Nov. 28, 1961 L. EWING ET AL 3,010,847

METHOD AND APPARATUS FOR BATCH IMPREGNATION OF POROUS ARTICLES

Filed July 1, 1958 3 Sheets-Sheet 1

Fig. 1

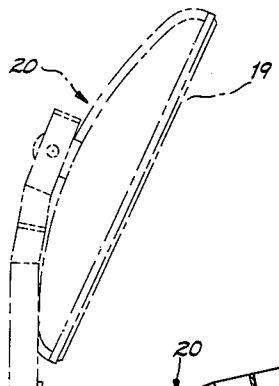
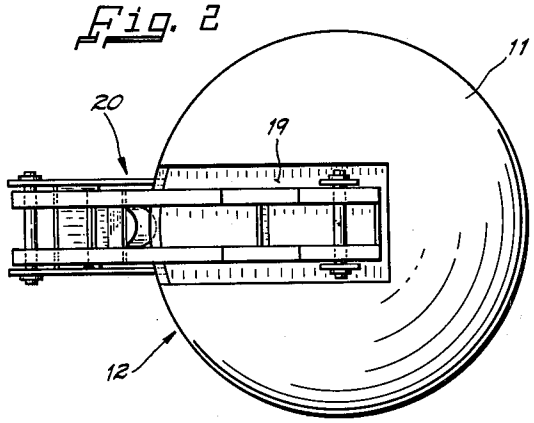


Fig. 2



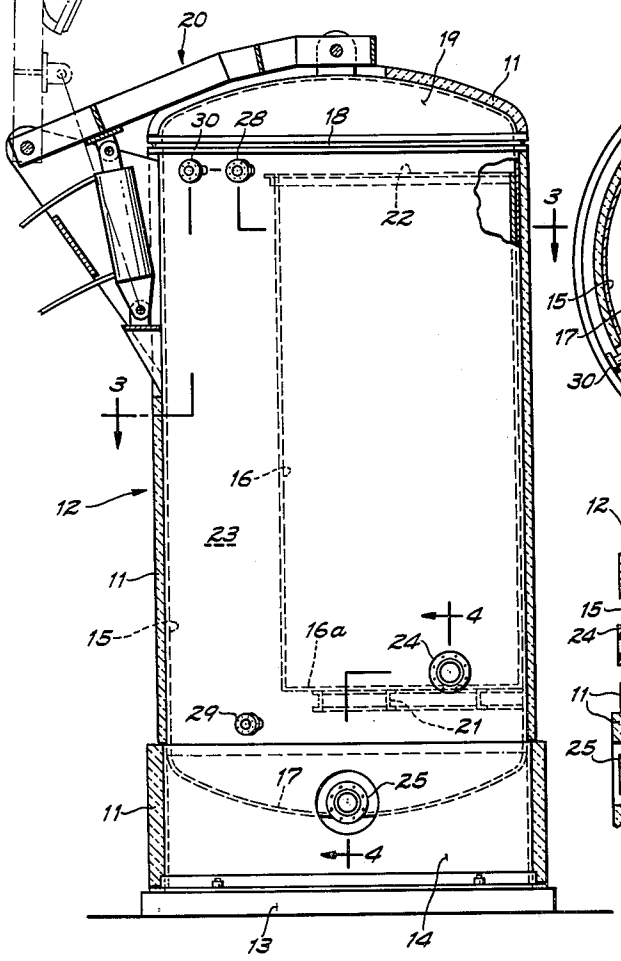


Fig. 3

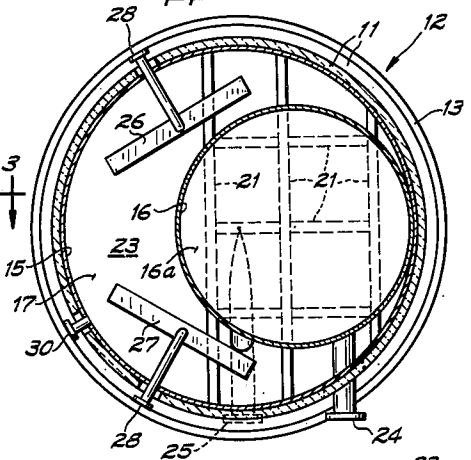
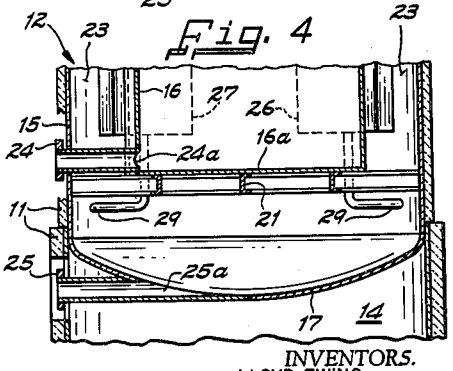


