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(54) PHOTOGRAPHIC CAMERAS AND FILM FOR USE THEREWITH

(71) We, EASTMAN KODAK COMPANY, a Company organized under the Laws of the State of New Jersey, United States of America of 343 State Street, Rochester, New York 14650, United States of America, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to the "in-camera" processing of photographic film units wherein a photosensitive element is exposed to light and thereafter is processed by the application of a processing fluid such as a liquid, usually in a viscous state, thereto, a second sheet being superimposed upon the element to assist in spreading the processing liquid thereover.

It is necessary to provide an excess of processing fluid in order to ensure that the exposed element is completely processed. Unfortunately the processing fluid, after use, is generally both highly corrosive and capable of indelibly staining an operator's hands or clothing. This disadvantage is overcome, prior to exposure, by containing the processing fluid in a fluid impermeable rupturable pod, and, after exposure, the excess fluid may be partially contained in a trap or a "throw-away" portion of the unit. As, in general, it is still necessary to separate the throw-away portion manually, contact with the excess fluid is normally unavoidable.

Efforts have been made at mechanical stripping of the throw-away portion from the photograph (which may be a print or a transparency) but such previous attempts have

involved the use of mechanical stripping fingers which physically contact the element and second sheet and, in stripping normally ride upon the confronting faces of the two sheets to separate the same. A basic disadvantage to such an arrangement is the likelihood of the wet and hence relatively soft surface including the picture area being damaged. U.K. Patent Specification 686673 shows an arrangement wherein a photograph may be manually stripped from a waste portion which is retained in a camera but the photograph bears the remains of the pod which originally contained and still would contain traces of the processing liquid.

U.S. Patent 3,424,072 describes an arrangement wherein only the finished print is ejected from the camera. However, in order to do this mechanical stripping fingers must be capable of clearly entering between the partially or totally cut leading edges of the element and second sheet which are in wet face-to-face contact.

It is an object of the present invention to avoid the aforesaid disadvantages in a simple and effective manner by the provision of a novel form of film unit and a camera for receiving the same.

The term "film unit" as used herein includes a photosensitive element, a second spreader sheet which may also receive a final image, for example in the manner of well known image transfer photography, the spreader sheet being permanently secured to the photosensitive element or being separable therefrom, and a rupturable processing fluid container.

If the film unit is used for the preparation

of reflection prints either the photosensitive element, the spreader sheet or both may be opaque. In the production of transparencies, the photosensitive element and/or the spreader sheet will be transparent.

The film unit preferably includes a trap for the collection and retention of excess processing fluid.

The term "photograph" as used herein denotes either a reflection print or a transparency or both as the contact allows.

According to the present invention there is provided a film unit, for use in a photographic camera, comprising a photosensitive sheet and a second sheet together forming an integral image recording unit, a carrier member strippably connected to the image recording unit and permanently supporting a rupturable container for processing fluid, the image recording unit being of a rigidity such that flexing of the carrier member causes peeling separation of the carrier member and the container from the image recording unit.

The unit preferably includes a trap for the excess processing fluid which trap is separably secured to the photograph and permanently secured to the waste portion so as, on flexing of the unit, to separate from the photograph.

The carrier member may be in the form of an elongate web forming with respective pods, a plurality of film units joined end to end.

The invention also provides a photographic camera for receiving a film unit as aforesaid comprising an exposure station whereat the photosensitive element may be photographically exposed, pressure applying means for rupturing a container and for spreading processing fluid therefrom over the photosensitive element, a first substantially rectilinear path from the exposure station through the processing means to the exterior of the camera and a second path divergent from the first path between the processing means and the camera exterior, the arrangement being such that, when a tension is applied to the film unit in the direction of the second path, the photograph separates from the waste portion to move along the first path to the exterior of the camera.

It is preferred that the second path extends to a waste chamber provided in the camera for the collection of waste.

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

Fig. 1 is a pictorial view illustrating a photographic camera in accordance with the present invention and a cartridge containing film units, for use therein;

Fig. 2 is a top view, with the cartridge loaded into the camera and with parts broken away more clearly to illustrate cartridge-

camera cooperation, of the camera and cartridge shown in Fig. 1;

Fig. 2a is a partial view of an alternative embodiment of the cartridge illustrated in Fig. 1;

Fig. 3 is a perspective view of a cartridge in accordance with the present invention and as shown in Figs. 1 and 2;

Fig. 4 is an exploded view of the cartridge of Fig. 3 and of a film assemblage adapted to be contained in the cartridge;

Fig. 5 is an exploded view of a film unit adapted to form part of the film assemblage illustrated in Fig. 4;

Fig. 6 is a composite view of the film unit of Fig. 5 with parts broken away more clearly to illustrate otherwise concealed parts of the unit;

Figs. 7, 8 and 9 are schematic views illustrating various stages in the operation of the camera;

Figs. 10 to 14 illustrate various mechanisms for effecting transport and metering of film units within and of photographs from the camera;

Fig. 15 is a pictorial view of a modified film unit in accordance with the present invention;

Fig. 16 is a plan view of the film unit depicted in Fig. 15;

Fig. 17 is an exploded cross-section, taken on the line 17—17 of Fig. 16, of the film unit depicted in Fig. 15;

Fig. 18 is a pictorial view depicting the film unit of Fig. 15 and illustrating a manner of separating the photograph from the waste portion;

Fig. 19 is a schematic side elevational view depicting a further manner of separation to that illustrated in Fig. 18;

Fig. 20 is a pictorial view depicting one manner of disposing of the processing waste material;

Fig. 21 is a perspective view of a further form of film pack in accordance with the present invention, including a casing for containing a modified film assemblage in accordance with the present invention;

Fig. 22 is a perspective view, part broken away of the modified film assemblage;

Figs. 23 and 24 are top and side views, respectively, of the film units depicted in Fig. 22, but illustrating the units in a laid-out or unstacked condition;

Figs. 25—28 are schematic cross-sectional views of the film unit depicted in Fig. 22 and illustrating various stages in the operation of the film unit with an associated camera;

Figs. 29, 30 and 31 correspond substantially to Figs. 25, 23 and 24, respectively, but illustrate a further alternative embodiment of the assemblage;

Figs. 32—35 correspond substantially to Figs. 25—28, respectively, but illustrate yet

another embodiment of the assemblage and its method of operation;

Fig. 36 is an expanded perspective view of yet another film assemblage in accordance with the present invention;

Fig. 37—40 are schematic cross-sectional views of the film assemblage depicted in Fig. 36 and illustrating various stages in the operation with an associated camera;

Figs. 41—43 are schematic cross-sectional views of an alternative embodiment of film assemblage illustrating various stages in the operation, with an associated camera;

Fig. 44 is a side, partially cut away, view of a further form of photographic camera in accordance with the present invention arranged to receive a cartridge as shown in Fig. 21 preferably containing an assemblage as shown in Fig. 36;

Fig. 45 is a fragmentary partially cross-sectioned pictorial view of a stripping mechanism in accordance with the present invention;

Figs. 46—49 are schematic cross-sectional views illustrating various stages in the operation of the camera of Fig. 44 with the film assemblage of Fig. 36 therein;

Fig. 50 is a partial perspective view of an unfolded assemblage of a further form of self-processing film units according to the present invention;

Fig. 51 is a sectional view of one of the film units in the assemblage of Fig. 50;

Fig. 52 is a sectional view of the film unit of Fig. 51 with an interconnecting leader thereof folded as in a stack of such units;

Fig. 53 is a perspective view of the film unit and folded leader of Fig. 52;

Fig. 54 is an exploded partial perspective view of the film unit and leader of Fig. 51;

Fig. 55 is an exploded perspective view, exaggerated for clarity of illustration, of a further form of cartridge according to the present invention containing the assemblage of Fig. 50 with its film units stacked in superposed relationship;

Fig. 56 is a perspective view of the cartridge of Fig. 55 fully assembled, with a portion thereof broken away to show an enclosed web winding and storage device;

Fig. 57 is a side-elevation view, partially broken away for clarity of illustration, of a camera having therein the cartridge of Figs. 55 and 56;

Fig. 58 is an enlarged sectional view of a portion of the camera of Fig. 57, showing a unit-transporting web and the pair of sheets of one of the film unit thereon as that pair of sheets is about to be expelled from the camera;

Fig. 59 is an enlarged sectional view similar to Fig. 58 showing the web and pair of sheets as the pair of sheets is being expelled from the camera; and

Fig. 60 is an enlarged sectional view similar to Figs. 58 and 59 showing the web and pair of sheets as the pair of sheets has been virtually expelled from the camera.

Referring first to Figs. 1 and 2, an embodiment of the present invention is depicted comprising photographic apparatus including a camera 1 and cartridge 3. The cartridge is adapted to receive a plurality of relatively stiff, integral or composite film units which remain after processing, and preferably are supplied before exposure, as pre-registered structures including both photosensitive and image-receiving layers. The units are attached, with co-operating pods and traps, to an elongate web or a leader system which interconnects all of the units and transports the units within and from the cartridge as the web is collected in an advancing and waste storage mechanism. The cartridge is received in the camera to position the unexposed integral film unit behind an exposure aperture of the camera, and cooperates with the camera such that the leader system may be advanced by a winding mechanism accessible from the camera exterior. After the exposure of the front film unit in the stack, the winding mechanism is operated to advance the leader system onto the waste storage mechanism of the cartridge and this in turn advances a film unit and cooperating pod and trap between pressure-applying members for rupturing the pod and spreading a processing fluid hereinafter described as a liquid from the pod across the unit and into the trap. Continued rotation of the winding mechanism effects, in accordance with the present invention, stripping of the integral film unit from the waste portion comprising the leader system, pod and trap, and automatically expels the unit along a rectilinear path from the camera. Completion of the processing cycle then is effected exteriorly of the camera while the processing waste material remains in the camera interior for later disposal with the cartridge. In this way the waste material need never be handled by the camera operator, either upon introducing the cartridge into the camera, or upon disposal of the cartridge after exhaustion of the film supply.

