

June 30, 1964

Filed June 20, 1962

V. K. ELORANTA
PHOTOGRAPHIC PROCESSING APPARATUS FOR DISPENSING
AND DISTRIBUTING LIQUID

3,139,019

4 Sheets-Sheet 1

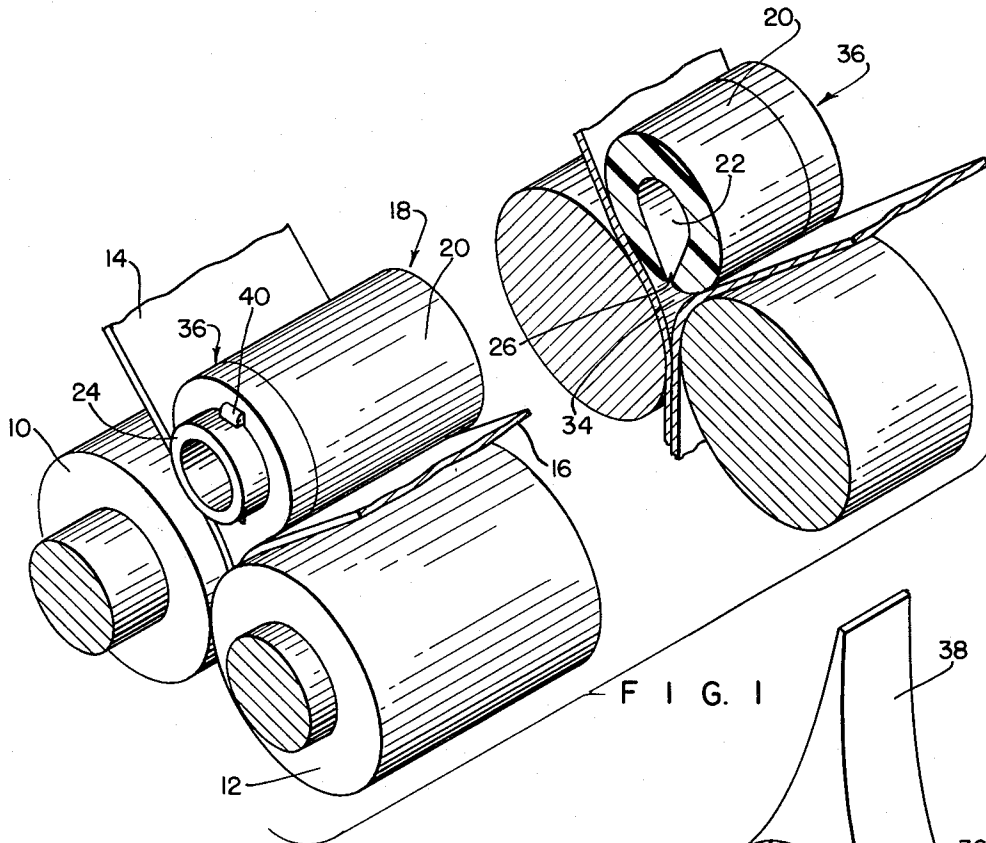


FIG. 1

