Aug. 18, 1931. B. C. MILLER 1,819,109

APPARATUS FOR TREATING FLEXIBLE MATERIALS

Filed Oct. 4, 1927 2 Sheets-Sheet 1

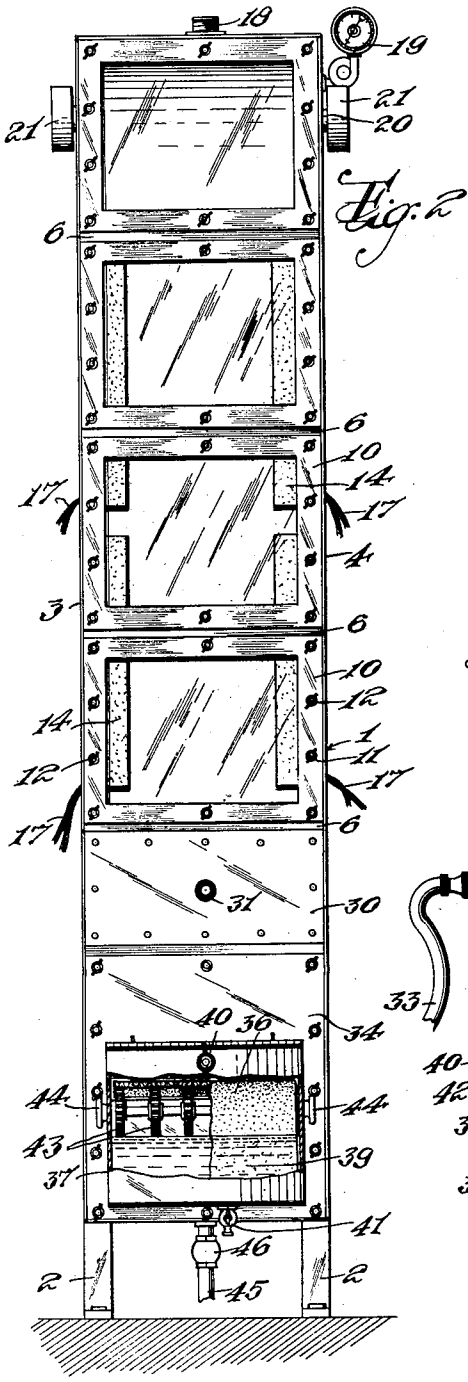


