April 26, 1932. C. OLDER 1,855,807

CONCRETE PIPE REENFORCEMENT

Filed March 25, 1931 2 Sheets-Sheet 1

Fig. 1.

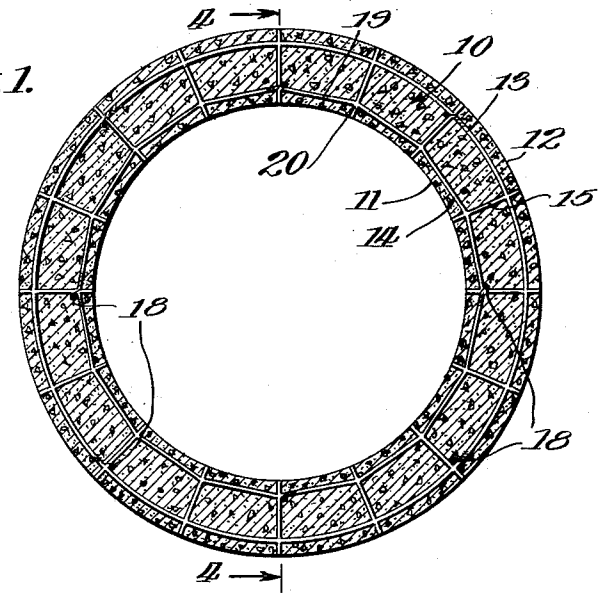


Fig. 2.

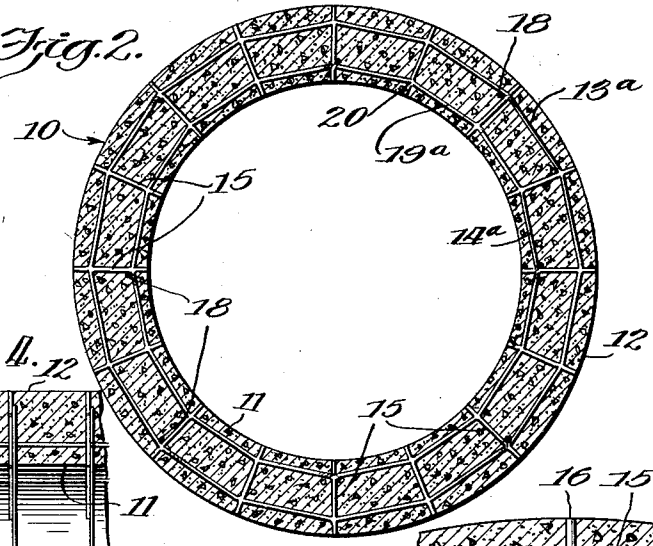


Fig. 4.

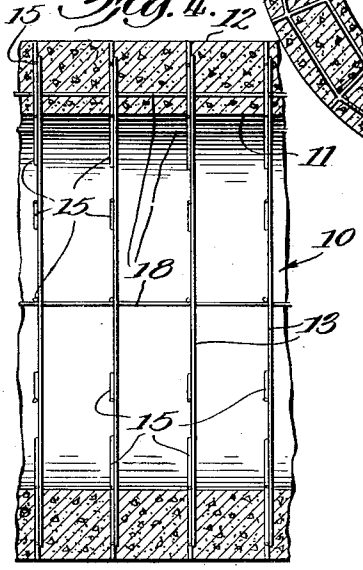
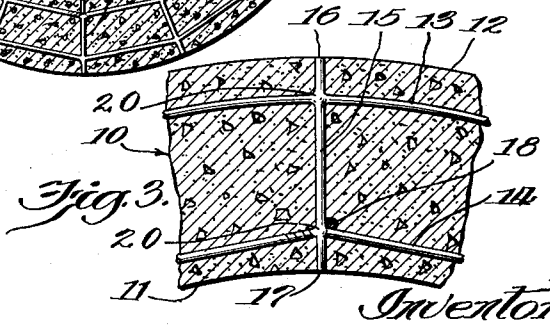


Fig. 3.



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Fig. 5.

