PHOTOGRAPHIC PROCESS AND APPARATUS FOR PRODUCING PHOTOGRAPHIC IMAGES

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ABSTRACT OF THE DISCLOSURE

This invention relates to a method and apparatus for applying an excess of processing liquid to one side only of an exposed photographic sheet to form a visible image by a diffusion transfer process and thereafter removing the excess processing liquid prior to the photographic sheet undergoing any substantial diffusion of image-forming substances therefrom. The apparatus comprises a reservoir for supplying processing liquid to a cavity and a pair of juxtaposed rollers, one of the rollers being mounted with a portion of its periphery located within the cavity so as to be immersed in the processing liquid, the other roller presenting a surface having a minimum contact area with the photographic sheet. An exposed photographic sheet is passed through the site of the rollers and then through a second pair of juxtaposed rollers to remove the excess liquid from the sheet.

This invention further relates to photographic processes and apparatus for exposing and treating, with a liquid, a photosensitive image-recording sheet material to produce visible images in the sheet material and, more particularly, to processes and apparatus useful in document copying.

The process and apparatus of the invention are intended for use with and to utilize photosensitive image-recording sheet material of the type described in copending applications Ser. No. 368,622, filed May 19, 1964, in the names of Edwin H. Land, now abandoned, and Ser. No. 368,621, filed May 19, 1964, in the name of Edwin H. Land et al., now abandoned. This image-recording sheet material typically comprises a support, such as paper, and at least one layer thereon containing a light-sensitive material, e.g., a silver halide emulsion, and an outer layer comprising a translucent material such as finely divided titanium dioxide, calcium carbonate, magnesium oxide, etc., dispersed in a suitable permeable colloidal carrier or matrix such as gelatin, which is permeable to an aqueous processing liquid. The translucent pigment may be incorporated in the layer containing the light-sensitive material and/or may comprise a separate outer layer which may also contain silver precipitating nuclei and is sufficiently transparent to permit exposure of the light-sensitive layer therebeneath while at the same time being sufficiently opaque to provide the requisite background for a positive silver image transferred thereto by diffusion and to mask a negative image formed thereunder. This photosensitive sheet material is particularly useful for duplicating documents because it forms the positive transfer print or copy so that only a single sheet is required for processing. Processing of the exposed image-recording sheet involves image formation by silver halide diffusion transfer reversal and is accomplished by applying a non-viscous, aqueous liquid-processing agent, including a silver halide developer and a silver halide complexing agent, to the side of the sheet opposite the support so as to impregnate the light-sensitive layer with sufficient processing liquid to produce a positive silver transfer image on the surface of the translucent layer.

It is highly desirable to apply only the minimum amount of processing liquid required for the obvious reasons that the processing agent is expensive and the sheet, following processing, must be dried; and it is also desirable to apply this liquid to only one side of the sheet and thereby minimize the amount of liquid which must be applied, absorbed and then removed from the sheet. It is also a requisite of the process and apparatus that the processing liquid be applied and impregnated into the light-sensitive layer uniformly and in such a way that every portion of the light-sensitive layer is subjected to treatment of the same duration.

Objects of the invention are: to provide novel and improved photographic processes and apparatus for exposing a composite light-sensitive and image-receiving sheet and process said sheet by uniformly applying a non-viscous liquid-processing agent to one side of the sheet and absorbing a predetermined quantity of the liquid into the sheet; and to provide processes and apparatus as described in which the liquid-processing agent is applied by a coating roll partially immersed in the liquid and rotated against the sheet to transfer the liquid thereto.

It has been found that the easiest and surest way to apply the required amount of the liquid to the sheet and be certain that the requisite amount is uniformly absorbed by the light-sensitive layer is to apply excess liquid and allow the liquid to be absorbed into the light-sensitive layer. However, excess liquid permitted to remain on the sheet causes the image-forming substance, e.g., silver complexes which transfer by diffusion from the light-sensitive layer outwardly to the surface of the outer translucent layer to form a visible positive image, to diffuse laterally to the extent of impairing or destroying the transfer image.

Other objects of the invention are to provide processes and apparatus of the type described in which the processing liquid is applied to one side of the image-recording sheet in an amount greater than that required to effect processing, the liquid is allowed to remain on the sheet until a predetermined uniform quantity is absorbed by the image-recording layer and excess liquid is removed from the sheet prior to any substantial diffusion of image-forming substances; and to provide processes and apparatus as described in which the processing liquid is applied and removed from the sheet progressively while the sheet is moved continuously so as to insure uniform absorption of the processing liquid by all portions of the sheet.

