Dec. 31, 1968 E. H. LAND ET AL 3,418,912

PHOTOGRAPHIC PROCESSING APPARATUS

Filed Dec. 1, 1966

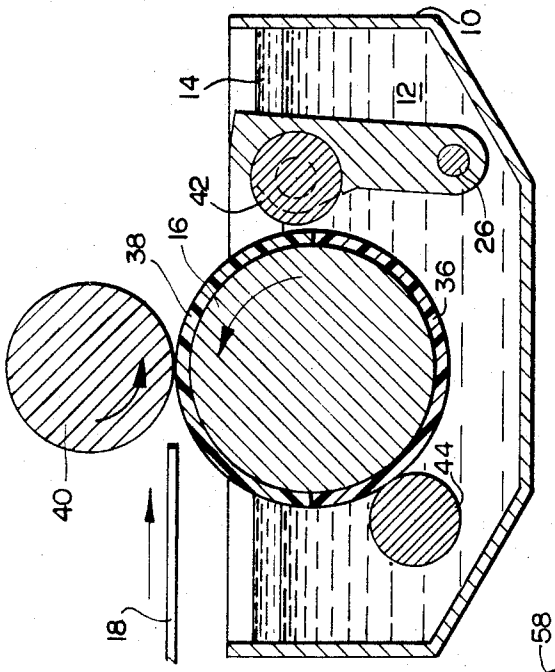


FIG. 3

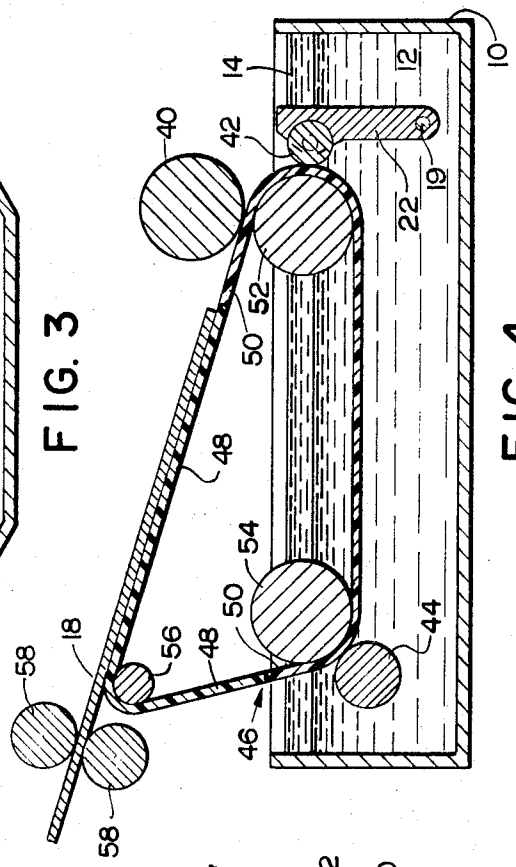


FIG. 4

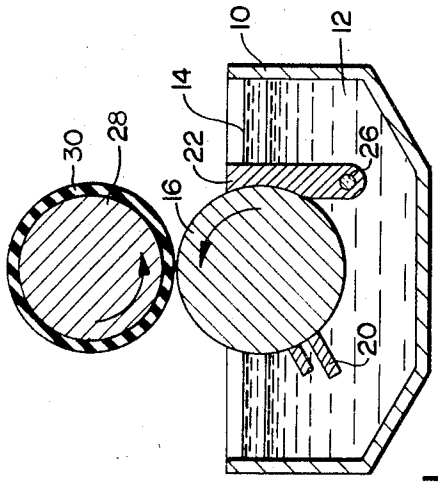


FIG. 1

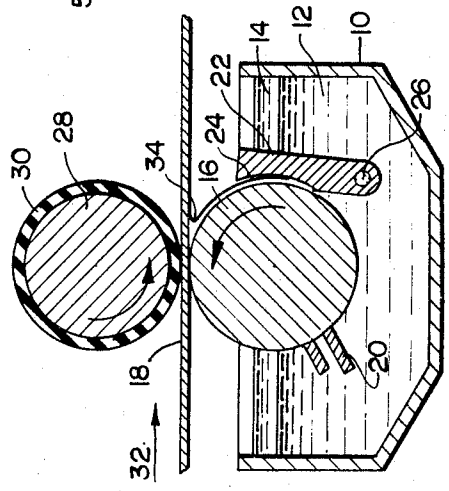


FIG. 2

INVENTORS
Edwin H. Land
and
Richard J. Cohen

BY Brown and Mikulka
and
Robert E. Gorb
ATTORNEYS

United States Patent Office 3,418,912
Patented Dec. 31, 1968

3,418,912

PHOTOGRAPHIC PROCESSING APPARATUS

Edwin H. Land, Cambridge, and Richard J. Chen, Winchester, Mass., assignors to Polaroid Corporation, Cambridge, Mass., a corporation of Delaware

Filed Dec. 1, 1966, Ser. No. 598,337
11 Claims. (Cl. 95—89)

This invention relates to photographic apparatus, and particularly to apparatus for treating photographic sheet material with a liquid to produce a visible image therein. More particularly, the apparatus is designed for treating photographic sheet material with a liquid processing agent subject to deterioration upon contact with the atmosphere while protecting the liquid from contact with the atmosphere.

This invention is particularly useful in conjunction with certain photographic sheet materials for duplicating documents. In the preferred form, the apparatus is designed to contain an aqueous alkaline processing liquid, subject to deterioration upon exposure to the atmosphere, in an open tray or the like and to process, with the aqueous liquid, a succession of exposed photosensitive sheets. The sheets are passed above the tray into engagement with an applicator associated with the tray for applying a predetermined, uniformly distributed quantity of the liquid to each sheet. A relatively non-volatile liquid immiscible with and having a specific gravity less than the processing liquid covers the processing liquid to protect it from contact with the atmosphere, and a barrier is provided to remove the covering liquid from a portion of the surface of the processing liquid adjacent the processing liquid applicator. The applicator comprises a continuous surface which moves from above the covering liquid into the processing liquid and then from the processing liquid, through the portion of the surface of the processing liquid from which the covering liquid has been removed, to apply a portion of the processing liquid to the exposed photosensitive surface of the photographic sheet material.

