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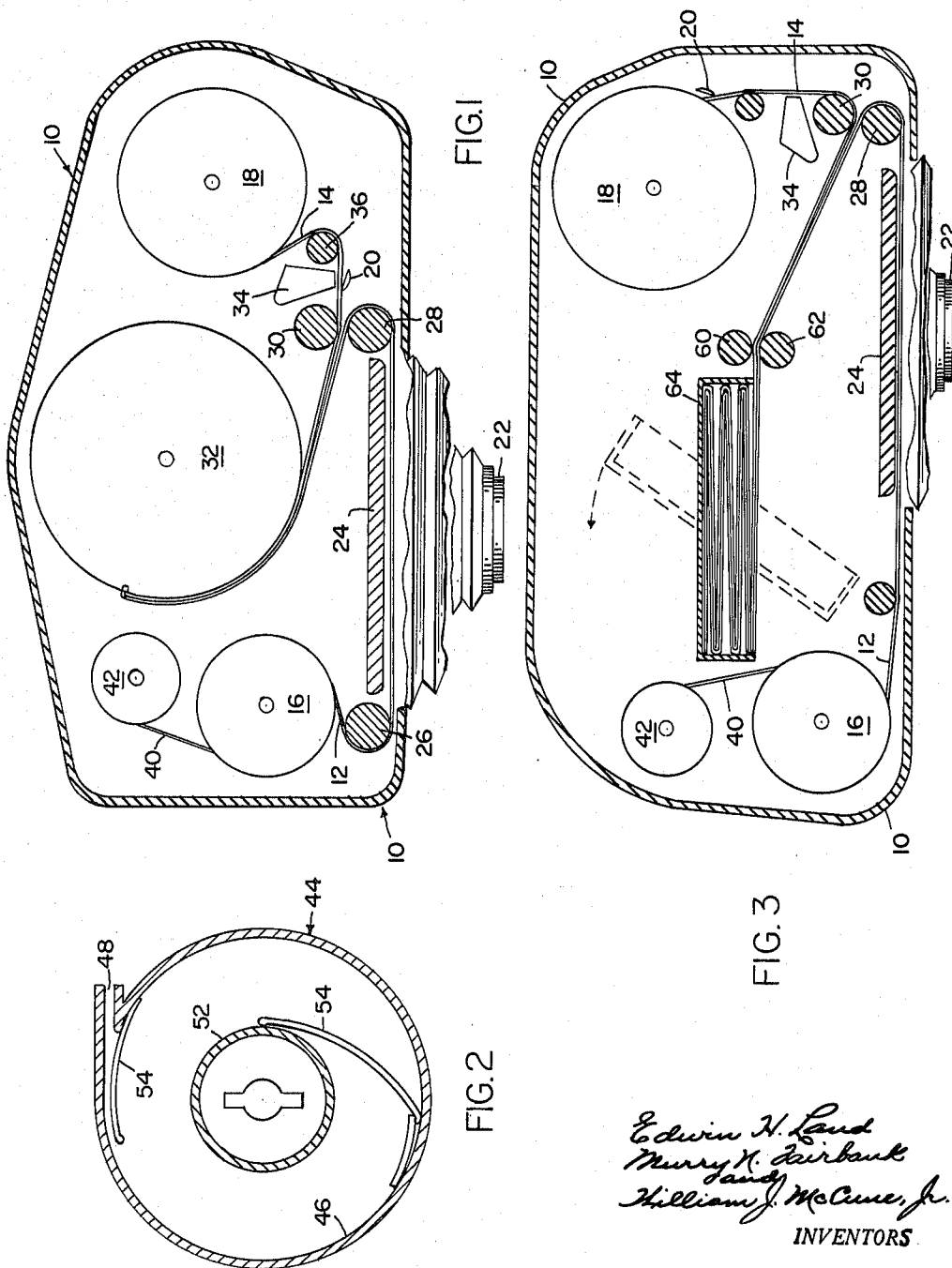
E. H. LAND ETAL

