July 3, 1962 E. HENNINGSEN 3,042,546

METHOD AND APPARATUS FOR IMPREGNATION OF POROUS ARTICLES

Filed Feb. 27, 1958 5 Sheets-Sheet 1

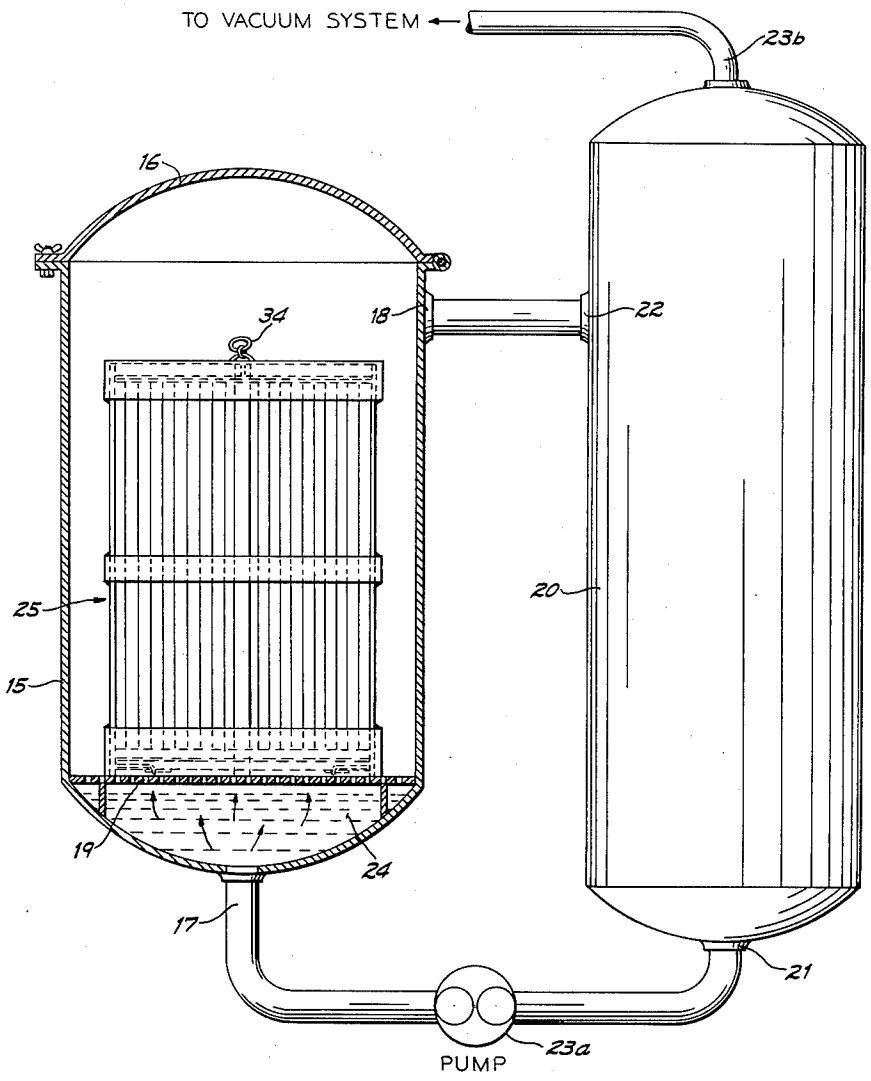


Fig. 1

INVENTOR.
Erik Henningsen
BY Robert D. Silver
ATTORNEY

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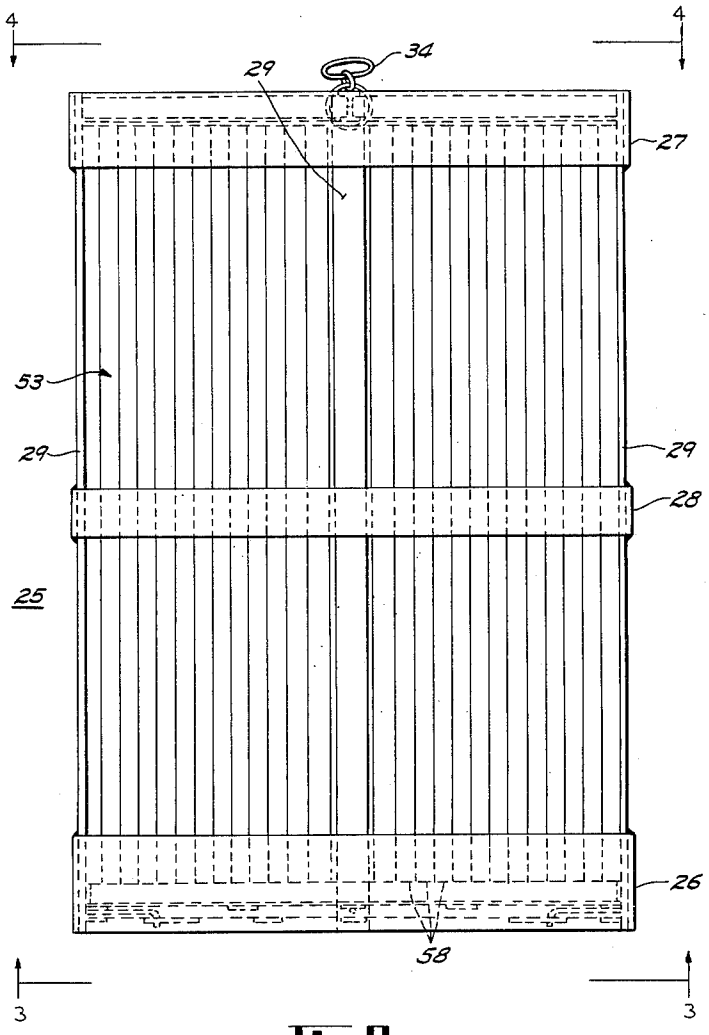


