US 20050108960A1

(19) **United States**

(12) **Patent Application Publication** (10) **Pub. No.: US 2005/0108960 A1**

Schluter (43) **Pub. Date: May 26, 2005**

(54) **POLYMER CONCRETE PIPE**

(76) Inventor: **James Schluter**, Franklin, OH (US)

Correspondence Address:
THOMPSON HINE L.L.P.
2000 COURTHOUSE PLAZA , N.E.
10 WEST SECOND STREET
DAYTON, OH 45402 (US)

(21) Appl. No.: **10/986,507**

(22) Filed: **Nov. 11, 2004**

Related U.S. Application Data

(60) Provisional application No. 60/525,506, filed on Nov. 26, 2003.

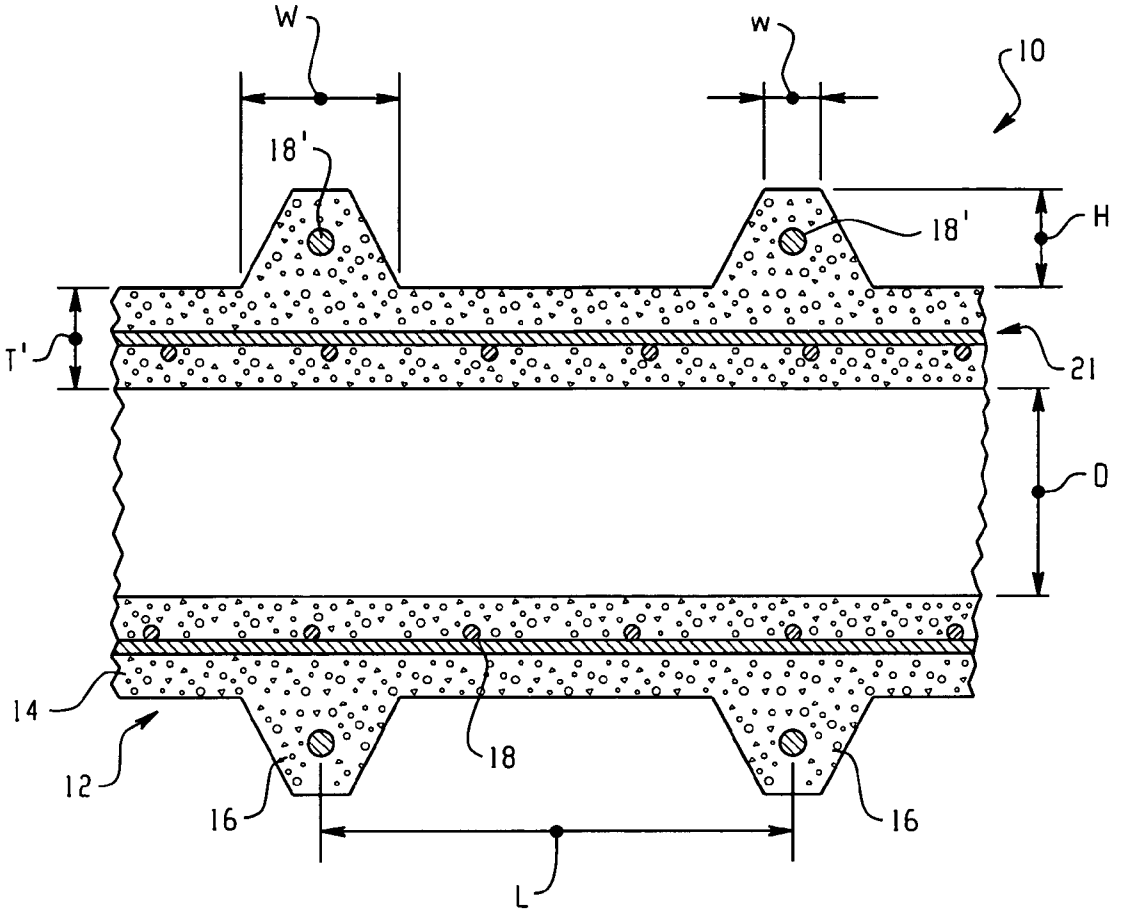
Publication Classification

(51) **Int. Cl.**[7] **E02D 1/00**

(52) **U.S. Cl.** **52/169.1**

(57) **ABSTRACT**

Polymer concrete pipe configurations may include reinforced ribs and/or void form reinforcement that displaces concrete.