3,249,434

PROCESS FOR RECOVERING PROCESSED PHOTOGRAPHIC SHEET MATERIAL

Filed March 16, 1961

3 Sheets-Sheet 1



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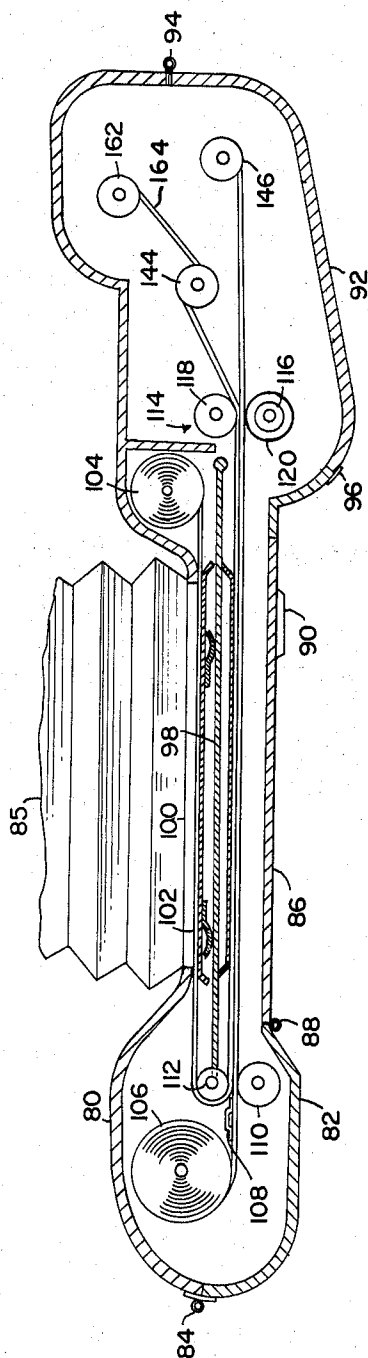
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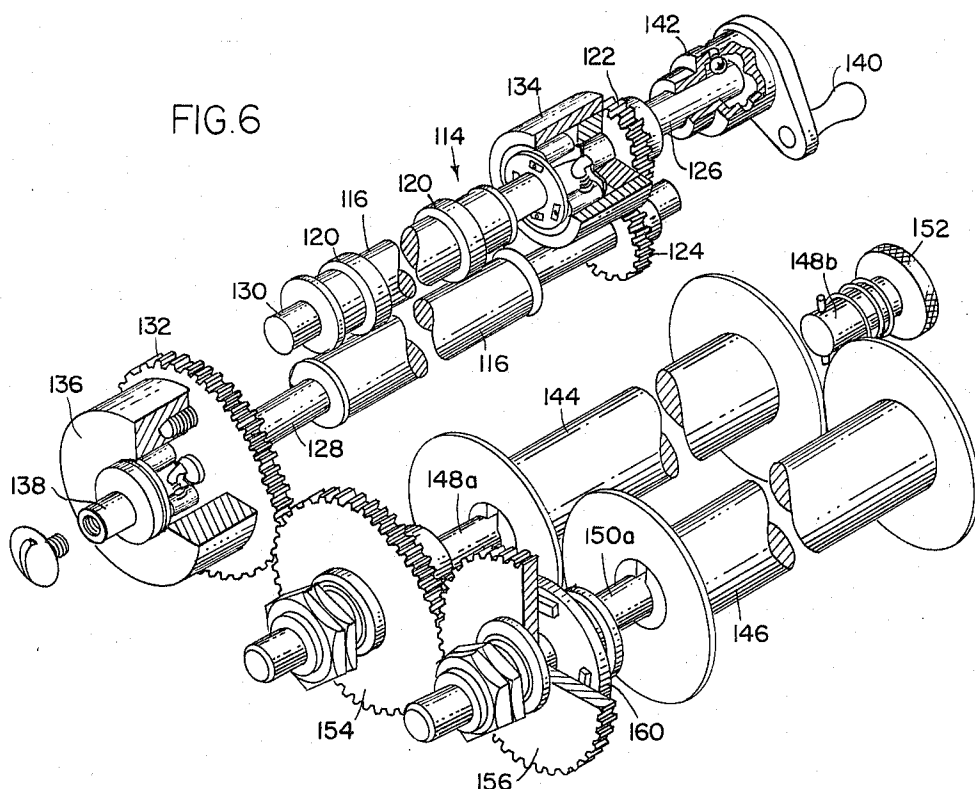
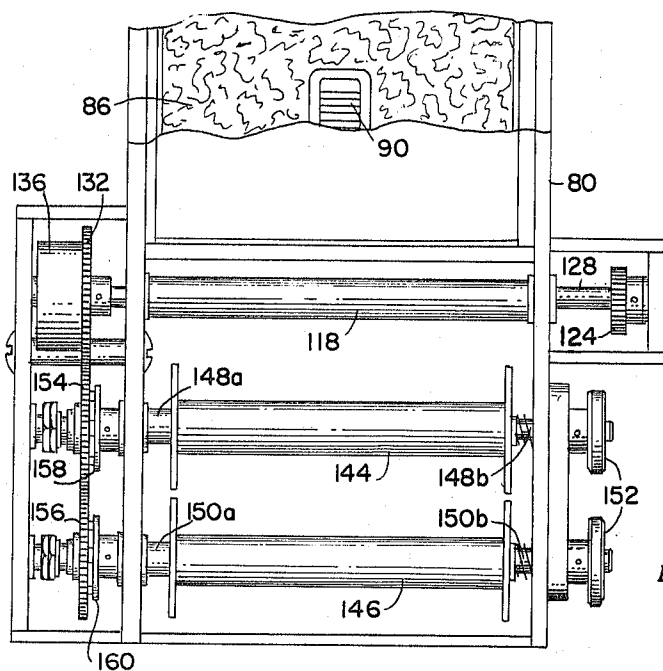


FIG. 5

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3,249,434

**PROCESS FOR RECOVERING PROCESSED
PHOTOGRAPHIC SHEET MATERIAL**

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The portion of the term of the patent subsequent to October 10, 1978, has been disclaimed.

9 Claims. (Cl. 96—29)

This application is a continuation in part of copending application Serial No. 537,464, filed September 29, 1955, and now Patent No. 3,003,871, issued October 10, 1961.

This invention relates to photography and more particularly to a novel method of recovering photographic sheet materials.

An object of the present invention is to provide a novel method of recovering for further use a continuous strip of photosensitive sheet material which has been exposed and thereafter processed within camera apparatus.

Another object of the present invention is to provide a novel method of recovering in reusable condition a single continuous strip containing a plurality of succession of exposed frames which have been processed within camera apparatus by superposing exposed frames of a photosensitive strip with areas of another strip with a layer of processing liquid therebetween, said frame and area portions of the two strips having been maintained in superposed relation and substantially stationary with respect to one another during a predetermined processing period and thereafter separated and taken up on suitable storage means.