Fig. 2

INVENTOR.
Erik Henningsen
BY Robert A. Silver
ATTORNEY

July 3, 1962 E. HENNINGSEN 3,042,546

METHOD AND APPARATUS FOR IMPREGNATION OF POROUS ARTICLES

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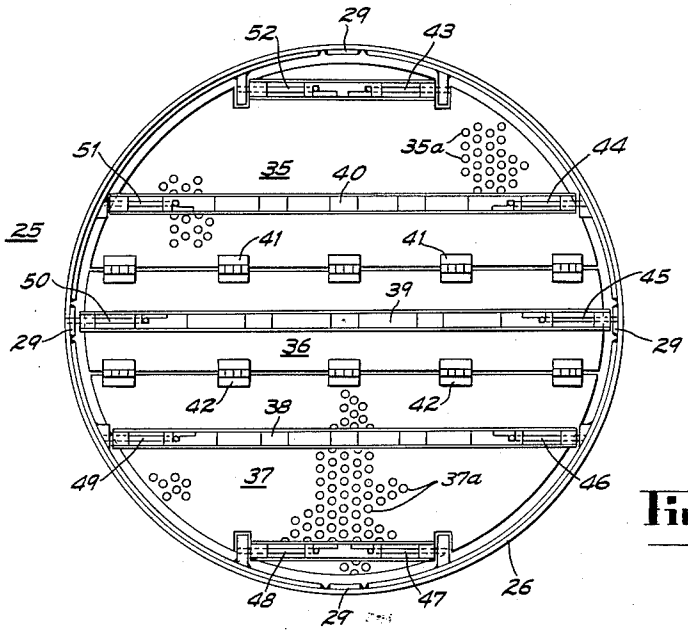