The processing liquid is aqueous, quite alkaline and hence, highly corrosive, deteriorates upon exposure to the atmosphere and is subject to contamination by the residue thereof. For these reasons and to insure wetting of only one side of the sheet, the invention has as a further object, the provision of a novel and improved backing roll structure for supporting successive sheets against a coating roll and moving the sheets tangentially to the surface of the coating roll in a direction opposite to the direction of movement of the surface while minimizing contact between the backing and coating rolls.

Other objects of the invention will in part be obvious and will in part appear hereinafter.

The invention accordingly comprises the process involving the several steps and the relation and order of one or more of such steps with respect to each of the others and the apparatus possessing the construction, combination of elements and arrangement of parts which are exemplified in the following detailed disclosure, and the scope of the application of which will be indicated in the claims.

For a fuller understanding of the nature and objects of the invention, reference should be had to the following detailed description taken in connection with the accompanying drawings wherein:

FIGURE 1 is a sectional elevational view of photo-
graphic document-copying apparatus embodying the invention;

FIG. 2 is an enlarged fragmentary sectional view of a portion of the apparatus of FIGURE 1;

FIG. 3 is an enlarged fragmentary sectional view taken through components of the apparatus and sheet material illustrating the method of the invention; and

FIG. 4 is a fragmentary perspective view of a component of the apparatus.

The apparatus of the invention is illustrated in FIGURE 1 as comprising means for exposing successive areas of a light-sensitive sheet by feeding the sheet from an original document, cutting the sheet into sections each approximately equal in size to the original and including an exposed area, and then treating the sections with a liquid-processing agent to form a positive image of the original. The operation of the apparatus is substantially automatic and the construction is such as to permit the apparatus to be loaded with sufficient materials including the light-sensitive sheet and liquid-processing agent to produce a large number of prints in the form of document copies.

The apparatus includes an exposure system of the type incorporating means for supporting a document or other two-dimensional surface in position for exposure, means for illuminating the surface to be photographed, an optical system including an objective lens for forming an image of the original at a plane, and means for positioning successive areas of the light-sensitive sheet material for exposure at this plane. This exposure system includes a generally horizontal transparent window comprising the upper wall of a chamber in which are mounted lamps and reflectors for illuminating an original document positioned for exposure on the upper surface of window.

The means for positioning successive areas of a light-sensitive image-recording sheet, designated 22, include a support plate 24 disposed in a plane parallel with the axis of the lens 20 substantially at the focal surface of the lens. A mirror 26 arranged substantially at a 45° angle with respect to both the lens axis and support plate 24 is provided for redirecting light from the lens toward the support plate. A frame 28 is mounted between the support plate and the mirror closely adjacent the support plate for holding sections of sheet 22 against the support plate. Sheet 22 is supplied coiled on a spool 30 mounted behind and beneath mirror 26 and extends from the spool around a feed roll 32 between the latter and a second feed roll 34 located in juxtaposition with roll 32 closely adjacent the lower edges of support plate 24 and frame 28, with the bite of the rolls located substantially in the same plane as the support plate. Feed rolls 32 and 34 function to advance sheet 22 from spool 30 upwardly between the support plate and frame into position for exposure by light transmitted by lens and shutter assembly 20 and reflected from mirror 26.

Mounted above the support plate and frame are a second pair of juxtaposed feed rolls 36 and 38 for advancing the sheet upwardly from between the frame and support plate into the section of the apparatus in which treatment with the liquid-processing agent is effected. A rotary knife 40 and an opposed anvil 42 are located between feed rolls 36 and 38 and the upper edges of the support plate and frame for severing each exposed section of the image-recording sheet from the next succeeding section of the image-recording sheet located in position for exposure. In the operation of the apparatus, a section of sheet 22 is advanced upward between the support plate and frame, feed rolls 32 and 34 into the bite of feed rolls 36 and 38. Movement of the sheet is then arrested, the section of the sheet between the support plate and frame is exposed, and then feed rolls 36 and 38 are rotated to advance the exposed section of the image-recording sheet upwardly from between the frame and area while, at the same time, advancing another section of the image-recording sheet into position for exposure. The trailing edge of the exposed section of the image-recording sheet between knife 40 and anvil 42, the knife is rotated, severing the section at its trailing edge. Following the next exposure, rolls 32 and 34 are driven, at least during the initial rotary cycle of rolls 36 and 38, to advance the upper leading edge of the image-recording sheet from adjacent anvil 42 into the bite of rolls 36 and 38.