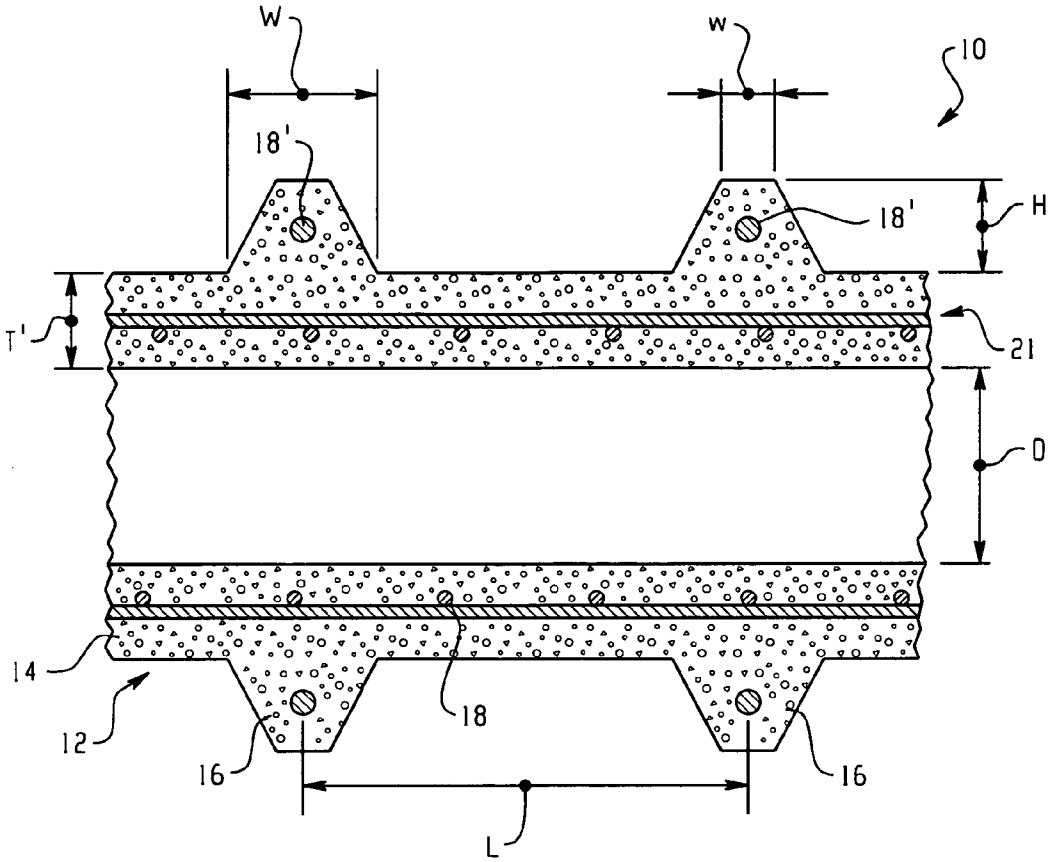


Fig. 1

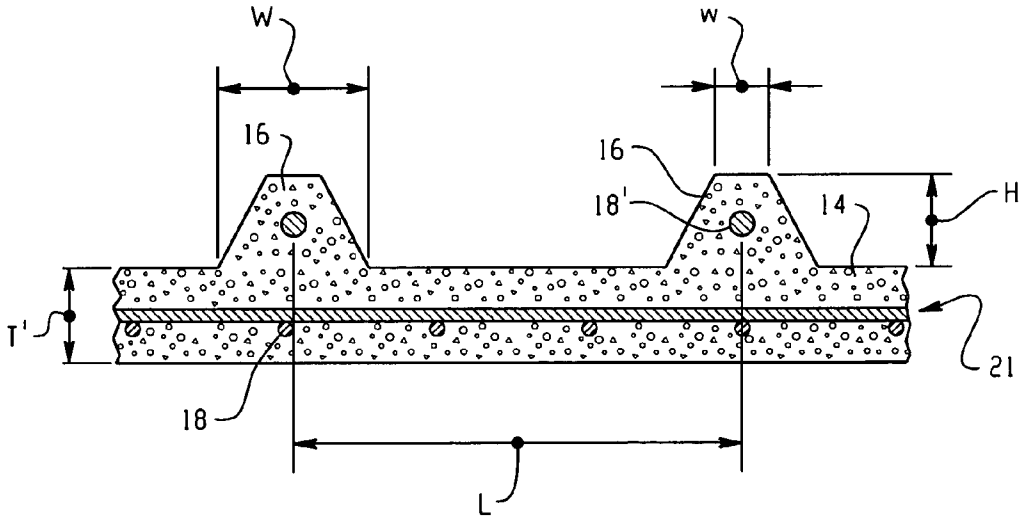


Fig. 2

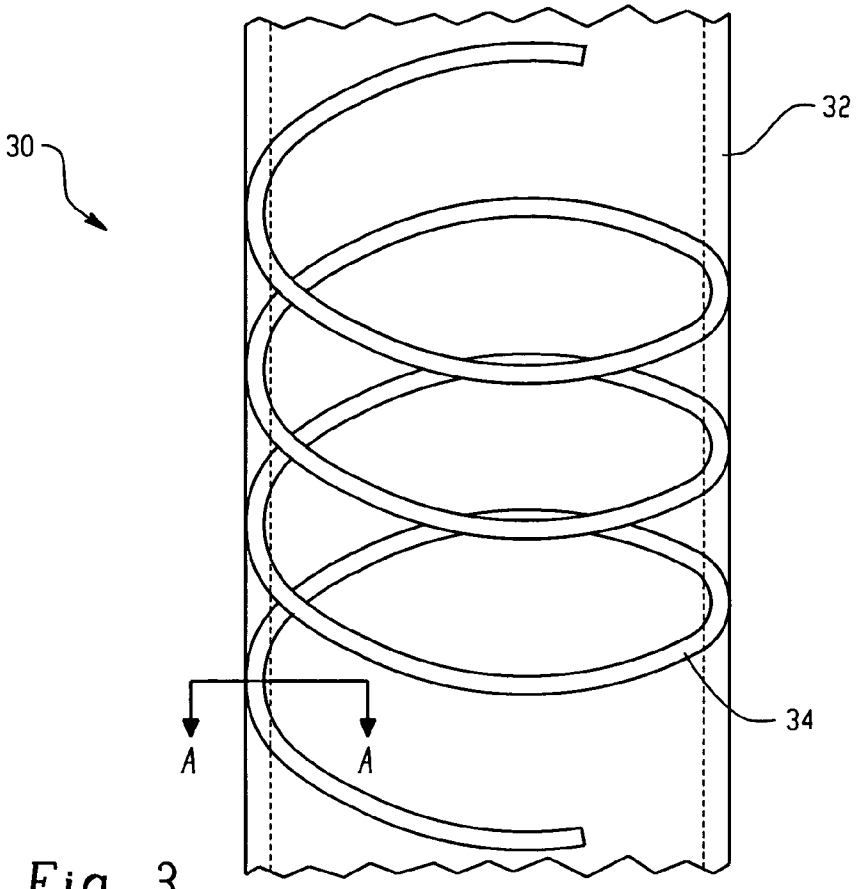


Fig. 3

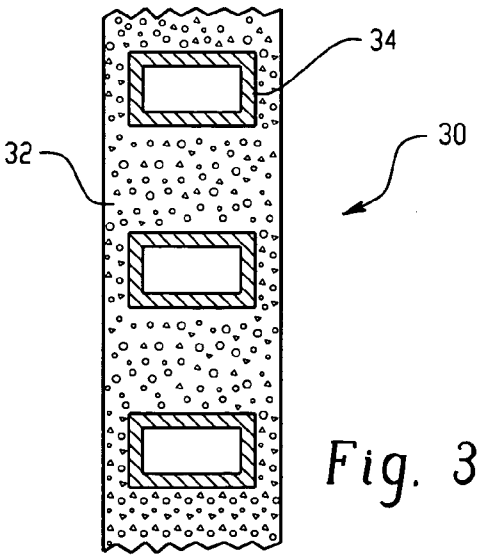


Fig. 3A

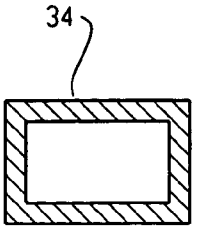


Fig. 4A

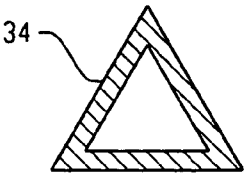


Fig. 4B

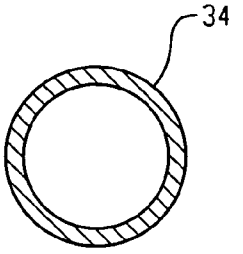


Fig. 4C

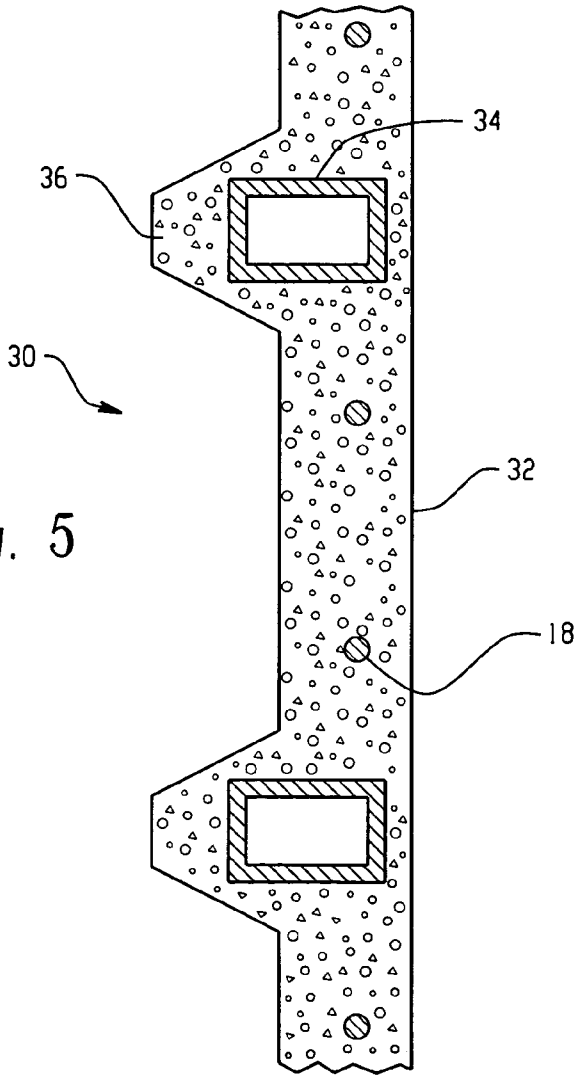


Fig. 5

POLYMER CONCRETE PIPE

CROSS-REFERENCE TO RELATED APPLICATION

[0001] This application claims the benefit of U.S. provisional application Ser. No. 60/525,506, file Nov. 26, 2003, the entire specification of which is incorporated herein by reference.

TECHNICAL FIELD

[0002] The present application relates generally to polymer concrete pipe, and more particularly to polymer concrete pipe having a cost-saving configuration.

BACKGROUND

[0003] Polymer concretes have been known and used for various purposes for some time. Examples of polymer concrete compositions include those described in U.S. Pat. Nos. 6,048,593; 6,034,155; 4,737,538 and 4,371,639.

[0004] One of the primary obstacles to widespread use of polymer concrete compositions is the cost associated with such compositions. For example, standard Portland cement concretes tend to cost about one fifth (⅕) that of a typical polymer concrete mix. To date, use of polymer concrete compositions has been mostly limited to specialized applications where the price of the structure formed of the polymer concrete composition can be justified and obtained in the marketplace. In most applications for concrete pipe, the additional cost cannot be justified in the marketplace. However, in certain concrete pipe applications it would be desirable to use pipe having the advantageous properties of polymer concrete. Those advantageous properties include added strength and exceptional chemical and corrosion resistance.

[0005] Accordingly, it would be desirable to provide a polymer concrete pipe configuration that provides the advantages of polymer concrete while at the same time reducing the impact of the high price of polymer concrete.

SUMMARY

[0006] Polymer concrete pipe configurations are formed to reduce the required amount of polymer concrete.

