

April 3, 1962

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3,027,821

FILM PROCESSING APPLICATOR

Filed June 18, 1958

2 Sheets-Sheet 1

Fig. 1

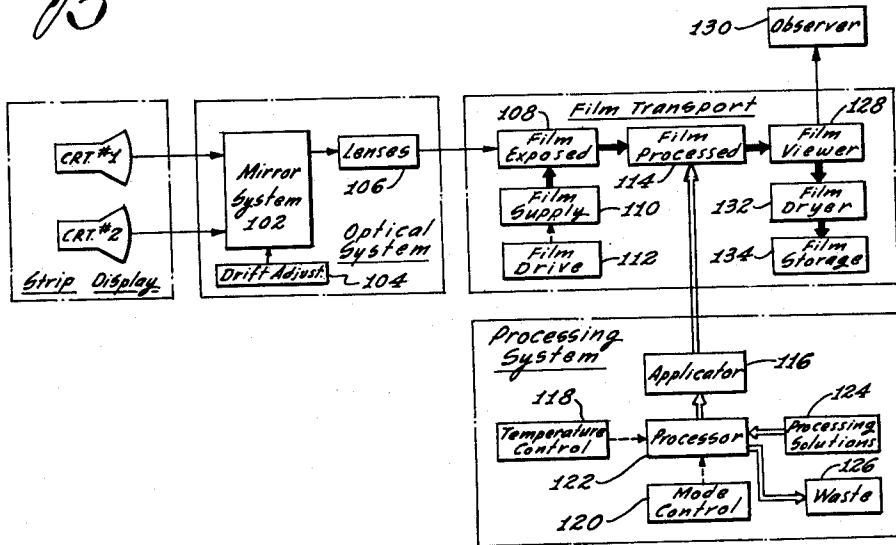
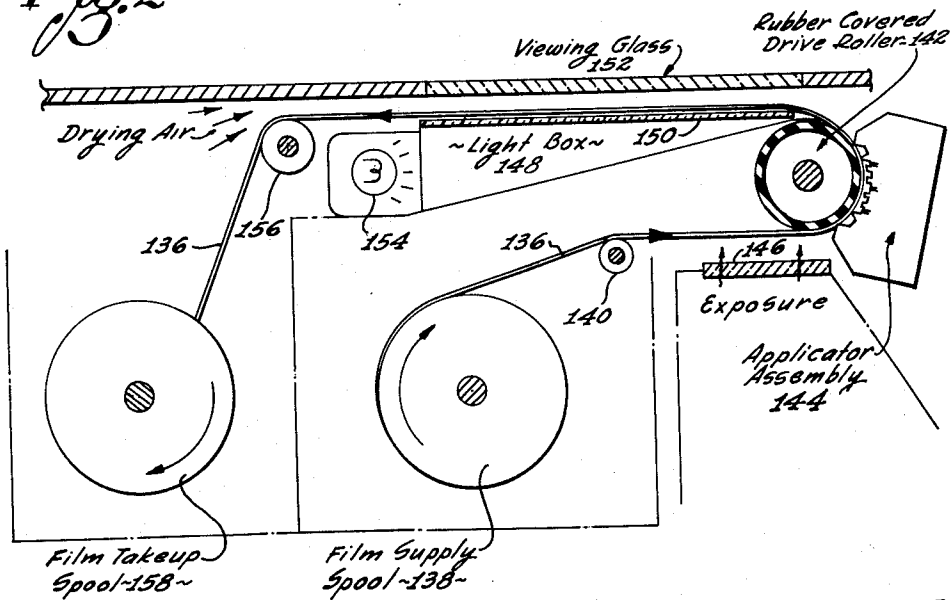


