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J. H. SHERRARD

1,910,643

CONCRETE PIPE, POLE, COLUMN, AND THE LIKE

Filed Aug. 22, 1930

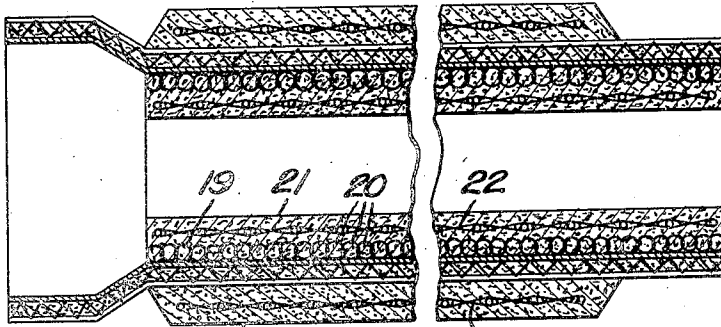


FIG. 1.

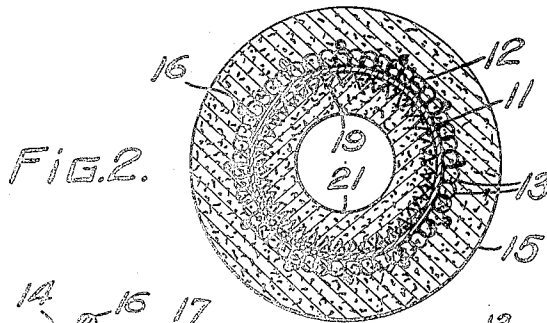


FIG. 2.

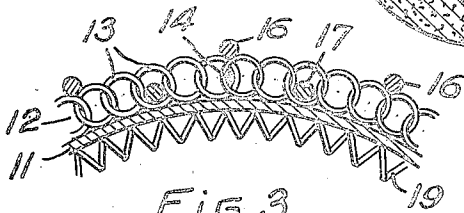


FIG. 3.

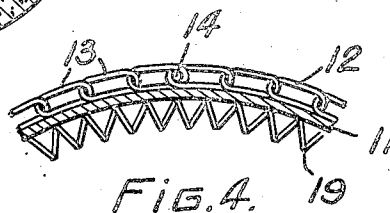


FIG. 4.

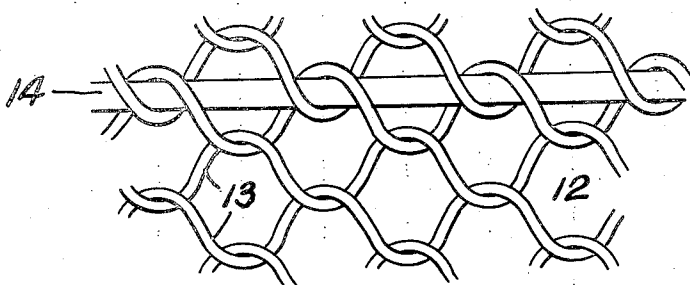


FIG. 5.

Inventor
J. H. Sherrard
By *R. W. Allen*
Attorney.

UNITED STATES PATENT OFFICE

JAMES H. SHERRARD, OF WESTMOUNT, QUEBEC, CANADA

CONCRETE PIPE, POLE, COLUMN, AND THE LIKE

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This invention relates broadly to improvements in pipes, columns, poles and like structures and to the process of making same, and relates more particularly to such structures composed of reinforced concrete or other matter capable of hardening from an initial plastic condition, and the primary object of the invention is to provide strong, durable and relatively inexpensive structures as aforesaid which may be manufactured easily and quickly. A further object is to provide a novel form of reinforcement for concrete or similar structures of the types mentioned which may easily, quickly and accurately set in place and which will afford a very secure bond for the concrete. A still further object is to provide structures having great girder strength and capable of withstanding relatively high internal pressures. Various other objects and the advantages of the invention may be ascertained from the following description and the accompanying drawing.

According to the present invention, a thin walled sheet metal tubular core is provided, the strength of the core being insufficient to withstand the stresses to which the finished structure will be subjected. The core is provided externally or internally or both externally and internally with a layer of reinforcing fabric presenting a multitude of loops or links in which concrete or other material may engage and thereby be connected to the core. The fabric is preferably composed of a series of interlinked helically formed rods or wires connected at intervals to the core or entirely separate therefrom according to circumstances. Additional non-helical reinforcing members may be provided and connected as desired to the reinforcing fabric or to the core. The reinforced core may be lined or filled, according to the purpose of the structure, with concrete or other suitable material and externally covered with concrete or other suitable material, the lining and covering being reinforced if desired.

The invention contemplates embodiment of the central idea and some or all of the details thereof in the manufacture of a variety of articles such as beams, columns,

piles, pipes, poles and other similar structures but for brevity and facility of explanation the following description will be largely confined to the embodiment of the invention in the manufacture of pipes.

