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(54) **SYSTEMS AND METHODS OF CONCRETE APPARATUS WITH INCORPORATED LIFTER**

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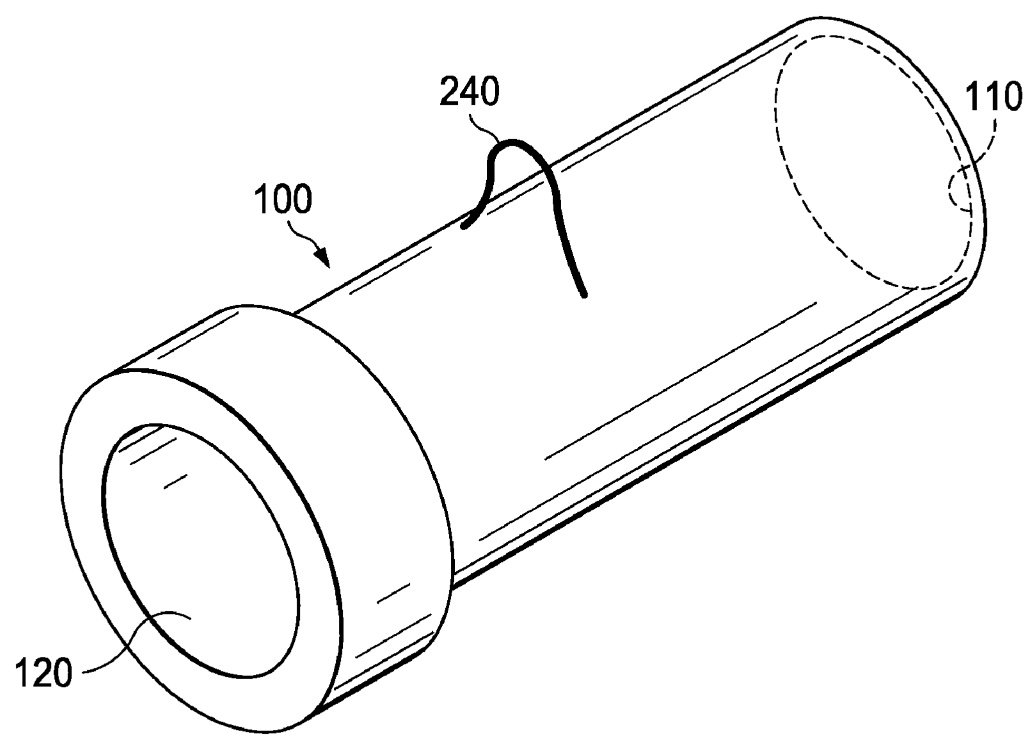
(57) **ABSTRACT**

Systems and methods for a concrete apparatus with incorporated lifter are provided. A concrete apparatus is formed by placing a reinforcement system in a mold. The reinforcement system comprises a lifter. Concrete is poured into the mold such that the lifter protrudes from the poured concrete. After the concrete has hardened and the mold is removed, the lifter is used to carry and position the concrete apparatus. After the concrete apparatus is positioned, the lifter is removed at the circumference of the concrete apparatus leaving no holes, thereby eliminating water leakage due to lifting methods.