Fig. 4



INVENTORS.
LLOYD EWING
REID EWING
EARL HAHN

BY Robert D. Silver

Attorney

Nov. 28, 1961 L. EWING ET AL 3,010,847

METHOD AND APPARATUS FOR BATCH IMPREGNATION OF POROUS ARTICLES

Filed July 1, 1958 3 Sheets-Sheet 2

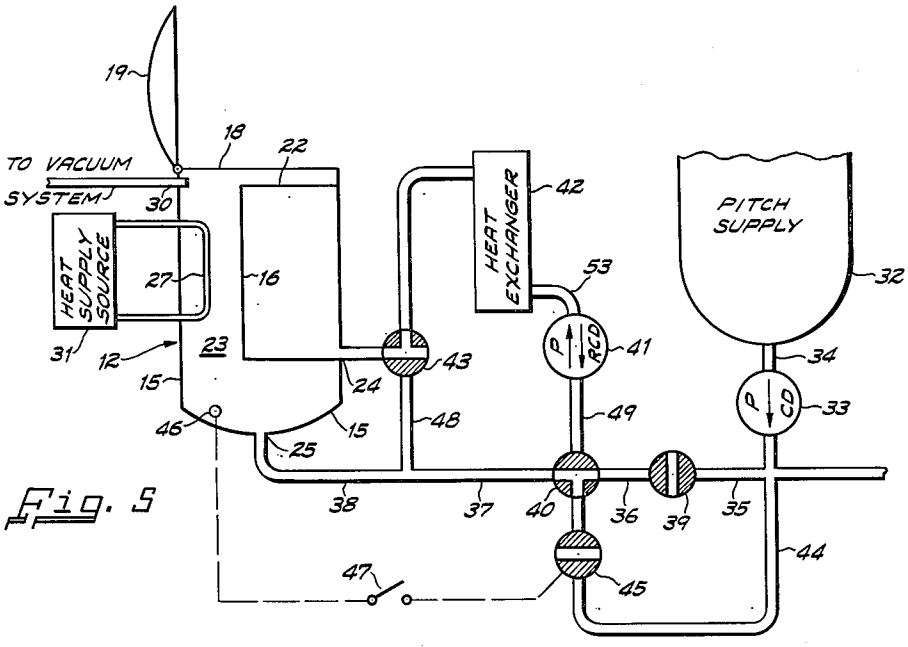


Fig. 5

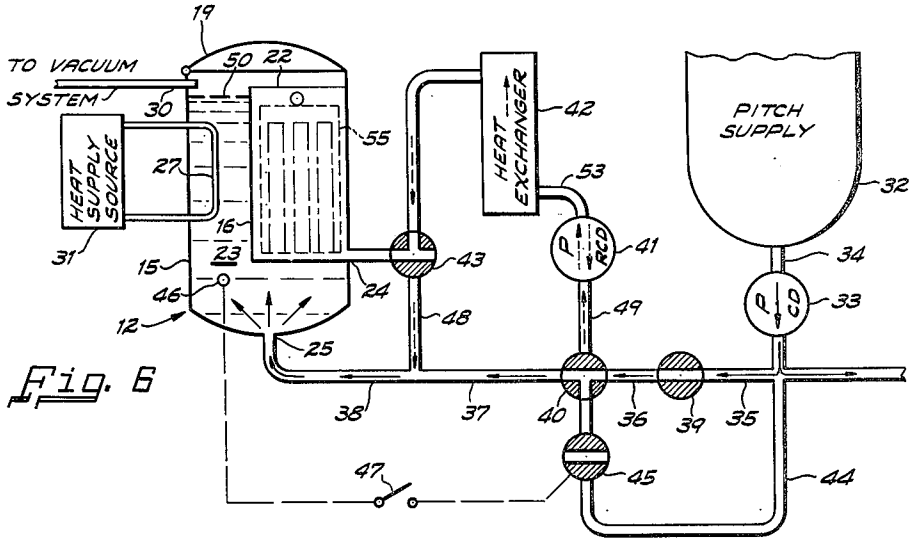


Fig. 6

INVENTORS.
LLOYD EWING
REID EWING
EARL HAHN

BY

Attorney

Nov. 28, 1961 L. EWING ET AL 3,010,847

METHOD AND APPARATUS FOR BATCH IMPREGNATION OF POROUS ARTICLES

Filed July 1, 1958 3 Sheets-Sheet 3

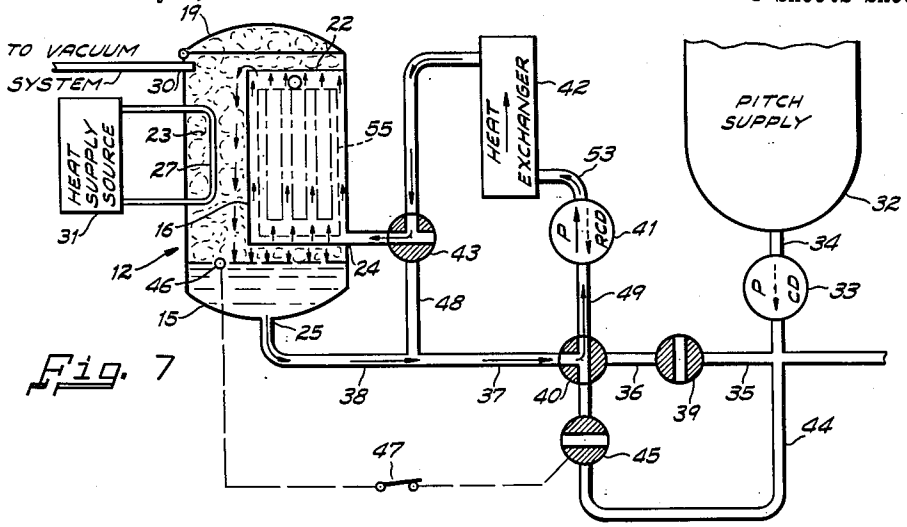


Fig. 7

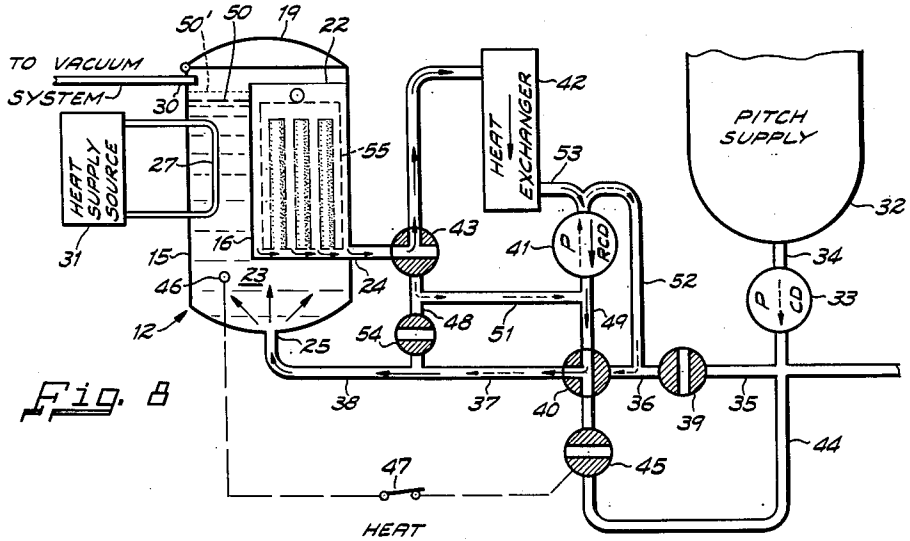


Fig. 8

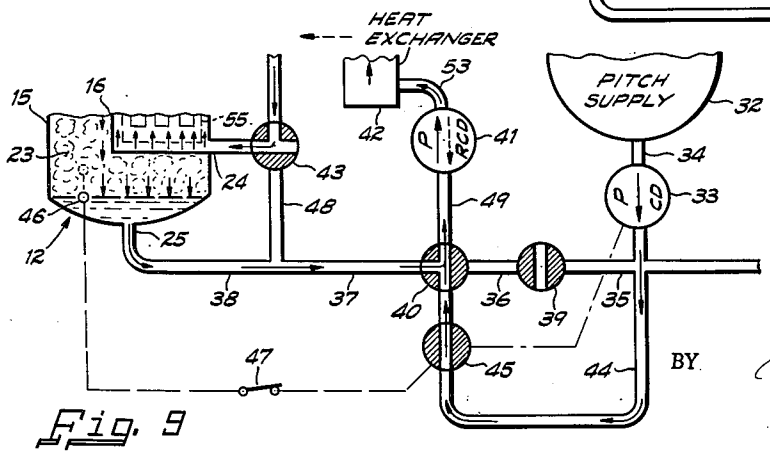


Fig. 9

INVENTORS.
LLOYD EWING
REID EWING
EARL HAHN

BY

Attorney

United States Patent Office 3,010,847
Patented Nov. 28, 1961

3,010,847
METHOD AND APPARATUS FOR BATCH IMPREGNATION OF POROUS ARTICLES

Lloyd Ewing, Milwaukee, Wis., Reid Ewing, Huntington, W. Va., and Earl Hahn, Milwaukee, Wis., assignors to McGraw-Edison Company, Milwaukee, Wis., a corporation of Delaware

Filed July 1, 1953, Ser. No. 768,512
7 Claims. (Cl. 117—94)
(Filed under Rule 47(b) and 35 U.S.C. 118)

This invention relates in general to a method and apparatus for saturating fibrous or other porous articles with a bituminous saturant.

