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FILM STRIPS AND METHODS OF PREVENTING
FOGGING THEREOF

The present invention relates to a method of preventing fogging of unexposed portions of a film strip producing imaged areas when imaged by imaging energy, and to such film strips, particularly as
5 encountered in archival microfiche film systems employing an intermediate film strip to carry a transferable image.

There has been developed by the applicants and co-workers an archival hard copy microfiche recording system which reflects light off of a document placed on
10 a document-receiving platform and projects an image of it in greatly reduced form onto an initially transparent intermediate dry silver film strip carried by a film head unit. The film strip is dispensed from a cassette mounted on the film head and is fed by film advancing
15 means to an imaging region where a selected area of the film strip to be exposed can receive the projected light image. A pressure element presses the selected area of the film strip against a planar backing aperture defining a projection plane and an imaging area, and the
20 film is then exposed to the light image. The film head is next moved along guides from the imaging station to a developing station, where a hot shoe pressing against the exposed area of the film causes de-

velopment of the image to form an opaque image in the exposed areas thereof. The film head is then moved to an image transfer station, where the image on the dry silver film is to be replicated on a positive initially opaque microfiche film card of the photo-developing type (See U.S. Patent 4,137,078 issued June 30, 1979 to Izu and Ovshinsky).

The microfiche card is held indexed on a movable carriage so that a pre-designated frame of the card receives the image on the intermediate film. A pressure element presses the film card and the intermediate film strip together between the output prism of a flash lamp housing and a backing plate. Image transfer is accomplished by triggering the flash lamp to direct light through the intermediate film, immediately rendering transparent the previously opaque areas struck by the high intensity flash lamp light on the selected frame of the microfiche film card. To replicate a new image the film head is returned to the imaging station, where the cycle is repeated.

The microfiche film cards are of the threshold photodeveloping type, and require a relatively high radiant flux for complete exposure compared to the dry-silver intermediate film used. The

transfer of the intermediate film image to the microfiche film is done by contact printing, using a high intensity flash lamp. A fraction of this illumination becomes trapped in the intermediate film, which is quite clear in unexposed regions, and proceeds to propagate laterally internally along the plane of the film by total internal reflection (light-piping), thereby making its way into unexposed film in the payout region of the film dispenser. A significant length of intermediate film thus becomes light struck in the film dispenser. This necessitates a long film advance between successive frames, and is thus wasteful of film.

15 This phenomenon is not significant during formation of the initial image because the requisite illumination level is much lower than for the transfer operation, owing to the relatively high speed of the intermediate film compared to the microfiche film. During the transfer operation the intermediate film is subjected to an illumination level several orders of magnitude higher than necessary for initial image formation, and the propagation of a small fraction of this by light-piping is sufficient to give rise to significant fogging effects.

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Additionally, the intermediate film is similarly fogged by prolonged exposure of the cassette to the ambient light of the system.

According to this invention there is provided a
5 method of preventing fogging of unexposed portions of a
film strip producing imaged areas when imaged by imaging
energy and contained within an imaging energy sealed
portion of film support means from which a limited area
of the film strip to be imaged is exposed to an external
10 imaging energy region, comprising forming in or on the
film strip at least one propagation barrier region
between each such limited area of the film strip and the
adjacent later to be exposed areas, each such barrier
region having the property of inhibiting the propagation
15 of said imaging energy into said adjacent later to be
exposed areas by internal reflection of said imaging
energy between the opposite surfaces of the film.

Also according to this invention there is
provided a film strip sensitive to imaging energy, having
20 at spaced intervals along the strip propagation barrier

regions each having the property of inhibiting the propagation of said imaging energy along the strip between adjacent areas separated by a barrier region by internal reflection between the opposite surfaces of the strip.