Fig. 2



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Fig. 3

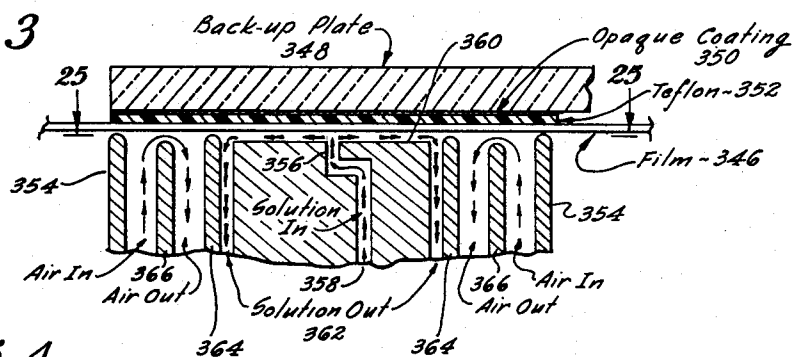
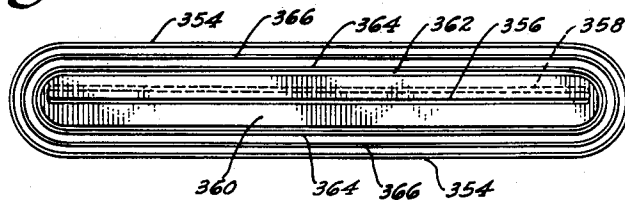


Fig. 4



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FILM PROCESSING APPLICATOR

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5 Claims. (Cl. 95—89)

This invention relates generally to rapid film processors and more particularly to a means and method for rapidly processing continuously moving exposed film to produce a high quality image for viewing within a short time interval and very small film travel distance.

The usefulness and convenience of immediately viewing a recorded picture is particularly great in reconnaissance systems, especially in an airborne system. Airborne reconnaissance systems are generally quite complex and utilize a variety of components which must all operate correctly and in synchronism. The ultimately required result is, of course, an accurately recorded image usually made on photosensitive film. If the exposed film can be rapidly processed for immediate viewing, it is easily possible to determine if the system is functioning satisfactorily, and that the desired information is being obtained. There are obviously many other uses and benefits in having rapidly processed film in an airborne reconnaissance system as well as in other similar systems.

It is an object of this invention to provide means capable of accomplishing high quality yet rapid processing of continuously moving film.

Another object of the invention is to provide a rapid film processor which can present an image for viewing on continuously moving film within a very short distance from point of film exposure.

Another object of the invention is to provide an applicator which can apply processing solution under turbulent agitation conditions to give enhanced film response to faint exposure light within a very short film processing time interval.

A further object of the invention is to provide a rapid film processor which can process continuously moving film in a flat plane under turbulent processing solution agitation conditions.

Another object of this invention is to provide a version of rapid film processor requiring only an extremely simple fluid flow system.

Briefly, the foregoing and other objects are preferably accomplished by providing applicator means which can be placed in direct contact with continuously moving film, and which can circulate a high pH monobath through the applicator to the film emulsion under turbulent agitation conditions. The applicator includes suitable seals or barriers which form guard zones that prevent leakage and oxidation of the solution. The monobath is supplied considerably hotter than the ambient air temperature to provide a high environmental processing temperature. The film itself can be given a pre-treatment consisting of pre-exposing of the entire film with a given exposure which removes the retousse dip at the toe of the characteristic curve of the emulsion. This effectively reduces the fog level and increases the film's low level light sensitivity.

An applicator version in which the guard zones are supplied with an air barrier and the processing solution is circulated between the space formed by a flat film plane

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passing in close proximity and parallel to a flat surface applicator head, within the processing zone, can be fabricated easily and to small tolerances. The processor fluid flow system is also simpler in this version.

The invention possesses other objects and features, some of which together with the foregoing, will be set forth in the following description of a preferred embodiment of the invention. The invention as described in detail will be more fully understood by reading the description with joint reference to the attached drawings, in which:

FIGURE 1 is a functional block diagram of the recording and processing section of an airborne radar strip recorder;

FIGURE 2 is a diagrammatic drawing illustrating in a generally sectional view, a preferred arrangement of a rapid film processor including film transport and viewing systems; and

FIGURES 3 and 4 are drawings which illustrate a different version of an applicator for rapid film processing on a flat plane.

