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PROCESS AND APPARATUS FOR REMOVING DIFFUSIBLE  
LIQUID FROM A PERMEABLE SOLID

3,448,528

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Sheet 1 of 2

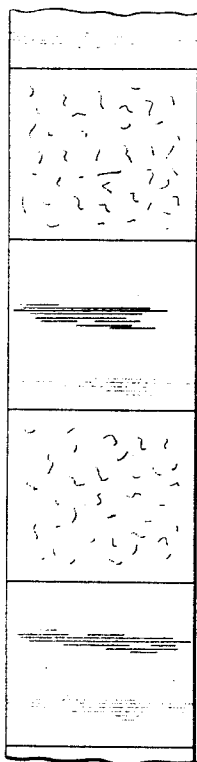


FIG. 1a

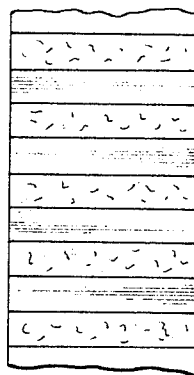


FIG. 1b

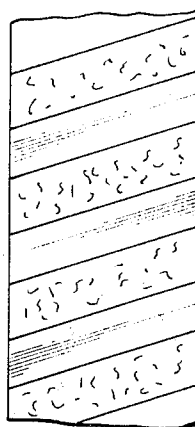


FIG. 1c

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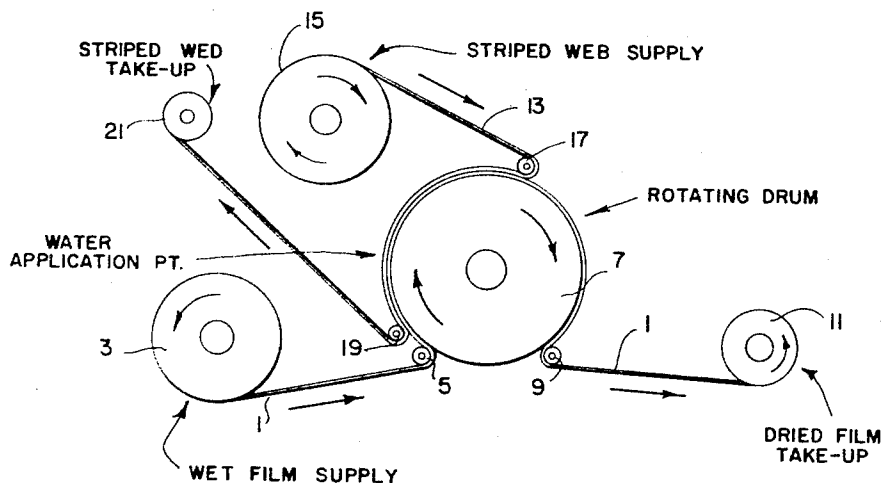


FIG. 2

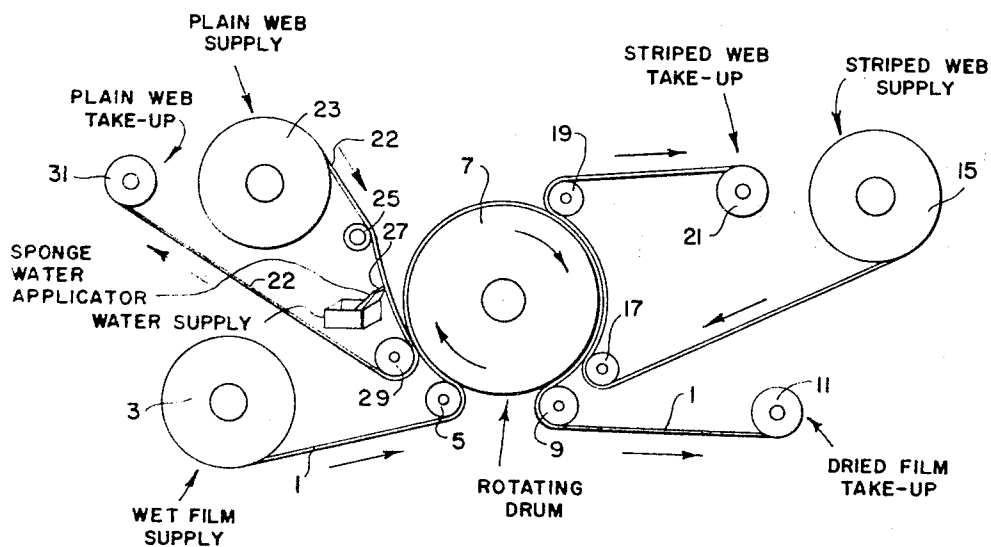


FIG. 3

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3,448,528

## PROCESS AND APPARATUS FOR REMOVING DIFFUSIBLE LIQUID FROM A PERMEABLE SOLID

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16 Claims

### ABSTRACT OF THE DISCLOSURE

Diffusible liquid is removed from a permeable solid containing such liquid by passing a support having interrupted, solid coating stripes containing a drying agent over the permeable solid in intimate contact therewith. For instance, a moist photographic element is dried by passing a support containing interrupted, solid coating stripes of a poly(ethylene oxide) over the moist photographic element in intimate contact therewith. One embodiment is use of a wet absorbent web to remove residual processing compounds from a processed photographic element before contacting the element with the striped coating.