The combined image-recording and image-receiving sheet (designated 22 in FIG. 3) as previously noted, comprises a support 44 preferably of paper, and at least another layer 46 including a silver halide emulsion and an opaque, white pigmented outer layer. For example, a combined photo-sensitive and image-receiving sheet useful in the method of the invention was prepared as follows: paper having a thickness of about .0025 inch and sold by Fitchburg Paper Company under the designation "Photographic Grade Paper" was coated with a first layer composed essentially of a gelatin silver halide emulsion, gelatin and a wetting agent. This first layer had a dry weight of approximately 3 grams per square foot. A second layer was applied composed essentially of titanium dioxide dispersed in gelatin and had a dry weight of approximately .8 gram per square foot. A third or outer layer was applied composed of gelatin in which a precipitating the emulsion in which the precipitating agent is added to the gelatin and the third layer had a dry weight of approximately .1 gram per square foot.

An example of a liquid-processing agent for treating sheet 22 following exposure thereof, to produce a silver image on the surface of the outer pigmented layer by diffusion-transfer reversal is given as follows:

<table>
<thead>
<tr>
<th>Component</th>
<th>Water (%)</th>
<th>Sodium hydroxide (%)</th>
<th>Potassium thioulate (%)</th>
<th>4-amino-2,5-dimethylphenol (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>8400</td>
<td>675</td>
<td>207</td>
<td>180</td>
</tr>
</tbody>
</table>

As previously noted, for best results this aqueous alkaline processing liquid is applied to the side of sheet 22 opposite support 44 for impregnation into the layer containing the silver halide emulsion, and it is important that the liquid be applied and absorbed in a way that all areas of the exposed light-sensitive material are subjected to the same treatment. Roll coating has been found to be the most convenient method of applying a non-viscous liquid, i.e., having substantially the viscosity of water, to one side of a sheet without wetting the opposite side of the sheet, and is particularly advantageous when the liquid to be applied is highly corrosive, subject to decomposition by exposure to the atmosphere, and is contaminated by residue resulting from evaporation of the water. The method of roll coating is quite simple and involves partially immersing a roll in a quantity of the liquid and rotating the roll while supporting and moving the sheet against the roll with the surface of the sheet substantially tangent to the surface of the roll.

It has been found that the best way to insure uniform absorption of the requisite amount of processing liquid is to apply the liquid as a layer on the surface of the sheet in a quantity in excess of the amount required. This is accomplished by rotating the roll in such a way that there is substantially relative movement between the roll surface and the surface of the sheet being coated, and preferably in such a way that the roll surface and sheet surface are moving in opposite directions. The liquid applicator means of the invention comprises a generally cylindrical applicator roll 48 formed of a material which is unaffected by the aqueous alkaline processing liquid. Roll 48 is mounted for rotation about a horizontal axis with the lower portion of the roll periphery disposed in a cavity.
5 in a member 51 into which the processing liquid, designated 52, is introduced. Since the processing liquid may be subject to fairly rapid deterioration, only sufficient liquid to treat a single exposed section of the image-recording sheet is introduced into the cavity at one time. Liquid 52 is supplied in a container 54 coupled to the cavity by a conduit 56 and suitable valve means (not shown) for controlling the flow of liquid from container 54 to cavity 50.

