Sept. 12, 1961 H. HÜLLMANN 2,999,538

IMPREGNATION APPARATUS

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Fig. 1

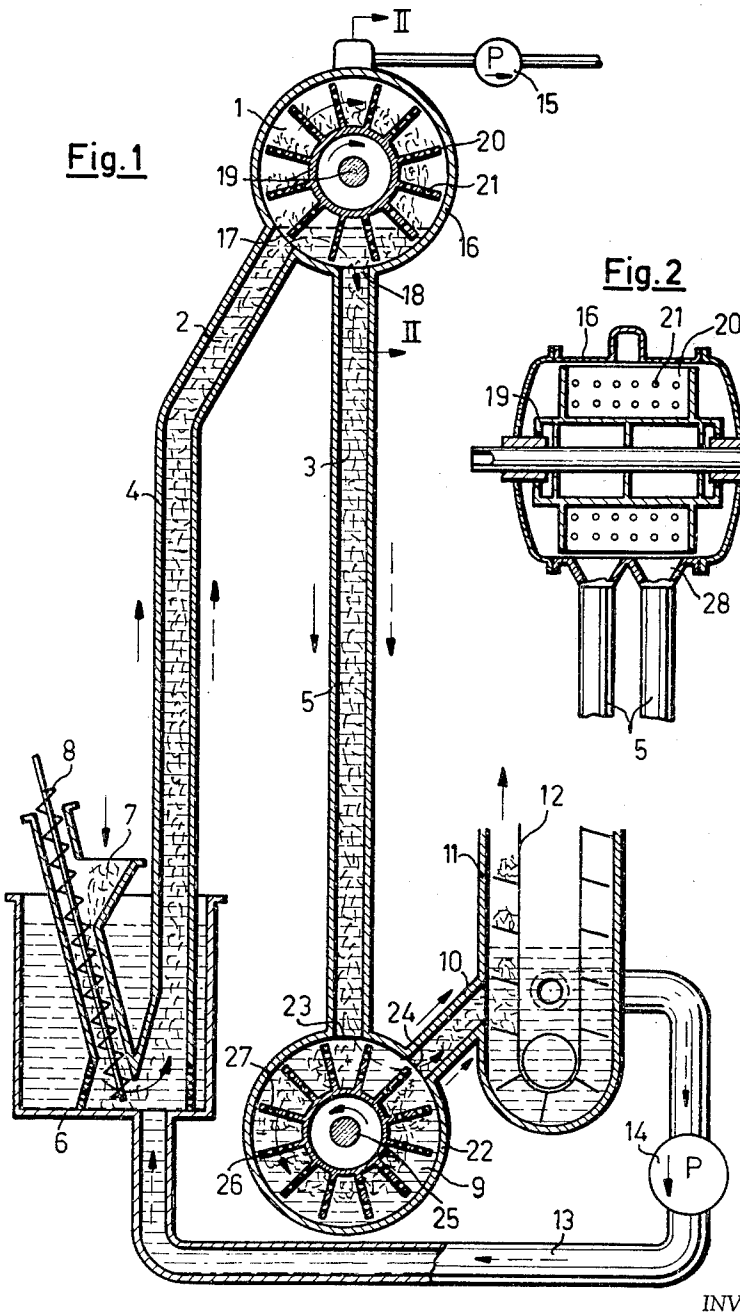