The invention will now be described by way of example, with reference to the drawings, in which:-

Figure 1 is a block diagram of the control circuitry of a microfiche recording system;

10 Figure 2 is a perspective view of a travelling film head including an intermediate film dispensing cassette positioned at the imaging station with a film head cover in the open position to show details of the film dispensing system;

15 Figure 3 is a perspective view of the travelling film head and a carriage therefor movably mounted on guides;

Figure 4 is a front elevation of the film head, showing its position in relation to the microfiche film card, the flash housing, and a backing element when positioned at the transfer station;

Figure 5 is an expanded front elevation of the imaging area of Figure 4 in the immediate vicinity of the flash housing and backing element, with the microfiche film card and the intermediate film strip shown partially sectioned;

Figure 6 shows the same region with the flash housing intermediate film, microfiche film card, and backing element in pressure contact for image transfer, and shows the light-piping propagation of light from the flash unit into the dispensing region;

Figures 7A-7C are elevational views of the imaging region between the payout and takeup lips of the intermediate film head of Figure 2 at the imaging, developing, and transfer stations;

Figure 8 is a perspective view showing a light source illuminating a strip of the intermediate film during the imaging process at the imaging station;

Figure 9 is a cross-sectional elevation of the film movement sensor and encoder wheel assembly, along with a block diagram of the associated control circuitry;

Figure 10 is a perspective view of the developed image on the intermediate film after development by the hot shoe, and shows the exposed barrier band created on the film strip;

5 Figure 11 is the view shown in Figure 6, but with the barrier band positioned over the flash housing so as to inhibit the propagation of flash lamp light into the film stored in the dispensing region;

10 Figure 12A is a top plan view of an intermediate film strip according to the invention with the pre-formed barrier stripes.

15 Figure 12B is a cross-sectional elevation of Figure 12A showing photographically pre-formed barrier stripes;

 Figure 12C is a cross-sectional elevation of Figure 12A showing lacquer or ink barrier stripes on the surfaces of the film strip;

20 Figures 13A and 13B are top plan views and cross-sectional side elevations, respectively, of a film strip according to the invention with barrier

stripes in the form of serrations; and

Figure 14 is a front elevation of the imaging region between the payout and takeup lips of the intermediate film head of Figure 2, showing film advance photoregulation means and the associated circuit functions in block diagram form.

Figure 1 includes a block diagram of the control system for sequencing the operation and movement of an intermediate film head 1 and head carriage 2 between various stations of a microfiche recording system. The head carriage is advanced to the various stations illustrated in Figure 1 by tension in a belt 3 extending between an idler pulley 4 and a motor drive pulley 5. A pulley drive motor 6 is controllably driven in both directions by a system timing and control circuit 7 operating through a motor control circuit 8. The stations illustrated are an imaging station 10, where the exposed area of the initially transparent intermediate film strip on the film head 1 is exposed to a light image, such as light reflected off of a hard copy a heat-applying developing station 12 where the light-exposed areas

of the intermediate film are rendered opaque, and
an image transfer station 14. A microfiche film
card carriage 16 at the image transfer station 14
positions, under control of a fiche carriage posi-
5 tion control means 18, a selected frame of a mi-
crofiche film card 20 for reception of an image
last formed on the film strip carried by the film
head 1. The microfiche film card 20 is preferably
made from a photo-developing initially opaque
10 archival film of the dispersal type disclosed in
U.S. Patent No. 4,137,078 issued to Izu and Ovshinsky,
wherein a transferred image is formed upon ex-
posure to a high intensity flash of radiant energy,
such film being completely insensitive to exposure
15 to normal room ambient light or even direct sun-
light. The film carried by the film head is pre-
ferably more light sensitive and is latently imaged
by the relatively less intense light reflector and
imaged from hard copy. The intermediate film
20 carried by the film head is preferably a dry-
silver heat-developed film. Throughout this text
the term film is used to denote a substrate carry-
ing a photosensitive layer.

As used herein, the term film head refers to
25 a frame removably attached to a carriage, and a

film supply unit removably mountable on the frame.

The film head 1 carries a film supply means E, a film takeup means F, and a film clamping or holding means B. In various embodiments of the inven-

tion all three are sequentially controlled by the system timing and control circuit 7. For example,

the supply means E may include a supply reel or cassette, and various guide rollers as well as film driving means where the supply reel is to be

driven. The takeup means F may include a takeup reel and guide roller means as well as film tensioning means and takeup reel drive means. In addition, the film head may include an end-of-film sensor D which may respond to a marking on the

film. The film head may also include a tension sensor G responsive to tension in the film. The end-of-film sensor D and tension sensor G perform control functions which respond to end-of-film or film breakage and disable operation of the system

under these circumstances. A film break warning means 25 and an end-of-film warning means 25' serve to warn the operator of such situations.