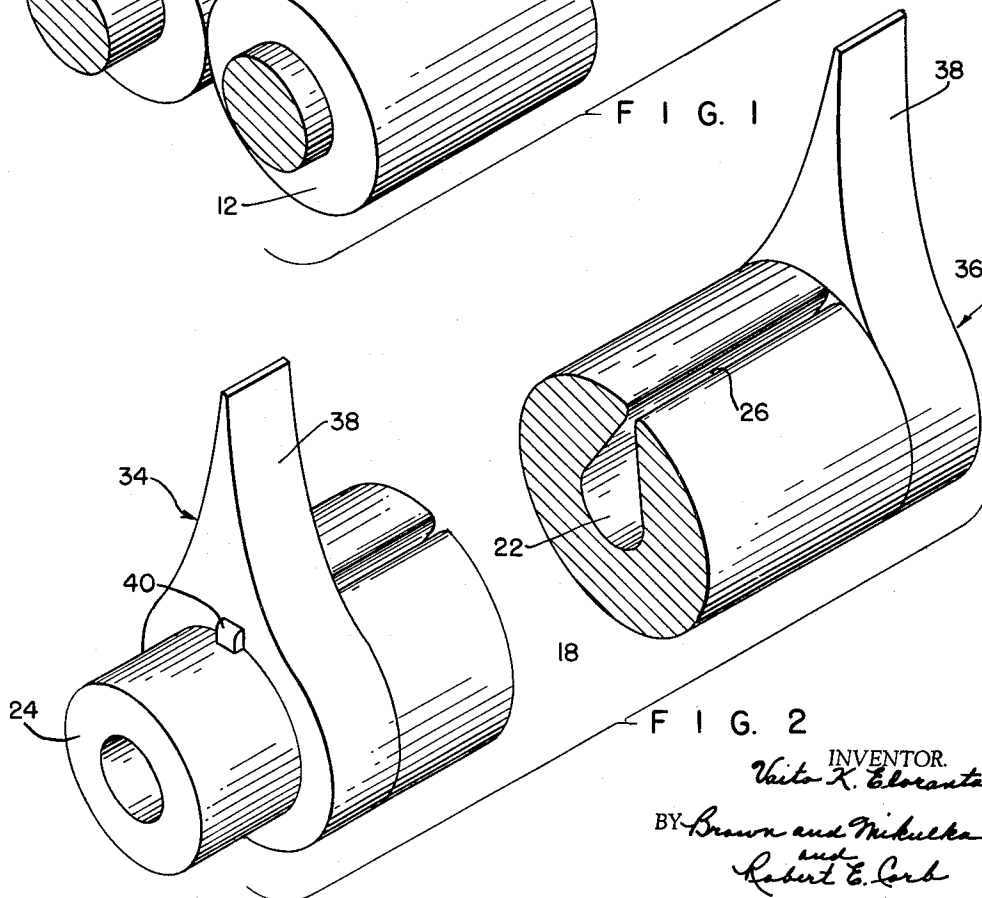


FIG. 2

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4 Sheets-Sheet 2

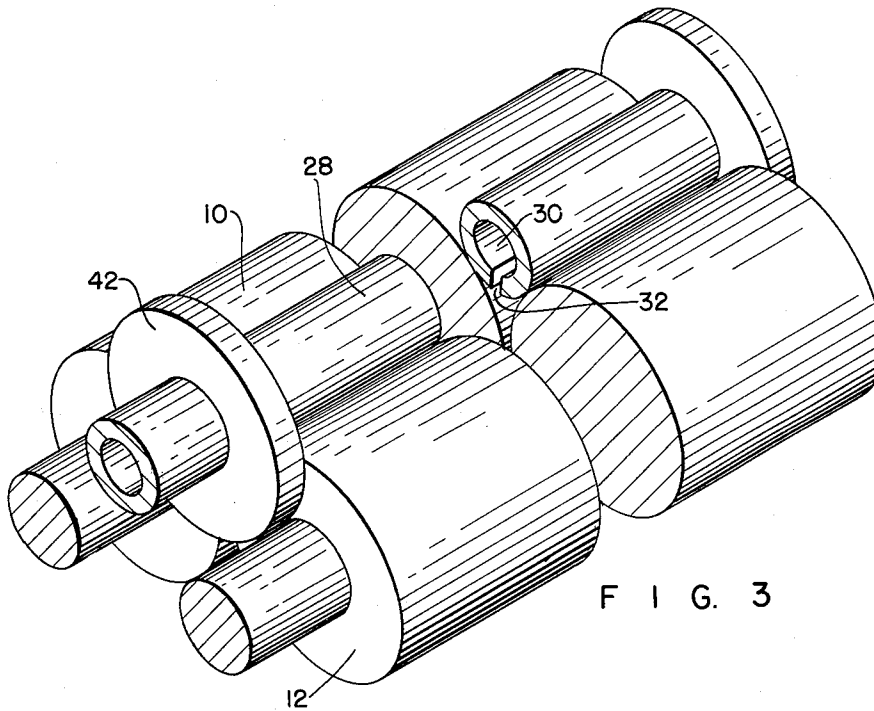


FIG. 3

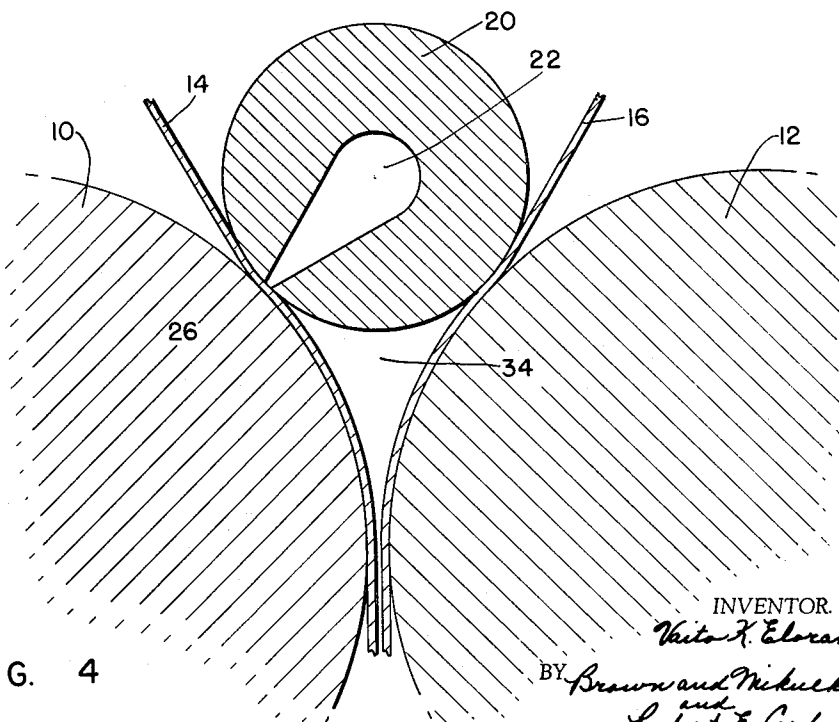


FIG. 4

