United States Patent

Nerwin

[15] **3,690,238**

[45] **Sept. 12, 1972**

[54] **STRIPPING MECHANISM**

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[73] Assignee: **Eastman Kodak Company**, Rochester, N.Y.

[22] Filed: **Oct. 2, 1970**

[21] Appl. No.: **77,515**

[52] **U.S. Cl.** **95/13**, 95/19

[51] **Int. Cl.** **G03b 17/52**

[58] **Field of Search** 95/13, 19, 22

[56] **References Cited**

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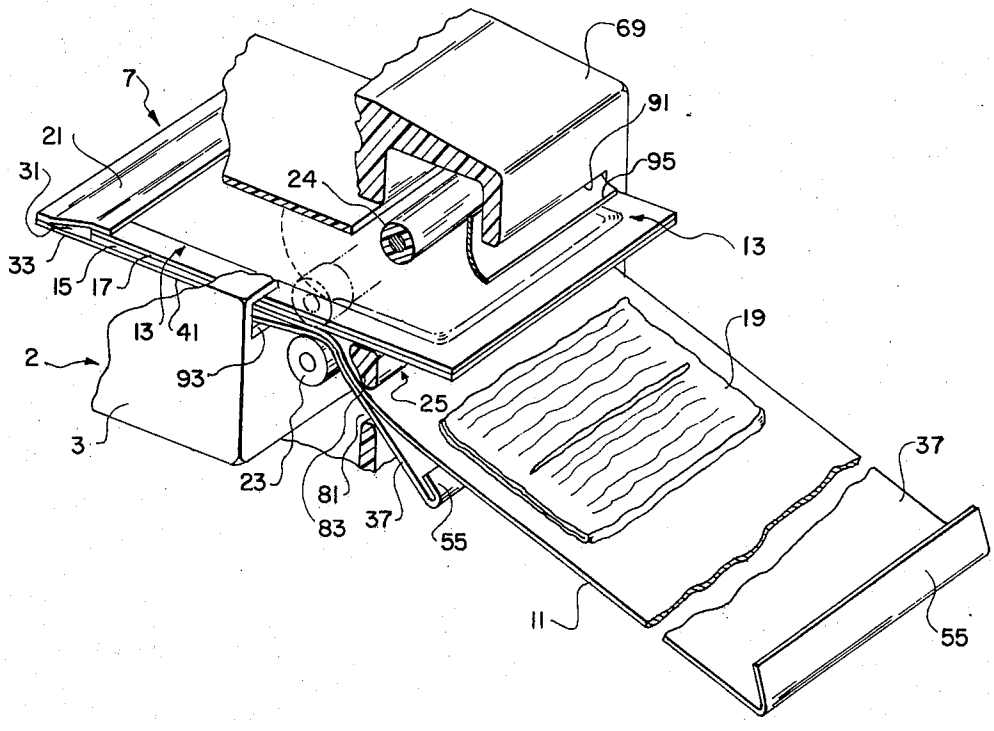
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Assistant Examiner—Alan A. Mathews
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[57] **ABSTRACT**

Photographic apparatus for stripping an image-recording unit of the self processing type from an associated carrier sheet, pod and trap. The image-recording unit includes integral photosensitive and process elements strippably mounted on a carrier sheet, with a cooperating pod (supply container for fluid processing composition) and trap (collector for excess fluid processing composition) permanently secured to the carrier sheet. The apparatus defines a first path along which the image-recording unit is adapted to be transported from the apparatus, and a second path, including a portion extending in a direction divergent to the first path, along which the carrier sheet is adapted to be transported from the apparatus. Movement of the above-mentioned elements along the respective first and second paths is effective to strip the recording unit from its associated carrier sheet, pod and trap, as the recording unit is transported from the apparatus.

