June 25, 1957 H. J. FRALISH 2,797,171

METHOD OF UNIFORMLY APPLYING LACQUER TO PAPER STRIPS

Filed April 25, 1951

FIG. 3

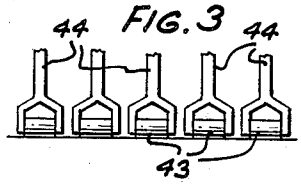


FIG. 1

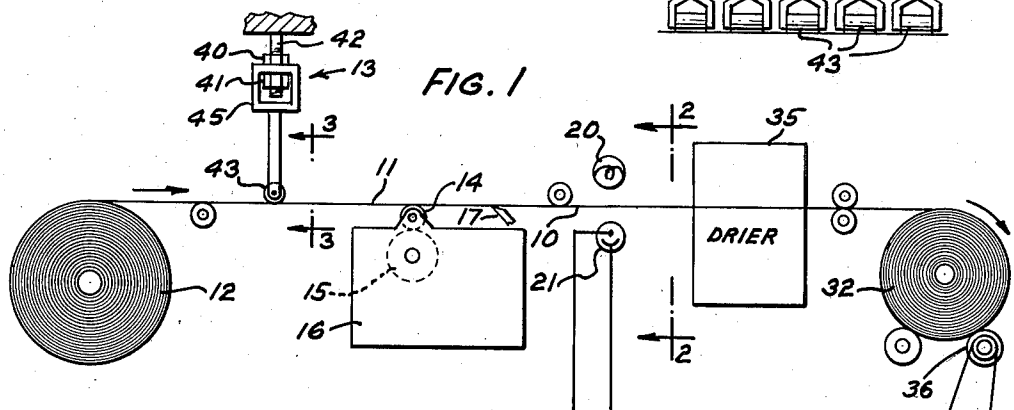


FIG. 2

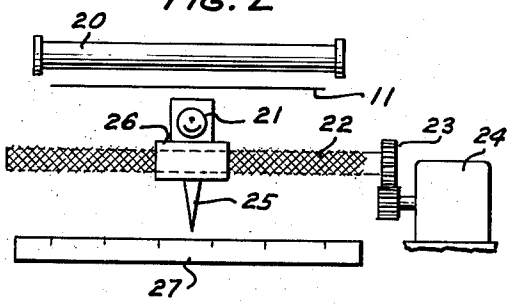
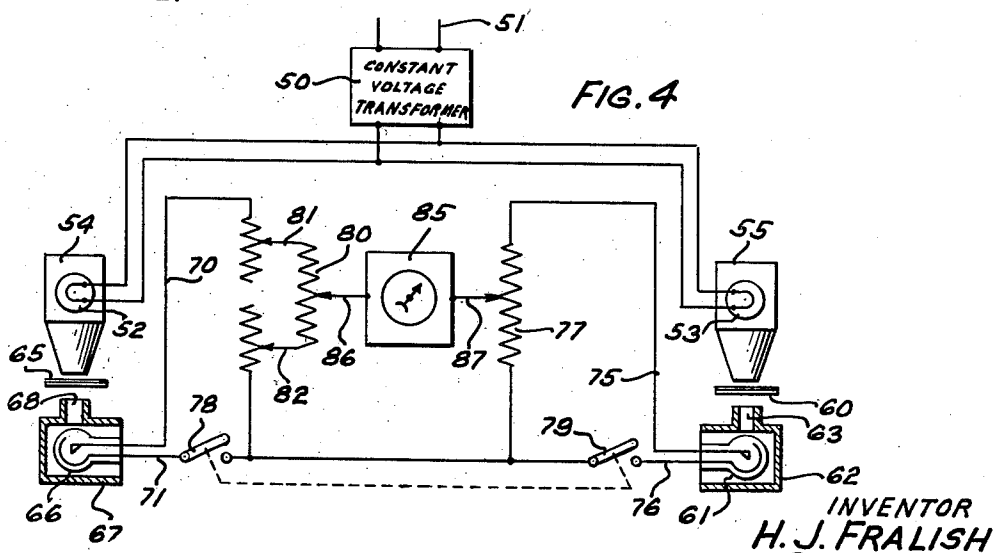


FIG. 4



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1 Claim. (Cl. 117—7)

This invention relates to methods of and apparatus for coating articles, and more particularly to methods of and apparatus for applying uniformly thick coatings of lacquer to strips of paper.