More particularly, this invention relates to a method and 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 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. Paper tubes may be formed by winding a wet sheet around 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 or ovens to remove the major portion of the moisture content. The fibre base may, of course, also be prepared in any other known manner. The tubes are made in several sizes commonly varying between two and six inches in internal diameter and having wall thickness of approximately ¼ inch to ½ inch depending upon internal diameter and use, and are made in five, eight and ten foot lengths. The wall thickness of the tubes may, of course, be greater or less than those aforestated and the other dimensions may also vary.

Porosity or absorptive characteristic of the walls of fibrous conduits may vary within wide limits from a very dense wall of a density corresponding to hardwood 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 saturants. Various types of saturants may be used, for example, coal tar pitch, gas tar pitch, asphalt, cutback pitch, blended pitch or other water proofing material may be used as suitable and desired.

It is an object of this invention to provide a novel method and apparatus for saturating fibrous conduit or other articles which include a novel double container batch type impregnator.

It is a further object of this invention to provide a novel method and apparatus which includes apparatus which is easy to operate, requires very little room to install in original installation, and is otherwise well adapted to manufacturing operations.

A further object of this invention is to provide a double tank apparatus as above set forth which requires no pressure differential on the impregnation tank whereby the impregnation tank may be made of much thinner gauge material which can considerably reduce the original cost.

It is a further object of this invention to provide apparatus which has less exposure to heat losses so that

the pitch or other impregnant may be kept at a higher temperature at less cost.

It is a further object of this invention to provide a novel float system to automatically actuate the valve mechanism to provide replenishment of the saturant by automatic refilling of the storage tank from a supply tank exterior thereof.

It is a further object of this invention to provide a novel apparatus of the type aforestated which contains an impregnation tank disposed within a storage tank in a manner to afford considerable foam capacity while maintaining the above described advantages.

It is a further object of this invention to provide an apparatus of the type aforementioned which has a power actuated cover for the storage tank which affords entry to the impregnation tank to provide access for the normal working operation as well as access for cleaning and maintenance of both tanks.

It is a further object of this invention to provide an apparatus wherein an outlet from the storage tank leading to an evacuation pump apparatus may be disposed in the storage tank at a point spaced away from the open top of the inner impregnation tank to prevent excessive entrainment of so-called "pitch foam."