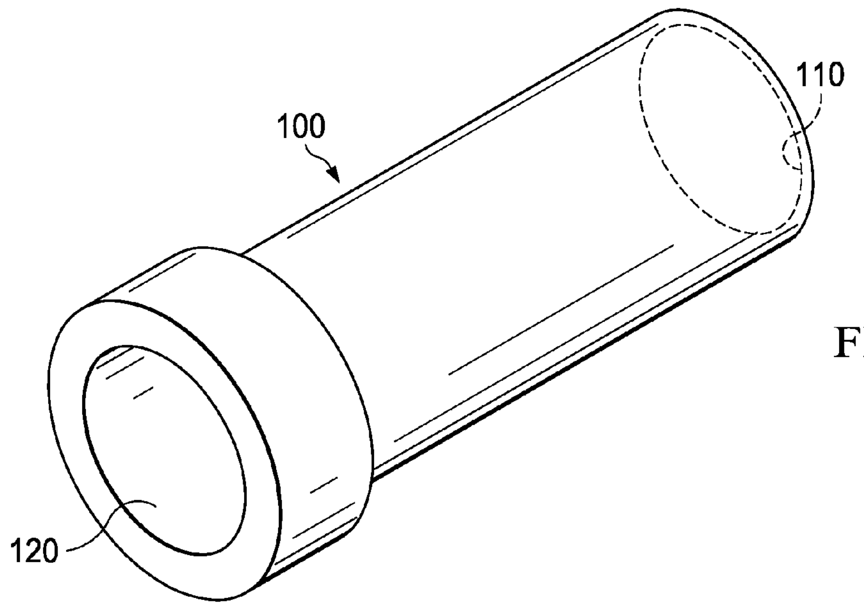



FIG. 1

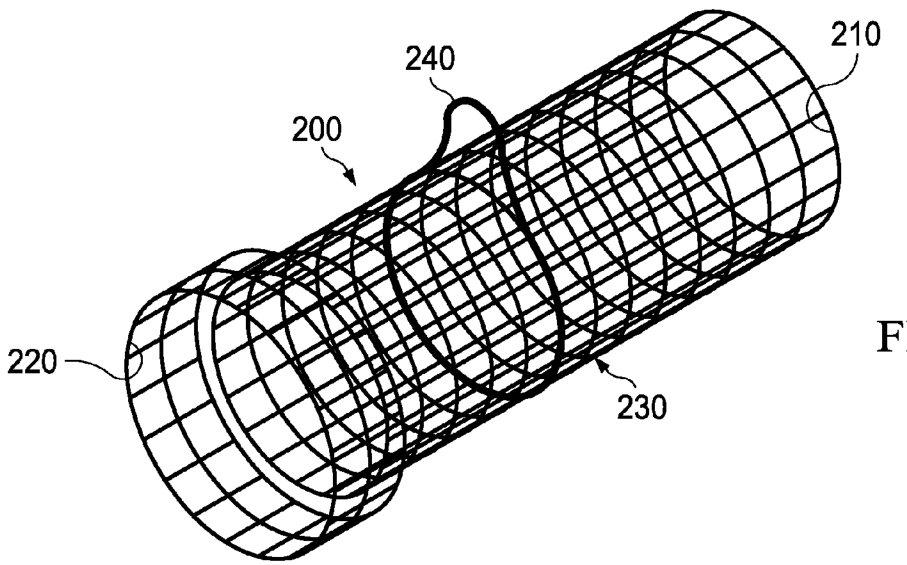



FIG. 2

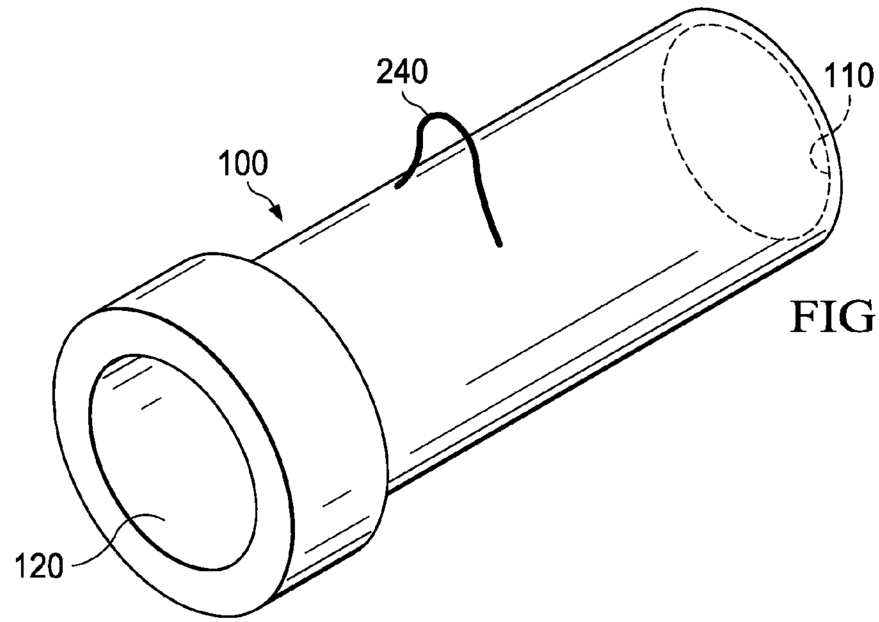



FIG. 3

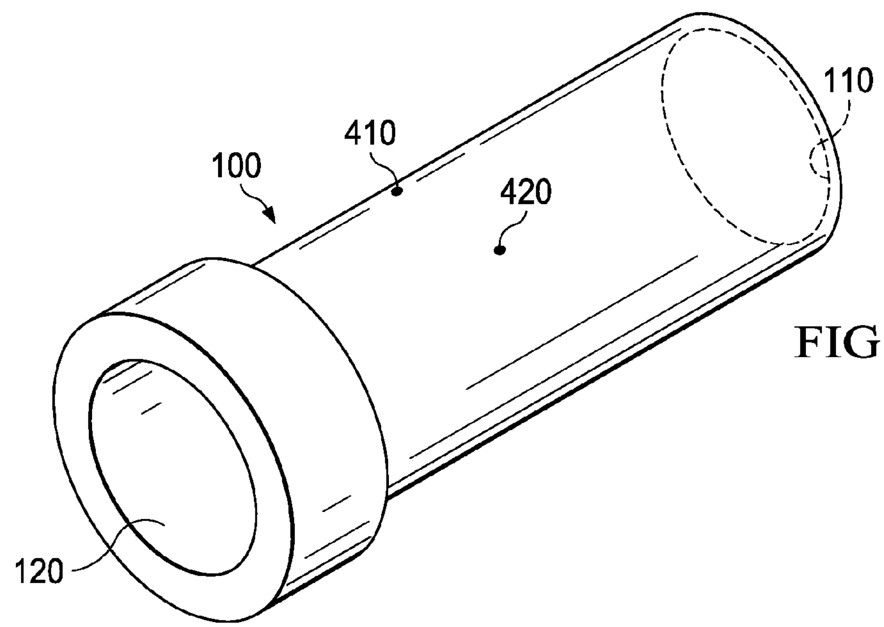



FIG. 4

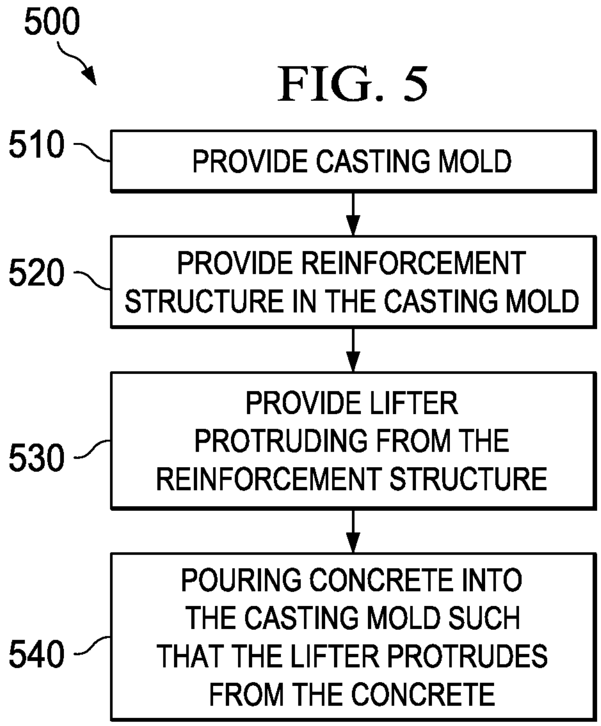

500
510
PROVIDE CASTING MOLD
520
PROVIDE REINFORCEMENT STRUCTURE IN THE CASTING MOLD
530
PROVIDE LIFTER PROTRUDING FROM THE REINFORCEMENT STRUCTURE
540
POURING CONCRETE INTO THE CASTING MOLD SUCH THAT THE LIFTER PROTRUDES FROM THE CONCRETE