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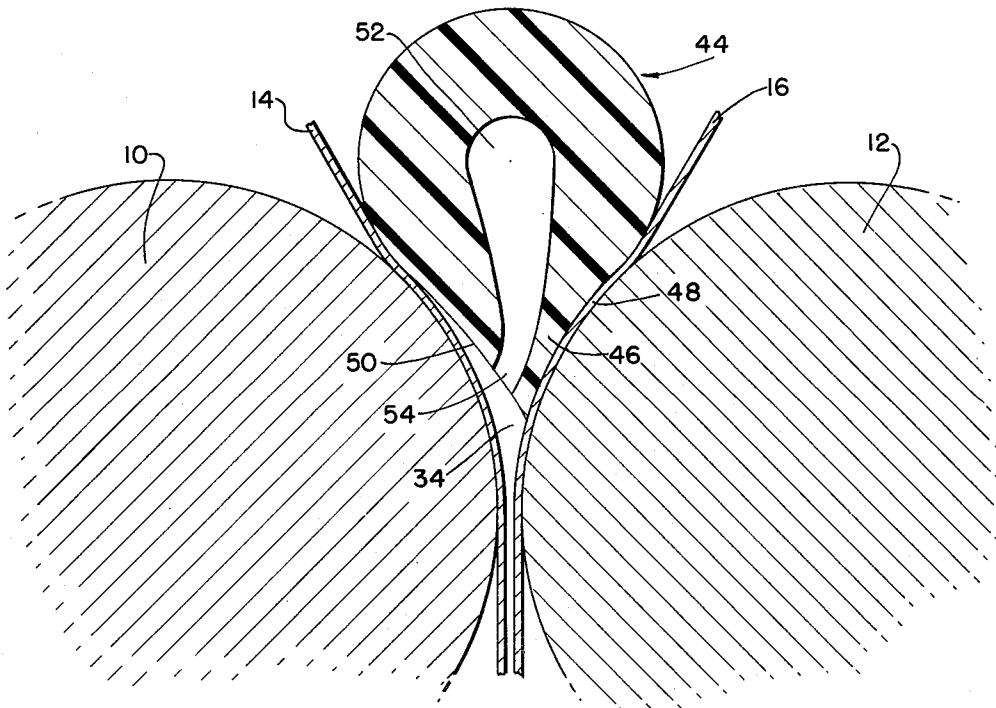
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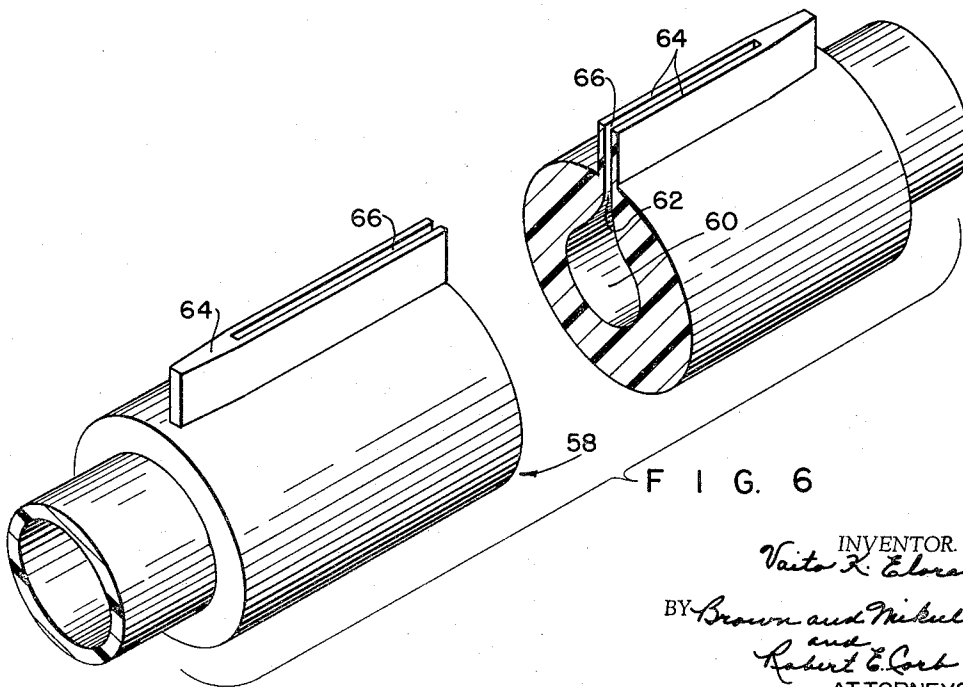
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3,139,019

