

July 28, 1964

E. H. LAND

3,142,243

PHOTOGRAPHIC PROCESSING APPARATUS AND PRODUCT USEFUL THEREIN

Filed Dec. 14, 1961

3 Sheets-Sheet 1

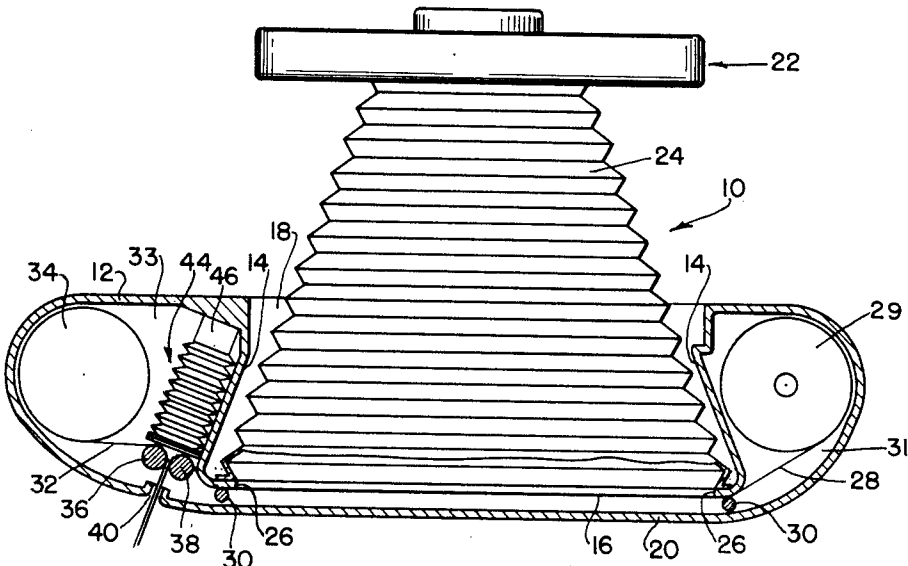


FIG. 1

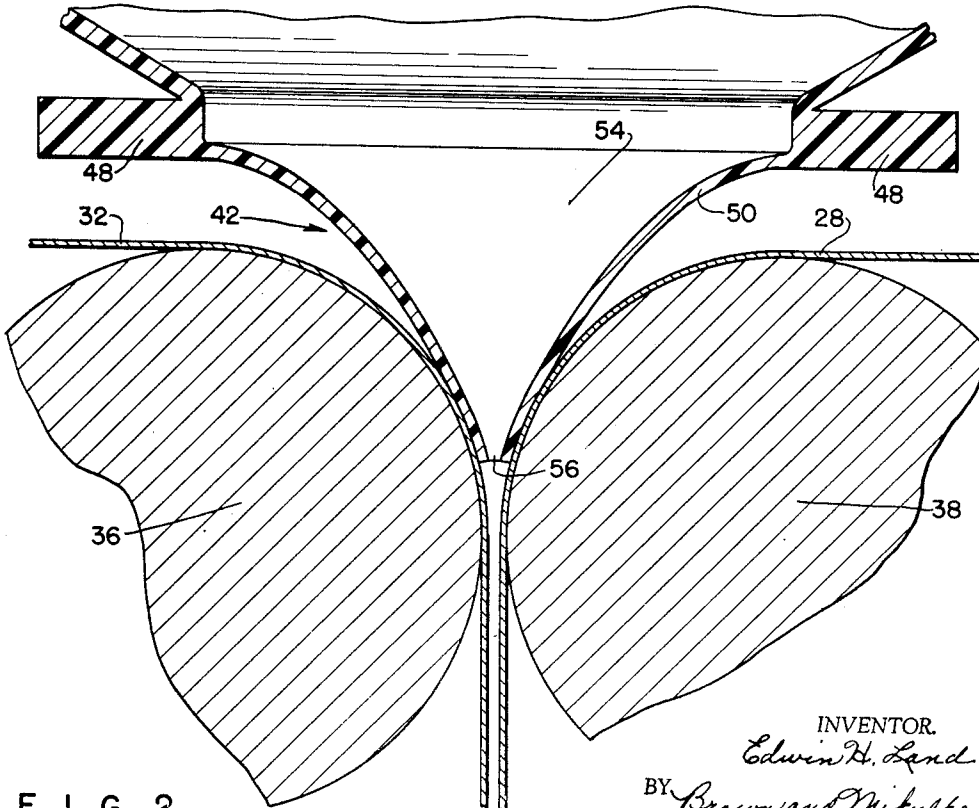


FIG. 2

INVENTOR.
Edwin H. Land
BY *Brown and Mikulka*
and
Robert C. Corb
ATTORNEYS

July 28, 1964

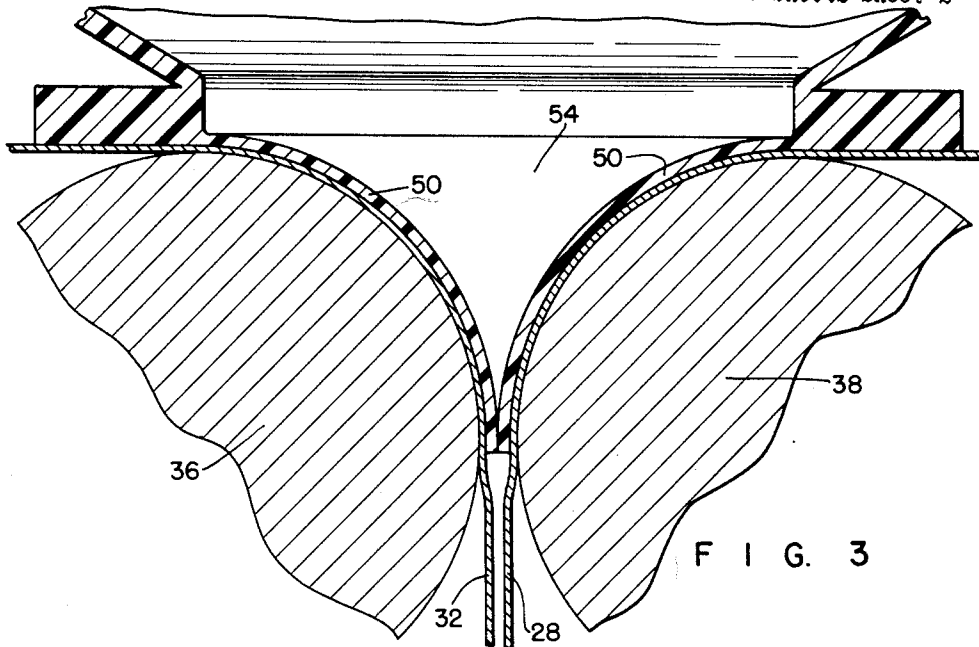
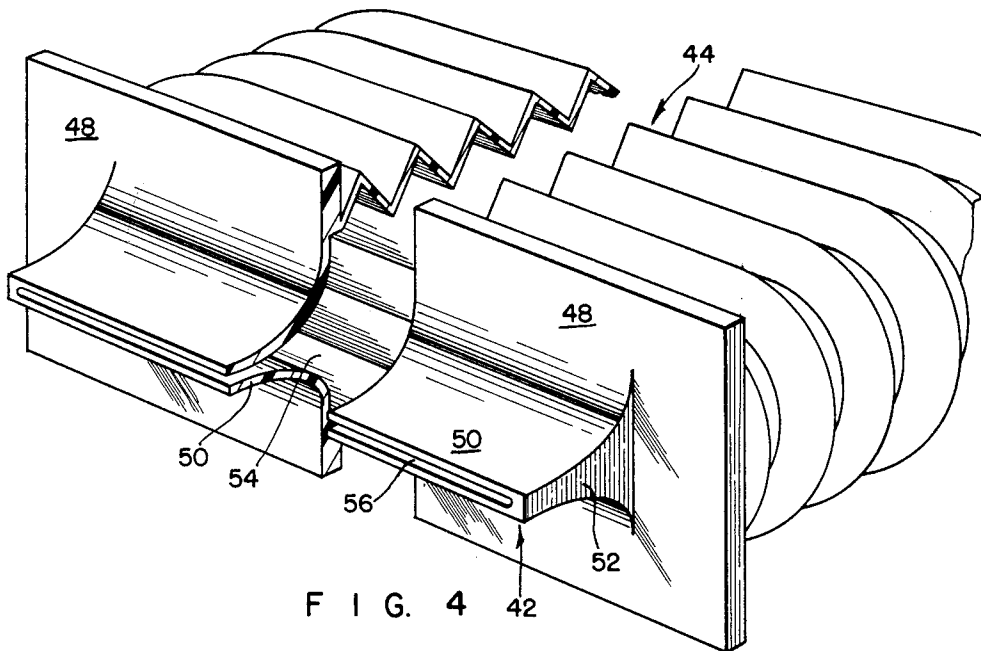
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3 Sheets-Sheet 2



INVENTOR
Edmund H. Land
BY *Brown and Mikulla*
and
Robert E. Lorb