The film unit 5 is represented in Figs. 5 and 6 with a cooperating pod or rupturable fluid container 7 and a trap or excess fluid collector 9. Units of this type but without a pod or trap are more clearly described and illustrated in U.K. Specification No. 1,330,524, the disclosure of which hereby is incorporated into the present application by reference. Briefly, each unit comprises a composite or integral structure including a first layer of photosensitive material for recording a latent image, a second layer of image receiving material or mordant for recording a developed image, and a processing-solution spreading mechanism for effecting develop-

ment of the latent image in the first layer and transfer of that developed image to the second layer. In the presently preferred and illustrated embodiment, both the first or photosensitive and second or mordanting layers are supported in a single first sheet 11, while the spreading mechanism comprises a second sheet 13 that is pre-registered with the first sheet and serves generally to control and contain the processing solution as that solution is spread over the first sheet to effect processing. Preferably, these first and second sheets are secured together and remain in the integral or composite condition both before exposure and after processing, but it is conceivable that they also could be supplied in a separated condition from which they could be placed in register and secured after the exposure operation. The unit further includes spacing members 15 longitudinally arranged in parallel relation along each edge of the unit to define a predetermined distance of separation between the first and second sheets at least during processing and to confine the processing solution in a layer of predetermined thickness between the edges of the unit.

The pod 7 is defined generally by one or more sheets of vapour impervious material that are securely sealed around three edges to define a fluid container and include a rupturable seal along the fourth edge for discharging fluid from the pod. The pod also may include or cooperate with fluid-flow controlling elements such as funnel 17 for directing fluid expelled from the pod to the interface defined between the first and second sheets 11 and 13. The trap, on the other hand, includes a skirt 19 that overlies the film unit, and spacers 21 that operate to collect excess processing solution at the opposite end of the unit from the pod.

The pod and trap components all are securely adhered to a leader system or elongate transporting web 23, to be described more fully hereinafter, while the integral unit is only strippably attached in a manner permitting its separation by the application of a force to the leader or web and in a direction divergent to the plane defined by the unit. To permit stripping of the unit from the pod (including the funnel) and trap, these components are releasably coupled to the unit by inserting the rupturable edge of the pod or its funnel between the sheets 11 and 13 but without securing the same to the unit in any positive or unyielding manner. Similarly, the skirt portion 19 of the trap is adapted to overlie the unit but also is not secured to the unit in a positive or unyielding manner. Thus, as the leader system or transporting web diverges from the unit, the pod or funnel is free to pull away from the interface between the sheets, while the skirt 19 of the trap is free to slide off the upper surface of the pro-

cessing sheet. The mechanisms of this operation will be described more fully hereinafter and are more clearly illustrated in Figs. 7-9.

Referring now to Fig. 4, a preferred assemblage of film units is illustrated with a leader system comprising the elongate web 23 to which each of the film units is coupled for transporting the units within and from the cartridge, and from which the units may be separated by pulling the leader in a direction divergent to the plane defined by the respective film unit being stripped from the leader. This type of connection is provided by an adhesive coupling that is relatively strong in shear but weaker in tension: such that pulling of the leader in a direction substantially parallel to the plane defined by the unit is not likely to cause separation of the unit from the leader, but pulling of the leader away from the plane defined by the unit will cause separation of the unit from the leader.

The units are received in cartridge 3 in stacked relation with the leading edge of one unit aligned with the leading edge of the other units. The web, on the other hand, winds back and forth between the respective units, and each unit is coupled on a single side of the web such that they would be arranged in a head-to-tail relationship if the web were pulled from the cartridge and laid out in an extended or flat position. The forwardmost or leading portion 25 of the transporting web includes an adhesive element 27 (Figs. 3 and 4) for connecting the web to a waste collecting mechanism to be described more fully hereinafter in connection with the cartridge. This leading portion of the transporting web also may be opaque to light actinic to the film units and may extend across the cartridge exposure aperture to provide a dark cover for preventing premature exposures and otherwise protecting the film. A trailing portion of the transporting web 29 also may be folded beneath the rearwardmost film unit in the cartridge to protect that unit against scratching or damage by the platen or foreign material that accidentally might have entered the cartridge.

The cartridge 3 includes a disposable casing 31 defining a supply chamber or compartment adapted to receive a plurality of integral film units in stacked relation, and further supports a transporting and waste collecting mechanism illustrated as a spool 33 having a clutch 35, or other appropriate engaging mechanism, adapted to cooperate with a camera winding mechanism for effecting the transport of film units within and from the camera. This spool is rotatably mounted in parallel arms 36 of the cartridge that extend outwardly of the supply chamber to support the spool at a position substantially midway between the cartridge front and back walls 37 and 38 at one end of the cartridge.

In order to permit correct alignment between the cartridge and the camera, the front wall of the cartridge includes light sealing and aligning surfaces 39 adapted to mate with corresponding camera surfaces correctly to locate the forwardmost film unit in a focal plane defined by the camera objective. The cartridge back wall further supports a film platen 43 for resiliently urging each of the respective film units in the cartridge toward their forwardmost position for correct alignment in the film plane. The film units are adapted to exit from the supply chamber through means defining a slot or opening 45 located adjacent the chamber forward wall at the same end of the supply chamber as take-up spool 33. The spool, however, is spaced from the opening or exit slot, both in a longitudinal direction away from the end of the supply chamber and in a rearward direction away from the forward wall, for purposes to become more fully apparent hereinafter.

The camera is most clearly illustrated in Figs. 1 and 2 and generally comprises a casing 51 defining a cartridge receiving or supply chamber 53 and supporting various camera components, including a pressure applying mechanism 55, a film winding mechanism 57, a body release or operating member 59, and a closure or cover door 61. The cartridge is inserted into the camera by opening the cover door which thereby permits access to the supply chamber and separates a pair of juxtaposed pressure applying members 63 and 65 of the pressure applying mechanism. This permits seating of the cartridge against a light seal 67 and positioning of the pressure applying members on opposite sides of the film transporting web 23. The closure member or cover door then is pivoted and latched in a closed position wherein the cartridge is resiliently urged against the sealing and locating surfaces by spring 69, and the respective members of the pressure applying mechanism are operatively positioned in opposed contact with the transporting web on opposite sides of the intended path of movement of the film units. This path is defined by the cartridge exit slot 45, the location of the nip between the pressure applying members 63, 65, and a camera exit slot 71, all of which lie in a substantially straight line when the cartridge is in the camera and the cover door is closed. In this manner the film units can be advanced along a substantially rectilinear path and without flexing, from the cartridge through the camera and to its exterior. Unlike the film units, however, web 23 is adapted to be flexed somewhat sharply to follow a second path divergent from the path taken by the film units and for this purpose is directed through the pressure applying members and then downwardly to the lowermost side of winding core 33. Of course this could be accomplished in other ways, as illustrated in

Fig. 2a, for example, where one of the pressure applying members comprises a part of the cartridge. Regardless of the particular apparatus used, it directs movement of the web to effect an increase in the distance between the web and the film unit and thus effects separation thereof.

Referring now to the operation of one aspect of the preferred embodiment, and to Figs. 7—9, the leader system or transporting web 23, and the film unit 5, are illustrated in three different positions of operation. The first position, depicted in Fig. 7 represents a period of time after exposure of the unit and after initial winding of the take-up mechanism to pull the unit out of the cartridge and into the bite of the pressure applying mechanism. In this position the unit is maintained in a substantially flat condition by supporting engagement at one end between the pressure applying members and at the middle and other end by the cartridge exit slot 45 and forward wall 37. The leader on the other hand is maintained in a relatively taut condition by the pressure-applying mechanism and flexes around the lowermost pressure-applying member 65 for movement onto the take-up spool 33 in a direction divergent to the plane defined by the film unit. Because of this direction taken by the web, the pod and its funnel, which are securely attached to the web, move in a direction that increases the distance between the pod and the unit and pulls the rupturable edge of the pod or the funnel out of the interface between the sheets of the unit to strip the unit from the pod and funnel. Continued winding of the take-up mechanism then will wind this pod and funnel onto the take-up spool while continuing to advance the film unit in substantially the same plane until the leading end of the unit enters and projects out through the camera exit slot 71.

In the second position depicted in Fig. 8, the leading end of the unit is projecting from camera exit slot 71, and the unit is supported in substantially flat condition by this exit slot and the bite between the pressure-applying members, while the transporting web 23 continues to be stripped from the lower surface of the unit by its movement in a direction divergent to the plane defined by the unit. This stripping between the film unit and the transporting web generally is effected by a change in the forces between the unit and web from the shear forces used in transporting the web to forces having at least a significant component in tension for separating the unit from the web.

In the third illustrated position, represented in Fig. 9, the trap 9 is being drawn between the bite of the pressure-applying members, and in a manner similar to that described above for the pod, is thereafter pulled away from the unit because of increasing distances

between the unit and the trap's point of attachment to the web as the web moves downwardly away from the plane defined by the unit. As in the pod stripping operation described above, this trap will be wound onto the take-up spool 33 as winding of this spool is continued, and the unit will be left supported in the camera exit slot in a condition entirely detached from the transporting web and from which it may be grasped and completely expelled by the camera operator. Of course, it also should be understood that the mechanism could be so arranged that the unit is automatically expelled completely from the camera without any assistance whatsoever from the camera operator. In either case, however, the outer surfaces of the unit are in a dry condition when they are first handled by the camera operator while the film transporting and processing waste material, that will include any excess solution, are wound into the spool or take-up mechanism of the cartridge and need never be directly handled by the camera operator. Moreover, since the processing solution spread between the sheets of the unit includes an opacifier, and since the processing chemistry of the unit is self-timing, the unit may be expelled from the camera immediately after exposure and automatically will be processed to completion without any necessary intervention by the camera operator either to time the processing cycle or to strip a finished print from the photosensitive material.