Heretofore, apparatus of this general type for applying processing liquids have allowed the surface of the liquid to be continuously exposed to the atmosphere and, thus, be subject to deterioration, and/or have included rather complicated mechanisms for handling the processing liquid so as to limit its exposure to the atmosphere.

It is an object of this invention to provide a novel and improved apparatus for treating photographic sheet material with a liquid processing agent subject to deterioration upon contact with the atmosphere while protecting the liquid against contact with the atmosphere.

Other objects of the invention are: to provide apparatus for applying accurately predetermined and uniformly distributed quantities of an aqueous liquid subject to deterioration upon contact with the atmosphere from a reservoir or body of said liquid to the surface of photographic sheet material and for protecting the body of aqueous liquid from contact with the atmosphere by covering it with a protective layer of another liquid; to provide in apparatus as described for protecting the body of aqueous liquid from contact with the atmosphere by covering it with a second relatively non-volatile liquid, immiscible with and having a specific gravity less than the aqueous liquid; an applicator for transporting the aqueous liquid from below the covering liquid to an exposed photosensitive surface without transferring the covering liquid to the exposed photosensitive surface.

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

The invention accordingly comprises 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:

FIGURES 1 and 2 are diagrammatic sectional views of one embodiment of the coating apparatus of the invention illustrating the operational steps thereof;

FIG. 3 is a sectional view of a second embodiment of the invention; and

FIG. 4 is a sectional view showing another embodiment of the invention.

A number of photographic processes, particularly diffusion transfer processes, involve the treating of a sheet including an exposed photosensitive image-recording material such as silver halide, with an aqueous, alkaline processing liquid including, for example, a silver halide developer, to produce a visible image in the sheet. Most liquid processing agents of this type and particularly those containing alkalis and silver halide developers are subject to deterioration, e.g., evaporation, oxidation, pH changes, etc., when exposed to the atmosphere, so that protection of such liquids from exposure to the atmosphere has posed a problem of long standing.