The film head 1 may also include a film head interlock switch C which communicates the status of a light sealed film dispenser cover to the system

timing and control circuit 7, so that the system cannot be operated with the cover open and the film inside thus subject to light fogging.

Initially, the film head 1 is moved to the
5 imaging station 10, where an imaging area of the film strip is placed under a projection lens 21 contained in a lens shroud 22 (see Fig. 7A). The film clamping means B is actuated to a film release condition and an area of fresh intermediate
10 film strip is advanced into the imaging area by driving the supply or takeup means E or F. Payout length is governed by the film movement sensing means A, which effects generation of electrical signals measuring the length of film payout to the
15 system timing and control circuit 7. In the exemplary form of the invention the film movement sensing means A effects generation of a series of pulses as the film advances, the number of which measures the payout length. After the requisite
20 film advance, the system timing and control circuit 7 stops driving of the film supply or takeup means E or F and actuates the clamping or holding means B back to a film holding condition, whereupon a signal from the system timing and control
25 circuit 7 raises a backing pad 26 up against a pad

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limit stop 23. A subsequent command from the system timing and control circuit 7 actuates a lens shroud moving means 21' to lower the lens shroud 22 to clamp the intermediate film between the backing pad 26 and the base of the lens shroud 22. A document receiving platform 28 is next illuminated by flash lamps 30 and 32 energized by the exposure pulser 34 on command from the system timing and control circuit 7, the image of the platform and its contents being relayed to the projection lens 21 by two mirrors 36 and 38. On command, the pad lifting solenoid 24 drops the pressure pad 26, and the lens shroud moving means 21' lifts the lens shroud 22, thereby releasing the film. The film head 1 is now moved to a developing station 12, where a shoe lifting solenoid 40 controlled by the system timing and control circuit 7 raises a hot shoe 42 (see Fig. 7B) against the imaging area 9 (see Fig. 2) of the film strip 71 for a predetermined length of time set by the system timing and control circuit 7, whereupon the shoe lifting solenoid 40 drops the hot shoe. The film head 1 is then moved to a position which places the imaging area 9 of the film strip over a flash prism 44 on a flash housing 46. A selected

frame of a microfiche film card 20 on a microfiche card carriage 16 is moved into appropriate position over the flash housing 46 with the system timing and control circuit 7 controlling the microfiche carriage position control means 18. The desired frame of the microfiche film card 20 is selected by operation of keys of a keyboard 17 which cause the control circuit 7 to operate the microfiche carriage position control means 18. On command of the system timing and control circuit 7, a flash lifting solenoid 48 raises the flash housing 46 against a limit stop 49. A backing element 50 is lowered by the backing element moving means 51 so as to press the imaging area of the intermediate film strip into intimate contact with the microfiche film card 20 and a backing element 50 (see Fig. 7C). Image transfer is achieved by triggering the flash tube (not shown) in the flash housing 46 by a command from the system timing and control circuit 7 operating through a flash pulser circuit 52. Immediately after exposure, the lifting solenoid 48 drops the flash housing 46, and the backing element moving means 51 raises the element 50, thereby releasing the two films.

The pad lifting solenoid 24 and a projection

light source 11 are mounted on an image station carriage 13. A station carriage position control means 15 is commanded by the system timing and control circuit to position either the pad lifting solenoid 24 or the projection light source 11 under the lens 21. For reading or updating a microfiche the fiche card carriage 16 is moved by the fiche carriage position control means 18 to a position under the lens 21, and the projection light source 11 is moved into position below it so as to project the image on the microfiche back onto the document receiving platform 28 for inspection and, where an add-on of information is to be made on the frame of the microfiche card involved, an overlay of the added information can be properly positioned over the projection image. The recording system, the system timing and control circuit 7 commands the immediate advance of a preset number of frames of intermediate film every time the power switch 53 is turned on.