It has been proposed in the manufacture of certain types of condensers to apply a thin coating of a thermoplastic material, such as for example, cellulose acetate butyrate, to one face of a thin sheet of paper to fill all the voids in the paper and make a thin sheet of insulating material of high dielectric strength. In the past, it has been difficult to apply the plastic material uniformly to the strips of paper because of variations in the thickness of the paper and sag in various portions in the strips of papers.

An object of the invention is to provide new and improved methods of and apparatus for applying coatings to articles.

Another object of the invention is to provide new and improved methods of and apparatus for applying uniformly thick coatings of insulating lacquer to thin paper strips.

A further object of the invention is to provide new and improved methods of and apparatus for applying to thin sheets of paper thin coats of lacquer uniformly thick throughout the lengths of paper and the widths thereof.

In one method illustrating certain features of the invention, a web of material may be advanced continuously over a coating roll, which applies lacquer thereto, a light is positioned on one side of the paper, and light-measuring means are reciprocated back and forth across the paper on the other side of the light. Means may be provided to give a constant indication of the amount of light passing through the paper at any position of the light-measuring means, and means are provided for differentially tensioning the web of paper as it is advanced past the lacquer-applying means.

A complete understanding of the invention may be obtained from the following detailed description of a method and apparatus forming specific embodiments thereof, when read in conjunction with the appended drawings, in which:

Fig. 1 is a diagrammatic view of an apparatus forming a specific embodiment of the invention;

Fig. 2 is an enlarged vertical section taken along line 2—2 of Fig. 1;

Fig. 3 is an enlarged vertical section taken along line 3—3 of Fig. 1; and

Fig. 4 is a diagrammatic view of a circuit for practicing portions of a method forming one embodiment of the invention.

Referring now in detail to the drawings, there is shown in Fig. 1 an apparatus for applying a coating 10 of lacquer, such as, for example, cellulose acetate butyrate, cellulose acetate, cellulose nitrate, regenerated cellulose, or other material having dielectric strength and being quite flexible in thin sheet form to a strip 11 of paper. The strip is advanced continuously from a supply roll 12 past an adjustable tensioning mechanism 13 and over a transfer roll 14 picking up lacquer from a fountain roll 15 immersed in a bath of lacquer in a tank 16. The roll 14 continuously applies lacquer to the under surface of the strip 11, and the lacquered paper is advanced over a doctor blade 17 and between an elongated fluorescent lamp 20 positioned above the paper and a photoelectric cell 21 positioned below the paper opposite to the lamp 20. The photoelectric cell 21 is reciprocated continuously back and forth transverse to the strip of paper by a distributor screw 22 driven through gearing 23 and a motor 24. A pointer 25 carried by a head 26 mounting the photoelectric cell 21 is reciprocated with the cell 21 along a scale 27 to indicate the position of the cell 21 with respect to the strip 11 at any particular time in the traverse of the cell with respect to the sheet. A galvanometer 30 mounted on an amplifier 31 indicates at each instance the amount of light being impinged on the photoelectric cell 21.

The strip 11 is advanced and taken up continuously by a takeup roll 32 rotated by a driving roll 36 driven by an electric motor 33 having variable speed characteristics. A manually operable speed controller 34 of the well-known type controls the speed of the motor 33 and the roll 36. A dryer 35 positioned in the path of the lacquered sheet dries the lacquer prior to the point in which the lacquered sheet is wound on the roll 32. Cellulose acetate butyrate normally is colorless liquid, and the mixture of this material with normal solvents therefor, such as acetone, or the like, normally results in a clear liquid so that small differences in thickness of the material do not differ detectably in light transmission characteristics. Consequently, dye is added to the lacquer to make the lacquer translucent so that the amounts of light transmitted through coatings of various thicknesses vary markedly. A dye which has been found to be satisfactory has been the dye, 2-methylamino-3-p-tolylamino-anthraquinone, sold under the trade name "Sudan Blue," which is an oil soluble dye compatible with the lacquer solution. A satisfactory percentage of the dye has been found to be about one percent by weight of the weight of the cellulose acetate butyrate component of the lacquer.