Fig. 3

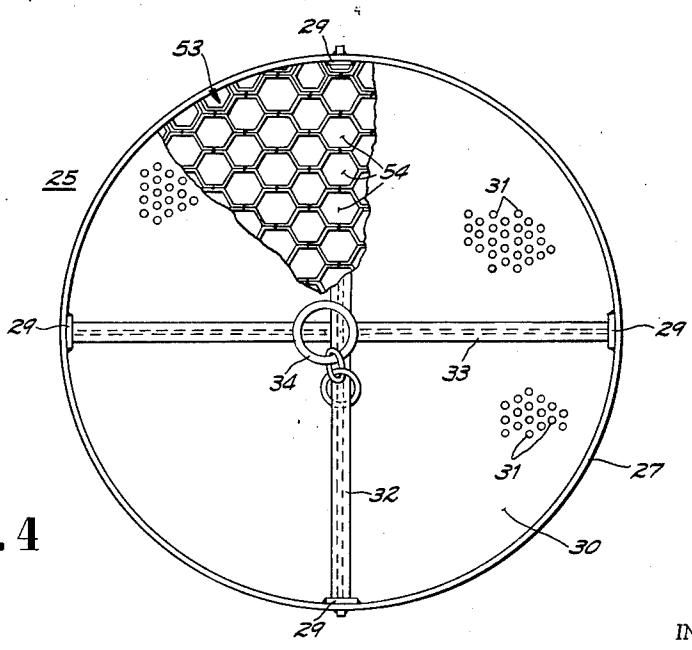


Fig. 4

INVENTOR.
Erik Henningsen
BY Robert D. Silver
ATTORNEY

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METHOD AND APPARATUS FOR IMPREGNATION OF POROUS ARTICLES

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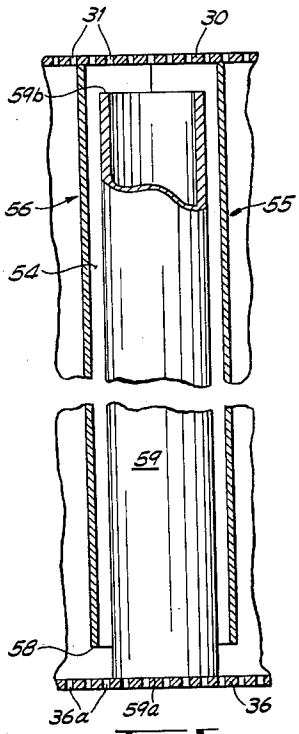