6 Claims, 8 Drawing Figures



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SHEET 1 OF 3

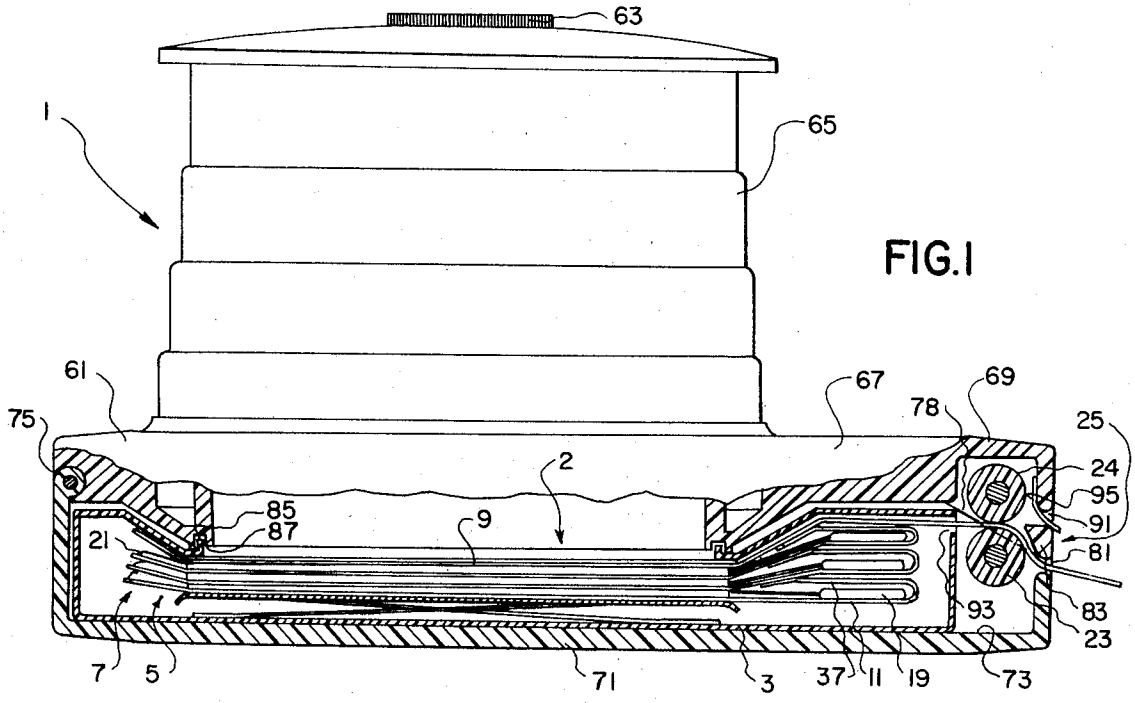


FIG.1

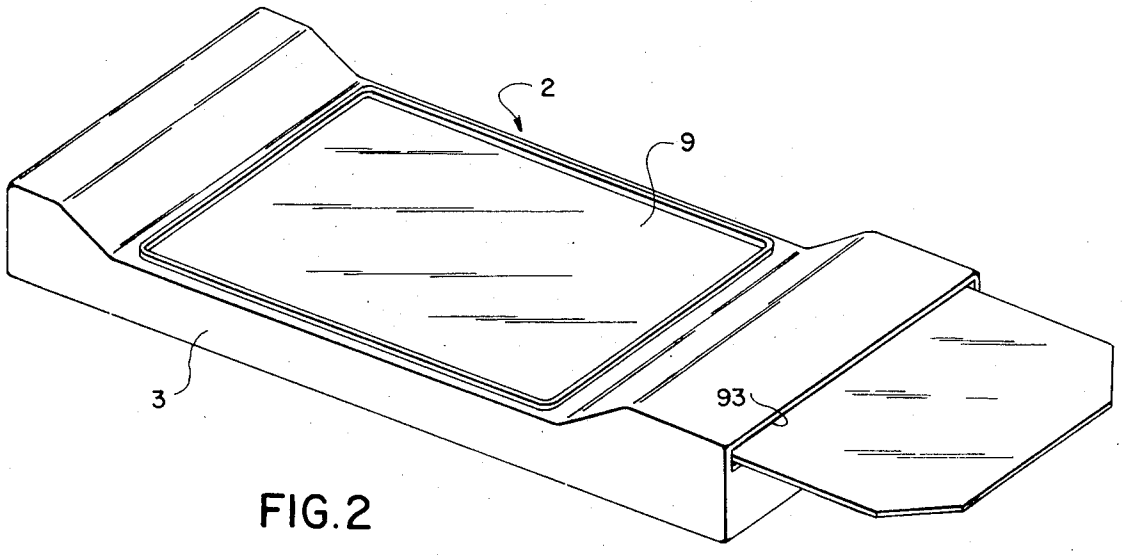


FIG.2

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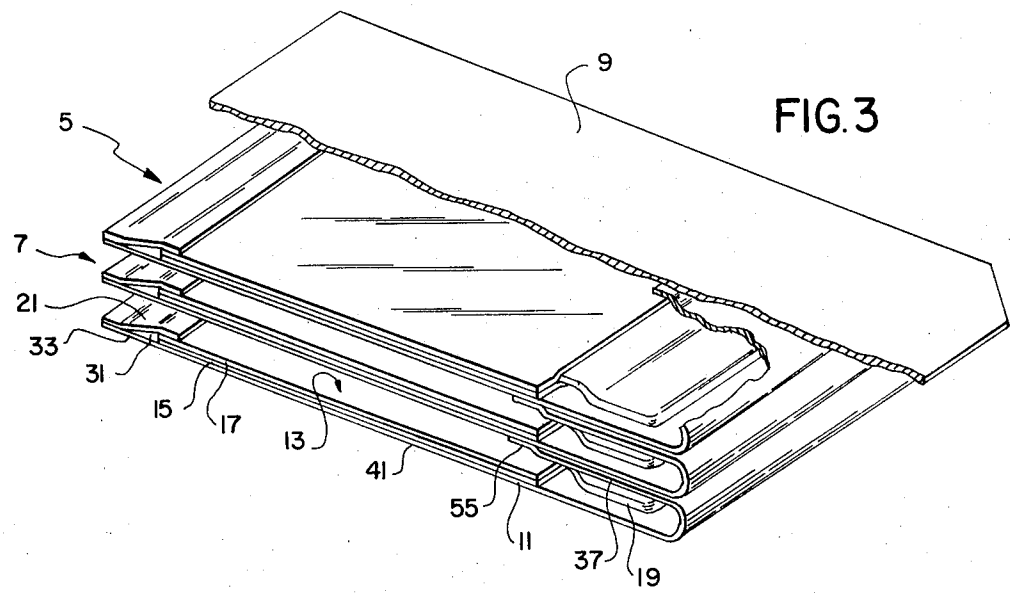


FIG.3

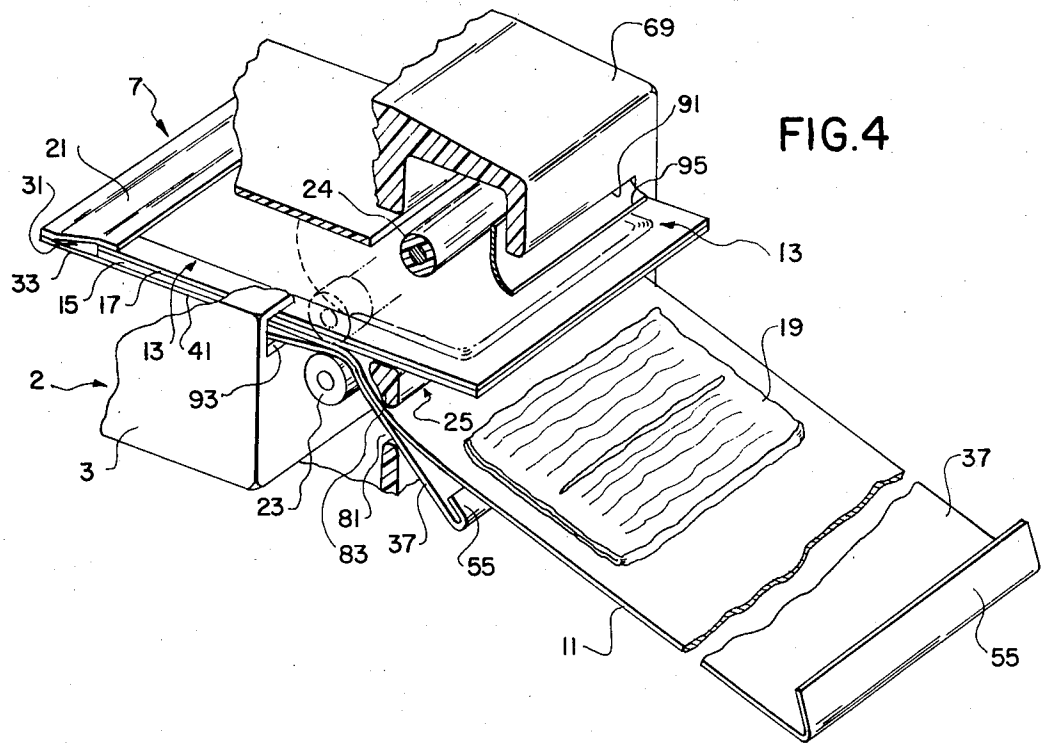


FIG.4

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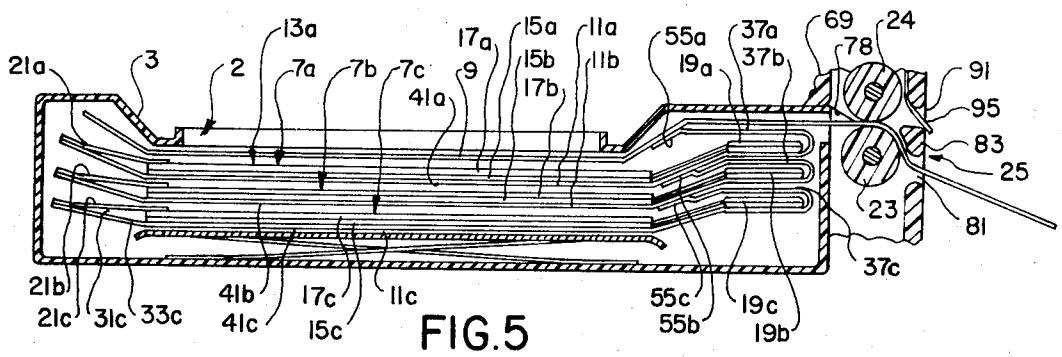


