair of claim 11 wherein said chair base has a generally circular shape.

[Claim 16] The rebar chair of claim 15 further including at least one fastener-receiving hole formed in said base.

[Claim 17] The rebar chair of claim 11 wherein said at least one gusset comprises a pair of intersecting, generally triangular gussets extending from said base in said first direction.

[Claim 18] The rebar chair of claim 11 wherein said support member comprises a cradle-shaped element carried by said at least one gusset.

[Claim 19] The rebar chair of claim 11 comprising an integrally molded plastic element.

[Claim 20] In a rebar spacer block having a base for contacting a closed mold side, and a free end for supporting a reinforcing bar in predetermined spaced relation to the closed mold side, the improvement comprising:

a depth gauge carried by said spacer block and projecting in a direction away from said base and terminating at a free end disposed beyond and in predetermined spaced relation with said spacer block free end.

[Claim 21] A method of producing a reinforced shell structure within an open-sided form, comprising the steps of:

constructing an open-sided form defining the shape of the to-be-formed shell structure;

constructing a reinforcing cage from a plurality of reinforcing bars;
supporting the cage relative to the open-sided form by means of a plurality of rebar chairs each having a base adapted to seat against the open-sided form, at least one gusset projecting from the base in a direction away from the open-sided form, and a support member for receiving and supporting one of the cage-forming bars in predetermined spaced relation from the open-sided form; at least some of the rebar chairs further including a depth gauge projecting in a direction away from the open-sided form and each having a free end disposed a predetermined distance beyond the associated support member; and applying shell-forming material to the open-sided form sufficient to cover each of said depth gauges, whereby the reinforcing cage is supported within the formed shell structure by predetermined spacing dimensions from outboard and inboard surfaces of the formed shell structure.

[Claim 22] A method of producing a reinforced shell structure within an open-sided form, comprising the steps of: constructing an open-sided form defining the shape of the to-be-formed shell structure; constructing a reinforcing cage from a plurality of reinforcing bars; supporting the cage relative to the open-sided form in predetermined spaced relation from the open-sided form; positioning a plurality of depth gauges relative to the cage and projecting in a direction away from the open-sided form, wherein said depth gauges each define a free end disposed a predetermined distance beyond the cage; and
applying shell-forming material to the open-sided form sufficient to cover each of said depth gauges, whereby the reinforcing cage is supported within the formed shell structure by predetermined spacing dimensions from outboard and inboard surfaces of the formed shell structure.

[Claim 23] The method of claim 22 wherein said supporting step comprises supporting the cage relative to the open-sided form by means of a plurality of rebar spacer blocks each having a base adapted to seat against the open-sided form, and a free end for supporting the cage in predetermined spaced relation to the open-sided form, and further wherein said depth gauges are carried respectively by said rebar spacer blocks.
FIG. 6