4 Sheets-Sheet 3



F I G. 5



F I G. 6

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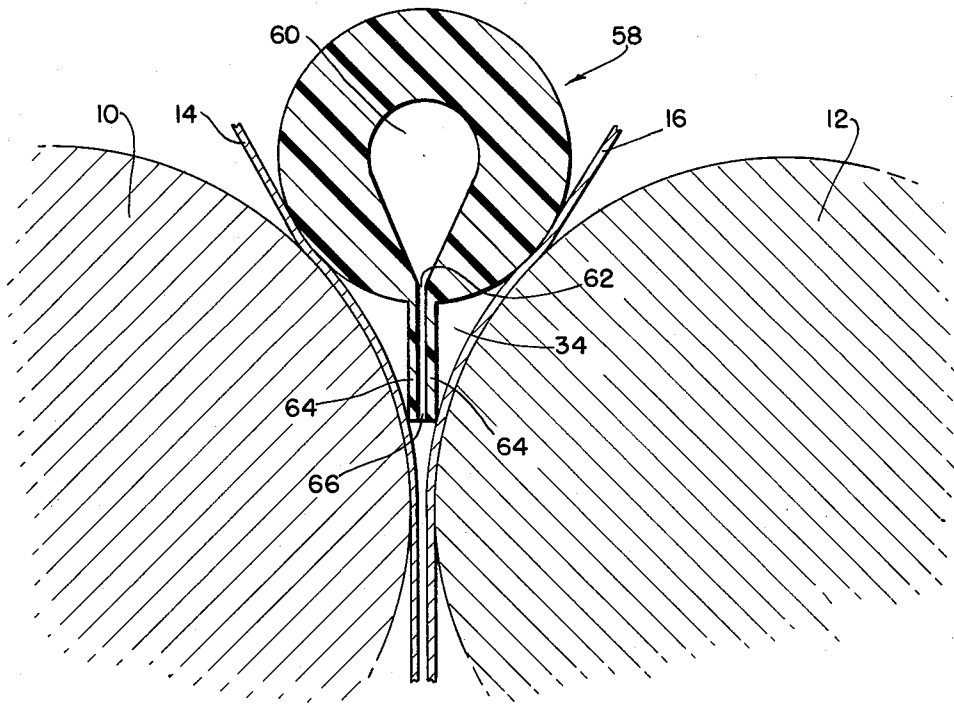
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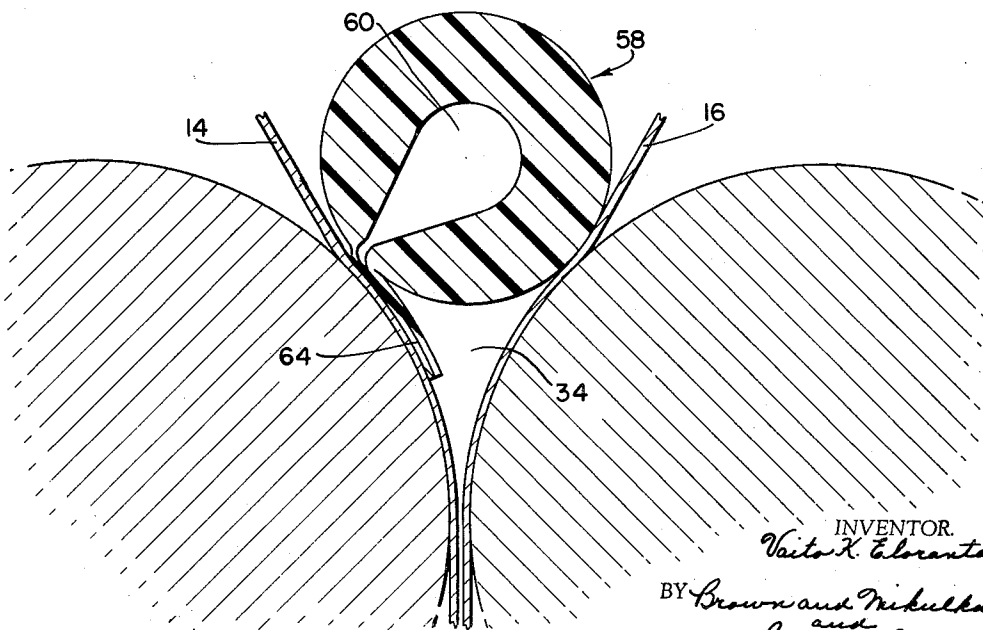
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4 Sheets-Sheet 4



F I G. 7



F I G. 8

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3,139,019

PHOTOGRAPHIC PROCESSING APPARATUS FOR DISPENSING AND DISTRIBUTING LIQUID

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Filed June 20, 1962, Ser. No. 203,811

8 Claims. (Cl. 95—39)

This invention relates to photographic processing apparatus and particularly to apparatus for processing a photographic image-recording sheet by distributing a processing liquid in a layer in contact with said sheet and another sheet superposed therewith.

The apparatus with which this application is concerned is of the type comprising means for superposing a pair of photographic sheets, supplying and dispensing a liquid to a space between the sheets and distributing the liquid in a thin layer between and in contact with the sheets. Apparatus of this type usually includes a pair of juxtaposed members for guiding the sheets into superposition and distributing the liquid between the sheets as the sheets are moved between the members, and a device for dispensing the liquid between the sheets during movement thereof relative to and between the members to effect the distribution of the liquid. The usual practice is to guide the sheets along convergent paths into superposition between juxtaposed members having convergent support surfaces and dispense the liquid from means, such as a nozzle, located adjacent the members between convergent portions of the two sheets.

An object of the invention is to provide novel and improved photographic processing apparatus of the type described especially designed for intermittent operation to treat successive exposed areas of a photographic image-recording sheet.

Another object of the invention is to provide a fluid dispensing and distributing device including a nozzle which cooperates with the juxtaposed members to form a liquid-receiving space between convergent portions of the two sheets and improved means for sealing the nozzle against the flow of liquid into the liquid-receiving space.

A further object of the invention is to provide a liquid dispensing and distributing device including a nozzle which is sealed by pivotal movement thereof and in which at least one of the sheets and the juxtaposed members cooperate to effect the sealing of the nozzle.

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 arrangements 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 perspective view, partially in section, illustrating fluid dispensing and distributing apparatus incorporating the invention;

FIG. 2 is a fragmentary perspective view of a component of the apparatus of FIGURE 1;

FIG 3 is a fragmentary perspective view illustrating another embodiment of the apparatus;

FIG. 4 is a fragmentary sectional view illustrating the operation of the apparatus of FIGURE 1;

FIGURE 5 is a view similar to FIG. 4 illustrating another embodiment of the apparatus;

FIG. 6 is a view similar to FIG. 2 illustrating a further embodiment of the apparatus; and

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FIGS. 7 and 8 are fragmentary sectional views illustrating the operation of the apparatus of FIG. 6.

