

Jan. 10, 1956

R. EWING

2,730,462

IMPREGNATION OF ABSORBENT MATERIALS

Filed April 7, 1953

2 Sheets-Sheet 1

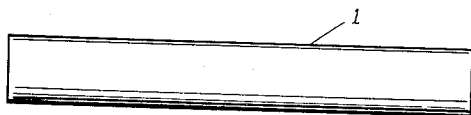


Fig. 1

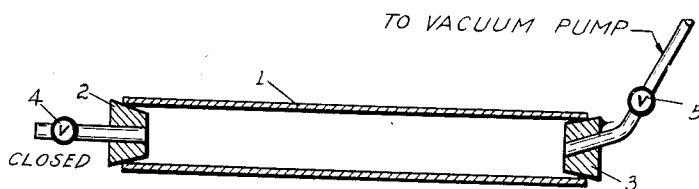


Fig. 2

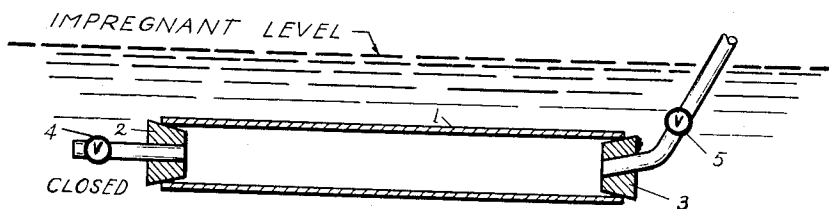


Fig. 3

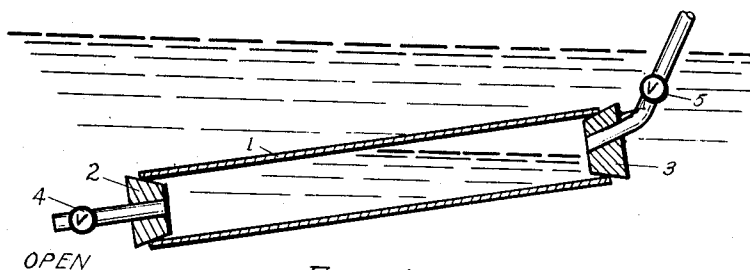


Fig. 4

INVENTOR.
Reid Ewing
BY *Arnold J. Ericson*
Attorney

Jan. 10, 1956

R. EWING

2,730,462

IMPREGNATION OF ABSORBENT MATERIALS

Filed April 7, 1953

2 Sheets-Sheet 2

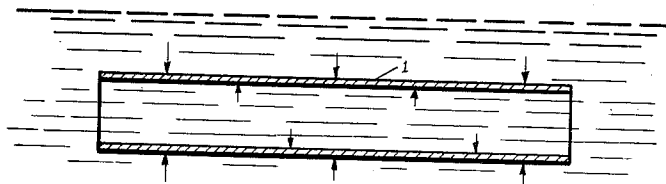


Fig. 5

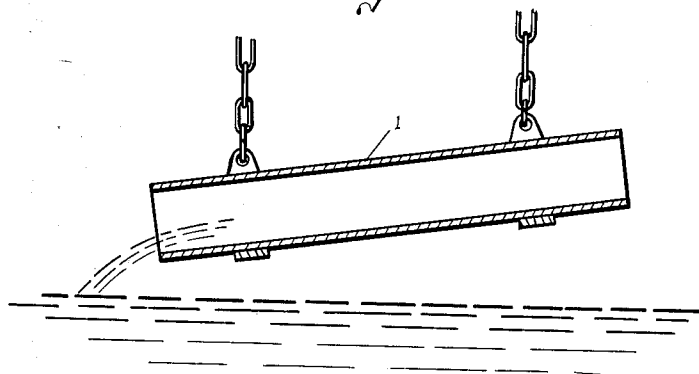


Fig. 6



Fig. 7

INVENTOR.
Reid Ewing
BY *Arnold J. Ewing*
Attorney

1

2,730,462

IMPREGNATION OF ABSORBENT MATERIALS

Reid Ewing, Milwaukee, Wis., assignor to McGraw Electric Company, Milwaukee, Wis., a corporation of Delaware

Application April 7, 1953, Serial No. 347,275

7 Claims. (Cl. 117-95)

This invention is directed to the impregnation of absorbent articles, and particularly, the impregnation of fibrous conduits, pipes, or other tubular members having a wall thickness requiring a predetermined degree of saturation of impregnating fluids.