This invention relates to removing liquids from permeable solid materials. In one of its aspects, it relates to removing diffusible liquid, such as water, from permeable solid materials, such as photographic elements. In another of its aspects, it relates to drying a moist colloid coating, such as a gelatino emulsion coating, by contacting the moist coating with a support having interrupted, solid polymeric coating stripes containing a drying agent.

Two methods have been generally employed heretofore for removing liquids from permeable solids containing such liquids. In one method, the liquid is removed by evaporation, for example, by a combination of heating the permeable solid and/or reducing the pressure around the solid material. In a second method, the solid material is immersed in an extractant, such as an extractant bath as set out in U.S. Patent 2,150,757—Bodine, issued Mar. 4, 1939.

These methods have not been entirely satisfactory in many cases, especially for removing moisture from photographic elements because they require costly equipment, excessive time, leave undesirable residue on the solid material dried, make the elements susceptible to accumulation of dust and/or cause undesirable changes in the material dried.

In the case of photographic elements, e.g., films, papers and the like, it has been usual practice to process such elements after exposure in solutions or processing baths which produce a wet or moist product. It has been necessary in such cases to wait, often for many minutes, for the element to dry before further processing or handling, such as contract printing, can be carried out. This time can be reduced by forced air drying at elevated temperatures, but this method has not been entirely satisfactory for removing diffusible liquid without undesirable affects to the element and without expensive equipment.

Drying of photographic elements, such as those processed without conventional processing baths, and inspection of the processed element as soon as possible has been especially important. One method which has been advantageous in decreasing the time from exposure to finished product without the use of conventional processing baths employs a wet or moist absorbent web typically a monobath which is contacted with the photographic element. This method and means for carrying out the meth-

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od are set out, for example, in U.S. Patent 3,179,517—Tregillus et al., issued Apr. 20, 1965. This method, however, like conventional processing, results in a processed photographic element which is moist after the film and the web containing processing compounds are separated and usually must be dried in some manner.

Efforts to dry such film have included application of a powdered inorganic drying agent, such as barium oxide, calcium chloride, activated aluminum and the like, dusted over the surface of the moist film or located on a surface opposite a protective porous web which is contacted with the moist film. This is disclosed in British Patent 1,012,391, issued Dec. 8, 1965. The moist processed film according to this method is not contacted directly with the inorganic drying agent in order to prevent adverse affects to the film, such as changes in the sensitometric properties of the film.

It is, accordingly, surprising that a polymeric coating on a support can be contacted directly on a surface of a permeable solid containing a diffusible liquid, such as a moist photographic element, removing the liquid without leaving a undesirable residue and without adversely affecting the properties of the element, such as the sensitometric properties.

An object of the invention is to provide novel means for rapidly removing liquid from a permeable solid such as a photographic element containing such liquid without undesirable changes in the solid.

Another object is to provide a novel apparatus for removing a liquid, such as water, from a permeable solid, such as a photographic element, employing direct contact of a drying agent on the permeable solid.

A further object is the provision of a means for rapidly removing diffusible liquid, such as water, from a moist photographic element, typically a photographic gelatino emulsion, without leaving undesirable residue on and/or in the element.

According to the invention, means and processes are provided for rapidly removing diffusible liquid from a permeable solid material containing such liquid by contacting a support having interrupted, solid polymeric coating stripes containing a drying agent over the permeable solid in intimate contact therewith without leaving undesirable residue on the solid material and without adverse affects to the solid material.

One of the embodiments of the invention, accordingly, comprises a process for removing a diffusible liquid from a permeable solid containing the liquid by contacting the permeable solid with a solid material which removes the liquid from a permeable solid, wherein a support having interrupted, solid polymeric coating stripes containing a drying agent is passed over the permeable solid in intimate contact therewith, the stripes being transversed to the direction of passage over the permeable solid.

According to this embodiment, a process is provided wherein the support can have interrupted transverse solid coating stripes containing poly(alkylene oxide), e.g. poly(lower alkylene oxide). Suitable poly(alkylene oxides) include poly(ethylene oxide) having an average molecular weight of about 190 to about 5,000,000 or more.