[0007] The details of one or more embodiments are set forth in the accompanying drawings and the description below. Other features, objects, and advantages will be apparent from the description and drawings, and from the claims.

BRIEF DESCRIPTION OF THE DRAWINGS

[0008] **FIG. 1** is a cross-section along a longitudinal axis of one embodiment of a polymer concrete pipe incorporating a series of spaced apart ribs;

[0009] **FIG. 2** is a partial cross-section along a longitudinal axis of another embodiment of a polymer concrete pipe incorporating a series of spaced apart ribs;

[0010] **FIGS. 3 and 3**A illustrate another embodiment of a polymer pipe using a reinforcing void form;

[0011] **FIGS. 4A-4C** are cross-section views of various reinforcing void form embodiments; and

[0012] **FIG. 5** is a partial cross-section along a longitudinal axis of another embodiment of a polymer concrete pipe.

DETAILED DESCRIPTION

[0013] Referring to **FIG. 1**, an exemplary polymer concrete pipe **10** has inner diameter D and includes a unitary tubular member **12** having a primary wall portion **14** and a plurality of reinforcing ribs **16** extending radially outwardly from the wall portion's periphery, positioned at selected locations along a length of the tubular member. The reinforcing ribs **16** are sized and positioned to reinforce the primary wall portion **14** and can be formed of the same polymer concrete forming the primary wall portion **14** of the tubular member **12**. The ribs may be unitary with the primary wall where the primary wall and the ribs are formed simultaneously with each other. In the example of **FIG. 1**, the ribs are generally annular in configuration.

[0014] In the illustrated embodiment of **FIG. 1**, reinforcing members **18** located in the primary wall have a solid, circular cross-section and are arranged in an overlapping cross-hatch style forming a layer or region **21** located within the primary wall portion, while reinforcing members **18'** are shaped as individual bands or rings located in the ribs **16**. Suitable materials for forming the reinforcing members include metal, such as steel, and/or fiberglass rods or strands. As will be described below, other configurations for reinforcing members are contemplated, such as helical coil forms, void forms, elliptical, triangular, rectangular cross-sections, etc. It is recognized that in some cases, such as in relatively low load carrying applications, it is possible for only the reinforcing ribs **16** to include the reinforcing member or material. It is also recognized that each rib may include more than one reinforcing member.

[0015] The reinforcing members are arranged to carry tension and compression forces. The area of concrete that can be replaced by 1 square inch of reinforcement is generally determined by the ratio of the Young's modulus of the two materials. With steel reinforcements for example, this ratio is expressed in E steel/E concrete, which in the case of polymer concrete can be in the range of 15 to 30, as compared to normal Portland cement concrete where the ratio is typically in the range of 7 to 10. Even though steel is roughly three (3) times as expensive as polymer concrete on a per pound basis and roughly nine (9) times more expensive by volume, the savings can be significant.

[0016] Referring still to **FIG. 1**, by utilizing ribs with reinforcing members **18'** formed of reinforcing steel, polymer concrete pipe **10** having a primary wall thickness of ¾ T can be provided with strength characteristics comparable to a smooth walled concrete pipe having a wall thickness of T, but at a reduction in required concrete of about 20 percent or more (in some embodiments, about 30-40 percent). This reduction in the amount of required concrete can decrease the cost of the polymer concrete pipe **10** as compared to a comparable strength smooth walled pipe.

[0017] In one example, a pipe has an inner diameter D of about 48 inches, a primary wall thickness T' is about 2 inches and the reinforcing ribs **16** are (i) spaced apart a length L of approximately 12 inches, (ii) raised from the wall portion **14** a height H of approximately 1.5 inches and (iii) tapered, having a base width W of about 3 inches and a top width w of about 1.5 inches, (resulting in a trapezoidal-shaped cross-

section. **FIG. 2** shows a partial cross-section (wall and ribs only) for another example of ribbed polymer concrete pipe having a 96 inch inner diameter and a primary wall thickness T' of about 2.5 inches. The ribs **16** are spaced apart a length L of approximately 12 inches, are raised from the wall portion **14** a height H of approximately 2.5 inches, are tapered, having a base width W of about 4 inches and a top width w of about 1.5 inches. In both illustrated examples of **FIGS. 1 and 2**, the primary wall portion **14** is cylindrical (both at its inner and outer surfaces), particularly right circular, and the ribs **18** extend circumferentially about the primary wall portion. However, other configurations for the primary wall portion are contemplated, including non-cylindrical pipe shapes and arch shapes (for one or both of the inner and outer surfaces). Accordingly, many variations are possible.