Fig. 2

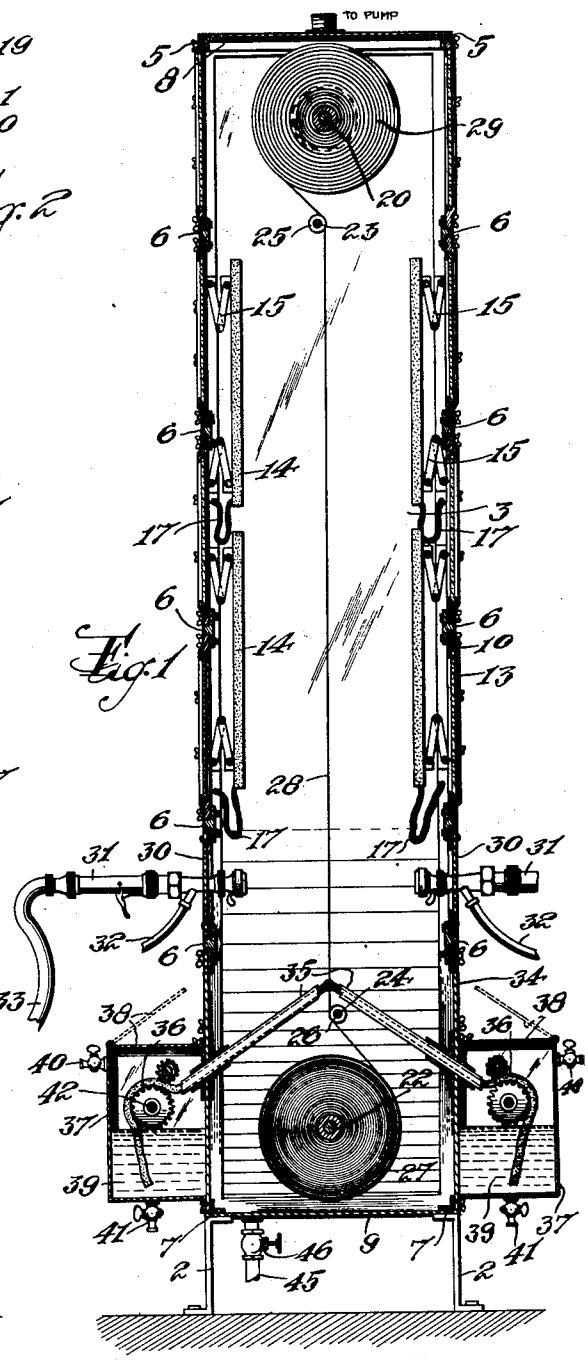


Fig. 1

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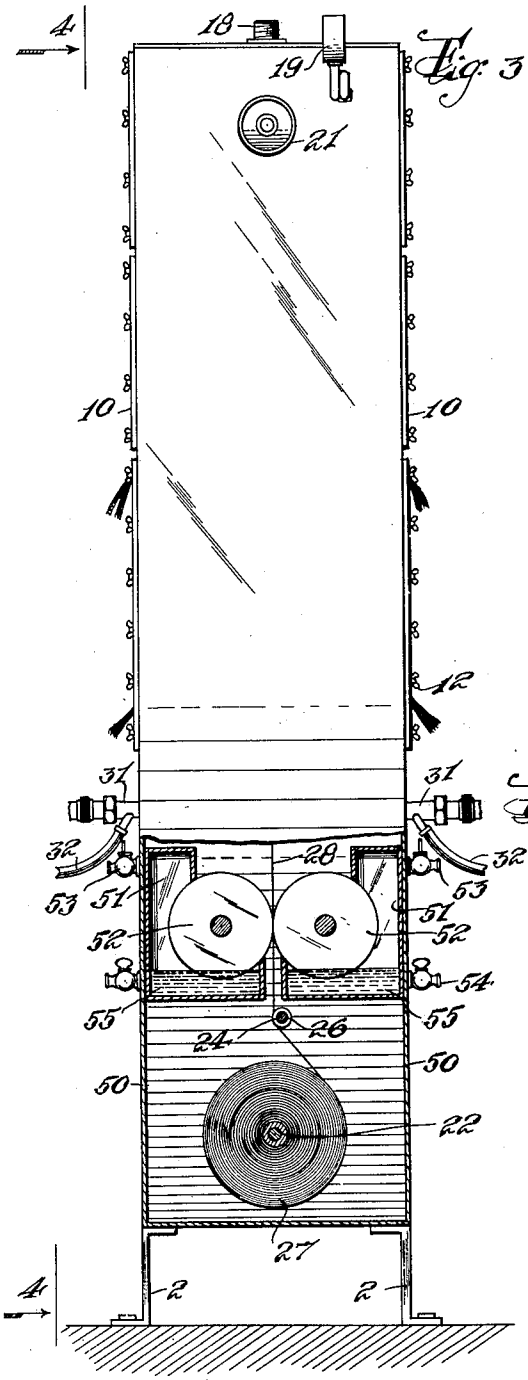