This is accomplished by program branching employing a routine microprocessor feature: a microprocessor forming part of the system timing and control circuit 7 responds to the onset of electrical power from the power supply 55 by auto-

atically steering its program counter to an initialization routine stored in a "read-only" memory unit, which is also part of the system timing and control circuit. This steering is referred to as
5 the "power-up reset" function, and is common to virtually all advanced microprocessors, such as the Zilog Z-80 and the Intel 8085. Functionally, this feature is shown outboard of the system timing and control circuit 7 in Fig. 1, and is labeled
10 "power up sensing means 54;" however, it should be understood that the actual circuit means are part of the system timing and control circuit. The initialization routine commands the immediate advance of a preset number of frames of intermediate film, and is shown functionally in Fig. 1
15 as "multiframe feed effecting means 56." This routine alters the program flow so as to cause normal signal sequencing of the supply means E, the takeup means F, and the clamping means B to
20 recycle a preset number of times before normal program flow is resumed.

A similar fogging problem arises during the loading of a fresh film dispenser, since normal room light is much more intense than the ambient
25 light in the system. A similar film advance is

initiated by mounting a normally closed interlock switch 57 to a system access door (not shown). Opening the door to replace the intermediate film dispenser disconnects power from the system. Upon
5 startup after loading the film advance routine is invoked as before.

Refer now to Figs. 2 and 3 which show the details of an exemplary film head 1. Fig. 3 shows the traveling film head 1 removably mounted as by
10 screws 63 on the carriage 2 guided for horizontal movement on guide rods 61. Fig. 2 shows the film head positioned at the imaging station 10. The backing pad 26, the hot shoe 42, the flash prism 44, and the projection light source 11 are also
15 shown. The film head is shown as including a film supply section 1A including a removable film dispensing cassette 62 mounted on a film head frame 64 and held in position by a cassette support ledge 66. The intermediate film strip 71 exits
20 the cassette through a slot 74 in a top ledge 70, passing next around an idler roller 76 which places a drag force on the film, and thence through an end-of-film sensor unit 80. The film strip 71 then passes around an encoder roller 82 and back
25 over a film clamp lifter 84, then over a clamping

block 86 where it then exits the film supply section between a payout lip pad 88' and a pad (not shown) mounted on a film head cover 89 and over a payout lip 88, where one frame width of the film strip is exposed for external processing at what
5 may be called an imaging area of the film head.

In this embodiment the film holding or clamping function is achieved by a short clamp blade (not shown) mounted inside the cover 89. When the
10 cover 89 is closed, the blade presses down on the film strip 71 to pin it to the clamping block 86. The cover 89 is tensioned down by a loading spring (not shown). Clamping release is achieved by a
15 solenoid (not shown) drawing down the exterior end of a pivoted lift bar 114, thus raising the interior end of the lift bar carrying the film clamp lifter 84 so as to force the lifter into contact with the interior face of the cover 89 against the force of the loading spring. This raises the
20 cover 89 sufficiently to raise the clamp blade out of its film engaging position, thereby releasing the film strip 71.

The frame 64 has a large open region 91 between the film supply section 1A and the film
25 takeup section 1B of the film head. This open

region receives the backing pad 26, hot shoe 42 and flash housing 46 at the imaging, developing and image transfer stations 10, 12 and 14. The film then passes over a takeup lip 90 on the take-
 5 up side of the imaging area and then proceeds over a dancing roller 94 carried on an arm 95 tensioned by a spring 93 which forces the roller away from the takeup lip 90, and serves to keep the film under tension. The film then winds on a motor
 10 driven takeup reel 98 driven by a takeup motor (not shown) mounted on the frame 64. The takeup reel 98 is mounted on a drive shaft 98' which makes connection to the motor in any suitable way, such as by a pulley belt coupling so that the
 15 entire film head 1 can be removed from the carriage 2, as by removing the screws 63-63 and raising the film head therefrom, where the film can be threaded through the film head conveniently away from the carriage.

