

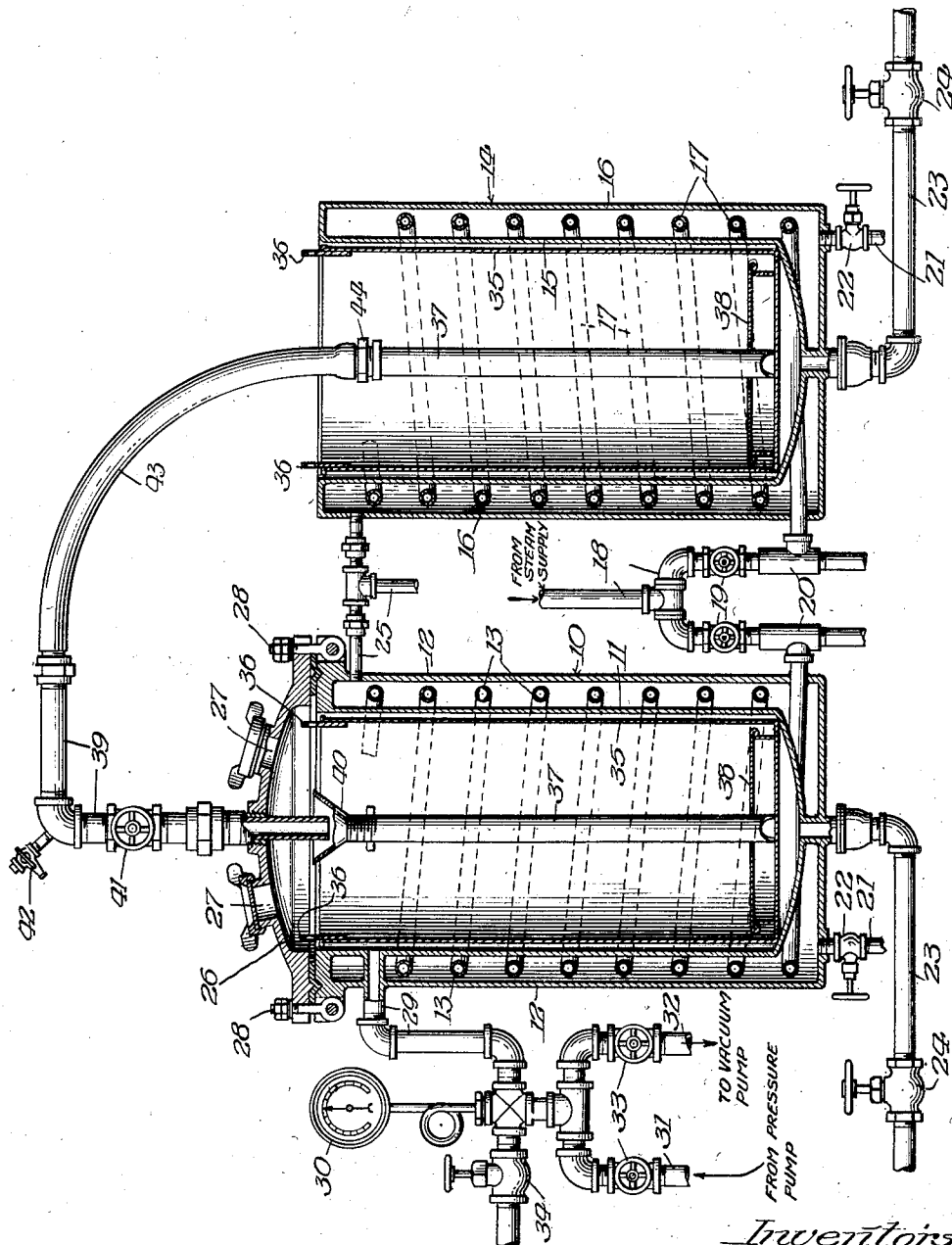
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APPARATUS FOR IMPREGNATING WOOD AND THE LIKE

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## UNITED STATES PATENT OFFICE

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APPARATUS FOR IMPREGNATING WOOD  
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Our invention relates to improvements in apparatus for impregnating wood and the like whereby the pores of the wood may be filled with a synthetic resin or other suitable material which will harden and become insoluble in the pores so as to give the finished product highly improved qualities with respect to strength, resiliency, texture, finish and durability and so as to make the wood fireproof or at least very slow burning and so as to protect the wood against decay and keep it from splitting when being worked.