A functional block diagram of a section of an airborne radar strip recorder including a rapid film processor is shown in FIGURE 1. Light connecting lines represent optical or visual signals, broken connecting lines indicate mechanical control, film is represented by broad, heavy lines and fluid routing is indicated by broad, unshaded lines. Radar strip images are displayed on two cathode ray tubes CRT #1 and CRT #2. The strip images are suitably reflected by a mirror system 102 which can be adjusted by drift adjustment means 104 to correct for image error caused by aircraft drift. The corrected strip images are focused by lenses 106 to expose 108 film from a film supply 110. The film is moved by film drive 112 and is processed 114 by applicator 116 as it is driven past the applicator 116. Temperature control 118 and mode control 120 by processor 122 of processing solutions 124, which are circulated to the applicator 116 and returned to waste 126, can be made according to film drive speed and operating conditions. The processed film is moved past a film viewer 128 for observation by an observer 130, and is dried by film dryer 132 at the same time. A television camera (not shown) can, of course, be substituted for the observer 130, for further remote transmission. The film is properly stored at 134 after it is dried.

The general structure and arrangement of a preferred embodiment of a rapid film processor is illustrated in FIGURE 2. The illustration is somewhat diagrammatic in nature but is representatively accurate and correct. Light sensitive film 136 is obtained from film supply spool 138 and passed over guide roller 140 and then between rubber covered drive roller 142 and applicator assembly 144 as shown. The film 136 passes in close proximity over a corrector plate 146 parallel to the surface plane of the corrector plate 146. The corrector plate 146 is part of the optical system, and film exposure from cathode ray tube light output is accomplished through this plate 146. The exposed film 136 is processed by solutions circulated through applicator assembly 144 under turbulent agitation conditions to produce a high quality image on continuously moving film with a short exposure-to-view distance. For example, an image on continuously moving 9½ inch wide film having a film velocity variable over a 12 to 1 range from ½ inch to 6 inches per minute, is

presented within two inches of exposure to cathode ray tube light output with this invention.

The exposed film 136 is rapid processed as it moves around drive roller 142 and is ready for viewing when it passes over a light box 148 having a ground glass plate 150 to illuminate the processed film 136. A viewing glass window 152 is provided in the rapid processor housing directly above the light box 148 so that an observer may view the film 136 immediately after processing. A tubular lamp 154 is positioned at an end opposite the drive roller 142 and extends across the width of the light box 148 so that light is directed evenly over the width of the film 136. The light box tapers angularly upwards from lamp 154 as shown to illuminate a rectangular area uniformly. The film 136 passes about guide roller 156 and is wound up by film takeup spool 158. Drying air is blown against the film 136 and passes between the viewing glass 152 and the film section being viewed, to dry the film emulsion. Radiant heat from the light box 148 accelerates the drying process to some extent.

A version of the invention which requires only simple applicator adjustment means is illustrated in FIGURES 3 and 4. The applicator there shown can apply a highly turbulent monobath solution to the moving surface of exposed film under all environmental conditions and still provide leakproof operation. Processing is performed over a substantially flat plane in this version and water wetting of the film as well as the acid rinse hardener is deleted. A double moving air seal is substituted to prevent escape of any fluid. Film 346 is passed over an applicator under a flat back-up plate 348 which is preferably glass having an opaque coating 350 covered with a thin Teflon sheet 352 as shown in FIGURE 3. The opaque coating 350 and the thin Teflon sheet 352 extends over the length of the applicator. The back-up plate 348 permits processing to be accomplished on a flat surface, the opaque coating 350 blocks off any light during processing, and the Teflon sheet 352 will reduce the drag on the back of the film 346. The width of the back-up plate 348, opaque coating 350, and Teflon sheet 352 are great enough to completely span the width of the outermost wall 354 (FIGURE 4) together with some leeway. The film 346 width must also be wider than the maximum width of the outermost wall 354 to achieve a satisfactory seal. The processed film 346 can be viewed through back-up plate 348 when it moves past the opaque coating 350.