A still further object of the invention is to provide novel diffusion-transfer processes wherein there may be produced recoverable positive prints and recoverable negatives.

A still further object of the invention is to provide camera apparatus for carrying out photographic processes of the above types.

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

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

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

FIGURE 1 is a diagrammatic sectional view of one apparatus capable of performing the method of the invention;

FIG. 2 is a diagrammatic sectional view of a component of the apparatus of FIG. 1;

FIG. 3 is a schematic view of an alternative embodiment of the apparatus of FIG. 1 illustrating another method of the invention;

FIG. 4 is a top schematic view of another apparatus illustrating the method of the invention;

FIG. 5 is a plan view of the assembly for advancing photographic sheet materials with the camera apparatus of FIG. 4 and for separating, winding and storing the photographic sheet materials after photoexposure and processing with the camera apparatus; and

FIG. 6 is a perspective view illustrating the assembly of FIG. 5.

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Photographic processes and apparatus of the type herein disclosed generally include the steps of and means for processing a plurality of successive exposed frames of a strip of a photosensitive sheet material by superposing said exposed frames with areas of another strip and spreading a thin layer of processing composition therebetween. The photosensitive strip includes a layer of photosensitive material, preferably an emulsion of silver halide, in which a latent image may be attained by differential exposure to actinic light. The other strip may merely aid in the distribution of the processing liquid, but is preferably adapted to serve as a support for an image-receptive layer in which a visible print of a latent image in the photosensitive layer may be produced. The processing composition, when spread in a uniformly thin layer between each exposed frame of the photosensitive strip and an area of the other strip, preferably effectuates a silver halide diffusion transfer-reversal process by which a latent image in the photosensitive strip is developed and a positive print is produced in the other strip. The processing composition, for example, may contain an aqueous solution of a silver halide developer such as hydroquinone, a silver halide solvent such as sodium thiosulfate and an alkali such as sodium hydroxide. In this processing, each exposed frame of the photosensitive strip and an area of the other strip are maintained in superposed relation with the layer of processing composition interposed between them for a predetermined processing period, during which the exposed silver halide of the photosensitive strip is reduced to silver and unreduced silver halide of the photosensitive strip forms a water-soluble complex silver salt which diffuses through the layer of composition to the other strip where, upon being reduced to silver, it forms a visible print. Examples of photographic materials useful in processes of the foregoing type are described in detail in Patent No. 2,543,181, issued to Edwin H. Land on February 27, 1951. It is, of course, to be understood that the processes and apparatus herein described are not limited to use with any particular species of photosensitive or other strips, the terms "photosensitive" and "other" being used in their broadest sense to indicate a first strip which is photosensitive and another strip which may merely aid in spreading the processing composition over the surface of the photosensitive strip and which may, if desired, possess other characteristics.

The minimum period during which the two strips must remain in superposed relation with a layer of processing liquid therebetween may vary greatly, depending on the nature of the specific materials being employed and their temperature during processing and may vary, for example, from several seconds to several minutes. At the end of this minimum period, the two strips may be maintained in superposed relation without substantial adverse effect during an additional period, also dependent on the nature and temperature of the materials, and which may vary from several seconds to several hours. This additional period, when added to the minimum processing period, defines the upper limit of the allowable processing period or the maximum time each exposed frame of the photosensitive strip may be permitted to remain in superposed relation with an area of the other strip with a layer of processing liquid therebetween. As shown in FIGS. 1 through 3, the entire length of exposed photosensitive strip starting at one end is superposed with the other strip with the processing liquid distributed between the strips, and the strips are maintained in superposed relation until the last frame of the photosensitive strip to be superposed has remained in superposition for at least the minimum processing period. After this, the two strips are separated commencing with the last frame to be superposed and this separation progresses at such a rate that the portions of the two strips including the first frame to be superposed

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are separated within the maximum allowable processing period. In FIG. 4 each exposed frame of the photosensitive strip is processed and then separated from the area of the other strip superposed therewith before or while the next exposed frame of the photosensitive strip is subjected to processing. As illustrated in FIG. 4, an individual exposed frame of the photosensitive strip is superposed with an area of another strip with the processing liquid distributed therebetween, and the frame and area of the strip are then maintained in superposed relation for at least the minimum processing period. After this, while the processed frame and area of the other strip are being separated, the processing of the next exposed frame of the photosensitive strip is commenced.

In many cases where a plurality of successive exposed frames of a strip of a photosensitive sheet material are processed within apparatus, it is very desirable to recover the processed frames in a single continuous strip. One difficulty heretofore experienced in attempting to recover such a processed photosensitive strip without damage or other adverse effects resided in that portions of the processed photosensitive strip wetted with processing fluid often became undesirably adhered together when wound or taken up on suitable storage means within the camera apparatus so that unwinding or separating of the wound or taken-up strip to achieve recovery thereof became impossible particularly if the wetted strip had been allowed to dry while on the storage means. In the present invention, in order to insure recovery of a processed photosensitive strip in suitable condition for further use where the strip of photosensitive sheet material is of a construction or composition which becomes adhered when wetted with processing fluid and taken up or rolled on suitable storage means within camera apparatus, there is provided a non-retentive interleaf strip material adapted to be taken up or coiled in superposed relation with the processed photosensitive strip on the storage means after separation of the processed strip from the other heretofore mentioned strip so as to prevent sticking or adherence of adjacent contacting portions or successive convolutions of the processed photosensitive strip due to the processing fluid. The interleaf strip may be formed of any suitable sheet material to which the processing fluid will not firmly adhere in the wet or dry state, nor disturb the latent image. The preferred interleaf strip material is therefore readily stripable or removable from the processed photosensitive strip, thus facilitating recovery of the processed photosensitive strip without damage or other adverse effects. In certain instances, the interleaf strip material may carry a coating which reacts with residual processing fluid on the processed photosensitive strip so as to aid in preserving the processed strip, for example by arresting the action of the processing fluid. Briefly, the method of the present invention comprises superposing successive exposed frames of a photosensitive strip with areas of another strip with a thin layer of a processing fluid interposed therebetween, separating the superposed portions of said strips upon termination of a predetermined processing period, superposing an interleaf strip with said photosensitive strip following separation of said photosensitive strip from said other strip, and advancing said superposed interleaf and photosensitive strips into a suitable storage member or means.

