

PATENT SPECIFICATION (11)

1 384 403

1 384 403

- (21) Application No. 4582/72 (22) Filed 1 Feb. 1972 (19)
 (31) Convention Application No. 111 467 (32) Filed 1 Feb. 1971 in
 (33) United States of America
 (44) Complete Specification published 19 Feb. 1975
 (51) INT. CL.³ G03B 17/52
 (52) Index at acceptance
 G2A 401 403 437 572 575 634 753 C
 (72) Inventor DONALD MALCOLM HARVEY



(54) PHOTOGRAPHIC APPARATUS FOR HANDLING SELF-PROCESSING FILM UNITS

(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:—

The present invention relates to photographic apparatus for handling self-processing photographic film units.

The commercial development of self-processing photographic film units has presented a plethora of unique problems that have long avoided fully satisfactory solutions. Convenient handling of the film units has been particularly troublesome, especially when it is attempted to provide mechanisms for feeding the film units and automatically separating waste materials from picture-recording portions of the units after their processing has been initiated.

Numerous different approaches to film handling have been tried, and many have been considered successful when weighed against the important advantages they permit in self-processing photography. However, none of these previously tried approaches have been able to provide the convenience, complexity and reliability desired, such as presently is available in conventional photography. A particularly difficult problem in film handling has been that of feeding the film units from an exposure position through a processing station to a manually accessible position. Heretofore, in general, this has been effected by means of a leader or plurality of leaders by means of which the individual film units are pulled manually or mechanically through the processing station to a manually accessible location.

It is an object of the invention to provide a photographic apparatus arranged to feed the film units without the use of leaders.

In accordance with the present invention, there is provided a photographic apparatus for exposing and initiating the processing of a self-processing photographic film unit which includes an image recording unit releasably connected to a resiliently flexible backing sheet of stiffness sufficient to enable the backing sheet to be pushed, without folding, along a desired path, the apparatus including a chamber for receiving a film unit in a position for exposure, means for transporting the film unit from the exposure position towards a station whereat processing and stripping are initiated and for pushing the backing sheet along a desired path whilst moving the image recording unit or permitting the image recording unit to move along another divergent path so as to strip the image recording unit from the backing sheet.

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

Fig. 1 is a perspective view of a self-processing photographic film unit suitable for use with apparatus in accordance with the present invention:

Fig. 2 is an exploded view of the film unit depicted in Fig. 1;

Fig. 3 is a perspective view of a first embodiment of apparatus in accordance with the present invention, with parts omitted and broken away for the sake of clarity.

Fig. 4 is a schematic representation of a portion of the apparatus depicted in Fig. 3, illustrating the manner in which an image-recording portion of the film unit is separated from waste materials after processing has been initiated;

Figs. 5—7 are views partially in cross-section of a portion of the apparatus, illustrating various stages in the operation of such apparatus for handling the film unit and for separating waste materials from the image-recording portion of the unit;

Figs. 8—10 illustrate a mechanism,

omitted from Figs. 5-7, for the sake of clarity, for moving the waste materials into their final location in a waste storage chamber;

5 Fig. 11 is a perspective view of a second form of a self-processing photographic film unit suitable for use with apparatus in accordance with the present invention;

10 Fig. 12 is an exploded view of the film unit illustrated in Fig. 11;

15 Fig. 13 is a perspective view of a second embodiment of apparatus in accordance with the present invention, with parts omitted and broken away for the sake of clarity; and

Fig. 14 is a view similar to Fig. 4 but illustrating the apparatus shown in Fig. 13.

20 Because photographic cameras and film units of the self-processing type are well known, the present description will be directed in particular to elements either forming part of, or cooperating more directly with elements forming part of the apparatus of the present invention. Camera and film elements not specifically shown or described herein are selectable from those known in the art.

25 Referring now to the drawings, and particularly to Figs. 1 and 2, a self-processing photographic film unit suitable for use with a first embodiment of the apparatus according to the invention and illustrated in Figs. 3 to 10 includes a resiliently flexible backing sheet 3 for mounting an image-recording portion 5, a container 7 for fluent processing composition, and a collector 9 for receiving any excess of the composition. As will be described more fully hereinafter, the image-recording portion 5 of the film unit is strippably connected to the resiliently flexible backing sheet 3 and is readily releasably associated with the container 7 and collector 9, which the container and collector are attached permanently to the backing sheet. This arrangement permits separation of the backing sheet 3, container 7 and collector 9 from the image-recording portion 5 of the unit, so that a finished print may result which is unencumbered by such materials as have served their purpose after processing has been initiated.

30 Referring to the film unit more specifically, and again to Figs. 1 and 2, the image-recording portion 5 includes a photosensitive element 11 and a process sheet 13, which preferably are coextensive and are preregistered and permanently secured and sealed together along their lateral margins 15, to form an integral unit. As used in this specification, the term "preregistered" refers to a unit in which the photo-sensitive element and process sheet are superposed and registered prior to exposure, preferably at some stage during manufacture of the unit or, at latest, before its sale to the customer. The term

"integral," on the other hand, is intended to connote a unit wherein the photosensitive element and process sheet are permanently maintained in superposed and registered relationship during and after processing. Thus, in a unit that is both preregistered and integral, the photosensitive element and process sheet are superposed prior to exposure and define a composite, permanently registered structure that remains substantially in the same physical form after processing.