Fig. 5

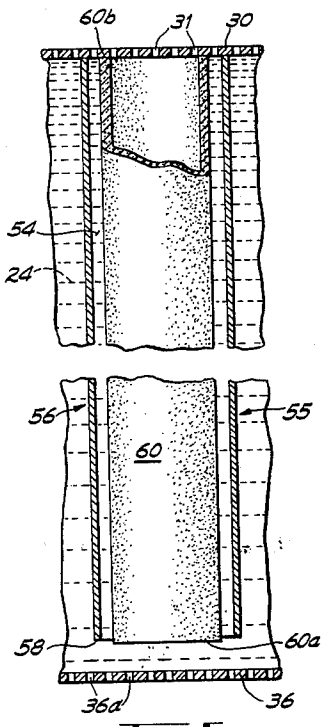


Fig. 6

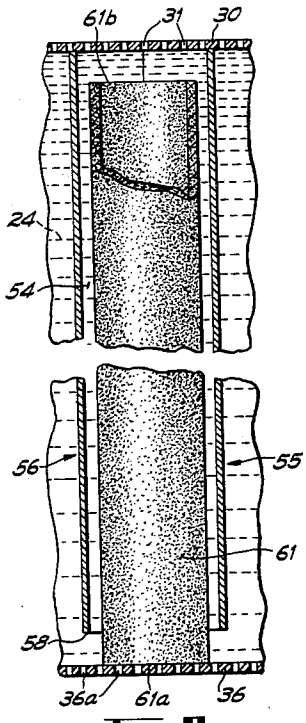


Fig. 7

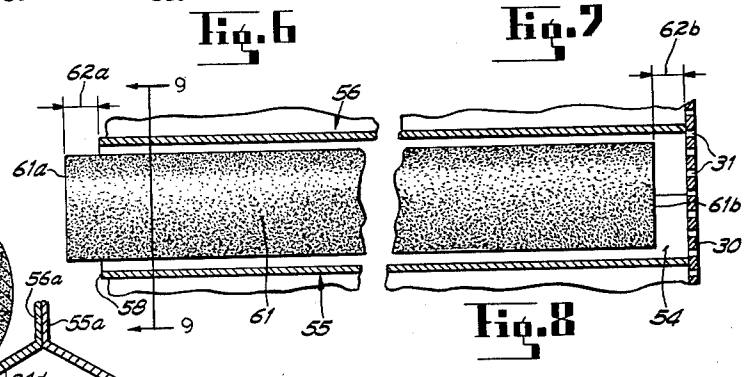


Fig. 8

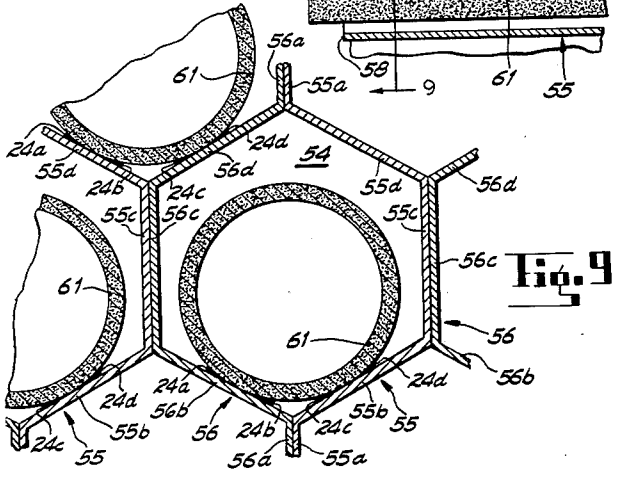


Fig. 9

INVENTOR.
Erik Henningsen
BY
ATTORNEY

July 3, 1962 E. HENNINGSEN 3,042,546

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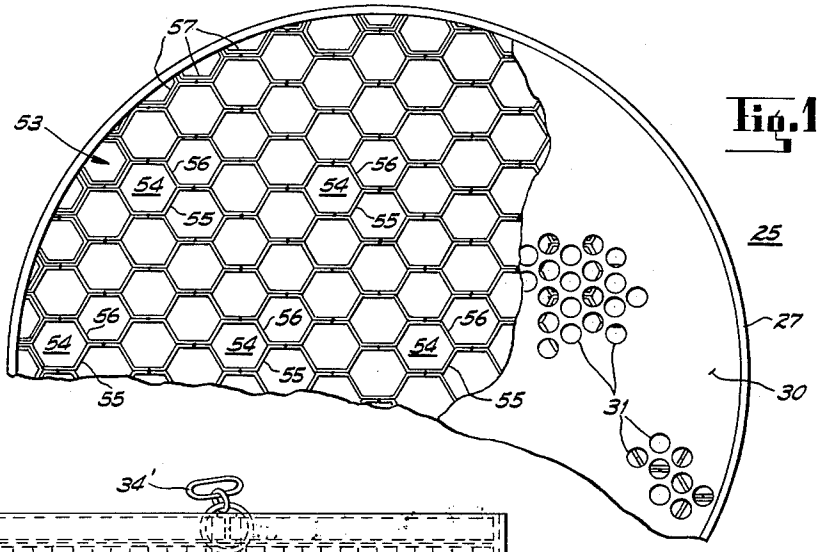