Fig. 3

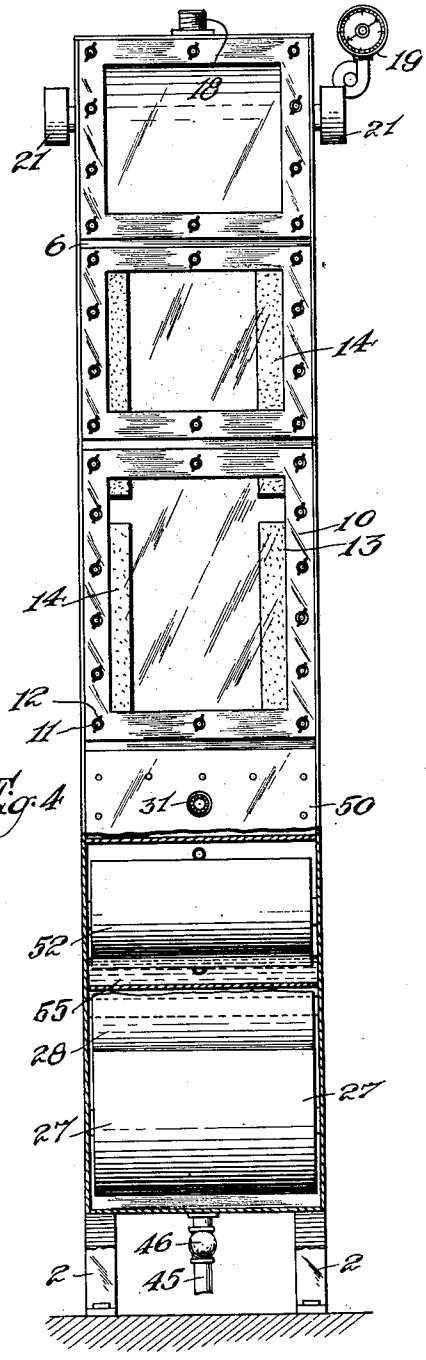


Fig. 4

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Patented Aug. 18, 1931 1,819,109

UNITED STATES PATENT OFFICE

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APPARATUS FOR TREATING FLEXIBLE MATERIALS

Application filed October 4, 1927. Serial No. 223,858.

The present invention relates, generally, to improvements in method and apparatus for coating or impregnating or treating papers, cloth or other such material with solutions or suspensions of varnishes, lacquers, or other materials or chemicals and for removing the solvent or carrier of the solution or suspension from the material treated, and also for drying the treated material. The invention relates, more particularly, to method and apparatus for impregnating, coating, or otherwise treating cloth, paper, nitro-cellulose or other products, in sheet, tape or other form, with a solution or suspension in a vacuum such as a nitro cellulose solution.

The invention has for a principal object to provide method and apparatus for rapidly and economically impregnating, coating or otherwise treating paper, fabric, or material such as nitro-cellulose films, or other materials and removing the solvent or carrier from the treated material.

Another object of the invention is to provide method and apparatus for rolling sheet material from one roll and rolling it up again into another roll in a short space and at a fairly rapid rate of speed, and treating and drying the material during the process of rolling and unrolling.

Other objects of the invention reside in the several steps of the method or process of the invention and in combinations of such steps, and also in several detail features of the apparatus and in combinations thereof, not at this time more particularly enumerated, but clearly understood from the following detailed description of the method and apparatus of the invention.

With the various objects of the invention in view, the same consists, primarily, in the novel arrangements and combinations of parts making up the treating apparatus hereinafter set forth, and of the method herein described, and, the invention also consists in the details of the construction of said parts and methods and steps thereof all of which will be hereinafter more fully described and finally embodied in the claims appended hereto.

The apparatus of the invention is clearly illustrated in the accompanying drawings, in which:—

Figure 1 is an elevation view in section of one form thereof; Figure 2 is a side elevation view, in part cut away, of the apparatus of Figure 1; Figure 3 is a side elevation view in part cut away of an alternate embodiment of the invention; and Figure 4 is an elevation view, in part cut away, and looking in the direction of the arrows 4—4 of Figure 3.

Similar characters of reference are employed in all of the hereinabove described views, to indicate corresponding parts.