As a means for supporting and enclosing the various components of the camera, there is provided a light-tight housing generally designated at 10. Within housing 10 is mounted a supply of a photosensitive strip 12 and preferably comprising a suitable base and a suitable photosensitive layer on one side of the base. The photosensitive layer, for example, may be composed of a silver halide emulsion and is provided with a succession of frames which are adapted to receive a series of latent images upon exposure. A supply of a second strip, designated 14, is mounted within housing 10 and preferably comprises a base and a suitable image-receiving layer on one side of

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the base. The image-receiving layer, for example, may comprise one of the compositions now well known in the art which adapt it to receive, in successive image-receiving areas thereof, positive prints of the latent images in frames of photosensitive strip 12. Strip 12 is preferably coiled on a spool 16 of conventional design located within the housing adjacent one end thereof and strip 14 is preferably coiled on a somewhat larger supply spool 18 of conventional design pivotally mounted adjacent the other end of said housing. Spool 18 is somewhat larger than spool 16 in order to accommodate to greater cross-sectional bulk of strip 14, due in large measure to a succession of containers 20 provided for carrying a liquid processing composition. As shown, containers 20 are affixed to strip 14 at substantially regularly spaced intervals from a location adjacent its leading end toward its trailing end, the containers being so spaced that one container is associated with one image-receiving area. Each container is provided with a rupturable mouth facing the trailing end of strip 14, this mouth being adapted to eject processing composition when opposed compressional forces are applied to the container.

A conventional lens and shutter assembly, designated at 22, is mounted on a lower wall of housing 10 in position to direct light through an aperture in the lower wall of the housing. As a means for positioning successive frames of strip 12 for exposure to actinic light from the lens of assembly 22, there is provided such means as a guide plate 24 positioned between spools 16 and 18 and with its lower surface substantially at the focal surface of the lens. Successive frames of strip 12 are advanced in contact with the lower surface of plate 24 and are thereby positioned for exposure. A guide roll 26 is provided adjacent one end of plate 24 to aid in the positioning of the photo-sensitive strip on said plate and suitable means (not shown) may be provided for holding each frame of strip 12 in contact with the lower surface of plate 24 during exposure of the frames.

As a means for superposing successive frames of strip 12 with areas of strip 14 and distributing a processing liquid therebetween, there are provided a pair of pressure-applying rolls 28 and 30 mounted adjacent one end of plate 24 and with their axes in parallel relation. Rolls 28 and 30 are resiliently urged toward one another so that advancement, between the rolls, of a frame of strip 12 with an associated image-receiving area of strip 14 causes ejection of the processing composition from the mouth of a container 20 and spreading of the processing composition between the frame and area to form a sandwich. Within the sandwich the latent image in the frame is processed and a positive print is formed in the image-receiving area. Pressure roll 30 is mounted on means permitting roll 30 to be spaced apart from roll 28 so that the strips may be advanced between the rolls without causing distribution of the processing liquid.

The camera includes a means for storing the photosensitive and second strips in superposed relation and, in the form shown, this means comprises a storage drum 32 mounted above plate 24 between spools 16 and 18 and having a cylindrical surface around which the strips may be coiled. In practice, strips 12 and 14 are provided with their leading ends joined together and preferably attached to a leader and their trailing ends attached to their respective spools. At the start of an exposure cycle of the apparatus, strip 12 is threaded from spool 16 across plate 24 and between rolls 28 and 30 where it joins the leader and strip 14, the latter extending from spool 18 between rolls 28 and 30. Drum 32 is rotated in a clockwise direction (viewing FIG. 1) so as to withdraw the strips from spools 16 and 18 and coil them in superposed relation on the drum. The apparatus includes means for rotating spools 16 and 18 so as to withdraw the strips from drum 32 and rewind them on their respective spools. Exposure of successive frames of photo-sensitive strip 12 is effected during this rewinding of the strips and may occur

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at any desirable frequency, being limited only by the rate at which the strips may be advanced.