A backing roll generally designated 58 is mounted in juxtaposition with coating roll 48 for rotation about an axis substantially parallel with the axis of the coating roll and, in the form shown, located above the axis of the coating roll. Backing roll 58 functions to support sheet 22 against the coating roll and move the sheet relative to the coating roll upwardly at an angle (to the right, viewing FIGS. 1 and 2) while the coating roll is rotated in a counterclockwise direction so that the surface of the coating roll, at the line of tangency with the sheet, is moved in the opposite direction. The applicator is designed to apply the processing liquid to one side of each of a succession of separate sheets so that the backing roll contacts the coating roll when there is no sheet passing between the two rolls. To prevent, or at least keep to a minimum, contamination of the backing roll and possible wetting of the rear surface of each sheet, the backing roll is provided with a plurality of circularly spaced collars axially spaced along the length of the backing roll. Each of collars 60 includes an outer knife edge for contacting both the coating roll and the rear surfaces of the sheets for supporting the sheets against the coating roll while minimizing the area of contact between the backing roll and the coating roll. Another advantage of this construction is that friction between the backing and coating rolls is reduced, thereby facilitating rotation of the two rolls in contact with one another in the same (counterclockwise) direction. In the operation of the liquid applicator, a sheet 23 is fed upwardly by feed rolls 36 and 38 between coating roll 48 and backing roll 58. As the leading edge of the sheet is moved upwardly, the coating and backing rolls commence to rotate and a predetermined quantity of processing liquid 52 is dispensed from container 54 into cavity 50 where it is picked up by the coating roll on the surface thereof and carried around the coating roll into contact with the sheet as the sheet is advanced by the backing roll, between the coating and backing rolls relative to the coating roll.

To prevent residue of the liquid from accumulating on the coating roll between coating operations or collecting in cavity 50, means are provided for removing residual liquid from the coating roll and cavity following each coating operation. These means, in the form shown, comprise an opening 62 in the bottom of cavity 50 and a flexible blade-like wiper 64 mounted within the cavity in closing relation to opening 62. Rod 66 is provided coupled with wiper 64 for moving the wiper upwardly from the closed position, shown in FIG. 2, to an open position at which the edge of wiper 64 bears against the surface of the roll for removing the liquid therefrom, and opening 62 is open so that the liquid within the cavity is free to flow therefrom.

As sheet 22, with a layer of processing liquid 52 thereon, is moved upwardly from between the coating and backing rolls, the processing liquid is absorbed into the photosensitive layer, initiating development of exposed silver halide and formation of transferable image-forming substances (diffusible silver complexes) from unexposed silver halide. To form the positive transfer image, the image-forming components are delivered from the outer surface of the pigmented translucent layer where they are reduced to silver in the presence of silver precipitating nuclei (constituting an image-receiving layer) to form dense deposits having a high covering power. It has been found that if excess processing liquid is permitted to remain on the pigmented layer on which the transfer image is formed, lateral diffusion and/or dispersion of the image-forming substances may occur to the extent that the transfer image is impaired or completely obliterated. For this reason, the excess processing liquid is removed from the sheet after the requisite amount of liquid has been absorbed by the photosensitive layer before formation of the transferable image-forming substances has progressed to any substantial extent; that is, before there is any substantial depthwise or lateral diffusion of the image-forming substances.

Excess processing liquid is removed from the sheet by passing the sheet between a pair of wringer rolls, designated 68 and 70, mounted in juxtaposition above and to one side of the applicator and backing rolls with the bite of the wringer rolls located substantially in the plane of movement of the sheets from between the applicator and backing rolls. Ringer rolls 68 and 70 are mounted for rotation with their axes substantially in a common plane and are biased toward one another so as to apply compressive pressure to the sheets as they pass between the wringer rolls. At least wringer roll 68 is formed with a smooth peripheral surface which will not mar the wet surface of a sheet and the roll preferably is formed with at least an outer layer of an elastomer such as rubber, which is compressible and has a high coefficient of friction.

The following is given as an example of the processing and the materials employed therein for producing copy of a document by the method and in the apparatus of the invention. A sheet 22 formed according to the example given hereinbefore and having an area of 100 square inches and measuring, for example, approximately 8½ x 12 inches, was exposed to form an image therein. This sheet was then moved lengthwise at a speed of between two and three inches per second between the coating and applicator rolls to apply 2.5 cc. of the processing liquid (described in the example given hereinbefore) to the pigmented side of the sheet. The distance between the nips of the applicator and backing rolls and the wringer rolls was two inches and the liquid absorbed by the sheet, i.e., not removed from the sheet at the wringer rolls, as 1.0 cc. After passage between the wringer rolls the sheet was retained in the dark for a period of ten to fifteen seconds during which a dense black positive transfer image was formed on the white pigmented side of the sheet.

