United States Patent

Erlichman

[15] **3,653,308**

[45] **Apr. 4, 1972**

[54] PHOTOGRAPHIC APPARATUS

[72] Inventor: **Irving Erlichman,** Wayland, Mass.

[73] Assignee: **Polaroid Corporation,** Cambridge, Mass.

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

[21] Appl. No.: **179**

[52] **U.S. Cl.** **95/13,** 95/19, 95/22

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

[58] **Field of Search** 95/13, 14, 19, 22, 30, 66

[56] **References Cited**

UNITED STATES PATENTS

641,268	1/1900	Chase	95/30
2,467,320	4/1949	Land	95/13
1,469,273	10/1923	Kauser	95/30
458,981	9/1891	Perry	95/19
458,907	9/1891	Kipper et al.	95/19
2,463,878	8/1949	Johnson	95/30 X
1,406,653	2/1922	Kauser	95/30 X
1,557,085	10/1925	Piller	95/30
3,511,152	5/1970	Erlichman	95/13

Primary Examiner—Samuel S. Matthews

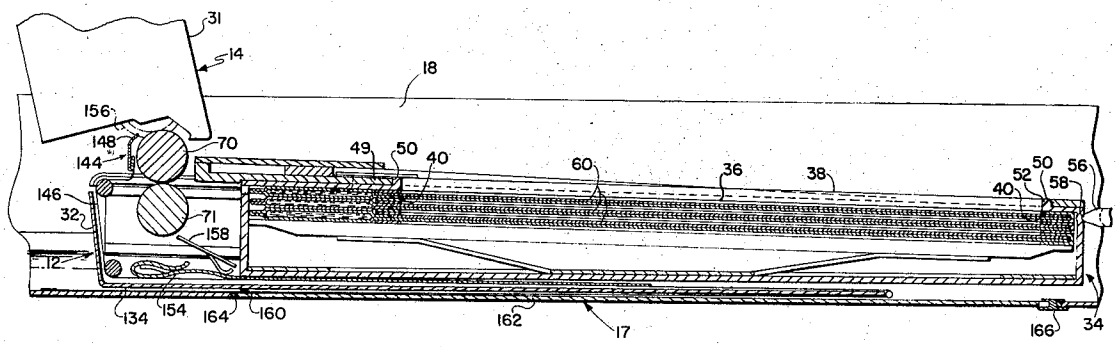
Assistant Examiner—Alan A. Mathews

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[57] **ABSTRACT**

Variable geometry photographic apparatus for carrying a photosensitive element from an exposure position through a plurality of pressure-applying rollers a distance sufficient to clear the rollers, and then returning the photosensitive element to the main body of the photographic apparatus. A lighttight drawer is utilized which only temporarily alters the normal fixed geometry and volume of the photographic apparatus so that processing of the photosensitive element can begin almost immediately after exposure. This temporary altering of the normal fixed geometry of the photographic apparatus enables the static dimensions of the photographic apparatus to be held to a minimum while producing a developed photosensitive element in a minimum time after exposure.

40 Claims, 17 Drawing Figures



Patented April 4, 1972

3,653,308

8 Sheets-Sheet 1

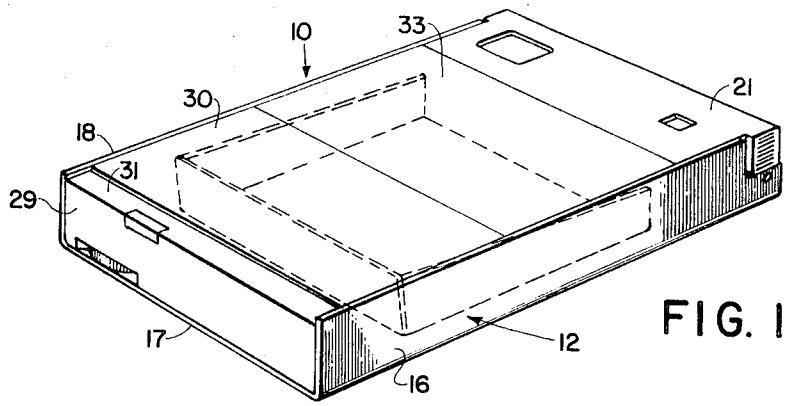


FIG. 1

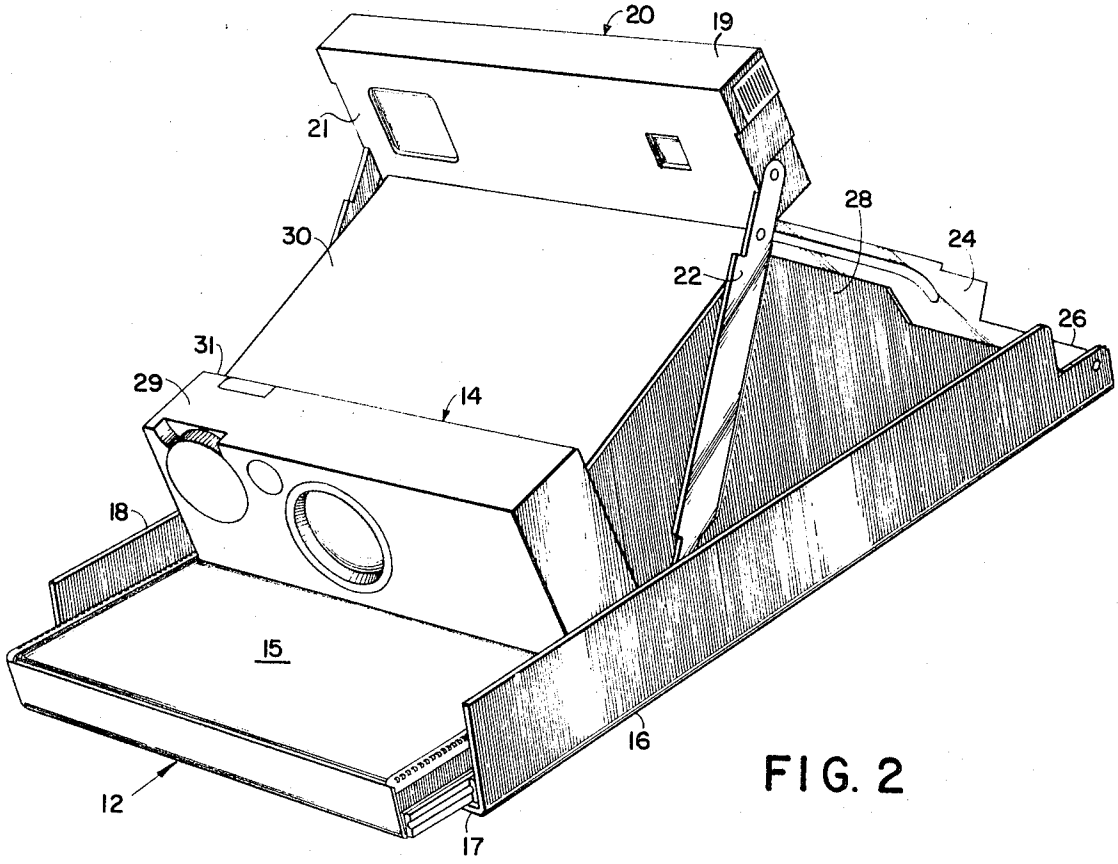


FIG. 2

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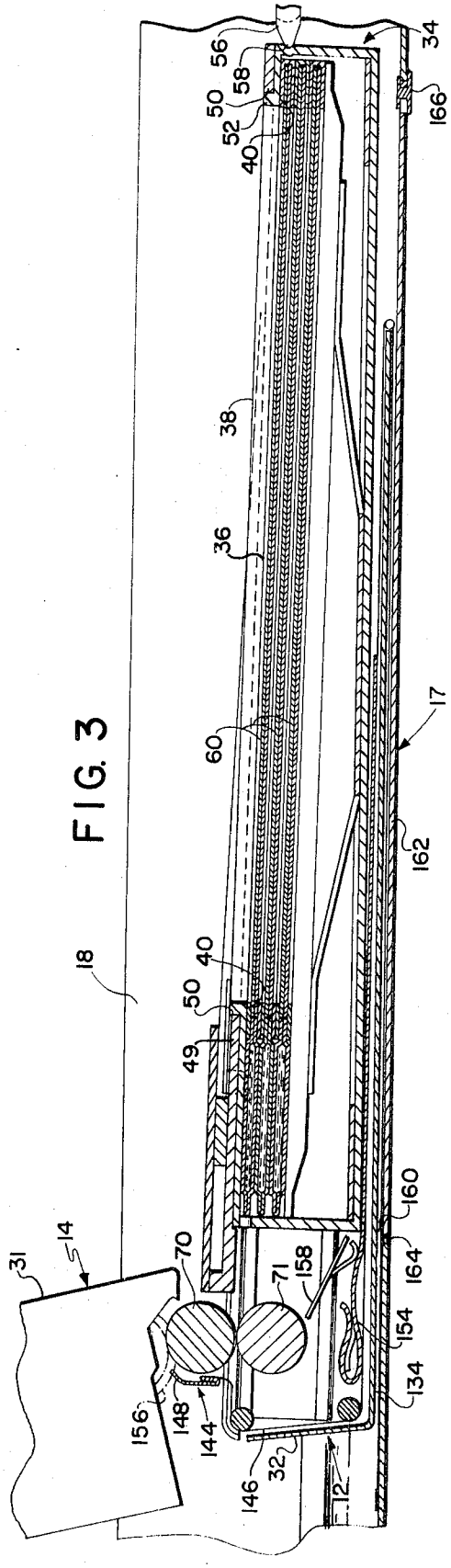


FIG. 3

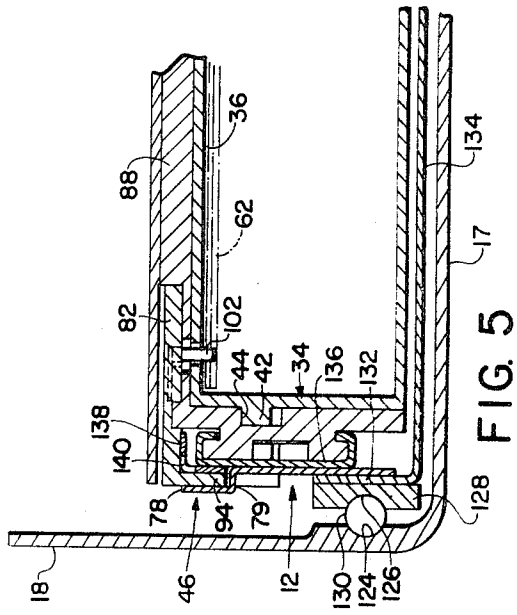


FIG. 5

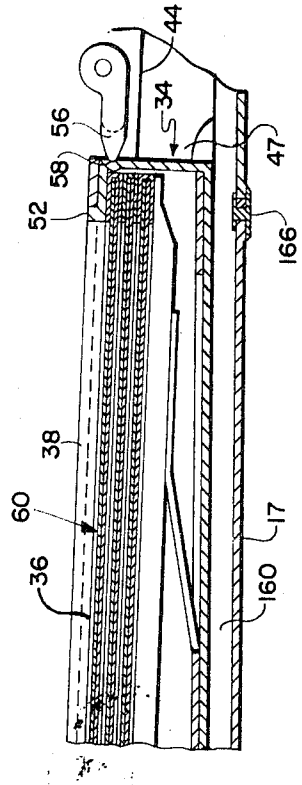


FIG. 4

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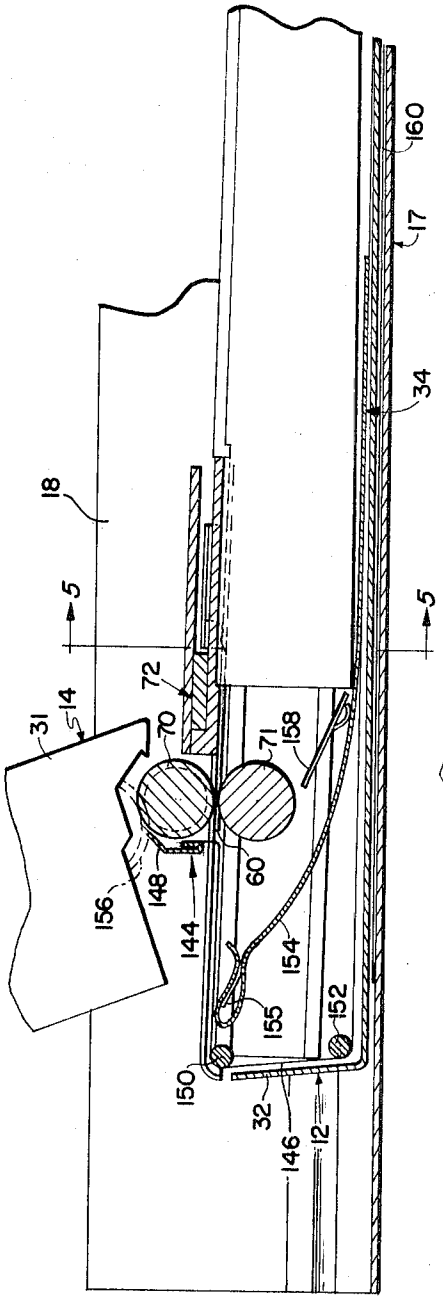


