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MULTIPLE LAYER COATING METHOD

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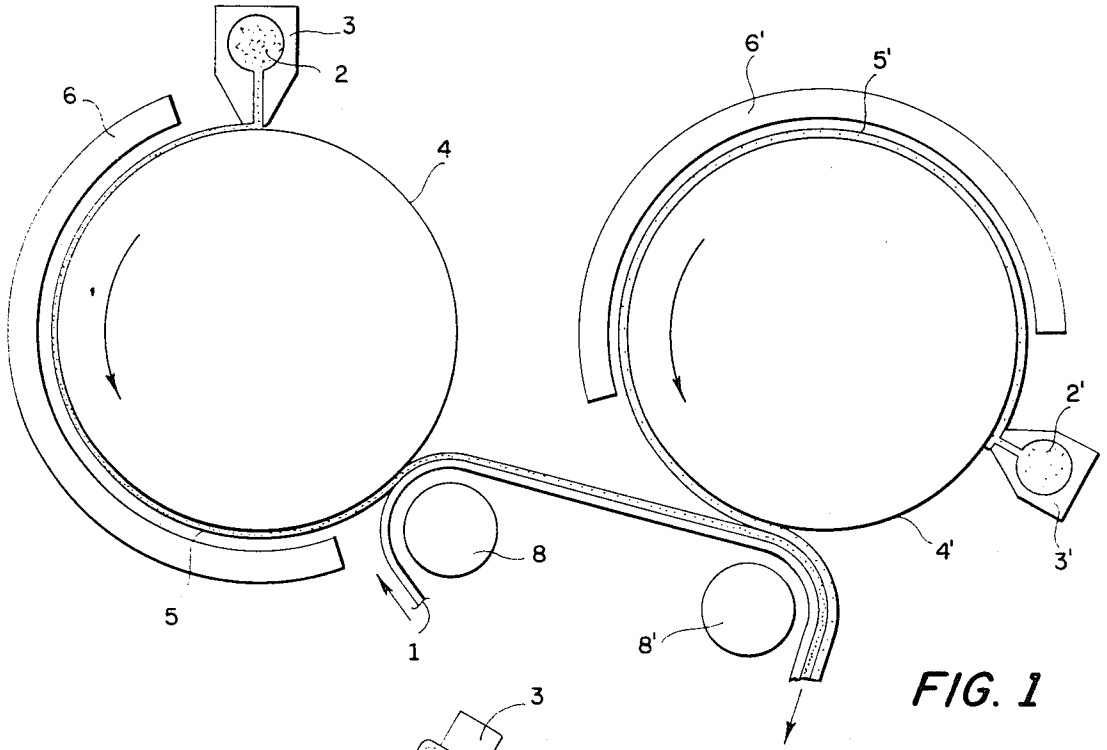