70 Generally, such image-recording units include one or more layers of photosensitive material, such as silver halide, for recording a developable latent image; means for aiding the distribution of a processing composition to effect development of the latent image; and a mordant layer for supporting or receiving a visible image representative of the developed latent image. These components can be associated in any number of different arrangements, but generally have taken either of two forms. In one form, illustrated and described in French Patent Specifications Nos. 2,006,255 and 2,006,256, the photosensitive material is included in a photosensitive element; the distribution aiding means includes a second element, termed a process sheet; and the mordant layer is located in the second element, to which materials for establishing the visible image diffuse. The second and preferred form is illustrated and described in U.K. Specification 1,330,524. In this form the photosensitive and mordant layers both are in a single element, often referred to as an integral-negative-receiver (INR), while a second element is provided for aiding in the distribution of the processing composition. It is with the second and preferred image-recording unit that an embodiment of the present invention will be described.

95 In the preferred form, photosensitive element 11 includes a substantially flat, resilient support of transparent cellulose triacetate film base or other suitable material. At least the central portion supports layers of image-receiving material, opaque reflecting material, and a silver-halide emulsion with associated dye-image providing material, respectively. Such layers preferably are arranged in the sequence in which they have been recited, with the support protecting one side of the layers, and the silver-halide emulsion layer at the other side of the layers being protected by the process sheet 13. As will become more apparent hereinafter, the silver-halide emulsion is exposed through the process sheet, from the top side of the unit (as seen in Figs. 1 and 2), and the developed print is viewed through the transparent support from the bottom side of the unit (as seen in Figs. 1 and 2).

100 The photosensitive element 11 further in-

cludes appropriate means, depicted schematically as a border or margin 17 that extends entirely around the circumferential portions of the element, (and indicated in Fig. 2 as projected on to the process sheet 13), which provides a sharp boundary defining both an exposure frame, within which a latent image may be recorded, and a print frame, which preferably is white and within which the finished print may be formed.

The process sheet 13 is a resilient, substantially flat sheet formed of transparent cellulose triacetate film base or other suitable material, and serves not only to aid in the distribution of the processing composition but also to protect the top side (as seen in Figs. 1 and 2) of the layers on the photosensitive element while permitting exposure of the silver-halide emulsion.

The photosensitive element 11 and process sheet 13 are formed accurately with straight edges, square corners and appropriate borders, and are registered accurately during manufacture to provide a uniformly flat, aesthetically pleasing structure that will maintain its integrity after processing.

Additional features and advantages of this preferred image-recording portion of the unit are illustrated and described more fully in UK Specification No. 1,368,792.

The image-recording portion of the unit described above, including the photosensitive element 11 and process sheet 13, is well suited to cooperate with other components of the film units with which it is illustrated in Figs. 1 and 2 and Figs. 11 and 12 of the accompanying drawings. The film unit illustrated in Figs. 1 and 2 includes the backing sheet 3, the container 7, and the excess fluent processing composition collector 9, all of which cooperate for recording and developing a latent image when used with apparatus in accordance with the present invention.

The container 7, often referred to in the art as a "pod," for supplying fluent processing composition includes a rupturable containing part formed from a rectangular blank of vapour-impervious material which has been folded along a line to form a first side edge 19 of the container 7 and has been securely sealed to itself along opposite margins to form ends 21 and 23 of the container. A second side 25 of the container, opposite the first side edge 29, is provided along substantially its entire length with a seal which is rupturable to release a fluent composition from the container upon the application of hydraulic forces generated by passing the container between a pair of juxtaposed pressure-applying members. The container 7 is coupled to or otherwise cooperates with the leading end of the image-recording unit 5 in a manner suitable for leading the fluent composition to between the photosensitive element 11 and process

sheet 13. For this purpose, as is illustrated, the container 7 may have its margin at its side 25 disposed between the photosensitive element and process sheet at the leading end of the image-recording portion 5.

The collector 9 for excess fluent composition, often referred to in the art as a "trap," includes a first part 27 (Fig. 2) formed by a marginal portion of the backing sheet 3 at the trailing end thereof, a second part 29 disposed in overlying relationship with the first part and forming with the first part a collecting chamber, and lifters 31 for separating the pressure-applying members of associated photographic apparatus whereby hydraulic forces are not created in the chamber as the collector 9 passes between the pressure-applying members. Preferably, one or more apertures or holes are provided in the collector 9 or between the component parts of the collector 9 to permit the escape of air from the image-recording portion and from the collector 9 as the processing composition is spread and as excess processing composition flows into the collector 9. The first and second collector parts 27 and 29 are permanently secured together along three sides of the chamber by adhesive depicted at 33 in Fig. 2, with the lifters 31 being interposed between the parts 27 and 29 at the ends of the chamber adjacent the lateral edges of the film unit 1. A leading portion 35 of the first part 29 overlies the trailing end of the image-recording portion 5 whereby the trailing end of the image-recording portion 5 is embraced by the backing sheet 3 and second part 9 in a manner which ensures that all of the excess processing composition expelled from the image-recording portion 5 will be directed into the chamber of the collector 9.

The backing sheet 3 carries the container 7, collector 9 and image-recording portion 5, to facilitate handling of the film unit, as well as separation of the image-recording portion 5 from the other portions of the unit which other portions constitute waste after processing has been initiated. For this purpose, the backing sheet 3 is a substantially flat impermeforate sheet of resiliently-flexible material, such as, for example, plastics sheeting.