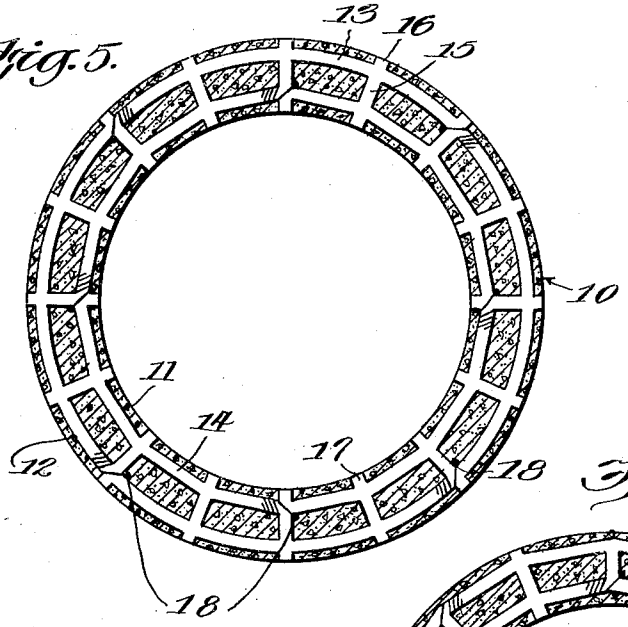


Fig. 6.

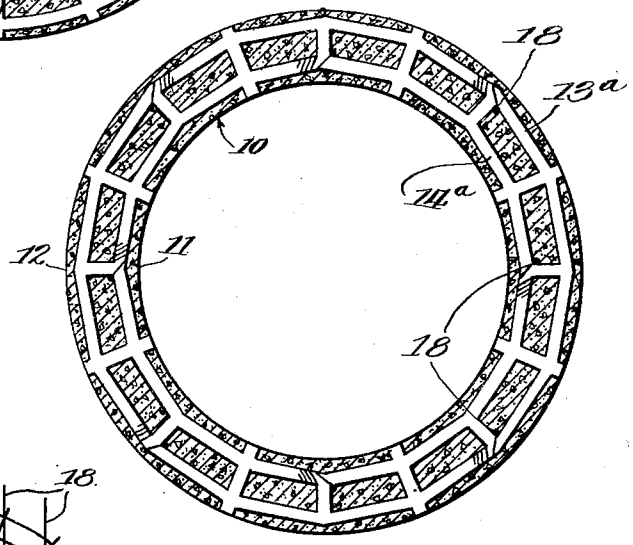
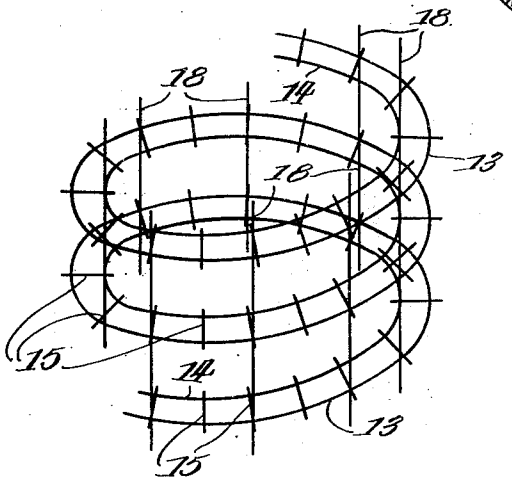


Fig. 7.



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UNITED STATES PATENT OFFICE

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CONCRETE PIPE REENFORCEMENT

Application filed March 25, 1931. Serial No. 525,121.

The present invention relates to concrete pipe reenforcement, and is particularly concerned with an improved reenforcement primarily intended to prevent the scaling off of the pipe on the inside when the pipe and reenforcement are subjected to a load.

In the devices of the prior art, every reenforcement for pipes of which I am aware, has been provided with some form of arcuate or curved members disposed adjacent the inner surface of the pipe and adapted to be placed in tension when a transverse load is placed on the pipe. When an unequally distributed transverse load is placed on a section of the pipe of the prior art, the outer hoops or bands of reenforcement are placed in compression beneath the point of load, and the inner hoops at that point are placed in tension. As a result, the inner curved hoops of the prior art tend to straighten out under tension, and it is this straightening action of the inner curved hoops which results in the scaling off of the concrete inside the pipe and below the point of application of force.

One of the objects of the invention is the provision of an improved concrete pipe having a reenforcement from which members, which might cause inside scaling of the concrete have been eliminated.

Another object is the provision of an improved concrete pipe reenforcement having elements disposed adjacent the inner pipe surface and adapted by their tension to resist breaking forces transverse to the pipe, without causing scaling of the concrete from the inside of the pipe.

Another object is the provision of an improved concrete pipe reenforcement which is peculiarly adapted to be automatically located in proper position in the pipe forms by engagement with the forms.

Another object is the provision of an improved concrete pipe reenforcement which is adapted to be manufactured and shipped very economically, by virtue of the fact that the reenforcement may be collapsed into compact form for shipment.