[**0018**] Reinforcing ribs **16** may be spaced and sized as necessary to provide the needed reinforcement in the exterior of the pipe. Besides bending tension, the reinforcement in the reinforcing rib carries the bending and ring compression loads that otherwise would have been at least partially carried by the polymer concrete portion that, in a smooth walled pipe, would fill the "valley" (void space) **35** between the ribs.

[**0019**] Referring now to **FIGS. 3 and 5**, exemplary polymer pipe configurations using void form reinforcing members **34** (**FIGS. 4A-4C**) are shown. In the case of each example, a unitary tubular member **30** is formed of polymer concrete and has a wall **32**. A void form reinforcing member **34** is located in the wall to displace polymer concrete and to provide compressive and tensile strength. In **FIGS. 3 and 3**A, the reinforcing member **34** is helically wound to form a coil having a relatively open, constant pitch with polymer concrete disposed between the individual turns. As above, the void form reinforcing member can be of any suitable configuration that provides the requisite reinforcement for the wall. In another example, a polymer concrete pupe such as that shown in **FIGS. 3 and 3**A could utilize a solid, rod-type reinforcing member in place of a void form reinforcing member.

[**0020**] In **FIG. 5**, the wall **32** includes a primary wall portion **40** and circumferential ribs **42**, but a helical rib could also be used, in which case void form reinforcing member **34** could also be helical. In some cases, and as shown by **FIGS. 3 and 3**A, a rib may not be included.

[**0021**] The void form reinforcing members can be tubular metal such as steel, or possibly tubular fiberglass. Other variations might be used. Referring also to **FIGS. 4A-4C**, the void form may have a cross-section that is rectangular, triangular, round, or some other shape.

[**0022**] Any suitable polymer concrete material can be used to form the polymer concrete pipe. Examples of potentially suitable polymer concrete material are described in U.S. Pat. Nos. 6,048,593; 6,034,155; 4,737,538 and 4,371,639, the disclosures of which are hereby incorporated by reference as if fully set forth herein.

[**0023**] It is to be clearly understood that the above description is intended by way of illustration and example only and is not intended to be taken by way of limitation. Other changes and modifications could be made, including both narrowing and broadening variations of the previously described embodiments and examples.

What is claimed is:

1. A polymer concrete pipe, comprising:

a unitary tubular member formed of polymer concrete and having a primary wall portion with a plurality of outer ribs projecting therefrom and extending therearound, the ribs formed of the polymer concrete and spaced apart along a length of the tubular member; and

a reinforcing member forming a discrete reinforcing region encased by the polymer concrete and localized in one of said ribs.

2. The polymer concrete pipe of claim 1 further comprising a second reinforcing member forming a second discrete reinforcing region encased by polymer material and localized in the primary wall portion.

3. The polymer concrete pipe of claim 1 wherein the ribs are spaced equidistant from each other.

4. The polymer concrete pipe of claim 1 wherein the primary wall portion is substantially cylindrical.

5. The polymer concrete pipe of claim 4 wherein the ribs extend circumferentially around the primary wall portion.

6. The polymer concrete pipe of claim 5 wherein the reinforcing member extends circumferentially with the rib.

7. The polymer concrete pipe of claim 6 wherein the reinforcing member has an inner diameter greater than an outer diameter of the wall portion.

8. The polymer concrete pipe of claim 1 wherein the reinforcing member comprises steel.

9. The polymer concrete pipe of claim 1 wherein the primary wall portion is non-cylindrical.

10. The polymer concrete pipe of claim 1 wherein each rib includes a respective reinforcing member forming a discrete reinforcing region encased by polymer concrete and localized within said rib.

11. A polymer concrete pipe, comprising:

a unitary tubular member formed of polymer concrete and having a primary wall portion with a plurality of ribs projecting therefrom and extending therearound, the ribs spaced apart along a length of the tubular member;

at least one layer of reinforcing steel within the primary wall portion; and

each projecting rib including at least one piece of reinforcing material arranged therein to carry tension and compression forces.