In order that each exposed frame of photosensitive strip 12 may be processed, each frame must be so superposed with an image-receiving area of strip 14 that the container 20 associated with the image-receiving area is located adjacent the leading edge of the exposed frame in position to discharge its contents between the frame and area. The frame and area of the two strips are initially located with respect to one another when the leading ends of the two strips are joined together but it is important that the frames of strip 12 be properly and accurately located on plate 24 for exposure. Accordingly, the apparatus includes control means for arresting the movement of the strips as they are being uncoiled from drum 32 and rewound on their respective spools each time a frame of strip 12 is accurately positioned for exposure on plate 24. Since the length of either or both strips may vary slightly as the result of the particular conditions of temperature and humidity occurring within the camera and because of the importance of accurately locating each exposed frame with an image-receiving area of strip 14, the control means is responsive to the movement of strip 14 for locating frames of strip 12 for exposure. By virtue of this arrangement, any error in alignment of a superposed frame and area due to variation in the length of the strips is limited to the stretch and/or shrinkage of the portions of the strips comprising that particular frame and area and is not allowed to accumulate for successive frames and areas of an elongated strip. One type of control means, shown schematically at 34, includes a lamp for directing light onto strip 14 and means such as a photoelectric cell responsive to variation in the light from the lamp reflected by strip 14 for discontinuing the rotation of spools 16 and 18 each time a frame of strip 12 is in position for exposure. To adapt it for use in the illustrated embodiment, strip 14 is provided with a series of regularly spaced index marks, configurations or apertures capable of predeterminedly modifying or varying the light from the lamp of control means 34 reflected from the strip, each index mark or configuration being associated with one image-receiving area of strip 14. The camera includes a guide roll 36 or other suitable bearing member located adjacent pressure rolls 28 and 30 and in the path of strip 14 between said rolls and spool 18 for supporting a section of strip 14 adjacent control means 34. In another form of the invention, the control means may include means adapted to be physically engaged by configurations on strip 14 and to be moved thereby for controlling the advancement of the strips through the apparatus. The apparatus also includes means for initiating the movement of the strips following exposure of a frame of strip 12.

At the start of the processing cycle, strips 12 and 14 are coiled, respectively, on spools 16 and 18 and pressure rolls 28 and 30, spaced apart during exposure, are allowed to move together into juxtaposition for applying pressure to the strips extending therebetween. Drum 32 is then rotated in a counterclockwise direction, advancing the superposed strips between rolls 28 and 30 to effect the spreading of a processing liquid from container 20 between successive superposed frames and areas and coiling the superposed strips around drum 32. Although the strips are substantially in a plane tangent to drum 32 as they are being superposed and then are curved as they are coiled around the drum, this variation in curvature of the strips occurs within a very short time after superposition of the strips and distribution of the processing liquid therebetween and consequently has no appreciable effect on the processing of the strips. It is desirable that drum 32 have the maximum diameter permitted by the limits of camera size in order to reduce the variation in curvature to a minimum. Once the superposed strips have been coiled on the drum, their curvature remains substantially

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constant throughout the processing period until they are separated from one another. By virtue of this arrangement, the sandwich comprising the two superposed strips with a layer of processing composition therebetween can be stored in a coil having a circumference or girth which is less than the length of the strips to be processed.

The minimum processing period is commenced with the movement of the last frame to be processed between pressure rollers 28 and 30, and when this minimum processing period has elapsed, pressure rolls 28 and 30 are again spaced apart and spools 16 and 18 are rotated so as to separate the superposed strips from one another and coil them on their respective spools. The apparatus preferably includes timing means actuated by movement of the last frame and area between rolls 28 and 30 and effective to cause the separation of rolls 28 and 30 and the rotation of spools 16 and 18 at the end of the minimum processing period. The strips are superposed and coiled on drum 32 and uncoiled and separated from one another at such a rate that the time during which the first frame and area are in superposition does not exceed the maximum allowable processing period.

The two strips and the processing liquid may be so constituted that the layer of processing liquid is caused to adhere to the photosensitive strip as the strips are separated, thereby producing a succession of finished positive prints in strip 14 which are substantially dry and ready for immediate use. It may be desirable to preserve the processed photosensitive strip for future use and, to prevent sticking or adherence of successive convolutions of strip 12 on spool 16 due to the processing liquid, there may be provided an interleaf strip 40 adapted to be coiled in superposed relation with strip 12 on spool 16. Interleaf strip 40 may be formed of any suitable sheet material, for example, paper coated with a material such as wax, to which the processing liquid will not adhere; and additionally interleaf strip 40 may carry a composition which reacts with the residual processing liquid to aid in preserving the photosensitive strip, for example by arresting the action of the processing liquid. Interleaf strip 40 is provided initially in superposed relation with strip 12 coiled on spool 16. A storage spool 42 is provided mounted adjacent spool 16 for separating interleaf strip 40 from strip 12 and storing strip 40 as strip 12 is coiled on drum 32. Then as strip 12 is rewound on spool 16, interleaf strip 40 is unwound from storage spool 42 and is superposed with strip 12 and rewound with the latter on spool 16.

As noted above, the interleaf strip material 40 is of a composition which does not firmly adhere to the processing liquid or to the photosensitive strip and which is readily stripped therefrom. In addition to suitable wax coated papers, other interleaf materials may be utilized. For instance, preferred materials for interleaving with conventional photosensitive strips comprise polyesters, for example, a polyalkylene terephthalate such as polyethylene terephthalate sold under the du Pont name of "Mylar." When conventional photosensitive strips and processing liquids or compositions are employed, fogging of the processed photosensitive strip by continued contact of the processing liquid therewith may be prevented by providing, for example, a suitable acid-containing coating on the surface of the interleaf strip which is positioned in face-to-face adjacent relation with the wetted photosensitive layer or stratum so that the resultant lowering of the pH terminates the developing action.