Referring now to certain alternative embodiments of film advancing aspects of the present invention, Figs. 10—14 illustrate various mechanisms for advancing the film and for automatically metering such advancement. In most respects the illustrations of these embodiments are believed to be self-explanatory and they will not be described in detail. However, brief descriptions are set forth below.

In the embodiment of Fig. 10 the transporting web 23 is provided with perforations along one edge thereof in positions correctly pitched to effect blocking of further advancement of the transporting web after the next preceding unit has been expelled from the camera and just before the web will begin to advance the next successive unit that then is positioned in the cartridge exposure aperture. While the exact configuration and location of the perforations have not been shown in Fig. 10, they would be similar to the perforation shown in Fig. 11 and also could be selected from other appropriate designs well known to those skilled in the art. The film is advanced by a lever 100 accessible from the camera exterior for reciprocation about pivot point 101. Such reciprocating movement of the lever is transferred to a driving gear through a one-way clutch comprising the pawl 104 and ratchet 106 which drivingly engage

during counterclockwise movement of the lever 100 but which slip relative to each other during clockwise or return movement of the lever. This winding force is then translated from the gear 102, to effect rotation of winding spool 33 much in a manner described above, through a spur gear 108 having teeth that mesh both with the driving gear and with teeth provided on the winding spool. Reciprocation of the winding lever 100 to advance the film is continued until a first end 110 of a metering pawl 112 drops into a perforation in the film to position the other end 114 of the pawl in locking engagement with the driving gear 102 of the winding mechanism. This prevents further winding of the transporting web and advancement of the film at the proper position for the next successive exposure. After that next exposure, the metering pawl again is pivoted out of the perforation by means, not shown, accessible from the camera exterior to permit further advancement of the film and positioning of still another film unit at the exposure aperture.

Another embodiment of film-advancing mechanism is illustrated in Figs. 11 and 12 and operates in a manner similar to that described in connection with the embodiment of Fig. 10 except that driving energy or power for advancing the transporting web is supplied by means of a Negator (Trade Mark) spring 200 located within the core of spool 33 and having one end 202 immovably attached to the camera casing and another end 204 coupled in winding relationship with the spool 33. Again, and like the embodiment of Fig. 10 metering of film advancement is effected automatically by a metering pawl 206 including a first end 208 adapted to enter a film perforation to position a second end 210 in locking engagement with the winding mechanism.

Yet another embodiment of film advancing and metering mechanism is illustrated in Fig. 13, and in this case is powered by energy supplied from an electrical source including, for example, a battery 300 and motor 302. In this embodiment a metering pawl 304 includes a first end 306 for entering a film perforation in the manner described above, and a second end 308 adapted to open the electrical circuit for driving motor 302 and stop further film winding when the first end so enters the perforation in the film.

Yet another embodiment for advancing and metering advancement of the transporting web is illustrated in Fig. 14. In this embodiment, the battery or source of electrical energy 400 may be supplied with the cartridge within the core of winding spool 33 and be electrically connected to the driving motor 402 through appropriate contacts 404 and 406 on the cartridge. In this embodiment, however, electrically conductive material 408 is supplied on one edge of the film in lieu of the per-

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forations of the above-described embodiments, and this conductive material is adapted to maintain the circuit in an energized condition, once it is energized by operating switch 409, for driving motor 402 until a gap 410 in the conductive material operates as a switch to break the circuit and discontinue such winding.

Referring now to Fig. 15, a film unit 5a is composed of a carrier sheet 2a, an image-recording unit 4a including photosensitive and process elements 11a and 13a, a pod or container 7a for processing composition and a trap or collector 9a for excess processing composition.

Whilst the previous embodiment described the units attached to a continuous web support, in this embodiment, each film unit has its own carrying sheet which enables the units to be used, if desired, in existing cameras.

The photosensitive and process elements 4a and 5a are constructed accurately to define sheets having straight edges, square corners and appropriate borders, and are registered correctly 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 4a 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 2a supports image-recording unit 4a with the pod 7a and trap 9a 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 5a 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 is associated with its respective film unit, although it may be coupled to other similar units in an assemblage thereof. The carrier sheet also is adapted to serve many different functions, and for this purpose has a sufficiently versatile design to permit, for example, easy alignment in assembly line or automated jigs during manufacture; transport of the film unit from an assemblage of such units during use in a camera; and rolling-up with other waste material, such as the pod and trap, for disposal after processing. These various functions will become more apparent from the following detailed description.

As in the previous embodiment, the pod 7a and trap 9a are permanently secured to the

carrier sheet, but are only releasably coupled to the image-recording unit 4a. Similarly, the image-recording unit is only releasably coupled to the carrier sheet. Such an arrangement of permanent and releasable couplings permits stripping, after processing, of the image-recording unit (then defining the finished print or photograph) 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.

In accordance with an additional feature of the invention, the trap of this embodiment is not only permanently attached to the carrier sheet but actually is enclosed or defined by such sheet even further to simplify and reduce manufacturing operations and to enhance operation of the unit during processing.

The photosensitive element 11a comprises a substantially flat, resilient support of transparent cellulose triacetate film base defining a first or leading end 10a, a second or trailing end 12a, lateral edges 14a and 16a and a central portion 18a. At least the latter portion 18a 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 20a (Fig. 17), where it can protect that side of the unit, and the silver-halide emulsion located near the top or inside face, where it is protected by the transparent process sheet 13a. 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 photosensitive element further includes appropriate means depicted schematically as a border or margin 22a which extends entirely around the circumferential portions of the element. Such border or margin provides a sharp boundary defining an exposure frame within which the latent image is adapted to be recorded, and a print frame that preferably is white, and within which the finished print is adapted to be formed. Preferably, the exposure and print frames are coextensive and vertically aligned, but they may be defined in any of a number of ways including pre-flash or photo-resist techniques applied either in a single layer of the unit or in separate layers, one defining each of the respective frames.

The process sheet or second element 13a is also 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 order to relieve crowding on the drawing, separate reference numerals have not been applied to these corresponding parts of the process sheet or film unit. It should be understood, however, that such parts are aligned with and can be referred to or located by the reference numerals applied to the photosensitive element, just as they are referred to in the same or similar terms. 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 11a and process sheet 13a preferably are rectangular and coextensive with one another, and may be maintained in registered or superposed facing relationship by a permanent seal 115a to define the image-recording unit 4a. The connection may comprise a contact-sensitive, cohesive material applied both to the photosensitive element and the process sheet. Other satisfactory connections may be provided by heat or ultrasonic seals, or by adhesive material applied to either one or to both the photosensitive element and process sheet. Preferably the connection extends in a longitudinal direction at the lateral edges of the unit from its leading end to its trailing end. The resulting connection should also be sufficiently impervious to the processing composition to prevent its escape from the lateral edges of the unit during processing.

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. Preferably, however, and as will be described hereinafter, the leading and trailing ends 10a and 12a are resiliently separable to permit the introduction of a processing composition between the elements at the leading end and the collection of any excess of the composition from between the elements at the trailing end.

The image-recording unit described above, comprising the photosensitive element 11a and process sheet 13a particularly is adapted to cooperate with various elements of the more comprehensive film unit 5a with which it has been illustrated. The latter unit includes the carrier sheet 2a, the container or pod 7a and the excess fluid collector or trap 9a 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 21a permanently mounted on a skirt 19a at the trailing end of the carrier sheet for collecting any excess fluid composition expelled from the trailing end of the image-recording unit 4a. 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. Patent No. 2,686,717. In accordance with one feature of the invention, the preferred trap embodiment is substantially entirely (except for the lifters) formed from a trailing end of the carrier sheet by folding the sheet over upon itself across the lifters and the trailing end of the image-recording unit 4a. This aspect of the trap will be described more fully hereinafter in connection with the carrier sheet.

The container or pod 7a 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 vapour impervious material that is folded along a first side edge 47a and is securely sealed or closed along its ends 48a and 50a. A second side 52a, opposite to folded side 47a, 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 (not shown). The containing part has two fluid containing chambers 46a and is coupled to or cooperates with a leading end of the unit for discharging its fluid contents between the photosensitive element and process sheet, and for this purpose has been illustrated with a funnel 17a 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 2a comprises an elongated web of flexible material that conveniently can be cut as a single piece having the desired shape. The configuration illustrated permits individual assembly of the film units independently of other such units and in a particularly convenient manner especially conducive to assembly line or automated assembly. By way of example only, the carrier can be held in a laid-out or extended configuration on a flat vacuum table and the various cooperating elements, such as the image recording unit 4a, pod 7a, and lifters 21a then can be coupled to the outstretched sur-

face of the carrier at appropriate locations. After such attachment the trailing end or skirt of the carrier may be folded over the trap lifters and the trailing end of the image-

5 recording unit 4a to enclose the trap and complete the more comprehensive film unit 5a.

Carrier sheet 2a also may serve to interconnect various ones of a plurality of such larger film units in an assemblage or pack (not shown), and for transporting such units in photographic apparatus such as a cartridge or camera (not shown). For this reason the carrier is adapted to be folded in almost any desired manner at one or more locations

10 long its leading end 159a for correct 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 supplemental leaders, (not shown).

The carrier preferably is cut from a continuous roll of coated paper. Such paper should be flexible and fold easily while resisting tearing and cracking even after long periods of storage. Moreover, it should be strong in tension and have a protective coating to repel fluids, such as the processing composition, that might result in reduced strength. The same coating can enhance the performance of the carrier by reducing its coefficient of friction and facilitating its ability to slide, for example, relative to other similar film units in a pack. The carrier sheet should have some slight resiliency but should not be stiff or so resilient as to interfere with compact and compressible stacking in a folded condition. Still further, it should accept a wide variety of adhesives, cohesives and seals (e.g. ultrasonic or heat) for coupling various elements to the leader either in a permanent or releasable manner.