Fig. 10

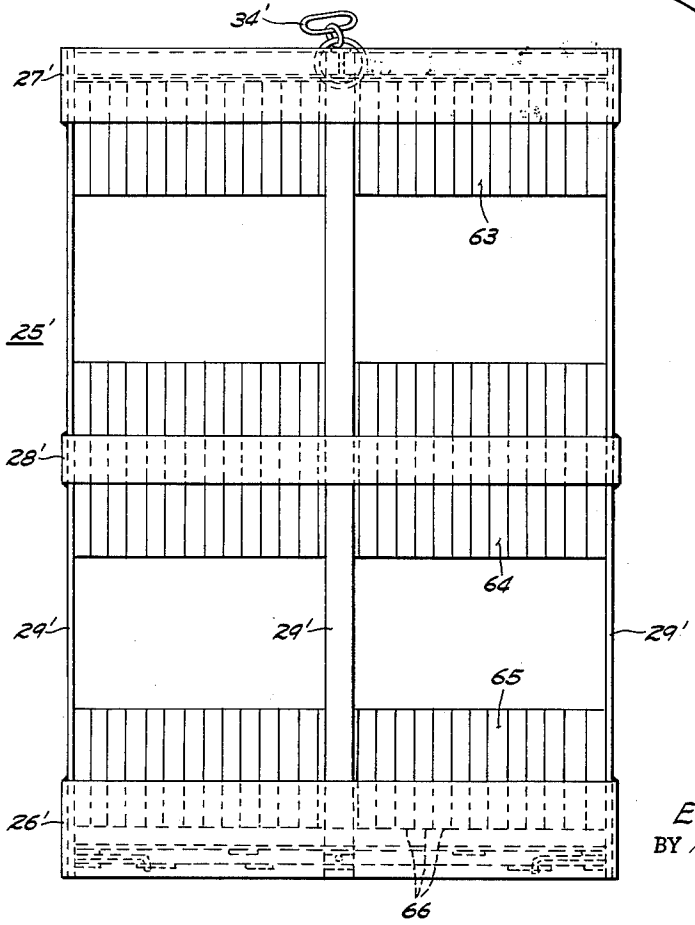


Fig. 11

INVENTOR.
Erik Henningsen
BY Robert D. Silver
ATTORNEY

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3,042,546

METHOD AND APPARATUS FOR IMPREGNATION OF POROUS ARTICLES

Erik Henningsen, Milwaukee, Wis., assignor to McGraw-Edison Company, Milwaukee, Wis., a corporation of Delaware

Filed Feb. 27, 1958, Ser. No. 717,962
5 Claims. (Cl. 117—95)

This invention relates in general to a method and apparatus for the impregnation of porous articles and, more particularly, relates to a method and apparatus for saturating fibrous or other porous articles with a bituminous saturant.

This invention relates to an apparatus for saturating fibrous or other porous conduits employed to conduct and protect underground cables, telephone lines, electric lights, and other conductors, and for the formation of water pipes, drain pipes, etc., to render the latter substantially waterproof and resistant to abrasion or corrosion and conditions encountered above or underground by fibrous conduit. While as above stated, the invention is particularly directed to the saturation of fibrous conduit, it is understood that it may be employed to saturate any small fibrous or other articles requiring impregnation.

The articles to be saturated may, of course, be prepared in any known manner. In the case of fibrous bases for tubes, newsprint or paper pulp or other fibrous material may be beaten in the usual paper beaters and the resulting stock screened and then pumped to paper machines and there formed into a wet sheet. The paper tubes may be formed by winding the wet sheet about a cylindrical or other shaped tube or mandrel to produce a wet conduit or tube of proper thickness. This conduit may be dried in kilns to remove the major portion of the moisture content. Fibre base may, of course, also be prepared in any other known manner. The tubes are made in several sizes commonly varying between 2 and 6 inches in internal diameter and having wall thickness of approximately ¼ of an inch to ½ of an inch depending on internal diameter and use and are made in 5, 8 and 10 feet lengths. The wall thicknesses of the tubes may, of course, be greater or less than those aforenoted and the other dimensions may also vary.

The porosity or absorptive characteristics of the walls of fibrous conduits may vary within wide limits from a very dense wall of a density corresponding to hard wood and exceedingly difficult to saturate with low carbon water gas tar pitch or even with other water proofing material, to a porous open wall similar in density to that of roofing felt, which will readily absorb bituminous saturates. Various types of saturants may be used, for example, coal tar pitch, gas tar pitch, asphalt, cut back pitch, blended pitch or other water proofing material may be used as suitable and desired. For the particular application of this disclosure, it is preferred that we use the coal tar pitch having a specific gravity of approximately 1.27.

The saturants hereinabove referred to are of greater specific gravity than the fibrous conduits prior to the saturation thereof. Hence, if the fibrous conduits are immersed in such saturants and left free, they will tend to float.

In the prior art saturating step of processing of a number of elongated fibre tubes, it has been common to dispose said tubes in a large container, all of the tubes being packed in intimate engagement one with the other for the dual purpose of avoiding bowing of the tubes and getting as many tubes as possible within the container. The container then is disposed in a large vat and the saturant (the coal tar pitch) is allowed to enter the vat for saturating of the tubes. In the beginning of the impregnation process

the tubes then tend to rise to the top of the container as a mass, or in some instances, by sliding against each other, all of the tubes still being in contact one with the other. In some cases the buoyancy of the tubes was so great that the container had to be held down within the vat. After impregnation, the container is removed from the vat and placed in a quenching bath which tends to congeal the saturant within the impregnated tube. The points of intimate engagement between adjacent tubes also congeals presenting grave problems in separation of the tubes. Further, the contacting surfaces are deleteriously affected by the separation.

It is an object of this invention to provide an apparatus and method for saturating a plurality of elongated porous articles with a saturant of a specific gravity greater than that of the unsaturated porous articles such as to give a product which has a constant mechanical strength and porosity so as to give uniform field performance.

It is another object of this invention to provide a method and apparatus as aforestated wherein novel container means is provided such that there is relative movement of the tubes relative to spacer means in a container means affording a floating action of the tubes during the impregnating process while preventing fixed contact of the tubes with other tubes or container.