While the photosensitive and second strips have been shown as being wound either on a spool or on a drum 32, they may also be coiled either separately and/or in superposed relation in cylindrical containers or cassettes 44 as illustrated diagrammatically in FIG. 2. Containers 44 may be provided in place of spools 16 and 18 and drum 32 and each includes a cylindrical wall 46 having an elongated axial slot 48 through which a strip or superposed strips may be fed into and withdrawn from the

container. As a means for feeding a strip into a container 44, a feed roller 52 is provided located within each container at its center and having a friction-generating surface. A guide member 54 is provided within the cassette for engaging the strips, preferably at their margins, to guide the strips into engagement with roller 52. Since it may be desirable to advance a strip 14 into a cassette 44 without applying compressive pressure to containers 20 mounted thereon, the cassette or cassettes into which strip 14 is to be coiled are provided with either a pair of feed rollers 52, located so as to engage only the margins of the strip, or a single feed roller having shoulders at its ends adapted to engage the margins of the strip. In the form shown, guide members 54 are curved to conform to cylindrical wall 46 of each cassette and each is pivotally mounted at one end of the container wall in such a manner that they may be either folded flat against wall 46 or pivoted inwardly toward the center of container 44. Spring means are provided for pivoting guide members 54 away from wall 46 toward the center of the container so that the end of each member engages feed roller 52 when the cassette is empty, or holds a strip coiled in the cassette against the feed roller. As a strip is continuously fed into container 44, the diameter of the coil increases as successive convolutions are added and the guide member 54 is gradually pivoted outwardly by the pressure of the coil toward wall 46. In this manner strips 12 and 14 can be supplied in cylindrical containers 44 rather than on spools 16 and 18 and the superposed strips can be coiled within container 44 rather than around a drum 32.

Also comprehended is folding the strips singly and/or in superposed relation, as illustrated diagrammatically in FIG. 3, instead of coiling the strips on spools or drums or within cassettes. To adapt the strips for this purpose, successive frames and areas thereof may be joined by hinge sections formed of a material more pliant than the remainder of the strips and consequently more easily folded. The superposed strips may be folded in such a manner that substantially little curvature is imparted thereto during the folding operation and the space occupied by the strips in folded condition is substantially smaller in girth than the length of the strips.

Referring now to FIGS. 4 through 6, wherein like numbers represent like elements, the camera apparatus includes a casing or housing comprising a frontal portion 80 and a rear portion 82 pivotally mounted with respect to one another at one extremity by hinge 84 and releasably secured at the other end by a latch (not shown). A fragment of the bellows 85 is shown, other operative elements associated therewith, for example, lens, shutter, shutter release, diaphragm, etc., not being shown. Housing portion 82 comprises a door 86 pivotally secured to said portion 82, as, for example, by hinge 88 and a latch 90, the function of said door being that of providing access to sheet materials within the camera after their treatment for removal, if desired, of each portion bearing a positive photographic image. In order to provide access to the treated sheet materials rolled and stored within the camera housing, and to the strip of sheet advancing separating and storage means, a second door 92 pivotally attached to housing portion 82 by hinge 94 and secured by latch 96 may be provided if desired.

Intermediate pivotal supporting means 98 is held at closed position by housing portion 82 when the latter is closed and latched. Intermediate supporting means 98 preferably comprises a pair of oppositely-facing planar surfaces, one of which is adapted to position and support the photosensitive strip for exposure and the other of which is adapted to position and support areas of said photosensitive strip and another strip material in a predetermined manner after they have been compressed together. Intermediate supporting means 98 is pivotally attached to frontal housing portion 80. A framing plate 100 rigidly fastened to frontal housing portion 80 is

adapted to cooperate with the intermediate supporting means 98 for positioning and holding an area or frame of photosensitive strip 102 for subjection to photoexposure.

A photosensitive strip 102 is supplied in convenient form from a spool 104 suitably supported or mounted and guided to and from exposure position and positioning in the focal plane by intermediate supporting means 98 and framing plate 100. A roll of another sheet material 106, such as a paper base, image-receptive element having a plurality of collapsible fluid containers 108 mounted in spaced relation upon surface portions thereof which are adapted to be advanced to facing relation with the photosensitive strip 102, is preferably supplied from a cartridge (not shown). Each container releasably holds a quantity of fluid for processing a predetermined exposed area of photosensitive strip 102. As shown, the other strip 106 is mounted separately from the photosensitive strip 102. The photosensitive strip 102 may comprise a support and a photosensitive layer or stratum. The support may be composed of, for example, cellulose nitrate or cellulose esters such as cellulose acetate, cellulose triacetate, cellulose propionate, cellulose butyrate, cellulose acetate propionate or cellulose acetate butyrate. The photosensitive layer may comprise, for example, one or more of the silver halides dispersed in a suitable protective material such as gelatin. The strip material 106, which is preferably an image-receptive element, may comprise a suitable paper support and an image-receptive layer or stratum which provides, for example, one of the vigorous silver precipitating environments described in Patents Nos. 2,698,237 and 2,698,245. When the photosensitive layer comprises a silver halide, the processing fluid confined within rupturable containers 108 comprises an aqueous alkaline solution of silver halide developer and a silver halide solvent. The image-receptive element on the surface thereof adapted to receive a transfer image may be provided with a framing means in the form of a mask of a relatively thin paper, e.g., tissue paper, or preferably of a relatively thin organic plastic material such as a polyester, e.g., a polyethylene terephthalate. The mask which is bonded to the surface of the image-receptive layer is provided with an aperture adapted to define the picture area on the image-receptive layer.