In the practice of the invention, the areas of the support which do not contain the described solid coating, i.e., do not contain the solid polymeric coating stripes, serve to absorb and carry away any diffusible liquid, e.g. moisture, along with any undesirable poly(alkylene oxide) remaining on the permeable solid, e.g. on the photographic element. Such solid coating stripes, accordingly, overcome the disadvantage encountered with lower molecular weight poly(ethylene oxide), e.g. molecular weight of about 190 to about 900, which can extract water from, for example, moist photographic film, but tend to leave undesirable residue on the solid.

The invention is further described with reference to the accompanying drawings wherein:

FIGURES 1a, 1b and 1c represent various inert supports, i.e. drying webs or tapes containing solid polymeric coating stripes suitable for use in the practice of the invention;

FIGURE 2 is a schematic representation of an apparatus for drying moist photographic film, paper or the like, in accordance with the invention;

FIGURE 3 is a schematic representation of an embodiment of the invention wherein the apparatus of FIGURE 2 includes additional means for wetting or rinsing the processed photographic film, paper, etc. with a liquid, such as water, prior to drying by contact with the striped drying surface, e.g. web or tape of the invention.

Referring to the figures, FIGURES 1a, 1b and 1c represent striped tapes or webs which have been used with success and demonstrate that the ratio of coated to uncoated area in the striped web can vary considerably. Also, the angle of the transverse stripe may be varied if desired, as in FIGURE 1c.

The particular ratio of coated to uncoated areas selected will be dependent upon a number of variables such as the degree of wetness, the particular poly(ethylene oxide) or other material used to effect drying, the thickness of the coating, etc. A suitable tape, for instance, can have alternating coated and uncoated stripes about 0.5 centimeter to about 4 centimeters wide, e.g. about 2 centimeters wide. Widths outside these ranges can also be used.

In FIGURES 2 and 3, moist photographic film, paper or the like, such as exposed silver halide gelatino emulsion containing photographic film which has been treated with developing and fixing solutions, is drawn from a wet film supply spindle 3 and threaded, with its moist emulsion surface up, under guide roll 5 onto rotating drum 7, under guide roll 9 and is taken up by dried film take up spindle 11. Power means, not shown, such as an electric motor, are provided the drum 7 and take up spindle 11. If desired, power means may also be supplied the supply spindle 3. The poly(ethylene oxide) striped web is drawn from striped web supply spindle 15 threaded under guide roll 17, passed onto the drum 7 over the previously threaded moist photographic film 1, under guide roll 19 and is taken up by the web rewind spindle 21. Installation of the striped web is, of course, with the coated striped areas down so as to contact the wet or damp surface of the film. Power means also not shown are provided the web rewind spindle 21. Having installed and threaded the wet film and striped web, the powering means of the respective take up spindles passes striped web 13 in counterflow over the wet film 1 and in intimate contact therewith, i.e., the drying web or tape 13 having interrupted solid polymeric coating stripes containing a drying agent is passed over the permeable solid photographic element in intimate contact therewith, the stripes being transverse to the direction of passage of the photographic element and the drying web or tape.

Referring to the embodiment of FIGURE 3, after installing the wet film as described above, a plain, inert, absorbent web 22, e.g. coated or uncoated with poly(ethylene oxide), is drawn from a plain web supply spool 23, over guide roll 25 passed through a wetting means 27, e.g. a water wetting means, such as a sponge and water applicator, over and in intimate contact with the moist film on the rotating drum 7, under guide roll 29 and is taken up by plain web take up spindle 31. Again power means, not shown, provided take up spindle 31, when actuated, passes the web with water in counterflow over the wet, processed film. This wet web means is provided to effect removal of residual compounds from the wet, processed photographic film, paper, etc. Removal of such compounds can accelerate drying. The water-wet web 22 can provide a brief rinse for the film prior to drying. As an alternative to this wet web means for effecting this water rinse preliminary to drying, water can

be applied to the polyethylene glycol striped web at a suitable point on the rotating drum, preferably at a point near its removal from the drum, for instance, as indicated by water application point A in FIGURE 2.

Although the above apparatus has been described with reference to the drying of the emulsion side of moist photographic film, paper or the like, it should be understood that the drying method is equally applicable to other permeable solids containing diffusible liquids.

Also, as a further variation of the present invention, instead of using a precoated poly-alkylene oxide) striped web or tape, the coating stripes can be applied immediately before the drying operation, for instance, just after an uncoated absorbent web comes off the supply spool or spindle while on its way to contact the wet film.

