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METHOD OF AND APPARATUS FOR TREATING FOILS OF CELLULOSE OR DERIVATIVES THEREOF BY MEANS OF SUITABLE FLUIDS

Filed March 25, 1925

Fig. 2.

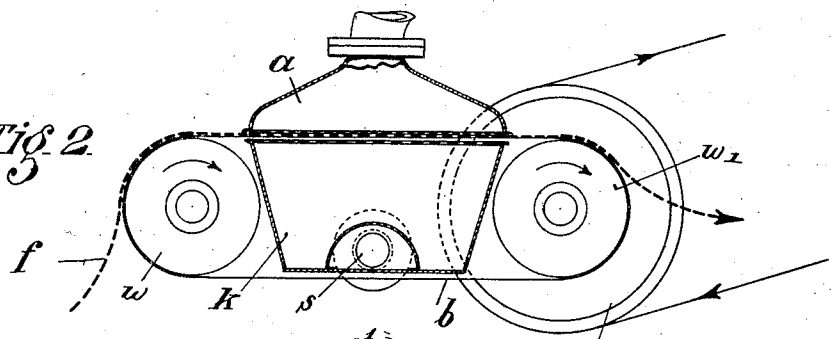



Fig. 1.

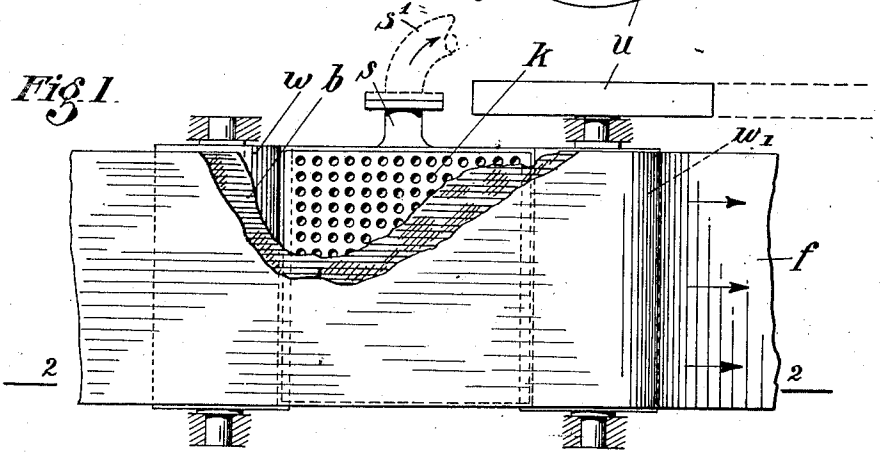
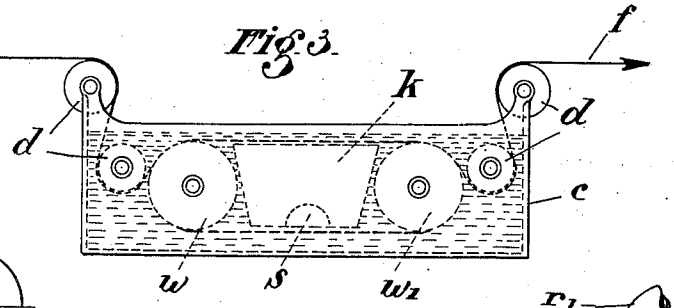



Fig. 3.



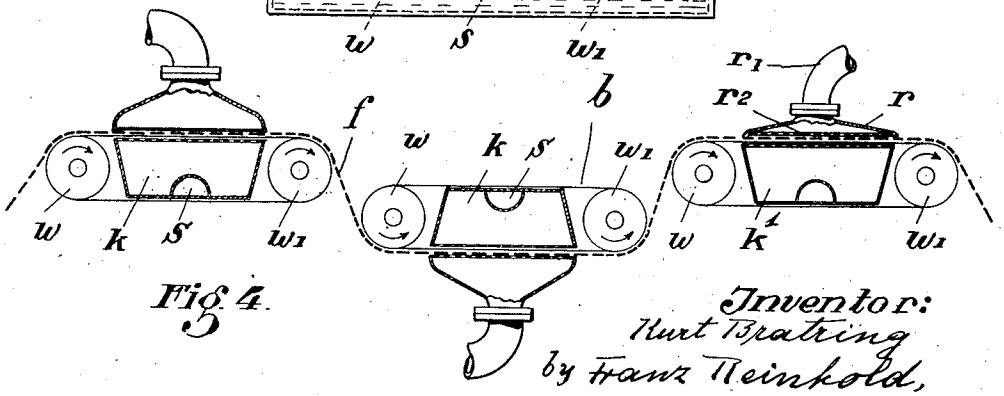




Fig. 4.

