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METHOD OF MANUFACTURING CONTINUOUS COATED SHEETS OF PAPER, FILM, OR THE LIKE

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Fig. 1

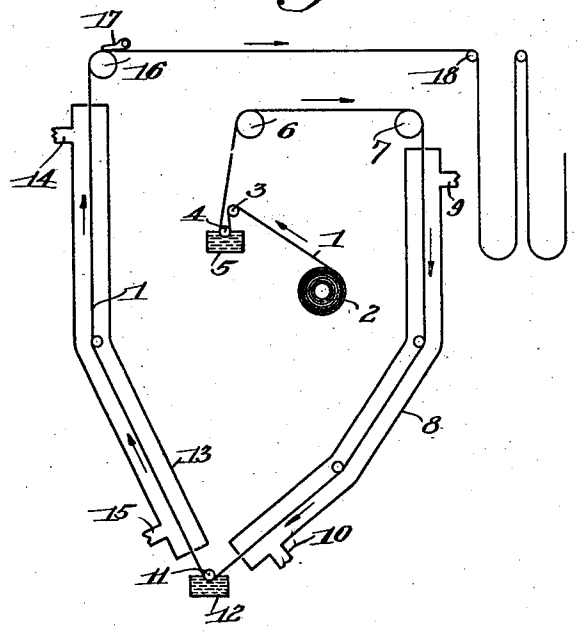


Fig. 2

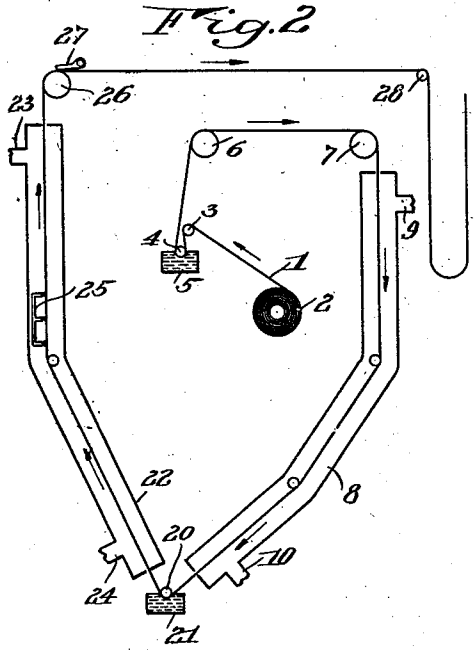
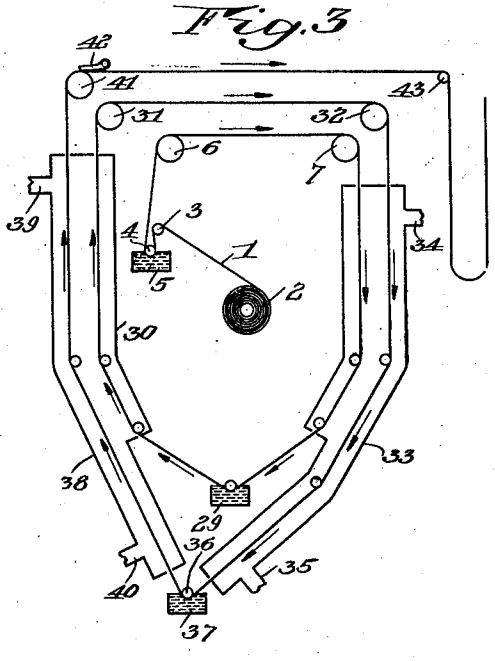


Fig. 3



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METHOD OF MANUFACTURING CONTINUOUS COATED SHEETS OF PAPER, FILM, OR THE LIKE

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1 Claim. (Cl. 91—69)

This invention relates to a method of manufacturing continuous coated sheets of paper, film or the like, and has to do more particularly with the treatment of light-sensitive coatings on photographic paper or film.

One object of the invention is to treat the wet colloidal, gelatin, or other light sensitive coating on a continuous sheet or base, after the coating is partially set and before applying heat for drying, so as to remove from the coating a substantial amount of the solvent or water, thereby reducing the amount of water to be removed by evaporation and lessening the time required in the heat drying operation and the amount of heat to be applied to the coating and base.