Fig. 2

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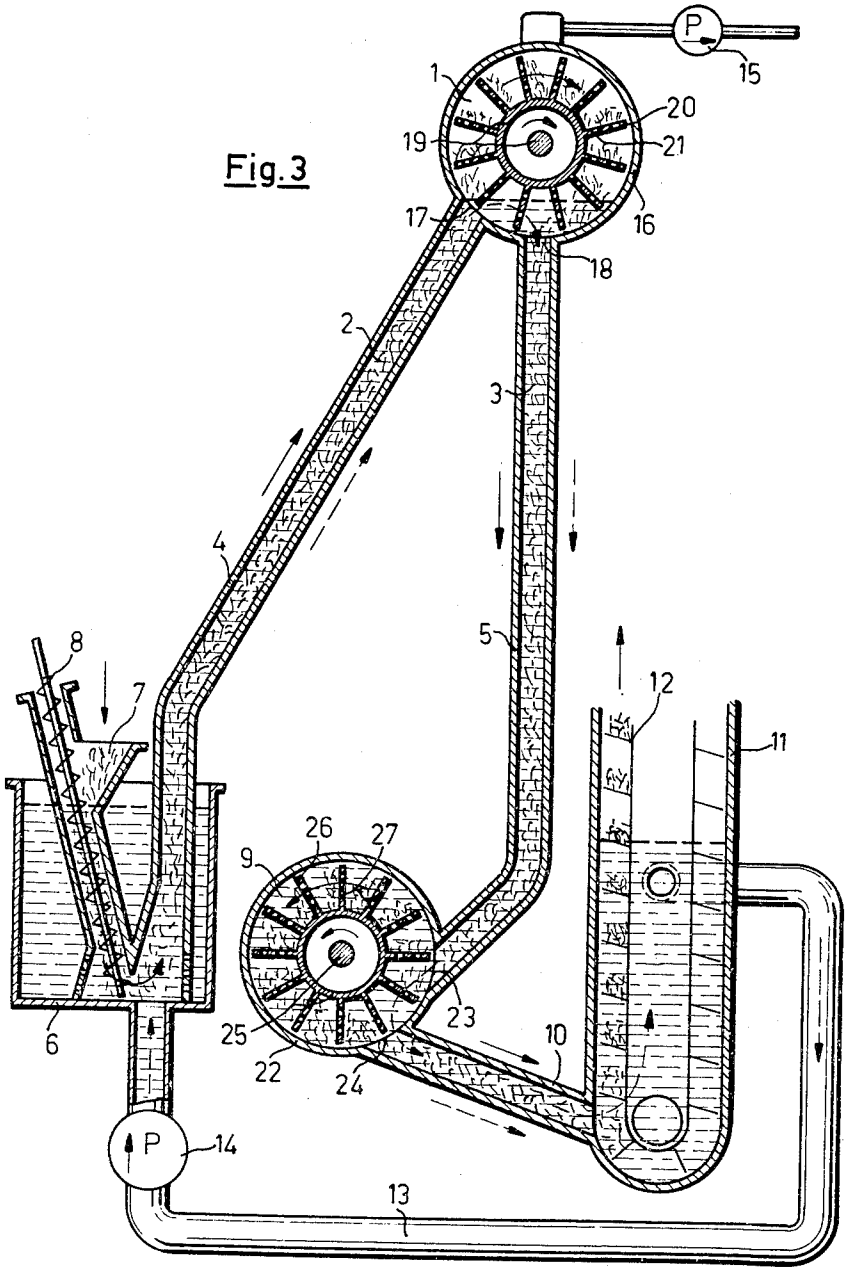
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Fig. 3