It can be seen from the above description, therefore, that the only power consumed is that required to transport the film and web. The drying apparatus is relatively small, the actual size employed being dependent upon the rate at which it is desired to dry the film and upon the amount of film to be dried without replenishing the web supply. Handling of the film is greatly simplified, involving merely installation of the wet roll, threading, and removing the roll from the take-up spindle after it has been dried. Unlike evaporative drying, the method of the invention is relatively independent of environment and the drying can be conducted in a dust tight enclosure.

The material comprising the polymeric coating stripes need not be present only on the surface of the support. It can be present in and/or on the support. For example, part of the poly(alkylene oxide) can be present in the support. The entire amount of such materials can be coated on one side or both sides of the support.

Any desirable coating techniques can be employed for preparing the drying means of the invention. The coating thickness can vary over a wide range depending upon the material to be dried, the composition of the coating, the type of support, the amount, and type of liquid to be removed from the permeable solid material, and the like. A suitable thickness of the solid coating stripes comprises about 0.001 mm. to about 0.1 mm., typically about 0.01 to about 0.05 mm., but a thickness outside this range can be used.

A wide range of coating materials can be used for preparing the solid polymeric coating stripes in the practice of the invention. Especially suitable solid polymeric coating materials comprise poly(alkylene oxides) having an average molecular weight of about 900 to about 20,000, e.g. those commercially available under the trade name Carbowax, from the Union Carbide Corporation, New York, N.Y. Also suitable are mixtures of a poly(alkylene oxide) having an average molecular weight of about 190 to about 20,000 with a high molecular weight, highly crystalline poly(alkylene oxide) commercially available under the trade name Polyox from Union Carbide Corporation, New York, N.Y.

Another suitable solid polymeric coating comprises a mixture of poly(alkylene oxide) with a binder, such as a polymeric binder, e.g. a copolymeric binder. Any binder is suitable in such mixture which maintains the coating stripes on the support, does not adversely affect the drying action of the coating, and leaves little or no residue on the material from which the diffusible liquid is removed. These can be employed in any suitable amount depending on the components of the coating, the support, and the like. Usually about 10% to about 95% binder in the coating is suitable. Typical binders include, for example, natural and synthetic resins, such as high molecular weight, highly crystalline poly(alkylene oxides), polyvinylalcohol, poly(acrylic acid), poly(acrylic acid esters), e.g. poly(methylmethacrylate), poly(vinyl ethers), cellulose esters, maleic acid copolymers, carboxyl derivatives, of cellulose, vegetable gums and silicone resins. A mixture of two or more binders can also be employed. The polymeric binders usually have a molecular weight sufficiently high to be

solid to provide the desired properties, usually a molecular weight of about 900 or more.

Examples of suitable materials which can be employed in the practice of the invention as the drying agent and/or as binders are disclosed, for example, in French Patent 1,482,699, issued Apr. 17, 1967. Specific examples of materials which can be employed in the practice of the invention include:

(1) Poly(ethylene oxide), usually available as mixtures, having an average molecular weight of about 900 to about 20,000. Such compounds are commercially available under the trade name, Carbowax, from Union Carbide Corporation, New York, N.Y.

(2) Poly(ethylene oxide), having a high molecular weight, i.e., typically more than 100,000, being highly crystalline, i.e., having a narrow melting point range. These compounds are commercially available under the trade name, Pluriox, from Union Carbide Corporation, New York, N.Y.

(3) Poly(acrylamide) and related polyamides, such as those having an average molecular weight of about 900 to about 5,000.

(4) Polyvinylpyrrolidones, such as those having an average molecular weight of about 900 to about 40,000.

(5) Alkylene oxide-silicone copolymers. Compounds of this type are produced by the Union Carbide Corporation, New York, N.Y. under the trade name, Silicone Polymers L-250, L-530, and the like.

(6) Ethylene oxide-propylene oxide copolymers in which the ethylene oxide comprises at least 40% by weight of the copolymer and having an average molecular weight of about 900 to about 20,000. Compounds of this type are produced under the trade name, Pluronic, by Wyandotte Chemical Company, Wyandotte, Mich.

(7) Polyvinyl glycols having an average molecular weight of about 900 to about 9,000.

(8) Urethane resins having an average molecular weight of at least about 900. Compounds of this type are produced by the Dow Chemical Company, Midland, Mich. under the trade name, Voranol.

(9) Polyacryloxy sulfonic acids having an average molecular weight of at least about 900.

(10) Vinyl ether-maleic anhydride copolymers having an average molecular weight of at least 900. Compounds of this type are produced by General Aniline and Film Corporation, New York, N.Y., under the trade name, Gantrez Resin AN-119.