Another object is the provision of an improved concrete reenforcement in which all of the elements are better adapted and located to withstand the strains placed upon them when a transverse load is placed on the pipe and which, therefore, facilitates a more economical use of steel and concrete.

Another object is the provision of a plurality of species of concrete reenforcement, each of which has advantages peculiar to the particular structure and arrangement of its elements.

Other objects and advantages of the invention will be apparent from the following description and from the accompanying drawings, in which similar characters of reference indicate similar parts throughout the several views.

Referring to the drawings of which there are two sheets;

Fig. 1 is a transverse sectional view taken on a plane at right angles to the axis of a concrete pipe constructed with my improved reenforcement.

Fig. 2 is a similar view of a modification in which both of the peripheral reenforcing members are polygonal in form.

Fig. 3 is a larger fragmentary sectional view showing the welded joints of a portion of the reenforcement of Fig. 1.

Fig. 4 is a longitudinal sectional view taken on the plane of the line 4—4 of Fig. 1.

Fig. 5 is a view similar to Fig. 1 of another modification in which the reenforcement has been manufactured out of sheet metal.

Fig. 6 is another similar view of another modification of sheet metal type of reenforcement.

Fig. 7 is a diagrammatic line drawing in perspective showing a helical arrangement for the reenforcement by means of which the reenforcement may be collapsed to a coil for shipment.

Referring to the drawings, Fig. 1 is a sectional view of a concrete pipe to be used for water, sewer or culvert pipe embodying one form of my improved concrete reenforcement. It should be understood that the concrete pipe may take any desired shape, but is ordinarily substantially round pipe with a cylindrical inner and outer surface. Many of the advantages of the present invention may be realized, however, in using the reen-

forcement with pipes of different shape, providing the reenforcement is arranged as described herein.

The pipe in Fig. 1 is indicated in its entirety by the numeral 10, and the ordinary form of pipe is provided with the inner cylindrical surface 11 and outer cylindrical surface 12. The reenforcement preferably consists of a plurality of outer peripherally extending members 13 and a plurality of peripherally extending members 14, joined together by tie bars 15.

The tie bars 15 are illustrated in greater detail in Fig. 3, and they may consist of short rods or bars of metal having a length substantially equal to the thickness of the pipe wall 10, so that the ends 16 and 17 of the tie bars 15 appear at the surface of the concrete or project slightly from the surface of the concrete to engage the concrete forms. The tie bars 15 are preferably fixedly secured to the inner and outer peripherally extending members 13, 14, by welding the joint where the tie bars 15 cross the members 13, 14, and the weld should preferably be so formed that the tie bars or rods 15 are integrally joined with the members 13 and 14 over the entire common area where the tie bars cross the peripheral members.

The peripheral reenforcing members 13 and 14, the tie bars 15 and longitudinal members 18 may all be constructed of stock materials, rods, bars or members of any desired section such as round rods, square rods, hexagonal rods, or rods having particular anchoring formations on them and the particular shape or cross-section of the reenforcing members does not affect the merits of the present invention excepting that the simpler shapes illustrated are the most economical.

The tie bars 15 which project sufficiently to engage the concrete forms, automatically locate the peripherally extending members 13 and 14 at the points desired inside the forms and the tie bars may also be utilized to locate the reenforcement longitudinally at the desired positions in the forms. The longitudinal position of the peripheral reenforcing members 13 and 14 may also be determined by tying members 13 and 14 to a plurality of longitudinally extending rods 18 any number of which may be utilized to give the pipe the desired tensile strength and the desired strength as a cantilever.

The inner peripheral member 14 preferably takes the shape of a closed polygon having a sufficient number of sides so that the sides 19 of the polygon may be located quite close to the inner surface 11. The sides are joined at the apices 20 and the apices 20 are located at the juncture of the inner peripheral member 14 and the tie bars 15. In the reenforcement shown in Fig. 1, the outer peripheral member 13 is a circular hoop and the tie bars 15 extend radially, one from each apex of the polygonal member 14 to the outer hoop 13.

In the devices of the prior art, curved reenforcing members or hoops were disposed adjacent the inner surface of the pipe and embedded in the pipe wall. Such curved reenforcing members tend to straighten when a force is applied to the pipe as, for instance, to the top of Fig. 1, and the tendency of the curved reenforcing members to straighten caused the concrete to scale off the inside 11 of the pipe.