A further purpose of the invention is to produce a superior photographic paper or film, due to subjecting the paper and coating to heat drying over a shorter period of time than heretofore and causing the sheet to travel a shorter distance during drying, thus reducing the possibility of defects in the photographic paper or film, improving its quality, and increasing the effective life of the product.

Heretofore in the manufacture of photographic paper or film, the general practice has been to set the gelatin, coating or emulsion partially, as by passing the sheet through a cooling chamber, and then to carry the sheet through drying rooms or chambers where the moisture is evaporated by successively subjecting it to progressively hotter currents of heated air, and it is a purpose of this invention to remove from the coating a large portion of the moisture or solvent, after the coating is initially set and before it is subjected to the heat drying operation. This is accomplished by applying, in a suitable manner to the coating, a fluid, or liquid, such as alcohol, having a high affinity for the solvent or water in the coating, and then removing from the surface of the coating the alcohol and solvent which it has extracted by any suitable means, such as a squeegee, roller, scraper, or air blast, so that when the coated sheet reaches the heat drying chamber, a considerable amount of moisture has been removed and correspondingly less time and heat is required in the heat-evaporating stage of the operations.

To these and other ends, the invention includes the method that will appear more clearly from the following description when read in conjunction with the accompanying drawing, the novel features being pointed out in the claim following the specification.

In the drawing:

Fig. 1 is a diagrammatic view illustrative of one form of apparatus for carrying out the improved method as applied to photographic paper or film having a single coating of light-sensitive emulsion;

Fig. 2 is a diagrammatic view showing another form of apparatus for treating photographic paper or film having a second protective coating applied over a light-sensitive coating, and

Fig. 3 is a diagrammatic view of a further modification of apparatus for treating photographic paper or film having a protective coating applied over a light-sensitive coating.

The invention is applicable to the manufacture of any continuous coated sheet or base, and the present disclosure, which is merely illustrative of some practical examples of its use, shows how it may be adapted to the manufacture of photographic paper or film.

Referring to Fig. 1, the sheet or base or support is designated at 1, and is fed from a supply roll 2, whence it travels around guide rolls 3 and 4 into a tank 5 containing a light-sensitive coating, usually in the form of a gelatin emulsion containing light-sensitive salt, such as halides of silver, which is applied to the exposed surface of the sheet 1.

The latter thereupon travels around guide rolls 6 and 7 and thence through a cold air chamber 8 having an inlet 9 and outlet 10 for refrigerated air, to bring about the initial setting of the coating on the sheet.

After the coating is initially set, and before it reaches the heat drying chamber, provision is made for removing a part of the solvent from the coating by spraying or otherwise applying to the coating a fluid or liquid having a high affinity for the water or solvent in the coating. To this end, after leaving the cold air chamber 8, the sheet 1 travels around a guide roll 11 located in a tank 12, where the sheet or film, with the emulsion coating partially set thereon, is passed through a bath of liquid, such as methyl or ethyl alcohol, having a high affinity for the solvent or water in the emulsion coating. This liquid on the coating attracts the water or solvent in the coating, withdrawing a large part of it from the body of the coating to the surface thereof, and into the superposed layer of alcohol, where it can be removed by suitable means, as will be described presently.

The sheet or support 1 thence travels through a cold air chamber 13 having an inlet 14 and outlet 15 for refrigerated air, causing a further setting of the emulsion coating on the film, following which the sheet travels around a guide roll 16, at which point it is preferably subjected to the action of the liquid removing means, which may be of any convenient form, such as a squeegee, roller, scraper, or air blast, which are comprehended by "mechanical pressure" in the claim, as distinguished from evaporation or drying. The liquid removing means is here shown for illustrative purposes in the form of a squeegee 17 located in juxtaposition to the surface of the coating and acting to engage the same and re-

move from it the alcohol, or superposed layer of whatever liquid may be employed for the purpose, together with the water or solvent that has been removed from the coating and is combined with the alcohol.

When methyl or ethyl alcohol is used, it chills the gelatin in the emulsion, and tends to precipitate the gelatin, hastening the setting and causing the gelatin coating to become hard and resistant to surface abrasion, and no further cooling of the coating is required before subjecting the sheet to the final heat drying operation. The sheet thereupon passes around a guide roll 18 and thence to the drying chamber or room, as usual in this class of apparatus, where it is subjected to hot air currents to evaporate the remaining moisture from the sheet and coating and effect complete drying thereof.