The effective resiliency and flexibility of the backing sheet must be within certain maximum limits such that it will return to a substantially flat condition after being separated from the image-recording portion and bent around a radius. However, it should be understood that these resiliency and flexibility parameters can be established by separate stiffeners associated with the backing sheet, rather than by the backing sheet itself. Further, it is not necessary, although it is preferred, that the backing sheet be of uniform resiliency throughout its entire area.

5 The backing sheet 3 cannot be rigid and should be bendable in an arcuate path, such as one hundred and eighty degrees about a $\frac{1}{8}$ to $\frac{3}{8}$ inch radius, without exceeding its elastic limit. While this is a function of many parameters, including the radius of bending, the thickness of the backing sheet, its modulus of flexibility and its modulus of resiliency, the backing sheet should tend to return without assistance to a substantially flat condition after travelling in the intended arcuate path.

10 The backing sheet 3 must have a degree of stiffness sufficient to enable it to be pushed along such arcuate path without a tendency to fold or buckle and hence cause jamming.

15 The word "resilient" has been used with "flexibility" to differentiate the backing sheet from materials, such as thin paper stocks, that are flexible but also are somewhat limp, and have little tendency to maintain a substantially flat condition without additional support, or to return to a flat condition after bending. However, this does not eliminate all paper materials because some, particularly those with plastics coatings on one or both sides have sufficient stiffness and are sufficiently resiliently flexible to be usable satisfactorily.

20 A backing sheet which is intended for use with a film unit having an image-recording portion which is either a $3\frac{1}{2}$ inch square or a $3\frac{3}{8} \times 4\frac{1}{4}$ inch rectangle, is about $1\frac{1}{2}$ inches longer and $\frac{1}{8}$ to $\frac{1}{4}$ inch wider than the image-recording portion, and is constructed from a .005 inch thick sheet of polyester (preferably, polyethylene terephthalate such as the type conventionally used as film base material) or a slightly thicker sheet of acetate.

25 The preferred pressure roller or bending diameter is about $\frac{3}{8}$ of an inch, though other practical diameters for use with the specific backing sheet defined above might range from $\frac{1}{4}$ of an inch to $\frac{5}{8}$ of an inch.

30 The dimensions of the backing sheet in the present embodiment are selected to be somewhat wider than the image-recording portion of the unit and longer than the image-recording portion with its attached container and collector, for cooperating with the transporting mechanisms of the associated photographic apparatus to be described more fully hereinafter. Similarly, the leading end of the backing sheet includes a V-shaped cutout or perimeter 41. A more detailed description of this backing sheet, and its relation to the other elements of the film unit, is set forth in our copending application No. 4583/72 (Serial No. 1,383,391).

35 The container 7 and collector 9 are attached permanently to the backing sheet, but they are associated only releasably with the image-recording portion 5. The image-recording portion is only releasably coupled to the card. Such couplings may be achieved

by adhesive, cohesive or seals depicted schematically at 33, 45 and 47 on the attached drawings. As will become more apparent hereinafter, such an arrangement of permanent attachment and releasable associations and couplings permits separation of the image-recording portion, as a first unit, from the backing sheet, container and collector, as a second unit. The latter three components, constituting waste after processing has been initiated, then can be collected, by directing them in an arcuate path to a chamber preferably behind the other film units in the pack, and can be discarded after exhaustion of the exposed film units in the pack with little possibility of damage to any sensitive environment (e.g. clothing or person) by any remaining processing composition in the waste material.

40 The above-described film unit, or a pack including a plurality of such film units, is well suited for use in the embodiment of apparatus in accordance with the present invention illustrated in Figs. 3 to 10. An embodiment of such apparatus, generally designated 53, forming part of a camera (schematically indicated in broken lines in Fig. 5 as including a housing 54, a lens 56, and a shutter 58) includes a pair of juxtaposed pressure applying members 55, and stripping and guiding fingers 57. These parts are intended to cooperate with the film unit 1 for transporting the backing sheet 3 from a first substantially planar position, through the pressure applying members 55 and then in an arcuate path to a waste storage chamber. During such movement of the backing sheet, the image-recording portion 5 of the film unit travels with the backing sheet 3 as it passes between the pressure applying members, but then continues to move along a substantially straight path exiting from the apparatus as depicted in Fig. 4. In this manner the backing sheet, container and collector are stripped from the image-recording portion and directed into the waste storage chamber, while the recording portion is directed from the chamber or to some other position where it will be accessible to the camera operator.

45 Movement of the film units is effected during the greater portion of the movement by frictional contact between the pressure member 61 and the film unit. For this purpose the pressure member 61 is rotatable by a motor (not shown) or other appropriate means such as a manual winding lever 63, that is operable from the camera exterior. However, an additional mechanism is provided for effecting initial movement of each film unit from its exposure position to a position in which the leading end of the backing sheet engages the nip of the pressure members. This additional mechanism includes a pair of lever arms 65 each having