The present inner reenforcing member 14 has straight sides 19 which are tensioned between the points 20, where they are joined to the tie bars. The tie bars being, in turn, joined to the outer hoops 13, the reenforcement shown, when embedded in concrete, constitutes a truss in which there is no tendency on the part of the reenforcing members near the inside of the pipe to straighten or cause scaling. The tie bars 15 also act as transverse anchors for both the peripheral members 13 and 14 and thereby resist the tendency for large cracks to appear between any tie bars and consequently the tie bars favor the distribution of the defects among a plurality of minute or small cracks even if the steel should be strained beyond its elastic limit.

In the modification shown in Fig. 2, the outer peripheral member 13 has also been made polygonal in form and the number of sides of the polygon 13*a* of Fig. 2 is the same as the number of sides 19*a* of the inner polygonal member 14*a*.

In the type of reenforcement of Fig. 2, the outer reenforcing member 13*a* is also better adapted to withstand compression stresses since the reenforcement extends straight between the points of juncture with the tie bars and there is a lesser tendency on the part of the outer reenforcing member to bend under compressive stresses, and therefore a tendency to avoid scaling at the outside of the pipe.

Referring to Fig. 5, this is another modification in which the reenforcing members have been stamped or punched out of sheet metal and provided with the outer hoop 13, inner polygonal member 14 and integral tie bars 15. The ends 16 and 17 of the tie bars also project from the reenforcement into engagement with the concrete form and the ends of the tie bars may thus be visible at the surfaces of the pipe. The mechanical operation of the reenforcement of Fig. 5, to prevent scaling under transverse loads is substantially the same as that of Fig. 1, but the reenforcement constructed of sheet metal may be very economically manufactured on a large scale.

In the embodiment of Fig. 6, the tie bars 15 do not project into engagement with the form at each tie bar, but only a predetermined number of tie bars have been made long enough to engage the form. In this

modification the outer peripheral member 13*a* is likewise a polygon having a number of sides equal in number to the sides of the inner polygonal member 14*a*.

Referring to Fig. 7, this is a diagrammatic line drawing showing another form in which the concrete reenforcement may be manufactured. Any of the reenforcement shown in Figs. 1 to 6 may take the form of closed loops or reenforcing members, the closed reenforcing members being disposed at regularly spaced points longitudinally of the pipe. Any of these modifications may also be made as shown in Fig. 7 in the general form of a helix. In such case the reenforcement actually consists of a pair of helices, the outer one larger than the inner one and the two helices being joined together by the transverse tie bars at regularly spaced points. It should be noted also that these helices merely have the general form of a helix and the parts of the helix are actually straight lines between the respective tie bars, as shown in Figs. 1 to 6, respectively.

The helical form of reenforcement possesses the advantage that the helix may be collapsed into a coil, the respective turns of this helix being tied together by a wire so that the reenforcement may be manufactured in the finished form and very conveniently shipped in the form of a coil. When it is used the reenforcement of helical form may be spread out until the peripherally extending members are spaced longitudinally in the pipe as desired and the separate turns of the helices may be secured in such spaced relation by tying the peripherally extending members or tie bars to the longitudinally extending members 18.

It will thus be observed that the reenforcement may take the closed polygonal form or the peripherally extending reenforcing members may be of open polygonal form with the ends of the successive turns connected together in the general form of a helix.

It will thus be observed that I have invented an improved form of reenforcement in which the reenforcement may be located closer to the inner or outer surfaces of the concrete pipe without causing scaling, thereby permitting a more economical use of steel and concrete since the steel is more effective when placed close to the surface. The concrete pipe constructed with the present reenforcement is stronger for the same amount of steel or concrete and there is no tendency on the part of the concrete to be scaled off by the straightening action of the reenforcement because the reenforcement already extends straight between anchored points.

The stripping action of the reenforcement of the prior art is thereby eliminated by eliminating the use of curved reenforcing members located adjacent to the surfaces, particularly the inner surface, since the inner reenforcement is placed in tension. The present concrete pipe may also be made thinner without sacrificing strength, and there is no tendency for the concrete reenforcement to become exposed and subjected to corrosive action of the elements or the material flowing through the pipe. Higher working stresses may be used in the steel and greater percentages of steel may be used than heretofore, resulting in a stronger and more economical pipe. The location of the reenforcement at a minimum distance from the inner surface of the pipe without danger of shearing or stripping out, thus increases the "effective depth" and secures the greatest strength for a given wall thickness of pipe and area of steel.

The length of the sides of the polygons may be any convenient length considering the diameter of the pipe, but the distance between the respective tie bars is preferably made less than the wall thickness of the pipe, as the tie bars also act as shear or diagonal tension reenforcement. The rigid connection at 20 of the tie bars and peripheral members serves to anchor the peripherally extending members against longitudinal slipping and serves to prevent the widening of a single crack at the top and bottom, but would result in a multiplicity of fine cracks if the steel were strained beyond the point at which the surrounding concrete usually cracks, thereby reducing the exposure of the steel to corrosion. In some embodiments of the invention, the tie bars may not be attached to the outer peripheral reenforcing members.