ATTORNEYS

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3 Sheets-Sheet 3

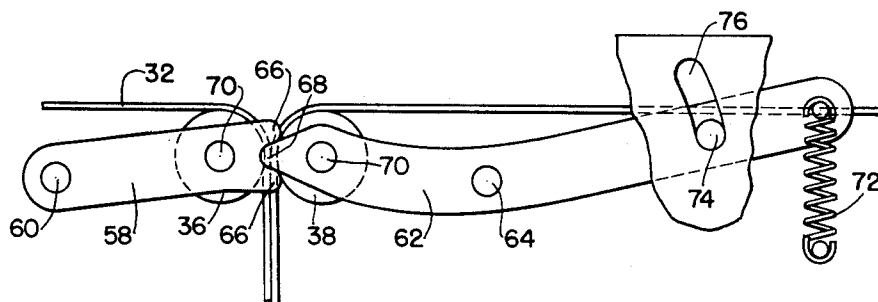


FIG. 5

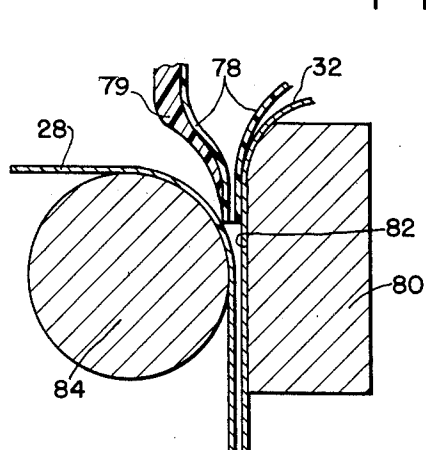


FIG. 6

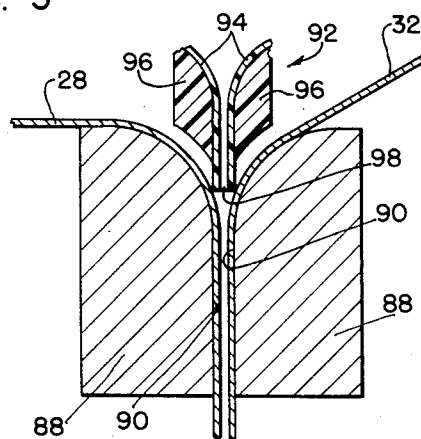


FIG. 7

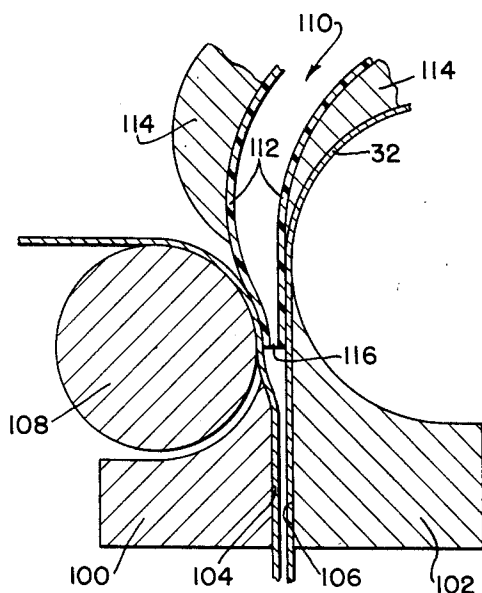


FIG. 8

INVENTOR
Edwin H. Land
BY *Brown and Mikulka*
Robert E. Gorb
ATTORNEYS

1

3,142,243

PHOTOGRAPHIC PROCESSING APPARATUS AND PRODUCT USEFUL THEREIN

Edwin H. Land, Cambridge, Mass., assignor to Polaroid Corporation, Cambridge, Mass., a corporation of Delaware