This application is concerned with apparatus for performing a photographic process of the general type known as the "Land" process and characterized by the distribution of a liquid processing composition in a layer between a pair of superposed sheets. For a description of a number of different processes performed in this manner and examples of materials employed in such processes, reference may be had to U.S. Patents Nos. 2,543,181, issued February 27, 1951, and 2,662,822, issued December 15, 1953, both in the name of Edwin H. Land.

This method of photographic processing involves the dispensing of a liquid between a pair of sheets and the movement of the sheets between a pair of juxtaposed members, usually capable of exerting compressive pressure, for spreading the liquid in a thin layer between the sheets to form a sandwich. A preferred method of dispensing and distributing the liquid between the sheets, particularly elongated sheets comprising a plurality of areas to be treated, is to supply the liquid continuously from a dispensing device including a nozzle located between the sheets as the sheets are advanced continuously relative to the nozzle. This basic approach is suited particularly to continuous, rather than intermittent, operation and numerous efforts have been made to adapt the dispensing nozzle to intermittent operation, requiring solutions to the problems of stopping and starting; arresting and reinstituting the flow of a liquid which may be quite viscous, is subject to hardening, and is readily oxidized; the sealing of the liquid dispensing nozzle against both the leakage of liquid and the admission of air; and dispensing the liquid at an accurately controlled volume rate.

The present invention represents a novel and improved approach to the problem of providing a nozzle for dispensing and distributing a viscous, hardenable and highly oxidizable photographic processing liquid between a pair of photographic sheets as the sheets are moved along convergent paths into superposition. The construction of the nozzle is such that the liquid contacts only the sheets and the nozzle itself. Sealing of the nozzle is effected in cooperation with the sheets, and the nozzle may be readily sealed and unsealed. The construction is simple and inexpensive, reliable in its operation and requires a minimum space within apparatus, such as a camera, in which it is incorporated.

Reference is now made to FIGS. 1 through 5 of the drawings wherein there is illustrated the essential components of photographic processing apparatus incorporating the invention. The apparatus shown is in the form of a device for producing a sandwich comprising superposed sheets with a layer of liquid therebetween and generally includes a pair of juxtaposed members in the form of pressure rolls 10 and 12 and means for dispensing and distributing a liquid between a pair of sheets as the latter are advanced into superposition between the rolls. The device may be incorporated in any type of photographic apparatus in which it is desired to treat successive exposed areas of a photosensitive image-recording sheet with a liquid, including cameras or other apparatus in which the image-recording sheet is exposed and/or apparatus the function of which is to process an image-recording sheet which has been exposed elsewhere. The juxtaposed members, herein illustrated as rolls 10 and 12, include convergent support surfaces defining a convergent passage between the members for guiding the sheets into superposition as the sheets are moved through the passage. While the juxtaposed members are shown as rolls, other forms are possible including fixed including fixed members having convergent surfaces which may be planar or curved and define a convergent passage through which superposed sheets are movable. The juxta-

posed members may be fixed with respect to one another or may be movable toward and away from one another and biased toward one another. Rolls 10 and 12 are provided with cylindrical sheet engaging surfaces and are mounted in juxtaposition with their axis substantially a common plane.

The image-recording and second sheets designated, respectively, 14 and 16, are guided into superposition by and between the convergent surfaces of rolls 10 and 12 and a liquid dispensing and distributing device in the form of a nozzle 18 is provided at the bite of the rolls between convergent portions of the sheets. Nozzle 18, in the form shown in FIGS. 1 and 2, comprises a tubular body 20 having a cylindrical cross section and an elongated cavity 22 extending lengthwise of the body, and coupled at one end with a conduit 24 in turn connected to a supply of the processing liquid. The opposite end of cavity 22 is closed, and this end of body 20 is provided with a cylindrical section of smaller diameter which may, in one form, comprise a plug engaged within one end of the cavity in the same manner of conduit 24. Body 20 is provided with an axial slot 26 approximately equal in length to cavity 22, preferably equal in length to the width of the areas of the image-recording sheet to be treated and communicating with the cavity throughout its length. Body 20 may be formed of substantially any material desired as long as it is impervious to the processing liquid and to air and is compatible with the reagents comprising the processing liquid. Especially desirable are materials which can be formed by molding or extrusion processes including organic plastics such as high density polyethylene, polypropylene, polyvinylidene chloride and polyethylene terephthalate resin.

In the embodiment shown in FIG. 3, the nozzle comprises a body in the form of a tube designated 28. Tube 28 may comprise an ordinary cylindrical tube or conduit having an axial bore 30 and an axial slot 32 communicating with bore 30. One end of tube 28 is connected with a supply of the processing liquid while the opposite end of tube 28 is provided with a plug and/or cap closing bore 30 against the flow of liquid. Regardless of the particular construction of the tubular body (20 and 28), it should be noted that the latter does not, of necessity, have a cylindrical cross section as long as the body does have cylindrical surfaces bordering slot 26 (or slot 32) having a common generatrix which, in the case of tube 28, is the axis of the tube. Body 20 (or tube 28 as the case may be) is positioned at the bite of rolls 10 and 12 between and in contact with convergent portions of the sheets with the cylindrical surface sections of the body in contact with the sheets and cooperating to define a liquid-receiving space designated 34 through which convergent portions of the sheets are advanced and into which the processing liquid is dispensed from slot 26. Resilient means (not shown) are preferably provided for biasing body 20 into contact with the sheets.