a first notched end 67 for engaging the trailing end of the uppermost film unit in the pack and a second end 69 fixedly secured to a shaft 73 which is mounted in lugs 71 of the apparatus for permitting pivotal movement of the arms 65 in unison about an axis parallel to the plane of the uppermost film unit during exposure, from a first position illustrated in broken lines in Fig. 6. Movement of the lever arms 65, for effecting initial movement of the uppermost film unit after exposure, is accomplished and controlled by a connecting arm 75 pivotally connected at one end 77 to one of the lever arms. The other end 79 of the arm 75 has a gear rack 81, and a finger 83 having a cam surface 85. The gear rack 81 in the position of the arm 75 illustrated in Fig. 3 engages a driving gear 89 attached to, for rotation with, the pressure roller 61, for imparting rightwards (as seen in Fig. 3) movement to the connecting arm 75, and corresponding pivotal movement to the lever arms 65, in response to rotation of the pressure roller, to push the uppermost film unit into the nip of the pressure members. The cam surface 85 of finger 83, on the other hand, is adapted to engage a second cam 91 secured to the body of the apparatus, for disengaging the rack 81 of the control arm from the gear 89 of the pressure roller after the lever arms or kickers have served their function. In operation, the pressure roller 61 is rotated in a clockwise direction (as viewed in Fig. 3) to effect initial advancement of the film unit into the bite between the pressure members, after which the initial advancing mechanism is disengaged by cams 85 and 91. The connecting arm is held in the disengaged position by a mechanism, not shown, which is actuated, by the return movement of the body release, to release the arm 75 to return to its initial position (illustrated in Fig. 3) under the influence of a spring 87, such return motion being effected after the shutter is released so that the arms do not move to their initial positions until the uppermost film unit has been exposed.

The stripping and guiding fingers 57 are most clearly illustrated in Figs. 3 and 4, and include arcuate guiding surfaces 93 that substantially follow the curvature of rotatable pressure member 61 through an arc of approximately 180° extending from the bite of the pressure members 97, 61 to a region adjacent the entrance to waste storage chamber 59. The fingers are radially spaced from the rotatable pressure member 61 by a distance slightly greater than the thickness of the backing sheet 3. The fingers 57 engage the backing sheet, as it exists from the bite of the pressure members, and direct the backing sheet 3, as it is pushed by frictional contact with the pressure member 61, in an arcuate path defined between the rotatable

pressure member 61 and the fingers 93. The fingers 93 are spaced from each other by a distance greater than the width of the image-recording portion 5, but less than the width of the backing sheet 3, whereby engagement of the lateral margins of the backing sheet is ensured and the backing sheet is directed along the previously mentioned arcuate path while permitting substantially straight line movement between the fingers of the image-recording portion (see Fig. 4).

Actual stripping of the image-recording portion 5 from the backing sheet 3 is most clearly illustrated in Fig. 4 and results from the fact that the backing sheet is directed in the abovementioned arcuate path and the inherent stiffness of the image-recording portion and the backing sheet are such that the coupling of the image-recording portion to the backing sheet is broken by virtue of the tendency of the image-recording portion to follow a straight path whilst the backing sheet is constrained to follow an arcuate path. The recording portion thus travels in a substantially straight line path between the fingers from the pressure members to the camera exterior.

The pressure members 55 can be of any suitable form, and will not be described in detail. Briefly, however, the second pressure member 97 has been illustrated as a plate shaped from sheet material into the proper configuration. In the embodiment illustrated, the stripping fingers 57 extend from the plate and are integral therewith.

The waste collecting and storage chamber 59 is part of a larger chamber 101 that is divided into two parts by a floating plate 103. The first, or uppermost (as seen in Figs. 5-10) portion of the larger chamber is adapted to hold a plurality of unexposed film units, and, as these film units are removed after exposure, the floating plate moves forwardly under the action of springs 105 to provide more room in the second, or lowermost (as seen in Figs. 5-10) portion for waste materials separated from the film unit withdrawn from the upper portion. In this manner, a very compact chamber can be utilized that need not be much larger than the original stack of unexposed film units.

It also should be apparent, and actually is preferred, that the film units be supplied in a cartridge. In such case, the cartridge would define both the upper, or supply, and lower, or waste, collecting portions of the larger chamber and also would include the floating plate 103.

Waste material is directed to an entrance 107 of the waste storage chamber 59 by the end 95 of the stripping fingers 57 remote from the second pressure member 97, and thereafter is urged forwardly against the plate 103 by the springs 105. In this manner, the entrance to the chamber is left un-

obstructed for receiving waste from the next successive film unit.

In Figs. 8—10 there is illustrated a mechanism 111 which includes two kickers 113 each of which is pivotally attached, as at 115, to the camera body and is resiliently urged in a clockwise direction (as viewed in Fig. 8) by a spring 117. Each kicker 113 is urged into the arcuate path defined by fingers 57 where it will be engaged by a respective side margin of the backing sheet, projecting axially beyond the respective guide, as the backing sheet is pushed along its arcuate path from the exposure position to the waste storage chamber. During such movement the backing sheet will engage and move the kickers 113 in a counterclockwise direction against the action of the resilient springs 117 from the first position of the kickers, illustrated in Fig. 8, to a second, cocked position, illustrated in Fig. 9. In this manner the backing sheet cocks and holds the kickers 113 in their cocked condition until the trailing end of the backing sheet passes beyond a predetermined point 119 (Fig. 9) where the kickers 113 move off the surface of the backing sheet and engage the trailing edge thereof to impart an additional final pushing movement of the backing sheet into the waste storage chamber. In Fig. 10 two positions of the kicker 113 are illustrated. The position indicated in broken lines is intermediate the position indicated in Fig. 9 and the position indicated in solid lines in Figs. 8 and 10. The kicker 113 is, of course, disposed laterally outside the path of the image-recording portion of the film unit.

For similar purposes, an additional roller 121 has been illustrated in Figs. 8—10. The roller 121 is spaced from the pressure roller 61 by an amount approximately equal to the thickness of the backing sheet to define the final portion of the arcuate path and permits the use of shorter stripping fingers and reduces frictional forces tending to restrain movement of the backing sheet.