FIG.5

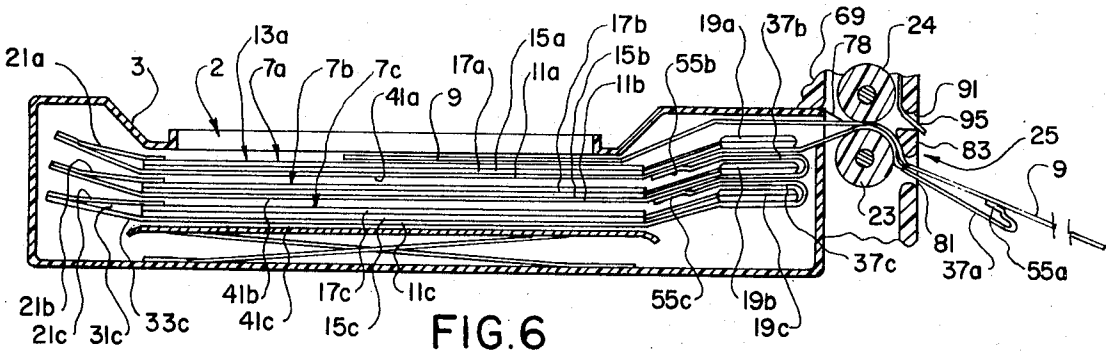


FIG.6

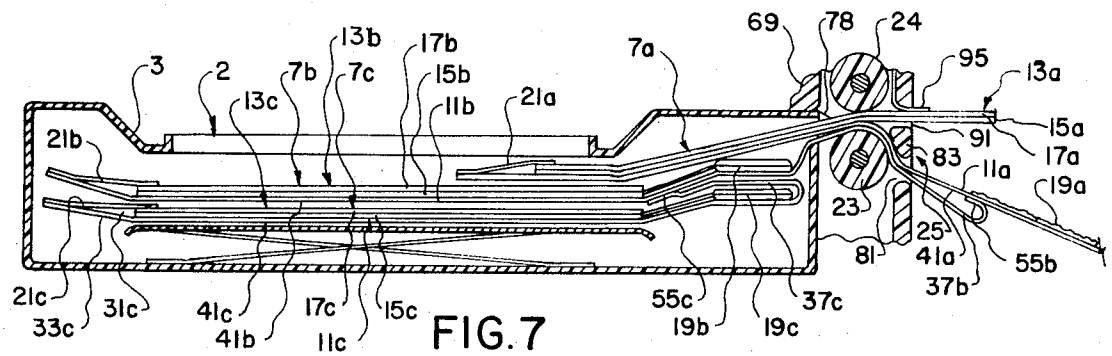


FIG.7

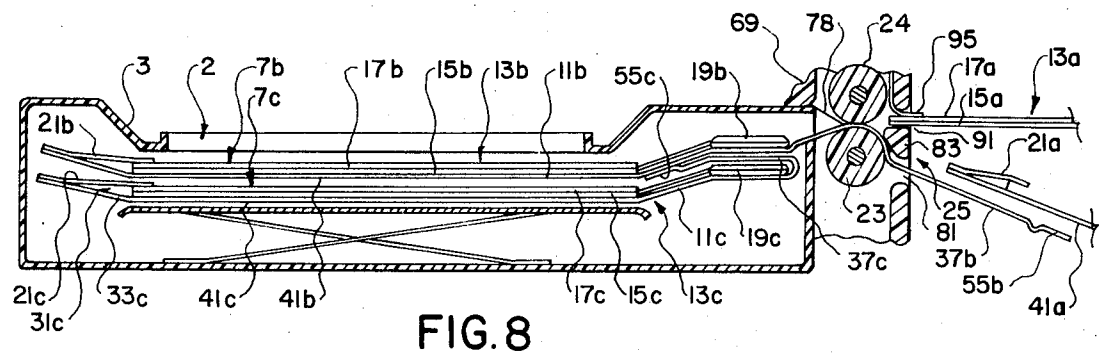


FIG.8

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STRIPPING MECHANISM

CROSS REFERENCE TO RELATED APPLICATIONS

Reference is made to my U.S. Pat. applications Ser. No. 70,836, entitled FILM UNIT, filed on Sept. 9, 1970; Ser. No. 70,835, entitled PHOTOGRAPHIC FILM UNIT, filed on Sept. 9, 1970; Ser. No. 77,474, now abandoned, entitled FILM ASSEMBLAGE, filed on even date herewith; and to commonly assigned copending U.S. application Ser. No. 33,677, entitled PHOTOGRAPHIC APPARATUS, filed on May 1, 1970 in the name of D. M. Harvey.

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to photographic apparatus useable with self-processing photographic film.

It is well known in the photographic arts to provide film units with materials for processing the units immediately after their exposure. Generally such units include a photosensitive element comprising a support having thereon at least one layer of photosensitive material, and a second element adapted to be registered over the photosensitive element for processing. A viscous processing composition is released from a rupturable pod at one end of the unit and is spread toward the other end by passing the unit between juxtaposed pressure-applying members that distribute the composition in a layer of predetermined thickness between the two elements. The distributed fluid composition then permeates the layers of the unit to effect development of the photosensitive layers, and an image-wise distribution of dye or silver is formed on or diffuses to an image-receiving layer, either in the photosensitive or second element, to form the finished print.

In most presently commercial film units, generally referred to as being of the "peel-apart" type, the photosensitive and second elements are spaced-apart during exposure and are brought into superposition for processing. The image or print-receiving layer is in the second element, and that element is stripped from the rest of the unit after processing to provide a positive, right-reading print. Such units are disclosed, for example, in U.S. Pat. Nos. 3,080,805 and 3,511,659.

In more recently developed film units, generally referred to as being of the "integral" type, the photosensitive and second elements permanently remain in superposed relationship during and after processing. These elements may be spaced-apart during exposure, but preferably are supplied in a composite, permanently registered or integral form. In the latter case, the elements are superposed prior to exposure and remain substantially in the same physical form after processing. The process sheet is transparent, to permit exposure of the photosensitive materials from the "top side" of the unit, and the image or print-receiving layer is located either in the process sheet or, preferably, in the photosensitive element, to provide a positive image without being stripped from the rest of the unit. Film units of this latter type are disclosed, for example, in commonly assigned, copending U.S. Pat. application Ser. No. 027,990, entitled PHOTOGRAPHIC FILM UNIT FOR DIFFUSION TRANSFER PROCESSING, filed Apr. 13, 1970 in the name of H. E. Cole; in the cross-referenced U.S. applications Ser. Nos. 70,836, 70,835, and 33,677; and in French Pat. Nos. 2,006,255 and 2,006,256 published on Dec. 26, 1969.