FIG. 1

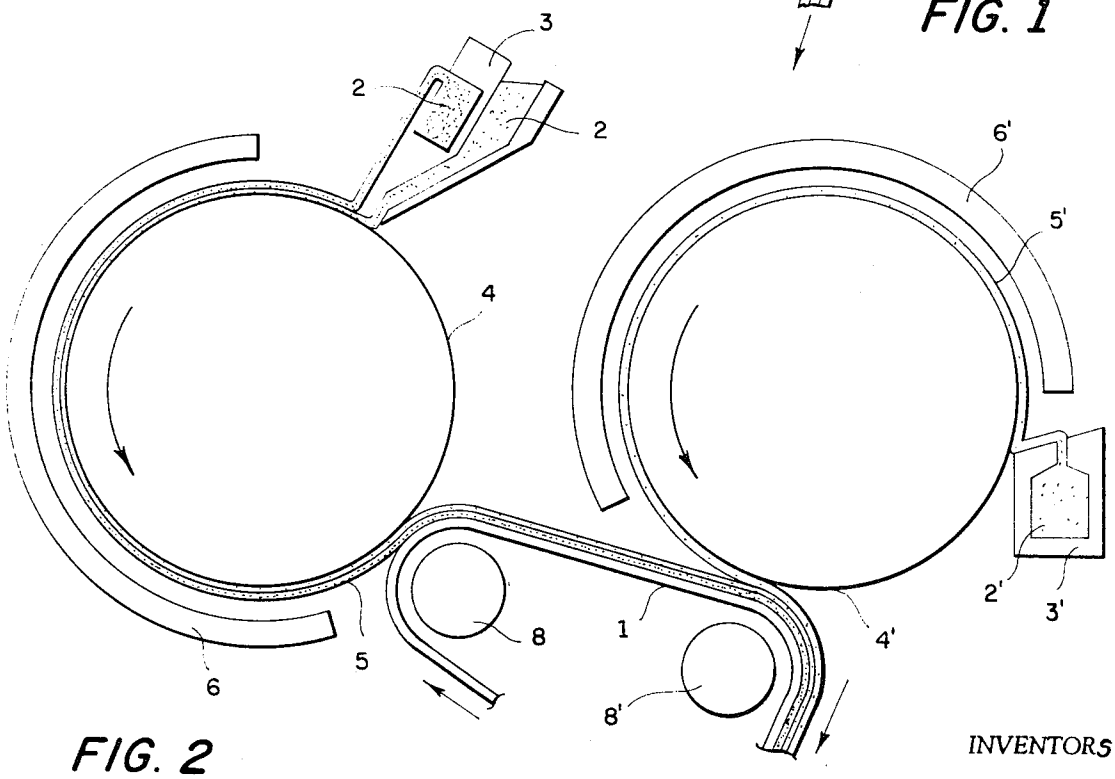


FIG. 2

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MULTIPLE LAYER COATING METHOD

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ABSTRACT OF THE DISCLOSURE

In a method of forming two or more superimposed layers of sol-gel conversive coating materials, at least two layers of the coating materials are formed separately on continuously moving cooling surfaces, gelled by cooling to form gelled films each on each cooling surface, and then transferred onto a traveling support successively to form thereon the superimposed layers.

BACKGROUND OF THE INVENTION

There have hitherto been proposed various multiple layer coating methods, for example, by repetition of a single step of coating and drying, by applying one coating liquid to other already gelled layer, and by applying one coating liquid to a layer in sol state. However, the method comprising repeating a single step of coating and drying has a low efficiency and the method comprising applying a coating liquid to a gelled layer or applying a coating liquid to a sol layer encounters restrictions about the characteristics of a coating material and about the coating conditions caused by the wetting and mixing problems of the adjacent layers. Such disadvantages or difficulties can be overcome by the method of our invention.

SUMMARY OF THE INVENTION

The present invention is concerned with a coating method for forming a multi-layer by superposing gelled coating material formed in thin films one after another on the surface of a traveling support. More particularly, it relates to a method suited for superposing sol-gel conversive coating materials such as photographic gelatino-silver halide emulsions one after another on a traveling support such as a film base or a baryta paper followed by drying the resulting layers at one time. In particular, the present method is suited for, after coating, drying two or more photographic color emulsion layers or photographic emulsion layers having a gelatin protective layer at one time.

The feature of the invention consists in applying coating materials corresponding to constituent layers to cooling surfaces such as rotary cooling drums or belt conveyor type cooling plates each moving at a substantially same circumferential velocity as the traveling rate of a support, thereby to form predetermined uniform thin films respectively, cooling the resulting films rapidly thereby gelling them, bringing the surface of the first gelled film to transferring the thin film from the cooling surface to the support, repeating the procedure successively to form multiple superimposed layers on the support.

DESCRIPTION OF THE DRAWINGS

FIG. 1 is a schematic of a first embodiment of invention; and

FIG. 2 is a schematic of a second embodiment.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

With particular reference to FIG. 1, a traveling support **1**, such as a film base or a baryta paper, to be coated is moved continuously and coating material **2** is applied by means of a coating device **3**, such as an extrusion hopper, in a predetermined, uniform thin film to a cooling surface **4** (for example, a cooling drum or a belt conveyor type cooling plate) moving at substantially the same speed as that of support **1**, where it is immediately cooled to be a gelled thin film **5**. In order to accelerate cooling, a cold air of a low temperature may be supplied onto the film by a cold air supplying apparatus **6**.