Filed Dec. 14, 1961, Ser. No. 159,234
11 Claims. (Cl. 95—89)

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

Photographic apparatus of the type with which this application is concerned generally comprise means for superposing a pair of photographic sheets, supplying and dispensing a fluid to a space between these sheets, and distributing the fluid in a thin layer between and in contact with the sheets. This means usually includes a pair of juxtaposed members for guiding the sheets into superposition and spreading the fluid between the sheets as the sheets are moved between the members and a device for dispensing the fluid between the sheets during movement thereof between the members to effect the spreading of the fluid. It is the practice to guide the sheets along convergent paths into superposition between the juxtaposed members and dispense the fluid from means such as a nozzle located adjacent the members between convergent portions of the sheets. Apparatus of this type proposed heretofore has been designed for continuous operation, that is, with the sheets being moved and the fluid dispensed continuously to effect the treatment, for example, of a succession of exposed areas of a photographic image-recording sheet.

The present invention has as an object, the provision of novel and improved photographic processing apparatus of this type which is designed especially for intermittent operation to treat successive areas of a photographic image-recording sheet.

Another object of the invention is to provide apparatus of the type described in which the area of contact between the sheets and fluid, and the quantity of fluid allowed to contact the sheets during intervals when the sheets are stationary is extremely limited, whereby the wasted area between treated areas is reduced and absorption of the fluid by the sheets is minimized.

Further objects of the invention are: to provide photographic apparatus as described including means for sealing the nozzle against the flow of said fluid and the admission of air when the sheets are not in motion; and to provide photographic apparatus as described in which the sealing and unsealing functions are substantially automatic and occur respectively when movement of the sheets relative to the nozzle is terminated and initiated.

In apparatus of this type proposed heretofore, the rate of flow of the fluid through the nozzle is regulated and is coordinated with the speed of movement of the sheets relative to the nozzle (also regulated), and it is in this manner that the fluid is fed to the sheets at a volume rate appropriate to the requirements of a layer of fluid of predetermined area and thickness between the sheets.

Still another object of the invention is to provide photographic processing apparatus as described in which the processing fluid is dispensed from the nozzle as it is required for spreading simply and automatically at the proper rate regardless of the rate of movement of the sheets relative to the nozzle.

Still a further object of the invention is to provide a photographic product including a nozzle of the type described coupled with a container of fluid under pressure

2

and means for sealing the lips of the nozzle to prevent the flow of said fluid therefrom.

The invention accordingly comprises the apparatus possessing the construction, combination of elements and arrangement of parts, and the product possessing the features, properties and the relation of components 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 plan view illustrating photographic apparatus in the form of a camera embodying the invention;

FIG. 2 is an enlarged sectional view illustrating the operation of components of the apparatus;

FIG. 3 is a view similar to FIG. 2 showing the components in another position;

FIG. 4 is a fragmentary perspective view partially in section illustrating a component of the apparatus;

FIG. 5 is a plan view illustrating components of the apparatus incorporating the invention; and

FIGS. 6, 7 and 8 are views similar to FIGS. 2 and 3 illustrating other embodiments of apparatus incorporating the invention.

This application is concerned with apparatus for performing a type of photographic process, generally known as the "Land" process, and characterized by the distribution of a fluid-processing composition in a layer between a pair of superposed sheets. Particular processes performed in this manner and materials employed in such processes are described, for example, in 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 concept of photographic processing involves the provision of the fluid between the sheets and the movement of the sheets between a pair of juxtaposed members, usually capable of exerting compressive pressure for spreading the fluid in a thin layer between the sheets to form a sandwich. One approach to supplying the fluid between the sheets, particularly elongated sheets comprising a plurality of areas to be treated, is, as previously indicated, to supply the fluid continuously from some type of dispensing device, such as a nozzle, between the sheets as the latter are advanced continuously relative to the nozzle. Not only is this type of apparatus designed especially for continuous rather than intermittent operation, but its complexity and bulk usually makes it unsuited for incorporation into photographic apparatus such as a camera intended for intermittent manual operation. There are a number of factors which render this approach unsuited for intermittent operation including for example: the problems involved in stopping and starting; mechanisms required for arresting and reinstituting of the flow of a fluid which may be quite viscous; the sealing of the fluid dispensing device against both the leakage of fluid and the admission of air particularly when the device is not in use; and a number of problems involved in the handling and dispensing of a fluid, subject to both oxidation and hardening, at an accurately controlled volume rate.

Another approach to supplying and dispensing a fluid has been proposed which is adapted to apparatus designed for intermittent and/or manual operation. This is to be found, for example, in the so-called "Land" camera manufactured and sold by Polaroid Corporation. In this approach, a quantity of fluid sufficient to treat a predetermined area of a sheet is provided in an individual container and is dispensed from the container onto one of the

sheets for subsequent distribution in contact with the area to be treated. This, of course, necessitates the provision of a plurality of containers when a plurality of areas are to be treated and the containers must be fabricated, filled, stored and provided in association with the sheets, and ruptured and their fluid contents dispensed. The fluid is usually provided in each container in an amount greater than that required for treating an area so that provision must be made for trapping and retaining any excess fluid from each container.