Film units of the peel-apart and certain of the integral types have been supplied with leaders to facilitate their handling in photographic apparatus. Additionally, the leaders often serve to interconnect a plurality of film units arranged in an assemblage or pack, and, at least in the case of peel-apart units, to couple the photosensitive and image-receiving elements of each respective film unit. Various different types of such leaders are disclosed, for example, in the above-mentioned U.S. application Ser. Nos. 77,474 and 33,677; and in U.S. Pat. Nos. 2,477,304; 2,558,856; 3,046,861; 3,080,805; 3,152,529; 3,309,201 and 3,511,659.

The present invention is concerned with means for facilitating the handling of self-processing film units, and with apparatus for separating the finished print from associated materials that are not necessary after processing has been initiated. More specifically, the invention is concerned with such apparatus as applied to the particular problems encountered in film units of the integral type. The invention has particular utility with pre-registered integral film units.

2. Description of the Prior Art

The development of commercially practical film units of the integral type, and especially pre-registered integral film units, has constituted a significant step toward reducing many of the problems inherent in peel-apart units. At the same time, however, numerous and often unexpected new problems have been encountered. By way of example only, the film handling mechanisms utilized with peel-apart units often are not entirely satisfactory for use with integral units. Similarly, with peel-apart units, it is relatively easy to separate the finished print from its leaders, and also from its pod, trap, and other materials left over as waste after processing. Such separation is facilitated by the moistened interface at the point of separation between the print-receiving element and the photosensitive element, resulting from the distribution of a processing composition therebetween. In integral units, on the other hand, the finished print permanently remains attached to the photosensitive element, as well as to the process sheet, and separation of the leaders and other processing waste materials becomes much more difficult because it cannot occur at the moistened interface provided by the distributed processing composition.

In commonly assigned copending U.S. application Ser. No. 33,677, entitled PHOTOGRAPHIC APPARATUS, and filed on May 1, 1970 in the name of D. M. Harvey, an integral film unit and stripping mechanism have been disclosed that suggest solutions to many of these newly encountered problems, and the solutions presented therein generally have been considered satisfactory. In at least certain respects, however, that unit and mechanism may not be sufficiently versatile in application to permit its use with different types of packs. For example, it is desirable to be able to manufacture integral film units and stripping mechanisms particularly adapted for manual operation. Moreover, it is important that the unit and mechanism

be simple and inexpensive to manufacture and assemble.

SUMMARY OF THE INVENTION

In accordance with an illustrated embodiment of the present invention, photographic apparatus is provided for handling integral film units preferably arranged in assemblages or packs that include leader arrangements for interconnecting and transporting the film units. Preferred film units useable with the apparatus each include a smaller image-recording unit coupled to a carrier sheet, with an associated container for processing composition and a trap for collecting any excess of the composition. The film units are arranged in a stack for sequential exposure and processing, and are interconnected such that the withdrawal of one of the film units between juxtaposed pressure-applying members in the apparatus also automatically threads a leading end portion of the next successive unit, or its leader, between the pressure-applying members. At the same time, the leading end portion is moved to a position where it may be grasped for withdrawing that next successive film unit from the apparatus. The apparatus includes a stripping guide that defines a first path for guiding the image-recording unit from the apparatus and a second path, including a portion extending in a direction divergent from the first path, for guiding the carrier sheet from the apparatus.

The preferred image-recording unit useable with the present apparatus is releasably coupled to its carrier sheet, and to its associated fluid container and trap, for separation therefrom after processing is initiated. The container and trap, on the other hand, permanently are attached to the carrier sheet, and remain therewith for disposal after being separated from the image-recording unit. Such separation is effected automatically by the apparatus as the recording unit and its carrier are guided from the apparatus along the respective paths and on opposite sides of the stripping guide.

It is an object of the present invention to provide photographic apparatus for handling integral film units.

Another object of the invention is to provide such apparatus for automatically separating an image-recording unit from various waste material after processing of the unit has been initiated.

A further object is to provide such an apparatus for use with an assemblage of film units wherein the withdrawal of one film unit from the assemblage automatically moves a leader portion of a next successive unit to a position where it may be grasped for manually withdrawing that next successive unit from the assemblage.

Still another object of the invention is to provide photographic apparatus, such as a camera, for exposing integral film units and having opposed pressure-applying members between which the units are adapted to be withdrawn to initiate processing, the camera further including a mechanism automatically for separating waste material from an image-recording portion of the film unit as the unit is withdrawn between the pressure members.

Another object is to provide apparatus for use with an assemblage of film units each including a pod and image-recording unit supported on a carrier, wherein the pod is permanently coupled to the carrier and the image-recording unit is strippably coupled to the pod and carrier, and wherein the apparatus is effective for stripping the image-recording unit from the carrier and pod after processing has been initiated.

BRIEF DESCRIPTION OF THE DRAWING

In the detailed description of the preferred embodiment presented below, reference is made to the accompanying drawing, in which:

FIG. 1 is a side, partially cut away view of photographic apparatus in accordance with the present invention.

FIG. 2 is a pictorial view of a film pack useable with the apparatus of the present invention.

FIG. 3 is a pictorial view of a film assemblage comprising part of the pack depicted in FIG. 2 and useable with apparatus in accordance with the present invention.

FIG. 4 is a fragmentary partially cross-sectioned pictorial view of a stripping mechanism in accordance with the present invention.

FIGS. 5–8 are schematic cross-sectional views illustrating various stages in the operation of the apparatus of FIG. 1 with the film assemblage of FIG. 3.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Because photographic film units are well known, the present description will be directed in particular to elements forming part of, or cooperating directly with the present invention. Elements not specifically shown or described herein should be understood as being selectable from those known to those skilled in the art.

Referring now to the drawings, and particularly to FIGS. 1–4, a preferred embodiment of the present invention is illustrated comprising photographic apparatus, such as a camera 1, for use with a film pack 2, including a casing 3 for containing an assemblage 5 of integral self-processing photographic film units 7 and a dark slide 9.

Preferred individual image-recording and film units for use in the apparatus are illustrated and described more fully in my previously mentioned U.S. applications Ser. Nos. 70,836, entitled FILM UNIT, and 70,835, entitled PHOTOGRAPHIC FILM UNIT. Briefly, however, each film unit comprises a carrier sheet 11; an image-recording portion or smaller unit 13, including photosensitive and process elements 15 and 17; a pod or container 19 for processing composition; and a trap or collector 21 for any excess processing composition. An assemblage of such film units is illustrated in my previously mentioned application Ser. No. 77,474, entitled FILM ASSEMBLAGE, and may contain any number of film units, for example eight, but has been illustrated with only three such units to simplify the illustrations and descriptions. Similarly, reference numerals generally are applied only to one of the illustrated film units, since all of the units are substantially identical in most respects.