(11) Copolymers of acrylamide with 2-acetoacetoxyethyl methacrylate, e.g. those containing 90% by weight acrylamide.

Some of the binders, according to the invention, can affect removal of diffusible liquid from a permeable solid, such as removal of water from a moist photographic element, alone without the presence of a poly(alkylene oxide). In such cases, it is not necessary to have a poly(alkylene oxide) present. Even if the binder material can effect liquid removal alone, it is often advantageous to have a poly(alkylene oxide) present.

While various polymeric coatings can be used for removing diffusible liquid according to the practice of the invention, high molecular weight, highly crystalline poly(alkylene oxides) are especially suitable either alone, as a binder, part of a mixture of binders or part of a mixture of drying agents and binders.

High molecular weight as employed herein to describe poly(alkylene oxides) means a molecular weight well above 20,000, e.g., above the highest average molecular weight of poly(ethylene oxide) sold under the trade name, Carbowax, by the Union Carbide Corporation, New York, N.Y., and typically well above about 100,000. Such high molecular weight typically means an average molecular weight of from about 100,000 to about 5,000,000 or more.

Highly crystalline as employed herein means that the

polymer in the solid state has a sharp melting point, e.g. about 65° C. for high molecular weight poly(ethylene oxides). The degree of crystallinity can typically be measured using nuclear magnetic resonance techniques.

The coatings of the invention can contain inorganic drying agents. Any suitable inorganic drying agent can be employed which does not adversely affect the material dried, does not leave an undesirable residue and does not adversely affect the removal of liquid by the coating of the invention. For example, the inorganic drying agents set out in British Patent 1,012,391 or inorganic drying agents known in the art as molecular sieve materials can be employed in combination with the polymeric materials of the invention. Suitable molecular sieve materials are described in an article by Rene Petit (University of Paris), in *Chim. Anal. (Parts)*, volume 47, No. 12, pages 643-656 (1965).

The addition of molecular sieve materials according to the invention produces an advantageous reduction in possible undesirable adhesion of the polymeric coatings of the invention to the materials from which diffusible liquid is to be removed. For example, the addition of a crystalline aluminosilicate molecular sieve material to a coating of the invention produces a pronounced decrease in adhesion of a polymeric coating to a photographic element. The amount of inorganic drying agent and/or method of preparation of a coating according to the invention containing such agents can vary depending upon other components in the coating, the material to be dried, the type of support, if one is employed, and the like. In general, less than about 90% by weight, e.g. about 0.01% to about 50% by weight of the total coating is inorganic drying agent. The inorganic drying agent can be admixed in a coating composition before coating on a suitable support, can be applied to or prepared in the support before application of the other components of the coating or can be applied in any suitable manner.

The invention is useful for drying and/or removing diffusible liquid from a wide range of permeable solid materials containing such liquid. For instance, the compositions and processes of the invention can be used for drying or removing liquid from:

(a) Textile fibers and/or fabrics, such as removing moisture from natural or synthetic fibers.

(b) Coatings of various types, such as, removing moisture from a gelatino emulsion coating.

In removing diffusible liquids from such materials, it is important that the material to be dried be intimately contacted with the materials according to the invention which effect removal of the liquid.

A semi-permeable membrane material, such as a thin sheet of cellophane, can be used between the permeable material from which diffusible liquid is to be removed and a coating according to the invention if desired. The semi-permeable material can be applied to the permeable material to be dried and/or to the coating according to the invention. The use of the semi-permeable membrane can be advantageous to reduce the possibility of undesirable amounts of residue remaining on the permeable material after removal of the diffusible liquid and after the coating employed according to the invention is removed from contact with the permeable material. It can also prevent undesired transfer of materials to the coating of the invention or to the support containing the coating.

A polymeric coating according to the invention can be employed more than once.

Various addenda can be present in and/or on the coating and/or support according to the invention, especially those known to be beneficial in photographic compositions and processes. The materials from which the diffusible liquid is removed can also contain such addenda. The types of addenda and concentrations to be employed can be determined by those skilled in the art. Suitable addenda include, for example, hardeners, such as those set out in British Patent 974,317; buffers, such as various sulfon-

amides and boraxes; coating aids; plasticizers; speed increasing addenda; stabilizing agents, and the like.

Various sugars, such as sucrose and dextrose, can be included in the solid polymeric coating stripes. The amount which is suitable can vary depending upon the coating components, the solid material from which liquid is to be removed and the like. For example, a solid polymeric coating stripe which can be employed for drying a moist photographic element can be prepared from a coating composition containing about 1 to about 1,000 grams of sucrose and/or dextrose per liter of coating composition. This coating composition can be applied in any suitable manner, such as simply brushing the stripes onto the surface of a web or tape.