20 Fig. 9 shows details of an intermediate film feed control means incorporated into the film head 1. Actuation of a film advancing means 340 in the system timing and control circuit 7 causes the intermediate film to advance under tension over
 25 the encoder roller 82 as previously described,

causing the encoder roller to rotate. The advancing means 340 controls the sequencing of the supply means E, the takeup means F, and the clamping means B in Fig. 1. The rotation of the encoder roller 82 is detected by a light sensing unit 126 mounted on the frame 64, which monitors the passage of opaque interruptor lines 128 on a transparent encoder wheel 130 attached to the outboard end of the encoder roller shaft 132, the wheel, shaft, and roller being rigidly interconnected. The passage of a line 128 interrupts a light beam from a light source 127 to a photodetector 129. The series of light pulses detected by the light sensing unit is transmitted to the system timing and control circuit 7 as the intermediate film pays out over the encoder roller 82 during film advance. The pulses are counted by the system timing and control circuit 7. When the count reaches a predetermined value the system timing and control circuit 7 terminates power to the film advance motor (not shown), which drives the takeup reel 98. Film breakage during the film advance process causes loss of tension in the intermediate film 71, resulting in loss of friction contact between the film and the encoder roller 82. The

encoder roller ceases to turn, and the sensing pulses cease as a result. Failure to generate the requisite number of pulses during a prescribed time interval is interpreted as a film break condition.

Fig. 9 further contains the related control circuitry to accomplish the foregoing in block diagram format. The film advance operation, like all other automatic sequencing operations carried out in the microfiche recording system, is governed by microprocessor execution of a stored program in read-only memory, both the microprocessor and the memory being integral to the system timing and control circuit 7. The light source 127 is energized by the system timing and control circuit 7 prior to film advance. A pulse from a film advance control circuit 330 within the system timing and control circuit 7 clears a pulse counter 332, preferably of the simple ripple type. The pulse counter 332 receives the output pulses from the photodetector 129 and proceeds to store the pulse count. During this period the stored program executes a conventional timing loop of duration somewhat in excess of that necessary to advance one frame, the program flow branching at

regular intervals to sense the contents of the counter 332 by activating periodically a counter comparison means 334. The counter comparison means 334 preferably consists of replicating the current pulse count in the A register of the microprocessor and comparing it with a preset stored number equal to the number of photodetector pulses characterizing one frame. When the requisite count is detected film advance ceases, and the program branches out of the timing loop and normal program flow continues. If, however, the film breaks and the pulses cease, the requisite pulse count is never attained and the timing loop runs its full cycle, whereupon the program proceeds to actuate an abort means 336 which preferably consists of terminating program sequencing by entering a program "halt" state and actuating the film break warning means 26. The timing loop is shown functionally as "timing means" 338 in Fig. 9.

Figs. 7A through 7C show plan views of the film head 1 in the region of the imaging area of the film head during image exposure (Fig. 7A), development (Fig. 7B), and image transfer (Fig. 7C). Since the intermediate film 71 is rigidly clamped internally on the payout side, the film is

fixed in position at the payout lip 88. However, the compliant tensioning of the film by the spring loaded dancing roller 94 on the takeup side permits a slight film payout to take place on the takeup side as shown by arrows in Figs. 7A, 7B, and 7C when the backing pad 26, hot shoe 42 and flash housing are raised into position. This prevents breakage of the intermediate film 71 under the forces involved.

10 In addition to long-term exposure of the intermediate film strip 71 to ambient light, film fogging also occurs by light-piping action during the transfer operation. Fig. 4 shows the relationship of the film head 1, microfiche film card 20, flash housing 46, and backing element 50 when positioned at the transfer station 14. Fig. 5 shows a partially sectioned view of the imaging region between the payout lip 88 and the takeup lip 90 with the microfiche film card 20 in place below the backing element 50. The flash prism 44 is located immediately below the intermediate film strip 71. Fig. 6 shows the same region during image transfer, with the flash prism 44 pressing the assembly into contact. The emulsion layer of the film strip 71 is in proximate contact with the

photodeveloping imaging layer 256 of the microfiche film card 20. Light from the flash prism 44 passes through the record indicia 258 to replicate them in the imaging layer. A fraction of this
5 light is trapped in the clear areas of unexposed intermediate film, and proceeds by total internal reflection into the unexposed film as indicated by the arrows.