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 the portions of the novel double tank batch impregnator apparatus;

FIG. 2 is a top view of the apparatus shown in FIG. 1;

FIG. 3 is a sectional view along lines 3—3 of FIG. 1;

FIG. 4 is a view along lines 4—4 of FIG. 1;

FIG. 5 is a semidiagrammatic view of the apparatus in FIGS. 1–4 along with other components showing the relative position of the parts prior to the filling of the storage tank of the double tank batch apparatus with impregnant;

FIG. 6 is a semidiagrammatic view similar to FIG. 5 showing the relative position of the components during the filling operation of the storage tank;

FIG. 7 is a semidiagrammatic view similar to FIGS. 5 and 6 showing the relative position of the parts during actual impregnation of the porous articles;

FIG. 8 is a semidiagrammatic view similar to FIGS. 5–7 showing the relative position of the parts and the direction of movement of the impregnant just prior to removal of the impregnated articles;

FIG. 9 is a fragmentary semidiagrammatic view similar to FIGS. 5–8 showing the novel float operation for automatic refilling of the storage tank upon attainment of a predetermined impregnant level within the storage tank.

Referring now to FIG. 1 of the drawings, the double tank batch type impregnator 12 may be generally cylindrical in shape and due to nature of the operation thereof is preferably mounted in the vertical or upright position shown in FIG. 1. The double tank impregnator 12 of the type shown is quite large, roughly 18 feet in height and 9 feet in outer diameter and due to this size is preferably placed on a suitable cement foundation 13 or on other similar strong firm support means. It is to be noted that all the dimensions referred to are intended to be illustrative rather than limiting. A generally annular base 14 may be provided to maintain the double tank structure 12 in the upright position, said base being fixedly mounted by suitable bolts to the foundation 13. Other types of bases may be provided if desired.

The double tank batch impregnator **12** essentially comprises an outer tank **15** which may be referred to as a storage tank and a smaller inner tank **16** which may be referred to as the impregnation tank. The storage tank **15** is formed with a closed bottom end **17** and an open top end **18**, the latter being sealingly closed by a movable cover **19**. The cover **19** has automatic cover opening means **20** here shown in the form of an air cylinder mechanism, but it is apparent that other forms of automatic opening devices as suitable and desired may be used. Suitable heat insulation means **11**, for example, magnesia block is disposed in surrounding relation to the outer tank **15** for reasons which will later be explained.

A support structure **21** is fixed firmly to the sidewalls of the tank **15** near the bottom **17** to support the inner impregnation tank **16**. The impregnation tank **16** is also cylindrical in shape having a closed bottom end **16***a* and an open upper end **22** which is adapted to receive the basket or other container means **55** which holds the articles such as conduit or pipe which are to be impregnated. The tank **16** is offset axially from tank **15** so that the sidewalls are in contact with one another (best shown in FIGS. 1 and 3) which aids in mounting as well as leaving room for access for maintenance men and the like for cleaning and maintenance of both of tanks **15** and **16**.

It will be noted that the impregnation tank **16** may be considerably smaller in diameter (approximately 6 feet) as compared to the storage tank **15**. The chamber or area **23** not taken up by tank **16** within the storage tank **15** is of sufficient capacity for storage of the impregnant and also of a size to give the desired foam capacity as shall be explained. The impregnation tank **16** may be formed of a relatively light gauge metal as compared to the outer tank **15** inasmuch as the inner tank does not have to withstand pressure differentials imposed upon the storage tank. This results in a substantial saving in original cost.

Each of the tanks **16** and **15** are formed with an aperture **24***a*, **25***a* near the respective bottoms **16***a*, **17** of the tanks, said apertures being connected to suitable pipes leading to the exterior of the storage tank **15** as shown in FIGS. 1, 3 and 4 of the drawings. As shown, the pipe from tank **16** extends through the sidewall of tank **15** and terminates in a fitting **24** which serves as both an inlet and outlet to impregnation tank **16**. The pipe leading from aperture **25***a* extends through the base **11** terminating in a fitting **25** which serves as both an inlet and outlet to tank **15**. Heating coils **26** and **27** are disposed in storage chamber **23** to maintain the impregnant at a standby temperature sufficient to afford easy movement thereof through the rest of the system yet to be described. Other types of heating means such as heating coils in contact with metal wall of tank **15** could be used if desired. The heating coils **26** and **27** are attached by suitable inlets such as **28** and outlets such as **29** to a heat source supply **31** shown semidiagrammatically in FIGS. 5–9.