The articles to be impregnated may be prepared in any known manner. In the case of fibrous bases for conduits and pipe, newsprint and paper pulp, or other fibrous material, may be beaten in the usual paper beaters and a resultant stock screened and then pumped to paper cylinder machines and there formed into wet felts or paper. The wet paper may be wound about a cylindrical tube or a mandrel to produce a wet conduit of proper thickness. This conduit may be dried in kilns to remove the major portion of its moisture content. It will be obvious that other fibrous bases may be prepared in the usual manner. The tube diameters generally range from 2 to 6" or larger in internal diameter and have an average wall thickness of approximately one-quarter of an inch, and are usually produced in 5 to 8 foot lengths. These dimensions, of course, may be greater or less than as given.

In the past, it has been the general practice to impregnate fibrous materials under batch methods of impregnation. This has been very effective, but does provide numerous difficulties such as foaming of the impregnant during the impregnation with a consequent loss of volatile oils from the pitch and restriction of the amount of pitch absorbed by the fibrous walls, building up of "free carbon" content of the pitch due to the long maintenance of large bodies of pitch in which the conduits or other articles are immersed under heat, resulting in decomposition of the impregnant; unsatisfactory saturation of the conduit due to the fibrous walls not absorbing sufficient saturant to render them substantially water proof; and charring or burning of the organic bases due to long time immersion of the organic or fibrous bases in hot saturant.

It is therefore an object of the present invention to provide a process for impregnating fibrous articles under a method which overcomes the above-mentioned difficulties.

It is another object of the present invention to provide a process for the impregnation of fibrous articles, which impregnation may be controlled to provide a predetermined degree of saturation.

It is a further object of this invention to provide a process for impregnating fibrous articles with impregnants of many known chemical compositions or mixtures.

It is still another object of this invention to provide a method of impregnation of fibrous articles which may take the form of a completely automatic process.

It is a specific object of the present invention to provide a method of impregnating an absorbent tubular article, wherein said member acts as its own vacuum chamber during an evacuating step preceding impregnation of the article.

Referring now to the drawings, the process of impregnation may be best described in connection with the following figures in which:

2

Fig. 1 is an elevational view of a pre-dried tube fabricated from a fibrous material and ready for impregnation.

Fig. 2 is a diagrammatic view, partly in section, of the unimpregnated tube provided with evacuation and impregnation fittings.

Fig. 3 diagrammatically illustrates the unimpregnated tube immersed in the impregnating fluid and undergoing an evacuation of residually contained air and moisture.

Fig. 4 is a diagrammatic illustration of the tube having its impregnant valve open under evacuating conditions established at the vacuum valve end, whereby the impregnant is permitted to flow within the bore of the tube.

Fig. 5 is a diagrammatic illustration of the evacuated and filled tube with the valve cones removed, and with the tube being retained under conditions of total immersion in the impregnant.

Fig. 6 is a diagrammatic view of the impregnated tube illustrating a step of draining the excess impregnant from the tube.

Fig. 7 is a diagrammatic view of the drained impregnated tube during the step of cooling and hardening of the impregnant.

The invention is best described in connection with the impregnation of conduits or pipe having a fibrous base consisting principally of the cellulose fibers from waste newsprint and the like.

The impregnant widely used for this purpose is generally a coal tar pitch, which is kept at an impregnating temperature of approximately 325° F. It is advisable to maintain the viscosity of the impregnant at a point below 100 centipoises measured at 325° F., and preferable at 75 centipoises. If the temperature rises too high, for instance above 340° F., the cellulose fibers of the article to be impregnated are apt to break down with a consequent loss of mechanical strength.