As the excess processing liquid is removed from a sheet 22 by passage thereof between wringer rolls 68 and 70, the processing liquid remains between the rolls at the nip thereof as a meniscus 72, and means are provided for removing this meniscus of liquid from the nip of the rolls so that it does not contaminate the next successive sheet as the latter is advanced between the wringer rolls. Suitable means for this purpose may comprise wringer roll 70 which is formed with an axial conduit 74 coupled with means such as a vacuum pump for reducing the pressure within the conduit and radial holes 76 extending outwardly from the conduit through the outer peripheral surface of the roll. Thus, as the wringer rolls rotate in contact with one another following advancement of a sheet from between the rolls, the liquid comprising meniscus 72 is drawn from the nip of the rolls through openings 76 into conduit 74, leaving the rolls in an essentially dry condition in readiness for receiving the next succeeding sheet therebetween.

Means are provided for guiding each sheet 22 from the applicator roll between the wringer rolls and thence along a path within a light-free environment and thence delivering the copy to the output. Typical of such means include guide wires 78 located adjacent opposite sides of the path of movement of the sheet from the applicator roll to the wringer roll and extending from near the nip of the applicator and backing rolls generally parallel with one another in the direction of movement of the sheets to the nip of the wringer rolls. Wire guides are
provided in order to reduce the area of contact between the sheets and the guide means so as not to interfere with the processing of the sheet and reduce friction between the sheet and the guide means. Another set of guide wires 80 are provided above the nip of wringer rolls 68 and 70 extending upwardly to point closely adjacent nip of a pair of juxtaposed feed rolls 82 and 84. Another pair of juxtaposed feed rolls 86 and 88 are provided to one side (left, viewing FIG. 2) and slightly above feed rolls 82 and 84, and a continuous belt or web 90 is engaged around feed rolls 84 and 86 and extending between feed rolls 84 and 82 and between rolls 86 and 88. The purpose of belt 90 is to change the direction of the path of movement of a sheet 22 so that the sheet passes between feed rolls 82 and 84 around feed roll 82 and thence around feed roll 88 between the latter, the belt and feed roll 86. Guide wires 94 are provided between feed rolls 82 and 88 adjacent belt 90 for supporting and guiding a sheet 22 during movement of the sheet from between the belt and feed roll 82 to feed roll 88 where it is again engaged between the latter and the belt. From feed roll 88 a sheet 22 is permitted to fall under the force of gravity downwardly through a chute defined by guide wires 96 and from the apparatus through an opening in the housing thereof. The path which the sheet must follow from between wringer rolls 68 and 70 until the trailing edge of the sheet moves from engagement between feed roll 88 and belt 90 is of a length sufficient to insure retention of the sheet in a light-free environment for the requisite processing period and to twenty to fifteen seconds, with the sheet being advanced at the same speed as during movement between the wringer rolls, e.g., to two inches per second.

Means, such as microswitches (not shown) may be provided along the path of movement of the sheets in position to be engaged and actuated to control the operation of the apparatus including the rotation of the various feed rolls, the coating roll and the knife. Also adjacent the path of movement of the sheets, there may be provided means such as a source of infrared radiation and/or hot air for drying each sheet 22 before it emerges from the apparatus.

It will be evident that the apparatus of the invention incorporates means for exposing and then treating with a liquid a succession of composite image-recording and image-receiving sheets to produce a succession of positive photographic prints, particularly in the form of copies of documents to be reproduced. The invention provides a means by which it is possible to uniformly impregnate a succession of photosensitive image-recording sheets with an aqueous alkaline processing liquid subject to deterioration upon exposure to the atmosphere to produce a high quality positive transfer image in each sheet, and to deliver each sheet as an essentially dry copy of a document. Since certain changes may be made in the above process and apparatus without departing from the scope of the invention as claimed, it is intended that all changes contained in the above description or shown in the accompanying drawings shall be interpreted as illustrative and not in a limiting sense.

What is claimed is:

1. A method of producing a visible photographic transfer image utilizing a single composite sheet comprising a support and at least a layer on said support including a strata containing a photosensitive image-recording material and an outer pigmented strata for supporting a visible image formed by outward diffusion of transferable image-forming substances from said strata containing said image-recording material toward the surface of said pigmented strata; said method comprising the steps of:

   a. Photoexposing said image-recording material to form an image in said image-recording material;
   b. Maintaining said exposed material in a light-free environment;
   c. Developing said image-forming substances and causing said image-forming substances to diffuse to said surface to form a visible transfer image thereon;
   d. Said liquid agent being applied in an amount substantially in excess of a predetermined amount required to effect formation of said transfer image;
   e. Allowing said predetermined amount of said liquid agent to be absorbed into said sheet and to form said diffusible image-forming substances;
   f. At the end of a predetermined period and prior to any substantial diffusion of said image-forming substances to said surface of said sheet, progressively applying compressive pressure to said successive portions of said sheet commencing at said edge of said area to remove said excess liquid agent not absorbed into said sheet and transferring said image-forming substances to said outer pigmented strata.