FIG. 6

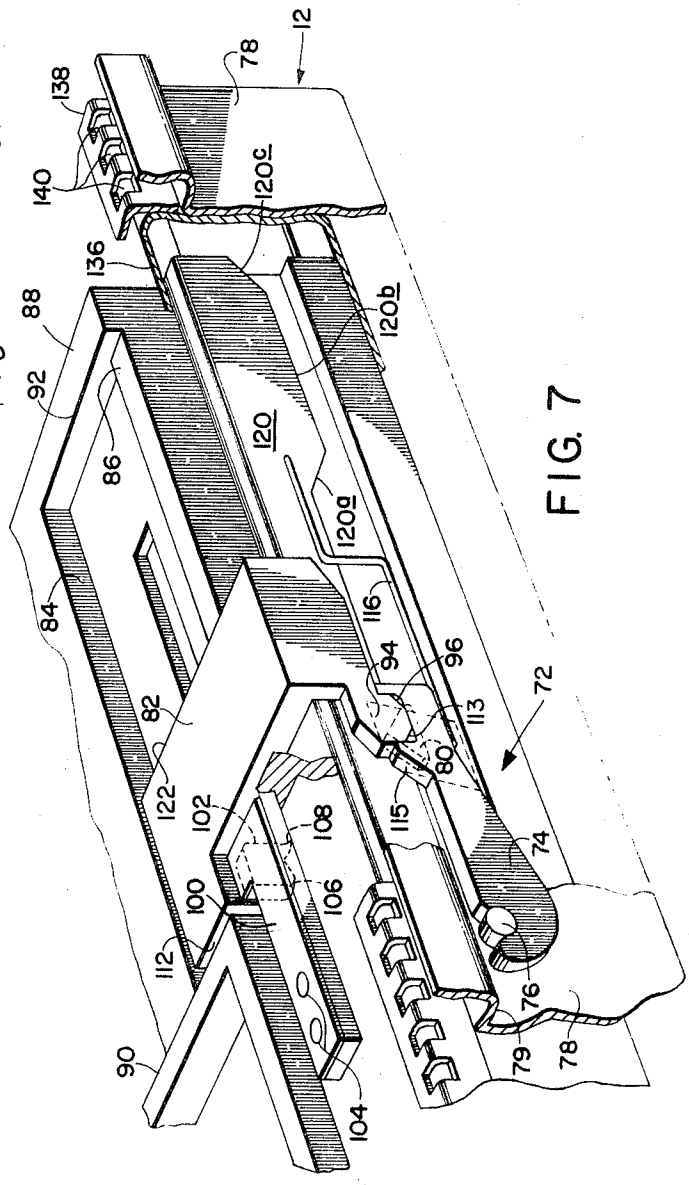
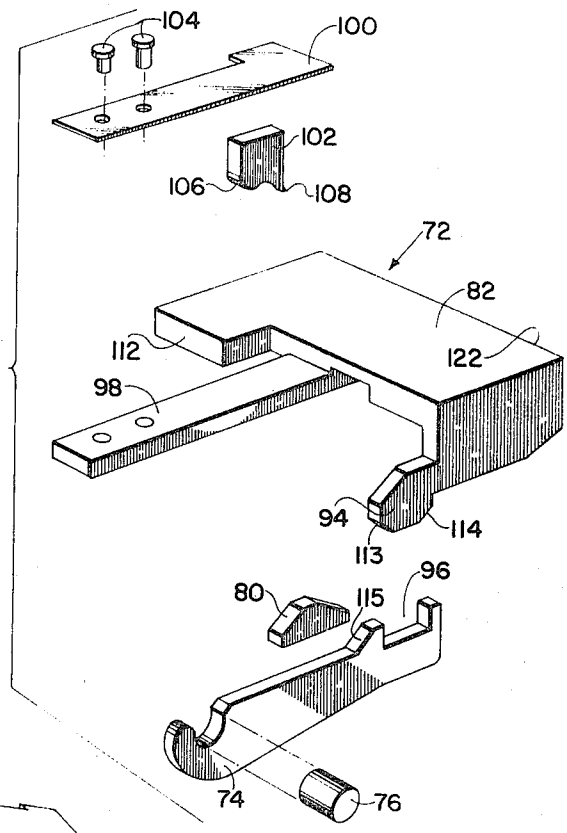


FIG. 7

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FIG. 8



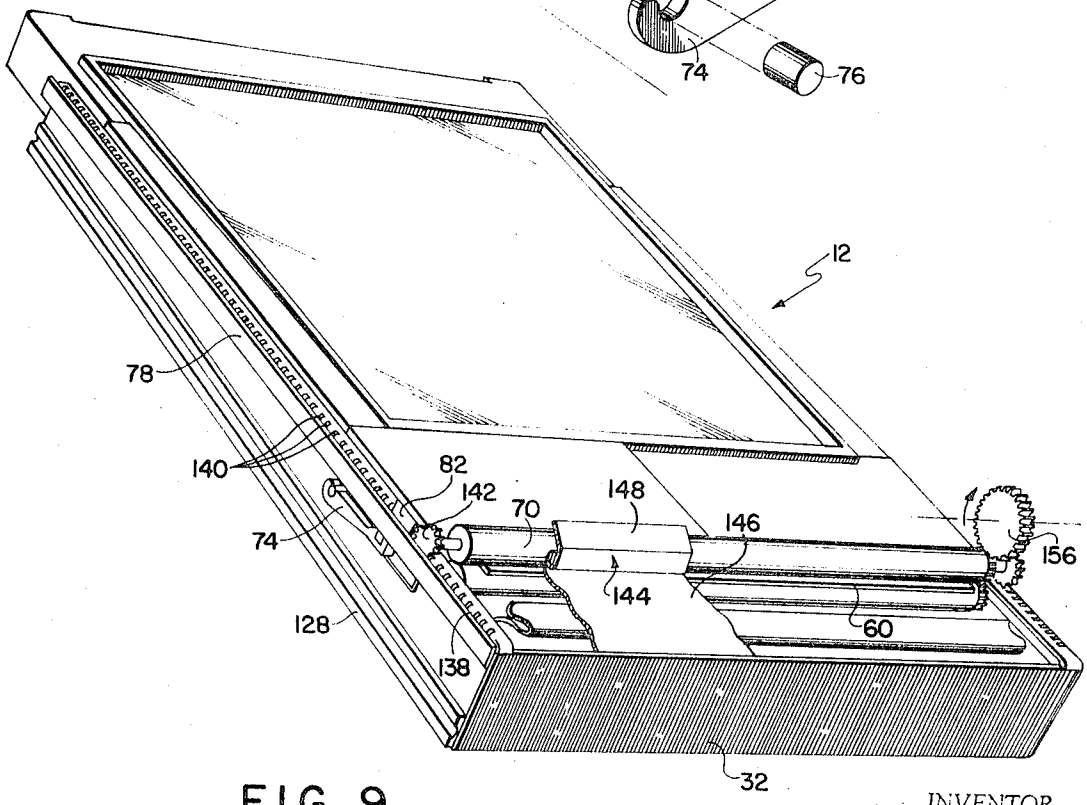


FIG. 9

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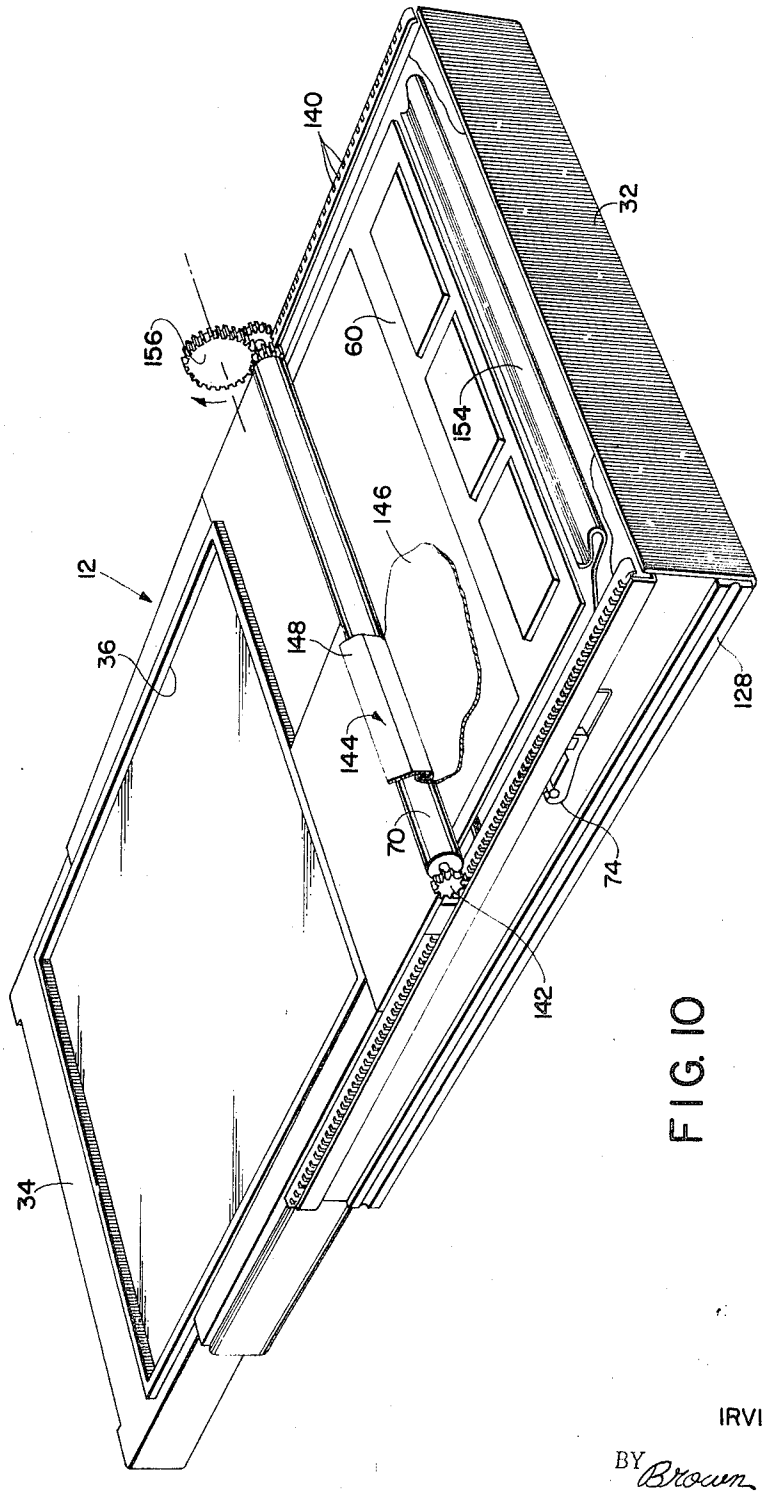