Referring now to said drawings, the reference character 1 indicates a vertical longitudinal casing supported by the legs 2, 2. The side walls 3 and 4, as shown, are continuous from top to bottom and between them across the front and back are the spaced apart slats or bars 5, 6, 6, and 7. Top and bottom closures 8 and 9 are made with air tight contact respectively with said sides 3 and 4 and bars 5, 5, and with said sides 3 and 4 and said bars 7, 7. As shown, across the upper four openings between the sides 3 and 4 and the bars 5, 6, 6, there are provided the air tight frames 10, 10 which are held in place by the bolts 11, 11 and wing nuts 12, 12, and have glass plate 13 set therein and carried thereby in air tight relation. Carried by said sides 3 and 4 are the electric heating units 14, 14, conventionally shown, which are movable on the jointed supporting arms 15, 15 so that they can be adjustably positioned between the window sides of the casing 1 and the center thereof. Flexible conductor leads 17, 17 extend through said sides 3 and 4 and serves to make electrical connection to said heaters 14, 14.

Said casing 1, at said top 8 is provided with a pipe connection 18 for joining to a pump, not shown; and a vacuum and pressure gauge 19 is provided at one side, near the top. Across the center of the sides 3 and 4 near the top is provided the winding axle 20, which extends therethrough in air tight bushings, not shown, and carries on its outside ends the driving pulleys 21, 21. Directly below the said shaft 20 and aligned

therewith near the bottom of said casing 1 is the shaft 22; and between said shafts 20 and 22, aligned therewith and one near each of said shafts 20 and 22, are the shafts 23 and 24, each of which carries an idler roller 25 and 26, respectively. On said shaft 22 is mounted a roll of paper 27 which extends over said idler roll 26 and therefrom in a span 28, to and over said idler roll 25 and thence to said shaft 20 where it is wound in a roll 29.

In the fourth open space from the top between said bars 6, 6, on each side, is mounted, in air tight relation, a closure 30 which is removable and replaceable. Each of said closures carries projecting therethrough a liquid or paint spray gun 31, of the well known type, having an air pressure hose 32 and a liquid or paint feed hose 33; said spray guns 30 being projected, one toward each side of said paper span 28 near the bottom thereof.

In the next open space, which is the lowermost, is mounted the air tight closure 34, one on each side of said casing 1. Each of said closures 34 carries in air tight relation thereto a flat wide tube 35 which extends diagonally upwardly and inwardly from a point outside said casing 1 to a point near the center thereof. Said tubes 35, 35 are of a width substantially that of the paper in said rolls 27 and 29; and each of these tubes carries a wick 36 which makes a good fit with its tube but is slidable therein and extends from the outer end of its tube into contact with the respective side of said paper span 28 which is next to it. Each of said closures 34, 34, carries in air tight relation therewith a box or casing 37 about the outer end of respective tube 35 and wick 36, and each has an air tight cover 38. In each of said boxes 37, 37 is shown a quantity of treating liquid 39 reaching above the outer end of the respective wick 36 and adapted to move through the wick and onto the paper surface in contact with the inner end of the wick. Near the upper end of each of said boxes 37 is mounted a valve 40 for applying air pressure, when desired, to the interior of the respective box to aid in feeding treating liquid through said wicks 36, 36. A drain valve 41 is provided for emptying each of said boxes 37, 37. Transversely across each of said boxes 37, 37 is mounted a shaft 42 which carries the toothed wheels 43, 43 which latter engage a respective wick 36, and, by the turning thereof by means of a handle 44, serve to move the wick into and out of engaging relation with said paper span 28. At the bottom of said casing 1 is mounted the pipe 45 and valve 46 for draining said casing 1 or for supplying thereto a treating liquid, or for connection to a suction pump or to a pressure pump, not shown.