It is an object of our invention to provide an improved form and arrangement of parts by which the successive steps of impregnation of articles made of wood or other fibrous material may be carried out to advantage by an operator following a prescribed routine in such manner as to insure that uniformly successful results will be obtained.

Another object of our invention is to provide an improved arrangement of means for handling the articles to be treated and for subjecting them to the influence of heat and a vacuum and optionally to the influence of air pressure many times greater than the normal atmospheric pressure. As will be readily appreciated, the receptacle in which the impregnating operation is carried out must be made comparatively heavy and strong to withstand a high internal pressure, for example, 150 pounds per square inch as is desired in connection with the impregnation of some types of article. Furthermore, synthetic resins of the phenol-formaldehyde type, which are preferably used as the base material for the preparation of the impregnating solution in the practice of our invention, are adapted to have a chemical reaction with the cheaper metals otherwise suitable for use, particularly when heated, such reaction being of a character to interfere seriously with effective impregnation operations. It is, therefore, necessary that a higher grade, more expensive metal be used for all metal parts with which the impregnating solution comes into contact in the course of the impregnation operation. Moreover, the impregnating solution has a marked tendency to polymerize to a considerable extent in a short time when heated and when subjected to a vacuum, with the result that it is necessary that the parts coming in contact with the impregnating solution be cleaned thoroughly between each two successive impregnating operations if the parts are to be kept in condition for continued use and so as to be capable of being handled conveniently. For insuring proper cleaning, these parts should be immersed in a hot bath

of caustic soda solution, or the like, promptly following each contact of the parts with the impregnating material. The metal used in such parts also must be inert with respect to such cleaning solutions. We have found that it is almost if not quite impossible to clean these parts by any practical method if the cleaning operations are delayed for any considerable time.

It is a further object of our invention to provide an improved arrangement of parts by the use of which the impregnating solution and the articles being treated may be handled expeditiously and easily, whereby the impregnating solution may be subjected to a minimum of disturbance when transferred from one container to the other or the like so as to cut down to a minimum the opportunity for the solution to harden in contact with a surface, whereby all parts with which the impregnating solution has any substantial continued contact may be readily immersed in a caustic or other suitable cleaning bath, and whereby all metal parts with which the impregnating solution is brought into contact may be made of nickel or some other suitable metal inert with respect to the impregnating solution and the cleaning solution without the necessity for forming the heavy impregnating receptacle of such metal.

For the accomplishment of these ends, it is one of the objects of our invention to provide an improved arrangement of impregnating receptacle and cooperating parts in which a light container or liner is used for holding the impregnating solution, which liner can be readily made of the desired form of inert metal and which may be readily manipulated for the required handling of the impregnating solution and the articles to be treated and for the required washing operations, in which arrangement a second receptacle is preferably provided for receiving a duplicate container or liner which is maintained therein at the desired even temperature, and in which arrangement means is provided for the convenient transfer of the impregnating solution at the proper time from one container or liner to the other for alternate use of said liners in the impregnating receptacle. As a result of our improved arrangement, we have found it feasible to make the heavy impregnating receptacle of steel or brass or of any other comparatively cheap metal providing the required strength, since the impregnating solution is not brought into direct contact with the metal of the receptacle, it being confined at all times within the liner which can readily be formed of a suitable inert metal.

Specifically, it is one of the objects of our invention to provide an improved arrangement comprising receptacles fixed in position side by side in pairs, one being provided with means for creating and maintaining a vacuum or a heavy air pressure therein, and both being provided with means for keeping them heated to the desired temperature, such receptacles being of substantially the same inside diameter and the same height for assuring substantially the same working fit of the liners therein. It is another object of our invention to provide, in an arrangement of this type, improved means for transferring the impregnating solution from the liner in one receptacle to a liner in the other receptacle, such transfer means being also formed of material inert with respect to the impregnating solution.

It is another object of our invention to improve apparatus of this type in sundry details herein-after pointed out. The preferred means by which we have accomplished our several objects are illustrated in the drawing and are hereinafter specifically described. That which we believe to be new and desire to cover by Letters Patent is set forth in the claims.