12. The polymer concrete pipe of claim 11 wherein the ribs extend circumferentially around the primary wall portion.

13. The polymer concrete pipe of claim 12 wherein the reinforcing material in each rib extends circumferentially with the rib.

14. A method for manufacturing a polymer concrete pipe, comprising:

placing a reinforcing member and polymer concrete into a pipe form to produce, when cured, a polymer concrete pipe having a primary wall portion with a plurality of ribs projecting outwardly therefrom and extending therearound, the ribs spaced apart along a length of the pipe, the reinforcing member forming a discrete reinforcing region encased within polymer concrete and localized in one of said ribs to carry compression and tension forces.

15. A method for manufacturing a polymer concrete pipe having strength comparable to a reference polymer concrete pipe having smooth walls, a thickness of X inches, and a length the same as the reference polymer concrete pipe utilizing polymer concrete having the same properties as polymer concrete of the reference polymer concrete pipe, the method comprising:

producing the polymer concrete pipe with a primary wall portion of a thickness of no more than ¾ X inches;

providing the polymer concrete pipe with a series of reinforcing ribs formed of the polymer concrete and extending from the outer side of the primary wall portion, each of ribs extending about the primary wall portion and including a reinforcing member forming a discrete reinforcing region encased by the polymer concrete and localized in an associated rib, the reinforcing member arranged to carry tension and compression forces;

wherein an amount of polymer concrete in the polymer concrete pipe is no more than eighty percent (80%) of an amount of polymer concrete in the reference polymer concrete pipe.

16. The method of claim 15 wherein the primary wall portion is produced to include a second reinforcing member forming a second discrete reinforcing region encased by the polymer concrete and localized in the primary wall portion.

17. A method for manufacturing a polymer concrete pipe having strength comparable to a reference polymer concrete pipe having smooth walls, a thickness of X inches and a layer of reinforcing steel near an inner side of the pipe, the polymer concrete pipe having a length the same as the reference polymer concrete pipe utilizing polymer concrete having the same properties as polymer concrete of the reference polymer concrete pipe, the method comprising:

producing the polymer concrete pipe with a primary wall portion of a thickness of no more than ¾ X inches, the primary wall portion including at least one layer of reinforcing material;

providing the polymer concrete pipe with a series of reinforcing ribs extending from the outer side of the primary wall portion, each of ribs extending about the primary wall portion and including one piece of reinforcing material arranged therein to carry tension and compression forces;

wherein an amount of polymer concrete in the polymer concrete pipe is no more than eighty percent (80%) of an amount of polymer concrete in the reference polymer concrete pipe.

18. A polymer concrete pipe, comprising:

a unitary pipe member formed of polymer concrete and having a wall;

a reinforcing void form located in the pipe member to displace polymer concrete and to provide reinforcement to carry compressive and tensile stresses.

19. The polymer concrete pipe of claim 18 wherein the reinforcing void form is helically wound within the wall.

20. The polymer concrete pipe of claim 18 wherein the reinforcing void form comprising tubular steel has a cross-section that is round, triangular or rectangular.

21. The polymer concrete pipe of claim 18 wherein the reinforcing void form comprises tubular metal or tubular fiberglass.

22. The polymer concrete pipe of claim 20 wherein the wall includes a primary wall portion and a helical rib portion, the reinforcing void form is located at least partially in the helical rib portion.

23. The polymer concrete pipe of claim 20 wherein the reinforcing void form comprises a series of spaced apart, circumferentially extending tubular members.

24. A polymer concrete pipe, comprising:

a unitary pipe member formed of polymer concrete and having a primary wall portion defining an elongated pipe axis, and an outer rib extending helically relative to the pipe axis;

a reinforcing member located in the outer rib to provide reinforcement to carry compressive and tensile stresses.

25. The polymer concrete pipe of claim 24 wherein the reinforcing member comprises a void form member.

26. The polymer concrete pipe of claim 24 wherein the reinforcing member comprises a solid, rod-type member.

27. A method for manufacturing a polymer concrete pipe, comprising:

placing at least one reinforcing void member within a pipe form,

introducing polymer concrete into the pipe form, whereby the presence of the reinforcing void form member displaces polymer concrete.

* * * * *