A vacuum pump (not shown) is attached to the storage chamber **23** by an outlet **30** which extends through the sidewall of tank **15** at a point spaced from the inner impregnation tank **16** as shown in FIG. 3 of the drawings. The outlet **30** also may be placed in the cover **19** if desired, the important consideration being that it be at the upper end of the tank **15** and spaced from the edges of the open end **22** of tank **15** to prevent excessive entrainment of foam during the impregnation operation. If desired, shielding means such as a baffle plate or the like (not shown) can be interposed adjacent the outlet **30** to help contain the foam.

The novel double batch impregnator **12** may be disposed in the system shown semidiagrammatically in FIGS. 5–9 inclusive. Assume the conditions are as shown in FIG. 5 of the drawing, i.e., the storage chamber **23** being empty, for example, just after a cleaning of the

entire device or when it is down for maintenance or repairs and/or for other suitable reasons and the impregnant such as coal tar pitch is located at a suitable storage supply **32**. Prior to starting the impregnation system in operation, the impregnant is pumped to the storage chamber **23** of tank **15** of a pump **33** through suitable conduits **34**, **35**, **36**, **37** and **38** as shown in FIG. 6 of the drawings. The cover **19** is generally closed during this operation to save on heat and because of deleterious fumes from the impregnant which are unpleasant to operating personnel. Valve members **39** and **40** control the flow of fluid impregnant to the chamber **23** and are located between portions of conduit **35**, **36** and **36**, **37** respectively. As shown in FIG. 6 the pitch impregnant may be pumped into chamber **23** until it reaches a level **50** somewhat below the top **22** of the impregnation tank **16**. Valve **39** is then closed.

Assuming a sufficient standby temperature of the pitch impregnant, the system is now ready for the normal impregnation cycle. The cycle starts with the opening of the cover **19** to the storage and impregnation tank, and the disposition of a basket **55** containing the oven predried porous elongated tubes or other articles to be impregnated within the impregnation tank **16**. Cover **19** is then sealingly closed and valve **40** is turned to the position shown in FIG. 7 of the drawings. The pitch impregnant located in the storage chamber **23** is then pumped out of chamber **23** by means of a reversible pump **41** and then through a heat exchanger **42**, through valve **43** and into the impregnation tank **16** as shown by the arrows in FIG. 7. The impregnant is heated from a standby temperature to the best impregnation temperature (approximately 340° F.) by means of the outside heat exchanger **42** thereby reducing the amount of heat that must be supplied to the system by heat source **31** while the pitch impregnant is stored in the storage chamber **23**. This outside heat exchanger **42** is advantageous in cost, maintenance and suitable for heating a direct supply of impregnant from source **32** as shall be explained. The pitch impregnant upon entering the impregnation tank **16** enters through suitable apertures in the basket **55** and rises upwardly until it overflows over the top edge **22** of the tank **16**. Thereupon the pitch impregnant falls down the sides of the tank **16** to the level of the pitch as shown in FIG. 7 for recirculation through the heat exchanger **42** to form a continuous circulating system. If desired, the overflow of the pitch impregnant can be controlled by means of a piping arrangement (not shown).

A vacuum is now drawn and released upon the storage tank chamber **23** by means of a vacuum pump system (not shown) to cause complete saturation of the porous articles disposed in the basket. A vacuum may be drawn and released as many times as necessary in accordance with established procedure as well understood in the art. Inherent in this impregnation system is a foaming action. This is caused by many things including the recirculating movement of the pitch as well as the removal of gas and water vapor trapped in the porous tubes or other articles. It will be noted that there is substantial foam capacity for this system as shown semidiagrammatically in FIG. 7, said foam capacity being very desirable for practical operating characteristics.

After completion of the impregnation of the articles, valve member **43** remains in the position shown in FIG. 8 and the impregnation tank **16** is drained by the pump **41** which pumps the impregnant back into the storage chamber **23**. However, since the elongated porous articles have absorbed a portion of the pitch impregnant, the pitch level is now at point **50'** rather than **50**, the original starting level. The cover **19** is now reopened and the basket **55** containing the elongated porous articles is removed from the impregnation tank and placed in the quench tank (not shown) to congeal the pitch impregnant.