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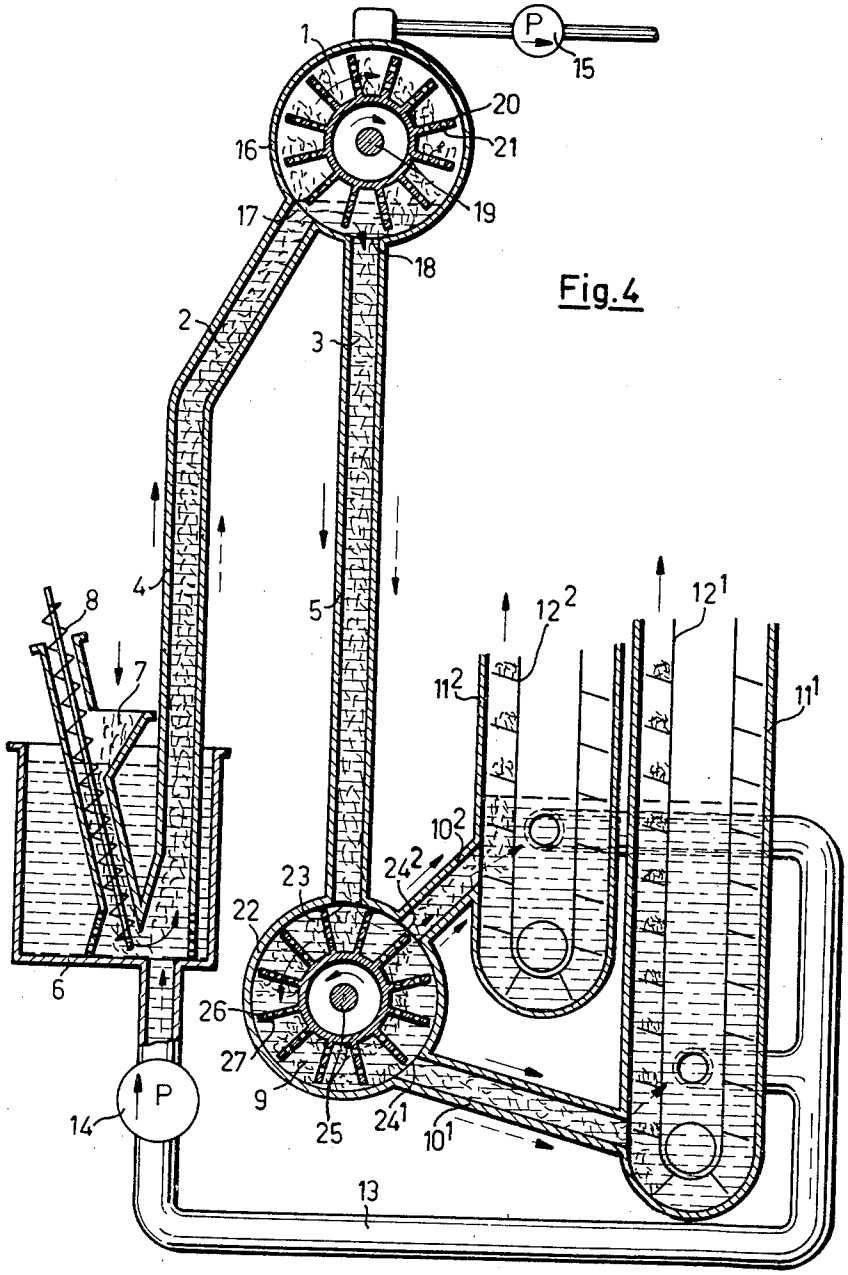


Fig. 4

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IMPREGNATION APPARATUS

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9 Claims. (Cl. 162—237)

This invention relates to an apparatus for the continuous evacuation and impregnation with liquid of fibre-containing substances more particularly of the cellulose and paper industry, in which the impregnation liquid is circulated serially through a vacuum chamber and an impregnation chamber and the materials to be impregnated are admixed with the impregnation liquid before it is fed to the vacuum chamber and the impregnated materials together with impregnation liquid absorbed and adsorbed by them are separated from the circulating liquid after leaving the impregnation chamber.

The aim of the invention is to provide a continuously operating apparatus, which is as simple as possible and which affords the certainty that the substances to be evacuated and impregnated stay exactly the necessary time in the vacuum or impregnation chamber, the time of stay being adaptable at any time in a simple manner to the varying working conditions.

In an apparatus of the hereinbefore described type, for this purpose according to the invention, the vacuum chamber and/or impregnation chamber comprises a generally cylindrical housing with a rotary bucket wheel arranged therein, which conveys the fibrous materials from an inlet opening to at least one outlet opening of the housing, the bucket wheel having radially extending partitions which have strainer-like orifices, allowing the impregnation liquid to pass in opposite direction to the rotation of the wheel but not the fibrous materials contained therein.

Constructional examples of the subject of the invention are shown in the drawing in a simplified representation, wherein

FIG. 1 shows a vertical section through an apparatus for the continuous evacuation and impregnation of fibre-containing substances,

FIG. 2 a section on the line II—II of FIG. 1, and

FIGS. 3 and 4 vertical sections through two other constructional forms.

The apparatus shown in FIGS. 1 and 2 is intended for impregnating fibrous materials with digesting liquid in the production of cellulose or semi-cellulose. The apparatus comprises a vacuum chamber 1 which is sealed by an inlet-side liquid column 2 and an outlet-side liquid column 3 of the impregnation liquid. The columns 2 and 3 are situated in pipelines 4 and 5 connected to the lower part of the vacuum chamber 1. The lower end of the inlet-side pipeline 4 dips below the level of the liquid in a liquid container 6 under atmospheric pressure. The container 6 serves as an introduction container for the fibrous materials to be impregnated. Mounted in the container 6 is a feed device for the fibrous materials, said device having a feed hopper 7 and a worm conveyor 8. The lower end of the outlet side pipeline 5 opens into an impregnation chamber 9, which is under about atmospheric pressure and is filled with impregnation liquid. From this chamber a pipeline 10 leads to a separation chamber 11 with a conveyor belt 12. The liquid space of the chamber 11 is connected by a pipeline 13, incorporating a pump 14, to the inlet-side container 6.