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# UNITED STATES PATENT OFFICE

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## METHOD OF AND APPARATUS FOR TREATING FOILS OF CELLULOSE OR DERIVATIVES THEREOF BY MEANS OF SUITABLE FLUIDS

Application filed March 25, 1925, Serial No. 18,335, and in Germany April 2, 1924.

My invention relates to improvements in the method of and apparatus for treating foils of cellulose or derivatives thereof by means of suitable fluids, such as liquids used for washing or otherwise chemically or physically treating the cellulose or air for drying the same. The object of the improvements is to provide a method in which the said treatment is completed in a rapid and effective way, and with this object in view my invention consists in forcing the treating medium through said foil by means of a difference of pressure produced on opposite faces of the said foil.

For the purpose of explaining the invention apparatus suitable for putting the same into effect have been shown in the accompanying drawing, in which the same letters of reference have been used in all the views to indicate corresponding parts. In said drawing,

Fig. 1, is a top plan view of the apparatus with a portion of the foil and the permeable tape supporting the same broken away for showing the top of the vacuum receptacle,

Fig. 2, is a sectional elevation taken on the line 2—2 of Fig. 1,

Fig. 3, is a diagrammatical elevation showing a modification, and

Fig. 4, is a similar elevation showing another modification.

As is known in the art, foils made from solutions of cellulose or cellulose derivatives by precipitation or coagulation are slightly impure, and in order to obtain a transparent and durable product it is necessary to wash and otherwise treat the foils by various baths. Further, it is necessary, after thus treating the foils with suitable liquids, to dry the same. I have found that the said treatment of the foils by means of liquids and drying media such as warm air is made in a speedy and effective way by driving the treating fluid through the foil by producing a difference of pressure at opposite faces of the foil and applying the medium to the face of higher pressure, the foil of cellulose or its derivatives being permeable to the said media while being subject to the process. The media used in my process are different according to the character of the cellulose or its derivatives and the result aimed at. When treating cellulose made from viscose I use water as a washing medium, while for treating the derivatives of the cellulose I use organic solvents, alcohol or ether being used for washing nitro-cellulose, ethyl or methyl alcohol or benzol being used for washing acetyl-cellulose, and benzine being used for washing ethyl-cellulose.

Preferably the foils are placed on a suitable tape of a material permeable to the solvent such as thin felt, which tape is trained on rollers for moving the foil over a suitable vacuum apparatus adapted to produce the desired pressure difference.

In the example shown in Figs. 1 and 2 the apparatus used in my improved process consists of a pair of rollers $w$ and $w^1$ having an endless band $b$ trained thereon, which band is made from a material permeable to the treating liquid. The said rollers are adapted to be rotated by suitable means such as a belt gearing $u$. Between the upper and lower branches of the tape there is a receptacle $k$ having a foraminated top wall located close to the upper branch of the tape. At its bottom the said receptacle is connected by a tubular portion $s$ with a pipe $s^1$ connected with a suitable vacuum pump or the like. Above the tape there is a pipe $a$ having a supply of a suitable treating liquid and provided at its bottom with bores for sprinkling the liquid on the top face of the foil $f$ placed on the tape $b$.

In the operation of the apparatus the foil is placed on the tape $b$ to which travelling movement is imparted by the belt gearing $u$. Thereby the foil is gradually moved over the top face of the receptacle $k$. Within the receptacle $k$ a vacuum is produced whereby the tape $b$ and the foil $f$ are pressed on the top face of the receptacle and air is drawn through the same. Simultaneously the treating liquid is sprinkled on the surface of the foil, which liquid is drawn by the vacuum through the foil and the permeable tape. As is known to those skilled in the art, in the manufacture of foils of the character referred to the viscose, and similar material made from solutions of cellulose or its derivatives

goes first through a stage in which it takes up water freely, in which however it is jelly-like, while in the course of the manufacture it is transformed into a more coherent mass which however does not allow a fluid medium to pass therethrough. In my improved process the foil is treated in the manner described in a stage intermediate the jelly-like and impermeable stages, in which the foil is sufficiently porous, and in which it is sufficiently coherent so that it is not torn by the fluid passing through the same.

After the foil has thus been washed it is dried by suitable means. However I prefer to use an apparatus similar to the one shown in Figs. 1 and 2 for drying the foil by drawing hot air therethrough, which apparatus will be described with reference to Fig. 4.

In Fig. 3 I have shown a modification of the apparatus which is similar to the one described with reference to Figs. 1 and 2, in which however the whole apparatus is disposed within a vat *c* filled with a suitable treating liquid, the foil being placed on the tape by means of suitable rollers *d*.