The drawing shows diagrammatically our preferred construction of apparatus.

It is to be understood that the process which is disclosed more or less completely in connection with the description of the apparatus is not claimed by this application but forms the subject-matter of our copending application of even date herewith, Serial No. 15,899.

In the arrangement shown in our drawing, 10 indicates a heavy strong receptacle made of steel or other comparatively cheap metal and comprising an inner shell 11 and an outer shell 12, having a steam coil 13 mounted about the sides of the inner shell. A second receptacle 14 is provided which in the construction illustrated is similar generally to the receptacle 10, comprising an inner shell 15 of approximately the same inside size as that of the shell 11, and an outer shell 16, having a steam coil 17 mounted about the sides of the inside shell. The lower ends of the coils 13 and 17 are connected by a line of piping 18 with a source of steam, the connection with each of the coils comprising a shut-off valve 19 and a heat-controlled drain trap 20 of any approved construction, the latter being arranged for draining the condensate from the associated coil when the temperature at the trap falls substantially below 100° C. The upper ends of the coils open into the space between the two shells. Drain pipes 21 provided with shut-off valves 22 are connected with the outer shells, and drain pipes 23 provided with shut-off valves 24 are connected with the inner shells. An overflow pipe 25 is connected with the outer shells near their upper ends, through which any surplus of water or other suitable heating medium may escape from the space about the heating coils.

The receptacle 10 is provided with a cover plate 26 hinged thereon and adapted to be secured down in tight-closure position by means of swivel bolts 28 spaced about the periphery of the plate. At opposite sides, the cover plate 26 is provided with glass-covered peep or sight openings 27 through which the progress of the operations in the receptacle can be observed. The receptacle 10 is also provided with means for exhausting the air therefrom, together with means for providing a heavy pressure therein when desired. This means comprises a pipe 29 having a pressure gauge 30 connected therewith and having two

branches 31 and 32 for connection with a pressure pump and a vacuum pump, respectively, each of said branches being provided with a shut-off valve 33 therein. A shut-off relief valve 34 is connected with the pipe 29.

Our apparatus further comprises containers 35 adapted to have an easy working fit within the receptacles 10 and 14 so as to serve as liners for said receptacles for keeping the impregnating solution out of contact with the metal of the receptacles. By the use of such containers 35, which are preferably formed of thin sheet metal, the handling of the articles for insertion into and withdrawal from the receptacles 10 and 14 and the manipulation of the containers for the necessary cleaning operations may be effected readily and easily. We have found that when phenol-formaldehyde resins are used for impregnating it is necessary from a practical standpoint to clean the containers thoroughly after each impregnating operation in order to prevent the formation of a coating or scale of the hardened resin on the parts coming into contact with the solution and in order to keep the parts in condition for convenient handling. If cleaning is delayed for a considerable time after an impregnating operation, or if a container is used for more than a single operation without an intermediate cleaning, it is almost impossible to remove the hardened resin from the surface, since it is practically impossible to prevent a start of the polymerization during or after the heat treatments included in the impregnation. In order to make such cleaning effective it is necessary from a practical standpoint to immerse the container in a heated solution of sodium hydroxide or other strong alkali whereby all of the ingredients of the impregnating solution are completely removed.

There is another marked advantage in the use of liners or light containers for receiving the impregnating solution, in that such impregnating solution is adapted to have a highly objectionable reaction with the ordinary cheaper metals such as it is desirable to use for the manufacture of the heavy receptacle 10 which must be of adequate strength to accommodate the high vacuum and heavy air pressure alternately employed therein. In order to prevent such reaction, particularly when the impregnating solution is heated, we have found it necessary to employ a special construction of container. We have found that satisfactory results are obtained by the use of containers made of nickel or monel metal, with which there is no objectionable reaction under any of the conditions prevailing in the practice of our improved process. By the use of such liners, which in the arrangement shown are formed of comparatively thin sheet nickel, the amount of the nickel or other expensive metal necessary to be used is kept at a minimum.

As is clearly shown in the drawing, each of the containers 35 is provided with perforated ears 36 at its upper end by which the container and its load are capable of being handled readily by the use of a hoist and crane or other suitable mechanism not shown. The containers are light enough to be manipulated easily by hand when empty.