FIG. 5

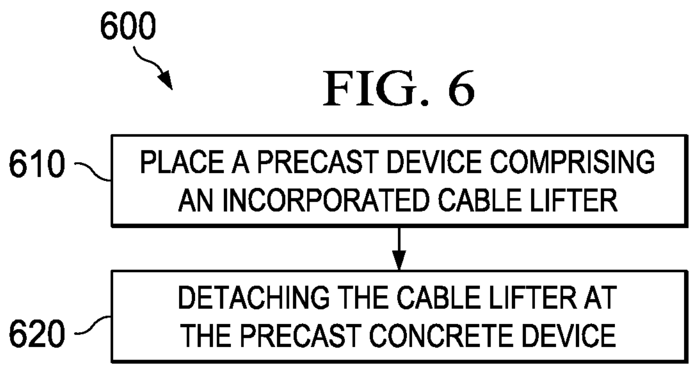

600
610
PLACE A PRECAST DEVICE COMPRISING AN INCORPORATED CABLE LIFTER
620
DETACHING THE CABLE LIFTER AT THE PRECAST CONCRETE DEVICE

FIG. 6

# SYSTEMS AND METHODS OF CONCRETE APPARATUS WITH INCORPORATED LIFTER

## CROSS REFERENCE TO RELATED APPLICATION

**[0001]** This application is a divisional application of U.S. patent application Ser. No. 12/421,337 filed on Apr. 9, 2009, entitled " Systems and Methods of Concrete Apparatus with Incorporated Lifter," which is incorporated by reference herein.

## TECHNICAL FIELD

**[0002]** The present disclosure is generally related to concrete fabrication and, more particularly, is related to precast concrete apparatus.

## BACKGROUND

**[0003]** Precast concrete is a form of construction, where concrete is cast in a reusable mold or "form" which is then cured in a controlled environment, transported to the construction site and lifted into place. In contrast, standard concrete is poured into site specific forms and cured on site. Precast stone is distinguished from precast concrete by using a fine aggregate in the mixture so the final product approaches the appearance of naturally occurring rock or stone.

**[0004]** By producing precast concrete in a controlled environment (typically referred to as a precast plant), the precast concrete is afforded the opportunity to properly cure and to be closely monitored by plant employees. Many states across the United States require a precast plant to be certified (either by NPCA or PCI) for a precast producer to supply their product to a construction site sponsored by State and Federal Departments of Transportation (DOTs).

**[0005]** Ancient Roman builders made use of concrete and soon poured the material into molds to build their complex network of aqueducts, culverts and tunnels. Modern uses for precast technology include a variety of architectural and structural applications featuring parts of or an entire building system. Precast architectural panels are also used to clad all or part of a building facade, free-standing walls used for landscaping, soundproofing and security walls. Storm water drainage, water and sewage pipes and tunnels make use of precast concrete units. The advantages of using precast concrete is the increased quality of the material, when formed in controlled conditions, and the reduced cost of constructing large forms used with concrete poured on site.

**[0006]** There are many different types of precast concrete forming systems for architectural applications, differing in size, function and cost.

## SUMMARY

**[0007]** Example embodiments of the present disclosure provides systems of concrete apparatus with incorporated lifter. Briefly described, in architecture, one example embodiment of the apparatus, among others, can be implemented as follows: a reinforcement cage; and at least one lifter, the at least one lifter an incorporated lengthened portion of the reinforcement cage.