FIG. 10

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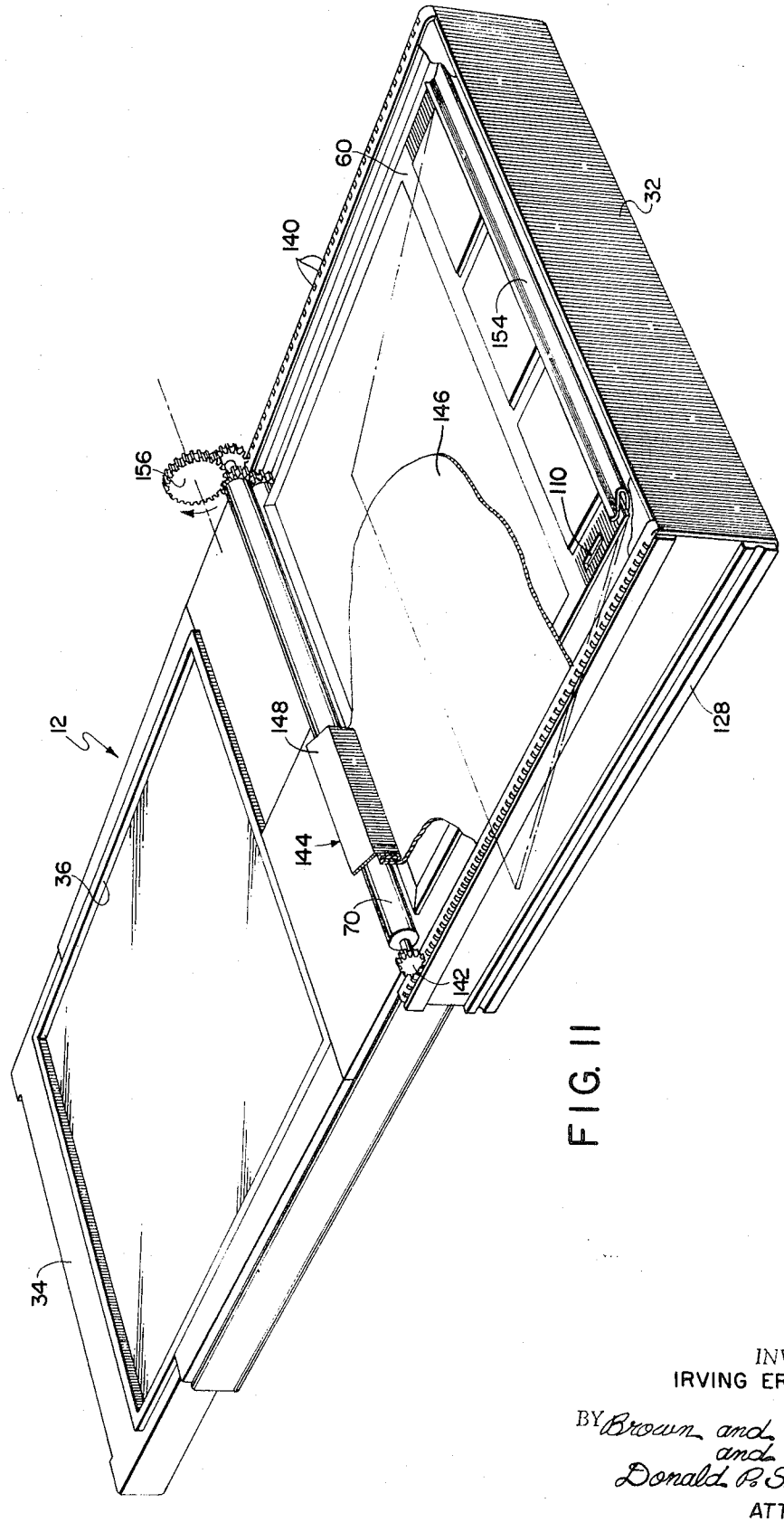


FIG. 11

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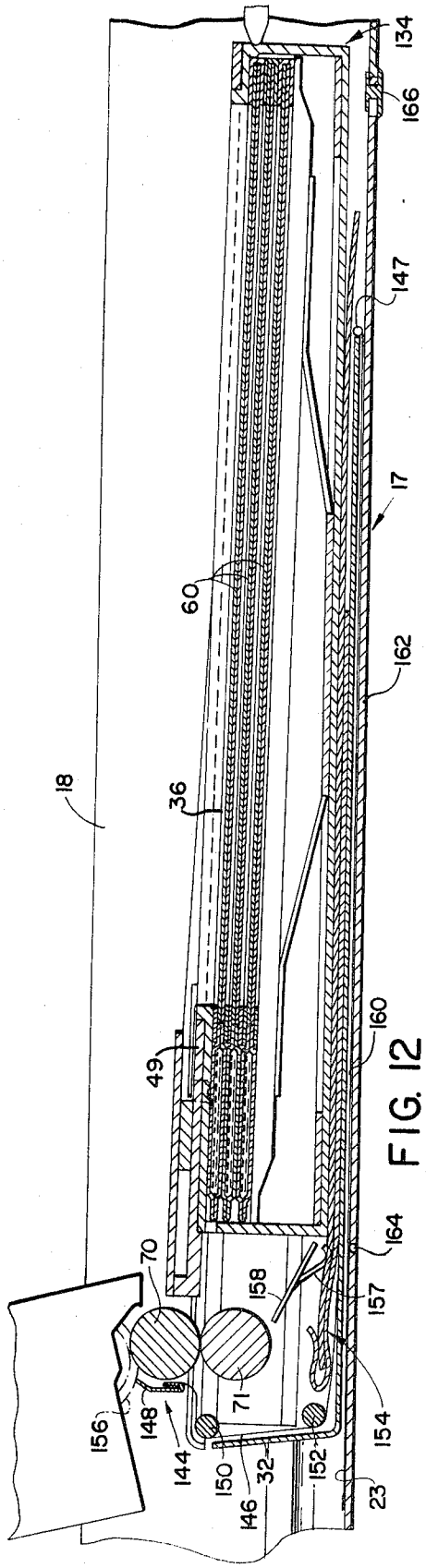


FIG. 12

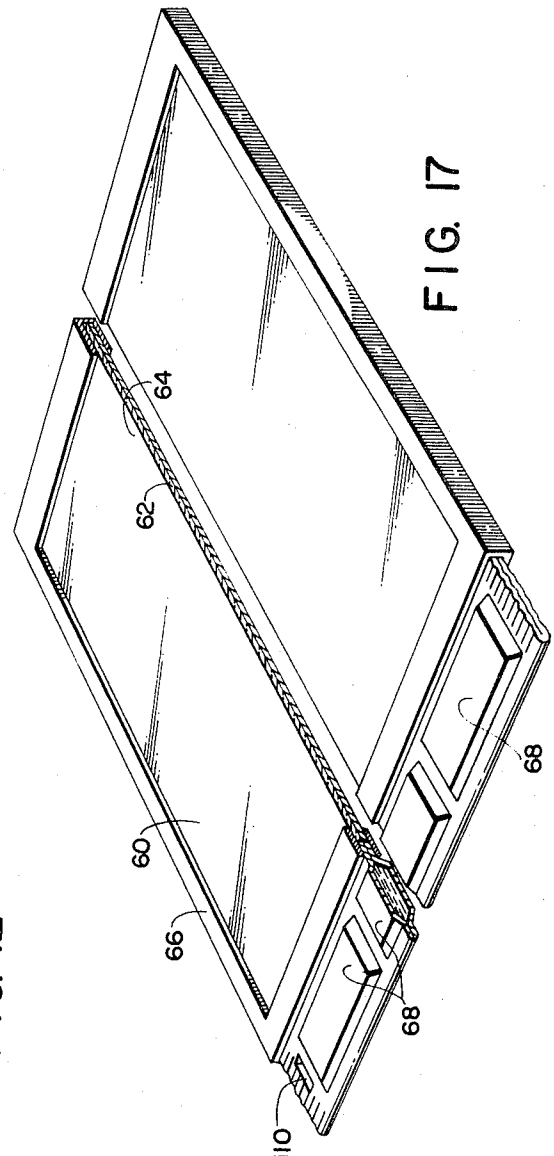


FIG. 17

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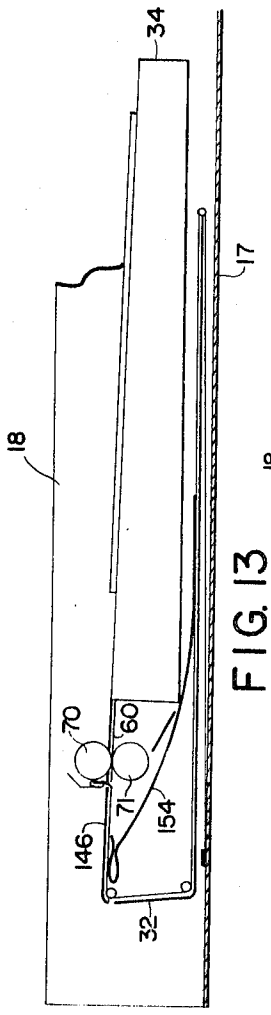