The pump 14 circulates the impregnation liquid in a circuit which leads serially through the introduction container 6, then through the vacuum chamber 1, then through the impregnation chamber 9, then through the separation chamber 11 and then again through the introduction container 6. A vacuum, supporting the liquid columns 2 and 3, is maintained in the vacuum chamber 1 by means of a pump 15, which removes the air which separates from the fibrous materials subjected to the vacuum.

The vacuum chamber is formed by a generally cylindrical housing 16 which encloses a coaxially arranged rotary bucket wheel 19 driven by means not shown and conveying the fibrous materials from an inlet opening 17 to an outlet opening 18 of the housing 16. The bucket wheel is provided with radially extending partitions having strainer-like orifices 21, which allow the impregnation liquid to pass in a direction opposite to the rotation of the wheel but not the fibrous materials contained therein.

The inlet opening 17 and the outlet opening 18, to which the pipelines 4 and 5 are respectively connected, are situated in the lower part of the housing 16, the axis of which is oriented horizontally, and the bucket wheel dips into the liquid columns 2 and 3 sealing the evacuation chamber 1.

The impregnation chamber 9 is built up of the same or similar elements as the vacuum chamber. Its generally cylindrical housing 22 accommodates a coaxially arranged rotary bucket wheel 25 driven by means not shown and conveying the fibrous materials from an inlet opening 23 to an outlet opening 24 of the housing 22, the partitions 26 of said bucket wheel having strainer-like orifices 27, which likewise allow only impregnation liquid to pass, but not the fibrous materials contained therein.

The fibrous materials for example wood chips to be impregnated with digesting liquid, are introduced by the hopper 7 and continuously admixed with the impregnation liquid by means of the worm conveyor 8. The materials are then carried upwardly to the vacuum chamber 1 by the current of liquid set in motion by the pump 14 in the return flow pipeline 4 and enter the bucket of the bucket wheel 19 which at the time is situated just opposite the opening 17, and are lifted out of the liquid and carried in the bucket through the vacuum chamber. The impregnation liquid, however, flows against the direction of rotation of the wheel through the strainer orifices 21 of the partitions 20 directly to the opening 18 and the pipeline 5. The fibrous materials carried through the vacuum chamber 1 are seized again by this stream of liquid and carried into the pipeline 5 as soon as the corresponding bucket is directed toward the opening 18.

The processes in the impregnation chamber 9 are similar. The fibrous materials are here again carried into the buckets of the bucket wheel 25 through the impregnation chamber 9 containing liquid, while the liquid stream flows substantially from the inlet opening 23 to the outlet opening 24 of the housing in opposite direction to the rotation of the wheel 25. The outlet opening 24 is circumferentially spaced from the inlet opening 23 by an acute angle in the direction opposite to the rotation of the wheel.

In the drawing the path of the fibrous materials is indicated by solid-line arrows, and the path of the liquid by dash-line arrows.

By regulation of the speed of the bucket wheel 19 and that of the bucket wheel 25, the times of stay of the fibrous materials in the vacuum and impregnation chambers can be adapted to the varying working conditions or can be adjusted to any desired value. By means of the steps according to the invention, therefore, the movement of the fibre-containing substances through the apparatus can be controlled as desired in the simplest way and with great certainty. Advantageously, the pump 14 for the flow of liquid will also be constructed to allow variation of the rate of flow.

In the constructional form shown in FIGS. 1 and 2, which is more particularly suitable for the impregnation of floating fibrous materials, the inlet opening **23** and the outlet opening **24** are situated in the upper part of the housing **22**. The discharge of the fibrous materials from the bucket wheel **25** to the pipeline **10** is thus assisted by the buoyancy of the materials.

The constructional form shown in FIG. 3, the parts of which have been given the same reference numerals as the corresponding parts of FIGS. 1 and 2, differs from the construction according to FIG. 1 merely by the fact that the openings **23** and **24** are situated in the lower part of the housing **22**. In the case of fibrous materials which sink after impregnation, their passage from the housing **22** to the pipeline **10** is assisted by the gravity of the materials.