The carrier comprises a first leading end portion 159a, a second trailing end portion 161a and a central supporting portion 163a. The length of leading end 159a depends on many factors, such as the manner in which the units are to be connected in a pack. In the illustrated embodiment, the carrier is adapted to be coupled to the carrier of another similar unit near the leading end of the other unit, and, for this purpose extends forwardly beyond pod 7a by an amount approximately equal to $\frac{1}{2}$ the length of the film unit itself (see Fig. 16). If it were desired to couple the leading end of one unit to the trailing end of another unit, the leading end portion 159a could be extended by the appropriate amount, of preferably, a supplemental leader could be provided for increasing the effective length of the leading end.

The central supporting portion 163a of the carrier is provided with suitable connecting

means, such as adhesives, cohesives or seals 165a, 167a, 169a and 170a (Fig. 16), for coupling the image-recording unit 4a, the pod 7a and trap 9a, to the carrier sheet.

The connecting means may be an adhesive applied only to the carrier sheet or only to the pod, image-recording unit and trap. Preferably however, and especially in the case of the pod and trap, a cohesive is used and is applied to both the carrier sheet and to the elements secured thereto. In fact, one particularly advantageous feature of the present invention is provided by using a cohesive that, once applied, will adhere only to the same or similar cohesives. Thus, the cohesive may be applied to the various parts of the film unit at some plant location other than, and sometimes prior to, actual assembly of the parts to form the unit. The various parts then can be handled with the cohesive applied and no particular precautionary measures need be taken to prevent sticking between the parts and the handling apparatus. On the other hand, when the parts are assembled in proper contacting relationship, the cohesive on each contacting part immediately will become effective to couple those parts together in the appropriate manner, e.g. releasably in the case of the image-recording unit and permanently in the case of the pod and trap.

The coupling means also may be applied over the entire contacting areas of the parts or only over a portion of such areas. Preferably, a cohesive is applied over a substantial portion of the contacting areas in the case of the pod and trap, to ensure a permanent connection, but only over small discrete portions of the contacting areas in the case of the image-recording unit, to facilitate stripping. Additionally, in accordance with one feature of the invention, an edge or corner portion 171a (Fig. 18) of the image-recording unit may be left free to separate from the carrier so that edge or corner can be grasped to facilitate stripping of the image-recording unit 4a from the rest of the film unit 5a after processing.

In accordance with another feature of the present feature invention, to be described more completely hereinafter, the trap is formed in part by a portion of the carrier sheet itself. In this case, the carrier sheet operates as the connecting means and no separate means, e.g. adhesive, cohesive or seal, is required, except perhaps to secure the lifters 21a to the carrier.

The pod 7a and trap 9a also are releasably coupled to the image-recording unit 4a. However, such coupling preferably is only functional. For example, lips 173a of the pod 7a, or its funnel 17a, may be inserted between the photosensitive and process elements 11a and 13a at the leading end thereof, and trailing ends of the photosensitive and process elements may be inserted between

similar lips 175a of the trap. In such case no adhesive, cohesive or separate sealing means is required.

5 The trailing end portion 12a of carrier sheet 2a is folded over and extends forwardly over itself to cover the trap lifters and enclose or define the trap. Additionally, this folded over portion overlies the trailing end of the image-recording unit 4a and cooperates with
10 the vertically aligned portion of the unfolded part of the carrier sheet to define the previously mentioned lips between which the trailing end of the image-recording unit is inserted.

15 The film unit may be used in photographic apparatus such as a camera having stepped pressure-applying members (not shown). 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
20 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
30 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. The height of the central recess in the members determines
35 and is selected to spread the composition in a layer of correct initial thickness (approximately .003 inch), and, since the thickness of the photosensitive element, process sheet and carrier sheet automatically are accounted for
40 by engagement between the shoulders of the members and the margins of the film unit, it has been found that this desired initial thickness can be established by providing each of the members with a step approximately equal
45 in height to three fourths of such desired composition thickness.

As the processing composition is distributed, it immediately begins to permeate the various layers of the photosensitive element
50 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
55 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
60 5%), 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 4a is adapted to be stripped from the carrier sheet as described more fully hereinafter, the finished print will be presented in the very same complete structure that was accurately cut and assembled as the image-recording unit at the time of manufacture.

70 The manner of stripping the image-recording unit 4a from the rest of the film unit 5a, as it normally would be accomplished after spreading of the processing composition, is most clearly illustrated in Figs. 18—20. While any number of different methods could be used, the most convenient is to flex or bend the carrier sheet downwardly at its ends and along one edge as illustrated in Fig. 18. Preferably, the photosensitive and process elements 11a and 13a have significantly more rigidity than the carrier sheet, and will tend to retain a substantially flat condition. The forces resulting from such bending of the carrier sheet will pull the pod from between the photosensitive and process elements, and similarly will pull such elements from the trap. Additionally, an edge of the image-recording unit 4a will separate from the carrier as provided for by the releasable connection therebetween. The image-recording unit then can be grasped at the dry presented surfaces and completely removed from the carrier for viewing as the finished print.

100 The pod and trap remain with the carrier sheet after stripping and can be rolled up in the sheet, as illustrated in Fig. 20, to enclose any remaining processing composition and to protect the environment, e.g. clothing and skin, 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.

110 The respective elements of the film unit 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
125 the bottom side by the opaque reflecting layer.

Referring now to Figs. 21 and 22, of the drawings, a further embodiment of the present invention is illustrated comprising a cartridge 3b including a casing 31b for con-

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taining an assemblage 6b of modified integral self-processing photographic film units 5b and a dark slide 8b.

Briefly, each film unit comprises a carrier sheet 23b, an image-recording portion or smaller unit 4b, including photosensitive and process elements 11b and 13b; a pod or container 7b for processing composition; and a trap or collector 9b for any excess processing composition. The assemblage may contain any number of film units, for example eight, but has been illustrated with only three such units to simplify the description. Additionally, reference numerals generally are applied only to the central illustrated film unit, since the first and last units may have a slightly different construction, for purposes which will become more fully apparent hereinafter.

The description of the units of the assemblage is similar to that given above in relation to Figs. 15 to 19 and will not be repeated. It should be noted that like parts have been indicated with the same reference number with a suffix "b" added.

The film assemblage comprises a plurality of film units 5b and a leader arrangement for coupling the leading end of one film unit to the trailing end of a next adjacent (preceding) film unit. In most cases the following description will be set forth in connection with the middle film unit in the assemblage. However, where it is necessary to refer to a particular film unit, the units will be distinguished by single, double or triple prime suffixes to represent the first, next and last film units, respectively, it being understood that ordinarily the assemblage will contain 8 rather than 3 film units. As briefly mentioned above, the leader arrangement may be defined by extensions or leading ends of the carrier sheets themselves, or, preferably, 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. 22—24, Figs. 23 and 24, and Figs. 25 to 28 utilizing single, double or triple primes to illustrate the first, second and third film

units respectively, the preferred leader arrangement comprises the carrier sheet 23b, or at least its leading end portion 25b, and a supplemental leader 24b coupled at one end 26b (Fig. 24) to the trailing end 29b of the carrier sheet of one film unit, and at its other end 28b (Fig. 24) to the leading end 25b of the carrier sheet of the next adjacent (successive) film unit. While the supplemental leader can be considered as a part of either of the film units to which it is coupled, the following description will assume the leader is a part of that film unit to which it is most securely coupled, as will become more apparent hereinafter.

The coupling at the first end 26b of the leader may be effected in any suitable manner and preferably is non-releasable or strong enough so the leader remains attached to the carrier sheet as a permanent part thereof. The second end coupling 28b, on the other hand, is designed to be released or stripped from the next successive carrier sheet at an appropriate time, and for this reason is provided with a reverse curl or is folded back upon itself adjacent the point of attachment to define a peel-apart connection. This connection, including an appropriate adhesive, is sufficiently strong in sheer to remain intact while transporting the leading end of the next successive carrier sheet within and from the assemblage. Assisting to this end is the compact condition of the film units in the pack, which does not provide the peel-joint with sufficient vertical space to separate in its usual manner, and also the excess material defined by the folded back leading end of the carrier sheet that can be moved 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 additional vertical space becomes available, the excess material is exhausted, and the suddenly increased resistance to movement of the leader, because it is coupled to the next successive film unit all effect an increase in the tensile forces applied to the connection. The connection is relatively weak in tension, and will separate or peel apart as the tensile 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 and apparatus.

In the embodiment illustrated, the peel-apart connection is spaced lengthwise along the leader, from the trailing end of the preceding image-recording unit, by an amount approximately equal to the length of the image-recording unit 5b and lies vertically below the leading end of the recording unit. Similarly, the connection is spaced from the leading end of the next successive recording unit by an amount approximately equal to

twice the length of the fluid container 7b and its funnel. These lengths have been established firstly so the leader will not pass between the pressure members until after the preceding film unit but will pass entirely between the pressure members (except for the carrier sheet parts thereof) before the next successive recording unit, and secondly, so only a relatively short leading end portion of the leader or carrier sheet of the next successive film unit will be left extending from the apparatus after separation of the peel-apart connection.

The leader 24b is somewhat narrower than the other elements of the film unit to facilitate its rolling upon itself as it is withdrawn from the assemblage and to reduce the frictional forces as it moves in the assemblage and between the pressure-applying members. While the exact width is not known to be critical, it preferably is narrower than the recessed portion of the pressure members and is sufficiently thin to pass between the members without rotating the members, in the case of rollers, or without significant frictional contact between the leader and the pressure members, in the case of non-rotating members. In this manner, and as described more fully in U.S. Patent No. 3,161,122, the leader can move laterally while between the pressure members to permit proper alignment of the film unit immediately prior to its entry into the bite between the members.