There are, of course, numerous advantages to each of these systems, and it is these advantages which characterize the photographic processing apparatus of the invention. The invention is equally useful for both continuous and intermittent processing; it provides for all of the fluid for a plurality of areas in a single container with a single fluid-dispensing nozzle; both the container and nozzle are of an inexpensive construction such that they can be discarded after the treatment of a predetermined number of areas; sealing and unsealing the container and nozzle is effected simply and automatically; the amount of fluid and sheet material wasted, for example, between processed areas is minimized; no provision for trapping of excess fluid is required; only the proper amount of fluid is dispensed regardless of the rate of movement of the sheets; the quantity of fluid dispensed is controlled automatically; the sheets, container and nozzle require a minimum of space within apparatus which is dependable in its operation but not complex in its construction.

Reference is now made to FIGURE 1 of the drawings wherein there is illustrated photographic apparatus in the form of a hand-held camera 10 embodying the invention. Camera 10 comprises a housing including a forward wall 12 having recessed or re-entrant sections 14 extending rearwardly to an inner forward wall 16, side walls 18, and a rear wall 20. The walls of the housing cooperate to provide chambers at opposite ends of the housing and an exposure chamber located between inner forward wall 16 and rear wall 20. Camera 10 includes a conventional lens and shutter assembly designated 22 coupled to the camera by a bellows 24 joined to the lens and shutter assembly and to inner forward wall 16 around the edges of an exposure aperture 26 provided in the inner forward wall for transmitting light from the lens to a photographic image-recording sheet positioned within the exposure chamber between inner forward wall 16 and rear wall 20. The bellows and the camera housing are constructed so that the shutter assembly can be displaced from the extended operative position shown in FIGURE 1 to a folded or closed position at which the bellows is collapsed within the recess described.

The photographic image-recording material comprising, for example, a gelatino silver halide emulsion carried on a flexible support sheet, is designated 28 and is supplied as a roll preferably coiled on a spool 29 mounted within a chamber 31 provided at one end of the housing. Image-recording sheet 28 extends from chamber 31 at one end of the housing between inner forward wall 16 and rear wall 20 across exposure aperture 26 in the rear wall to a chamber 33 at the opposite end of the housing. The rear surface of wall 16 is preferably located at the focal surface of the lens of assembly 22, and guide rolls 30 are provided adjacent opposite ends of aperture 26 for holding sheet 28 in position for exposure against the rear surface of inner forward wall 16.

As previously indicated, the photosensitive image-recording sheet is treated with a fluid in conjunction with a second sheet. This second sheet designated 32 is supplied in a coiled condition, and the coil designated 34 of second sheet 32 is mounted within chamber 33. A pair of juxtaposed members are provided for superposing the photosensitive and second sheet and aiding in the distribution of the processing fluid in a layer between the sheets, and in the form shown, these members comprise a pair of pressure-applying rolls 36 and 38 mounted in juxtaposition

with chamber 33 adjacent an end of wall 16 between the latter and coil 34. Photosensitive sheet 28 is guided from spool 29 toward the opposite end of the housing between wall 16 and rear wall 20 and around roll 38 and between the rolls toward the rear of the camera. Second sheet 32 is guided from coil 34 around roll 36 into superposition with sheet 28 between rolls 36 and 38. A passage 40 is provided in rear wall 20 in alignment with the gap between rolls 36 and 38 to permit the withdrawal of sheets 28 and 32 from the housing. The sheets are thus guided along convergent paths into superposition between the rolls, and it is between the convergent portions of these sheets at the bite of the rolls that the fluid-processing composition is introduced.

In accordance with the invention, means are provided within chamber 33 for introducing the processing fluid between the sheets; and in the form shown in FIGS. 2 through 4, this means comprises a nozzle 42 coupled with a collapsible container 44. Container 44 is shown as being pleated or formed in the shape of a bellows so that the container may be compressed to eject substantially all of its fluid contents into nozzle 42 which is coupled with the container, and in the form shown, comprises an integral portion of the container. The container and nozzle are both preferably formed of a material which is impervious to the fluid and to air and has some flexibility and resiliency, various organic plastics and rubber being suited for this purpose. As examples of suitable materials, mention is made of high density polyethylene, polypropylene, polyvinylidene chloride, and polyethylene terephthalate resins. The body of the container may take a number of different forms such as collapsible bags and envelopes which are coupled with the nozzle and which may be compressed either by means in the camera or by virtue of their own resiliency for exerting pressure on the fluid and ejecting the fluid contents of the container. In the form shown in FIGURE 1, a spring 46 is provided within chamber 33 for compressing container 44 so as to collapse the container and cause the complete discharge of its fluid contents. As previously indicated, other means are conceivable for maintaining the fluid in the container under pressure and thereby causing the ejection of the fluid contents of the container. In addition to resilient means within the camera, such means may include means which are a part of or are coupled with the container including, for example, a spring or other elastic means engaged with or around the container so as to exert compressive pressure on the container, or providing the necessary pressure on the fluid to cause its ejection by an inert gas introduced into the container under pressure along with the fluid.

Nozzle 42 includes a generally rectangular and comparatively rigid base section 48 coupled with container 44 and having a central rectangular opening, a pair of thin flexible lips 50 extending from the sides of the openings and tapered end walls 52 extending from the ends of the opening cooperating with the lips, which converge toward one another, to define a tapered passage or recess 54 terminating in a very narrow elongated mouth 56 through which the fluid contents of container 44 are dispensed. The material comprising lips 50 and end walls 52 and the construction of the lips and end walls of the nozzle are designed so that mouth 56 can be sealed by the application of compressive pressure at the edge portions of the lips.