During the operation of the apparatus, the operator observes the reading of the galvanometer 30 and compares it with what the reading thereof should be with the optimum amount of lacquer on the sheet 11. If the lacquer is too thick, the operator actuates the speed controller 34 to speed up the travel of the sheet 10 over the transfer roll 14 to make the coating of lacquer thinner. The photoelectric cell 21 is traversed, and if the thickness of the lacquer on one portion of the sheet 11 is different from that on another portion of the sheet 11 spaced laterally therefrom, the reading of the galvanometer will be different at each of these two portions. The tension of the sheet is then adjusted by threading nuts 40—40 and 41—41 on fixed threaded posts 42—42 upwardly or downwardly, to cause rollers 43—43 mounted on thrust yokes 44—44 connected by frames 45—45 to the posts 42—42 differentially tension the offending portion or portions of the sheet 11.

An apparatus for giving the coated paper a final check and acting as a control for the apparatus shown in Fig. 1 is shown in Fig. 4. This apparatus includes a constant voltage output transformer 50 connected to a powerline 51 applying a constant voltage to incandescent lamps 52 and 53 mounted in projectors 54 and 55, respectively. A standard sample of known thickness of paper and lacquer is positioned between the reflector 60 and a photoelectric cell 61 mounted in a housing 62 having an aperture 63 directed toward the projector 55. A sample 65 of lacquered paper, the thickness of the lacquer of which is to be measured, is positioned between the projector 54 and a photoelectric cell 66 mounted in a housing 67 having an aperture 68 directed toward the projector 54.

Conductors 70 and 71 connect the elements of the photoelectric cell 66 to resistors 72 and 73, respectively, and conductors 75 and 76 connect the elements of the photoelectric cell 61 to opposite ends of a resistor 77. Manually operable switches 78 and 79 mounted in the conductors 71 and 76, respectively, are mechanically linked together, and may be closed and opened together. A resistance 80 is connected by adjustable contactors 81 and 82 to the resistors 72 and 73, respectively, and a highly sensitive galvanometer 85 is connected adjustably by contactors 86 and 87, respectively, to the resistors 80 and 77, respectively. If the coating of lacquer on the sample 65 is thicker than the coating of lacquer on the standard 60, less light will be transmitted to the photoelectric cell 66 than to the photoelectric cell 61. With the switches 78 and 79 closed, the cell 61 causes a higher potential to appear at the junction of the contactor 87 and the resistor 77 than appears at the junction of the contactor 86 and the resistor 80. Hence, the galvanometer 85 will indicate that current is flowing from the contactor 87 through the galvanometer to the contactor 86 thereby indicating that the lacquer of the sample 65 is thicker than the lacquer of the standard 60. If the lacquer on the sample 65 is less thick than that on the standard 60, the current will flow through the galvanometer 85 from the contactor 86 to the contactor 87, which will actuate the galvanometer 85 to indicate that the tested lacquer is thinner, and the magnitude of the deviation from the standard 60 will be indicated by the galvanometer 85.

In one specific example, the strip 11 consisted of paper 0.0003 inch thick which was advanced past the transfer roll 14 at the rate of 200 feet per minute, and a lacquer coating in uniform thickness both as to length and across the paper was applied to one face thereof. This coating was held between the limits of 0.12 milligram of lacquer per square centimeter of paper and 0.20 milligram of lacquer per square centimeter, which coatings formed a thickness roughly about 0.00005 inch.

It is to be understood that the above-described arrangements are simply illustrative of the application of the principles of the invention. Numerous other arrangements may be readily devised by those skilled in the art which will embody the principles of the invention and fall within the spirit and scope thereof.

What is claimed is:

The method of forming lacquered paper, which comprises advancing a translucent web of paper continuously over an applicator to coat it with a colored lacquer having a predetermined translucency, projecting light through the coated web at different points across the web, measuring the intensities of the light transmitted through the web at said points, and pressing the web with differential forces at different points across the web in accordance with said measurements to obtain uniform tension across the portion of the web being coated.

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