It is another object of this invention to provide a method and apparatus as aforementioned which affords easy unloading of the fibre tubes after impregnation.

The novel features that are characteristic of the invention are set forth with particularity in the appended claims. The invention itself, both as to its organization and its method of operation, together with additional objects and advantages thereof, will best be understood by the following description of specific embodiments when read in connection with the accompanying drawings in which:

FIG. 1 is a front elevational view, a portion of which is in section, showing impregnating apparatus including the novel container means disposed in an impregnation vat, portions of the apparatus being shown semidiagrammatically;

FIG. 2 is an enlarged front elevational view of the novel container means shown in FIG. 1;

FIG. 3 is a bottom end view along lines 3—3 of FIG. 2;

FIG. 4 is a top end view along lines 4—4 of FIG. 2, a portion of the view being in section;

FIG. 5 is a fragmentary elevational view, a portion of which is in section, of a fibre tube disposed in one of the honeycomb apertures of the novel container prior to introducing the saturant;

FIG. 6 is a fragmentary elevational view similar to FIG. 5, the tube being depicted during an early stage of the impregnation cycle and having floated to engagement with the top of the container;

FIG. 7 is a view similar to 5 and 6 showing the fibre tube after the impregnation has reached the point where the specific gravity of the tube is higher than the pitch;

FIG. 8 is a view similar to views 5–7 rotated 90° and showing the fibre pipe ready for removal from the honeycomb aperture subsequent to the quenching operation;

FIG. 9 is a cross sectional view through the honeycomb spacer means along lines 9—9 of FIG. 8, portions of more than one honeycomb cell being shown;

FIG. 10 is a fragmentary plan view of the top of the container means shown in FIG. 4, a portion of the perforated top plate being removed to show the construction of the internal honeycomb wall;

FIG. 11 is a front elevational view similar to FIG. 2 of an alternative embodiment of container means.

Returning now to FIG. 1 of the drawings, the reference numeral 15 indicates an impregnation vat having a hinged cover 16, an inlet 17 and an outlet 18. Suit-

able coal tar pitch saturant 24 may be pumped from a storage container 20 having an outlet 21 and an inlet 22, said outlet 21 being in communication with the inlet 17 of vat 15. The inlet 22 is in communication with outlet 18 of the vat as shown and when the saturant 24 rises to the level of outlet 18, a continuous closed circulatory system is formed. The container or vats 15 and 20 have therein a heater coil (not shown) which elevates the temperature of the pitch saturant as is well known in the art. The pump 23*a* (shown in semidiagrammatic form) pumps the saturant 24 from storage vat 20 to impregnation vat 15 through the system shown. A vacuum pump (not shown) is attached to storage vat 20 as shown semidiagrammatically at 23*b* and draws a vacuum on the system during the impregnation step in accordance with established procedures in the art.

Returning now to the impregnation vat 15, a perforated bottom wall supporting plate 19 is disposed across the bottom of the vat 15 to provide a supporting stop for an impregnation basket means 25. The container means or basket means 25 constitutes one of many designs which embody the major novel concepts of this invention and is shown in FIG. 2 in enlarged front elevational view. As shown, container means 25 is generally cylindrical in shape, having annular supporting bottom hoop 26 and top hoop 27 and an intermediate hoop 28, all of which are attached to generally elongated vertical spaced stringers 29. The top, as shown in FIG. 4, of the container 25 is formed with a perforated cover 30 having a large plurality of apertures 31 therein for free flow of the pitch saturant. The cover is further formed with crossed I beams 32 and 33 which serve to give the required mechanical strength to the basket means. A hoisting ring 34 is attached to the I beam 32 to allow easy purchase with the end of a crane hoist or the like.

The bottom end portion (FIG. 3) of the container means 25 is formed with perforated segmented cover portions 35, 36 and 37 having apertures 35*a*, 36*a* and 37*a* respectively. The cover portions are hingedly mounted to each other by hinges 41 and 42. Reinforcing members 38, 39 and 40 are disposed along the various sections to strengthen same and the end portions of the reinforcing members contain tongue and groove means for latching the various cover portions of the annular ring 26. More particularly, reinforcing member 38 has tongue and groove latching means 46 and 49 at its opposite extremities, reinforcing means 39 has tongue and groove means 45 and 50 and reinforcing means 40 has tongue and groove means 44 and 51. The ends of the tongues cooperate with suitable grooves or apertures formed in hoop 26. The end portion 37 of the bottom cover plate has additional and separate latching means 47 and 48 associated therewith and portion 35 has latching means 43 and 52. Thus, segmented opening of the bottom cover is possible.