A pair of pressure-applying or compressing members 110 and 112 are suitably mounted adjacent an end of framing plate 100 and of intermediate support means 98 from which an area of exposed photosensitive strip 102 is withdrawn for ready feeding thereto both of strip 102, after its exposure, and other strip 106. Strip 102 and other strip 106 are pressed between compressing members 110 and 112 in superposed relation to one another, the exposed surface of strip 102 and the surface of other strip 106 which bears the fluid containers 108 being positioned in face-to-face, adjacent relation by said members 110 and 112. After being compressed between said members 110 and 112, the photosensitive strip 102 and other strip 106 are positioned within a narrow light-tight imbibition chamber formed by housing portion 82 and superposed strips 102 and 106. After a predetermined processing period, door 86 may be opened and a portion of strip 106 bearing a positive image may be removed or detached. It should also be noted that such portions need not be removed so that there is instead obtained a continuous succession of finished positive prints in strip 106. Furthermore, the other strip 106 need not be as described, that is, suitable for the production thereon of positive images. The strip 106 may be such as to merely aid in spreading the processing composition over the surface of the photosensitive strip.

It should be pointed out that more detailed descriptions of the elements of the camera mentioned specifically above are set forth in a number of patents such as, for example, in U.S. Patents Nos. 2,455,111, 2,740,340, and many others.

Positioned closely adjacent the point of egress of superposed strips 102 and 106 from the light-tight imbibition chamber and along the path of travel of said superposed strips is an advancing and separating means 114 for the strips comprising a pair of mounted feed rollers 116 and 118 having their respective axes preferably lying substantially within a single horizontal plane, the said roller 116 having a pair of spaced members or tires 120 of rubber or other suitable resilient material which contact said roller 118 to provide a positive gripping and propelling action with respect to superposed strips 102 and 106. The ratio of the rollers is preferably such that roller 118 is of a larger diameter than the tires on roller 120. Mutually engaged spur gears 122 and 124 are attached near one extremity of shafts 126 and 128 respectively. Shaft 128, in turn, is rigidly fixed to roller 118 while shaft 130 is rigidly fixed to roller 116. A drive gear 132 predeterminedly spaced from spur gear 124 is attached near the other extremity of shaft 128 and is adapted to rotate with shaft 128 and transmit rotational force to other elements of the apparatus. To insure rotation of each roller in a given direction only and to hold strips 102 and 106 substantially taut, means such as unidirectional clutch devices 134 and 136 are associated respectively with gear 122 and shafts 126 and 130 and gear 132 and shafts 128 and 138. The clutch devices illustrated which permit drive in one direction only with free-wheeling action in the opposite direction may be of well-known constructions, the devices shown comprising units including a central cam block, a plurality of hardened and ground rollers, a plurality of springs, and two side retainers, a unit being secured to each of shafts 130 and 138 and the housings for such units being secured to gears 122 and 132 attached to shafts 126 and 128 respectively. Shaft 126 is adapted to extend externally of the camera housing 82 for attachment at the extremity thereof of rotational means such as handcrank 140, the manual rotation of which imparts rotation to shaft 126 and gear 122 which, in turn, imparts rotation to shaft 128 and the roller and gears attached thereto. Roller 118 then drives the superposed strips while tires 120 on roller 116 follow this motion by rotating until arresting mechanism, such as of the type shown in U.S. Patent No. 2,543,159, retards strip 106. This, in turn, brakes the rotation of roller 116 through tires 120. Secured to handcrank 140 is a torque limiting means 142 shown here as being of the bell-detent type to avoid advancing the strips 102 and 106 too far. Means 142 is adapted to slip without harm upon meeting a predetermined torque thus preventing undesirable movement through sheet-arresting and -indexing means of the type shown, in Patent No. 2,543,159, which may result in overadvancement and misalignment of the strips. Instead of handcrank 140, a suitable motor mechanism may be employed for driving advancing means 114.

Releasably mounted in the camera are a pair of storage or take-up spools 144 and 146 spaced from and actuated by advancing means 114. Take-up spool 144 utilized for photosensitive strip 102 is releasably carried by shaft members 148a and 148b while take-up spool 146 utilized for the other strip 106 or part thereof is releasably carried by shafts 150a and 150b. Shaft members 148b and 150b adapted to extend exteriorly of housing portion 80 are provided with spring-loaded knob means 152 which when pulled outwardly facilitate release of take-up spools 144 and 146. Mutually engaged gears 154 and 156 are attached near one extremity of shafts 148a and 150a respectively, gear 154 in turn mutually engaging drive gear 132. To prevent slippage of strips 102 and 106 as they are being separately wound on take-up spools 144 and 146 respectively, slip clutch devices 158 and 160 are mounted respectively with shaft 148a and gear 154 and shaft 150a and gear 156. Slip clutch 160 shown through the cutaway portion of gear 156 may be of any well-known construction such as that shown which comprises

a plate member carrying a plurality of frictional pads, e.g., cork, in contact with the inner face or surface of gears 154 and 156. As can be seen, actuation of advancing means 114 by manual rotation of handcrank 140 also imparts rotation to take-up spools 144 and 146.

When the wetted photosensitive strip 102 to be wound on take-up spool 144 is of a construction or composition which may become adhered together, there is provided a spool 162 supported for free rotation but suitably braked to limit unspooling thereof carrying a supply of an interleaf strip material 64 which does not adhere to the negative and which can be readily stripped therefrom. One preferred material for interleaving with conventional photosensitive strips comprises polyethylene terephthalate sold under the Du Pont trade name of "Mylar."