The photosensitive and process elements 15 and 17 accurately are constructed to define sheets having straight edges, square corners and appropriate borders, and properly are registered during manufacture, to provide a uniformly flat, aesthetically pleasing structure that will maintain its integrity after processing. Except

for a pod, trap, and carrying sheet, included in the more comprehensive structure to be described hereinafter, the image-recording unit **13** is intended to be supplied with all parts necessary for processing by the intended apparatus, and all such parts permanently are retained together without adversely effecting the finished print.

The carrier sheet **11** supports image-recording unit **13** with the pod **19** and trap **21** coupled to the recording unit for discharging a suitable processing composition between the elements at one end of the recording unit and for collecting any excess of the composition from between the elements at the opposite end thereof. The carrier is particularly adapted for convenient handling of the entire film unit **7** from the first stages of manufacture, to completion of the finished print and disposal of any processing waste material. For this purpose the carrier comprises an individual sheet that most closely is associated only with one film unit, although it is coupled to other similar units in the assemblage as described hereinafter.

The pod **19** and trap **21** permanently are secured to the carrier sheet, but only releasably are coupled to the image-recording unit **13**. Similarly, the image-recording unit is only releasably coupled to the carrier sheet **11**. As will be described more fully hereinafter, such an arrangement of permanent and releasable couplings permits stripping after processing of the image-recording unit (then defining the finished print) from the carrier, pod and trap. The latter three elements, then comprising processing waste material, may be rolled up and discarded in one packet, with the carrier sheet surrounding the pod and trap and protecting any sensitive environment (e.g. clothing and skin) from any remaining processing composition in the waste material.

The preferred photographic apparatus or camera **1** is adapted to receive the above-mentioned assemblage **5** and pack **2** for sequentially exposing and for initiating the processing of film units in the assemblage. For the latter purposes, the apparatus includes stepped pressure-applying members **23** and **24** for rupturing pod **19** and for distributing a processing composition between the elements **15** and **17** of the image-recording unit **13**. Additionally, the apparatus is provided with a stripping mechanism **25** for separating the image-recording unit from certain processing waste material (such as the carrier sheet, pod, trap and any leaders) as the film unit is withdrawn between the pressure-applying members and after processing of the image-recording unit has been initiated.

IMAGE-RECORDING UNIT

(Photosensitive Element and Process Sheet)

In a preferred form, photosensitive element **15** comprises a substantially flat, resilient support of transparent cellulose triacetate film base defining a first or leading end, a second or trailing end, lateral edges and a central portion. At least the latter central portion supports respective layers of image-receiving material, opaque reflecting material, and silver-halide emulsion with associated dye image-providing material. Such layers preferably are arranged in the sequence given, with the support located near the bottom or outside face adjacent the carrier sheet, where it can protect that side of the unit, and the silver-halide emulsion located near the top or inside face adjacent the process sheet, where it is protected by the process sheet. As will become more apparent hereinafter, the silver-halide emulsion is adapted to be exposed through the process sheet, from the top side of the unit, and the developed print is adapted to be viewed through the transparent support, from the bottom side of the unit.

The process sheet or second element **17** also preferably is formed of a transparent material, such as cellulose triacetate film base, and defines a resilient, substantially flat sheet having leading and trailing ends, lateral edges, and a central portion corresponding to equivalent parts of the photosensitive element. In addition to its function in spreading the processing composition, to be described more fully hereinafter, the transparent process sheet protects the top side of the photosensitive element and film unit while permitting the above-mentioned exposure of the silver-halide emulsion.

Photosensitive element **15** and process sheet **17** preferably are rectangular and coextensive with one another, and may be maintained in registered or superposed facing relationship by any permanent seal or connection to define the image-recording unit **13**. Regardless of the particular type of seal or connection, or of its particular manner of application, the photosensitive and process elements are secured substantially in direct contacting relationship, or the equivalent thereof, at lateral marginal edge portions and in such a manner that the central portions of the elements are retained in registered overlying relationship, but may be resiliently spaced apart in their central portions to permit the spreading of a processing composition therebetween. Additionally, the leading and trailing ends of the recording unit are resiliently separable to permit the introduction of the processing composition between the elements at the leading end and the collection of any excess composition from the trailing end.

COMPREHENSIVE FILM UNIT

(Including Carrier, Pod and Trap)

The image-recording unit described above, comprising the photosensitive element **15** and process sheet or second element **17**, particularly is adapted to cooperate with various elements of the more comprehensive film unit **7** with which it has been illustrated. The latter unit includes the carrier sheet **11**, the container or pod **19**, and the excess fluid collector or trap **21**, all of which cooperate for recording and developing a latent image when used with the intended apparatus.

The trap or excess-fluid collector generally comprises one or more lifters **31** permanently mounted on a skirt **33** at the trailing end of the carrier sheet for collecting any excess fluid composition expelled from the trailing end of the image-recording unit **13**. The lifters are substantially incompressible and cooperate with the carrier to define appropriate surfaces preferably completely enclosing a chamber or void that is maintained even when between the pressure members. A more detailed description of the operation of such lifters is set forth in U.S. Pat. No. 2,686,717.

The container or pod **19** may include various cooperating parts, together defining a suitable

processing-composition supplying mechanism, and preferably including a rupturable containing part generally comprising a rectangular blank of a vapor impervious material that is folded along a first side edge and is securely sealed or closed along its ends. A second side opposite from the folded side, is provided along substantially its entire length with a rupturable seal adapted to release a fluid composition from the container upon the application of hydraulic forces generated by passing the container between a pair of juxtaposed pressure-applying members, such as rollers **23** and **24**. The containing part of the fluid supplying mechanism is coupled to or cooperates with a leading end of the recording unit in any suitable manner for discharging its fluid contents between the photosensitive element and process sheet, and for this purpose has been illustrated with a funnel inserted into a space or slot provided between the photosensitive element and process sheet at the leading end of the image-recording unit.

Carrier sheet **11** comprises an elongated web of flexible material defined by one or more sheets cut and joined to provide the desired configuration and length. As will be described more fully hereinafter, this carrier sheet, either alone, or in combination with various leaders, serves to interconnect various ones of a plurality of the film units in assemblage **5** or pack **2**, and also serves for transporting such units in photographic apparatus such as a cartridge **3** or the camera **1**. For this reason the carrier is adapted to be folded or rolled back in almost any desired manner at one or more locations along its leading end **37** for proper attachment to such other units, and to provide a more compact (shorter) assemblage. This same unit may be assembled in many different arrangements, both simple and complex, and with no significant change in the unit itself, except, perhaps in its manner of folding or in the attachment of one or more leaders as mentioned above.

The carrier comprises a first leading end portion **37**, a second trailing end portion and a central supporting portion **41**. The length of leading end **37** depends on many factors, such as the manner in which the units are to be connected in a pack. The central supporting portion **41** of the carrier is provided with suitable connecting means, such as adhesives, cohesives or seals, for coupling the image-recording unit **13**, the pod **19** and trap **21**, to the carrier sheet in a manner described more fully in the abovementioned U.S. Pat. application Ser. No. 70,835, entitled PHOTOGRAPHIC FILM UNIT. Briefly, however, the image-recording unit is strippably attached to the carrier, while the pod and trap are permanently attached thereto, such that the carrier, pod and trap may be stripped from the recording unit, to leave an aesthetically unencumbered print, and for convenient discarding of the processing waste materials.