Intermediate the end portions of the basket means 25 is a honeycomb of walls 53 defining apertures 54. The apertures 54 are generally hexagon in shape and are formed by the joining of sections of upset elongated pieces of sheet metal as probably best shown in FIG. 10 of the drawing. In enlarged detailed sectional view FIG. 9, it is seen that the individual back-to-back plates 55 and 56 are formed identically to each other of upset portions 55*a*, 55*b*, 55*c*, 55*d*, 56*a*, 56*b*, 56*c* and 56*d* and then disposed in a back-to-back or opposing relationship to form the hexagon apertures, the portions 55*a* to 56*a* and 55*c* and 56*c* engaging one another. Each hexagon aperture is of sufficient size such that it is adapted to contain a fibre tube during the impregnation cycle as shall be described hereinafter.

In the embodiment shown in FIG. 2 of the drawings, it is seen that the honeycomb of walls 53 has a long dimension slightly shorter than the over-all dimension between end portions of the container means. More particularly, the end of the honeycomb wall 53 at 58 is spaced from the bottom wall 36 approximately equal to the dimension 62*a* or 62*b* shown in FIG. 8, as shall become apparent.

Each aperture 54 of the honeycomb 53 is adapted to contain a fibre tube therein during the impregnation and quenching cycles.

In the normal impregnation cycle, as shown in the fragmentary sectional views of FIGS. 5–9, inclusive, an unsaturated tube 59 is disposed within the basket means 25, one each to an individual hexagon cell 54. The basket means 25 is then placed in the impregnation vat 15 and the tube 59, under the influence of gravity, engages bottom plate 36 at 59*a*. (See FIG. 5.) As shown, the end surface 58 of the honeycomb walls 53 is spaced from the end plate 36 and the top 59*b* of the tube is spaced from the top cover plate 30. As the pitch enters the vat 15 from storage vat 20 rising to the outlet 18 and starts circulating through the continuous closed circulatory system, the porous tubes such as 59 start to become saturated with the impregnant 24. The partially impregnated tube is shown in FIG. 6 and is given reference number 60. Since the tube 60 has a specific gravity lower than that of the saturant 24, the tube 60 immediately rises to the top of the cell 54 so that the top surface of the tube 60*b* engages the plate 30.

The pitch 24 enters vat 15 through pipe 17, continues to flow through the holes 36*a* in the bottom plate 36, through the honeycomb 53 up to and through the apertures 31 in the plate 30 and out outlet 18. The tube 60 will stay at the top of the enclosure until the impregnation has reached the point where the tube has the same specific gravity as the pitch. From here on the tube will float down and return to engagement with the bottom plate 36 at 61*a*. This position is shown in FIG. 7 and saturated tube is marked 61, the top 61*b* being spaced from top end portion 30 as shown. When the tube is completely saturated, the vat 15 is drained and the container means 25 (still loaded) is then moved to a quench bath which congeals the saturant.

The basket means 25 is then turned on its side so as to permit access through the segmented bottom portions for removal of the impregnated tubes. The position of the tube within the honeycomb cell 54 is shown in FIG. 8. The end portion 61*a* extends beyond the end of the honeycomb 58 by dimension 62*a*. This exposed surface 61*a* makes it quite simple to remove the tube since the congealed saturant (at points of contact 24*a*, 24*b*, 24*c* or 24*d*) may be quite easily fractured by a light rapping of the end surface 61*a* of the tube. The tube 61 when so rapped has plenty of clearance (dimension 62*b*) to insure a good clean fracture line between the saturant and walls of the cell 54, the excess saturant at contact points 24*a*, 24*b*, 24*c* and 24*d* tending to remain upon the outer surface of the tube rather than on the walls of the cell 54. This does not deleteriously affect the tube. When no spacing means such as the walls 53 are disposed between the tubes, the fracture lines deleteriously affect at least one of the tubes.