A light-sensitive, image-recording sheet material suitable for duplicating documents and suitable for use with the apparatus of this invention is disclosed in copending U.S. patent applications of Edwin H. Land, Ser. Nos. 368,662 and 368,621, filed May 19, 1964. This sheet material comprises, for example, a paper support having a layer of light-sensitive 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 colloidal carrier or matrix such as gelatin which is permeable to the processing liquid. This outer layer may also contain silver precipitating nuclei and is sufficiently transparent to permit photoexposure 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 and to mask the negative image formed thereunder.

An example of the composition of a non-viscous processing liquid suitable for use with the above described photosensitive sheet material is as follows:

Water	cc	8400
Sodium sulfite	gm	675
Sodium hydroxide	gm	180
Potassium thiosulfate	gm	207
4-amino-2, 5-dimethylphenol	gm	180

This aqueous and highly alkaline liquid processing agent is obviously susceptible to the heretofore mentioned deterioration upon exposure to the atmosphere.

Reference is now made to FIGURES 1 and 2 of the drawings wherein there is illustrated one embodiment of the apparatus of the invention. The apparatus includes tray **10** for containing a body of the non-viscous, aqueous processing liquid **12** which is protected from deterioration due to contact with the atmosphere by a covering layer **14** of a second liquid floated on the surface of the processing liquid. The covering liquid has a specific gravity less than that of the aqueous liquid, is substantially immiscible with the aqueous liquid, is substantially non-volatile at ordinary temperatures and constitutes a poor solvent for gases in the atmosphere. An example of fluid meeting this criterion is "mineral oil," the commonly accepted term used to describe a mixture of hydrocarbons within the viscosity range of products commonly called oils and not volatile at normal temperatures. An example of a par-

ticular mineral oil found suitable for use in this apparatus is extra heavy mineral oil produced by E. R. Squibb & Sons having a viscosity of approximately 200 centipoises at 70° F. Mineral oil is particularly desirable because, in addition to the above enumerated properties, it is relatively inert at least insofar as photographic chemicals are concerned, is colorless, odorless, and any thin coating of the oil remaining on the surface of a sheet following the processing does not tend to become tacky or change color. The depth of the layer **14** is not critical and good results have been obtained for example, with layers of the order of one-eighth inch to one-quarter inch deep.

An applicator roll **16** having a smooth, firm, non-absorbent, hydrophylic surface stable in both liquids **12** and **14**. Roll **16** is mounted on tray **10** for rotation about the axis of the roll with a portion of the roll periphery submerged in the aqueous processing solution and another portion of the roll periphery extending above the surface of the covering liquid **14**. The surface of roll **16** may be of any number of materials; for example, stainless steel or glazed ceramic materials. Rotation of roller **16** causes a descending portion of its endless surface to advance from above the covering liquid into the body of aqueous processing liquid **12** and causes an ascending portion of its surface to advance from the processing liquid to above covering liquid **14** for delivering a portion of the processing liquid from beneath the covering liquid to above the covering liquid where it is applied to one side of sheet **18**. Scrapers **20** are mounted within tray **10**, beneath the interface of liquids **12** and **14**, against the surface of roller **16** along a line substantially parallel to the rotational axis of the roller for removing traces of the covering fluid or contaminants from the surface of roll **16**.

Barrier means are provided for maintaining liquid **14** out of contact with the ascending portion of the surface of roll **16**. Barrier **22** is pivotally mounted within tray **10** for movement into and out of contact with the ascending surface of roller **16** and comprises a plate having concave surface **24** complimentary to the curvature of roller **16** pivotally mounted on shaft **26** on opposing walls of the tray. The barrier plate is disposed perpendicularly to the walls and the pivotal axis of barrier **22** is parallel to the axis of roller **16**. Movement of the barrier away from and into contact with roller **16** establishes and closes a space between the barrier and the roller. The barrier extends from beneath the surface of aqueous liquid **12** to above the surface of covering liquid **14**. Edges of barrier plate **22** contact, in a fluid tight manner, the side walls of tray **10** to which the barrier is attached for preventing passage of fluid **14** from one side of the barrier, between the edges thereof and the side walls of the tray, to the area between the barrier and the ascending portion of roller **16**. This seal may be effected, for example, by a flexible wiper blade formed of flexible, resilient material such as of polytetrafluoroethylene, mounted along the edges of the barrier plate in contact with the side walls. Barrier **22** may be pivotally displaced from roller **16**, as shown in FIGURE 1, to displace liquid **14** and establish a space between the roll and the barrier or it may be positioned with the concave surface **24** of barrier **22** against the complimentary convex surface of roller **16** for closing the space, as shown in FIG. 2.