While the mechanism 111 and the roller 121 are desirable in the presently described embodiment for gaining the best stacking of the waste in the waste chamber, it will be realized that embodiments may be constructed which do not require the mechanism 111 and/or the roller 121.

Referring now to the operation of the above-described embodiment a plurality of the film units are positioned in the photographic apparatus with the forwardmost unit located in a film plane of the apparatus. The forwardmost unit is located in the film plane by virtue of the force of the springs 105 urging the forwardmost unit, through the intermediary of the plate 103 and other film units, against a wall 104 having an exposure aperture 106. After exposure, the driven pressure-applying roller 61 is rotated by

manually operating winding lever 63 and the film unit is initially pushed into the bite of the pressure-applying members 61, 97 by the lever arms 65 operated through arm 75, rack 81 and gear 89. Once the film unit has entered between the pressure members, the co-operating cams 85 and 89 disengage arm 75 and rack 81 from gear 89. The arm then is retained in the disengaged position until released by the body release, (or other appropriate mechanism) and returned under the action of spring 87 to its initial position illustrated in Fig. 5. Once the film unit has entered between the pressure-applying members, further movement of the unit is effected by frictional pushing engagement of the driven pressure roller 61 on the backing sheet 5. This frictional engagement is sufficient to move the film unit from the stack and to push the backing sheet in the arcuate path defined by the guiding fingers 91 and into the waste storage chamber 59 defined behind the remaining film units in the pack. At the same time, and because of the coupling between the image-recording portion of the unit and the backing sheet, the recording portion is pulled from the stack and between the pressure-applying members for rupturing the fluent processing composition container and distributing the processing composition between the photosensitive element and process sheet. Immediately, or soon after passing between the pressure-applying members, however, the image-recording portion of the unit continues to move in a substantially straight line through an exit and to the exterior of the apparatus. In this manner the image-recording portion of the unit is separated from the backing sheet without any intervention by the camera operator. Moreover, since the container and collector are permanently attached to the backing sheet, but only releasably are coupled to the image-recording portion, the container and collector also will be separated from the recording portion and will follow the backing sheet into the waste storage chamber behind the remaining units in the pack. As the spent container, backing sheet and collector are pushed into the waste storage chamber, the resilient springs 105 engage the then lowermost (as seen in the Figures) surface of the backing sheet and urge the backing sheet in an upward direction against the plate 103 or against the backing sheet, container and collector of the film unit immediately previously exposed. The kicker 113 serves to complete the sliding movement of the backing sheet into the waste chamber in the manner described above. Thus, the spent backing sheet, container and collector are moved to a position where they will not interfere with entrance of similar waste from successive film units into the waste storage chamber.

In Figs. 13 and 14 there is illustrated a second embodiment of apparatus in accordance with the present invention and in Figs. 11 and 12 there is illustrated a film unit which is suitable for use in the apparatus illustrated in Figs. 13 and 14.

In the ensuing description parts physically or functionally similar to parts previously described herein may be given the same reference numeral, but with the addition of a prime (') suffix, as the parts to which they are similar.

The film unit 210 illustrated in Figs. 11 and 12 includes an image recording portion 212, a backing sheet 214 of resiliently flexible material, a container 216 for fluent processing composition and a collector 218 for excess fluent processing composition. The image recording portion 212 is substantially the same as the image recording portion 5 of the film unit illustrated in Figs. 1 and 2 and reference should be made to the description of the image recording portion 5. The container 216 is substantially the same as the container 7 of the film unit illustrated in Figs. 1 and 2 and reference should be made to the description relating to Figs. 1 and 2 for an understanding of the manner in which it is constructed, in which it is intended to operate and in which it is associated with the image recording portion. The backing sheet 214 is shorter than the backing sheet 3 of the film unit illustrated in and described with reference to Figs. 1 and 2, and is of such a length as to project beyond the leading end of the container 216 in one direction and to be overlapped for a short distance by the leading end of the image recording portion 212 in the other direction. The backing sheet is releasably coupled to the film unit by regions 213 of adhesive. The backing sheet 214 has a V-shape, or re-entrant, leading edge 220 as does the backing sheet 3. The container 216 is permanently connected to the backing sheet 214 by a region 222 of adhesive.

The collector 218 is formed from a sheet 224 of fluid impervious paper, plastics or the like and by spacer, end-closure members 226 which also serve as lifters in the manner of the lifters 31 illustrated in and described with reference to Figs. 1 and 2. The sheet 224 is folded over and wrapped around the trailing end of the image recording portion where it is permanently secured to the exterior trailing end surfaces of the photosensitive element and process sheet by regions 223 of adhesive. The members 226 are received and adhered between the folded over portions of the sheet 224 and cooperate with the sheet to prevent the escape of any processing composition from the lateral edges of the collector. The members 226 also act as stiffening elements against which a feeding mechanism, to be described, of a camera

can act to push the film unit. The collector is provided with vent paths to allow air to escape from the image recording portion and the collector itself during distribution of processing composition.

The collector 218 has the same transverse dimension as does the image recording portion but the backing sheet 214 projects laterally beyond the lines of both side edges 228 of the image recording portion 212.

The second embodiment of the invention is illustrated in Figs. 13 and 14 and uses film units as illustrated in Figs. 11 and 12 but it will be understood that it could use film units as illustrated in Figs. 1 and 2.