FIG. 13

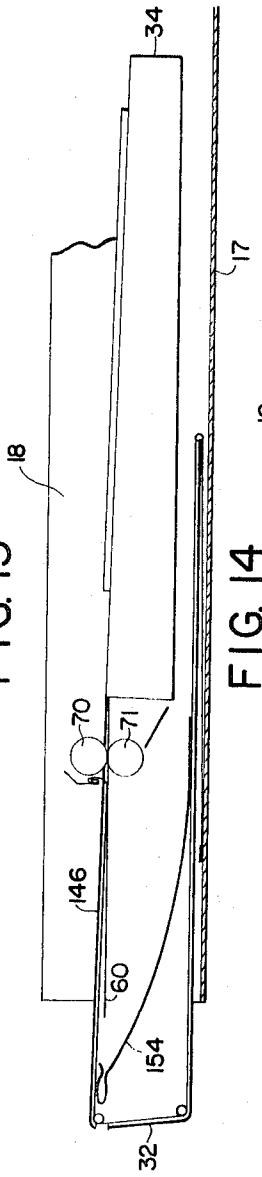


FIG. 14

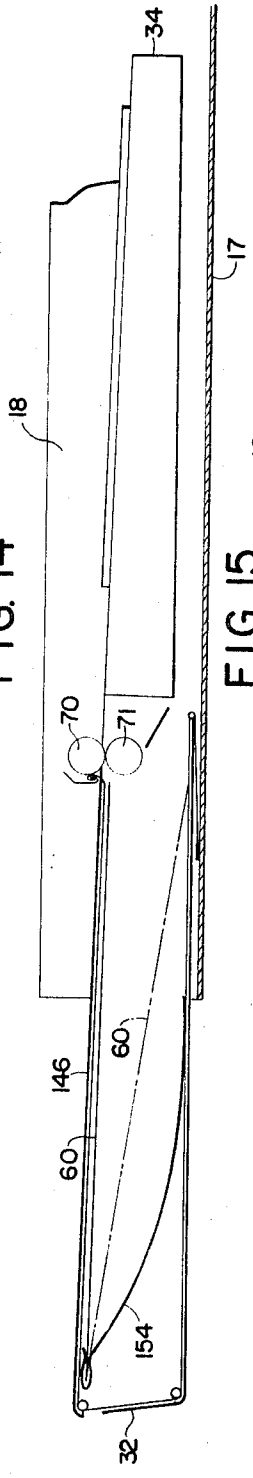


FIG. 15

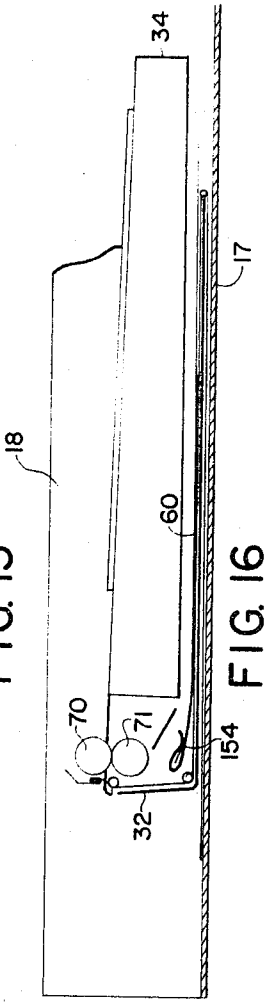


FIG. 16

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PHOTOGRAPHIC APPARATUS

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to photographic apparatus and, more particularly, to a variable geometry chamber for use in a self-developing camera wherein the film format is one utilizing a diffusion transfer process in which the film is processed within the camera.

The self-developing camera with which the present invention is concerned is generally of the type shown in Ser. No. 763,883, filed Sept. 30, 1968, in the name of Irving Erlichman and assigned to the same assignee as the present invention, and now U.S. Pat. No. 3,589,253. The diffusion transfer process utilized by the self-developing film unit of the present invention is one of the type more completely described in U.S. Pat. No. 3,415,644, issued Dec. 10, 1968, in the name of Edwin H. Land, and assigned to the same assignee as the present invention. The general nature of the film unit utilizing the abovementioned process in the present invention is more completely described in Ser. No. 622,286, filed Mar. 10, 1967, in the name of Edwin H. Land et al. and assigned to the same assignee as the present invention, and now abandoned. It is to be understood that, while the embodiment described herein involves an application of the invention to a camera and film format of the foregoing type, the invention is also applicable to other systems in which the film unit is to be processed within the camera.

In the film unit of the type previously mentioned, a photosensitive element is positioned in face-to-face relationship with a transparent element and bound together therewith to form a film unit. The photosensitive element is exposed through the transparent element. A developing composition is contained in at least one pod situated at one end of the face-to-face elements. After exposure of the photosensitive element, the developing composition is spread between the sheets whereupon the diffusion transfer process is initiated. For a short period of time thereafter, if the film unit is exposed to actinic light, it is possible for some light to pass through the processing composition. That is to say, sufficient light can conceivably impinge on the exposed photosensitive element by passing through the transparent element and the processing composition for a limited period of time after the original exposure to result in a fogging of the ultimately developed image. The developed image is viewable through the transparent element and a complete protected photograph results which requires no further processing utilizing all of the components of the originally exposed film unit. Therefore it is important that, once exposed, the photosensitive element is not later exposed to actinic light until the diffusion transfer process has been completed.

In the camera of the type previously mentioned, an important characteristic thereof is its small size relative to the film format utilized. In other words, the camera, when in a nonerected condition, occupies the minimum space necessary to house the operative parts of the camera and a plurality of film units. When in an erected condition, suitable links position various camera components, such as a lens, rangefinder-viewfinder, and exposure apparatus, into operative positions while maintaining a plurality of film units in a stored position. In order to maintain the desirable small size of such a camera, it is critical that the camera dimensions necessary to house accessory controls and for film storage be kept to an absolute minimum. Therefore, the basic problem with which the present invention is concerned is utilizing a film format of the type previously described, for example, in a camera occupying the least amount of space while at the same time permitting processing of the film within the camera. It should be understood that the normal fixed geometry of the camera, as herein termed, is the volume displaced by the camera when in an erected, operative configuration.

2. Description of the Prior Art

In Ser. No. 786,352, filed Dec. 23, 1968, in the name of Edwin H. Land and assigned to the same assignee as the present invention, a means for chemical opacification is shown. That is to say, Ser. No. 786,352 describes a means for chemically opacifying a film unit of the type previously described so that a second deleterious exposure of the photosensitive element is precluded. It is obvious that, when using the chemical opacification technique, the need for maintaining the film unit in a lighttight environment for a significant period of time after exposure becomes unnecessary. However, when the aforementioned opacification technique is utilized, the film unit must still be removed from the exposure position during processing to permit subsequent exposures. Stated another way, irrespective of whether chemical opacification is utilized some means must still be provided to move the exposed film units from the exposure area and to make these developed film units available for subsequent viewing.

Various types of mechanical means are known in the art for preventing film units from being exposed to light prematurely. For example, in U.S. Pat. No. 2,467,320, issued April 12, 1949, in the name of Edwin H. Land and assigned to the same assignee as the present invention, a film-processing system is shown which transfers an exposed film unit into a chamber pivotally attached to the exterior portion of the camera. This is a developing chamber, and the film can be stored therein while developing or can be stored therein until all of the film units present within the camera are exposed. However, this arrangement does not completely solve the problem hereinbefore set forth because the developing chamber and film storage means is an additional structure, external of the basic camera, and represents an added volume to the dimensions of the basic camera which cannot be tolerated in the desirable small-volume camera of the present invention.

In U.S. Pat. No. 3,350,990, issued Nov. 7, 1967, in the name of P. L. Finelli et al. and assigned to the same assignee as the present invention, a camera is shown in which a film unit is moved from an exposure position to another position within the camera. The second position is a lighttight chamber but significantly increases the fixed volume necessary for the functioning of that camera but for the addition of the lighttight chamber. Consequently, the problem herein set forth is not solved by the Finelli camera.

In U.S. Pat. No. 3,460,452, issued Aug. 12, 1969, in the name of Edwin H. Land and assigned to the same assignee as the present invention invention, a small-volume camera similar to the camera of the present invention is illustrated. Also illustrated in this patent is a developing chamber which is utilized to house a film unit during processing and thereby maintain that film unit in a lighttight environment. However, while providing the needed developing chamber and while utilizing a small amount of space, this chamber is external of the camera body and therefore necessitates additional space to accommodate the chamber. Consequently, this approach does not fully solve the problem herein set forth. It becomes clear that the prior art does not provide an adequate solution to the problem of providing a very compact camera using a self-developing film format that is capable of moving the exposed film unit from the exposure area and processing the film unit within the camera without significantly increasing the fixed dimensions of the camera.

OBJECTS OF THE INVENTION

Accordingly, it is an object of the present invention to provide, in photographic apparatus of the self-developing type, an improved film-handling mechanism in which the fixed physical dimensions of the apparatus are minimized.

It is another object of the present invention to provide, in improved photographic apparatus of the type described in the previous object, means which temporarily alters the normal fixed volume of the photographic apparatus so as to transport an exposed photosensitive element from an exposure position to a second position within the photographic apparatus.

It is still another object of the present invention to provide improved photographic apparatus wherein a reciprocating drawer can be utilized both as an imbibition chamber and as a film transport system.

It is a further object of the present invention to provide improved photographic apparatus of the type described in the previous object wherein provision is made in the photographic apparatus for storage of at least one processed film unit.

It is still a further object of the present invention to provide improved photographic apparatus of the self-developing type wherein a film unit of a relatively rigid format is developed by the diffusion transfer process and is moved from an exposure position in a lighttight environment within a camera by use of a translationally reciprocable drawer that only temporarily alters the normal fixed geometry of the photographic apparatus.

It is yet a further object of the present invention to provide an improved photographic process.

Other objects of the invention will in part be obvious and will in part appear hereinafter.

The invention accordingly comprises the apparatus possessing the construction, combination of elements and arrangement of parts and the process involving the several steps and the relation and order of one or more of such steps with respect to each of the others which are exemplified in the following detailed disclosure, and the scope of the application of which will be indicated in the claims.

For a fuller understanding of the nature and objects of the invention, reference should be had to the following detailed description taken in connection with the accompany drawings.

SUMMARY OF THE INVENTION

Briefly, I accomplish the foregoing objects by providing a variable geometry camera in which the dimensional geometry is temporarily altered in a reversible manner through a closed cycle after each exposure to move the film unit from the exposure area through an intermediate position external to the fixed geometry of the camera and then back to a second position which is a position for storing or viewing within the camera. The second position does not interfere with the exposure area, and once the film unit is thus moved to its second position, the camera is in a condition permitting a subsequent exposure without interference with or from the storage or processing functions associated with the preceding film unit and without the encumbrance of a significant increase in the fixed dimensions of the camera. More specifically, in the particular embodiment shown and described, a drawer-type mechanism is translationally and reversibly reciprocable from a position adjacent an exposure area in a camera to a position outside the camera body and back to a storage position within the camera. Provision is made in this drawer arrangement for the acceptance of a film unit that is sequentially moved from an exposure position, through pressure-applying rollers for distributing the processing composition, and then is redirected to a second position within the camera spatially removed from the exposure position. In this manner another film unit can be positioned in the exposure plane and immediately exposed to complete a second cycle.

Further provision is made for the storage within the camera of subsequently exposed and processed film units without increasing the normal fixed volume of the camera. More specifically, I have found it convenient to coordinate the operation of the present invention with the shutter-actuating mechanism for automatic operation. That is to say, a battery is provided within the camera to electrically and sequentially operate the shutter mechanism and the processing mechanism so as to provide a fully automatic camera.

A process is also taught in the present invention that involves supporting the photosensitive element in position for exposure, then, in sequence, distributing a processing composition on the exposed photosensitive element and, finally, temporarily altering the normal fixed volume of the camera so as to transport the photosensitive element from the exposure position to a second position within the photographic apparatus by utilizing a drawer-type processing chamber.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a perspective view of the camera of the present invention, shown in a folded position, with the position of a drawer-type processing chamber shown in dotted lines;

FIG. **2** is a perspective view of the camera of FIG. **1**, shown in the erected position, with the drawer-type processing chamber shown partially extended from the camera body;

FIG. **3** is a sectional view of the camera of FIG. **1** showing a package of film units operatively positioned for exposure;

FIG. **4** is an enlarged partial sectional view of a mechanism for holding the film package in place;

FIG. **5** is a partial sectional view taken along line **5—5** of FIG. **6**;

FIG. **6** is a partial sectional view of the subject camera showing the film unit advanced from the exposure position to a position between processing rollers;

FIG. **7** is a partial perspective view of FIG. **5** showing a pick mechanism in more detail;

FIG. **8** is an exploded perspective view of the operative components of the pick mechanism;

FIG. **9** is a perspective view of the drawer-type processing chamber with a film unit shown beyond the exposure position entering the processing rollers;

FIG. **10** is a perspective view of the drawer-type processing chamber with a film unit shown in a position partially advanced beyond the processing rollers;

FIG. **11** is a perspective view of the drawer-type processing chamber with the film unit shown fully engaging a film angle-changing mechanism;

FIG. **12** is a sectional view similar to FIG. **3** with an exposed film unit shown in a stored position;

FIG. **13** is a diagrammatic illustration of the film unit position corresponding to the detailed sectional view of FIG. **6**;

FIG. **14** is a diagrammatic illustration of the film unit position corresponding to the position shown in the detailed perspective of FIG. **10**;

FIG. **15** is a diagrammatic illustration of the film unit position corresponding to the position shown in the detailed perspective of FIG. **11**;

FIG. **16** is a diagrammatic illustration of the film unit position corresponding to the detailed sectional view of FIG. **12**; and

FIG. **17** is a perspective view of a film unit of the type used with the present invention.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to FIG. **1**, a perspective view of a camera, generally designated by numeral **10**, is illustrated. A drawer-type processing means **12**, hereinafter termed drawer, is translationally reciprocable and is shown in a stored position by dotted lines in FIG. **1**. The processing means **12** actually comprises the drawer mechanism itself and a curtain **146** cooperating to form a lighttight chamber of variable volume. Therefore, means **12** provides a lighttight chamber which is an extension of the lighttight environment of camera **10**, and a support for a film unit as it is transported to a storage position. Hence, the term processing is appropriate. Referring to FIG. **2**, camera **10** is shown in an erected position which is the operative position of the camera, and drawer **12** is illustrated in a position slightly extended from the position wherein it is normally positioned in the main portion of camera **10** when the camera is erected. As previously stated, camera **10** is generally of the type described in my aforementioned U.S. Pat. No. 3,589,253. Therefore, the operation of camera **10** will be described herein only sufficiently to fully explain the cooperation of the present invention therewith.