Mounted above roll **16** is roll **28** having a series of circumferential ridges **30** which press the photosensitive material into contact with applicator roll **16**. Roll **28** moves with the direction of travel of the sheet material while applicator roll **16** moves counter to the direction of travel of the sheet material.

Operation of the above described apparatus is as follows: Sheet material **18** bearing an exposed photosensitive area is advanced between rolls **16** and **28** in the direction of arrow **32** so that the exposed area faces roll **16**. Just prior to movement of material **18** between the rolls, barrier plate **22** is pivoted out of contact with roll **16** to establish a space between the roll and the barrier and to displace covering layer **14**. Non-viscous aqueous processing solution **12** then rises in the space between the barrier and the adjacent surface of roll **16**. Sheet material **18** is advanced between the rolls and pressed into intimate surface contact with roll **16** by ridges **30** of roll **28**. Upon rotation of roll **16** the non-viscous aqueous processing fluid adheres thereto and is transported by the ascending surface thereof from tray **10**, past barrier **22** and liquid **14**, to the exposed area of photosenstive material **18** which has an affinity for the processing liquid. The relative speed of the exposed surface of sheet **18** and the hydrophylic surface of roll **16** is such that a meniscus **34** of aqueous processing solution **12** is formed adjacent the location at which the two surfaces contact each other. The meniscus establishes a supply of processing liquid for application to the exposed area of sheet **18** as it is advanced between rolls **16** and **28**. An exposed area of 8½ x 11 inches may require, for example, approximately 1.5 cc. of processing liquid uniformly distributed thereacross. Since the meniscus provides a continuous supply of processing liquid adjacent the location where the surface of roll **16** and a surface of sheet **18** contact each other, uniform distribution of the liquid across the exposed area of the sheet is insured and even amounts thereof are absorbed by every portion of the exposed area. The quantity of liquid applied to the exposed area is dependent upon and controlled by the rotational velocity of roll **16** relative to the velocity of sheet **18**.

After contact with sheet **18**, the surface of roll **16** diverges from sheet **18** and advances through covering layer **14** into the body of aqueous processing fluid **12**. Scrapers **20** remove from the descending portion of the surface of roll **16** any foreign material which may have adhered thereto or any residual coating of fluid **12** which was not previously applied to the surface of material **18**. The scrapers also remove from roll **16** any fluid from layer **14** which may have adhered to the surface thereof. It is unlikely, however, that liquid of layer **14** will adhere to the surface of roll **16** if there is a residual coating of aqueous solution **12** on the descending portion thereof due to oleophobic properties of aqueous solution **12**.

Barrier **22** is maintained out of engaging relationship with the surface of roll **16** during rotation thereof and fluid **12** is continuously transported from beneath the surface of fluid **14** above the surface of fluid **14** as long as a succession of sheets **18** are being advanced between rolls **16** and **28**.

The apparatus also maintains the side of sheet **18** opposite the side thereof bearing the exposed areas substantially free of liquid. The liquid remaining on roll **16** after the trailing edge of the sheet material passes from the rolls tends to be transferred to roll **28** and then applied to said opposite side of the next sheet advanced between the rolls. Liquid allowed to remain on roll **28** will deteriorate and also tend to be transferred by roll **16** from roll **28** back to the body of processing liquid and thereby contaminate the same. Ridges **30** on roll **28**, however, insure that only a very small area of roll **28** will contact roll **16** so that only an insignificant amount of the fluid can possibly be transferred to roll **28** and thus to said opposite side of sheet material **18** or back into the body of the processing liquid. Optionally, the surface of roll **28** may be hydrophobic to further inhibit the tendency of the aqueous processing liquid to adhere thereto.

When coating of a sheet is complete, rotation of roll **16** is terminated and barrier **22** is returned to engaging relationship with the surface of roller **16** to prevent exposure to the atmosphere of the aqueous liquid in the space between barrier **22** and roll **16**.