The embodiment illustrated in Figs. 13 and 14 includes a chamber bounded by side walls 230 and a back wall 231 and divided by a plate 232 into a sub-chamber for unexposed film units and a sub-chamber 234 between the plate 232 and back wall 234, for waste materials. The plate 232 is resiliently biased away from the back wall 231 by leaf springs 236.

A pair of rollers 238, 240 are provided for applying compressive pressures to an exposed film unit for aiding in the distribution of processing composition. The roller 240 is biased by a spring 243 towards the roller 238 but is limited in its approach to the roller 238 by stops (not shown) which serve to control the minimum width of the nip and thereby control the thickness of the layer of processing composition distributed between the photosensitive element 11¹ and process sheet 13¹ of the image recording unit 210.

The roller 238 is rotatable by a crank 63¹ or by a motor (not shown).

The roller 238 is provided at one end with a gear wheel 89¹ and at the other end with a gear wheel 242. The gear wheel 242 meshes with a gear wheel 244 drivingly connected to the roller 240. The gear ratio of the gear wheels 242, 244 is the same as the ratio of the diameters of the rollers 238, 240 so that rotation of the crank 63¹ serves to drive the rollers 238, 240 with the same peripheral speed.

The gear wheel 89¹ is intended for cooperation with the rack 81¹ of the connecting arm 75¹. As in the embodiment illustrated in Fig. 3, the connecting arm 75¹ is pivotally connected to a lever arm 65¹ which is one of two lever arms 65¹ which are united and pivotally mounted from lugs 71¹ by a shaft 73¹. In the present embodiment the arms 65 are so spaced apart and disposed as to cooperate with the collector immediately behind the members 226.

The gear wheel 89¹, rack 81¹, connecting arm 75¹ and lever arm 65¹ serve to push that film unit which is in the exposure position and has been exposed, longitudinally in the plane of the film unit so that

the leading end of the backing sheet 214 engages the nip of the rollers 240, 238 upon rotation of the crank 63.

5 The connecting arm 75¹ is biased by a spring 250 towards engagement of the rack 81¹ with the gear wheel 89¹ and has a re-entrant portion 246 at the end of the rack 81¹ towards the lever arms 65¹. The last tooth of the rack 81¹ in the direction towards
10 the lever arms 65¹ is so located that as it is passing rightwards (as seen in Fig. 13) out of engagement with the gear wheel 89¹ the lever arms 65¹ are at their required limiting positions in which they have pushed the
15 exposed film unit to a position in which the leading end of the backing sheet engages the nip of the rollers 238, 240. Having reached this position, upon further rotation of the crank 63¹ the last tooth merely chatters on the gear wheel 89¹ with no further
20 rightwards movement of the connecting arm 75¹.

Further rotation of the crank 63¹ causes the leading end of the backing sheet 214 to be moved through the nip of the rollers 238, 240. Continued rotation causes the container 216 to pass through the nip and the hydraulic forces created in the composition in the container causes rupture of the seal in the container and the processing composition flows into the image recording portion 212. Continued rotation of the crank causes the image recording portion to pass through the nip and, as the width of the nip is now
30 accurately defined, the thickness of the layer of processing composition between the photosensitive element 11¹ and the process sheet 13¹ is also accurately defined. Yet, further rotation of the crank causes the collector
35 218 to pass through the nip.

40 Considering now the downstream side of the nip, guides 57¹ are provided which are spaced from the surface of the roller 238 by a distance only slightly greater than the thickness of the backing sheet 214. The guides 57¹ are spaced apart by a distance greater than the width of the image recording unit but less than the width of the backing sheet.

50 As the leading end of the backing sheet 214 issues from the nip of the rollers 238, 240 its lateral margins are engaged by the guides 57¹ so that the backing sheet 214 is constrained to follow an arcuate path over the surface of the roller 238 as it is pushed
55 by frictional cooperation therewith and with the roller 240. The container 216 moves with the backing sheet because it is permanently secured thereto. As the leading end portion of the image recording unit issues from the nip of the rollers, it tends to follow a straight line path rather than the arcuate path followed by the backing sheet and by virtue of the inherent stiffness of the image
60 recording portion and of the backing sheet,

the coupling of the image recording portion of the backing sheet is broken and the association of the leading end of the image recording portion with the trailing end of the container 216 is discontinued. Thus, the backing sheet is pushed towards and into the waste chamber 234 and the image recording portion is moved out of the camera.

When the next film unit is exposed by an operation caused by depression of the body release 254, a resilient tongue 256 associated with the body release moves relative to the connecting arm 75¹ so that a shoulder 258 in the tongue passes under a flange 260 integral with the connecting arm 75¹, the end portion of the latter at this time being in the position indicated in broken lines in Fig. 13. As the body release 254 returns to its initial position under the influence of a spring 262, the shoulder 258 engages the underside of the flange 260 and continued movement of the body release 254 under the influence of the spring 262 lifts the connecting arm 75¹ against the bias of the spring 250 so that the rack 81¹ is taken out of engagement with the gear wheel 89¹, and the connecting arm 75¹ is free to move leftwards (as seen in Fig. 13) under the influence of the spring 87¹. During this leftwards movement, the flange 260 slides over the shoulder 258. The flange 260 is of such a length that it leaves the shoulder 258 when the lever arms 65¹ are in their initial positions and when the flange 260 has left shoulder 258 the spring 250 forces the connecting arm down so that the rack again engages the gear wheel 89¹.

Because the backing sheets 214 are short in comparison to the backing sheets 3, they do not extend all the way along the waste chamber 234 but stack up between the spring 236 and plate 232.