The use and operation of the apparatus illustrated in Figures 1 and 2 and above described, and according to the method of the invention, for the purpose of treating, coating, sizing, impregnating, coloring, or fusing of paper or paper surfaces, fabric, or any flexible material for altering or qualifying such materials for various uses can be done as follows. In the first place, the method consists in running a continuous roll of the material to be treated in a heated or unheated vacuum chamber and to impregnate or coat with a solution or liquid suspension maintained exterior to the vacuum chamber and supplied to the material as it is applied thereto, without breaking the vacuum.

An unwind roll 27 is mounted on said shaft 22 and the outer end thereof over said rollers 26 and 25 and started on said rewinding shaft 20, the casing 21 is closed up to a tight seal, and heat supplied by passing current through said resistor heaters 14, 14. A suction system is then connected to said casing 1 through either or both of said pipes 18 and 45. As shown, and particularly when both sides of the material is to be treated, the material is, preferably, run vertically through the treating chamber. The shaft 20 then is rotated by power means, not shown, and applied as by means of said pulleys 21, 21 to rewind the material into a roll 29 and unwind it off said roll 27, the span 28 thereof being exposed to the liquid applying and the drying means shown.

When liquid is to be applied from said box 37, 37 the handles 44, 44 are turned to bring the inner ends of said wicks 36, 36 against the surfaces of said span 28 above said roll 26. The suction applied to said casing 1 will draw the liquid 39 from said box 37 through wicks 36, 36 which will apply it to flexible material as it is unrolled from the roll 27 and passed to said roll 29. Both the heat and vacuum cooperate to drive the solvent from the liquid coating or impregnation on said span 28 and carry it out of the chamber whereby a rapid and complete drying is effected together with a curing of the material left after the vaporization of the vehicle or solvent of the suspension or solution. When desired or necessary pressure can be applied through the valves 40, 40 to aid in feeding the liquid suspension or solution 39, 39 through said wicks 36, 36. Said wicks serve also as a scraper or smoothers to secure an even and uniform application of the liquid to the material passed therebetween, and the amount of contact of the ends of said wicks 36, 36 with said span 28 is adjustable to regulate the amount of liquid applied to said span. The rate of speed of the unwind and the rewind can be regulated in accordance with the rate of application of solvent and the rate of drying or curing of the treating material.

Treating solution can also be applied by means of the spray guns 31, 31 which latter

can be controlled in a well known manner to regulate the amount or rate of feeding to the span 28 as it passes thereby. In some cases it will be advantageous to use both the wicks 36, 36 and the spray guns 31, 31 for applying the liquid or liquids and particularly where they are of a different nature or constituency.

In Figures 3 and 4 of the drawings is shown an alternate embodiment of the apparatus of the invention which is somewhat similar to that of Figures 1 and 2 except for the following distinction. In place of said closures 30 and 34, on each side, there is a single closure member 50, each of which, near its top, carries a spray gun 31. Each of said closures 50 carries on its inner side a box or tank 51 which is entirely closed except at the inner side thereof wherein is an opening through which extends a liquid feeding roll 52. Each of these said feeding rolls 52, 52 extends into its respective box 51 to a level below the upper level of the inner wall of said box 51 and also extends laterally and inwardly beyond the edge of said inner wall. The two said rolls 52, 52 are movable, by means not shown, toward and from each other for regulation of the distance between them in accordance with the thickness of the material to which liquid is to be fed by these rolls. The walls of said boxes 51, 51 extend into such close proximity to its respective roll 52 as to provide substantial obstruction against evaporation of liquid from said box but at the same time permitting a rotation of said rolls on their axes. Each of said boxes 51 is provided with a valve 53 and a valve 54 at the top and bottom, respectively, of the respective box. These valves serve for supplying liquid to said boxes 51 and for withdrawing it therefrom.

In the use and operation of this embodiment of my invention, the spray guns 31, 31 may be used for applying the liquid to the material span 28 as it is wound from one roll onto another, the same as in the operation of the embodiment shown in Figures 1 and 2.