Another form of the apparatus embodying the invention is shown in FIG. 3 wherein the same numerals are employed to denote the same parts previously shown and

described. In this embodiment, roll **16** comprises fluid applying portion **36** and hydrophobic portion **38**. Fluid applying portion **36** of the surface of roller **16** is absorbent rather than firm and non-absorbent as is the surface described in the preceding embodiment. Suitable materials for surface portion of roll **16** are oleophobic materials such as wet gelatin or polyvinyl alcohol which reduce any tendency of liquid from covering layer **14** to adhere to portion **36**. Portion **38** of the surface of roll **16** is formed of a hydrophobic material such as polyethylene so that it will not transport aqueous fluid **12** above the surface of fluid **14**. Materials used for the surfaces **36** and **38**, in addition to other characteristics, must be stable and insoluble in both the aqueous alkaline solution **12** and the layer **14**. Roll **40** is mounted above roll **16** for pressing the sheet material into compressive contact with roll **16**. The surface of roll **40** is smooth so that compression across the surface of the sheet material will be uniform.

Portion **36** of the surface of roller **16** is of such circumferential length that, considering the length of sheets **18** and the rotational speeds of roller **16**, a portion thereof will contact the surface of the sheet along its entire length as the sheet is advanced between the rotating rolls **16** and **40**. Portion **38** is of such circumferential length that when the apparatus is not in use it is below the surface of the liquid, out of contact with the atmosphere. If absorbent portion **36** of the surface is exposed to the atmosphere for prolonged periods of time, liquid **12** absorbed in the sheet is subject to evaporation and deterioration due to contact with the atmosphere, resulting in possible damage to the surface and contamination of the remainder of the body of fluid **12** when the absorbent material containing the deteriorated fluid and/or residue thereof passes into the body of fluid **12**.

The surface materials for the roll shown in the embodiment of FIG. 3 may be relatively soft and, unlike the surface material described for the embodiment shown in FIGURES 1 and 2, may be subject to abrasion. The surfaces of the barrier means and the means for treating roll **16** which contact the surface of roll **16** are thus rotatably mounted to avoid undesirable abrasive contact. Barrier **22** includes roll **42** mounted therein for rolling contact with the surface of roll **16** when the barrier is positioned for contact with roll **16**. The roll treating means comprises frictionally driven roll **44** mounted within tray **10** for pressing contact with surface **36** of roll **16** to compress surface **36** for removing therefrom any of either fluids **12** or **14** held therein. Roll **44** is optional and may be omitted from the apparatus since absorbent surface portion **36** retains enough aqueous liquid to render it oleophobic when it descends through oil layer **14** and since the portion of fluid **12** retained in the porous surface **36** during operation of the apparatus is not subject to contact with the atmosphere for a sufficient length of time for a significant amount of deterioration to occur.

Operation of this device is as follows: Sheet material **18** having an exposed photosensitive area is advanced to a position between rolls **16** and **40** so that the exposed area faces roll **16**. As the leading edge of sheet **18** is advanced into the nip of the rollers, rotation of roll **16** is initiated in a direction counter to the direction of the sheet and barrier **22** is moved out of surface contact with roll **16**. The leading edge of the sheet is inserted between the rollers so that the leading edge of the exposed area is in approximate registration with the leading edge of surface portion **36** as it advances from beneath the body of liquid carrying a quantity of non-viscous liquid **12**. Since roll **40** uniformly presses sheet **18** into contact with surface portion **36**, fluid **22** held in portion **36** is uniformly absorbed therefrom into the sheet **18**. As the trailing edge of sheet **18** advances from the nip of rolls **16** and **40**, the trailing edge of portions **36** also passes from the nip and the leading edge of surface **38** enters therein. Since portion **38** is hydrophobic, it does not transfer liquid to the surface of roll **40** and thus deteriorated liquid does not contaminate the side of sheets **18** opposite the side bearing the exposed area of the body of liquid. Subsequent to the exit of sheet **18** from the nip of the rolls rotation of roll **16** is terminated when the roller reaches the position wherein surface portion **36** is disposed above fluid **12**.

In the embodiment shown in FIG. 4, a movably mounted endless belt is used for applying the processing fluid to the exposed surface of the photographic sheet material. Like numerals have been used to denote parts like those in the embodiments previously described.