The alternative form shown in FIG. 11 of the drawings shows the honeycomb comprised of three spaced sections which permit longitudinal floating movement of the tubes disposed therewithin while preventing tube-to-tube contact. These three sections are the top honeycomb section 63, the intermediate section 64 and the end section 65. Various other types and kinds of spacing means, of course, are possible, the main desired function being that they permit longitudinal floating movement while preventing fixed transverse contact of the tubes. It is to be noted that no part of the spacing means engages the interior surface of the tube which is the critical surface in most applications. No marks must be on the interior of the tubes and, hence, no spacing means can be used to contact same. It has been found that products made by use of the new and improved container means afford a

tube of greater uniformity to give better field performance, reduce waste in the manufacturing operation and is otherwise well adapted for the purposes for which it was designed.

Although specific embodiments of the invention have been shown and described, it is with full awareness that many modifications thereof are possible. The invention, therefore, is not to be restricted except insofar as is necessitated by the prior art and by the spirit of the appended claims.

What is claimed as the invention is:

1. The method of impregnating a plurality of elongated fibre tubes with a saturant having a specific gravity greater than that of the unimpregnated tubes and less than that of the impregnated tubes comprising the steps of disposing said elongated tubes vertically within a common zone in a body of the saturant and concurrently confining each of said tubes along its outer wall to preclude extensive lateral movement and contact between the tubes while permitting independent vertical movement, retaining said tubes in said body of saturant until complete impregnation is achieved, whereby said tubes independently rise in said saturant when first disposed therein and then sink during the impregnation, and removing said tubes from said saturant.

2. Apparatus for impregnating a plurality of elongated porous articles comprising perforate container means having top and bottom portions vertically spaced from each other a predetermined distance greater than the length of said elongated articles, connector means between said top and bottom portions for maintaining the spacing between said portions, and vertically-extending transverse spacer means positioned between said top and bottom portions for preventing contact between the individual porous articles during impregnation, said spacer means defining a plurality of vertically extending spaces of sufficient size to include one of said elongated articles in each of said spaces and to further permit vertical movement of said articles relative to said spacer means and to each other during impregnation of the articles.

3. Apparatus for impregnating a plurality of elongated porous articles with a saturant having a specific gravity greater than that of the unimpregnated articles and less than that of the impregnated articles so that the porous articles have a tendency to float when first immersed in said saturant and then to sink during impregnation comprising container means having perforate top and bottom portions vertically spaced from each other a predetermined distance greater than the length of said elongated articles, connector means for maintaining the spacing between said top and bottom portions, and a plurality of vertically extending spacer walls fixedly disposed between said top and bottom portions, said spacer walls defining a plurality of vertically extending spaces of sufficient size to include only one of said elongated articles in each of said spaces and to further permit vertical floating and sinking movement of the articles relative to said spacer walls and to each other during impregnation of the articles.

4. Apparatus for impregnating a plurality of elongated porous articles with a saturant having a specific gravity greater than that of the unimpregnated articles and less than that of the impregnated articles comprising container means having perforate top and bottom end portions vertically spaced from each other a predetermined distance greater than the length of said elongated articles, connector means for maintaining the spacing between said top and bottom end portions, and a honeycomb of walls fixedly disposed between said top and bottom end portions and extending vertically for a part of the distance between said end portions, said walls defining a plurality of vertically extending spaces of a size sufficient to include one of said elongated articles in each of said spaces and to further permit vertical movement of said articles relative to each other and to said walls during impregnation of the articles, said walls being spaced from one of said end portions so that ready access to said porous articles is provided after the impregnation for separation of said articles from said spacer walls.

5. Apparatus for impregnating a plurality of elongated porous tubes with a pitch saturant having a specific gravity greater than that of the unimpregnated tubes and less than that of the impregnated tubes so that the tubes have a tendency to float when first immersed in said pitch saturant and to then sink during impregnation comprising perforate container means having top and bottom end portions vertically spaced from each other a predetermined distance greater than the length of said elongated porous tubes, connector means for maintaining the spacing between said top and bottom end portions, and a honeycomb of walls fixedly disposed between said top and bottom end portions and extending vertically between said portions, said walls defining a plurality of vertically extending spaces of a size sufficient to include one of said elongated tubes in each of said spaces and to permit vertical floating and sinking movement of said tubes relative to said walls and to each other during impregnation, at least one of said end portions being removable for loading and unloading of said porous tubes.

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