Body 20 is mounted for pivotal movement about the generatrix of the cylindrical surface sections between an open position, shown in FIGURE 1, in which opening 26 faces in a direction of movement of sheets 14 and 16 between rolls 10 and 12; and a closed position, shown in FIG. 4, in which opening 26 is located in facing relation to one of the sheets (shown as sheet 14) supported on roll 10. In the open position, liquid introduced into cavity 22 is free to flow through slot 26 into liquid-receiving space 34. In the closed position of the body, portions of the body at the edges of slot 26 are pressed against one of the sheets closing the slot against the flow of liquid into liquid-receiving space 34. It is quite obvious that body 20 may be pivoted in either direction so that slot 26 can be closed by either sheet 14 or sheet 16 depending upon the direction of pivotal movement of the body from the open position thereof. The portions of the body at the edges of slot 26 may be rounded

slightly, as shown, to facilitate pivotal movement of the body with respect to the sheets.

Means are provided for closing the ends of liquid-receiving space 34 and, in the form shown in FIGS. 1 and 2, comprise collars 36 mounted near the ends of body 20 at the ends of slot 26. Each of collars 36 includes a wedge-shaped tapered section 38 designed to extend into the passage between rolls 10 and 12 in engagement with the lateral margins of sheets 14 and 16. Each of collars 36 is mounted for pivotal movement with respect to body 20 so that the collar remains more or less stationary with respect to the rolls during pivotal movement of body 20 between the open and closed positions thereof. Collars 36 may be mounted, as shown in FIGS. 1 and 2, on conduit 24 and a plug provided in the opposite end of cavity 22 and body 20 and are retained in place by projections 40 on conduit 24 and the aforementioned plug. In the operation of the fluid dispensing and distributing device, the processing liquid is conducted to cavity 22 under pressure sufficient to cause the liquid to flow from the cavity through opening 26 into liquid-receiving space 34. A suitable container for this purpose is illustrated, for example, in U.S. patent application Serial No. 169,264, filed Jan. 29, 1962, in the name of Edwin H. Land. The body is located in the open position thereof so that the fluid enters fluid-receiving space 34 and may fill the latter, if this mode of operation is desired. The sheets are then advanced along opposite sides of body 20 through the liquid-receiving space between rolls 10 and 12 and the liquid in the liquid-receiving space is distributed as a layer between the two sheets to form a sandwich. When an area of the image-recording sheet to be treated has been advanced through the liquid-receiving space and formed into a sandwich, body 20 is pivoted to its closed position arresting the flow of the liquid into the liquid-receiving space and movement of the sheets is arrested. In a preferred manner of operation, pivotal movement of the body into closed position and arresting the flow of the liquid is accomplished prior to arresting the movement of the sheets so that all of the liquid in the liquid-receiving space is distributed between the sheets and substantially no liquid remains in this space during the period between operations of the apparatus. The liquid, as previously noted, may be quite viscous due to a film-forming agent which hardens as the liquid evaporates. An advantage of the structure of the invention resides in the fact that the closure for the nozzle is one of the sheets thereby eliminating valves and the like which are subject to becoming clogged or rendered inoperative by the hardened liquid. Pivotal movement of the body from its closed position to its open position may be accomplished simultaneously with the initiation of movement of the sheets to facilitate the pivotal movement of the body.

The embodiment of the fluid-dispensing device shown in FIG. 3 differs from that shown in FIGS. 1 and 2 by virtue of the means for closing the ends of the liquid-receiving space between rolls 10 and 12. In the form shown, these means comprise circular collars 42 mounted on tube 28 at the end of slot 32. Slot 32 may extend to the lateral edges of the sheets which are equal in width to the length of rolls 10 and 12 and the liquid-receiving space extends to the ends of the rolls and the edges of the sheets so that the liquid is spread to the edges of the sheets. Collars 42 extend outside of the ends of rolls 10 and 12 and may be biased by suitable means (not shown) toward one another into engagement with the ends of the rolls and thereby provide closures for the ends of the liquid-receiving space. Collars 42 may be mounted on tube 28 so as to rotate therewith, or they may be pivotable with respect to the tube.

Another form of nozzle is shown in FIG. 5 of the drawings comprising a cylindrical body 44 similar in many respects to body 20 but having a projecting section 46 which extends into liquid-receiving space 34 and

from end to end of the body. Projecting section 46 includes opposed surfaces which are continuations of the cylindrical outer surface of the body. One of these surfaces, designated 48, is curved to conform to the curvature of one of the sheets and is disposed against one of the sheets in the open position of the body. The other surface, designated 50, of projecting section 46 is curved to conform to the surface of the other sheet in the closed position of the body and in the open position thereof is displaced from the other sheet so as to provide a liquid-receiving space between the sheets and surface 50. Body 44 is provided with a central cavity 52 and a channel 54 extending from cavity 52 through surface 50 of projecting section 46. This embodiment of the invention has the advantage that the opening in channel 54 moves toward and away from one of the sheets during movement between open and closed positions, and extended section 46 occupies a greater portion of the liquid-receiving space so that the amount of liquid in this space is smaller.