Camera **10**, as seen in FIG. **1**, has a very low profile and occupies a minimal volume whether erected or not erected. That

is to say, in an inoperative or nonerected condition, camera **10** occupies a volume that exceeds the size of the film pack contained therein only to minimally sufficient extent to store the other essential operative parts of the camera. The geometry of the camera when not erected is determined by the volume required to store all components of the camera. The geometry of the camera when erected is determined by the volume required when camera components are operatively positioned. For example, housing **14** is pivotable to the erected position shown in FIG. **2** to operatively position a lens and certain shutter-control mechanisms. When the camera is not in use, housing **14** is retracted into space **15** provided between the outer camera walls **16** and **18** in front of the space occupied by drawer **12**. Walls **16** and **18** are connected by wall **17**, which can be integrally formed therewith to form a single element. Similarly, another housing **20** typically carries a rangefinder-viewfinder mechanism and therefore must be optically synchronized with housing **14**. Link **22** and link **24** are respectively pivotable at a first end on camera wall **16**. Similar links are identically pivotally carried by means, not shown, inside camera wall **18**. These links establish the relative positions of housings **14** and **20**. Therefore, housing **20** can fold down in the direction of area **26** into a portion of the camera body which is to the rear of the position of drawer **12** when the drawer assumes a fully retracted position.

Flexible bellows **28** maintains the exposure area of camera **10** in a lighttight condition and is connected to plate **30**, housing **14**, and plate **33**, as well as peripherally of the exposure area, so that only light admitted controllably by the exposure system reaches the exposure area. Consequently, the geometry of camera **10** when operative is defined by a top surface **29** and a portion of the back surface **31** of housing **14**, plate **30**, bellows **28**, surfaces **19** and **21** of housing **20**, camera housing walls **16**, **17**, and **18**, and plate **33**, best shown in FIG. **1**. As a practical matter, the normal geometry of camera **10** referred to herein is the shape of the enclosure formed by the aforementioned components of the camera as erected. When in a folded configuration, the normal fixed volume and, accordingly, the geometry, is as shown in FIG. **1**. When in an erected or operative configuration, the normal fixed volume and geometry is as shown in FIG. **2**. The geometry of camera **10**, whether folded or erected, is not permanently altered by the inclusion of drawer **12**. Because the drawer **12** is disabled when the camera is in a folded configuration, the recitation herein of a temporary change in geometry is significant only in a situation where the camera is in the erected configuration. However, it should be understood that the present invention has utility in the environment of a camera of the box or nonerectable type. Consequently, the compactness of camera **10** is not disturbed by the inclusion of drawer **12** in either configuration.

It becomes clear from the foregoing description that the geometry of the camera illustrated in FIG. **1** is a desirable configuration and represents the minimum volume necessary to house all of the operative portions of the camera. This compact volume is very desirable, and, in order to maintain the compact camera theme in the environment of the present invention, it is very desirable that the drawer **12** be completely contained within the space or volume shown in FIG. **1**. The present invention to be hereinafter described satisfies the foregoing requirements in that the drawer **12** only temporarily changes the erected camera geometry and this temporary change takes place very rapidly immediately after a photosensitive element is exposed. In other words, the temporary change in geometry occurs at a time when it does not interfere with normal operation of the camera nor with the portability and storage characteristics of the camera in its folded position.

Referring to FIG. **3**, a film container **34** is operatively situated beneath the exposure plane **36** and supports a stacked array of film units for exposure. Referring to FIG. **17**, a film unit, designated by numeral **60**, generally comprises a photosensitive element **62** covered by a transparent element **64** and is exposed through element **64** by way of opening **38** in container **34**. Binding means **66** peripherally engages the elements **62** and **64**, holding them in face-to-face relationship. Therefore, after the photosensitive element **62** is exposed through the transparent element **64**, at least one container, such as designated by numeral **68**, is ruptured so as to enable a quantity of a processing composition to be dispensed between the face-to-face elements to initiate the diffusion transfer process hereinbefore mentioned. This rupturing is brought about by pressure-applying means, such as processing rollers, which are hereinafter described.

Exposure plane **36** is the plane at which light from a scene is directed to a film unit **60** positioned for exposure. Stated another way, the subject camera optically delivers an image to be photographed to exposure plane **36**, on which plane is disposed the photosensitive element **62** of film unit **60**. As seen in FIGS. **3** and **12**, desirably a plurality of film units are disposed immediately beneath the exposure plane **36** so that as a given film unit is exposed and moved from the exposure position, another unexposed film unit reposes directly beneath the exposed film unit and is automatically positioned for exposure. Accordingly, it is necessary to position film container **34** immediately adjacent the edges of an exposure aperture in plate **49** in lighttight relationship therewith. Due to the angular relationship of exposure plane **36** with respect to wall **17**, the lower edge **40** of film container **34** must be precisely coplanar with the exposure plane **36**. To insure this relationship, the rear portion of camera **10** can be adapted to pivot outwardly or a suitable door, such as door **162**, can be provided in the back of camera **10** so that film container **34** can be slid into position adjacent the exposure aperture **38** on rails **42** integrally formed with container **34**. Rails **42** of container **34** cooperate with slots **44** formed on the side wall of a drawer-support structure **46**. The drawer-support structure and related container structure is more clearly shown in FIG. **5**.

When peripheral lip **52** of container **34** comes into engagement with the forward portion of the peripheral edge **50** of the exposure aperture in plate **49**, the film container **34** must be moved upwardly so that a rear portion of peripheral lip **52** comes into lighttight sealing engagement with peripheral edge **50**. Therefore, rail **42** has a relatively constant vertical dimension which is less than the dimension of rearward portion **47** of slot **44**. This permits an upward shifting of film container **34** so that lip **52** and edge **50** come into registry. Once this registry is completed, spring-loaded pawl **56** enters and engages notch **58** holding film container **34** in its operative location. This structure is best seen in FIG. **4**. It should be noted that each side of film container **34** contains a similarly constructed rail **42**, and drawer-support structure **46** contains a slot **44** on either side thereof adapted to engage the rails **42**. Consequently, the film container **34**, when inserted into the body of camera **10**, is operatively positioned so that the surface of photosensitive element **62** in film container **34** becomes coplanar with exposure plane **36** and is supported by the rails **42** and pawl **56** on this plane.

Referring to FIG. **6**, film unit **60** is shown driven forward to an intermediate position where it engages pressure-applying means in the form of rollers **70** and **71**. Roller **70** is a drive roller that is rotated by a suitable driving mechanism, such as gears, attached to a motor, and roller **71** is contrarotatably driven by roller **70** to insure their synchronism. Rollers **70** and **71** perform multiple functions. First, these rollers combine to propel film unit **60** forwardly so as to engage a portion of drawer **12** as hereinafter described. Second, rollers **70** and **71** combine to rupture container **68** of film unit **60** to distribute the processing composition across the exposed photosensitive element. Third, drive means or gears **142** (see FIGS. **9–11**), attached to roller **70** and later described, move the drawer **12** in translational reciprocating movement. The movement of film unit **60** to an intermediate point where it engages rollers **70** and **71** is brought about by a pick mechanism **72** operated, in turn, by drawer **12**. Therefore, the pick mechanism **72** is the means for engaging and moving the exposed photosensitive

element from the exposure position into the pressure-applying means, i.e., rollers 70 and 71.

The pick mechanism 72 is more clearly shown in FIGS. 7 and 8. Referring to FIG. 7, the operative portions of pick mechanism 72 are slidably carried on a fixed portion of the camera body, whereas the drive portion of the pick mechanism is pivotally supported on drawer 12. More specifically, the drive portion of the pick mechanism comprises a pick-drive member 74 pivotable on pin 76 which is carried by side rail member 78 of drawer 12, and therefore pin 76, pick-drive member 74, and side rail member 78 move with drawer 12 throughout the range of movement thereof. Cam follower 80 is carried by pick-drive member 74 and moves therewith. Cam follower 80 can be integrally formed with pick-drive member 74 or can be attached thereto in any well-known fashion such as by welding, rivets, etc.

Slide 82 moves in ways 84 and 86 formed in member 88 which is a fixed portion of the camera. Line 90 and line 92 define the limits of sliding movement of slide 82. That is to say that slide 82 moves forwardly in a manner hereafter described only during the initial portion of the movement of film unit 60 from the exposure position to a point where it engages pressure-applying rollers 70 and 71. Thereafter, the rollers transport the film unit forward into drawer 12, and the pick mechanism 72 is disabled.

Referring to FIG. 8, slide 82 is shown as having a downwardly projected lug 94 formed therewith which cooperates with locking slot 96 formed in pick-drive member 74. Extension 98 of slide 82 carries spring 100 and pick member 102 which is attached to spring 100. Spring 100 is attached to extension 98 by means of rivets 104, for example. Pick 102 has a cam follower surface 106 and a film-drive surface 108. Film-drive surface 108 of pick 102 engages a slotted aperture 110 in film unit 60, the slot being best shown in FIG. 17. It should be noted that container 34 has a slot in a top surface thereof, not shown, overlying slots 110 of the film units, which is at least as long as a slot 110 in the film units to allow pick 102 to reach the uppermost film unit for withdrawal thereof. Cam follower surface 106 therefore allows the pick 102 to move across the leading edge of container 34 to reenter a slot in a new film unit after a first unit has been exposed. Surface 106 also allows easy exit of pick 102 from the rear end of slot 110 as the pick 102 stops and the film unit continues forward after contacting rollers 70 and 71.