A dark slide 8b is provided for protecting the film units from premature exposure. While this dark slide may be coupled to the first or uppermost film unit in any suitable manner, a strippable or peel-apart connection has been illustrated which is similar to the connections described above except for its location, and which has been selected to reduce the waste material left over after withdrawal of the dark slide.

This particular assemblage is designed so that it may be used in known cameras in which an operator subsequent to each exposure, pulls the individual film units from the camera in order to effect processing and render the photograph accessible.

Referring now more specifically to Figs. 25—28, the operation of this embodiment is illustrated. In order to position the pack within the camera, the camera back or door 61b is pivoted about hinge 30b and away from front body portion 51b. A parting line 32b is provided between the camera back and the front body portion such that opening of the camera back will separate the pressure member 65b from the pressure member 63b and from a stripping guide 34b. The pack then can be inserted into the camera with a leading end portion of the dark slide 8b projecting therefrom, and when the camera back 61b is closed the pressure members will be located on opposite sides of the dark slide

and the leading end portion of the dark slide will project from a first exit channel 40b and to a position outside the camera where it is accessible for withdrawing the dark slide through exit channel 40b and from the camera. The function of the stripping guide 34b and channel 40b is more fully illustrated and described hereinafter in relation to Figs. 44—49 and will not be described in detail in relation to the present embodiment. However, it should be understood that other camera structures for guiding the film units from the camera may be utilized without departing from the present invention.

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 leading end portion of carrier sheet 25b' will move with the dark slide and will be threaded between the pressure-applying members and through the first exit channel 40b to the position illustrated in Fig. 26. In its folded condition (illustrated in Fig. 25 the leading end of the carrier sheet 25b' provides sufficient excess material to move freely to the position illustrated in Fig. 26 without substantial frictional resistance. However, after reaching such position, the excess material is used up and significant additional resistance to movement is presented by the first film unit 5b'. This additional resistance may result inherently from the compact arrangement of the pack or may 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 leading end of the carrier sheet, also as depicted in Fig. 26.

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 leading end of carrier sheet 25b'. As that carrier sheet is withdrawn, the pod 7b', the trap 9b', the leader 24b', and the leading end of the next successive carrier sheet 25b'' all follow the first carrier sheet 25b' between the rollers and through first exit channel 40b. The film unit, on the other hand, is stripped from these other various elements, in a manner described above and is guided through a second exit channel 41b to the camera exterior. 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 at which point it may be releasably held by a holding spring 42b 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

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from this processing waste material and automatically will be processed to a finished print without further intervention by the camera operator.

5 An alternative embodiment of the present invention is illustrated in Figs 29—31. This embodiment is substantially identical in many respects with the embodiment described above in relation to Figs. 22 to 28. Those features
10 which are the same as described above have been identified by the same reference characters and will not be described in detail.

This alternative embodiment differs from the above described embodiment primarily in the
15 elimination of separate leader 24b and the substitution therefor of an extended trailing end portion 29b of the carrier sheet to provide a leader 44b for coupling the trailing end
20 of one film unit to the leading end of the next successive film unit. In a manner similar to that described above, this extended trailing end or leader 44b is strippably coupled to the leading end portion of the next successive
25 carrier sheet by a separable or peel-apart connection 49b that operates in the same manner as the peel-apart connection 28b described above. Also unlike the leader of the previous
30 embodiment, this extended trailing end portion or leader 44b is substantially equal in width to the other portions of the carrier sheet and to the image-recording unit.

Yet another form of the present invention is illustrated in Figs 32—35. Many features
35 of this alternative embodiment are substantially identical to the preferred embodiment described above and have been identified by similar reference numerals. Unlike the previous described embodiments, however, the film units are coupled within the assemblage
40 by an extended leading end or leader portion defined by the carrier sheet itself and coupled to the trailing end of the next preceding film unit. Additionally, the strippable connection is located at the trailing end of the next
45 preceding film unit instead of being located vertically adjacent the leading end of the image-recording unit as described above. Similarly, the coupling 54b between the dark
50 slide and the first film unit has been provided at the trailing end of the dark slide. In all other respects, however, these strippable connections 56b and 54b are intended to be substantially identical to those described
55 above.

The above-described film units can be used to produce positive images in single or multi-colours as described above.

Referring now to Figs. 36—43 of the drawings, and particularly to Fig. 36, a further
60 embodiment of an assemblage of the present invention is illustrated comprising a cartridge 3c including a casing 31c for containing an assemblage 6c of integral self-processing
65 photographic film units 5c and a dark slide 8c.

The preferred film assemblage, illustrated in Figs. 36—40, comprising a plurality of film units 5c and a leader arrangement for coupling the leading end of one film unit to the leading end of a next adjacent (preceding) film unit. The parts of the film units of the assemblage are indicated by similar reference numerals to those used in the previous embodiment, except in that the numerals are given a suffix "c". In most cases the following description will be set forth in connection with the middle film unit in the assemblage. However, where it is necessary to refer to a particular film unit, the units will be distinguished by single, double or triple primes to represent the first, next and last film units, respectively, it being understood that ordinarily the assemblage will contain 8 rather than 3 film units. The leader arrangement preferably is defined by extensions or leading ends of the carrier sheets themselves, or, in an alternative embodiment, 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. 36—40 the present leader arrangement comprises a leader or leading end portion of carrier sheets 25c that extends first forwardly from the leading end of the image-recording unit 4c and then rearwardly to a position at its end 58c where it is coupled to the carrier sheet of the next adjacent (preceding) film unit. The coupling 58c 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 58c is transported within and from the assemblage but is sufficiently weak to separate from the next preceding film unit when the leading end 58c is located in a position outside the assemblage where it can be grasped manually. To this end, additional length defined by the rearwardly extending folded-back portion 25c of the carrier sheet permits movement of the leading end 58c

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 it most clearly illustrated in Fig. 38, the leader reverses its direction as it is withdrawn from the assemblage such that its leading end 58c 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 tensile 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 tensile force increases, thus depositing the leading end outside the apparatus in a position where it may subsequently be grasped for withdrawing the next successive unit from the assemblage.

In the embodiment illustrated, the strippable connection is spaced lengthwise along the extended carrier sheet or leader, from the leading end of the image-recording unit, by an amount approximately equal to twice the length of the fluid container 7c and its funnel 17c (Fig. 37). These lengths have been established first so the coupling point or end 58c will pass between the pressure members before the preceding film unit, and second, so only a relatively short portion of the leader (i.e., the leading end portion of the carrier sheet) will be left extending from the apparatus after separation of the peel-apart connection.

The dark slide 8c 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.

Referring now more specifically to Figs. 37—40, the operation of this embodiment is illustrated. In order to position the pack within the camera, the camera back or door 61c is pivoted about hinge 30c and away from front body portion 51c. A parting line 32c is provided between the camera back and the front body portion such that opening of the camera back will separate the pressure member 65c from the pressure member 63c and from a stripping guide 34c. The pack 3c then can be inserted into the camera with a leading end portion of the dark slide 8c projecting therefrom, and when the camera back 61c is closed the pressure members will be located on opposite sides of the dark slide and the leading end portion of the dark slide will project from a first exit channel 40c and to a position outside the camera where it is accessible for withdrawing the dark slide through exit channel 40c and from the camera. The

function of the stripping guide 34c and channel 40c is more fully illustrated and described hereinafter in relation to Figs. 44—49, and will not be described in detail in connection with this embodiment.

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 25c' of carrier sheet 23c will move with the dark slide and will be threaded between the pressure-applying members and through the first exit channel 40c to the position illustrated in Fig. 38. In its folded condition (illustrated in Fig. 37), the leading end 25c' provides sufficient excess material to move freely to the position illustrated in Fig. 38 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 5c'. 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 25c' also as depicted in Fig. 38.

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 25c' of carrier sheet 23c'. As that carrier sheet is withdrawn, the pod 7c' the trap 9c', and the leading end 25c'' of the next successive carrier sheet 23c'' all follow the first carrier sheet 23c' between the rollers and through first exit channel 40c. The film unit 4c on the other hand, is stripped from these other various elements and is guided through a second exit channel 41c to the camera exterior. 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 42c 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 5c' is withdrawn in the manner described above, and after the leader 25c'' of the next film unit is threaded to its fully extended position illustrated in Fig. 39, the leading end 58c'' thereof automatically will be stripped from the preceding

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film unit and will be left in that position outside the apparatus where it is accessible for withdrawing the next successive film unit 5c''.

5 As illustrated in Fig. 39, the leader 25c'' of the next successive film unit will remain between the pressure members 63c and 65c while the preceding image-recording unit 4c' is being withdrawn between the members.
10 However, the leader thickness is known and the pressure members can be designed to 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 58c'' passes between the members
15 before the image-recording unit 4c'', the increased thickness of the connection also will not effect proper spreading of the composition.
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The remaining film units in the assemblage also are withdrawn for processing in a similar manner and will not be described in further detail.

25 A further alternative embodiment of the present invention is illustrated in Figs. 41—43. This embodiment is substantially identical in many respects to the embodiments described above in relation to Figs. 36—40. Those
30 features which are the same as described above have been identified by the same reference characters.

This alternative embodiment differs from the above described embodiment primarily in
35 the addition of a supplemental leader 24c between and for interconnecting the carrier sheets of adjacent film units. In a manner similar to that described above, this additional leader 24c provides a strippable coupling for automatically threading a portion of each
40 respective film unit between the pressure-applying members as the preceding film unit is withdrawn and then for automatically separating the units. Additionally, the supplemental leader 24c is securely coupled at one end
45 26c to the dark slide or preceding film unit and the strippable connection is located at a position spaced at the opposite end 28c of the additional leader from the preceding film unit. The camera illustrated for use with this
50 embodiment has been illustrated without any stripping guide similar to the guide 34c depicted with the camera of the preferred embodiment. Such a camera is intended to operate with this embodiment in a manner similar
55 to that disclosed above in Figs. 15—20 wherein subsequent manual flexing of the film unit 5a caused separation of the image recording unit 4a.