2. The method of claim 1 wherein said liquid agent is applied to said sheet continuously and at a uniform rate without interruption and said excess liquid agent is removed from said sheet continuously and without interruption so that substantially the same amount of said liquid agent is absorbed into each of said successive portions of said sheet.

3. The method of claim 1 wherein compressive pressure is applied to said sheet to remove said excess liquid agent therefrom by advancing said sheet relative to and between a pair of juxtaposed members at least one of said members being a roll having a smooth surface disposed in contact with said surface of said sheet and rotated at a rate such that there is substantially no relative movement between said surface of said sheet and said surface of said roll.

4. The method of claim 3 wherein substantially all of said excess liquid is removed from between said juxtaposed members immediately following movement of the trailing edge of said sheet from between said members.

5. The method of claim 1 wherein said liquid agent has substantially the viscosity of water.

6. The method of claim 5 wherein said liquid agent is applied to said sheet by first applying said agent to the surface of a transfer member and thereafter supporting said surface of said sheet against said surface of said transfer member to transfer said liquid from the latter to said sheet.

7. The method of claim 6 wherein said transfer member comprises a generally cylindrical roll, impermeable to said liquid and partially immersed in a body of said liquid, and said sheet is moved relative to said roll while said roll is rotated so that all liquid contained in the above description or shown in the accompanying drawings shall be interpreted as illustrative and not in a limiting sense.

8. The method of claim 6 wherein said sheet is moved tangent to the liquid-coated surface of said roll in a direction opposite to the direction of movement of said surface of said roll.

9. The method of claim 6 wherein substantially all of said liquid is removed from said surface of said roll immediately after application of said liquid to said sheet is completed.

10. Photographic apparatus for applying a free-flowing processing liquid to one side only of a photographic
sheet to impregnate said sheet with a uniformly distributed, predetermined quantity of said liquid within a predetermined time interval, said apparatus comprising, in combination:

cavity means for holding a body of said liquid;

an applicator roll having a smooth, liquid impervious peripheral surface mounted for rotation with a portion of its periphery located within said cavity means so as to be immersed in said body of liquid;

means for moving said photographic sheet relative to and past said roll with said side of said sheet in contact with said surface to transfer liquid from said roll to said sheet, the last-mentioned means comprising rotatable means including means providing for minimum contact with said sheet and said applicator roll for supporting said sheet and moving said sheet relative to said applicator roll;

means for rotating said applicator roll and rotatable means at predetermined constant speeds to apply a layer of liquid to said surface of said applicator roll and transfer said liquid to said sheet;

a pair of juxtaposed wringer rolls mounted a predetermined distance from said applicator roll and rotatable means and biased toward one another for applying compressive pressure to said sheet to remove excess liquid from said sheets during movement thereof between said wringer rolls;

means for guiding said sheet from between said applicator roll and rotatable means into the bite of said wringer rolls; and

means for so rotating said wringer rolls as to advance said sheet therebetween at substantially the same rate as said sheet is advanced by said rotatable means.

11. The photographic apparatus of claim 10 wherein said applicator roll and rotatable means are rotated in the same direction so that adjacent portions of the peripheries of the applicator roll and rotatable means move in opposite directions.

12. The photographic apparatus of claim 10 wherein said rotatable means includes a plurality of axially spaced annular collars each having a sharpened outer peripheral edge for contacting said sheet.

13. The photographic apparatus of claim 10 wherein said means for guiding said sheet comprise narrow spaced members extending from adjacent said applicator roll to adjacent the wringer rolls for contacting said wet side of said sheet along substantially parallel lines extending in the direction of movement of said sheets.

14. Photographic apparatus as defined in claim 13 including means for removing substantially all of said liquid from said surface of said applicator roll following application of said liquid to said sheet.

15. Photographic apparatus as defined in claim 13 including means for removing substantially all of said excess liquid from the bite of said wringer rolls.

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