Referring to FIG. 7, locking slot 96 of pick-drive member 74 is shown engaging lug 94 of slide 82. It should be noted that slide 82 is at the rearward extreme of its movement as noted by the alignment of surface 112 thereof with line 90. When surface 112 is in alignment with line 90, film unit 60 is positioned in the exposure position and pick 102 is situated near the rear edge of slot 110 of film unit 60. Therefore, it is clear that pick 102 has a range of movement in slot 110 for reasons hereinafter described. With locking slot 96 and lug 94 engaged, any movement of pick-drive member 74 results in a corresponding movement of slide 82. Slide 82 has a camming surface 114 on lug 94 which allows slide 82 to reengage slot 96 almost immediately upon the return of the pick-drive member 74 with drawer 12 after movement thereof. Spring 116 is adapted to bias pick-drive member 74 upwardly against surface 79 of side rail member 78 where it is normally carried. Cam follower 80 is engageable with cam 120 which controls the pivoting of pick-drive member 74 in and out of engagement with slide 82 near its forward extreme of movement. That is to say, as pick-drive member 74 is initially moved, slide 82 also moves because of the interlocking of lug 94 with locking slot 96. As slide 82 approaches its forward extreme of movement, cam follower 80 engages surface 120*a* of cam 120 pivoting pick-drive member 74 downwardly against the bias of spring 116 and disengaging locking slot 96 thereof from lug 94 of the slide 82. Surface 113 is angularly disposed parallel to surface 120*a* so as to adapt a smooth withdrawal of lug 94 from slot 96 as leading edge 122 of slide 82 approaches an alignment with line 92 at the end of ways 84 and 86. It should be noted that cam follower 80 extends through aperture 81 of member 78 and is therefore in interference with cam 120 as it moves with drawer 12. At this point, follower 80 rides across surface 120a of cam 120, across surface 120b, and across surface 120c thereof, and is positioned again against surface 79 of side rail member 78.

When pick-drive member 74 returns after outward movement of drawer 12, cam follower 80 reengages surfaces 120*c*, 120*b*, and 120*a* sequentially. If edge 122 of side 82 is precisely positioned along line 92, slot 96 will merely reengage lug 94, and slide 82 will return with the drawer to its other extreme of travel where surface 112 falls along line 90. If slide 82 is not so precisely positioned, camming portion 115 of member 74 will engage camming surface 114 of lug 94 and will move relative thereto to positively reestablish the interlock between lug 94 and slot 96 as slide 82 reaches its rearward extreme of movement defined by line 90.

Referring to FIG. 5, drawer 12 includes elongated bearing portions. Specifically, drawer 12 is translationally reciprocable in camera 10 by being driven along slot 124 in camera wall 18. A similar slot 126 formed in elongated member 128 combines with slot 124 to trap a series of balls 130. A series of slots and balls, not shown, similar to slots 124 and 126 and balls 130 are carried on an opposite side of camera 10 to balance the load of drawer 12.

Elongated member 128 is carried by upturned flange 132 which is an extension of bottom surface 134 of the drawer 12. Front face 32 of the drawer is the forwardmost extension of bottom surface 134 as best seen in FIG. 3. Side rail member 78 is attached to upturned flange 132. Attached in turn to member 78 is guide rail 136. Attached to guide rail 136 is angular member 138 having apertures 140 therein to form a rack. Hereinafter, reference to a rack will mean a composite of member 138 having apertures 140 therein. Members 128, 132, 134, 136, and 138 may be conveniently formed of a ferrous metal with their method of attachment being by welding or soldering, for example. These members are duplicated on either side of drawer 12. Referring to FIG. 9, the rack, as shown, cooperates with gear 142 to generate the translational reciprocable movement of drawer 12. Gear 142 is seen as being carried on an end of a shaft connected to upper drive roller 70 and rotates therewith.

Referring now to FIGS. 9 through 12, progressive positions of drawer 12 are shown. Drawer 12, along with curtain 146, forms a processing chamber and, consequently, provides a lighttight environment for a film unit that is exposed and drawn from the exposure position. To this end, curtain 146 of fixed length is provided which is attached at one end to curtain support member 144. Curtain 146 can be of any type of material that will not admit actinic light and can be typically formed of a rubberized fabric-type material. Curtain support 144 is fastened on either end to an internal portion of the camera structure (not shown). However, support 144 is placed as close as possible to the forward side of rollers 70 and 71 to guarantee that no actinic light can strike the exposed photosensitive element as it extends past the rollers. To this end, it will be noted in FIG. 12, curtain support 144 has an upturned portion 148 that is bent backwardly over roller 70 to prevent the admission of light. Curtain 146 passes around roller 150, roller 152 situated in the forward portion of drawer 12, and then curtain 146 extends backwardly within the drawer, wraps around the rearward edge 147 thereof which can be rounded to prevent abrasion, and then is attached to inside surface 23 of camera bottom wall 17. Alternately, a roller could be carried at the rear edge 147 of drawer bottom surface 134 instead of rounding this edge as shown. It is to be noted that curtain 146 has a constant length and, once operatively positioned, remains taut throughout the movement of the drawer. In this way, the space in drawer 12 is progressively bridged by curtain 146 as this volume expands due to the drawer 12 moving from the main body of camera 10. Rollers 150, 152, and the rear portion 147 of drawer bottom surface 134 therefore cooperate as the drawer moves outwardly to

prevent abrading the surfaces of the curtain **146**. Accordingly, an expandable lighttight chamber is provided which is defined by curtain **146** selectively covering the front, bottom, and top of drawer **12** with side walls **136** completing a chamber of varying volume.

A film angle-changing mechanism is provided in drawer **12**. This film angle-changing mechanism takes the form of a spring element **154** having a lip **155** biased toward spring element **154**. Spring element **154** as a unit is normally biased in the direction of rollers **70** and **71** and grips the exposed film unit as the drawer nears its outward extreme of movement. After the film unit passes from between rollers **70** and **71**, the trailing end thereof is pivoted downward by the bias of lip **155** of spring **154** so that, when the drawer returns, the film unit is directed beneath the roller **71**. This is best seen in FIG. **11**. It is obvious from an examination of FIGS. **9** through **12** that the exposure plane is essentially parallel to the curtain **146** as it extends with drawer **12**, but, as best seen in FIG. **12**, the film is redeposited within the camera body beneath the film pack, and thus, it is desirable that the plane of film movement be changed from one parallel to the exposure plane to one substantially parallel to the bottom surface **134** of the drawer **12**. Therefore, the exposed photosensitive element bypasses the pressure-applying means **70** and **71** on its return to the second or storage position.

OPERATION

When it is desired to take a photograph with the apparatus of the present invention, the camera as shown in FIG. **1** is erected so that is assumes the configuration shown in FIG. **2**. One variance from the relative position of parts shown in FIG. **2** to be noted is that the drawer **12** is actually in a position such as shown in FIG. **9** when the camera is initially erected. Viewing FIG. **3**, it will be assumed that appropriate shutter and exposure mechanisms have been actuated within camera **10** so that the uppermost film unit **60** in container **34** is exposed. The remainder of the cycle can be executed manually or automatically. In the camera of the type shown in FIG. **2** and of the type described in the aforementioned U.S. Pat. No. 3,589,253, the following sequence would be initiated automatically.

Means such as a gear **156** would be actuated by an electric motor, for example, not shown, to rotate drive roller **70** and gears **142** attached thereto. The gears **142** at either end of roller **70** act as drive means to move the drawer **12** by engaging similar racks on either side of the drawer **12** and thereby balance the force applied thereto. The initial rotation of the gears **142**, which constantly engage the apertures **140** and angular member **138** forming the racks, function to drive the drawer **12** to the left as viewed in FIG. **3** and also carries the film unit **60** in the direction of the rollers **70** and **71** through pick mechanism **72**. The number of teeth in the gears **142** determines the speed of drawer **12** relative to the speed of film unit **60** which, of course, is a function of the rotational speed and circumference of rollers **70** and **71**. More specifically, and referring to FIG. **7**, side rail member **78**, angular member **138**, guide rail **136**, upturned flange **132**, and elongated member **128** move as a unit along slots **124** on balls **130**. Pin **76** is carried by side rail member **78**, and this pin likewise moves with the aforementioned elements. This causes pick-drive member **74**, at that point interlocked with slide **82**, also to go forward. While a film unit **60** is in the exposure position, such as shown in FIG. **3**, pick **102** is disposed in slot **110** in the film unit. Pick **102** is resiliently carried on spring **100**, in turn carried by slide **82**. Therefore, the initial movement of gears **142** causes slide **82** to move along with drawer **12**.

Referring to FIGS. **6** and **7**, as slide **82** moves toward the right as viewed in FIG. **7**, the exposed photosensitive element of the film unit **60** engaged by pick **102** will likewise move with drawer **12** toward the right as viewed in this figure to another position into the bite of rollers **70** and **71**. As film unit **60** enters the bite of rollers **70** and **71**, which is the situation illustrated in FIG. **6**, cam follower **80** engages surface **120***a* of cam **120**, deflecting pick-drive member **74** around pivot pin **76** away from slide **82** against the bias of spring **116**. When cam follower **80** has reached the highest surface **120***b* of cam **120**, locking slot **96** will be completely freed from lug **94**. Therefore, slide **82** will move no further. When leading edge **122** of slide **82** attains a position along line **92**, slide **82** has reached its limit of movement which coincides with the initial position on surface **120***b* of cam follower **80** and, likewise, coincides with the entry of the film unit **60** into the bite of rollers **70** and **71**. At this point, the pick element **102** is disengaged from slot **110** in film unit **60** because the rear of slot **110** is driven into the cam follower surface **106** of pick element **102** which is stationary at this time while the film unit is driven ahead by the rollers. Pick-drive member **74** is resiliently mounted as previously indicated, and, after cam follower **80** drops off the trailing surface **120***c* of cam **120**, the pick-drive member **74** is merely biased by spring **116** back against surface **79** and follows drawer **12** in its continued movement out of the main enclosure provided by camera **10**.

Referring to FIGS. **6** and **9**, film unit **60** has now entered the bite of rollers **70** and **71**, and pick mechanism **72** has been disabled. The continued movement of film unit **60** is governed by the motion generated by the rotating rollers **70** and **71**. As seen in FIG. **6**, drawer **12** has moved a distance from its normal position of rest, and curtain **146** has been extended slightly to maintain the area on the output side of rollers **70** and **71** in a lighttight environment.

Referring to FIG. **10**, drawer **12** has progressed further from the position of rest within camera **10** and is effectively now increasing the volume of camera **10**. Film unit **60** has been driven approximately halfway through rollers **70** and **71**, and due to a differential rate of travel between drawer **12** and film unit **60**, the film unit is closing on spring **154**. This differential rate of travel is necessary because the film unit is initially positioned behind spring **154** when being exposed and then must catch up to spring **154** as it moves with the drawer. Therefore, the number of teeth in gears **142** is designed to have the speed of the drawer be less than the speed of the film unit driven by the rollers **70** and **71**.

Referring to FIG. **11**, film unit **60** is shown by solid lines having overtaken the drawer **12**, fully engaged spring **154**, and also having cleared the bits of rollers **70** and **71**. Therefore, film unit **60** pivots downwardly toward bottom surface **134** of drawer **12** due to the bias of lip **155** of spring **154**. It should be noted at this point that film unit **60** does not actually touch bottom surface **134** due to the interposition of curtain **146**. Film unit **60**, however, has had its support angle changed, and now, upon reinsertion of drawer **12** into the main body of the camera, film unit **60** will pass beneath roller **71**.

At the extreme of movement of drawer **12** as shown in FIG. **11**, a suitable switching mechanism, not shown, can be brought into play to change the polarity of a motor that is driving gear **156** so that a change in the direction of rotation of roller **70** and, consequently, gears **142**, is brought about.

Referring now to FIG. **12**, drawer **12** has been completely reinserted into the camera body with the previously exposed film unit **60** deflected by spring **158** near the end of its travel having passed beneath film container **34** but still remaining in drawer **12**.