A wide range of diffusible liquids can be removed from a permeable solid in the practice of the invention. In general, any diffusible liquid compound which forms a hydrogen bond with poly(ethylene oxide) can be removed according to the invention. Hydrogen bonding between materials is known, as described, for example, in *The Hydrogen Bond*, by Pimentel and McClellan, W. H. Freeman and Co., San Francisco, 1960. Suitable diffusible liquids which can be removed include, for example, lower alkyl amines, or lower alkanolamines.

The time required for removal of diffusible liquid from a permeable solid in the practice of the invention can vary depending on many factors, such as the material to be dried, the components of the material to be employed, and the like. In general, a support containing solid polymeric coating stripes, according to the invention, can remove a diffusible liquid, such as water, from a permeable solid containing such liquid, such as a moist photographic film, paper, and the like, in less than 120 seconds, e.g. about 1 to about 60 seconds. For instance, a paper support such as a web or tape containing solid polymeric coating stripes comprising a mixture of poly(ethylene oxides) can remove more than 90% by weight of the water from a moist photographic element under ambient temperature and pressure, e.g. a temperature of about 20° C. to about 30° C. as at pressure of about 760 mm. of Hg, in less than about 60 seconds contact time and usually in a fraction of a second up to about 15 seconds contact time.

The temperatures, pressures, and humidities which are suitable for use can vary over wide ranges. Usually ambient temperature, pressure, humidity, and other conditions are suitable; however, in some cases it can be desirable to use and/or store the support containing the solid polymeric coating stripes of the invention under controlled conditions. The support containing the solid polymeric coating stripes can be stored and/or packaged before use, e.g. in foil and/or plastic wrappers which are air and moisture tight.

If desired, the solid polymeric coating stripes can be applied to the support immediately before contact with the permeable solid from which the diffusible liquid is to be removed.

Any suitable support can be used in the practice of the invention. These can be in any suitable shape or form which is effective for contacting with the permeable solid containing diffusible liquid to be removed. These include, for example, any absorbent support of natural or man made materials including cellulose acetate, polyesters, such as polyethylene terephthalate, polyvinyl acetal, polycarbonate and related materials, papers, e.g. paper supports uncoated, fiberglass, fabrics, and the like. Supports in the form of a web or tape are especially suitable. Supports which act as a reservoir for diffusible liquid removed are essential.

Accordingly, one embodiment of the invention comprises a drying tape for drying a moist photographic element comprising a flexible support, especially a film or paper support, having an interrupted, solid polymeric coating stripe containing a drying agent. This embodiment includes, for example, a drying tape comprising a paper sup-

port having a length to width ratio greater than 1, and having interrupted coating stripes containing poly(ethylene oxide) having a molecular weight of at least 900, the stripes being transverse to the length of the support.

A support containing solid polymeric coating stripes can be used in the practice of the invention for rapidly removing diffusible liquid from a wide variety of photographic elements containing such liquid. For example, it can be used for removing water from any suitable photographic element in a moist condition.

Photographic elements employed in the practice of the invention typically contain a layer comprising any of the known hydrophilic water permeable binding materials. These include, for example, gelatin, cellulose derivatives, polymerized vinyl compounds, as well as mixtures of such binding agents. These binding agents can contain water insoluble polymers, such as polymerized ethylenically unsaturated compounds, e.g. polymers of acrylates and methacrylates.

The photographic elements which can be dried according to the invention include, among others, those which contain a photographic silver salt emulsion, e.g., a photographic silver halide gelatin emulsion layer, or a non-silver photographic emulsion. These can be non-spectrally sensitized emulsions, such as X-ray type emulsions, or they can be orthochromatic, panchromatic, infra-red sensitive and the like emulsions containing spectral sensitizing dyes, such as described in U.S. Patents 2,562,632 and 2,503,776. Spectral sensitizers which can be used include cyanines, mercocyanines, styryls and hemicyanines.

For example, the invention can be employed for removing diffusible liquid, such as water, from emulsions used for color photography, e.g. it can be used for drying films and/or prints used in photography, such as emulsions containing color-forming couplers or emulsions developed by solutions containing couplers or other color generating materials; emulsions of the mixed packet type, such as described in U.S. Patent 2,698,794 of Godowsky, issued Jan. 9, 1955; or emulsions of the mixed grain type, such as described in U.S. Patent 2,592,243 of Carroll and Hanson.