In the arrangement shown in the drawing, the impregnating solution is introduced into the container 35 in the receptacle 10 through an upright pipe 37 extending downwardly to the bottom wall of the container, such pipe being supported by a grill 38 of any approved type resting on the bottom wall of the container, the lower end of the

pipe having cut-out portions so that it is effectively open at all times. The pipe and grill serve as a supporting stand for the articles to be treated in said receptacle 10, said pipe and grill being also formed of nickel or other suitable material. When the supporting stand comprising the pipe 37 and grill 38 are in position in the receptacle 10, the upper end of the pipe 37 stands normally directly beneath the lower end of a line of piping 39 extending through and supported by the cover plate 26, a funnel 40 being loosely mounted in the upper end of the pipe 37 for preventing any splashing of fluid passing downwardly from the pipe 39 to the pipe 37. A shut-off valve 41 of any approved type is interposed in the piping 39, and a pet cock 42 of any approved type opens into the piping above the valve 41. A flexible hose 43 is provided, connected with the upper end of the pipe 39 at one end and provided with a readily operable coupling device 44 at its opposite end adapted to be connected readily with the upper end of the pipe 37 of a similar supporting stand located in the receptacle 14. The pipe 39 and its fittings, and the funnel 40, are also formed of nickel or other suitable material so as to prevent reaction with the impregnating solution and with the cleaning solution.

In carrying out our improved process as above set forth in connection with the apparatus just described, an adequate supply of impregnating solution is placed in one of the liners 35 and brought to the proper temperature within the receptacle 14, such liner 35 being empty except for the presence of the solution and the supporting stand comprising the pipe 37 and grill 38. At the same time, the receptacle 10 is brought to the desired working temperature by means of the coil 13. A thoroughly cleaned container or liner 35 is then provided with a cleaned supporting stand, and a supply of articles to be impregnated is placed in position on the supporting stand within such liner, the liner and its load being then lowered into position within the receptacle 10. The cover plate 26 is then secured in closed position, the flexible hose 43 being connected with the pipe 37 of the supporting stand in the receptacle 14, and the several valves 41, 42, 33 and 34 being all closed. As shown in the drawing the receptacle 14 is open to the atmosphere. The valve 33 in the branch pipe 32 is then opened and a substantially complete vacuum is produced within the receptacle 10 and maintained for a few minutes for completing the drying of the wooden articles and exhausting the pores thereof. The valve 34 is then opened momentarily to a slight extent for reducing the strength of the vacuum in the receptacle 10 so as to have an absolute pressure therein of approximately three pounds to the square inch, after which the valve 41 is opened under the continued control of the operator for causing the desired amount of impregnating solution to flow through the conduit comprising the pipe 37 of the receptacle 14, hose 43, and pipe 39, into the container 35 in the receptacle 10 through its pipe 37 about the articles being treated in said container. After the desired amount of solution has been drawn into position about the articles being treated, the valve 33 in the branch pipe 32 is closed and the relief valve 34 is opened for establishing normal atmospheric pressure in the receptacle 10.

If very deep penetration of the resins into the wood is desired, the valves 34 and 41 are closed and the valve 33 in the branch pipe 31 is opened for the production of the desired air pressure

within the receptacle,—say from 50 to 150 pounds per square inch.

After the major portion of the impregnating solution is transferred from the liner 35 in position in the receptacle 14, as above described, the hose 43 is detached from the pipe 37 of the supporting stand in said liner and that liner is then withdrawn from the receptacle 14 and the remaining portion of the impregnating solution is removed from the liner, after which said liner is thoroughly cleaned and provided with a fresh supply of articles for impregnation ready for the next succeeding impregnating operation.

As our invention is preferably practiced, after atmospheric pressure has been restored in the receptacle 10 the liner therein, together with its load of articles and impregnating solution, is transferred to the receptacle 14 and such liner is at this time preferably provided with an additional quantity of the impregnating solution. Thereupon a clean liner with a load of articles to be impregnated is lowered into the receptacle 10 and the above described process is repeated and the impregnating solution drawn from the liner in the receptacle 14 into the liner then within the receptacle 10, whereupon the liner in the receptacle 14 is removed and the impregnated articles removed therefrom. It will be appreciated that in the preferred practice of our invention a saving of the time required for the absorption of the impregnating solution is effected by transferring the liner 35 from the receptacle 10 immediately after the impregnating operation to the receptacle 14 and then recharging the receptacle 10 with another liner loaded with articles and the transfer of the impregnating solution from one to the other of the said liners by atmospheric pressure due to the production of a vacuum in the receptacle 10.