60 Referring now to Figs. 44 and 45 of the drawings a further embodiment of a camera 1d according to the present invention is illustrated for use with a film cartridge 3d, including a casing 31d for containing an assemblage 6d of integral self-processing photo-

graphic film units 5d and a dark slide 8d.

The individual image-recording and film units for use in the camera are illustrated in Figs. 36 to 40, and are identical by the same reference numeral with a suffix "d".

70 The photographic camera 1d is adapted to receive the above-mentioned assemblage 6d and cartridge 3d for sequentially exposing and for initiating the processing of film units in the assemblage. For the latter purposes, the
75 apparatus includes stepped pressure-applying members 63d and 65d for rupturing pod 7d and for distributing a processing composition between the elements 11d and 13d of the image-recording unit 4d. Additionally, the
80 apparatus is provided with a stripping mechanism 60d for separating the image-recording unit from certain processing waste material (such as the carrier sheet, pod, trap and any
85 leaders) as the film unit is withdrawn between the pressure-applying members and after processing of the image-recording unit has been initiated.

More specifically, and as illustrated in Figs. 46—49, the preferred leader arrangement comprises a leader or leading end portion of carrier sheet 23d that extends first forwardly from the leading end of the image-recording unit 4d and then rearwardly to a position at
90 its end 58d where it is coupled to the carrier sheet of the next adjacent (preceding) film unit. The coupling 58d is designed to be released or stripped from the next preceding carrier sheet at an appropriate time, and for
95 this reason is provided with a suitable connecting mechanism that is sufficiently strong to remain intact while the leading end 25d is transported within and from the assemblage but is sufficiently weak to separate from the next preceding film unit when the leading end
100 25d is located in a position outside the assemblage where it can be grasped manually. Assisting to this end is the additional length defined by the rearwardly extending folded-back portion 25d of the carrier sheet that permits movement of the leading end 58d from the assemblage without substantial frictional resistance. However, after that leading
105 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
110 most clearly illustrated in Fig. 47, the leader reverses its direction as it is withdrawn from the assemblage such that its leading end 25d 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 tensile forces, and a peeling effect results that facilitates the separation. The connection is relatively weak
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in tension, and will separate or peel apart as the tensile 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 8d 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.

The camera 1d is most clearly illustrated in Fig. 44 and generally comprises a casing 51d for supporting various camera elements including an objective 62d a retractable housing 64d for mounting the objective, and a main body portion 66d.

The body portion includes a front housing section 68d and a rear housing section 61d separably coupled to the front housing section in any suitable manner. The rear section also serves as a cover or door for a cartridge compartment 53d and is coupled to the front section by a pivotal hinge 30d that permits opening of the camera back and positioning of the film cartridge 3d into the cartridge compartment 53d. A parting line 32d is provided between the front and back sections at one end of the camera such that opening of the camera back will separate the pressure member 65d, in the camera back, from the other pressure member 63d in the front section. The parting line also is located for maintaining a stripping guide 34d in the front housing section, adjacent the front pressure member 63d upon opening of the camera back. The cartridge 3d is located in the camera with a leading end portion of the dark slide 8d extending therefrom, such that closing of the camera back will position the pressure members 63d and 65d on opposite sides of the dark slide and the leading end portion of the dark slide will project from a first exit channel 40d to a position outside the camera where it is accessible for withdrawing the dark slide through that first exit slot.

Cartridge 3d is located in the camera by cooperating surfaces 39d on the casing and 67d 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 7d 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 9d.

The stripping mechanism is illustrated most clearly in Fig. 45 and comprises the stripping guide 34d located on the opposite side of the pressure members from the film units and de-

fining first and second paths leading from the cartridge or cartridge chamber to the camera exterior. One of the paths, including a second exit slot 41d defines a substantially straight or flat plane from the cartridge casing exit 45d through the pressure-applying members and to the exterior of the apparatus through the second exit slot 41d. 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 40d spaced from the above-mentioned exit 41d.

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 25d' of carrier sheet 23d' will move with the dark slide and will be threaded between the pressure-applying members and through the first exit channel 40d to the position illustrated in Fig. 47. In its folded condition (illustrated in Fig. 46), the leading end 25d' provides sufficient excess material to move freely to the position illustrated in Fig. 47 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 5d'. 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 25d' also as depicted in Fig. 47.

The first film unit is then exposed, and is transported from the assemblage and between the pressure-applying members by grasping and pulling on the leader or leading end 25d' of carrier sheet 23d'. As that carrier sheet is withdrawn, the pod 7d', the trap 9d', and the leading end of the next successive carrier sheet 23d'' all follow the first carrier sheet 23d' between the rollers and along a first curved or arcuate path to first exit channel 40d. The image-recording unit 4d, on the other hand, is relatively stiff and moves along a straight second path to a second exit channel 41d and the camera exterior. Such first and second paths lie in opposite sides of the stripping guide 34d, that defines the paths and ensures 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 unit its trailing end reaches the second

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exit channel, in which point it may be releasably held by a holding spring 42d 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 5d' is withdrawn in the manner described above, and after the leader 25d'' of the next film unit is threaded to its fully extended position illustrated in Fig. 48, the leading end 58d 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 5d'.

As illustrated in Fig. 48, the leader 25d'' of the next successive film unit will remain between the pressure members 63d and 65d while the preceding image-recording unit 4d' is being withdrawn between the members. However, the leader thickness is known and the pressure members can be designed properly to accommodate that known thickness without deleterious effect on the desired thickness of the processing composition layer intended to be spread. Moreover, since the stripable connection 58d'' passes between the members before the image-recording unit 4d'' 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.

Figs. 50—60 of the drawings illustrate yet another embodiment of an assemblage of self-processing film units according to the present invention, a cartridge and a camera adapted for use therewith and also in accordance with the present invention. In Fig. 50 is shown part of a film assemblage 6c which, similarly to the embodiments described above, comprises a plurality of self-processing film units 5e', 5e'' and 5e''' and a unit-transporting web 23c including a plurality of interconnected leaders 44e', 44e'', 44e''' and 44e'''. The film units 5e are of the type described in relation to Figs. 1 to 9. Film unit 5e and leader 44e are illustrated in Figs. 51 to 54, as exemplary of other such units and leaders in the assemblage. Each unit is substantially identical to that described in relation to Fig. 6, similar reference numerals suffixed 'e' being used and single, double, triple or quadruple primes indicating sequentially the respective units in the assemblage 6c,

Referring once again to Fig. 50, it will be seen that leaders 44e', 44e'', 44e''' and 44e'''' are interconnected in an overlapping or shingled relationship to form the unit-transporting web 23c to which the film units 5e', 5e'' and 5e''' are attached. Taking film unit 5e'' as exemplary of all film units in the assemblage, the film unit 5e'' has a first or leading end 10e'' and a second or trailing end 12e'' defining the overall length L of the unit. Similarly, taking leader 44e'' as exemplary of all leaders forming web 23c, leader 44e'' has a first or leading end 25e'' and a second or trailing end 29e'' defining the overall length of the leader, which, as shown in Fig. 51, is equal to $2L+S$. Thus, film unit 5e'' is disposed in superposed relationship to leader 44e'' so that second end 12e'' of film unit 5e'' coincides with second end 29e'' of leader 44e'' and the leading end 10e' of film unit 5e' coincides with first end 25e'' of leader 44e'', thereby leaving the relatively small amount of space S between ing end 12e' of film unit 5e'. Because sheets ing end 12e' of film unit 5e''. Because sheets 11e'' and 13e'' of film unit 5e'' are permanently maintained in their preregistered, superposed relationship, only sheet 11e'' need be stripably attached to leader 44e''. Pod 7e'' of film unit 5e'' is securely attached to leader 44e'' at a first location on leader 44e'' between first end 25e'' and second end 29e'', which location is substantially coincident with the leading end of leader 5e'''. First end 25e'' of leader 44e'' is securely attached, or inseparably coupled to leader 44e' at a second location along the length of leader 44e' which is between the leading and trailing ends of leader 44e' and which, as pointed out above, is substantially coincident with the leading end of film unit 5e'. In like manner, the leading end of leader 44e''' is securely attached, or inseparably coupled, to leader 44e'' at a location on leader 44e'' which is substantially coincident with first end 10e'' of film unit 5e''. Similarly, the leading end of leader 44e'''' is connected to leader 44e''' at a location substantially coincident with the leading end of film unit 5e'''. Thus, in manufacturing assemblage 6c; the individual leaders can first be appropriately coupled to form web 23c, and the film units can thus be appropriately coupled to respective leaders along the web. Alternatively, each film unit and its leader can be appropriately coupled to form a subassembly such as that illustrated in Fig. 51, and such subassemblies can then be assembled to form the entire assemblage. Fig. 51 illustrates a subassembly comprising film unit 5e and leader 44e unfolded to show the length relationship mentioned above. Fig. 52 illustrates the same subassembly with leader 44e folded over the leading half of film unit 5e as when assemblage 6c is arranged with its film units stacked in superposed relation-

ship. Fig. 53 is a perspective view of the subassembly of Fig. 52.