In the accompanying drawing which illustrates the chosen embodiment of the invention but to the details of which the invention is not confined;—

Fig. 1 is a central longitudinal sectional view of a pipe constructed according to the invention.

Fig. 2 is a cross sectional view of the pipe shown in Figure 1.

Fig. 3 is a fragmentary cross sectional view of the core and reinforcing on an enlarged scale.

Fig. 4 is a view similar to Figure 3 illustrating a slightly modified form of reinforcing.

Fig. 5 is a plan view of a fragment of the reinforcing fabric.

Referring more particularly to the drawing, 11 designates a tubular core preferably formed of relatively thin sheet metal bent to the desired shape and having the edges thereof riveted, seamed or welded together. In the manufacture of pipes, it is preferred the core should be fluid tight but this characteristic is not of importance in other structures. The strength of the core is preferably less than will withstand the stresses which the finished structure is designed to withstand. By way of example, it may be stated it is now preferred to make the cores for pipes three to four feet in diameter out of sheet metal approximately one-sixteenth of an inch thick but it will be understood there is no limitation to this thickness of metal as cores may be made of metal either thinner or thicker for these sizes of pipes as well as for pipes of smaller and larger diameters. While the core is, for pipes, preferably cylindrical, it will be understood there is no limitation to this form, as other cross-sections may be adopted.

The core is externally reinforced by a layer of metal fabric designated 12. This fabric is composed of a series of suitably hard helically formed rods or wires 13, the

helices of which are of any suitable pitch and are interlaced as clearly shown in Figures 3 and 5. The fabric may be preformed and applied to the core as hereinafter described or may be formed upon the core. The fabric is preferably arranged with the axes of the helical members parallel with the axis of the core. It will be readily seen that in this arrangement, the fabric is very flexible circumferentially of the core, so that it may be wrapped around the core substantially without resistance but is substantially inelastic circumferentially of the core, so that it may be heavily tensioned without causing material elongation. The low factor of elasticity is due to the fact that the interlinked helical members constitute in effect a series of chains extending circumferentially of the core, as will be clearly seen from Figures 2, 3 and 4. Where it is desired to have the fabric in great tension circumferentially of the core, the helices may be flattened as shown in Figure 4. The effect of tension in the fabric circumferentially of the core is a tendency to reduce the pitch of the helices and in applying the fabric to the core this tendency is resisted by fixing the ends of the helical members to the ends of the core, so that no relief of circumferential tension will occur. The meeting edges of the fabric may be readily connected by interdigitating the helices of the two edges and passing a rod 13 through them, as shown in Figures 3, 4 and 5. In addition to the fixing of the ends of each helical member to the ends of the core, the fabric may be and preferably is rigidly connected to the core at a plurality of points in the circumference and in the length of the structure by welding, brazing or other suitable means, so as to prevent the fabric moving locally relatively to the core. The fabric forms an excellent bond with concrete or other cementitious material by reason of the material engaging in the multitude of helices. When the material is so engaged in the helices, it will prevent flattening of the same due to increase of tension circumferentially of the structure and will likewise prevent any change in the pitch of the helices which would relieve the tension.

The reinforced core is covered with a layer of cement concrete or other suitable material 15 applied by moulding or plastering on and, if necessary or desired, consolidated by pressure or vibration applied in any suitable way. This constitutes the primary and most simple form of pipe according to this invention.

If it is desired to impart greater girder strength to the pipe, longitudinal reinforcing bars 16 may be provided outside the fabric 12 and welded, brazed or tied thereto. Also, as alternative to the bars 15 or as additional thereto, longitudinal bars 17 may be threaded through the helical members and

welded or brazed to the core or to the helical members or to both. The covering of concrete or other material may, if desired, be provided with reinforcing 18 embedded therein to retain the covering in place in the event of fracture such as would otherwise permit separation thereof from the reinforced core.

A layer of fabric 19 which may be and preferably is similar to the outer layer 12 may be provided within the core 11. When the inner layer of fabric 19 is of the type already described, it is preferred to arrange the same so that the helically formed members 20 of which it is composed extend circumferentially of the core, i. e., at right angles to the similar members of the outer layer 12. In this disposition, each helical member is bent to the curvature or other form of the core and, by reason of tendency to return to normal flat form, presses outwardly against the inner surface of the core. The inner layer of fabric may be connected to the core at intervals in its length and circumference by welding, brazing, or other suitable means. A lining 21 of concrete or other suitable material may be provided in which the fabric layer 19 is embedded. This lining 21 may be provided with reinforcement 22 independently of the fabric layer 19. Alternatively, the lining of concrete or other material may be provided without the prior provision of the inner fabric layer 19.

The ends of the pipes may be formed in any suitable or conventional manner to permit joining together. For example, one end of the core may be enlarged to internal diameter greater than the outside diameter of the core and reinforcement so as to permit the ends of the pipes to be telescopically assembled.