Finally, FIG. 4 shows a constructional form in which, in addition to the parts as shown in the other figures, there are provided for the discharge of the fibrous materials from the housing **22** two outlet openings 24^1 and 24^2 and two pipelines 10^1 and 10^2 leading to separation chambers 11^1 and 11^2 with conveyor belts 12^1 and 12^2, respectively. The two separation chambers 11^1 and 11^2 are thus traversed in parallel by the circulating impregnation liquid. The axis of the housing **22** is oriented horizontally. The pipeline **5** in this case opens into the upper part of the housing **22**, the pipeline 10^1 issues from the lower part of the housing and the pipeline 10^2 from the upper part of the housing. The direction of rotation of the wheel is from the inlet opening **23** toward the lower outlet opening 24^1. In this case, the impregnated fibrous materials which sink are discharged through the pipeline 10^1 and the still-floating impregnated fibrous materials are discharged separately through the pipeline 10^2.

The pipelines **4**, **5**, **10** in the constructional examples, as shown in FIG. 2 for pipeline **5**, are formed of two parallel pipes, connected to the housing **16** and **22** by funnel-shaped intermediate pieces **28**. These intermediate pieces **28** are of such a form that the fibrous materials can pass substantially unimpeded over the entire width of the bucket wheel from the buckets to the pipelines or in the opposite direction.

The pipelines, however, without departing from the scope of the invention, may also have only a single pipe, in which case for connection to the containers, it would be necessary to provide a single intermediate piece likewise extending over the entire width of the bucket wheel.

Advantageously, the housing openings and the intermediate pieces connected to them may be arranged obliquely to the axial direction of the bucket wheel, to ensure that the discharge of the fibre-containing substances from the bucket wheel will not be stepwise but continuous.

Finally, also for this purpose, the compartments of the bucket wheel could be set obliquely to the axial direction, or the bucket wheel could be subdivided in width into individual bucket rings separated from one another, and having the buckets offset in the peripheral direction.

What I claim is:

1. An apparatus for impregnating fibrous materials with digesting liquid in the production of cellulose or semi-cellulose comprising an introduction container for the fibrous materials to be impregnated; a vacuum chamber; an impregnation chamber; a separation chamber; flow connections defining a circuit for impregnation liquid which leads serially through said introduction container, then through said vacuum chamber, then through said impregnation chamber, then through said separation chamber and then again through said introduction container; means in said circuit for circulating the impregnation liquid; means for introducing the fibrous materials to be impregnated into the introduction container and for continuously admixing them with the circulating liquid; means arranged in said separation chamber for separating the fibrous materials together with impregnation liquid absorbed and adsorbed by them from the circulating liquid; the vacuum chamber comprising a generally cylindrical housing having circumferentially spaced openings for the inlet and outlet of the circulating liquid; a rotary bucket wheel arranged within said housing coaxially therewith and provided with radially extending partitions for conveying the fibrous materials from the inlet opening to the outlet opening; said partitions having strainer-like orifices which allow the impregnation liquid to pass from the inlet opening to the outlet opening in opposite direction to the rotation of the wheel but not the fibrous materials contained herein; and pump means for removing separated air from the vacuum chamber and maintaining the vacuum.

2. The apparatus defined in claim 1 in which the axis of rotation of the bucket wheel is oriented horizontally and the inlet and outlet openings of the housing are situated in the lower half of the housing, only a part of the housing being filled with impregnation liquid.

3. An apparatus for impregnating fibrous materials with digesting liquid in the production of cellulose or semi-cellulose comprising an introduction container for the fibrous materials to be impregnated; a vacuum chamber; an impregnation chamber; a separation chamber; flow connections defining a circuit for impregnation liquid which leads serially through said introduction container, then through said vacuum chamber, then through said impregnation chamber, then through said separation chamber and then again through said introduction container; means in said circuit for circulating the impregnation liquid; means for introducing the fibrous materials to be impregnated into the introduction container and for continuously admixing them with the circulating liquid; pump means for removing separated air from the vacuum chamber and maintaining the vacuum; means arranged in said separation chamber for separating the fibrous materials together with impregnation liquid absorbed and adsorbed by them from the circulating liquid; the impregnation chamber comprising a generally cylindrical housing having circumferentially spaced openings for the inlet and outlet of the circulating liquid; and a rotary bucket wheel arranged within said housing coaxially therewith and provided with radially extending partitions for conveying the fibrous materials from the inlet opening to the outlet opening; said partitions having strainer-like orifices which allow the impregnation liquid to pass from the inlet opening to the outlet opening in opposite direction to the rotation of the wheel but not the fibrous materials contained therein.