Referring to FIGS. **13** through **16**, the operation of the subject invention previously described is diagrammatically shown with only the essential parts illustrated so as to clarify the sequential movement of the film unit. FIG. **13** is similar to FIG. **6** in that the film unit **60** just previously exposed is shown entering the bite of rollers **70** and **71**. It will be noted in FIG. **13** that the spring element **154** is shown near an upward extreme position in which direction it is normally biased. Referring to FIG. **14**, the film unit that was exposed has now proceeded approximately halfway through the bite of rollers **70** and **71** and is closer to spring element **154** than in the position shown in FIG. **13**. This is due to the differential in the rate of travel of the film unit and the drawer **12**. It is also to be noted that drawer **12** as seen in FIG. **13** moves a certain

distance prior to extending beyond walls **16** and **18** of camera **10**, and, therefore, even the temporary increase in camera volume is held to a minimum.

Referring to FIG. **15**, the film unit is shown in a position where it has passed beyond the bite of rollers **70** and **71** and has fully engaged the spring element **154**. When in the position shown in FIG. **15**, the film unit is pivoted to the position shown by the dotted lines, illustrating that a change in the support angle of the film unit has taken place. This allows the subsequent transporting of the film unit into the camera body beneath roller **71** and the container **34** to a position of storage.

Referring to FIG. **12**, to insure that the film unit returning to the camera body does not inadvertently contact the container **34**, spring element **158** acts as a deflector to push the returning film unit beneath container **34**.

If the exposed and now developed film unit is to remain within the camera body, the film unit can be positioned beneath the drawer in space **160**, if desired. More specifically, as the drawer operates for the next sequence, the film unit can be very simply retained in its position along the longitudinal axis of the movement of the drawer by a spring stop **157** and, when the rear edge of the drawer passes a given point, the film unit will merely be driven to the lower level by the bias of spring **157**. The bottom wall **17** can also be fitted with a door **162** for facilitating removal of the developed film unit. Door **162** is hinged at **164** and latched at **166** so that the developed film unit can be extracted before another cycle of the drawer or can be removed after a subsequent cycle.

Also described in the present application is a novel process for processing a film unit. First, the photosensitive element is supported in an exposure position within photographic apparatus. Sequentially, the photosensitive element is exposed and a processing composition is distributed on the exposed photosensitive element. Finally, the normal fixed volume of the photographic apparatus is temporarily altered while transporting the exposed photosensitive element from the exposure position to a second position within the photographic apparatus. Among other advantages, this accomplishes the goal of maintaining the overall dimensions of photographic apparatus at an absolute minimum, and of course the needed space for processing an exposed film unit is provided as needed without allowing this volume to exist permanently in the photographic apparatus. Additionally, the exposed photosensitive element is maintained in a lighttight environment during this processing, allowing the development to commence almost immediately after exposure.

It should be pointed out that the subject invention has advantages in an environment where chemical opacification of the exposed film unit is accomplished in that the film unit is then removed from the exposure area and transported to a storage position within the photographic apparatus. This precludes the necessity for having apparatus external of the basic photographic apparatus to grip and hold each film unit after it has passed through the bite of the processing rollers if the film unit were immediately ejected from the apparatus. In such an environment the curtain might be eliminated, and the camera is provided with a storage capability. The present invention has the advantage, therefore, of operating equally well whether chemical opacification is practiced in the processing of the film unit or not. Consequently, the present invention provides a processing means and a means for handling exposed photosensitive elements. The present invention has the added advantage of operating when any process for desensitizing and developing a film unit is practiced without any substantial alteration in the fixed size of the apparatus whatsoever. In other words, the drawer of the present invention is useful in handling a film unit that is chemically opacified.

One of the advantages of the invention is that it permits the combination of the desirable features of compact size, light weight, and portability in a hand-held camera with the additional features of a self-developing film format and in-camera storage of exposed film units. It will be noted, for example, with reference to the embodiment of the invention herein described, that the overall fixed dimensions of the camera are not materially greater than the minimum attainable to accommodate the basic photographic functions of the camera. In other words, the geometry of the camera is altered only during film unit transportation and storage, and then only for a relatively short time, say for a few seconds after each exposure, thereby permitting the combination of the processing and storage features herein described together with the advantages of a compact, portable camera.

The subject invention has a further advantage in that it adapts itself very easily for use with a camera of the type shown in the aforementioned U.S. Pat. No. 3,589,293. That is to say, an automatic camera of the type that is motor driven throughout its sequence of operation can be very easily adapted to drive the drawer-type processing means of the present invention to fully accomplish its function automatically. In addition, the subject apparatus uses no extra space within the photographic apparatus itself because of its drawer- or tray-type design. Stated another way, the shape of a drawer with a rear open end is such that, when positioned within the photographic apparatus proper, it is on the periphery of all of the internal components; and the only thickness necessary to accommodate the subject invention is the thickness of the tray itself beneath the film container. The thickness of the subject tray can be on the order of 0.020 to 0.030 inches. This obviously is a minimal thickness, and this thickness can vary depending upon the materials used. However, even with the thickest materials that would be desirable in such an environment, the thickness need not exceed 0.100 inches. Therefore, the actual volume required by the present invention within the camera is not significantly greater than the volume already required in such photographic apparatus.

Since certain changes may be made in the above process and apparatus without departing from the scope of the invention herein involved, it is intended that all matter contained in the above description or shown in the accompanying drawings shall be interpreted as illustrative and not in a limiting sense.

What is claimed is:

1. In a camera of the type having a normal operative fixed volume wherein a photosensitive element is exposed and then treated with a processing composition to form a visible image, the improvement comprising:

support means for maintaining a photosensitive element in a position for exposure;

pressure-applying means adapted to transport an exposed photosensitive element in a direction away from the exposure position and adapted to distribute a processing composition across the exposed photosensitive element; and

processing means mounted for reciprocating movement away from said exposure position and then toward said exposure position and operatively associated with said pressure-applying means whereby the exposed photosensitive element is transported to a second position within the camera after said element has passed the pressure-applying means while maintaining the exposed photosensitive element in a lighttight environment during at least a portion of the time required to develop the visible image.

2. The improvement according to claim **1** wherein said processing means temporarily alters the normal fixed volume of the camera as the photosensitive element is transported from the exposure position to said second position.

3. The improvement according to claim **1** wherein said pressure-applying means includes at least one pressure-applying roller.

4. The improvement according to claim **1** wherein said processing means includes a drawer translationally reciprocable from a position within the camera and having a rack carried thereby cooperating with said pressure-applying means for moving at least a portion of said processing means from the camera to an extreme of movement and sequentially back to a second position within the camera.

5. The improvement according to claim **1** wherein said processing means includes means for driving the photosensi-

tive element from an exposure position to the pressure-applying means, said pressure-applying means sequentially transporting the exposed photosensitive element to an intermediate position corresponding to the extreme position of movement of said processing means, said processing means being adapted to receive the photosensitive element at said intermediate position and to return the photosensitive element to a second position within the camera.

6. The improvement according to claim 3 wherein a gear is carried by said pressure-applying roller and engages said processing means so as to impart translational reciprocable movement thereto.

7. The improvement according to claim 4 wherein said processing means includes means adapted to engage a single photosensitive element and move the exposed photosensitive element from an exposure position into an advanced position wherein the photosensitive element is engaged by said pressure-applying means.

8. The improvement according to claim 4 wherein said processing means includes a drawer-type member having at least two side walls, a bottom wall connecting said side walls, and a front wall, the side walls and front wall being progressively bridged by a curtain as said processing means translationally reciprocates to maintain a volume within said drawer-type member in a lighttight condition.

9. The improvement according to claim 8 wherein said curtain has a fixed length and is attached at opposite ends to fixed portions of the camera.

10. In photographic apparatus, the improvement comprising:

means defining a fixed volume representing an operative condition of said apparatus;

means for supporting a photosensitive element in said apparatus in a position for exposure;

means for exposing said photosensitive element to light from a scene;

means for transporting said photosensitive element from its exposure position for subsequent movement to a second position within said apparatus;

means operable in a preselected relationship with said transporting means for temporarily altering said fixed volume during the period of movement of said exposed element from said exposure position to said second position, said operable means including translationally reciprocable means for moving an exposed photosensitive element outwardly of the photographic apparatus away from the exposure position and back into the photographic apparatus during development of the exposed photosensitive element; and

said means for transporting includes pressure-applying means and means for engaging and moving the exposed photosensitive element from the exposure position into engagement with said pressure-applying means, said engaging means being disengaged from the exposed photosensitive element as said element contacts said pressure-applying means.

11. The improvement according to claim 10 wherein said operable means includes a lighttight chamber and the developing of the exposed photosensitive element is initiated after movement of said element from the exposure position to an intermediate position in said lighttight chamber, said operable means moving with the exposed photosensitive element from said intermediate position to said second position within the photographic apparatus while maintaining the exposed photosensitive element in said lighttight chamber.

12. The improvement according to claim 10 and further including means for driving the exposed photosensitive element and the translationally reciprocable means in a direction away from the exposure position at different rates of speed whereby the exposed photosensitive element overtakes the translationally reciprocable means as said translationally reciprocable means reaches an extreme of movement in a first direction to a position defining an intermediate position, said translationally reciprocable means reversing direction and driving the exposed photosensitive element to a second position within the photographic apparatus.

13. The improvement according to claim 12 wherein the plane of movement of the exposed photosensitive element from the exposure position is angled with respect to the plane of movement of said exposed photosensitive element back into the photographic apparatus.

14. The improvement according to claim 13 wherein a means for changing the plane of movement of the exposed photosensitive element pivots the exposed photosensitive element from a plane parallel to the exposure plane to another plane angled with respect thereto whereby the reentry of the exposed film unit into the photographic apparatus is facilitated.

15. In photographic apparatus, the improvement comprising:

means defining a fixed volume representing an operative condition of said apparatus;

means for supporting a photosensitive element in said apparatus in a position for exposure;

means for exposing said photosensitive element to light from a scene;

means for transporting said photosensitive element from its exposure position for subsequent movement to a second position within said apparatus; and

means operable in a preselected relationship with said transporting means for temporarily altering said fixed volume during the period of movement of said exposed element from said exposure position to said second position, said operable means includes translationally reciprocable means for moving an exposed photosensitive element outwardly of the photographic apparatus from the exposure position and back into the photographic apparatus during development of the exposed photosensitive element, said translationally reciprocable means further includes curtain means and drawer means, said drawer means including a bottom wall, two side walls, and a front face, an open top portion being progressively covered by said curtain means which is fixed at either end to the photographic apparatus so that a lighttight chamber of varying volume is formed within the walls of said drawer means and said curtain means, said curtain means being mounted for movement into said second position to carry an exposed and processed photosensitive element to said second position.

16. The improvement according to claim 15 wherein rack means is formed on at least one surface of said side walls, said rack means cooperating with said means for transporting to impart the translational reciprocating movement to said drawer means.

17. The improvement according to claim 15 wherein said curtain means comprises an elongated sheet of material having a fixed length.

18. The improvement according to claim 15 wherein said curtain means is composed of a rubberized fabric material.

19. In a photographic apparatus, the improvement comprising:

means defining a fixed volume representing an operative condition of said apparatus;

means for supporting a photosensitive element in said apparatus in a position for exposure;

means for exposing said photosensitive element to light from a scene;

means for transporting said photosensitive element from its exposure position for subsequent movement to a second position within said apparatus; and

means operable in a preselected relationship with said transporting means for temporarily altering said fixed volume during the period of movement of said exposed element from said exposure position to said second position, said operable means includes translationally reciprocable means for moving an exposed photosensitive element out-

wardly of the photographic apparatus from the exposure position and back into the photographic apparatus during development of the exposed photosensitive element and means for changing the plane of movement of the exposed photosensitive element to one which is angularly disposed with respect to the plane of exposure, thereby moving an end of the photosensitive element to a position wherein its return to the photographic apparatus to a position spaced from the exposure plane is facilitated.