It will be obvious that many other impregnating compounds may be used, including asphalt which may be maintained at the desired viscosity and heated to approximately the same temperature as the coal tar pitch for proper impregnation. It is to be understood, however, that the invention is not to be limited to the particular impregnants suggested, but will apply to any desired impregnating compound and absorbent base materials having voids that are to be substantially filled with impregnating material. This will become more apparent by the following description:

The preferred steps of the impregnating process are illustrated by the series of diagrammatic views included in the drawings. For instance, Fig. 1 illustrates a tube or pipe section 1, which has been formed from waste newsprint or the like and subjected to a drying atmosphere for removing most of the water from the tube. The unimpregnated, dried tube is known in the trade as a "white tube." Although the impregnant is preferably maintained at a temperature above the boiling point of water, which might aid in the removal of occluded water and water vapor, it is preferred to immerse a tube that has been previously dried as much as possible. If this is not done, the rapid evolution of water and water vapor on immersion will cause the impregnant to foam with a consequent loss of volatile oils and restriction of the amount absorbed by the fibrous material. In addition, any moisture included in the fibrous article will cause an immediate cooling effect at that area which will prevent thorough impregnation and entrapment of the moisture with a consequent loss in mechanical strength.

It has been found preferable, in most instances, to maintain the unimpregnated article just prior to impregnation at a temperature approximating the vat temperature of the impregnant. This is not an essential step in every instance, as the prime object is to provide an unimpregnated article that is as dry as possible to avoid random

3 cool areas created by occluded moisture. Preheating does assure a very dry product, however.

The tube 1 is fitted as illustrated in Fig. 2 with plug members 2 and 3 at opposite ends thereof. It is preferable to provide tapered plug members for engaging the tube ends at as close as possible to the extremities to permit a thorough evacuation and impregnation of the entire tube length, as will hereinafter be described. Each of the plug members 2 and 3 have an opening for communicating with control valves 4 and 5, respectively. The valve 4 is normally closed and adapted to be opened at a predetermined period of time during the impregnation cycle. This valve 4 will hereinafter be called the "impregnant valve."

The impregnant valve obviously may take the form of a slow delivery orifice which will permit a simultaneous filling of the tube bore with impregnant while evacuation is taking place, as will hereinafter be described. However, it is to be understood that substantially complete evacuation should have taken place before very much impregnant has been admitted to the bore of the tube.

The vacuum valve 5 communicates with the plug 3 at one side, and with vacuum pump (not shown) at its other entrance. This valve may be automatically operated by means of a conventional float actuated device (not shown), if so desired.

The entire preheated tube 1 fitted with the plug members, is next immersed below the top level of the impregnant, as shown in Fig. 3. The impregnant valve 4 remains closed, and a vacuum is drawn through the valve 5. It has been found desirable to maintain the vacuum as low as possible, and preferably less than 10 millimeters Hg. It will be apparent that the evaluation may be started at any time after the plug members have been inserted and continued as the tube is being immersed below the impregnant level.

After a predetermined period of time has expired for removing the maximum amount of air, water and water vapor from the tube and the tube walls, the impregnant valve 4 is opened. In the case of automatic equipment, it will be obvious that this valve may be opened, at the proper moment by means of cams, levers, or the like (not shown). It will also be apparent that the entire tube 1 bearing the plug member 2 must be totally immersed below the impregnant level before the valve is opened. Opening the valve 4 permits the impregnant to enter the bore of the tube as shown in Fig. 4, filling the tube until the entire bore is filled with the impregnant, which displaces the air and water vapor previously removed by the vacuum pump through the valve 5. It has been found desirable to maintain the immersed tube at an angle which will permit ease in removal of the maximum amount of residual air and moisture. If the tube is held horizontally it would be next to impossible to remove residual air and moisture between the upper wall and the impregnant level.

It will be apparent that under this system of individually plugging both tube end openings, the tube acts as its own vacuum chamber. It has been found that the unimpregnated tubes have substantial mechanical strength when unimpregnated, but tend to lose this strength almost as soon as they are contacted by hot liquified pitch. Under the present method, the tubes are evacuated from within, and then, after a predetermined evacuation takes place, are immediately filled with impregnant from the interior, which acts as a strengthening column for providing internal support during subsequent impregnation, as will hereinafter be described.