The pod **19** and trap **21** also are releasably coupled to the image-recording unit **13**. However, such coupling preferably is only functional. For example, lips of the pod, or its funnel, may be inserted between the photosensitive and process elements at the leading end thereof, and trailing ends of the photosensitive and process elements may be inserted between similar lips of the trap. Such arrangements are more fully illustrated and described in commonly assigned copending U.S. application Ser. No. 33,677, entitled PHOTOGRAPHIC APPARATUS, and filed on May 1, 1970 in the name of D. M. Harvey.

Preferably the photographic apparatus includes stepped pressure-applying members as illustrated and described in previously mentioned U.S. application Ser. No. 70,836, entitled FILM UNIT. In operation, raised shoulder portions of the pressure members are adapted to ride on the marginal portions of the film unit as the unit is pulled between the members, while recessed central portions of the members simultaneously are adapted to rupture the container and spread the processing composition in a uniform layer.

As the fluid processing composition is expelled from the container and distributed between the photosensitive and process elements, hydraulic forces in the fluid composition will separate the resilient elements in their central portions and force them (with the carrier sheet) into engagement with the central portions of the pressure members.

As the processing composition is distributed, it immediately begins to permeate the various layers of the photosensitive element to initiate processing in a manner to be described more fully hereinafter. Additionally, various components of the processing composition, including water, begin to escape or dissipate entirely through or otherwise from between the photosensitive and process elements to the surrounding atmosphere, resulting eventually in a drying of the processing composition. The composition comprises only a very small percentage of solids (e.g. less than 5 percent), and most of the rest of the composition (essentially water) eventually escapes from between the elements (e.g. within a few hours). As a result, the forces holding the photosensitive and process elements apart are relieved and the resiliency of the elements effects their return to facing engagement. By this time the image-recording unit again has assumed its original uniformly flat configuration. Additionally, since the image-recording unit **13** is adapted to be stripped from the carrier sheet, the finished print will be presented in a form unencumbered by the various materials, such as the pod and trap, that are necessary only for processing.

The pod and trap remain with the carrier sheet after stripping and can be rolled up in the sheet to enclose any remaining processing composition and to protect the environment, e.g. clothing and person, from the composition. Preferably, this roll, including all processing waste material, is discarded immediately. However, it also may be deposited temporarily in a pocket or drawer without substantial risk of damage thereto.

ASSEMBLAGE AND PACK

(Leader Arrangement)

The preferred film assemblage, illustrated most clearly in FIGS. **3** and **5–8** is more fully illustrated and described in my previously mentioned U.S. application Ser. No. 77,474, entitled FILM ASSEMBLAGE. Briefly, however, the assemblage comprises a plurality of film units **7** and a leader arrangement for coupling the leading end of one film unit to the leading end of a next adjacent (preceding) film unit. In most cases the

following description will be set forth in connection with the last film unit in the assemblage. However, where it is necessary to refer to a particular film unit, the units will be distinguished by *a*, *b* and *c* to represent the first, next, and last film units, respectively, it being understood that ordinarily the assemblage will contain eight rather than three film units. The leader arrangement preferably is defined by extensions or leading ends of the carrier sheets themselves, or, by one or more additional or supplemental leaders coupled to the leading end of each of the carrier sheets. The coupling between the film units is such that the withdrawal of one of the film units from the assemblage automatically will effect both: (1) the withdrawal of a leading end portion of the leader of the next successive film unit from the assemblage; and (2) the automatic stripping or separation of that leading end portion from the preceding withdrawn film unit. When used in photographic apparatus having juxtaposed pressure-applying members, the withdrawal of one unit between the members automatically threads the leader of the next successive film unit between the pressure members and leaves a portion of that leader in a position outside the apparatus where it may be grasped for pulling the next unit between the pressure members.

More specifically, and as illustrated in FIGS. 5–8 the preferred leader arrangement comprises a leader or leading end portion of carrier sheet **11** that extends first forwardly from the leading end of the image-recording unit **13** and then rearwardly to a position at its end **55** where it is coupled to the carrier sheet of the next adjacent (preceding) film unit. The coupling **55** is designed to be released or stripped from the next preceding carrier sheet at an appropriate time, and for this reason is provided with a suitable connecting mechanism that is sufficiently strong to remain intact while the leading end **55** is transported within and from the assemblage but is sufficiently weak to separate from the next preceding film unit when the leading end **55** is located in a position outside the assemblage where it manually can be grasped. Assisting to this end is the additional length defined by the rearwardly extending folded-back portion **37** of the carrier sheet that permits movement of the leading end **55** from the assemblage without substantial frictional resistance. However, after that leading end is withdrawn and threaded between the pressure members of an associated photographic apparatus, the originally folded-back portion becomes fully extended, and the suddenly increased resistance to movement of the leading end effects an increase in the forces applied to the connection. Additionally, as is most clearly illustrated in FIG. **6**, the leader reverses its direction as it is withdrawn from the assemblage such that its leading end **55** will be folded or rolled back upon itself just before it is intended to separate from the next preceding unit. At such time the forces applied to the connection change in nature from mainly sheer forces to mainly tensil forces, and a peeling-effect results that facilitates the separation. The connection is relatively weak in tension, and will separate or peel apart as the tensil forces increase, thus depositing the leading end outside the apparatus in a position where it may be grasped for withdrawing the next successive unit from the assemblage.

The dark slide **9** is coupled to the first or uppermost film unit in the same manner described above in connection with the couplings between the respective film units.

CAMERA AND STRIPPING MECHANISM

The camera **1** is most clearly illustrated in FIG. **1** and generally comprises a casing **61** for supporting various camera elements including an objective **63**, a retractable housing **65** for mounting the objective, and a main body portion **67**.

The body portion includes a front housing section **69**, and a rear housing section **71** separably coupled to the front housing section in any suitable manner. In the preferred embodiment the rear section also serves as a cover or door for a cartridge compartment **73**, and is coupled to the front section by a pivotal hinge **75** that permits opening of the camera back and positioning of the film pack casing **3** into the cartridge compartment **73**. A parting line **78** is provided between the front and back sections at one end of the camera such that opening of the camera back will separate one of the pressure members **23**, in the camera back, from the other of the pressure members **24**, in the front section. The parting line also is located for maintaining a stripping guide **83** in the front housing section, adjacent the front pressure member **24** upon opening of the camera back. The pack **2** is located in the camera with a leading end portion of the dark slide **9** extending therefrom, such that closing of the camera back will position the pressure members **23** and **24** on opposite sides of the dark slide and the leading end portion of the dark slide will project from a first exit slot **81** to a position outside the camera where it is accessible for withdrawing the dark slide through that first exit slot.