Also, when a body of treating liquid solution 55 is in said boxes 51 to a height above the bottom of said rolls 52 and said rolls 52 each moved laterally into frictional contact with said span 28, the said rolls 52 will be rotated by the material of said span 28 as it passes from said roll 27 to said roll 29 and said rolls 52, 52 will pick up said liquid 55 and feed it onto the material passed therebetween.

The apparatus shown in Figures 1 and 2 and also shown in Figures 3 and 4 can be used for applying the liquid in still another manner, as follows:—

A roll of material 27 is mounted on the shaft 22 and the bottom of the casing 1 is filled to a level above the top of said roll 27 and the latter thoroughly moistened or impregnated therewith. The material is then unwound from roll 27 onto said roller or shaft 20 after which the excess of liquid is withdrawn through said valve 46 which is then closed to make air tight. Heat is then applied by means of the units 14, 14 and the casing attached to a suction system, the material is wound back from the roll 29 onto the shaft 22 at a proper rate to provide for the curing and drying of the solvent or suspension liquid and for the remaining material to dry or set at a proper rate.

The apparatus above described and obvious modifications thereof can be used for coating, impregnating, sizing, coloring or otherwise treating paper and other flexible materials or for fusing or otherwise treating material on the surface thereof or for the treatment of a plurality of fabrics simultaneously as for example, for pasting two materials together into a single flexible sheet with a water proofing application.

The method of the invention provides for an effective and even distribution of material over the surface to which it is applied for uniform and thorough drying, curing or other treatment of the material applied.

This method also does away with the disadvantages attending treatment in the open air and particularly it eliminates wrinkles, cockles, air blisters, and unevenness which often occurs in the application of varnishes, sizing, impregnations and other materials to fabrics, papers and other such materials. The apparatus and method of the invention are of advantage in the treatment of fabric, paper, or other material with short fibres because the treatment provides drying with a minimum amount of heat and time. Likewise, because a minimum amount of heat can be used for drying, colored materials can be treated, or can be applied and treated in the apparatus of the invention without deteriorating the colors.

I am aware that some changes, other than those already indicated, may be made in the various arrangements and combinations of several devices and parts, without departing from the scope of this invention, as above described, and as defined in the appended claims, hence, I do not limit my invention to the exact arrangements and combinations of parts or devices nor to the exact combinations or sequence or order of the steps in the method as described in the foregoing specification, nor do I confine myself to the exact details of the construction of said parts as illustrated in the accompanying drawings.

I claim:—

1. In an apparatus comprising an enclosed chamber, a liquid applying means comprising a wick extending from without through substantially air tight passage through a wall of said chamber, means within said chamber for handling flexible material for movement in contact with and past said applying means,

means permitting the supplying of a liquid to said wick at a point outside said chamber and permitting the maintenance of a greater pressure outside said chamber than in it whereby feeding of the liquid by means of said wick is aided.

2. Apparatus for applying a liquid suspension or solution having a volatile constituent, comprising, an enclosing chamber adapted for maintaining a reduced pressure when connected to a suction system, and means for feeding a liquid in a continued stream from a point outside said chamber to an application point within, said means extending from outside said chamber to the interior and being in reduced pressure maintaining relation with respect to the wall thereof.

3. Apparatus for the applying of liquid suspension or solution having a volatile constituent to a flexible sheet, comprising a substantially closed chamber, liquid reservoirs at either side thereof, wicks inclined upwardly from the reservoirs and extending through the walls of the chamber, said wicks having juxtaposed ends to engage a flexible sheet therebetween, means for drawing such a sheet past the wick ends, and duct connections to the chamber and reservoirs respectively, whereby a pneumatic pressure differential may be set up in the same to aid flow of liquid along the wicks.

In testimony that I claim the invention set forth above I have hereunto set my hand this 27th day of September, 1927.

BERT C. MILLER.