When the bore of the tube has been filled with impregnant, the valve 5 is closed. A convenient arrangement for closing this valve may be accomplished by means of a float actuated member (not shown), which is responsive to the pitch level as it approaches the valve. It is to be noted that during this period of evacuation, due to the reduced pressure within the tube wall, the impreg-

nant is continually entering the wall thickness of the tube from the outside as well as from the inner wall contacted by the filling impregnant.

The next step in the process is to remove the plug members 2 and 3 while the tube 1 is maintained under conditions of total immersion. Thus, due to the fact that the evacuated void spaces between the fibrous particles of the tube wall are under reduced pressure, it will be obvious that the impregnation will continue as the pipe or tube is maintained below the impregnant level until the optimum degree of saturation relative to this pressure has been reached. The direction of impregnation from without and within is shown by the arrows in Fig. 5.

After the desired saturation has been completed, the article is removed from the impregnant and drained as shown in Fig. 6. It is preferable to drain the tube while it is kept at a relatively high temperature. After draining, the impregnated tube is cooled as illustrated in Fig. 7, until the impregnant is hard enough to permit handling for further machining operations, inspection, and packing.

It will be apparent that the present invention provides a method of impregnating absorbent articles that results in a controlled saturation, optimum strength, economy of manufacture, minimum losses and which is readily adaptable for completely automatic installations.

I claim:

1. A process for impregnating an article having a permeable wall surface defining a chamber having two openings in said wall surface, which process comprises maintaining a body of impregnant, closing said chamber at one of said openings with a first plug member having a normally closed aperture adapted to be opened to admit said impregnant to said chamber at a predetermined time and rate, closing the remaining opening with a second plug member having an aperture normally open to communicate with an evacuating means, positioning said article so that the said normally open aperture in said second plug member is near the top of said chamber, immersing said article in said impregnant, evacuating said chamber and said wall surface through said second plug member, opening the normally closed aperture in said first plug member to admit said impregnant to said chamber while said article remains immersed in said impregnant and until said chamber is substantially filled therewith, interrupting said evacuation, removing both of said plug members while said article remains immersed in said impregnant, continuing said immersion until the wall surface has been impregnated to a predetermined degree of saturation.

2. A process for impregnating a tubular article having a permeable wall surface defining an elongated chamber substantially coextensive therewith, which process comprises maintaining a body of impregnant, closing said chamber at one end thereof with a first plug member having a normally closed aperture adapted to be opened to admit said impregnant to said chamber at a predetermined time and rate, closing the opposite end of said chamber with a second plug member having an aperture normally open to communicate with an evacuating means, positioning said article so that the said normally open aperture in said second plug member is near the top of said chamber, immersing said article in said impregnant, evacuating said chamber and wall surface through said second plug member, opening the normally closed aperture in said first plug member to admit said impregnant to said chamber while said article remains immersed in said impregnant and until said chamber is substantially filled therewith, interrupting said evacuation, removing both of said plug members while said article remains immersed in said impregnant, continuing said immersion until the wall surface has been impregnated to a predetermined degree of saturation.

3. A process for impregnating a tubular article having

a permeable wall surface defining an elongated chamber substantially coextensive therewith, which process comprises maintaining a body of impregnant, maintaining said tubular member to a temperature approximating the temperature of said impregnant, closing said chamber at one end thereof with a first plug member having a normally closed aperture adapted to be opened to admit said impregnant to said chamber at a predetermined time and rate, closing the opposite end of said chamber with a second plug member having an aperture normally open to communicate with an evacuating means, positioning said article so that the said normally open aperture in said second plug member is near the top of said chamber, immersing said article in said impregnant, evacuating said chamber and wall surface through said second plug member, opening the normally closed aperture in said first plug member to admit said impregnant to said chamber while said article remains immersed in said impregnant and until said chamber is substantially filled therewith, interrupting said evacuation, removing both of said plug members while said article remains immersed in said impregnant, continuing said immersion until the wall surface has been impregnated to a predetermined degree of saturation.