Reference is now made to FIGS. 6 through 8 of the drawings wherein there is illustrated still another embodiment of the nozzle. This nozzle comprises a generally cylindrical body 58 similar to body 20 and having a cavity 60 and an axial slot 62 coupled with the cavity. Surrounding slot 62, however, are extended flexible lips 64 providing a narrow channel 66 at least equal in length to the width of the area of the sheets over which the liquid is to be distributed. Lips 64, in the open position, extend in the direction of the sheets between the rolls and function as a conduit for conducting the fluid into contact with the sheets at the bite of the rolls. The lips may extend into contact with the sheets and limit contact between the sheets and liquid to a very small portion of the sheets well within the passage between the rolls as shown in FIG. 7. In an alternative arrangement, the lips may extend only part way into liquid-receiving space 34 and provide means for conducting the liquid into the space. Mouth 62 is closed by pivoting body 58 in the same manner as described to the closed position shown in FIG. 8 in which lips 64 are pinched between the body and one of the sheets effectively closing channel 66 against the flow of the processing liquid. In the embodiment shown in FIG. 7 in which lips 64 extend into contact with the sheet in the open position, end closure members for the liquid-receiving cavity are unnecessary; whereas in the other embodiment mentioned in which the lips extend into the cavity but not into contact with the sheets, end closure collars such as collars 36 or collars 42 may be required.

The fluid dispensing and distributing devices shown are characterized by the fact that they cooperate with the juxtaposed members (shown as rollers) to define a liquid-receiving space into which the liquid is dispensed and through which the sheets are advanced to distribute the liquid in a layer between the sheets. The liquid-receiving space may be quite small and hold very little liquid as compared to the amount of liquid distributed on each exposed area of the image-recording sheet, and the device is ideally suited for intermittent operation requiring only a slight pivotal movement to close the nozzle and arrest the flow of liquid. The amount of liquid dispensed during treatment of each exposed area may be very carefully controlled since the volume of the liquid-receiving space is accurately predetermined, and the flow of liquid may be arrested during movement of the sheets at a time in the process when the liquid contents of the liquid-receiving space are just sufficient to complete the processing of a predetermined area of the image-recording sheet. Moreover, the device, namely the nozzle, has a simple reliable construction which can be made sufficiently inexpensive to be discarded following use for processing the materials with which it is supplied. An expendable construction such as this is most desirable in the case of developing compositions used in photography because of the highly oxidizable nature of these compositions and the fact that viscous compositions particularly suited for use in the

Land process are subject to hardening when exposed to 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. In photographic apparatus for treating successive areas of a photographic image-recording sheet with a processing liquid distributed in contact with said sheet, in combination:

means including a pair of juxtaposed members for guiding said sheet and a second sheet along convergent paths into superposition;

said members having support surfaces cooperating to provide a convergent passage between said members through which said sheets are movable into superposition;

a fluid-dispensing nozzle for dispensing said liquid between and in contact with convergent portions of said sheets supported on said members within said convergent passage;

said nozzle including a body having an elongated cavity extending lengthwise of said body;

said body being positioned at the entrance to said convergent passage in closing relation thereto with said cavity extending transversely of the direction of movement of said sheets into said passage;

said body being formed with an elongated opening at least equal in length to the width of said areas of said image-recording sheet and communicating with said cavity;

said body including generally cylindrical surface sections having a common generatrix, located adjacent opposite sides of said opening, at least equal in length to said opening, disposed in contact with said convergent portions of said sheets supported on said juxtaposed members, and cooperating therewith to define a liquid-receiving space between said convergent portions of said sheets;

means for supplying said liquid to said cavity; and

means mounting said body for pivotal movement about said generatrix between an open position in which said opening faces said liquid-receiving space, and a closed position in which said opening is disposed in facing relation to one of said sheets supported on one of said juxtaposed members and is closed, by said one sheet, to prevent flow of said liquid into said space.

2. The photographic apparatus of claim 1 in which said body is cylindrical in cross section and is mounted for pivotal movement about its axis with its periphery in contact with said sheets.

3. The photographic apparatus of claim 2 in which said opening is a narrow axial slot.

4. The photographic apparatus of claim 1 in which closure members are provided on said body at the ends of said opening for cooperating with said juxtaposed members to close the ends of said liquid-receiving space defined by said body and said juxtaposed members.

5. In photographic apparatus for treating successive areas of a photographic image-recording sheet with a processing liquid distributed in contact with said sheet, in combination:

means including a pair of juxtaposed members for guiding said sheet and a second sheet along convergent paths into superposition;

said members having support surfaces cooperating to provide a convergent passage between said members through which said sheets are movable into superposition;

a fluid-dispensing nozzle for dispensing said liquid between and in contact with convergent portions of

said sheets supported on said members within said convergent passage;

said nozzle including a body having an elongated cavity extending lengthwise of said body, an elongated opening at least equal in length to the width of said areas of said image-recording sheet and comprising a narrow slot connecting with said cavity, and flexible lips surrounding said slot;

said body being positioned at the entrance to said convergent passage in closing relation thereto with said cavity extending transversely of the direction of movement of said sheets into said passage;

said body including generally cylindrical surface sections having a common generatrix, located adjacent opposite sides of said opening, at least equal in length to said opening, disposed in contact with said convergent portions of said sheets supported on said juxtaposed members, and cooperating therewith to define a liquid-receiving space between said convergent portions of said sheets;

means for supplying said liquid to said cavity; and

means mounting said body for pivotal movement about said generatrix between an open position in which said opening faces said liquid-receiving space, and a closed position in which said opening is disposed in facing relation to one of said sheets supported on one of said juxtaposed members and said lips are pinched between said body and said one sheet to prevent flow of said liquid into said space.