**[0008]** Example embodiments of the present disclosure can also be viewed as providing systems of concrete apparatus with incorporated lifter. In this regard, one embodiment of such a system, among others, can be broadly summarized by the following: a concrete mold configured to accept: a reinforcement cage, the reinforcement cage comprising at least one lifter, the at least one lifter an incorporated lengthened portion of the reinforcement cage; and concrete for molding around the reinforcement cage.

**[0009]** Example embodiments of the present disclosure can also be viewed as providing systems of concrete apparatus with incorporated lifter. In this regard, one embodiment of such a method, among others, can be broadly summarized by the following: a reinforcement cage comprising at least one lifter, the at least one lifter an incorporated lengthened portion of the reinforcement cage; and a concrete mold configured to accept the reinforcement cage.

## BRIEF DESCRIPTION OF THE DRAWINGS

**[0010]** FIG. **1** is a diagram of an example embodiment of a concrete device.

**[0011]** FIG. **2** is a diagram of an example embodiment of a reinforcement structure with incorporated lifter used in the concrete device of FIG. **1**.

**[0012]** FIG. **3** is a diagram of an example embodiment of the concrete device of FIG. **1** with the lifter of FIG. **2**.

**[0013]** FIG. **4** is a diagram of an example embodiment of the concrete device of FIG. **3** with the lifter removed at the outer circumference of the concrete device.

**[0014]** FIG. **5** is a flow diagram of an example embodiment of a method of manufacturing the concrete device of FIG. **3**.

**[0015]** FIG. **6** is a flow diagram of an example embodiment of a method of using the concrete device of FIG. **3**.

## DETAILED DESCRIPTION

**[0016]** Embodiments of the present disclosure will be described more fully hereinafter with reference to the accompanying drawings in which like numerals represent like elements throughout the several figures, and in which example embodiments are shown. Embodiments of the claims may, however, be embodied in many different forms and should not be construed as limited to the embodiments set forth herein. The examples set forth herein are non-limiting examples and are merely examples among other possible examples.

**[0017]** Concrete is the world's most commonly used building material. In its simplest form, concrete may be a mixture of paste and aggregates. The material (paste) used to manufacture concrete pipe may be composed principally of cement and water, and may be used to coat the surface of the fine and coarse aggregates. The cement may be a closely controlled chemical combination of calcium, silicon, aluminum, iron, and small amounts of other compounds, to which gypsum may be added in the final grinding process to regulate the setting time of the concrete. The cement's chemistry comes to life in the presence of water. Soon after the cement and water are combined, hydration occurs and the paste hardens and gains strength to form a rock-like mass, the concrete. During hydration, a node forms on the surface of each cement particle. The node grows and expands until it links up with nodes from other cement particles or adheres to adjacent aggregates. Within this process lies the key to concrete—it's plastic and malleable when newly mixed and strong and durable when hardened.

**[0018]** The character of the concrete may be determined by the quality of the paste. The strength of the paste, in turn, may depend on the ratio of water to cement. The water-cement ratio is the weight of the mixing water divided by the weight of the cement. High-quality concrete may be produced by lowering the water-cement ratio as much as possible without sacrificing the workability of fresh concrete. Generally, using less water produces a higher quality concrete provided the concrete is properly placed, consolidated, and cured. Typically, a mix may be about 10 to 15 percent cement, 60 to 75 percent aggregate and 15 to 20 percent water. Entrained air in many concrete mixes may also take up another 5 to 8 percent.

**[0019]** Almost any natural water that is drinkable and has no pronounced taste or odor may be used as mixing water for concrete. However, some waters that are not fit for drinking may be suitable for concrete. Specifications usually set limits on chlorides, sulfates, alkalis, and solids in mixing water unless tests can be performed to determine what effect the impurity has on various properties.

**[0020]** The type and size of the aggregate mixture depends on the thickness and purpose of the final concrete product. A continuous gradation of particle sizes is desirable for efficient use of the paste. In addition, aggregates are preferably clean and free from any matter that might affect the quality of the concrete.