As can be seen in Figs. 13 and 14, a guide 264 is provided to ensure that the leading end of the film unit moves into the nip of the rollers 238, 240.

The lever arms 65, 65¹ are so formed that they engage only one film unit at a time and so that if they are in a position displaced from their positions illustrated in Figs. 3 and 13 during exposure of a film unit they do not interfere optically or physically with the film unit being exposed.

In both of the above described forms of film units it is desirable to use, for the adhesive connecting the image recording portion to the backing sheet, an adhesive which is strong in a shear but weak in tension. With such an adhesive, separation of the image recording portion from the backing sheet is facilitated because the divergence of the backing sheet from the recording portion when the former follows its arcuate path induces tensile stresses in the adhesive.

Particularly when the second embodiment 130

of the invention is operating upon film units of the form illustrated in Figs. 11 and 12, it has been found advantageous to apply a high friction coating to the side of the backing sheet engaged by the roller, i.e. the side of the backing sheet remote from the container, and also to apply a low friction coating or polish to at least those portions of the other surface of the backing sheet which may engage the arcuate guides.

It will be realized that whilst a pressure applying means including two rollers has been disclosed in the second embodiment, such an arrangement could be used in the first embodiment and an arrangement including one roller and one non-rotatable member could be used in the second embodiment.

It is also to be understood that the film unit illustrated in and described with reference to Figs. 1 and 2 could be used in the apparatus illustrated in and described with reference to Figs. 13 and 14 and that the film unit illustrated in and described with reference to Figs. 11 and 12 could be used in the apparatus illustrated in and described with reference to Figs. 4 to 10.

If found necessary or desirable, a mechanism similar to the mechanism 111 illustrated in Figs. 8 to 10 may be included in the embodiment illustrated in Figs. 13 and 14.

Whilst in both of the embodiments specifically described above the arcuate path which the backing sheet is constrained to follow after issuing from the nip of the pressure applying means is bounded at one side by guides and at the other side by the, or a, roller, it is to be understood that in some embodiment both sides of the arcuate path might be bounded by guides and in such cases means would be provided for moving the backing sheet along its arcuate path after its trailing end has left the nip.

The stiffness of the image recording portion has been referred to in relation to the separation of the image recording portion from the backing sheet. It is to be understood that the term stiffness is not intended to imply that the image recording portion is rigid, although it may be. Rather, the term stiffness is intended to indicate that the image recording portion has sufficient resistance to bending so that it ruptures its coupling to the backing sheet rather than move over the arcuate path of and with the backing sheet. Further the sufficiency of stiffness of the backing sheet enables such separation of the image recording unit and backing sheet without substantially deformation of the backing sheet or deviation thereof from the desired arcuate path to which it is constrained by the guides 57¹.

WHAT WE CLAIM IS:—

1. A photographic apparatus for exposing and initiating the processing of a self-

processing photographic film unit which includes an image recording unit releasably connected to a resiliently flexible backing sheet of stiffness sufficient to enable the backing sheet to be pushed, without folding, along a desired path, the apparatus including a chamber for receiving a film unit in a position for exposure, means for transporting the film unit from the exposure position towards a station whereat processing and stripping are initiated and for pushing the backing sheet along a desired path whilst moving the image recording unit or permitting the image recording unit to move along another divergent path so as to strip the image recording unit from the backing sheet.

2. An apparatus as claimed in Claim 1 wherein the processing initiating station includes a pair of cooperating pressure members arranged to rupture a fluent processing composition container permanently secured to the backing sheet and to spread processing composition therefrom between superposed photosensitive and processing elements of the image recording unit, at least one of the pressure members serving also to push the backing sheet along the desired path.

3. An apparatus as claimed in Claim 1 or 2 further including guide means for constraining the backing sheet to movement along the desired path.

4. Apparatus as claimed in Claim 2 and 3 wherein the at least one of the pressure members is a roller and the guide means comprises arcuate fingers arranged concentrically with the roller and spaced therefrom to define guides for the backing sheet.

5. An apparatus as claimed in Claim 3 or 4 wherein the guide means are arranged to constrain the backing sheet by engagement with marginal portions thereof.

6. An apparatus as claimed in Claim 4 or any claim appendant thereto wherein the other of the pressure members is stationary and is integral with the guide means.

7. An apparatus as claimed in any of Claims 1 to 6 wherein the desired path is arranged to extend from the processing initiating station to a waste collection chamber.

8. An apparatus as claimed in Claim 7 including additional means for pushing the backing sheet into the waste collection chamber.

9. An apparatus as claimed in Claim 2 or any claim appendant thereto including separate means for pushing the film unit from the exposure position into engagement with a nip defined by the pressure members.

10. An apparatus as claimed in Claim 2 or any claim appendant thereto except Claim 6 or any claim when appendant to Claim 6 wherein the other of the pressure members is a second drivable roller.

of the invention is operating upon film units of the form illustrated in Figs. 11 and 12, it has been found advantageous to apply a high friction coating to the side of the backing sheet engaged by the roller, i.e. the side of the backing sheet remote from the container, and also to apply a low friction coating or polish to at least those portions of the other surface of the backing sheet which may engage the arcuate guides.

It will be realized that whilst a pressure applying means including two rollers has been disclosed in the second embodiment, such an arrangement could be used in the first embodiment and an arrangement including one roller and one non-rotatable member could be used in the second embodiment.