6. In photographic apparatus for treating successive areas of a photographic image-recording sheet with a processing liquid distributed in contact with said sheet, in combination:

means including a pair of juxtaposed members for guiding said sheet and a second sheet along convergent paths into superposition;

said members having support surfaces cooperating to provide a convergent passage between said members through which said sheets are movable into superposition;

a fluid-dispensing nozzle for dispensing said liquid between and in contact with convergent portions of said sheets supported on said members within said convergent passage;

said nozzle including a body having an elongated cavity extending lengthwise of said body;

said body being positioned at the entrance to said convergent passage in closing relation thereto with said cavity extending transversely of the direction of movement of said sheets into said passage;

said body including an elongated opening at least equal in length to the width of said areas of said image-recording sheet and communicating with said cavity, and generally cylindrical surface sections having a common generatrix, located adjacent opposite sides of said opening, at least equal in length to said opening, disposed in contact with said convergent portions of said sheets supported on said juxtaposed members, and cooperating therewith to define a liquid-receiving space between said convergent portions of said sheets;

means for supplying liquid to said cavity; and

said body including an outwardly projecting section intermediate said cylindrical surface sections, said projecting section including convergent surfaces one of which conforms to said support surface of one of said juxtaposed members and is disposed in face-to-face contact with one of said sheets in said open position of said body, the other of said surfaces conforming to said support surface of the other of said members, being spaced therefrom in said open position of said body and being movable in face-to-face contact with the other of said sheets in said closed position of said body, and said opening comprising a

channel extending through said other surface of said projecting section of said body.

7. In photographic apparatus for treating successive areas of a photographic image-recording sheet with a processing liquid distributed in contact with said sheet, in combination:

means including a pair of juxtaposed members for guiding said sheet and a second sheet along convergent paths into superposition;

said members having support surfaces cooperating to provide a convergent passage between said members through which said sheets are movable into superposition;

a fluid-dispensing nozzle for dispensing said liquid between and in contact with convergent portions of said sheets supported on said members within said convergent passage;

said nozzle including a body having an elongated cavity extending lengthwise of said body;

said body being positioned at the entrance to said convergent passage in closing relation thereto with said cavity extending transversely of the direction of movement of said sheets into said passage;

said body including an elongated opening at least equal in length to the width of said areas of said image-recording sheet and communicating with said cavity, and a pair of generally cylindrical surface sections having a common generatrix, located adjacent opposite sides of said opening, at least equal in length to said opening, disposed in contact with said convergent portions of said sheets supported on said juxtaposed members, and cooperating therewith to define a liquid-receiving space between said convergent portions of said sheets;

means for supplying said liquid to said cavity;

means mounting said body for pivotal movement about said generatrix between an open position in which said opening faces said liquid-receiving space, and a closed position in which said opening is disposed in facing relation to one of said sheets supported on one of said juxtaposed members and is closed, by said one sheet, to prevent flow of said liquid into said space; and

members mounted on said body at the ends of said opening for cooperating with said juxtaposed members to close the ends of said liquid-receiving space defined by said body and said juxtaposed members, said closure members extending into said passage between said sheets in engagement with the lateral margins of said sheets and being pivotable with respect to said body.

8. In photographic apparatus for treating successive areas of a photographic image-recording sheet with a processing liquid distributed in contact with said sheet, in combination:

means including a pair of juxtaposed members for guiding said sheet and a second sheet along convergent paths into superposition;

said members having support surfaces cooperating to provide a convergent passage between said members through which said sheets are movable into superposition;

a fluid-dispensing nozzle for dispensing said liquid between and in contact with convergent portions of said sheets supported on said members within said convergent passage;

said nozzle including a body having an elongated cavity extending lengthwise of said body;

said body being positioned at the entrance to said convergent passage in closing relation thereto with said cavity extending transversely of the direction of movement of said sheets into said passage;

said body including an elongated opening at least equal in length to the width of said areas of said image-recording sheet and communicating with said cavity,

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and a pair of generally cylindrical surface sections having a common generatrix, located adjacent opposite sides of said opening, at least equal in length to said opening, disposed in contact with said convergent portions of said sheets supported on said juxtaposed members, and cooperating therewith to define a liquid-receiving space between said convergent portions of said sheets; 5

means for supplying said liquid to said cavity;

means mounting said body for pivotal movement about said generatrix between an open position in which said opening faces said liquid-receiving space, and a closed position in which said opening is disposed in facing relation to one of said sheets supported on one of said juxtaposed members and is closed, by said one sheet, to prevent flow of said liquid into said space; and 10 15

members mounted on said body at the ends of said opening for cooperating with said juxtaposed members to close the ends of said liquid-receiving space defined by said body and said juxtaposed members, said juxtaposed members being substantially equal in length to the width of said sheets and said closure members being disposed outside of the ends of said juxtaposed members in engagement with said ends thereof in the region of said passage.

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