**[0021]** Curing may begin after the exposed surfaces of the concrete have hardened sufficiently to resist marring. Curing ensures the continued hydration of the cement and the strength gain of the concrete. Concrete surfaces may be cured by steam or water. The longer the concrete is kept moist, the stronger and more durable it will become. The rate of hardening may depend upon the composition and fineness of the cement, the mix proportions, and the moisture and temperature conditions. Most of the hydration and strength gain may take place within the first month of concrete's life cycle, but hydration continues at a slower rate for many years. Concrete continues to get stronger as it gets older.

**[0022]** Precast concrete products may be cast in a factory setting. Precast concrete products may benefit from tight quality control achieved at a production plant. Precast concrete pipe may be produced in highly controlled plant environments under rigid production standards and testing specifications. Previous methods of moving precast concrete pipe have involved leaving a hole in the precast concrete pipe, inserting a lifting means in the hole and using the lifting means to move the precast concrete pipe into position. After the precast concrete pipe was moved into position, the lifting means was removed and the hole is plugged. The hole may be a source for leaking and weakness in the precast concrete pipe. However, using the apparatus and methods of precast concrete device with incorporated lifter disclosed herein, the hole in the concrete pipe is eliminated such that the concrete pipe isn't weakened, and is actually strengthened compared to the previous lifting methods.

**[0023]** FIG. **1** provides an example embodiment of precast concrete pipe **100**. It should be noted that an example of a concrete pipe is used in this disclosure, the methods and systems disclosed herein may be applicable in any type of precast concrete device. Concrete pipe **100** is shown with a first end **120** and a second end **110**. Although this pipe is shown as a hollow pipe, the pipe could be solid, or the device could alternatively be a precast culvert, pullbox, catch basin, retaining wall, manhole sections, and building panel, as non-limiting examples. Concrete pipe **100** is shown to be straight and circular, but may be elliptical, arched, bent, and curved, as non-limiting examples.

**[0024]** FIG. **2** provides an example embodiment of reinforcement system **200**.

**[0025]** This example embodiment of reinforcement system **200** comprises reinforcement cage **230** with a first open end **220** and a second open end **210**. Reinforcement cage **230** may be constructed of steel, fiber, and fiber-reinforced plastic as non-limiting examples. Lifter **240** is incorporated to provide lifting functionality after concrete is poured around reinforcement cage **230**. Lifter **240** is placed such that lifter **240** protrudes past the outer diameter of concrete pipe **100**. Lifter **240** may be separate from reinforcement cage **230** or it may be an integrated part of reinforcement cage **230**. Lifter **240** may be incorporated into reinforcement cage **230** by interweaving in an over and under method. Lifter **240** extends out from reinforcement cage **230**, and may be a lengthened piece of reinforcement cage **230** or a slackened piece of reinforcement cage **230** as non-limiting examples. Lifter **240** may be comprised of galvanized steel or any other material which is strong enough to support the weight of concrete pipe **100**. Regarding the use of the galvanized lifter cable, the galvanized cable will not rust and it is easy to use. Additionally, no further attachments are necessary.

**[0026]** Reinforcement system **200** is placed in a concrete mold (not shown) and concrete is poured into the mold encasing reinforcement system **200**. Once the concrete is poured into the mold, lifter **240** may be folded down until the mold is removed and lifter **240** springs up for lifting. FIG. **3** provides concrete pipe **100** after the mold has been removed with lifter **240** protruding from concrete pipe **100**. Lifter **240** makes for a safe and easy way to lift, transport, and lay concrete pipe **100**.

**[0027]** After pipe **100** is laid in a desired position, lifter **240** may be left in position. In an alternative embodiment, however, lifter **240** may be removed. FIG. **4** provides concrete pipe **100** with the protruding section of lifter **240** detached at points **410**, **420** on the outer surface of concrete pipe **100**. If lifter **240** is a galvanized cable, lifter **240** may be severed with a cable cutter or other detachment means. By severing lifter **240** at the outer surface of concrete pipe **100**, lifting holes and water leakage may be reduced or substantially eliminated.