By the use of our improved, simplified and inexpensive apparatus as shown in the drawing, in which two light containers or liners 35 are used alternatively in the impregnating receptacle 10, with the other of said liners in position in the other receptacle 14, in which both of said receptacles are provided with means for heating the impregnating solution in the liners which have a working fit in the receptacles interchangeably, in which the receptacle 10 is provided with means for creating a vacuum therein or for providing a heavy air pressure therein as may be desired, and in which the liners or containers 35 and all other parts coming into direct contact with the impregnating solution are made of nickel or other material inert with respect to the impregnating and cleaning solutions, we are enabled to carry out our improved impregnating operations economically and conveniently with a minimum of labor and are enabled to make the practice uniform and routine for obtaining universally satisfactory results.

It is to be understood that we prefer to employ the apparatus as shown in our drawing, but that our invention is not limited to such apparatus except so far as the claims setting forth the invention may be so limited by the prior art. It will be understood that the apparatus might be changed with respect to some of the features at least without departing from the spirit of our invention.

We claim:—

1. In an apparatus for impregnating wood and the like with a synthetic resinous solution, the combination of two receptacles arranged side by

side adjacent to each other, means for heating the side walls of each of said receptacles, a cover plate mounted on one of said receptacles for effectively closing the receptacle, the other of said receptacles being open to the atmosphere, upright pipes in said receptacles respectively supported with their lower ends effectively open at the lower end portions of the receptacles, a conduit comprising a short length of pipe extending downwardly through said cover plate and supported thereby in substantial alignment with the upright pipe in said closed receptacle and comprising a flexible hose effectively connected at one end with said short length of pipe, means for detachably connecting the other end of said hose with the upright pipe in said open receptacle, and means for exhausting air from said closed receptacle serving to transfer the impregnating solution from said open receptacle through said conduit to said closed receptacle.

2. In an apparatus for impregnating wood and the like with a synthetic resinous solution, the combination of two receptacles arranged side by side adjacent to each other, means for heating the side walls of each of said receptacles, a cover plate mounted on one of said receptacles for effectively closing the receptacle, the other of said receptacles being open to the atmosphere, upright pipes in said receptacles respectively supported with their lower ends effectively open at the lower end portions of the receptacles, a conduit comprising a short length of pipe extending downwardly through said cover plate and supported thereby in substantial alignment with the upright pipe in said closed receptacle and comprising a flexible hose effectively connected at one end with said short length of pipe, means for detachably connecting the other end of said hose with the upright pipe in said open receptacle, means for exhausting air from said closed receptacle serving to transfer the impregnating solution from said open receptacle through said conduit, valve means for closing said conduit for controlling the passage of the impregnating solution therethrough, and other valve means in the wall of said conduit for providing an opening through the wall to the air for permitting the impregnating solution to drain from the conduit to said open receptacle.

3. In an apparatus for impregnating wood and the like with a synthetic resinous solution, the combination of two receptacles of substantially the same inside size and shape in fixed position side by side, two comparatively light containers fitting said receptacles interchangeably, means for applying heat to said receptacles for heating the contents of said containers in position therein, a conduit opening at one end into one of said containers and opening at its opposite end into the other of said containers, and means for creating a differential in pressures in said receptacles and for transferring the impregnating solution from one of said containers through said conduit to the other of said containers.

4. In an apparatus for impregnating wood and the like with a synthetic resinous solution, the combination of two receptacles of substantially the same inside size and shape in fixed position side by side, two comparatively light containers fitting said receptacles interchangeably, means for applying heat to said receptacles for heating the contents of said containers in position therein, a cover plate for effectively closing one of said receptacles, the other of said receptacles being open to the atmosphere, a conduit opening

at one end into said closed receptacle and opening at its opposite end into the lower end portion of the container in the open receptacle, means for exhausting air from said closed receptacle serving to transfer the impregnating solution from the container in said open receptacle through said conduit, and means in said closed receptacle for receiving the stream of the impregnating solution from said conduit and discharging it in the lower end portion of the container in said closed receptacle.