Belt **46** comprises liquid applying portion **48** and a non-absorbent or hydrophobic portion **50**. Liquid applying portion **48** may include a surface of a hygroscopic material such as polyvinyl alcohol, which will absorb the aqueous processing liquid **12** for transporting the same above the surface of covering liquid **14**. The remaining portion, **50**, of belt **46** is preferably formed of hydrophobic material such as polyethylene.

Belt **46** is drawn over like rolls **52** and **54** mounted on tray **10** and over relatively small roll **56** mounted above tray **10**. The exposed photosensitive material **18** is fed between pressure roll **40** and moving belt **46** so that the direction and velocity of movement of material **18** is the same as the direction and velocity of movement of the portion of the belt. The length of hygroscopic portion **48** must therefore be equal to the length of exposed area or sheet **18** which is to be treated. The dimensions of the apparatus are such that hygroscopic portion **48** of belt **46** can be maintained beneath the fluid surface when the apparatus is not in use so portion **48** and aqueous processing fluid retained therein will not be maintained above the level of covering fluid **14**, in contact with the atmosphere where the liquid will be subject to deterioration. Since such deterioration may be harmful to the aqueous liquid applying surface and residual or deteriorated liquid may contaminate the body of fluid **12** upon entry of the liquid containing portion of the liquid applying surface into the body of fluid **12**, and portion **50** of belt **46** is formed of a non-absorbent, preferably hydrophobic material, aqueous processing solution will not adhere thereto and it may therefore be positioned above the surface of the liquid in contact with the atmosphere when the apparatus is not in use.

As in the other embodiments of this invention, barrier **22** extends from above the surface of liquid **14** into the body of liquid **12** and is mounted for movement into and out of engagement with the applicator member.

Operation of the apparatus of FIG. 4 is as follows: Rotation of roll **56** is initiated to drive belt **46** and barrier **22** is moved from engaging relationship with the surface of belt **46**. Movement of the barrier establishes a space between the barrier and the belt, displaces a portion of liquid **14** and prevents liquid **14** from moving into the space between barrier **22** and belt **46** in the manner theretofore described. The leading edge of the exposed area of sheet **18** is advanced between roll **40** and belt **46** so that an exposed area faces the belt and the leading edge of the area is in registration with the leading edge of the hygroscopic portion **48** of the belt having a quantity of non-viscous liquid **12** evenly distributed therein. The exposed surface of sheet **18**, which is hydrophylic, is pressed by roll **40** into face-to-face contact with aqueous processing liquid bearing portion **48** of belt **46** so that all portions of the exposed surface of photosensitive sheet **18** will absorb uniform amounts of the processing solution from the surface of portion **48** as the sheet and belt **46** advance into face-to-face relationship. The exposed surface of sheet **18** remains in surface contact with portion **48** during the period of time required for the sheet to move from roll **40** to roll **56**. This distance and speed of travel of the belt may be predetermined to control the length of the period during which sheet **18** and portion **48** are in face-to-face contact and thus

insure that the correct amount of processing liquid is transferred from portion **48** of the belt to the adjacent exposed area of sheet **18**. The fluid, when absorbed into the sheet, produces a visible image therein, for example, by a diffusion transfer process.

Belt **46** makes a sharp turn around roll **56** so that its path diverges from the surface of sheet **18**. The leading edge of sheet **18** continues to move in its previous direction to be engaged between rolls **58** and guided from the belt. Movement of belt **46** is terminated subsequent to movement of the trailing end of sheet **18** away from the surface of the belt, after hygroscopic portion **48** thereof is advanced to a position wherein it is submerged below the surface of the liquid **12** in tray **10**. The leading edge of hydrophobic portion **50** of belt **46** is in registration with the trailing edge of the exposed area of sheet **18** so that as soon as the trailing edge of the sheet passes from between roll **40** and belt **46**, roll **40** contacts hydrophobic portion **50** so as to prevent transfer of contaminated liquid to roll **40** and thus to the body of liquid and to the side of sheet **18** opposite the side bearing the exposed area.

When operation of the apparatus is terminated, barrier means **22** is returned to engaging relationship with belt **46** to close the space therebetween so that liquid **12** is not exposed to the atmosphere.