The alcohol may be sprayed on the surface of the coating, as shown in Fig. 2, instead of carrying the sheet through the liquid as in Fig. 1, and the invention may be applied to a sheet having a light-sensitive coating and a second protective coating, as shown in Figs. 2 and 3.

In the construction shown in Fig. 2, the arrangement of the parts and the treatment of the sheet is the same as in the Fig. 1 construction up to the point where it passes through the cooling chamber 8. Following this, the sheet 1 is passed around a guide roll 20 located in a tank 21 which contains a protective coating of plain gelatin or like substance such as used for protective coatings in the manufacture of photographic film and paper, and thereafter the sheet is carried through a cooling chamber 22 having an inlet 23 and outlet 24 for refrigerated air currents. 25 designates a sprayer to be supplied with methyl or ethyl alcohol, or other liquid having a high affinity for the water or solvent in the coating, and such liquid is preferably sprayed on to the surface of the protective coating at this point, the coatings having previously been partially set by movement through the cooling chambers.

Thereafter the sheet passes around the guide roll 26 and is subjected to the action of the liquid removing means preferably in the form of a squeegee 27 which engages the surface of the outer coating and removes the alcohol or other liquid together with the water or solvent that has been withdrawn thereby from the body of the coatings to the surface of the outermost coating. The gelatin in the coatings is partially precipitated by the action of the alcohol, resulting in a quicker setting of the coatings. Thereafter the sheet is carried around the guide roll 28 and thence to the drying room or chamber where it is subjected to currents of air sufficiently heated to bring about the evaporation of the remaining moisture in the coatings and final drying.

In Fig. 3 is illustrated a modified arrangement for drying a double coated sheet by dipping it in a liquid bath instead of spraying the liquid thereon, as in Fig. 2. With this arrangement, the sheet is dipped in a protective coating emulsion in the tank 29, after which it travels through the cooling chamber 30, around the guide rolls 31 and 32 and is thence carried a second time through the cooling chamber 33 which has an inlet 34 and outlet 35 for refrigerated air currents. After leaving the cooling chamber 33, the sheet travels around a guide roll 36 at which point it passes through the tank 37 containing the alcohol or other liquid, which has the requisite solvent-withdrawing effect upon the coating. The sheet travels thence through the cooling chamber 38 having an inlet 39 and outlet 40 for the refrigerated air currents, and thence around the guide roll 41 at which point the outer surface of the protective coating is subjected to the action of liquid removing means which may consist of a squeegee 42 or other suitable instrumentality that removes the surface liquid together with the solvent that has been withdrawn from the coatings. After this the sheet travels around the guide roll 43 and thence to the drying room or chamber where the final drying operation is effected.

Any suitable apparatus may be employed for collecting the alcohol after it has been removed from the coating, and this may be recovered from the solution by distillation or other suitable method and again used.

With this process, a considerable saving in the cost of manufacture is possible, due to the reduced refrigerating and drying requirements, This greatly lessens the cost of the necessary heating and air-circulating equipment in the production of photographic papers and film, and also reduces the floor space required in such manufacturing processes.

In addition to substantial savings in the manufacturing cost, the invention also results in a superior product, since the extreme heat required in previous drying methods results in shortening the life of such products. By lessening the amount of heat to which the product must be subjected during its manufacture, and by shortening the time during which it is exposed to air while wet, the effective life of the product is lengthened and its quality greatly enhanced.

As a result, the light-sensitive coating will retain its desirable properties longer, drying marks are eliminated from the finished product, a greater uniformity of photographic quality is had, improved color in paper coated with warm tone emulsions is effected, there is less tendency for the product to curl, or expand and contract during drying, and the possibility of defects caused by chemical or physical action of impurities in the sheet or in the surrounding atmosphere during the drying operation is greatly reduced.

The invention may be carried out in ways and with apparatus other than that particularly set forth, and this application is intended to cover any adaptations or applications of the improvement coming within the intent of the method herein disclosed or the scope of the following claim.

We claim:

The method which consists of the following steps, namely, first applying a water-containing light sensitive coating to a continuous sheet, secondly applying to the surface of said coating a highly concentrated liquid alcohol which acts to harden the coating partially and to extract a portion of the water from the body of the coating to the surface thereof, thirdly, partially drying the coating by removing a major part of said surface alcohol and water by applying mechanical pressure to the surface of the coating, and finally drying the sheet and coating by evaporation.

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