In Fig. 4 I have shown a modification in which the foil is passed over a plurality of washing apparatus for treating the same with different liquids. As shown the said apparatus are similar in construction to the one described with reference to Figs. 1 and 2, with exception, however, of the second apparatus in which the foil *f* is passed in contact with the lower branch of the tape *b*, the receptacle *k* being reversed so as to present its foraminated bottom to the said lower branch of the tape. Preferably the apparatus successively traversed by the foil are disposed at different levels. I have found that thereby the foil is more readily carried from one apparatus to the next one. In addition to the apparatus for treating the foil with liquid media I have shown a similar apparatus used for treating the foil with air, and preferably with hot air, for drying the same. As shown the hot air is supplied through bores $r^2$ of a pipe *r* having an admission pipe $r^1$ connected with a supply of hot air. The vacuum is produced by means of a receptacle $k^1$.

While in describing the invention reference has been made to washing and drying the foil, I wish it to be understood that I do not limit myself to these methods, and that the same method may be used for treating the foil with other fluids having chemical or physical action on the foils. For example I intend to use the same method for treating the foils so as to reduce the sensibility thereof as against the action of water.

I claim:

1. The method of treating foils made from solutions of matter of the character of cellulose, which consists in placing the foil while in a permeable state on a permeable tape, producing a difference of pressure on opposite faces of the foil and in a direction for pressing the foil on said tape, and passing a suitable fluid through said foil by applying the same to the face exposed to higher pressure.

2. The method of treating foils made from solutions of matter of the character of cellulose, which consists in placing the foil while in a permeable state on a permeable tape, producing a vacuum on the side of the tape opposite to the foil, and passing a suitable fluid through said foil by applying the same to the side thereof opposite to the side exposed to the vacuum.

3. The method of washing foils made from solutions of matter of the character of cellulose, which consists in placing the foil while in a permeable state on a permeable tape, producing a difference of pressure on opposite faces of the foil and in a direction for pressing the foil on said tape, and passing a suitable washing liquid through the foil by applying the said liquid to the face of the foil exposed to higher pressure.

4. The method of washing foils made from solutions of matter of the character of cellulose, which consists in placing the foil while in a permeable state on a permeable tape, producing a vacuum on the side of the tape opposite to the foil and passing a suitable washing liquid through the foil by applying the said liquid to the surface of the foil opposite to the surface exposed to the vacuum.

5. The method of washing foils made from solutions of matter of the character of cellulose, which consists in placing the foil while in a permeable state on a permeable tape, producing a difference of pressure on opposite faces of the foil and in a direction for pressing the foil on said tape, applying a suitable washing liquid to the face exposed to higher pressure, and thereafter applying a drying fluid to the face exposed to higher pressure.

6. The method of washing foils made from solutions of matter of the character of cellulose, which consists in placing the foil while in a permeable state on a permeable tape, producing a difference of pressure on opposite faces of the foil and in a direction for pressing the foil on said tape, applying a suitable washing liquid to the face exposed to higher pressure, and thereafter applying a drying fluid to the face exposed to higher pressure.

7. An apparatus for treating foils made from solutions of matter of the character of cellulose, comprising a tape made from a material permeable to the treating fluid, means for imparting travelling movement to said tape, a foraminated plate having said tape travelling in contact therewith, means to place a foil on said tape, and means to produce a difference of fluid pressure respectively at the outsides of said foraminated plate and the part of the tape in contact therewith, the differential pressure being directed from the

side of the tape and the foil thereupon towards the foraminated plate, the strength of said tape and the size of the foraminations of said plate being such that when passing the tape in contact with the plate it is practically not deformed by the differential pressure.

8. An apparatus for treating foils made from solutions of matter of the character of cellulose, comprising a tape made from a material permeable to the treating fluid, means for imparting travelling movement to said tape, a foraminated plate having said tape travelling in contact therewith, means to place a foil on said tape, means to produce a difference of fluid pressure respectively at the outsides of said foraminated plate and the part of the tape in contact therewith, the differential pressure being directed from the side of the tape towards the foraminated plate, and means to supply a treating fluid to said tape and foil thereupon and the side opposite to said foraminated plate, the strength of said tape and the size of the foraminations of said plate being such that when passing the tape in contact with the plate it is practically not deformed by the differential pressure.

9. An apparatus for treating foils made from solutions of matter of the character of cellulose, comprising a tape made from a material permeable to the treating fluid, means for imparting travelling movement of said tape, a vacuum box having a foraminated wall located in position for having the tape travelling in contact therewith, means to place a foil on said tape, means to produce a vacuum in said box, and means to supply a treating fluid to said tape and foil thereupon at the face opposite to said foraminated plate, the strength of said tape and the size of the foraminations of said wall being such that the tape travelling in contact with said wall is practically not deformed by the vacuum in said box.

In testimony whereof I hereunto affix my signature.

KURT BRATRING.