The traveling support **1** is closely pressed onto the gelled thin film **5** by a press means **8**, for example, an air support means to support and press the support by supplying the air, whereby the film **5** is stripped from cooling surface **4** and transferred to the surface of the support **1**.

In the stripping of gelled thin film **5** from the cooling surface **4**, an auxiliary stripping means may be employed or the cooling surface **4** may be suitable treated so as to facilitate stripping.

In the same manner as mentioned above, a coating material **2'** is applied to a cooling surface **4'** in a predetermined uniform thin film by means of a coating device **3'**, where it is immediately cooled to be a gelled thin film **5'**. In this case also, the cooling or gelling may be accelerated by the use of cold air supplying apparatus **6'**. The support having the gelled thin layer **5** is contacted closely with the gelled thin film **5'** by a press means **8'**, and the gelled film **5'** is stripped from the cooling surface **4'** and then transferred to the support, whereby superimposed layers consisting of the thin film **5** and the thin film **5'** are formed on the support.

In FIG. 2, there is shown another embodiment of this invention in which three layers are formed on a traveling support. In the shown system, two kinds of coating liquids **2**, are applied to the cooling surface **4** by means of a coating means **3** to provide two superimposed layers **5** on the surface. The layers are gelled and transferred to a traveling support **1** as in the case of the embodiment as shown in FIG. 1, on which a gelled thin film **5'** is similarly transferred from the cooling surface **4'** to form three superimposed layers on the support.

Although only two embodiments are illustrated, it will be understood that any desired multiple layers may be formed by properly selecting the kinds of coating devices and the number of cooling members.

In the method as mentioned above, a coating material is applied to a cooling surface in the form of a thin film while it is in sol, and after being gelled by cooling the layer is contacted closely with a traveling support and transferred to the support from the cooling surface. Subsequently, other coating material is applied to other cooling surface of other cooling apparatus in a thin film in sol, and after being gelled by cooling, the layer is contacted with the surface of the gelled thin film on the support obtained in the foregoing step and transferred to the surface of the film on the support.

By utilizing the cooling apparatus or the combination of the cooling apparatus and cooling air in the formation of superimposed gelled layers on a support as mentioned above, it becomes possible to accomplish gelling or setting more rapidly as compared with the gelling only by utilizing a cold air in the prior art. Moreover, it becomes possible in the method of this invention to dry thus formed multiple layers on a support at one time and the restrictions on the characters of coating solutions and coating conditions caused by the mixing or wetting properties between superimposed layers are eliminated.

The following example is given to illustrate the invention:

EXAMPLE

In the apparatus as shown in FIG. 2, coating materials for a photographic positive cine-color film were applied to an undercoated cellulose triacetate film base under the following condition:

	Viscosity, cps.	Coated quantity, ml./m².
First layer, blue sensitive emulsion	50	70
Second layer, red sensitive emulsion	50	50
Third layer, green sensitive emulsion	40	80

The first layer and the second layer were applied to the surface of a rotary cooling drum of a .2 m. in diameter, cooled or set and then transferred to a film base traveling at a speed of 12 m./min. Subsequently, the third layer cooled or set similarly was contacted therewith closely to form multiple layers on the support followed by drying immediately. The resulting dried film had a good quality and uniform thickness of thus formed layers and the diffusion of the coating materials between the adjacent layers as well as coating unevenness were not found therein.

We claim:

1. In a method of forming two or more superimposed layers of sol-gel conversive photographic coating liquids onto a traveling support, a coating method comprising applying one or more layers of the photographic coating liquid onto a continuously moving cooling surface of a cooling drum or belt conveyor type cooling plate to form thereon a layer of the coating liquid or superimposed layers of the coating liquid, gelling said layer or layers by cooling into thin film or films, transferring said gelled film or films to the surface of a travelling support, said support being closely pressed to the gelled film at the point at which it is separated from the cooling surface, and further transferring another gelled film or films formed similarly on another cooling surface to the surface of the thus formed gelled layer on the support, said support likewise being closely pressed to this gelled film at the point at which it is separated from the cooling surface on which it is formed, the travelling support positioned between the cooling surfaces.

2. The coating method as in claim **1**, wherein the gellating is further enhanced by supplying a cooling air onto the layer or layers applied on the cooling surface.

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