The apparatus is now ready for another basket which

may be disposed in impregnation tank and the same procedure will be followed.

In the original filling of chamber 23 of tank 16 from supply 32, it is sometimes desired to run the pitch impregnant through the heat exchanger 42 to raise the temperature to a higher level. To accomplish this, valve 39 remains as shown in FIG. 6, whereas valve 40 is rotated 90° to the left and valve 43 is rotated 90° to the right. The impregnant will now enter chamber 23 by flowing through conduit or pipe 48 as shown by the dotted arrows in FIG. 6.

The system shown may be operated with a continuous replenishment of the pitch impregnant or may be operated such that after the occurrence of, for example, five or more impregnation cycles, the system may be refilled through valves 39 and 40 as described earlier. This depends upon the desired characteristics at the precise location of the impregnation apparatus. The particular apparatus shown has a bypass pipe 44 from the pitch supply 32 leading through a valve 45 and a valve 43 so that during pumping of the impregnant from the storage chamber 23 during an impregnation cycle, additional pitch may be brought in from the pitch supply 32 and brought through the heat exchanger 42. This is accomplished by a float 46 which is actuatingly attached to a suitable switch 47 which actuates the valve 45 and the pump 33. The refinement of the float operated switch 47 and the bypass conduit 44 and valve 45 are not absolutely necessary to the system but do provide for automatic replenishment of the pitch supply when that function is desired.

In some applications it is desired that pump 41 be run in a single direction or be a single directional pump rather than reversing the operation thereof as aforedescribed. In the latter event, two additional pieces of conduit or pipe 51 and 52 may be interposed between conduit or pipes 48—49 and 53—36 respectively as shown in FIG. 8. An additional valve 54 may be placed in conduit or pipe 48 below the connection of conduit 51 to take care of back pressure if desired. Then when it is desired to empty tank 16, valve 43 is moved 180° from the position shown in FIG. 8 and valve 49 is moved to 90° to the left from the position shown in FIG. 8. The emptying flow will then be as shown by dotted arrows in FIG. 8.

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. Apparatus for saturating elongated fibrous articles comprising a large cylindrical thermally insulated first tank forming a storage chamber and having a cover detachably sealingly mounted thereon, both said tank and said cover being formed of thick gauge material adapted to withstand high pressure differentials between the interior and exterior of said chamber, a second cylindrical tank having an open top end portion and formed of relatively thin gauge material and adapted to normally contain impregnating material and fibrous articles, said second cylindrical tank being of smaller diameter than said first tank and disposed in axially offset relation within said first tank, vacuum producing means, vacuum outlet means from said storage tank chamber disposed at a point spaced away from said second tank, said vacuum outlet means being attached to said vacuum producing means, heat producing means internally of said first tank and exterior of said second tank, passageway means communicating said first tank and second tank, reversible pump means in said passageway means, and heat exchanger means in said passageway means, whereby impregnant may be stored and maintained at a standby temperature in said storage chamber exterior of said second tank and then the impregnant may be pumped through said passageway means including said heat exchanger to raise the temperature thereof en route to said impregnation tank, the impregnant during pumping spilling over the open end of said second tank into said storage chamber for recirculation through said passageway means.

2. Apparatus for impregnating elongate fibrous articles comprising outer enclosure means defining a sealed storage chamber, support means disposed within said storage chamber, a second enclosure means mounted on said support means to provide a separate impregnation chamber within said storage chamber, said second enclosure means adapted to contain said fibrous articles and impregnating material, access means through said sealed storage chamber affording entry to said impregnation chamber, and passageway means having a portion external to both of said enclosure means and providing communication between said storage chamber and said impregnation chamber to afford ingress and egress of the impregnant.

3. Apparatus for impregnating elongate fibrous articles comprising an outer tank defining a sealed pitch storage chamber, a support structure disposed near the bottom of and within said storage chamber, a second tank mounted on said support structure to provide a separate impregnation chamber within said storage chamber so that said fibrous articles may be immersed in impregnant, a movable cover providing access through said sealed storage chamber and affording entry to said impregnation chamber, and passageway means having a portion external to both of said enclosure means and providing communication between said storage chamber and said impregnation chamber to afford ingress and egress of the pitch impregnant.