Various methods of manufacture may be adopted. The outer fabric 12 may be wrapped around the core under suitable tension and its edges connected by the rod 16 or the edges of the fabric may be first connected and the core then thrust into the tube of fabric thus formed. In either of these methods, the fabric may be compressed in longitudinal direction of the core, so as to render the operation easy and the fabric then tensioned in the longitudinal direction of the core so as to contract it circumferentially upon the core and thus obtain the desired circumferential tension. The fabric may be manufactured in seamless tubular form and the core thrust into the fabric, the longitudinal tension being applied after or during insertion of the core. The reinforcing fabric 12 may be applied to the empty core which may be supported on a mandrel or the core may be first lined with concrete, with or without the inner layer of fabric 19, so as to have stiffness sufficient to enable the outer fabric to be heavily tensioned thereon.

Alternatively, the fabric 12 may be formed around the core. In the formation of the lining it is preferred, if the nature of the lining material permits, to consolidate the lining material by centrifugal means in any of the known or any other suitable manner. The outer covering 15 may be plastered on or formed in a mould, consolidation of the material being effected by pressure, vibration, or other known or suitable method.

In the manufacture of columns, piles and the like according to the invention, the process may be similar in general to that already described. In the columns or piles themselves, it is preferable that the concrete filling extend beyond the ends of the core or that suitable pediments and caps fitting inside the core be used so as to avoid placing the core in longitudinal compression, the function of the core and its reinforcement being to resist bursting stresses in the concrete filling when the filling is under longitudinal compression.

Pipes capable of withstanding high internal pressure without leaking may be produced according to this invention if the reinforcing fabric is applied under sufficient tension and, in the case of a concrete lined pipe, after the lining is placed in the core.

Having thus described my invention, what I claim is:—

1. A composite pipe, column and the like structure subject to bursting stress comprising a thin-walled metal core and an external metal reinforcing fabric tensioned around the core and rigidly attached to the core independently of the tension of said fabric, said reinforcing fabric being composed of a series of helically formed members disposed axially lengthwise of the structure, the helices of adjoining members being interlinked and constituting substantially inelastic binding elements extending circumferentially of the core, and a covering of cementitious material entering into the interstices of the fabric and being thereby retained even in the event of fracture, independently of any other reinforcement.

2. A structure according to claim 1, in which the reinforcing fabric is tensioned circumferentially and longitudinally of the core.

3. In combination with a structure according to claim 1, a series of reinforcing rods disposed longitudinally of the core and rigidly connected to the reinforcing fabric and imparting girder strength to the structure.

4. In combination with a structure according to claim 1, a layer of fabric, similar to the outer reinforcing fabric, located within the core, a lining of cementitious material in which the helices of the inner fabric are embedded.

5. In combination with a structure according to claim 1, a layer of fabric, similar to

the outer reinforcing fabric, located within the core and disposed with the helical members thereof extending circumferentially of the core, and a lining of concrete or other suitable material in which the helices of the inner fabric are embedded.

6. In a structure subject to bursting stress, a thin-walled metal core and an external reinforcing fabric surrounding the core and rigidly attached thereto and composed of a series of helically formed members extending longitudinally of the core, the helices of said members being interlinked and constituting substantially inelastic elements extending circumferentially of the core, the fabric being tensioned longitudinally and circumferentially of the core, a rigid lining within the core supporting the circumferential tension of the outer reinforcing fabric and an outer protective covering of rigid cementitious material engaging in the interstices of the fabric with cover retaining and fabric supporting effect.

7. A structure including a thin-walled metal core, outer and inner layers of metal fabric in contact with the core and composed of parallel helically formed members, the helices of each member being interlinked with the helices of the adjoining members, the helical members of the outer layer being disposed longitudinally of the core and the helical members of the inner layer being disposed circumferentially of the core and outer and inner coverings in which the helices of the fabric layers are embedded with cover retaining effect.

8. In combination with a structure according to claim 7, nonhelical reinforcing bars extending longitudinally of the core and embedded in the covering material.

9. In combination in a composite pipe, column and like structure, a thin-walled metal core and an external metal reinforcing fabric encircling the core, said fabric being composed of a series of helically formed members disposed axially lengthwise of the structure, the helices of adjoining members being interlinked and constituting core encircling elements adapted for engagement in a covering material applied in plastic state with cover retaining effect upon said material when hard and adapted to be supported, by said covering material when hard, against flexion such as would produce elongation of the encircling elements by pressure within the structure.

10. In combination in a composite pipe, column and like structure subject to bursting stress, a core, metal reinforcement for said core comprising a series of helically formed members disposed longitudinally of the structure, the helices of adjoining members being interlinked and constituting core encircling elements, said helices tending to be distorted by pressure within the structure

acting radially outwardly, and a covering of hard material in which the helices of the reinforcement are embedded with cover retaining effect, said helices being supported by the covering against distortion as aforesaid and operating, when subject to forces tending to cause distortion as aforesaid, to exert inwardly acting pressure on the covering material within them.

10 In witness whereof, I have hereunto set my hand.

JAMES H. SHERRARD.

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