Casing **3** is located in the camera by cooperating surfaces **85** on the casing and **87** on the camera that align the foremost film unit in the camera focal plane and also serve as a light seal. The film units are arranged in stacked relation in the camera and are adapted to be exposed sequentially and then processed by withdrawing the film units between the juxtaposed pressure-applying members and from the camera. As the units pass between the members the pods **19** are ruptured and the processing composition is distributed between the photosensitive and process elements from the leading end of the unit to its trailing end where any excess of the composition is collected in trap **21**.

The stripping mechanism is illustrated most clearly in FIG. **4** and comprises the stripping guide **83** located on the opposite side of the pressure members from the film units and defining first and second paths leading from the cartridge or cartridge chamber to the camera exterior. One of the paths, including a second exit slot **91**, defines a substantially straight or flat plane from the cartridge casing exit **93**, through the pressure-applying members and to the exterior of the apparatus through the second exit slot **91**. The other path, on the other hand, passes from the cartridge casing exit, through the pressure members, and then extends in a direction divergent to the first mentioned path and through the first exit **81** spaced from the above-mentioned exit **91**.

The pack is prepared for a first exposure by grasping the leading end of the dark slide and withdrawing the dark slide between the pressure-applying members and

from the camera. As the dark slide is withdrawn, the leader or leading end portion **37***a* of carrier sheet **11***a* will move with the dark slide and will be threaded between the pressure-applying members and through the first exit channel **81** to the position illustrated in FIG. **6**. In its folded condition (illustrated in FIG. **5**), the leading end **37***a* provides sufficient excess material to move freely to the position illustrated in FIG. **6** without substantial frictional resistance. However, after reaching such position, the excess material is exhausted and significant additional resistance to movement is presented by the first film unit **7***a*. This additional resistance can result inherently from the compact arrangement of the pack, or can be supplemented by a frangible coupling between the trailing end of the film unit and the pack casing in a manner well known to those skilled in the art. In any event the increased resistance is sufficient to effect a peeling apart of the dark slide from the leader or leading end **37***a* also as depicted in FIG. **6**.

The first film unit then is exposed, and is transported from the assemblage and between the pressure-applying members by grasping and pulling on the leader or leading end **37***a* of carrier sheet **11***a*. As that carrier sheet is withdrawn, the pod **19***a*, the trap **21***a*, and the leading end of the next successive carrier sheet **11***b* all follow the first carrier sheet **11***a* between the rollers and along a first curved or arcuate path to first exit channel **81**. The film unit **13***a*, on the other hand, is relatively stiff and moves along a straight second path to a second exit channel **91** and the camera exterior. Such first and second paths lie on opposite sides of the stripping guide **83** that defines the paths and effects the stripping of the image-recording unit from its carrier sheet, pod and trap as they pass on opposite sides of the guide and from the camera.

The image-recording unit may be expelled entirely from the camera, or it may be expelled only until its trailing end reaches the second exit channel, in which point it may be releasably held by a holding spring **95** until it is convenient for the camera operator to retrieve the unit. The carrier sheet, pod, trap and leader then may be rolled up and discarded in any convenient manner. The print, on the other hand, is retained separate from this processing waste material and automatically will be processed to a finished print without further intervention by the camera operator.

As the first film unit **7***a* is withdrawn in the manner described above, and after the leader **37***b* of the next film unit is threaded to its fully extended position illustrated in FIG. **7**, the leading end **55***b* thereof automatically will be stripped from the preceding film unit and will be left in that position outside the apparatus where it is accessible for withdrawing the next successive film unit **7***b*.

As illustrated in FIG. **7**, the leader **37***b* of the next successive film unit will remain between the pressure members while the preceding image-recording unit **13***a* is being withdrawn between the members. However, the leader thickness is known and the pressure members can be designed to properly accommodate that known thickness without deleterious effect on the desired thickness of the processing composition layer intended to be spread. Moreover, since the strippable connection **55***b* passes between the members before the image-recording unit **13***b*, the increased thickness of the connection also will not effect proper spreading of the composition.

The remaining film units in the assemblage also are withdrawn for processing in a similar manner and will not be described in further detail.

CHEMISTRY

The above-described film units can be used to produce positive images in single or multicolors. In a three-color system, the image-recording unit preferably is provided with three emulsion layers having predominant sensitivity ranges corresponding, respectively, to different ones of the primary colors, and further having associated dye image-providing materials possessing spectral absorption ranges substantially complementary to the predominant sensitivity ranges of the respective emulsion layers: i.e., a blue-sensitive silver-halide emulsion layer is provided with an associated yellow dye image-providing material, a green-sensitive silver-halide emulsion layer is provided with an associated magenta dye image-providing material, and a red-sensitive silver-halide emulsion layer is provided with an associated cyan dye image-providing material.

In commonly assigned, copending U.S. application Ser. No. 027,990, entitled PHOTOGRAPHIC FILM UNIT FOR DIFFUSION TRANSFER PROCESSING and filed on Apr. 13, 1970 in the name of H. E. Cole, the dye image-providing materials described are non-diffusible couplers capable of reacting with oxidized color developing agent to produce diffusible dyes. However, other dye image-providing materials can be employed in film units useful with the present invention, including dye developers, coupling dyes, etc. Also as described in said U.S. application Ser. No. 027,990, such dye image-providing material, may be contained either in the silver-halide emulsion layers with which they are associated, or in layers contiguous thereto.

After exposure of the film unit through the transparent process sheet, an opacifying agent contained in the processing composition is distributed as described above in a layer over at least the exposure frame. Since the negative portion of the film unit is surrounded by opaque material and the emulsion layers now are covered by an opacifying agent, the unit is rendered light insensitive, and can be removed from the camera during processing. The processing composition then diffuses into the photosensitive element to effect an imagewise development of the silver-halide emulsion layers, and imagewise distributions of diffusible dye image-providing material (contained in the silver-halide emulsion layers or in layers contiguous thereto) are formed as a function of the image-wise exposure of the silver-halide emulsion layers. At least a portion of the imagewise distributions of diffusible dye image-providing material diffuse to the image-receiving layer to produce a positive dye image that is viewable through the transparent support as a right-reading image on the opaque reflecting layer background. The image-receiving layer does not have to be stripped away from the rest of the film unit and no timing of development is required.

While the image-recording unit described, generally is of the type illustrated in previously mentioned U.S. application Ser. No. 027,990, other film units, such as

the type disclosed in U.S. Pat. No. 3,415,644, issued Dec. 10, 1968, or integral film units for obtaining black and white images, also can be employed with the present invention.

The alkaline processing composition employed in the rupturable container is the conventional aqueous solution of an alkaline material (e.g., sodium hydroxide, sodium carbonate or an amine such as diethylamine, preferably possessing a pH in excess of 12) and an aromatic primary amino color developing agent such as a p-phenylenediamine developing agent. The solution also preferably contains a viscosity-increasing compound, such as a high molecular weight polymer (e.g., a water-soluble ether inert to alkaline solutions such as hydroxethyl cellulose or alkali metal salts of carboxymethyl cellulose such as sodium carboxymethyl cellulose), in a concentration of about 1 to about 5 percent by weight of the processing composition to impart thereto a viscosity of about 100 cps. to about 200,000 cps.