While, for purposes of illustration, Fig. 50 shows only a three-unit portion of assemblage 6e, the assemblage in its entirety comprises a greater number of film units such as the eight units shown stacked in the cooperating apparatus of Fig. 55. Film units 5e', 5e'', and 5e''' of Fig. 50 are shown as the three uppermost units in the stack of units illustrated in Fig. 55. As may be seen in both Figs. 52 and 55, when the units are stacked in superposed relationship, each leader is folded upwardly and around the leading end of its film unit and extends rearwardly toward the trailing end of the unit to a point midway between the leading end and the trailing end of the unit, at which point the leader is then folded again and brought back upon itself toward the leading end of the unit so that the leading end of the leader then coincides with the leading end of the unit. The leading end of the leader, it will be remembered, is securely attached to the leader preceding it at a point coinciding with the leading end of the film unit supported by the preceding leader. The forwardmost or leading portion 25e of unit-transporting web 23e includes an adhesive element 27e for connecting web 23e to a storage device to be described more fully hereinafter in connection with the cooperating apparatus. Leading portion 25e is opaque to light actinic to the film units and extends across the uppermost film unit 5e to provide a dark cover for preventing premature exposure and for otherwise protecting the film units when contained in cooperating apparatus such as the cartridge 3e illustrated in Figs. 55 and 56. A trailing portion of web 29e also may be folded beneath the lowermost film unit in the stack to protect that unit against scratching or other damage by the cartridge itself or by some foreign material that accidentally might enter the cartridge.

The cartridge 3e includes a disposable housing 31e that defines a supply chamber or compartment adapted to receive an assemblage of stacked film units and a rectangular opening 72e through which the units can be exposed. Cartridge 3e supports a web transporting and storage device such as spool 33e having a clutch 35e adapted to cooperate with a camera winding mechanism to effect movement of the unit-transporting web and its attached film units within the cartridge. Supporting housing 31e is a bottom wall member 38e having a pair of semi-circular bearing surfaces 74e (only one of which is visible in Fig. 55) for rotatably supporting spool 33e between surfaces 74e and a pair of complementing semi-circular surfaces 76e (only one of which is visible in Fig. 55) in housing 31e. In order to permit appropriate alignment between the cartridge 3e and a camera receiving the cartridge, housing 31e

includes an aligning and light-sealing surface 39e surrounding opening 72e and adapted to mate with a corresponding surface of the camera to locate properly the uppermost film unit 5e' in a focal plane defined by the camera objective. Housing 31e is also provided with a rectangular opening 77e adapted to receive a pressure-applying member of the camera in a manner to be described more fully hereinafter. Near opening 77e but in the end wall 78e of housing 31e is another rectangular opening 45e, through which opening the pre-registered first and second sheets of each film unit are adapted to be expelled from the cartridge. Bottom wall member 38e further supports a platen 43e adapted to urge resiliently each of the film units in the assemblage toward its uppermost position for proper alignment in the focal plane. Supported within housing 31e is a pressure-bearing and web-guiding member 65e, the upper surface of which is disposed for alignment with the aforementioned pressure-applying member of the camera when the cartridge is received in the camera. It should be noted at this juncture that exit opening 45e and member 65e are both located in one end portion of housing 31e, and that spool 33e is located in the opposite end portion of the cartridge. While Fig. 55 is an exploded view of cartridge 3e exaggerated for clarity of illustration, Fig. 56 shows cartridge 3e as it appears fully assembled with a portion of the topmost wall of casing 31e broken away to better illustrate how spool 33e is supported and enclosed by the cartridge. In cartridge 3e there is provided an interior wall member 79e adapted to define a passageway between platen 43e and bottom wall member 38e, through which passageway the unit-transporting web is movable from member 65e to spool 33e, as will be explained more fully below.

A camera adapted to receive a cartridge of the type illustrated in Figs. 55 and 56 is shown in Fig. 57. The camera, designated generally by the numeral 1e, comprises a housing 51e defining a cartridge receiving chamber 53e and supporting various camera components including a pressure applying member 63e, a web advancing member 57e, a shutter operating member 59e and a closure or cover door 61e. The cartridge 3e is inserted into camera 1e by opening cover door 61e, placing the cartridge into receiving chamber 53e, and then closing door 61e. This effects seating of cartridge 3e against a light seal 67e in the camera and positioning of pressure applying member 63e partially into the cartridge through opening 77e in alignment with pressure-bearing and web-guiding member 65e. Because pressure applying member 63e is biased downwardly by a mounting spring 79e, member 63e bears directly against the portion of the film assemblage that lies between members 65e and 63e, as shown in

Fig. 57. When cover door 61e is in its closed position, a spring member 69e thereon urges cartridge 3e forwardly into its operative position shown. In the right end wall 80e of housing 51e is an exit slot 71e in alignment with exit opening 45e of the cartridge, thereby providing a path of travel along which the preregistered first and second sheets of each film unit in the assemblage can pass out of the cartridge and camera. While the preregistered sheets of each film unit travel in a substantially straight line after passing between pressure members 65e and 63e, the unit-transporting web is guided by member 65e downward, and thus away from that straight line, to effect separation of the web from the sheets. In Fig. 57, the image recording units 4e', 4e'' and 4e''' of film units 5e', 5e'' and 5e''', respectively of the assemblage 6e have already been expelled from the camera, and the image recording unit 4e'''' of film unit 5e'''' is virtually expelled from the camera with its trailing end portion still in exit openings 45e and 71e, leaving the last four film units of the assemblage in the cartridge. Unit-transporting web 23e is shown partially wound on spool 33e, and trap 9e'''' of film unit 5e'''' is shown on web 23e to the right of pressure applying member 63e.

Referring now to the operation of assemblage 6e in cartridge 3e in camera 1e, Figs. 58, 59 and 60 are enlarged partial sectional views of camera 1e having in its receiving chamber 53e, the cartridge 3e containing film assemblage 6e. In Fig. 58, leading portion 25e of web 23e is shown wrapped around spool 33e, which has been rotated in response to the camera operators manipulation of web advancing member 57e. This, of course, would normally occur only after film unit 5e' has been exposed in response to the operator's manipulation of shutter operating member 59e. In Fig. 58, web 23e has been wound on spool 33e just enough to pull film unit 5e' into the bite of pressure members 65e and 63e. Because the web is pulled downwardly around a pressure bearing and web guiding member 65e, leader 25e and the attached pod 7e' and funnel 17e' are directed along a path divergent from the path of travel of the image recording unit 4e', thereby effecting separation of the leader, pod, and funnel from the sheets. At this stage of the operation, pod 7e' has been ruptured by its passage between pressure members 65e and 63e to initiate spreading of the processing fluid between preregistered sheets 11e' and 13e'. Fig. 59 illustrates a stage of the operation reached after further winding of web 23e on spool 33e in response to continued manipulation of member 57e. At this stage, leader 25e is partially wound on spool 33e and has pulled almost all of film unit 5e' through the bite of pressure members 63e and 65e. Because the image recording unit 4e' is

relatively stiff as compared with the relatively flexible web, the unit 4e' follows the aforementioned substantially straight-line path through exit openings 45e and 71e, as shown. The continued divergence of movement of the sheets and the web thus causes their continued separation. Fig. 60 illustrates a still later stage of the operation reached when further winding of web 23e on spool 33e has caused the unit 4e' to be virtually expelled from both the cartridge and the camera, leaving only the trailing end portion of the unit in the exit openings and the trailing end portion 29e' of web 23e' and trap 9e' between the pressure members. During passage of film unit 5e' between the pressure members, the processing fluid supplied by pod 7e' and funnel 17e' is spread between sheets 11e' and 13e', any excess portion of the fluid being received and retained by trap 9e'. The image recording unit 4e' can now be exposed to ambient illumination and be handled by the camera operator, even though development of the latent image and recording of the visible image may not have been completed, because of the opacifying agent in the processing fluid between sheets 11e' and 13e' protects the photosensitive layer on sheet 11e' from exposure to such illumination and because the processing is self-timed to produce a right-reading positive print without further attention on the part of the operator.

As shown in Figs. 59 and 60, film unit 5e'' follows closely behind film unit 5e', the linear space between the two units being the small amount S illustrated in Figs. 50, 51 and 52. Because of the small space between succeeding film units, relatively little web winding on spool 33e is needed in order to effect the necessary movement of the film units through the bite of pressure members 63e and 65e, so that the time required for such movement, the diameter of the web winding on the spool, the space needed in the cartridge for the winding, and hence the size of both the cartridges and the camera, can all be less than would be necessary with an assemblage having a greater space between succeeding film units.

It will be seen in relation to all the embodiments described that the present invention has provided an improved photographic apparatus, film unit, assemblage thereof and cartridge containing the same which provides the facility of removing the image recording unit from the waste portion without manual dexterity and without the danger or contamination by the processing fluid. The apparatus of the present invention is more symmetrical than similar apparatus known heretofore, thereby rendering the apparatus more convenient to use and more pleasing in appearance; the apparatus is less complex and costly to manufacture; and the apparatus more readily separates desired portions of the film

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units from the web so that such portions can be expelled from the apparatus while the web and remaining portions may be received by a waste storage device in the apparatus.

5 WHAT WE CLAIM IS:—

1. A film unit, for use in a photographic camera, comprising a photosensitive sheet and a second sheet together forming an integral image recording unit, a carrier member strip-
10 pably connected to the image recording unit and permanently supporting a rupturable container for processing fluid, the image recording unit being of a rigidity such that flexing of the carrier member causes peeling
15 separation of the carrier member and the container from the image recording unit.

2. A film unit as claimed in Claim 1 wherein the photosensitive sheet and the second sheet are unsecured at a leading end and the container or a funnel secured thereto and constituting a fluid duct therefrom lies between the unsecured leading ends so as to be movable from such location on flexing.

3. A film unit as claimed in Claim 1 or 2 further including a trap for excess processing fluid at a trailing end of the image recording unit and arranged to receive processing fluid expressed from between the photosensitive sheet and the second sheet at
30 such end, the trap being permanently secured to the carrier member and being separable from the image recording unit on flexing of the carrier member relative to the image recording unit.

4. A film unit as claimed in any of Claims 1 to 3 wherein the carrier member comprises a sheet including a leader formed by a leading portion of the sheet and arranged to be grasped manually to cause flexing of the carrier sheet.