For facility in loading or threading the strips through the camera apparatus, shafts 126 and 130 and the elements attached to and carried thereby are suitably mounted in housing portion 82 while shafts 128 and 138 and the elements carried thereby, the take-up spool assemblies and the interleaf supply assembly, are mounted in housing portion 80.

Operation of the apparatus in terms of the elements and viewing position of FIG. 4 is as follows. Leaders of strip 102 and other strip 106, e.g., the image-receptive strip, are threaded through the apparatus as shown and attached to take-up spools 144 and 146 respectively. Superposed portions of strips 102 and 106 thus pass between and are frictionally engaged by roller 118 and tire members 120. In order to prevent adhesion of the processed photosensitive strip 102 together when wetted and wound upon take-up spool 144, interleaf material 164 which is readily strippable from strip 102 is supplied from supply roll 162 which is freely rotatable but suitably braked to limit unspooling thereof. As shown, the interleaf strip material is superposed and wound with the strip 102 as take-up spool 144 rotates.

Photosensitive strip 102 is advanced by clockwise rotation of handcrank 140 until the first exposable area or frame thereof is positioned across framing plate 100. It is apparent that clockwise rotation of the handcrank 140 causes rotation of mutually engaged spur gears 122 and 124, shafts 128 and roller 118. Roller 118 causes rotation of shaft 130 and roller 116 through tires 120, the rotation of rollers 116 and 118 being in opposite directions relative to each other in such a manner as to propel the superposed strips inserted between and gripped by roller 118 and tire members 120. Rotation of gear 124 and shaft 128 attached thereto further causes rotation of gear 132 which in turn drives or actuates the gear from compressing overdriven gears 154 and 156 so as to rotate take-up spools 144 and 146. As the superposed strips are propelled through advancing means 114 they become separated and then wound. After photoexposure of the frame, the handcrank 140 is rotated, and strip 102 and other strip 106, e.g., image-receptive strip, are advanced and a fluid container properly positioned therebetween is compressed between members 110 and 112, thus releasing processing fluid between facing surfaces of strip 102 and other strip 106. The superposed and compressed strips are advanced to the imbibition chamber for a predetermined processing period, e.g., for completing formation of a positive print on strips 106, after which time door 86 may be opened and a portion of strip 106 bearing said positive image may be stripped from strip 102 and removed from the camera. Concurrently with the advancement of exposed photosensitive strip 102 from the exposure position and into processing arrangement with strip 106, an unexposed portion of strip 102 is positioned across framing plate 100. Also concurrently with the advancement of strips 102 and 106, rotation of take-up spools 144 and 146 takes place so that leading portions of the strips or previously processed portions of the strips are propelled by advancing means 114 from the processing or imbibition chamber and separated as

they are wound on spools 144 and 146. Following separation of the strips 102 and 106, an interleaf strip 164 is superposed with strip 102, and the superposed interleaf strip and photosensitive strip 102 are then wound and stored on spool 144 while the other strip 106 or remnants thereof including, for example, surplus marginal portions of image-receptive paper material and masking means are wound and stored on spool 146. Upon exhaustion of the strips within the camera, the spools 144 and 146 are removed.

The processed photosensitive strip 102, which comprises a plurality of successive frames or areas of images wound with interleaf strip 164 on spool 146 may then be unwound, separated from the non-retentive interleaf strip and utilized to provide additional positive prints.

Since certain changes may be made in the above process and 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. A photographic process comprising the steps of superposing an exposed photosensitive strip and another strip with a thin layer of processing fluid superposed therebetween, maintaining said strips in superposed relation for a predetermined period, separating said strips upon termination of said predetermined processing period, superposing an interleaf strip with said photosensitive strip following separation of said photosensitive and other strips, and taking up said superposed interleaf and photosensitive strips on a storage member, said interleaf strip being substantially nonadherent to said processing fluid and to said photosensitive strip and comprising polyethylene terephthalate.

2. The photographic process of claim 1 in which said photosensitive strip and said interleaf strip are coiled around a supporting member.

3. The photographic process of claim 1 wherein said fluid contains a thickening agent and said layer of fluid is adhered to said photosensitive strip during separation of said strips.

4. A photographic process comprising the steps of: superposing an exposed photosensitive strip with a second strip and distributing a thin layer of a process-

ing liquid between and in contact with adjacent sides of said superposed strips; maintaining said strips and said layer of processing liquid in superposed relation for a predetermined processing period;

separating said strips upon termination of said predetermined processing period;

superposing an interleaf strip with said side of said photosensitive strip following separation of said photosensitive and second strips; and

coiling said superposed interleaf and photosensitive strips to prevent adherence of convolutions of said photosensitive strip to one another, said interleaf strip being substantially non-adherent to said processing liquid and to said photosensitive strip.

5. The photographic process of claim 4 wherein said processing liquid contains water and the surface of said interleaf strip superposed with said photosensitive strip is hydrophobic.

6. The photographic process of claim 5 in which said liquid includes a thickening agent and said layer of liquid is adhered to said photosensitive strip as said photosensitive and second strips are separated.

7. The photographic process of claim 4 wherein said photosensitive and interleaf strips are coiled on a storage spool.

8. The photographic process of claim 4 wherein said second strip comprises an image-receptive material on which a visible transfer print is produced by said liquid from said photosensitive strip.

9. The photographic process of claim 4 wherein a visible image is formed by said liquid in said photosensitive strip.

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