Operation of the apparatus of FIG. 4 may be continuous if means are provided for automatic intermittent advancement of sheets **18** between belt **46** and roll **40** according to the position of belt **46**.

This invention thus provides novel and improved apparatus for applying a predetermined, uniformly distributed quantity of a non-viscous, photographic processing liquid subject to deterioration upon contact with the atmosphere, to the surface of a sheet from a body of such liquid while protecting the body of liquid from contact with the atmosphere.

Since certain changes may be made in the above apparatus without departing from the scope of the invention herein involved, it is intended that all matter 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. Photographic apparatus for treating a photographic sheet with a liquid processing agent subject to deterioration upon exposure to the atmosphere, said apparatus comprising, in combination:

an open container for holding a quantity of a processing liquid;

a quantity of a second liquid, substantially non-volatile at normal temperatures, immiscible with and having a specific gravity less than said processing liquid, sufficient to form a layer of predetermined thickness on the entire surface of a body of said processing liquid within said container to preclude contact between said processing liquid and the atmosphere;

a applicator member having an endless surface wettable by said processing liquid disposed with a portion of said endless surface located above said second liquid and another portion of said surface located within said processing liquid;

means for so moving said applicator as to advance a descending portion of said endless surface from above said second liquid downwardly into said processing liquid and advance an ascending portion of said endless surface upwardly from said processing liquid through and from said second liquid;

barrier means extending from above said second liquid into said processing liquid and disposed in contact with said ascending portion of said endless surface to prevent contact between said ascending portion of said endless surface and said second liquid;

means for moving said barrier means from contact with said ascending portion of said endless surface to remove said second liquid from the surface of said processing liquid in the region of said ascending portion of said endless surface; and

means for pressing said photographic sheet into contact with a portion of said endless surface exterior of said liquids.

2. The photographic apparatus of claim **1** for use with an aqueous liquid processing agent wherein said endless surface is hydrophilic.

3. The photographic apparatus of claim **1** for use with an aqueous liquid processing agent wherein said endless surface is the outer surface of a layer of hygroscopic material.

4. The photographic apparatus of claim **1** wherein said applicator means is an endless belt.

5. The photographic apparatus of claim **1** wherein said applicator means is a roll.

6. The photographic apparatus as in claim **1** including means within said processing liquid for engaging said descending portion of said endless surface and removing said second liquid therefrom.

7. Photographic apparatus for treating a photographic sheet with a liquid processing agent subject to deterioration upon exposure to the atmosphere, said apparatus comprising, in combination:

an open container for holding a quantity of a processing liquid;

a quantity of a second liquid, substantially non-volatile at normal temperatures, immiscible with and having a specific gravity less than said processing liquid, sufficient to form a layer of predetermined thickness on the entire surface of a body of said processing liquid within said container;

a generally cylindrical roll mounted for rotation about its axis above the surface of said second liquid with the lower portion of said roll extending through said second liquid into said processing liquid;

means for rotating said roll about said axis;

barrier means extending from above the surface of said second liquid beneath said surface of said processing liquid and disposed in contact with a portion of the surface of said roll extending from above said surface of said second liquid to a location beneath said surface of said processing liquid on the emerging side of said roll to prevent contact between said portion of said roll and said second liquid, said barrier means being movable from contact with said roll to remove said second liquid from said surface of said processing liquid in the region thereof immediately adjacent said portion of said surface of said roll.

8. The photographic apparatus of claim **7** wherein means are provided within said processing liquid for contacting an axial portion of said surface of said roll on the side thereof opposite said barrier means for removing said second liquid from said surface of said roll.

9. The photographic apparatus of claim **7** wherein said surface of said roll is wettable by said processing liquid and substantially nonwettable by said second liquid.

10. The photographic apparatus of claim **7** useful with a processing liquid including water wherein said second liquid is mineral oil.

11. The photographic apparatus of claim **10** wherein said surface of said roll is oleophobic.

References Cited

UNITED STATES PATENTS

3,288,609	11/1966	Land et al.	96—50
3,379,113	4/1968	Hosoya et al.	95—89

NORTON ANSHER, *Primary Examiner.*

C. E. SMITH, *Assistant Examiner.*