**[0028]** FIG. **5** provides a flow chart of an example embodiment of method **500** of manufacturing a concrete device with an incorporated lifter. In block **510** of method **500**, a casting mold is provided. In block **520**, a reinforcement structure is provided in the casting mold. In block **530**, a lifter is provided, the lifter protruding from the reinforcement structure. In block **540**, concrete is poured into the casting mold such that the lifter protrudes from the concrete.

**[0029]** FIG. **6** provides method **600** of using a concrete device with incorporated lifter. In block **620** a precast concrete device is placed, the precast concrete device comprising an incorporated cable lifter. In block **620**, the cable lifter is detached at the perimeter of the precast concrete device.

**1**. An apparatus comprising:

a reinforcement cage; and

at least one lifter, the at least one lifter an incorporated into a lateral side of the reinforcement cage by interweaving in an over and under method, the lifter further configured to fold down during pouring of concrete over the reinforcement cage in position in a mold and to spring up after the mold is removed.

**2**. The apparatus of claim **1**, wherein the at least one lifter is comprised of galvanized steel.

**3**. (canceled)

**4**. The apparatus of claim **1**, further comprising concrete molded around the reinforcement cage.

**5**. The apparatus of claim **4**, wherein the concrete is molded into a pipe comprising a first open end, a second open end, and a hollow interior such that, material or liquid may pass into the first open end, through the hollow interior, and out of the second open end.

**6**. The apparatus of claim **4**, further comprising a mold configured to accept the reinforcement cage and concrete to form a precast concrete structure with an integrated lifter protruding from a flush, lateral side of the concrete.

**7**. An apparatus comprising:

a concrete mold configured to accept:

a reinforcement cage, the reinforcement cage comprising at least one lifter, the at least one lifter aft incorporated into a lateral side of the reinforcement cage by interweaving in an over and under method, the lifter further configured to fold down during pouring of concrete over the reinforcement cage in position in a mold and to spring up after the mold is removed; and

concrete for molding around the reinforcement cage.

**8**. The apparatus of claim **7**, further comprising the concrete.

**9**. The apparatus of claim **8**, wherein the concrete mold is configured to mold the concrete into a pipe, such that, when hardened, the concrete forms a first open end, a second open end, and a hollow interior such that material or liquid may pass into the first open end, through the hollow interior, and out of the second open end.

**10**. The apparatus of claim **8**, further comprising the reinforcement cage.

**11**. (canceled)

**12**. The apparatus of claim **11**, wherein the at least one lifter is comprised of galvanized steel.

**13**. The apparatus of claim **11**, wherein the at least one lifter comprises a loop that protrudes from a lateral, flush side of the molded concrete.

**14**. An apparatus comprising:

a reinforcement cage comprising at least one lifter, the at least one lifter act incorporated into a lateral side of the reinforcement cage by interweaving in an over and under method, the lifter further configured to fold down during pouring of concrete over the reinforcement cage in position in a mold and to spring up after the mold is removed; and

a concrete mold configured to accept the reinforcement cage.

**15**. The apparatus of claim **14**, wherein the at least one lifter is comprised of galvanized steel.

**16**. The apparatus of claim **14**, wherein the at least one lifter protrudes from a lateral side of the concrete poured into the concrete mold.

**17**. The apparatus of claim **14**, wherein the concrete mold is configured to form a pipe comprising a first open end, a second open end, and a hollow interior such that, material or liquid may pass into the first open end, through the hollow interior, and out of the second open end.

**18**. The apparatus of claim **14**, further comprising concrete for pouring into the concrete mold.

**19**. The apparatus of claim **4**, wherein the lifter protrudes from a lateral side of the molded concrete.

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