In the exemplary form of the invention a
10 barrier region is created in the intermediate film 71 so as to interpose between the flash prism 44 and the payout lip 88 a means for significantly reducing this light-piping transmission. In the exemplary form of the invention this barrier is
15 formed at the imaging station 10 (Fig. 1) by producing a photographically blackened band 260 (see Fig. 10) on the intermediate film strip 71. Fig. 8 shows a perspective view of the lens shroud 22, intermediate film 71 and backing pad 26 in position for imaging the archival record onto the
20 film. The shroud 22 forms a light-tight seal of the film about the imaging region 9 (see also Fig. 2). A small lamp 270 actuated by the system timing and control circuit illuminates the film 71
25 between the shroud 22 and the payout lip 88. Col-

limation is achieved by means of a reflector 272. After exposure of the film 71 to the image of the archival record, both latent images are developed by the hot shoe 42, which subjects substantially the entire width of the imaging region between the payout lip 88 and the takeup lip 90 to the development process. Fig. 10 shows a developed film 71 bearing record indicia 258 and the blackened band 260.

Fig. 11 shows the banded film strip 71 in position for image transfer, as in Fig. 6. The band 260 now covers the edge of the flash prism 44. Light entering the banded region by light-piping from the flash lamp 44 must reflect internally off of the band of blackened silver emulsion 260 to enter the payout region 88, and suffers significant absorptive attenuation in doing so, thereby accomplishing one of the objects of the invention.

Other forms of transmission spoiling barrier regions may be formed such as by spoiling the local planarity of the surface of the film, as for example by a serrated roller timed to engage and emboss the film locally in the desired region, the disturbance of the surface causing the trapped

light to escape through the serrations on the film. An example of intermediate film 71 with serrations 274 is shown in Figs. 13A and 13B. Alternatively, the barrier strips may be pre-

5 formed during the manufacture of the film itself. The film may be exposed to light in narrow regions and simultaneously heated by a narrow hot shoe to locally develop the image so formed. Fig. 12A is a top plan view of a strip of intermediate film 71

10 with pre-formed barrier stripes 262. Fig. 12B is a cross-sectional elevation of Fig. 12A showing photographically formed barrier stripes 262. Alternatively, the optical properties of the surface of the film may be altered by painting or other-

15 wise depositing a stripe which destroys total internal reflection by optically coupling to the film and leading the light out into an absorbing region in the stripe. For increased light absorption efficiency such stripes may be positioned in

20 opposing pairs on opposite faces of the film. Fig. 12C is a cross-sectional elevation of Fig. 12A showing this alternative form of barrier stripe 262'. A simple stripe of dark lacquer of conventional variety will accomplish this, as will many

25 other substances. For best efficiency the index

of refraction of the stripe material should equal that of the film so as to give maximum coupling efficiency.

Such pre-formed markings may also be used in conjunction with elementary photosensing means to regulate film advance. Fig. 14 shows one embodiment of such a system. A light source 344, preferably an infra-red light emitting diode, is mounted on the film head cover 89. A light pipe 346 conducts the emitted light to illuminate the film strip 71 immediately adjacent to the edge of the payout lip 88. Light passing through the film strip is collected by a second light pipe 348 and conducted to a photodetector 350, preferably a phototransistor. Film advance is controlled by a film advance control means 352 in the system timing and control circuit 7, and is terminated when an opaque barrier stripe 262 is advanced to interrupt the light beam. The film advance control means 352 is under control of the minicomputer in the system timing and control circuit 7.

Immediately prior to actuating the film advance sequence of control signals to the film supply means E, the film takeup means F, and the film clamping means B (see Fig. 1), the film ad-

vance control means 352 actuates a power means 354 to power the light source 344, and resets a peripheral flip-flop 356 responsive to output signals from the photodetector 350. Functionally, this is shown as an interaction via a reset means 358; on the circuit level this is simply accomplished by sending a reset pulse to the flip-flop from the minicomputer. The flip-flop is of the conventional slope-triggered type, and is biased to output a "1" signal when it receives a "1-0" transition signal at its input. Thus, the flip-flop will output a signal only when the light beam received by the photodetector is undergoing a reduction in intensity, i.e., when a barrier stripe first moves across the light beam. The film advance sequence continues until this condition occurs, at which time the flip-flop output state changes from "0" to "1," causing an inhibiting means 360 to terminate the film advance sequence. In more detail, during film advance the stored program which governs the film advance sequence periodically branches to interrogate the status of the flip-flop. Upon sensing a "1" the film advance sequencing is terminated by program branching to continue the remaining system operations.