4. The apparatus defined in claim 3 in which the outlet opening of the impregnation chamber is spaced by an acute angle from the inlet opening in opposite direction to the rotation of the wheel.

5. The apparatus defined in claim 4 in which the inlet and outlet openings of the impregnating chamber are arranged in the upper part of the housing.

6. The apparatus defined in claim 4 in which the inlet and outlet openings of the impregnating chamber are arranged in the lower part of the housing.

7. An apparatus for impregnating fibrous materials with digesting liquid in the production of cellulose or semi-cellulose comprising an introduction container for the fibrous materials to be impregnated; a vacuum chamber; an impregnation chamber; two separation chambers; flow connections defining a circuit for impregnation liquid which leads serially through said introduction container, then through said vacuum chamber, then through said impregnation chamber, then in parallel through said two separation chambers, and then again through said introduction container; means in said circuit for circulating the impregnation liquid; means for introducing the fibrous materials to be impregnated into the introduction container and for continuously admixing them with the circulating liquid; means for removing

separated air from the vacuum chamber and maintaining the vacuum; means arranged in each of said separation chambers for separating the fibrous materials together with impregnation liquid absorbed and adsorbed by them from the circulating liquid; the impregnation chamber comprising a generally cylindrical housing having it axis oriented horizontally and being provided with at least three circumferentially spaced openings, one serving for the inlet of the circulating liquid arriving from the vacuum chamber and the two other openings serving for the outlet of the circulating liquid toward the two separation chambers, respectively; and a rotary bucket wheel arranged in said housing coaxially therewith and provided with radially extending partitions for conveying the fibrous materials from said inlet opening to said outlet opening; said partitions having strainer-like orifices which allow the impregnation liquid to pass from the inlet opening to the outlet openings in opposite direction to the rotation of the wheel but not the fibrous materials contained therein; the inlet opening and one of the outlet openings being situated in the upper half of the housing and the other outlet opening in the lower half of the housing; and the direction of rotation of the wheel being from the inlet opening toward the said other outlet opening.

8. An apparatus for impregnating fibrous materials with digesting liquid in the production of cellulose or semi-cellulose comprising two vessels arranged at different levels, each having a substantially cylindrical housing with its axis oriented horizontally, and a rotary bucket wheel enclosed by said housing and provided with radially extending partitions; conduit means defining a closed circuit for impregnation liquid leading serially through said two vessels, including a conduit for the flow of liquid from the upper vessel to the lower vessel and a return flow conduit from the lower vessel to the upper vessel, respective circumferentially spaced inlet and outlet openings being provided in the housings of the vessels; a vacuum pump connected to the upper vessel; means for circulating impregnation liquid in said circuit; means connected with the said return flow conduit for continuously introducing the materials to be impregnated into the liquid flowing through the return flow conduit, so that they travel with the liquid through the upper vessel and the lower vessel; said return flow conduit further including means for separating the fibrous materials together with impregnation liquid absorbed and adsorbed by them from the circulating liquid at a point in advance of the introduction of the materials to be impregnated; the partitions of the said bucket wheels being provided with strainer-like orifices which allow the circulating impregnation liquid to pass from the respective inlet opening to the outlet opening of the housing in opposite direction to the rotation of the wheel but not the fibrous materials contained therein.

9. The apparatus defined in claim 8 in which the level difference of the two vessels is such that a vacuum prevails in the upper vessel and at least atmospheric pressure prevails in the lower vessel and the means for circulating the liquid comprise a pump arranged in the return flow conduit at a point between the separation of the impregnated materials and the introduction of the materials to be impregnated.

References Cited in the file of this patent

UNITED STATES PATENTS

1,938,060	Wood	Dec. 5, 1933
2,709,652	Plunguian	May 31, 1955