It is also to be understood that the film unit illustrated in and described with reference to Figs. 1 and 2 could be used in the apparatus illustrated in and described with reference to Figs. 13 and 14 and that the film unit illustrated in and described with reference to Figs. 11 and 12 could be used in the apparatus illustrated in and described with reference to Figs. 4 to 10.

If found necessary or desirable, a mechanism similar to the mechanism 111 illustrated in Figs. 8 to 10 may be included in the embodiment illustrated in Figs. 13 and 14.

Whilst in both of the embodiments specifically described above the arcuate path which the backing sheet is constrained to follow after issuing from the nip of the pressure applying means is bounded at one side by guides and at the other side by the, or a, roller, it is to be understood that in some embodiment both sides of the arcuate path might be bounded by guides and in such cases means would be provided for moving the backing sheet along its arcuate path after its trailing end has left the nip.

The stiffness of the image recording portion has been referred to in relation to the separation of the image recording portion from the backing sheet. It is to be understood that the term stiffness is not intended to imply that the image recording portion is rigid, although it may be. Rather, the term stiffness is intended to indicate that the image recording portion has sufficient resistance to bending so that it ruptures its coupling to the backing sheet rather than move over the arcuate path of and with the backing sheet. Further the sufficiency of stiffness of the backing sheet enables such separation of the image recording unit and backing sheet without substantially deformation of the backing sheet or deviation thereof from the desired arcuate path to which it is constrained by the guides 57¹.

WHAT WE CLAIM IS:—

1. A photographic apparatus for exposing and initiating the processing of a self-

processing photographic film unit which includes an image recording unit releasably connected to a resiliently flexible backing sheet of stiffness sufficient to enable the backing sheet to be pushed, without folding, along a desired path, the apparatus including a chamber for receiving a film unit in a position for exposure, means for transporting the film unit from the exposure position towards a station whereat processing and stripping are initiated and for pushing the backing sheet along a desired path whilst moving the image recording unit or permitting the image recording unit to move along another divergent path so as to strip the image recording unit from the backing sheet.

2. An apparatus as claimed in Claim 1 wherein the processing initiating station includes a pair of cooperating pressure members arranged to rupture a fluent processing composition container permanently secured to the backing sheet and to spread processing composition therefrom between superposed photosensitive and processing elements of the image recording unit, at least one of the pressure members serving also to push the backing sheet along the desired path.

3. An apparatus as claimed in Claim 1 or 2 further including guide means for constraining the backing sheet to movement along the desired path.

4. Apparatus as claimed in Claim 2 and 3 wherein the at least one of the pressure members is a roller and the guide means comprises arcuate fingers arranged concentrically with the roller and spaced therefrom to define guides for the backing sheet.

5. An apparatus as claimed in Claim 3 or 4 wherein the guide means are arranged to constrain the backing sheet by engagement with marginal portions thereof.

6. An apparatus as claimed in Claim 4 or any claim appendant thereto wherein the other of the pressure members is stationary and is integral with the guide means.

7. An apparatus as claimed in any of Claims 1 to 6 wherein the desired path is arranged to extend from the processing initiating station to a waste collection chamber.

8. An apparatus as claimed in Claim 7 including additional means for pushing the backing sheet into the waste collection chamber.

9. An apparatus as claimed in Claim 2 or any claim appendant thereto including separate means for pushing the film unit from the exposure position into engagement with a nip defined by the pressure members.

10. An apparatus as claimed in Claim 2 or any claim appendant thereto except Claim 6 or any claim when appendant to Claim 6 wherein the other of the pressure members is a second drivable roller.



11. An apparatus according to Claim 9, or Claims 9 and 10 wherein the separate means for pushing the film unit includes a pair of arms mounted for pivotal movement about an axis parallel to the exposure plane, a link member having a rack for engagement with a gear wheel mounted for rotation upon movements of the at least one of the pressure members, the end of the link member remote from the rack being pivotally connected to the pair of arms whereby movement of the at least one of the pressure members causes longitudinal movement of the link member which in turn causes pivotal motion of the pair of arms from a starting position to push a film unit in the exposure position towards the nip of the pressure members.

12. An apparatus according to Claim 11, including means for returning the link member and the pair of arms to the starting position after exposure of a film unit.

13. An apparatus according to any one of the preceding claims, including a guide for guiding a leading end of a film unit towards the processing initiating station.

14. An apparatus according to Claims 4 and 9 or any claim appendant thereto wherein the additional means for pushing the back-

ing sheet into the waste collection chamber includes a member mounted for pivotal movement about an axis parallel to the axis of the roller, the member being spring-biased towards a position in which an end portion is disposed in the arcuate portion of the desired path, the member being movable from the position by movement of the backing sheet along the arcuate portion, the end of the member being engageable with the trailing end of the backing sheet after the latter has left the nip of the pressure members whereby the backing sheet is pushed into the waste collection chamber under the influence of the spring bias on the member as the member tends to move towards its said position.

15. A photographic apparatus for exposing and initiating the processing of a self-processing photographic film unit and substantially as hereinbefore described with reference to and as illustrated in Figs. 3 to 10 or Figs. 13 and 14 of the accompanying drawing.

L. A. TRANGMAR, B.Sc. C.P.A.
Agent for the Applicants.

Printed for Her Majesty's Stationery Office by Burgess & Son (Abingdon), Ltd.—1975
Published at The Patent Office, 25 Southampton Buildings, London, WC2A 1AY
from which copies may be obtained.



* C L H S *