As shown in FIG. 2, the photosensitive and second sheet 28 and 32 are drawn around and between pressure-applying rolls 36 and 38 through a gap between the rolls. Movement of the sheets through the apparatus of FIGURE 1 and between the pressure-applying rolls is preferably accomplished by engaging portions of the superposed sheets extending from between the rolls, either within the housing of the camera or outside of the housing at passage 40, and applying tension to the sheets for advancing the sheets. In the operation of camera 10, an area of photosensitive sheet 28 positioned across aper-

ture 26, is exposed, and this area is advanced into superposition with a corresponding area of second sheet 32 between pressure-applying rolls 36 and 38 while the fluid contents of container 44 are distributed from nozzle 42 in a thin layer between the sheets to form a sandwich; and the sandwich is advanced through opening 40 from the camera housing until the exposed area has been withdrawn from the camera. Movement of the sheets is then discontinued to permit another succeeding area of the photosensitive sheet to be exposed. The portion of the sandwich comprising the previously exposed area of photosensitive sheet 28 may be severed from the remainder of the sandwich extending between rolls 36 and 38. The diameter of at least roll 38 is relatively small, as is the distance between the end of aperture 26 and roll 38, so that the length of the material between successive exposed areas of image-recording sheet 28 can be maintained at a minimum thereby effectively reducing the amount of sheet material between exposed areas, which material is largely waste. The sandwich is, of course, severed as close as possible to rolls 36 and 38 leaving only sufficient material to allow the sandwich to be engaged for withdrawing the sandwich from the camera between the pressure-applying rolls.

The operation of the apparatus for supplying and distributing the processing fluid and for sealing the container between processing operation is illustrated in FIGS. 2 and 3. Nozzle 42 is located with lips 50 extending toward the bite of the rolls between convergent portions of sheets 28 and 32 with the outer surfaces of at least the edge portions of the lips located in face-to-face contact with the facing surfaces of the sheets. When rolls 36 and 38 are in the operative or spreading position shown in FIG. 2, the maximum width of the gap at the narrowest portion of the gap between the rolls is fixed. In the case of the cylindrical rolls shown, this narrowest portion of the gap occurs at a plane through the axes of the rolls and is approximately equal to the combined thicknesses of the photosensitive and second sheets and the thickness of the layer of fluid to be distributed between the sheets. For example, if the processing involves two sheets having a total combined thickness of .004 inch and the layer of fluid is to have a thickness of .003 inch, then the width of the gap at its narrowest portion will be about .007 inch. Lips 50 extend between the convergent sheets within the convergent passage between the sheets to a position short of a plane through the axes of the rolls so that the width of mouth 56 is substantially equal to the thickness of the layer of fluid, i.e., the spacing between the sheets at the narrowest portion of the gap. The length of mouth 56 is preferably equal in length to the width of the area of the photosensitive sheet to be treated with the fluid.

The processing fluid is preferably quite viscous, having a viscosity at 24° C. in excess of 1,000 centipoises and ranging from 1,000 to 200,000 centipoises. The pressure exerted on the fluid is preferably just sufficient (although it may be greater), to cause the fluid to flow into convergent recess 54 to mouth 56 of the nozzle and preferably insufficient to cause any appreciable flow of the fluid from mouth 56. The moving fluid, being quite viscous, tends to adhere to the surfaces of sheets 28 and 32, and it is mainly this phenomena which causes the fluid to be withdrawn from the mouth of the nozzle as a layer between the sheets as the sheets move past the edges of lips 50 adjacent mouth 56. It is possible to adjust the pressure exerted on the fluid so that the fluid will flow from the mouth of the nozzle only when the sheets are in motion relative to the nozzle and only at a rate sufficient to provide a layer of the desired thickness between the sheets. The flow of the fluid within recess 54 towards mouth 56 results in pressure being exerted outwardly on the lips of the nozzle thereby pressing the outer surfaces of the lips against the surfaces of the sheets and preventing both the entrapment of air between the sheets and the escape

of fluid outside of the lips between the lips and the sheet.

Another advantage of this structure resides in the fact that the fluid is prevented from contacting the sheets until an extremely short time before the sheets are located in superposition a predetermined distance apart. This permits the use of fast-acting reagents and/or relatively slow sheet advancement rates, since there is an extremely short time lapse between contact of the sheets and fluid, and superpositioning of the sheets. For a better understanding of the advantages of this system, reference may be had to the copending U.S. patent application of Herman Erikson entitled "Photographic Processing Apparatus," Serial No. 159,227, filed on an even date herewith.

When the apparatus is not being used for treating an exposed area of the photosensitive sheet with the fluid, and the sheets are no longer being advanced between the pressure-applying rolls, the rolls are moved to an inoperative or sealing position at which the rolls compress the lips of the container toward one another so as to seal mouth 56. The sealing action of the rolls is illustrated in FIG. 3, in which the rolls are shown displaced from the operative position of FIG. 2 in a direction opposite the direction of movement of the sheets between the rolls, so that the edge portions of lips 50 are located within the bite of the rolls at the narrowest portion of the gap between the rolls. This movement of the rolls from their operative to inoperative position may also involve (as shown) a slight displacement of the rolls apart from one another necessitated by the fact that the combined thicknesses of the two lips may be in excess of the thickness of the layer of fluid, i.e., the gap between the sheets. Using the example previously given of sheet thicknesses totaling .004 inch, each of the lips may have a thickness of .003 inch so that the gap between the rolls in the sealing position is .010 inch as opposed to the .007 inch gap during fluid spreading. As the rolls are displaced from the spreading to the sealed position in a direction opposite the direction of the movement of sheets and toward the container, the lips are required to remain substantially stationary; and it is for this purpose that base section 48 of the nozzle is made substantially more rigid than the lips, since it functions as a support for the lips during movement of the rolls into sealing position.

A number of different mechanisms are available for effecting the movement of the pressure-applying rolls between their operative and nozzle-sealing positions. These mechanisms may embody approaches ranging from manually operated devices on one hand, to devices which are substantially automatic in their operation and operate in response to movement of the sheets. Apparatus of this latter type is illustrated in FIG. 5 and is operative by direct engagement with the sheets to move the rolls into fluid-spreading position in response to movement of the sheets and to move the rolls into nozzle-sealing position when movement of the sheets is discontinued. The device shown in FIG. 5 is designed for incorporation in the camera of FIGURE 1 and includes a pair of arms 58 on which roll 36 is pivotally mounted at its ends. Each of arms 58 is pivotally mounted at its end opposite roll 36 on a pivot 60 in turn mounted in fixed position on the camera housing within chamber 33. Roll 38 is mounted at its ends on a pair of levers 62 each pivotally mounted intermediate its ends on a pivot 64. Each of arms 58 is provided on its free end (adjacent roll 36) with a pair of fingerlike projections 66 in the form of gear teeth disposed in engagement with a similar projection 68 on the end of lever 62 adjacent roll 38. Projection 68 is engaged between projections 66 so that arms 58 and levers 62 pivot simultaneously with one another. Each of rolls 36 and 38 is pivotally mounted at its ends on arms 58 and lever 62, respectively, and on shafts 70 which extend from the ends of each roll. The spacing between the axes of pivot 60 and shaft 70 along each of arms 58 is equal to the spacing between pivot 64 and shaft 70 along each of levers 62 so that each of the rolls describes substantially the same

movement as the other when the arms and levers are pivoted simultaneously. The axes of shafts 70, it should be noted, lie along on a line parallel with a line through the centers of pivots 60 and 64, which further insures the proper and substantially identical movement of the two rolls.