The invention can be used in processing emulsions intended for use in diffusion transfer processes which utilize the undeveloped silver salts in the non-image areas of the negative to form a positive by dissolving the undeveloped silver salts and precipitating them on a receiving layer in close proximity to the original silver salt emulsion layer. Such processes are described, for example in U.S. Patent 3,020,155 of Yackel et al., issued Feb. 6, 1962; U.S. Patents 2,584,029, issued Jan. 29, 1952, 2,698,236, issued Dec. 28, 1954, and 2,543,181, issued Feb. 27, 1951, of E. H. Land and U.S. Patent 2,352,014 of Rott, issued June 20, 1944. The invention can also be used in color transfer processes which utilize the diffusion transfer of developer, coupler, or dye, from a light sensitive layer to a second layer, such as described in U.S. Patent 2,559,643, of Land, issued July 10, 1951, U.S. Patent 2,698,798, issued Jan. 4, 1955, U.S. Patent 2,756,142, of Yutzy, issued July 24, 1956, U.S. Patent 3,252,915 of Weyerts et al., issued May 31, 1966, and U.S. Patent 3,227,550 of Whiteman et al., issued Jan. 4, 1966.

The invention can be used in processing emulsions used in lithography, preparation of direct prints or in colloid transfer processes as well as in processing of elements using monobath processes, such as described in U.S. Patent 2,875,048 of Haist et al., issued Feb. 24, 1959, and web-type processing such as described in U.S. Patent 3,179,517, of Tregillus et al. It can also be used in so-called stabilization processing such as processing an element containing an incorporated developer through an activator bath containing a thiocyanate stabilizer, as described, for example, in British Patent 1,061,892, issued Mar. 15, 1967, or in an article titled "Stabilization Processing of Films and Papers" by H. D. Russell, E. C. Yackel and J. S. Bruce, P.S.A. Journal, August 1950, pages 59-62.

One of the useful characteristics of a coating of the invention is that in removing diffusible liquid from a permeable solid certain solid materials dissolved in the diffusible liquid are also removed from the permeable solid. For example, certain compounds in a photographic element containing a diffusible liquid can be removed from the element with the diffusible liquid according to the invention. These compounds in the case of a photographic element processed with one or more aqueous processing solutions, e.g., a monobath, a stabilizer bath or a bath causing some of the compounds in the element to become water soluble, such as silver halide solvents, are usually water soluble. When the moist element containing such compounds is contacted with a coating according to the invention these compounds are removed from the element with the water removed. For instance, in processing a photographic element using web processing techniques as set out in, for example, U.S. Patent 3,179,517 of Tregillus et al., certain processing agents are present in the moist processed element. A significant amount of these processing agents and other water soluble compounds formed in processing, such as a water soluble complex formed between unexposed silver halide and a silver halide solvent, are removed from the element when a coating according to the invention is contacted with the moist processed element. The amounts and types of compounds removed from the moist photographic element can vary over a wide range and will depend on many factors such as the type of element, the type of processing carried out, the coating according to the invention employed, and the like.

Any suitable method of and/or means for contacting the support on the solid polymeric coating stripes can be used which provides the desired removal of liquid from the permeable solid. The apparatus described and shown in the drawings is especially suitable. The support containing the solid polymeric coating stripes, however, can, for example, be on a flat, vertical, horizontal or angular surface, such as one which has vibratory motion. It is important, however, that the method and means employed provide intimate contact and alternate exposure to polymeric coating and absorbent support.

The amount of solids in the solid polymeric coating stripes can vary over wide ranges depending upon the components of the coating material to be dried, and the like. Solid polymeric coating stripes containing about 3 to about 30 grams per square foot, typically about 4 to 10 grams per square foot of polymeric materials, in and/or on the support, can be suitable for removing moisture from a photographic element.

The invention is further illustrated in the following examples.

#### Example 1

This example illustrates removal of moisture from a processed photographic film according to the invention.

A drying tape, according to the invention, is prepared by coating a paper tape about 35 mm. wide with solid polymeric coating stripes using a brush. The stripes are about 0.1 mm. thick and contain poly(ethylene oxide) having an average molecular weight of about 6,000 to 7,500. The stripes are 90° transverse to the length of the drying tape and alternate with uncoated areas on the tape. The coated stripes are about 30 millimeters wide and spaced out 30 millimeters apart on the drying tape.

A photographic film containing a medium grain, silver bromoiodide gelatino emulsion layer, prehardened during manufacture, is exposed imagewise to light. It is then processed in processing solution and apparatus as described in U.S. Patent 3,179,517—Tregillus et al., issued Apr. 20, 1965. The film in dry condition has a total thickness of 108 microns. In moist condition, it is 130 microns thick.

The resulting moist film is contacted with the described drying tape by passing the tape over the moist

film with the polymeric coating stripes transverse to the motion of the tape.

The film is dry within a contact time of less than 60 seconds and no undesirable residue is noticeable on the film.