The tie bars not only locate the reenforcement at the proper point within the concrete pipe or wall, but the frequent tie bars fastened to the peripheral members at predetermined points insure the use of a sufficient amount of reenforcement, and make it practically certain that the steel will be placed and held in the position where it will be most effective.

While I have illustrated a preferred embodiment of my invention, many modifications may be made without departing from the spirit of the invention, and I do not wish to be limited to the precise details of construction set forth, but desire to avail myself of all changes within the scope of the appended claims.

Having thus described my invention, what I claim is new and desire to secure by Letters Patent of the United States, is:

1. In a concrete pipe reenforcement, the combination of a peripherally extending reenforcing member of polygonal form, said member having the sides of the polygon disposed adjacent the inner surface of the pipe and embedded in the wall of the pipe, with an outer peripherally extending reenforcing member adapted to be embedded in the pipe adjacent the outer surface of the pipe, and

a plurality of transverse reenforcing members, extending in a radial direction and integrally secured to said outer peripheral reenforcing member and to said inner peripheral reenforcing member at the apices of said polygon.

2. In a concrete pipe reenforcement, the combination of a peripherally extending reenforcing member of polygonal form, said member having the sides of the polygon disposed adjacent the inner surface of the pipe and embedded in the wall of the pipe, with an outer peripherally extending reenforcing member adapted to be embedded in the pipe adjacent the outer surface of the pipe, a plurality of transverse reenforcing members, extending in a radial direction and integrally secured to said outer peripheral reenforcing member and to said inner peripheral reenforcing member at the apices of said polygon, said outer reenforcing member also forming a polygon of the same number of sides as said inner member and secured to said transverse members at its apices.

3. In a concrete pipe reenforcement, the combination of a peripherally extending reenforcing member of polygonal form, said member having the sides of the polygon disposed adjacent the inner surface of the pipe and embeded in the wall of the pipe, with an outer peripherally extending reenforcing member adapted to be embedded in the pipe adjacent the outer surface of the pipe, a plurality of transverse reenforcing members, extending in a radial direction and integrally secured to said outer peripheral reenforcing member and to said inner peripheral reenforcing member at the apices of said polygon, said transverse members extending past one of said peripherally extending members into engagement with the concrete form to locate said reenforcement in the form.

4. In a concrete pipe reenforcement, the combination of a peripherally extending reenforcing member of polygonal form, said member having the sides of the polygon disposed adjacent the inner surface of the pipe and embedded in the wall of the pipe, with an outer peripherally extending reenforcing member adapted to be embedded in the pipe adjacent the outer surface of the pipe, a plurality of transverse reenforcing members, extending in a radial direction and integrally secured to said outer peripheral reenforcing member and to said inner peripheral reenforcing member at the apices of said polygon, and a plurality of longitudinally extending reenforcing members secured to one of said other members to space the peripherally extending members.

5. In a concrete pipe reenforcement, the combination of a peripherally extending reenforcing member of polygonal form, said member having the sides of the polygon disposed adjacent the inner surface of the pipe and embedded in the wall of the pipe, with an outer peripherally extending reenforcing member adapted to be embedded in the pipe adjacent the outer surface of the pipe, and a plurality of transverse reenforcing members, extending in a radial direction and integrally secured to said outer peripheral reenforcing member and to said inner peripheral reenforcing member at the apices of said polygon, said reenforcement comprising an assembled coiled unit having a plurality of turns, each including said peripherally extending members and said transverse members, and the coils of which are adapted to be spread to take the general form of a helix.

6. In a concrete pipe reenforcement, the combination of a peripheral extending reenforcing member of polygonal form, said member having the sides of the polygon disposed adjacent the inner surface of the pipe and embedded in the wall of the pipe, with an outer peripherally extending reenforcing member adapted to be embedded in the pipe adjacent the outer surface of the pipe, and a plurality of transverse reenforcing members, extending in a radial direction and integrally secured to said outer peripheral reenforcing member and to said inner peripheral reenforcing member at the apices of said polygon, said reenforcement comprising an integral unit having its peripherally extending and transversely extending members formed of sheet metal, the plane of the sheet being disposed transversely to the length of the pipe.

In witness whereof, I hereunto subscribe my name this 20 day of March, 1931.

CLIFFORD OLDER.