4. Apparatus for impregnating elongate fibrous articles comprising outer cylindrical tank means defining a sealed storage chamber, a second cylindrical tank means having an open end and axially offset from and disposed within said first tank means to provide a separate impregnation chamber within said storage chamber so that said fibrous articles may be immersed in impregnating fluid, removable cover means for said sealed storage chamber affording entry to said open end of said second tank means to afford loading of said impregnation chamber, and passageway means having a portion external to both of said enclosure means and providing communication between said storage chamber and said impregnation chamber to afford ingress and egress of the impregnant.

5. Apparatus for saturating elongated fibrous articles comprising a large cylindrical thermally insulated first tank forming a storage chamber and having a cover detachably sealingly mounted thereon, both said tank and said cover being formed of thick gauge material adapted to withstand high pressure differentials between the interior and exterior of said chamber, a second cylindrical tank having an open top end portion and formed of relatively thin gauge material and adapted to serve as a receptacle for impregnant so that said fibrous articles may be immersed therein, said second cylindrical tank being of smaller diameter than said first tank and disposed in axially offset relation within said first tank, vacuum producing means, vacuum outlet means from said storage tank chamber disposed in spaced relation to said second tank, said vacuum outlet means being attached to said vacuum producing means, heat producing means internally of said first tank and exterior of said second tank, impregnant storage means spaced from said first tank, passageway means communicating said first tank, second tank and impregnant storage means, reversible pump means in said passageway means, heat exchanger means in said passageway means, valve means in said passageway means and float means in said first tank connected to said valve means to cause, under predetermined conditions, opening of said valve means to afford move-

ment of impregnant to said first tank from said storage means.

6. The process of saturating oven pre-dried tubes with a pitch impregnant while said tubes are disposed in an impregnation tank which is in turn disposed within a pitch filled storage tank, comprising the steps of disposing said tubes within said impregnation tank, sealing said storage tank, pumping pitch impregnant from said storage tank through a heating means to said impregnation tank, filling said impregnation tank with pitch impregnant from said storage tank to fully immerse said tubes and to substantially empty said storage tank to provide substantial pitch foam capacity immediately adjacent said impregnation tank, continuing to pump impregnant to said impregnation tank to cause said impregnant in said impregnation tank to spill over the sides thereof into said storage tank for recirculation, drawing a vacuum on the storage tank to remove any residual vapors from the tubes to afford complete saturation thereof, releasing the vacuum, removing impregnant from the impregnation tank to the storage tank, unsealing the storage tank, and removing the pitch saturated impregnated tubes from said impregnation tank.

7. The process of saturating oven pre-dried tubes with a heated pitch impregnant while said tubes are disposed in an impregnation tank which is in turn disposed within a pitch filled storage tank, comprising the steps of disposing said tubes within said impregnation tank, sealing said storage tank, pumping pitch impregnant from said storage tank through a heating means to said impregnation tank, filling said impregnation tank with pitch impregnant from said storage tank to fully immerse said tubes and to substantially empty said storage tank to provide substantial pitch foam capacity immediately adjacent said impregnation tank, continuing to pump impregnant to said impregnation tank to cause said impregnant in said impregnation tank to spill over the sides thereof into said storage tank for recirculation, drawing a vacuum on the storage tank to remove any residual vapors from the tubes to afford complete saturation thereof, releasing the vacuum, reversing the pumping operation to empty the impregnation tank and to refill the storage tank, and removing the pitch saturated impregnated tubes from said impregnation tank.

References Cited in the file of this patent

UNITED STATES PATENTS

1,864,674	Schur	June 28, 1932
1,920,191	Ford et al.	Aug. 1, 1933
1,986,319	Bongrand et al.	Jan. 1, 1935
1,988,955	Nehmert	Jan. 22, 1935
2,012,968	Miller	Sept. 3, 1935
2,012,970	Miller	Sept. 3, 1935
2,016,060	Strauch	Oct. 1, 1935
2,096,888	Emberg	Oct. 26, 1937
2,303,257	Campbell et al.	Nov. 24, 1942
2,478,439	Liedtke	Aug. 9, 1949
2,529,699	Lach	Nov. 14, 1950
2,628,173	Fair	Feb. 10, 1953