5. A film unit as claimed in Claim 4 including a supplemental leader strippably connected to the carrier sheet and arranged, on the application of tension thereto, to present
45 the leader and to be stripped therefrom.

6. A film unit as claimed in Claim 3, Claims 3 and 4 or Claims 3, 4 and 5 wherein the trap is constituted in part at least by the carrier member.

7. An assemblage of film units comprising a plurality of film units as claimed in any of Claims 1 to 6 joined leading end to trailing end and arranged sequentially to be flexed to strip the image recording units therefrom.

8. An assemblage as claimed in Claim 7 wherein the carrier members of the plurality of film units each constitute a portion of a continuous carrier web whereto the individual image recording units are strippably
60 connected and the respective containers are permanently secured.

9. An assemblage as claimed in Claim 8 wherein the film units are stacked one up-

on another and the carrier web is convoluted to a zig-zag form to permit such stacking
65 and presents a leader forming also a cover for the assemblage.

10. An assemblage as claimed in Claim 7 wherein the carrier members of the respective units are secured together to form a continuous carrier web.

11. An assemblage as claimed in Claim 10 wherein the carrier members of the respective units are secured together end-to-end by supplemental leaders.

12. An assemblage as claimed in Claim 10 wherein the carrier members of the respective units are secured together directly in overlapping relationship.

13. An assemblage as claimed in Claim 10, 11 or 12 wherein the carrier members are secured together by strippable connections.

14. An assemblage as claimed in any of Claims 10 to 13 wherein the film units are stacked one upon another and the continuous carrier web is convoluted to a zig-zag form to permit such stacking and presents a leader forming also a cover for the assemblage.

15. A cartridge containing an assemblage of film units as claimed in any of Claims 7 to 14 comprising a casing defining on one surface a gate for exposure of the film units, means in the cartridge for urging the film units towards the gate, a cartridge exit slot
95 wherethrough a leading end of the carrier member of a first of the contained film units initially extends.

16. A cartridge as claimed in Claim 15 comprising waste take up means for receiving the carrier member, the ruptured container and, if provided, the trap after the image recording unit has been stripped therefrom.

17. A cartridge as claimed in Claim 16 wherein the waste take-up means comprises a spool arranged to be driven by a camera's film winding mechanism to wind the waste portions thereonto.

18. A cartridge as claimed in Claim 17 wherein the waste take-up means serves also as a force transmitting means for presenting the film units seriatim for exposure, for withdrawing the film units through the cartridge exit slot, and for causing flexing and hence stripping of the image recording unit from the carrier member.

19. A cartridge as claimed in Claim 16, 17 or 18 wherein a pressure applying member, arranged to cooperate, in use, with a camera pressure applying member for rupturing the container and spreading the processing fluid between the photosensitive sheet and the second sheet, is provided on the cartridge.

20. A cartridge as claimed in Claim 19 wherein the cartridge pressure applying member serves also as a carrier web guide means for guiding the web along a path divergent from a substantially rectilinear path of move-
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units from the web so that such portions can be expelled from the apparatus while the web and remaining portions may be received by a waste storage device in the apparatus.

5 WHAT WE CLAIM IS:—

1. A film unit, for use in a photographic camera, comprising a photosensitive sheet and a second sheet together forming an integral image recording unit, a carrier member strip-
10 pably connected to the image recording unit and permanently supporting a rupturable container for processing fluid, the image recording unit being of a rigidity such that flexing of the carrier member causes peeling
15 separation of the carrier member and the container from the image recording unit.

2. A film unit as claimed in Claim 1 wherein the photosensitive sheet and the second sheet are unsecured at a leading end and the container or a funnel secured thereto and constituting a fluid duct therefrom lies between the unsecured leading ends so as to be movable from such location on flexing.

3. A film unit as claimed in Claim 1 or 2 further including a trap for excess processing fluid at a trailing end of the image recording unit and arranged to receive processing fluid expressed from between the photosensitive sheet and the second sheet at
30 such end, the trap being permanently secured to the carrier member and being separable from the image recording unit on flexing of the carrier member relative to the image recording unit.

4. A film unit as claimed in any of Claims 1 to 3 wherein the carrier member comprises a sheet including a leader formed by a leading portion of the sheet and arranged to be grasped manually to cause flexing of the carrier sheet.

5. A film unit as claimed in Claim 4 including a supplemental leader strippably connected to the carrier sheet and arranged, on the application of tension thereto, to present the leader and to be stripped therefrom.

6. A film unit as claimed in Claim 3, Claims 3 and 4 or Claims 3, 4 and 5 wherein the trap is constituted in part at least by the carrier member.

7. An assemblage of film units comprising a plurality of film units as claimed in any of Claims 1 to 6 joined leading end to trailing end and arranged sequentially to be flexed to strip the image recording units therefrom.

8. An assemblage as claimed in Claim 7 wherein the carrier members of the plurality of film units each constitute a portion of a continuous carrier web whereto the individual image recording units are strippably
60 connected and the respective containers are permanently secured.

9. An assemblage as claimed in Claim 8 wherein the film units are stacked one up-

on another and the carrier web is convoluted to a zig-zag form to permit such stacking
65 and presents a leader forming also a cover for the assemblage.

10. An assemblage as claimed in Claim 7 wherein the carrier members of the respective units are secured together to form a continuous carrier web. 70

11. An assemblage as claimed in Claim 10 wherein the carrier members of the respective units are secured together end-to-end by supplemental leaders. 75

12. An assemblage as claimed in Claim 10 wherein the carrier members of the respective units are secured together directly in overlapping relationship.

13. An assemblage as claimed in Claim 10, 11 or 12 wherein the carrier members are secured together by strippable connections. 80

14. An assemblage as claimed in any of Claims 10 to 13 wherein the film units are stacked one upon another and the continuous carrier web is convoluted to a zig-zag form to permit such stacking and presents a leader forming also a cover for the assemblage. 85

15. A cartridge containing an assemblage of film units as claimed in any of Claims 7 to 14 comprising a casing defining on one surface a gate for exposure of the film units, means in the cartridge for urging the film units towards the gate, a cartridge exit slot
95 wherethrough a leading end of the carrier member of a first of the contained film units initially extends.

16. A cartridge as claimed in Claim 15 comprising waste take up means for receiving the carrier member, the ruptured container and, if provided, the trap after the image recording unit has been stripped therefrom. 100

17. A cartridge as claimed in Claim 16 wherein the waste take-up means comprises a spool arranged to be driven by a camera's film winding mechanism to wind the waste portions thereonto. 105

18. A cartridge as claimed in Claim 17 wherein the waste take-up means serves also as a force transmitting means for presenting the film units seriatim for exposure, for withdrawing the film units through the cartridge exit slot, and for causing flexing and hence stripping of the image recording unit from the carrier member. 115

19. A cartridge as claimed in Claim 16, 17 or 18 wherein a pressure applying member, arranged to cooperate, in use, with a camera pressure applying member for rupturing the container and spreading the processing fluid between the photosensitive sheet and the second sheet, is provided on the cartridge. 120

20. A cartridge as claimed in Claim 19 wherein the cartridge pressure applying member serves also as a carrier web guide means for guiding the web along a path divergent from a substantially rectilinear path of move- 125

ment whereby to strip the waste portions from the image recording units.

21. A cartridge as claimed in Claim 20 wherein the waste take-up means is provided at an opposite end of the cartridge to the cartridge exit slot.

22. A photographic camera arranged to receive a cartridge as claimed in any of Claims 15 to 21 and including means for locating the gate in an exposure station of the camera, pressure applying means for rupturing a container for spreading the processing fluid therefrom between the photosensitive and its respective second sheet of a film unit, a first substantially rectilinear path from the cartridge exit slot to the exterior of the camera and a second path divergent from the first path between the pressure applying means and the camera exterior arranged such that as the carrier member is moved along the second path, the image recording units will strip therefrom and move along the first path.

23. A camera as claimed in Claim 22 further including a transporting mechanism for transporting the film units seriatim through the cartridge exit slot and the carrier member along the second path.

24. A camera as claimed in Claim 22 including a first exit channel to the exterior of the camera wherethrough the image recording units are arranged to pass and a second exit channel to the exterior of the camera wherethrough the carrier members and attached ruptured containers are arranged to pass.

25. A camera as claimed in Claim 24 including resilient means for retaining an image recording unit, stripped from its carrier member, projecting from the first exit channel.

26. A camera as claimed in Claim 22, 23,

24 or 25 wherein the pressure applying means comprises a pair of rollers or a single roller arranged to cooperate with a pressure applying means in the cartridge, the pressure nip being located on the first path.

27. A camera as claimed in Claim 26 wherein the rollers are stepped.

28. A camera as claimed in Claim 26 wherein the roller is resiliently urged towards engagement with the cartridge pressure applying means.

29. A film unit substantially as hereinbefore described with reference to and as illustrated in Figs. 5 and 6, Figs. 15 to 20, or Figs. 51 to 54 of the accompanying drawings.

30. An assemblage of film units substantially as hereinbefore described with reference to and as illustrated in Fig. 4 or Figs. 22 to 24, or Figs. 30 and 31, Fig. 36, or Figs. 50 and 55 of the accompanying drawings.

31. A photographic cartridge substantially as hereinbefore described with reference to and as illustrated in Figs. 1 to 4, or Figs. 1 to 4 as modified by Fig. 2A, Figs. 21 and 25 to 29, Figs. 37 to 43, Figs. 46 to 49, or Figs. 55 to 60 of the accompanying drawings.

32. A photographic camera substantially as hereinbefore described with reference to and as illustrated in Figs. 1, 2 and 7 to 9, Fig. 10, Figs. 11 and 12, or Fig. 13, or Fig. 14, or Figs. 25 to 29 and Fig. 32, or Figs. 33 to 35, or Figs. 37 to 43, or Figs. 44 to 49 or Figs. 57 to 60 of the accompanying drawings.

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