The applicator is preferably fabricated from corrosion resistant steel and introduces processing solution at the center along a narrow slit 356 sufficiently long to span the picture width of the film 346. The processing solution is pumped up a channel 358 having a joggle (which consists, for example, of two right angular bends separated by a short distance in the channel 358 to displace the upper vertical portion of the channel a short lateral distance to one side of the lower vertical portion of the channel, as shown most clearly in FIGURE 3) near the top to produce an even solution flow outward across the face 360 of the applicator and into a return port 362 formed by wall 364 which surrounds the flat applicator face 360 to bring the processing solution back to the suction side of the pump. The slit 356 is, for example, .010 to .015 inch wide and 4.5 inches long. The space between the film plane and the applicator face 360 is held to a small dimension to increase fluid velocity and thus maintain highly active solution in contact with the film emulsion. Thus, turbulent motion of the processing solution is accomplished by providing the solution into the center of the applicator and circulating the solution between a small dimension separation of applicator face and film emulsion.

Between the outermost wall 354 and the inner wall 364 is an intermediate wall 366. The wall 364 is just slightly lower than the outermost wall 354, and the intermediate wall 366 is slightly lower than the inner wall 364. The outermost wall 354 is the only wall that normally touches

the film 346. A blower introduces air at a reasonably high velocity at ambient pressure into the outer zone formed by the outer wall 354 and the intermediate wall 366. The air flows over the lower intermediate wall 366 and into the inner zone formed by the innermost wall 364 and the intermediate wall 366. The inner zone is kept at reduced pressure, and the ambient pressure within the processing zone (within inner wall 364) is maintained very close to atmospheric pressure. The inner wall 364 is sufficiently high to close off this area and prevent the entry of any significant amount of air into the processing zone which might oxidize the monobath developer solution. Thus, a double guard wall of air which prevents processing solution from escaping from the processing zone is provided. It is noted that the film 346 is in very light contact with a solid member, the outer wall 354, only when the film 346 is dry before processing and when cooled by the guard wall of air after processing.

The processing solution transport system can be similar to the flow system described in the copending application of Thomas C. Leighton and Malor Wright, Serial No. 742,790, filed June 18, 1958, the highest point of the system being the applicator and the lowest point is a waste tank so that adequate drainage of all components is provided when the system is shut down. The solution can be heated in the supply tank to a higher temperature required for fast processing, and solution is recycled at a high rate in order to provide the turbulence required for high quality processing. The fluid velocity can be, for example, 12 inches per second at the film emulsion surface. The recycled processing solution is continuously replenished as before and excess solution continuously overflows to the waste tank. Replenishment rate is approximately 6 milliliter of solution per foot of film travel, for example. It is noted that the guard air may contain a small amount of processing solution due to leakage. The blower which increases the pressure of the air, however forces the air through a conventional separator (not shown) where liquid is drawn off and returned to the suction side of the processing solution pump.

While some specific dimensions and components have been given as examples above, it is to be understood that the particular embodiment of the invention described above and shown in the attached drawings is merely illustrative of and not restrictive of the broad invention, and that various changes in design, structure and arrangement may be made without departing from the spirit and scope of the broader of the appended claims.

What is claimed is:

1. A film processing applicator, comprising: a column structure having a flat surface face and a central slit opening therein for discharge of processing solution toward film passing thereover in close proximity to the face; a wall spaced apart from and surrounding said column structure to form an exit port about said column structure; and means in contact with the film adapted to form a barrier around said wall to prevent leakage of processing solution over said wall.

2. The invention according to claim 1 including, in addition, a back-up plate for restraining film in a flat plane parallel to and in close proximity to the flat surface face of said column structure.

3. A film processing applicator, comprising: a column structure having a flat surface face and an internal passageway terminating in an elongated slit opening in the face for discharge of processing solution toward film positioned thereover in close proximity to the face; an inner wall spaced apart from and surrounding said column structure to form an exit port around said column structure, said inner wall having a top edge which is slightly higher than the flat surface face of said column structure; an intermediate wall spaced apart from and surrounding said inner wall, said intermediate wall having a top edge which is slightly lower than the top edge of said inner wall; and an outer wall spaced apart from and surround-

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ing said intermediate wall, said outer wall having a top edge which is slightly higher than the top edge of said inner wall.

4. The invention according to claim 3 including, in addition, a back-up plate for restraining film in a plane parallel to the flat surface face of said column structure, the film contacting only the top edges of said outer wall and is movable in a direction at right angles to the slit opening.

5. The invention according to claim 3 wherein the internal passageway includes a joggle near the slit opening

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to produce even discharge of processing solution from the slit opening.

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