A spring 72 is provided engaged between the camera housing and the end of each of levers 62 opposite roll 38 for pivoting each lever so as to bias rolls 36 and 38 into the nozzle-sealing position shown in FIG. 5. Sheets 28 and 32 extend from opposite directions toward one another around portions of the roll peripheries and into superposition between the rolls, and the movement of the sheets between the rolls is in substantially the same direction as movement of the rolls from the nozzle-sealing to the fluid-spreading position. The line of centers of the rolls is displaced from the line of centers of pivots 60 and 64 in a direction opposite to the direction of movement of the sheets between the rolls when the rolls are in fluid-spreading position. Means are provided in the camera for exerting a drag on at least sheet 28 at a location between roll 38 and the trailing end of the sheet. This drag causes tension to be exerted on sheet 28 as the sandwich comprising sheets 28 and 32 is pulled between the rolls; and the arrangement of the rolls and their mounting arms and levers is such as to cause the arms and levers to pivot moving the rolls into the fluid-spreading position when movement of the sheets is initiated. The tension on sheet 28 is sufficient to cause the pivotal movement of levers 62 against the bias of springs 72 and remains sufficient to maintain the rolls in fluid-spreading position for as long as movement of the sheets is continued. As soon as the operator discontinues drawing the sandwich between the rolls, the tension on sheet 28 is immediately relieved, and springs 72 then cause levers 62 to move the rolls into the nozzle-sealing position. Various expedients may be employed for maintaining tension on sheet 28, and these include mounting guide rolls 30 in such a way as to inhibit their rotary movement in response to engagement with moving sheet 28; or by providing means for otherwise restraining the movement of sheet 28 including means for inhibiting the rotation of roll 38, and means coaxing with spool 29 on which sheet 28 is coiled to inhibit the rotation of the spool. Means are also provided for limiting the movement of levers 62 between the nozzle-sealing and fluid-spreading positions and, in the form shown, comprise a pin 74 mounted on each of levers 62 and engagement in a slot 76 formed in the means, such as the camera housing or other fixed member, on which levers 62 are pivotally mounted.

Movement of the sheets through the apparatus, shown in the form of a camera by way of example, is effected manually by engaging the portion of the sandwich extending between the pressure-applying rolls and pulling the sandwich from the camera. Movement of the rolls between fluid-spreading and nozzle-sealing positions is effected substantially automatically by engagement of the sheets with the rolls by virtue of the means for mounting the rolls. Other means are contemplated for both advancing the sheets to effect their processing and moving the rolls between their operative and inoperative positions. For example, the sheets can be advanced through the apparatus and processed by driving either or both rolls 36 and 38. In this embodiment, the drive means would be coupled either directly or through one of the sheets to means for moving the rolls between their operative and inoperative positions. This last-mentioned means might also include a metering device for controlling the lengths of the sheets advanced during each operation of the camera. The drive means (for rotating the rolls) may be a direct manual drive, or a motor of some type powered by any conventional energy storage device such as a spring, battery, etc.

Various other forms of nozzles, fluid-spreading and nozzle-sealing devices are conceivable, and fall within the

scope of the present invention. One of these alternative forms is shown, by way of example, in FIG. 6 and comprises a nozzle including a pair of flexible lips 78 which may comprise extensions of the walls of a bag-like container formed of thin flexible water- and air-impervious sheet material. One of lips 78 is also provided with a stiffening member 79 which helps to support lip 78 both during fluid spreading and nozzle sealing. The fluid-spreading or pressure-applying members, in the form shown, comprise a fixed member 80 having a generally flat or planar support surface 82 and a rotary cylindrical roll 84 mounted in juxtaposition with surface 82 of member 80 and movable with respect to member 80 in the direction of movement of sheets 28 and 32 between member 80 and roll 84 and toward and away from surface 82. One of the sheets (herein shown as 28) is guided around a portion of roll 84 into superposition with the other sheet (32) between roll 84 and support surface 82. The roll and fixed member cooperate to define a convergent passage having a minimum gap (in the operative or fluid-spreading position shown) approximately equal to the combined thicknesses of the sheets and layer of fluid. The nozzle-comprising lips 78 extend into the space between convergent portions of the sheets within the convergent gap between the roll and fixed member. With each of the lips being disposed with at least a portion of its outer surface in contact with one of the sheets, the nozzle extends into the space between convergent sheets to an extent such that the opening between the lips is approximately equal to the thickness of the layer of fluid. Roll 84 can be mounted in a manner similar to roll 38 for movement with respect to fixed member 80, from the operative position shown, in a direction opposite the direction of movement of the sheets and away from member 80 into inoperative or nozzle-sealing position at which roll 84 compresses lips 78 against one another and sheet 32 supported on surface 82 of member 80. The movement of roll 84 between the operative and inoperative positions thereof may, of course, be substantially automatic as is the movement of roll 38.