The photosensor assembly need not be positioned at the payout lip, but may alternatively be placed at any point in the film circuit where the passage of a barrier stripe signals the emergence of a barrier stripe from the payout lip 88. It should also be noted that the end-of-film mark 124 and photosensor 80 shown in Fig. 2 cannot be employed as shown to signal an incipient end-of-film condition, since the passage of a barrier stripe would be interpreted as the passage of the end-of-film marker. This problem may be solved by preparing the intermediate film with a clear trailing end without barrier stripes. Following the approach previously described using the encoder wheel 130 shown in Fig. 9, failure of a barrier stripe to pass the film advance photosensor unit during a preset time interval is interpreted by the system timing and control circuit 7 as a film break or end-of-film condition, resulting in an automatic abort of normal system sequencing and actuation of a suitable operator warning means. In such a system the interval photosensor 80 is either dispensed with entirely, or is positioned as previously described and serves as the film advance photosensor itself.



CLAIMS:

1. A method of preventing fogging of unexposed portions of a film strip producing imaged areas when imaged by imaging radiant energy and contained within an imaging radiant energy-sealed portion of a film support
5 means from which a limited area of the film strip to be imaged is exposed to an external imaging radiant energy region, comprising forming in or on the film strip at least one propagation barrier region between each such limited area of the film strip and the adjacent, later
10 to be exposed, areas each such barrier region having the property of inhibiting the propagation of said imaging radiant energy into said adjacent, later to be exposed, areas by internal reflection of said imaging radiant energy between the opposite surfaces of the film.
- 15 2. A method according to claim 1, wherein each of said barrier regions is formed by deforming the film so it permanently has one or more bends or deviations from local planarity therein.
3. A method according to claim 1, wherein each barrier
20 region is formed by forming a radiant energy absorbing region on or in the film.
4. A method according to any preceding claim, wherein the unexposed portions of the film strip are transparent and produce opaque imaged areas when imaged by said
25 imaging radiant energy and thereafter developed.
5. A method according to claim 3, wherein each barrier region is formed by the photographic exposure of the chosen region involved, followed by a local photographic development.
- 30 6. A method according to any preceding claim wherein said barrier regions are formed during the manufacture of said film strip.



7. A method according to any one of claims 1 to 5, wherein said film strip is an intermediate film having at least one imaged opaque portion and an adjacent unexposed transparent portion with one of said barrier regions therebetween and serving to inhibit the propagation of said imaging radiant energy into said unexposed portion during transfer of the image from said imaged opaque portion to another film by subjecting said imaged opaque portion to said imaging radiant energy.
- 5 8. A film strip sensitive to imaging radiant energy, having at spaced intervals along the strip propagation barrier regions each having the property of inhibiting the propagation of said imaging radiant energy along the strip between adjacent areas separated by a barrier region, by internal reflection between the opposite surfaces of the strip.
- 10 9. A film strip according to claim 8, for use in a microfiche recording system, wherein the strip has a photoactive layer on a surface thereof at least over said areas, each said area being exposable to a light image to form an image thereon, which image is transferable to microfiche film card by subjecting said area to said imaging radiant energy.
- 15 20 10. A film strip according to claim 8 or claim 9, wherein said barrier regions comprise permanent bends or deviations from local planarity in the strip.
- 25 11. A film strip according to claim 8 or claim 9 wherein said barrier regions comprise reflection spoiling layers applied to at least one surface of the strip.
- 30 12. A film strip according to claim 9, wherein said barrier regions comprise locally exposed and developed areas in said photoactive layer on the strip.
- 35 13. A film strip substantially as hereinbefore described with reference to, and as illustrated in, Figures 12A to 12C, or 13A and 13B of the drawings.



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14. A method of preventing fogging of a film strip, substantially as hereinbefore described with reference to the drawings.