5. In an apparatus for impregnating wood and the like with a synthetic resinous solution, the combination of two receptacles of substantially the same inside size and shape in fixed position side by side, two comparatively light containers fitting said receptacles interchangeably, means for applying heat to said receptacles for heating the contents of said containers in position therein, a cover plate for effectively closing one of said receptacles, the other of said receptacles being open to the atmosphere, a conduit opening at one end into said closed receptacle and opening at its opposite end into the lower end portion of the container in said open receptacle and comprising a short length of pipe extending downwardly through the cover plate and supported thereby, a flexible hose connected at one end with said short length of pipe, and another pipe connected with the opposite end of said hose and opening at the lower end portion of the container in said open receptacle, and means for exhausting air from said closed receptacle serving to transfer the impregnating solution from the container in said open receptacle through said conduit into the container in said closed receptacle.

6. In an apparatus for impregnating wood and the like with a synthetic resinous solution, the combination of two receptacles of substantially the same inside size and shape in fixed position side by side, two comparatively light containers fitting said receptacles interchangeably, means for applying heat to said receptacles for heating the contents of said containers in position therein, a cover plate for effectively closing one of said receptacles, the other of said receptacles being open to the atmosphere, upright pipes in said containers respectively supported with their lower ends effectively open at the lower end portions of the containers, a short length of pipe extending downwardly through the cover plate and opening directly above the upright pipe in said closed receptacle, a flexible hose connected at one end with said short length of pipe, means for detachably connecting the other end of said hose with the upright pipe in said open receptacle, and means for exhausting air from said closed receptacle serving to draw the impregnating solution from the container in said open receptacle through said hose and said connected pipes into the container in said closed receptacle.

7. In an apparatus for impregnating wood and the like with a synthetic resinous solution, the combination of a receptacle, a light container having a working fit in said receptacle so as to be readily removable therefrom and made of material normally inert with respect to the impregnating solution under the conditions prevailing during an impregnation operation, means for applying heat to said receptacle for heating the contents of said container in position therein, a cover plate for effectively closing said receptacle about said container, a conduit opening at one end into said receptacle and opening at its op-

posite end outside of the receptacle and into means containing a supply of the impregnating solution, valve means for closing said conduit, and means for exhausting air from said receptacle 5 whereby when said valve is opened the impregnating solution may flow into said container through said conduit.

8. In an apparatus for impregnating wood and the like, with a phenol-formaldehyde resinous 10 solution, the combination of a receptacle made of comparatively cheap metal such as steel and having sufficient strength to withstand heavy pressure therein, a light container having a working fit in said receptacle so as to be readily re- 15 movable therefrom and made of material normally inert with respect to the impregnating solution under the conditions prevailing during an impregnation operation, means for applying heat to said receptacle for heating the contents of 20 said container in position therein, a cover plate for effectively closing said receptacle about said container, a conduit opening at one end into said receptacle and opening at its opposite end outside of the receptacle and into means containing a 25 supply of the impregnating solution, valve means for closing said conduit, said conduit and said valve means being formed of a material normally inert as aforesaid, and means for exhausting air

from said receptacle whereby when said valve is opened the impregnating solution may flow into said container through said conduit.

9. In an apparatus for impregnating wood and the like with a synthetic resinous solution, the 5 combination of two receptacles made of comparatively cheap metal such as steel and having substantially the same inside size and shape with at least one of said receptacles of sufficient strength to withstand heavy fluid pres- 10 sure therein, two comparatively light containers fitting said receptacles interchangeably and made of material normally inert with respect to the impregnating solution under the conditions pre- 15 vailing during an impregnation operation, means for applying heat to said receptacles for heating the contents of said containers in position therein, a cover plate for effectively closing said one receptacle, a conduit opening at one end into 20 said closed receptacle and opening at its opposite end into the lower end portion of the container in the other receptacle, and means for exhausting air from said closed receptacle serving to transfer the impregnating solution from the 25 container in said other receptacle through said conduit.

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