While the alkaline processing composition can be employed in a rupturable container, as described previously, to conveniently facilitate the introduction of processing composition between the transparent process sheet and the photosensitive element, other methods of inserting processing composition into the film unit could also be employed, (e.g., interjecting processing solution with communicating members similar to hypodermic syringes).

The alkaline solution-permeable, substantially opaque, light-reflective layer in the above-described photographic film unit generally comprises any opacifier dispersed in a binder. Particularly desirable are white light-reflective layers, since they provide esthetically pleasing backgrounds on which to view a transferred dye image, and also possess the optical properties desired for reflection of incident radiation. (Suitable opacifying agents include titanium dioxide, barium sulfate, zinc oxide, barium stearate, silver flake, silicates, alumina, zirconium oxide, zirconium acetyl acetate, sodium zirconium sulfate, kaolin, mica, or mixtures thereof in widely varying amounts depending upon the degree of opacity desired.) The opacifying agents may be dispersed in any binder such as an alkaline solution-permeable polymeric matrix (including, for example, gelatin, polyvinyl alcohol, and the like). When it is desired to increase the opacifying capacity of the light-reflective layer, dark-colored opacifying agents may be added to it (e.g., carbon black, nigrosine dyes, etc.). Another technique to increase the opacifying capacity of the light-reflective layer is to employ a separate opaque layer underneath the reflecting layer (comprising, e.g., carbon black, nigrosine dyes, etc., dispersed in an alkaline solution-permeable polymeric matrix including, for example, gelatin, polyvinyl alcohol, and the like). Such an opaque layer generally would have a density of at least 4 and preferably greater than 7 and substantially would be opaque to actinic radiation.

The transparent process sheet and support for the photosensitive element described above can be any transparent material as long as it does not deleteriously effect the photographic properties of the film unit and is dimensionally stable. Typical actinic radiation transmissive flexible sheet materials include cellulose nitrate film, cellulose acetate film, poly (vinyl acetal) film, poly-styrene film, poly (ethyleneterephthalate) film, polycarbonate film, poly-α-olefines, such as polyethylene and polypropylene film, and related films or resinous materials as well as glass. In this latter case only the photosensitive element would be sufficiently resilient to accommodate the layer of processing composition.

The respective elements of the film unit described above are selected and designed to provide a pleasing aesthetic appearance and preferably are stiff enough to be suitable for handling both within and outside of the camera. On the other hand, the structure is sufficiently flexible for manipulation by camera mechanisms and is sufficiently resilient to recover from any normal flexing. In the preferred unit (exposed from the process sheet or top side and viewed from the bottom side through the transparent support), the photosensitive portion of the film unit and any negative image remaining after processing permanently are hidden from the top side by the opacifying agent and from the bottom side by the opaque reflecting layer.

The invention has been described in detail with particular reference to the preferred embodiment thereof, but it will be understood that variations and modifications can be effected within the spirit and scope of the invention.

I claim:

1. Photographic apparatus for use with a self-processing film unit, the film unit including an integral image-recording unit and a carrier sheet, the image-recording unit being adapted to record a processable latent image and being separably coupled to the carrier sheet, said apparatus comprising:

a body portion defining an external boundary of said apparatus and an interior chamber for receiving the film unit;

means defining a first path and a second path from said chamber to and through said boundary, said second path including a divergent portion diverging from said first path;

means for guiding the image-recording unit along said first path and beyond said boundary, and for directing the carrier sheet along said second path and beyond said boundary, to separate the image-recording unit from the carrier sheet; and

juxtaposed pressure-applying members for engaging the film unit between said members and for applying compressive pressure to the film unit to initiate processing of the film unit; said first path and said second path including a common portion lying between said members, and said diverging portion lying between said members and said external boundary.

2. The apparatus claimed in claim 1 wherein said first path is substantially straight from said interior chamber, through said pressure-applying members and to said external boundary.

3. A camera for exposing and initiating the processing of a film unit, the film unit including a photosensitive element for recording a processable latent image, a process element for aiding in spreading a processing composition between the photosensitive and process elements to process the latent image, and a leader separably coupled to the photosensitive and process elements, said camera comprising:

a casing defining a chamber for receiving the film unit and including an external wall portion;

a pair of pressure-applying members, mounted within said casing between said chamber and said wall portion, for engaging the film unit between said members and for applying compressive pressure to the film unit to effect spreading of the processing composition between the photosensitive and process elements;

means defining a first aperture and a second aperture in said wall portion; and

means for first directing the photosensitive and process elements and the separably coupled leader between said pressure-applying members, and for then guiding the photosensitive and process elements through said first aperture and the leader through said second aperture, to separate the photosensitive and process elements from the leader.

4. In combination, a photographic film unit adapted to be processed by a processing composition and a camera adapted to effectuate an exposure and to initiate processing of said film unit, said film unit being removable from said camera after the processing is initiated:

said film unit comprising a photosensitive element for recording a processable latent image in response to the exposure, a process element permanently registered with said photosensitive element, said elements together forming an integral image-recording unit, and a carrier sheet separably coupled to said image-recording unit; and

said camera comprising means for effectuating the exposure, a pair of juxtaposed pressure-applying members for receiving said image-recording unit therebetween to spread the processing composition between said elements and thereby initiate the processing, and means for thereafter separating said image-recording unit from said carrier sheet and for directing said image-recording unit and said carrier sheet from said camera.

5. The combination claimed in claim 4 comprising a plurality of film units wherein one of said film units includes a leader separably coupled to another of said film units next adjacent to said one film unit by separable coupling means permitting said leader to be threaded between said members, and then separated from said adjacent film unit, as said adjacent film unit is removed from said camera.

6. Photographic apparatus for use with a self-processing film unit; the film unit including an image-recording portion, a container of processing initiating fluid releasably coupled to the image-recording portion for supplying the processing initiating fluid to the image-recording portion, and a carrier permanently attached to the container and strippably coupled to the image-recording portion for facilitating handling of the film unit by said apparatus; the image-recording portion having a photosensitive element for recording a processable latent image and a process sheet permanently attached to the photosensitive element in registered relationship for aiding in the processing of the latent image; said apparatus comprising:

a casing defining a supply chamber and including means for locating the film unit in a position for exposure to establish the latent image in the photosensitive element, said supply chamber having an end through which the film unit is removable from said supply chamber for processing of the film unit after its exposure;

means for initiating processing of the film unit after exposure of the film unit, said processing initiating means including a pair of opposed pressure-applying members located adjacent said end of said chamber, the film unit being movable between said members and in engagement with said members for applying compressive pressure to the film unit; and

means spaced adjacent said pressure-applying members on the opposite side of said pressure-applying members from said supply chamber for deflecting the carrier away from the image-recording portion to strip the carrier and release the container from the image-recording portion, the film unit being movable from between said members to said deflecting means along a first path, and the container and carrier being movable beyond said deflecting means along second and third relatively diverging paths.

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