#### Example 2

The procedure set out in Example 1 is repeated with the exception of employing solid polymeric coating stripes containing a mixture of 10% by weight poly(ethylene oxide) having a molecular weight of 6,000 to 7,500 and 90% by weight highly crystalline poly(ethylene oxide) having a molecular weight of about 600,000.

The moist film is dried within less than 60 seconds contact time using this process and drying tape of the invention.

#### Example 3

The procedure set out in Example 1 is repeated with the exception of employing solid polymeric coating stripes containing 100% by weight poly(ethylene oxide) having an average molecular weight of about 1300 to 1600.

The moist film is dry within a contact time of less than 60 seconds.

#### Example 4

The procedure set out in Example 1 is repeated with the exception that the solid polymeric coating stripes are each 7 millimeters wide and the uncoated spaces between the stripes are also 7 millimeters wide.

Substantially the same results are obtained as in Example 1.

#### Example 5

The procedure set out in Example 1 is repeated with the exception that the solid polymeric coating stripes are each one centimeter wide and 70° transverse to the length of the tape. The uncoated spaces between the coated stripes are also one centimeter wide.

The moist film is dry within 60 seconds contact time.

The invention has been described in detail with particular reference to preferred embodiments thereof, but it will be understood that variations and modifications can be effected within the spirit and scope of the invention as described hereinabove and as defined in the appended claims.

We claim:

1. In a process for removing a diffusible liquid from a permeable solid containing said liquid by contacting the permeable solid with a solid material which removes the liquid from the permeable solid, the improvement comprising passing a support having interrupted, solid polymeric coating stripes containing a drying agent over the said permeable solid in intimate contact therewith, said stripes being transverse to the direction of passage of the said support over the permeable solid.

2. A process as in claim 1 wherein said support has interrupted, transverse solid coating stripes containing poly(alkylene oxide).

3. A process as in claim 1 wherein said support has interrupted, transverse solid coating stripes containing poly(ethylene oxide) having an average molecular weight of about 190 to about 5,000,000.

4. A process as in claim 1 wherein said support is a paper web and said stripes contain poly(ethylene oxide) having an average molecular weight of at least about 900.

5. A process as in claim 1 wherein said stripes contain an inorganic drying agent.

6. A process for removing water from a moist photographic element comprising intimately contacting the said element with a support having interrupted, transverse, solid coating stripes containing poly(alkylene oxide).

7. A process as in claim 6 wherein said poly(alkylene oxide) is poly(ethylene oxide).

8. A process as in claim 6 wherein said support comprises a paper web and said poly(alkylene oxide) is poly

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(ethylene oxide) having a molecular weight of at least 900.

9. A process as in claim 6 wherein a moist, processed photographic film is intimately contacted with a paper web having interrupted, transverse, solid coating stripes containing poly(ethylene oxide).

10. A process of drying a moist flexible photographic element comprising:

- (a) feeding said element onto a rotating drum,
- (b) passing a first inert, web having interrupted, transverse, solid coating stripes containing poly(alkylene oxide) over and in intimate contact with said element on the rotating drum in the direction opposite to the rotation of the drum, and
- (c) removing the resulting photographic element and said inert, web from the drum.

11. A process as in claim 10 wherein a second inert, web wet with water is passed, in a direction opposite to the motion of the said photographic element, in intimate contact with the photographic element, before contacting the said photographic element with said first inert, web.

12. A process as in claim 10 for drying an exposed, processed, moist photographic film comprising

- (a) feeding said film onto a rotating drum,
- (b) passing an inert, paper web having interrupted, transverse, solid coating stripes consisting of poly(ethylene oxide) having an average molecular weight of about 900 to about 5,000,000 over and in intimate contact with said film on the rotating drum in the direction opposite to the rotation of the drum, and
- (c) removing the resulting film and paper web from the drum.

13. Apparatus for removing a diffusible liquid from a photographic element containing such liquid comprising a rotating drum, means for feeding said element onto said

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drum, means for removing said element from the drum, means for passing an inert web having interrupted, transverse solid coating stripes containing a drying agent over and in intimate contact with said element on said drum in the direction opposite to rotation of the drum, and means for removing said web from said element.

14. Apparatus as in claim 13 also comprising a means for wetting said element on said drum.

15. A drying tape for drying a moist photographic element comprising a flexible absorbent support having on at least one surface thereof, interrupted, solid polymeric coating stripes containing a drying agent.

16. A drying tape as in claim 15 comprising a paper support having a length to width ratio greater than 1 and having interrupted solid polymeric coating stripes containing poly(ethylene oxide) having a molecular weight of at least 900, said stripes being transverse to the length of the said support.

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