Another embodiment of the invention is illustrated in FIG. 7 in which the pressure-applying members are shown as a pair of elements 88 having opposed support surfaces 90 having convergent curved portions and generally parallel planar portions cooperating to define a convergent passage between the elements. Pressure elements 88 are fixed with respect to one another so that the dimensions and configuration of the convergent passage do not change. The nozzle designated 92 is similar in construction to the nozzle of FIG. 6 and comprises a pair of thin flexible lips 94 to which are attached comparatively rigid support members 96. The lips are spaced from one another to provide a discharge mouth 98 substantially equal in width to the layer of fluid to be spread between sheets 28 and 32 and extend into the space between convergent portions of the sheets within the convergent passage between elements 88 to positions wherein the outer surfaces of the lips contact the facing surfaces of the sheets in the operative or fluid-spreading position of elements 88. To seal the lips of the nozzle, pressure elements 88 are moved together with respect to and toward lips 94 in a direction opposite to the direction of movement of the sheets through the passage between elements 88. Elements 88 may be mounted in the same manner as roll 38 so that movement of elements 88 is substantially automatic.

In the embodiment of the invention shown in FIG. 8, the fluid-spreading device comprises a pair of fixed members 100 and 102 having opposed support surfaces designated, respectively, 104 and 106. Support surface 106 is substantially planar as is support surface 104 with the exception of an edge portion thereof which is curved so as to converge toward support surface 106 and defines the entrance of a passage between members 100 and 102 of substantially uniform width throughout most

of its length. A generally cylindrical roll 108 is provided mounted for rotation in juxtaposition with a portion of support surface 106 adjacent the entrance to the passage between surfaces 104 and 106, and cooperates with surface 106 to define a convergent gap into which sheets 28 and 32 extend. One of the sheets (herein shown as sheet 28) extends around a portion of roll 108 between the latter and support surface 106 and thence into the passage between support surfaces 104 and 106 of members 100 and 102. Sheet 32 extends into superposed relation with sheet 28 between the latter and support surface 106 on which sheet 32 is supported. Nozzle 110 is basically the same as the nozzles of FIGS. 6 and 7 and includes a pair of flexible lips 112 to which are attached more rigid backing members 114. Edge portions of lips 112 extend beyond backing members 114 into the space between convergent portions of sheets 28 and 32 within the gap between roll 108 and fixed member 102. The width of this gap is approximately equal to the combined thicknesses of the two sheets, the lips and the layer of fluid to be spread between the two sheets, so that the width of mouth 116 between the edges of the lips is substantially equal to the thickness of the layer of fluid.

Sealing of lips 116 is effected by displacing roll 108 from the operative fluid-spreading position shown in FIG. 8, toward surface 106 of fixed member 102 so as to compress the lips between portions of the sheets located within the gap between roll 108 and member 102. A suitable mechanism is, of course, provided in the camera for mounting roll 108 and moving the roll between its operative and inoperative positions. Such a mechanism might operate on much the same principle as the mechanism of FIG. 5 and would comprise, for example, means mounting the roll for movement toward and away from fixed member 102 and means for urging the roll toward the fixed member into nozzle-sealing position. The force of this last-mentioned means, for example, a spring, would be sufficient to effect sealing of the nozzle while permitting movement of the roll away from member 102 into operative position in response to the application of tension to sheet 28 in response to withdrawal movement of the sheets between members 100 and 102.

The container of processing fluid with a nozzle attached may be supplied as a unit together with a supply of photosensitive and print-receiving sheets; it would contain sufficient processing fluid to effect the treatment of the sheets with which it is supplied; and can be of a construction sufficiently inexpensive to be expendable following processing of the sheet material. The construction of the container may be such that the fluid is maintained under pressure at all times, that is, both prior to loading into the camera and while it is within the camera. Such an arrangement might necessitate the provision of means for sealing the nozzle prior to loading of the container and nozzle into the camera at which time the mechanism of the camera would take over the sealing of the nozzle. Suitable sealing means may be as simple as a clip provided in engagement with the lips of the nozzle for compressing the lips and adapted to be removed from engagement with the lips prior to or during loading of the camera; or the photosensitive and print-receiving sheets may be initially supplied with portions thereof extending in contact with the outer surfaces of the lips of the nozzle and into superposition adjacent the mouth of the nozzle. In this embodiment, such means as a clip for retaining the lips in a sealed condition might extend outside of the sheets and compress the lips through the sheets in much the same manner as the mechanism of the camera. Alternative sealing arrangements may include, for example, securing the sheets to one another and to the nozzle so that the sheets form a seal which is ruptured on the first occasion that the sheets are advanced within the apparatus relative to the nozzle.

The operation of the camera shown in FIGURE 1 is quite simple, requiring only that the operator advance

the sandwich from the camera through opening 40 after each exposure is made. The fluid is spread in a layer of the correct, predetermined thickness automatically during movement of the sheets; and the nozzle, which dispenses the fluid at the proper rate, is sealed when movement of the sheets is discontinued and opened when movement of the sheets is recommenced. During exposures and periods when the camera is not in use, the sheets are permitted to contact only the minute amount of fluid which comprises the layer between the short portions of the sheets extending from between the fluid-spreading members and immediately adjacent the sealed mouth of the nozzle of the edges of the lips. The advantages of this system are quite apparent when it is realized that the material comprising the sheets may be capable of absorbing the fluid, e.g., water, which, if permitted to occur with any appreciable amount of fluid, might result in weakening of the physical strength of the sheets, swelling of the sheets, and depletion of the fluid. Moreover, the length of the portions of the sheets between exposed and processed areas of the sheets (and constituting waste material) is substantially restricted as a result of the relatively small dimensions possible with the construction of the invention.

Since certain changes may be made in the above apparatus and product 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 successive areas of a photographic image-recording sheet with a fluid composition distributed in contact with said sheet, said apparatus comprising, in combination:

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

said members cooperating to provide a convergent passage between said members through which said sheets are movable in superposition, at least one of said members including a curved surface subtending an angle at least of the order of 90° and defining one side of said passage;

a fluid dispensing nozzle for dispensing said fluid between and in contact with convergent portions of said sheets in the region of said members;

said nozzle including an end section terminating in opposed flexible lips defining therebetween a narrow elongated discharge mouth substantially equal in length to the width of said areas of said image-recording sheet;

said nozzle being so positioned with respect to said members as to locate the outer surfaces of said lips in face-to-face contact with the inner opposed surfaces of said convergent portions of said sheets;

means coupled with said nozzle for supplying said fluid to said nozzle under pressure sufficient to cause said fluid to flow into a cavity defined by said lips and terminating in said discharge mouth;

means mounting at least said one member for movement with respect to said nozzle between a first position at which said members press on said lips through said sheets to close said mouth against the flow of fluid between said lips and a second position in which the pressure on said lips is relieved and said mouth is free to open, said one member being mounted for movement from said first position into said second position in the direction of movement of said sheets through said passage;

means for biasing said one member into said first position; and

means for guiding one of said sheets around and in contact with said curved surface for moving said one member against said bias from said first to said second position in response to movement of said one

sheet around said one member against said curved surface thereof.