4. A process for impregnating a tubular article having a permeable wall surface defining a chamber substantially coextensive therewith, which process comprises maintaining a body of impregnant, closing said chamber at one end thereof with a first plug member having a normally closed aperture adapted to be opened to admit said impregnant to said chamber at a predetermined time and rate, closing the opposite end of said chamber with a second plug member having an aperture normally open to communicate with an evacuating means, positioning said article so that the said normally open aperture in said second plug member is near the top of said chamber, supporting said article with the said opposite end including the second plug member being inclined from the horizontal and immersing said article in said impregnant while so inclined, evacuating said chamber and wall surface while so supported, opening the normally closed aperture in said first plug member to admit said impregnant to said chamber while said article remains immersed in said impregnant and until said chamber is substantially filled therewith, interrupting said evacuation, removing both of said plug members while said article remains immersed in said impregnant, continuing said immersion until the wall surface has been impregnated to a predetermined degree of saturation.

5. A process for impregnating an article having a permeable wall surface of organic fibrous material and defining a chamber having two openings in said wall surface, which process comprises maintaining a body of heat liquified coal tar pitch, closing said chamber at one of said openings with a first plug member having a normally closed aperture adapted to be opened to admit said coal tar pitch to said chamber at a predetermined time and rate, closing the remaining opening with a second plug member having an aperture normally open to communicate with an evacuating means, positioning said article so that the said normally open aperture in said second plug member is near the top of said chamber, immersing said article in said coal tar pitch evacuating said chamber and said wall surface through said second plug member, opening the normally closed aperture in said first plug member to admit said coal tar pitch to said chamber while

said article remains immersed in said coal tar pitch until said chamber is substantially filled therewith, interrupting said evacuation, removing both of said plug members while said article remains immersed in said coal tar pitch, continuing said immersion until the wall surface has been impregnated to a predetermined degree of saturation.

6. A process for impregnating a tubular article having a permeable wall surface of organic fibrous material and defining an elongated chamber substantially coextensive therewith, which process comprises maintaining a body of heat liquified coal tar pitch, maintaining said tubular member to a temperature approximating the temperature of said coal tar pitch, closing said chamber at one end thereof with a first plug member having a normally closed aperture adapted to be opened to admit said coal tar pitch to said chamber at a predetermined time and rate, closing the opposite end of said chamber with a second plug member having an aperture normally open to communicate with an evacuating means, positioning said article so that the said normally open aperture in said second plug member is near the top of said chamber, immersing said article in said coal tar pitch, evacuating said chamber and wall surface through said plug member, opening the normally closed aperture in said first plug member to admit said impregnant to said chamber while said article remains immersed in said coal tar pitch and until said chamber is substantially filled therewith, interrupting said evacuation, removing both of said plug members while said article remains immersed in said coal tar pitch, continuing said immersion until the wall surface has been impregnated to a predetermined degree of saturation.

7. A process for impregnating a tubular article having a permeable wall surface of organic fibrous material and defining a chamber substantially coextensive therewith, which process comprises maintaining a body of heat liquified coal tar pitch, closing said chamber at one end thereof with a first plug member having a normally closed aperture adapted to be opened to admit said coal tar pitch to said chamber at a predetermined time and rate, closing the opposite end of said chamber with a second plug member having an aperture normally open to communicate with an evacuating means, positioning said article so that the said normally open aperture in said second plug member is near the top of said chamber supporting said article with the said opposite end including the second plug member being inclined from the horizontal and immersing said article in said coal tar pitch while so inclined, evacuating said chamber and wall surface while so supported, opening the normally closed aperture in said first plug member to admit said coal tar pitch to said chamber while said article remains immersed in said coal tar pitch and until said chamber is substantially filled therewith, interrupting said evacuation, removing both of said plug members while said article remains immersed in said coal tar pitch, continuing said immersion until the wall surface has been impregnated to a predetermined degree of saturation.

References Cited in the file of this patent

UNITED STATES PATENTS

561,712	Lynch	June 9, 1896
2,012,961	Emberg	Sept. 3, 1935
2,012,969	Miller	Sept. 3, 1935
2,531,156	Piercy	Nov. 21, 1950