2. Photographic apparatus for treating successive areas of a photographic image-recording sheet with a fluid composition distributed in a layer of predetermined thickness in contact with said sheet, said apparatus comprising, in combination:

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

said members cooperating to provide a convergent passage between said members through which said sheets are movable in superposition;

at least one of said members including a curved surface subtending an angle at least of the order of 90° and defining one side of said passage;

a fluid dispensing nozzle for dispensing said fluid between and in contact with convergent portions of said sheets within said passage;

said nozzle including an end section terminating in two thin, flexible lips defining therebetween a narrow elongated discharge mouth substantially equal in length to the width of said areas of said image-recording sheet;

said nozzle being so positioned with respect to said members as to locate the outer surfaces of said lips in face-to-face contact with the inner opposed surfaces of said convergent portions of said sheets;

means coupled with said nozzle for supplying said fluid to said nozzle under pressure sufficient to cause said fluid to flow into a cavity defined by said lips and terminating in said discharge mouth;

means mounting at least said one member for movement with respect to said nozzle between a first position at which said members press on said lips through said sheets to close said mouth against the flow of fluid between said lips and a second position in which the pressure on said lips is relieved and said mouth is free to open;

means for biasing said one member into said first position; and

means for guiding one of said sheets around and in contact with said curved surface for moving said one member from said first to said second position in response to movement of said one sheet around said one member against said curved surface thereof.

3. The photographic apparatus of claim 2 wherein said other member is fixed against movement with respect to said nozzle, said one member is movable with respect to said nozzle and said other member between said first and second positions, and said second position of said one member is displaced from said first position in the direction of movement of said sheets between said members.

4. The photographic apparatus of claim 3 wherein the gap between said members at the narrowest portion of said passage is greater at the said first position of said one member than at the said second position of said one member.

5. The photographic apparatus of claim 2 in which the gap between said members at the narrowest portion of said passage is approximately equal to the combined thicknesses of said sheets and said layer of fluid when said members are in said second position and approximately equal to the combined thicknesses of said sheets and said lips when said members are in said first position.

6. The photographic apparatus of claim 2 wherein both of said members are mounted for movement from said first position relative to said lips in the direction of movement of said sheets through said passage, are biased into said first position and are coupled with one another for movement into said second position in response to movement of said first sheet around said first member against said curved surface thereof.

7. The photographic apparatus of claim 6 wherein said

members are mounted for movement along convergent arcuate paths between said first and second positions.

8. The photographic apparatus of claim 6 wherein said one member is moved in the direction of movement of said sheets through said passage from said first to said second position and said nozzle is positioned with the edges of said lips at said mouth extending to a position short of said narrowest portion of said passage when said members are in said second position.

9. The photographic apparatus of claim 6 wherein the width of said elongated discharge mouth is substantially equal to the thickness of said layer of fluid when said members are in said second position.

10. Photographic apparatus for treating successive areas of a photographic image-recording sheet with a fluid composition distributed in contact with said sheet, said apparatus comprising, in combination:

a pair of members at least equal in length to the width of said areas;

means for mounting said members in juxtaposition; at least one of said members including a curved surface portion cooperating with a surface portion of the other of said members to provide a convergent passage between said members through which said sheet is movable in a predetermined direction;

means for guiding said sheet in a second direction around said surface portion of said one member and between said members;

a nozzle including sections providing a discharge mouth disposed between said surface portions within said convergent passage for dispensing said processing fluid through said mouth onto said sheets;

means for maintaining tension on at least the portion of said sheet extending along in said second direction and around said one member during movement of said sheet in said second direction toward and around said one member and between said members;

the first-mentioned means mounting at least said one member for movement between first and second positions;

said member in said first position defining a passage of predetermined width at the narrowest portion of said passage, and said one member being movable toward said other member and in the direction of movement of said sheet therebetween into said second position to reduce the width of said passage;

and means for urging said one member into said first position to press said sections of said nozzle together closing said discharge mouth;

said one member being movable into said second position by engagement of said sheet with said one member during movement of said sheet around said one member and through said passage between said members.

11. Photographic apparatus for treating successive areas of a photographic image-recording sheet with a fluid composition distributed in contact with said sheet, said apparatus comprising, in combination:

a pair of members at least equal in length to the width of said areas;

members at least equal in length to the width of said areas;

means for mounting said members in juxtaposition; at least one of said members including a curved surface portion cooperating with a surface portion of the other of said members to provide a convergent passage between said members through which said sheet is drawn in a first direction;

means for guiding said sheet in a second direction toward and around said surface portion of said one member and through said passage between said members;

a nozzle including sections providing a discharge mouth disposed between said surface portions within said

13

convergent passage for dispensing said processing fluid through said mouth onto said sheets;
 means for maintaining tension on at least the portion of said sheet extending in said second direction around said one member and through said passage during movement of said sheet through said passage;
 the first-mentioned means mounting both of said members for movement between first and second positions;
 said members in said first position defining a passage of predetermined width at the narrowest portion of said passage and being movable toward one another and in the direction of movement of said sheet therebetween into said second position at which the width of said passage is reduced;
 means for urging said members into said first position to press said sections of said nozzle together closing said discharge mouth;

5

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15

14

said one member being movable into said second position by engagement of said sheet with said one member during movement of said sheet around said one member and through said passage between said members;
 and means coupled between said one member and the other of said members for moving said other member into said second position in response to movement of said one member into said second position.

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