20. In photographic apparatus, the improvement comprising:

means defining a fixed volume representing an operative condition of said apparatus;

means for supporting a photosensitive element in said apparatus in a position for exposure;

means for exposing said photosensitive element to light from a scene;

means for transporting said photosensitive element from its exposure position for subsequent movement to a second position within said apparatus;

means operable in a preselected relationship with said transporting means for temporarily altering said fixed volume during the period of movement of said exposed element from said exposure position to said second position, said operable means including a lighttight camber and the developing of the exposed photosensitive element is initiated after movement of said element from the exposure position to an intermediate position in said lighttight chamber, said operable means moving with the exposed photosensitive element from said intermediate position to said second position within the photographic apparatus while maintaining the exposed photosensitive element in said lighttight chamber; and

said means for transporting the exposed photosensitive element includes at least one pressure-applying member relative to which the exposed photosensitive element is progressively moved, said member including drive means coacting with said member and engaging said operable means to cause a movement of said operable means outwardly from the photographic apparatus a distance sufficient to allow the rear edge of the exposed photosensitive element to clear said member, thereby allowing said operable means to displace the exposed photosensitive element reversibly into the photographic apparatus into a light-sealed second position wherein development of the exposed photosensitive element is concluded.

21. In photographic apparatus, the improvement comprising:

means defining a fixed volume representing an operative condition of said apparatus;

means for supporting a photosensitive element in said apparatus in a position for exposure;

means for exposing said photosensitive element to light from a scene;

means for transporting said photosensitive element from its exposure position for subsequent movement to a second position within said apparatus; and

means operable in a preselected relationship with said transporting means for temporarily altering said fixed volume during the period of movement of said exposed element from said exposure position to said second position, said operable means includes a lighttight chamber and the developing of the exposed photosensitive element is initiated after movement of said element from the exposure position to an intermediate position in said lighttight chamber, said operable means moving with the exposed photosensitive element from said intermediate position to said second position within the photographic apparatus while maintaining the exposed photosensitive element in said lighttight chamber, said lighttight chamber includes curtain means and translationally reciprocable means, said curtain means being fixed at one end to the upper portion of the photographic apparatus near the exposure position and at another end to the photographic apparatus at a point displaced from the attachment point of the first-mentioned end, said curtain means passing around an end of said translationally reciprocable means whereby said curtain means is fed around said end and toward the front end thereof as the translationally reciprocable means moves from the photographic apparatus, thereby maintaining said curtain means in a taut condition.

22. The improvement according to claim **16** wherein said translationally reciprocable means includes a drawer that moves relative to said curtain means during movement of the translationally reciprocable means from the photographic apparatus in a first direction, said translationally reciprocable means being movable relative to said curtain as the translationally reciprocable means returns to a stored position within the photographic apparatus, said curtain being movable only between its fixed end portions.

23. In photographic apparatus, the improvement comprising:

means defining a fixed volume representing an operative condition of said apparatus;

means for supporting a photosensitive element in said apparatus in a position for exposure;

means for exposing said photosensitive element to light from a scene;

means for transporting said photosensitive element from its exposure position for subsequent movement to a second position within said apparatus, said means including means for applying pressure to the element as said element moves progressively relative thereto;

means operable in a preselected relationship with said transporting means for temporarily altering said fixed volume during the period of movement of said exposed element from said exposure position to said second position; and

drive means rotating with at least a portion of said means for applying pressure, said drive means engaging said operable means for moving said operable means outwardly from the photographic apparatus a distance sufficient for the rear edge of the exposed photosensitive element to clear said means for applying pressure, thereby adapting said operable means to displace the exposed photosensitive element reversibly into the photographic apparatus to a storage position.

24. In photographic apparatus, the improvement comprising:

means defining a fixed volume representing an operative condition of said apparatus;

means for supporting a photosensitive element in said apparatus in a position for exposure;

means for exposing said photosensitive element to light from a scene;

means for transporting said photosensitive element from its exposure position for subsequent movement to a second position within said apparatus; and

means operable in a preselected relationship with said transporting means for temporarily altering said fixed volume during the period of movement of said exposed element from said exposure position to said second position, said operable means includes translationally reciprocable means for moving an exposed photosensitive element outwardly of the photographic apparatus from the exposure position and back into the photographic apparatus during development of the exposed photosensitive element, said translationally reciprocable means includes curtain means and drawer means, said drawer means including a bottom wall, two side walls, and a front face, an open top portion being progressively covered by said curtain means which is fixed at either end to the photographic apparatus so that a lighttight chamber of varying volume is formed within the walls of said drawer means and said curtain means, said curtain means being adapted to carry an exposed and processed photosensitive element to a

second position within the photographic apparatus, said drawer means further includes elongated bearing portions carried by said side walls cooperating with bearing portions formed on fixed portions of the photographic apparatus whereby the direction of movement of said drawer is controlled.

25. In photographic apparatus, the improvement comprising:

means defining a fixed volume representing an operative condition of said apparatus;

means for supporting a photosensitive element in said apparatus in a position for exposure;

means for exposing said photosensitive element to light from a scene;

means for transporting said photosensitive element from its exposure position for subsequent movement to a second position within said apparatus; and

means operable in a preselected relationship with said transporting means for temporarily altering said fixed volume during the period of movement of said exposed element from said exposure position to said second position, said operable means includes translationally reciprocable means for moving an exposed photosensitive element outwardly of the photographic apparatus from the exposure position and back into the photographic apparatus during development of the exposed photosensitive element, said translationally reciprocable means includes a spring element adapted to engage an exposed photosensitive element near an extreme of its movement in a first direction for changing the plane of movement of the exposed photosensitive element to one which is angularly disposed with respect to the plane of exposure, thereby adapting the exposed photosensitive element to be returned to the photographic apparatus to a position spaced from the exposure plane.

26. The improvement according to claim 25 wherein said spring element is normally biased in the direction of the exposure plane and grips the exposed photosensitive element as said last-mentioned means nears its outward extreme of movement, and sequentially pivots the trailing end of the exposed photosensitive element toward the plane of movement of said last-mentioned means whereby, on the return movement of the exposed photosensitive element, said element is directed on the plane of movement of said last-mentioned means.

27. In photographic apparatus, the improvement comprising:

means defining a fixed volume representing an operative condition of said apparatus;

means for supporting a photosensitive element in said apparatus in a position for exposure;

means for exposing said photosensitive element to light from a scene;

means for transporting said photosensitive element from its exposure position for subsequent movement to a second position within said apparatus;

means operable in a preselected relationship with said transporting means for temporarily altering said fixed volume during the period of movement of said exposed element from said exposure position to said second position, said operable means includes means for sequentially moving the exposed photosensitive element from the exposure position to an intermediate position back to said second position within the photographic apparatus; and

said means for transporting includes means for moving the exposed photosensitive element from the exposure position to said intermediate position, said means for moving the exposed photosensitive element includes drive portions carried by said means for temporarily altering the normal fixed volume, and operative portions carried by fixed portions of the photographic apparatus cooperating to move an exposed photosensitive element from an exposure position into a position where said element engages said means for transporting.

28. The improvement according to claim 27 wherein said drive portions include a biased pivotable element selectively operable by means for interlocking said drive and operative portions of said means for moving the exposed photosensitive element.

29. The improvement according to claim 27 wherein said operative portions include a slide member movable between two extreme positions corresponding to a first position where a film unit is in the exposure position and a second position where a film unit first engages said means for transporting.

30. The improvement according to claim 28 wherein said means for interlocking includes a cam for actuation thereof, said cam carried by a fixed portion of the photographic apparatus.

31. The improvement according to claim 29 wherein said slide member resiliently carries a member for engaging a slot in an exposed photosensitive element.

32. In photographic apparatus, the improvement comprising:

means defining a fixed volume representing an operative condition of said apparatus;

means for supporting a photosensitive element in said apparatus in a position for exposure;

means for exposing said photosensitive element to light from a scene;

means for transporting said photosensitive element from its exposure position for subsequent movement to a second position within said apparatus;

means operable in a preselected relationship with said transporting means for temporarily altering said fixed volume during the period of movement of said exposed element from said exposure position to said second position, said operable means includes means for sequentially moving the exposed photosensitive element from the exposure position to an intermediate position back to said second position within the photographic apparatus; and

said means for transporting includes means including a pick member cooperating with an aperture in the exposed photosensitive element for moving said element from the exposure position to said intermediate position.

33. In a photographic apparatus of the type having a normal operative fixed volume wherein a photosensitive element is exposed and then treated with a processing composition to form a visible image, the improvement comprising:

support means for maintaining a photosensitive element in a position for exposure;

pressure-applying means including at least one pressure-applying roller adapted to transport an exposed photosensitive element in a direction away from the exposure position and adapted to distribute a processing composition across the exposed photosensitive element;

processing means operatively associated with said pressure-applying means whereby the exposed photosensitive element is transported to a second position within the photographic apparatus after said element has passed the pressure-applying means while maintaining the exposed photosensitive element in a lighttight environment during at least a portion of the time required to develop the visible image; and

a gear carried by said pressure-applying roller and engageable with a rack carried by said processing means so as to impart translational reciprocable movement thereto.

34. In a photographic apparatus of the type having a normal operative fixed volume wherein a photosensitive element is exposed and then treated with a processing composition to form a visible image, the improvement comprising:

support means for maintaining a photosensitive element in a position for exposure;

pressure-applying means adapted to transport an exposed photosensitive element in a direction away from the exposure position and adapted to distribute a processing composition across the exposed photosensitive element;

processing means operatively associated with said pressure-applying means whereby the exposed photosensitive element is transported to a second position within the photographic apparatus after said element has passed the pressure-applying means while maintaining the exposed photosensitive element in a lighttight environment during at least a portion of the time required to develop the visible image, said processing means includes a drawer translationally reciprocable from a position within the photographic apparatus and having a rack carried thereby cooperating with said pressure-applying means for moving at least a portion of said processing means from the photographic apparatus to an extreme of movement and sequentially back to a second position within the photographic apparatus; and

means adapted to engage a single photosensitive element and move the exposed photosensitive element from an exposure position into an advanced position wherein the photosensitive element is engaged by said pressure-applying means, said means adapted to engage a single photosensitive element includes an operative portion and a drive portion, said operative portion being slideably carried by fixed portions of the photographic apparatus and said drive portion being carried by said processing means.

35. The improvement according to claim **34** wherein said drive portion is operatively associated with a cam carried by a fixed portion of the photographic apparatus, said cam being engageable by said drive portion during movement of said processing means, thereby adapting the drive portion to be selectively interlocked and disengaged from said operative portion.

36. The improvement according to claim **34** wherein said drive portion includes a pivotable drive member having an interlocking slot.

37. The improvement according to claim **36** wherein said operative portion includes a slide movable between a first and second position, said slide having a lug interlockable with said interlocking slot carried by said drive portion so as to move between said first and second positions in response to movement of said processing means.

38. The improvement according to claim **37** wherein said slide resiliently carries a pick element which selectively engages a photosensitive element to move the photosensitive element from an exposure position into said pressure-applying means.

39. In a photographic apparatus of the type having a normal operative fixed volume wherein a photosensitive element is exposed and then treated with a processing composition to form a visible image, the improvement comprising:

support means for maintaining a photosensitive element in a position for exposure;

pressure-applying means adapted to transport an exposed photosensitive element in a direction away from the exposure position and adapted to distribute a processing composition across the exposed photosensitive element; and

processing means operatively associated with said pressure-applying means whereby the exposed photosensitive element is transported to a second position within the photographic apparatus after said element has passed the pressure-applying means while maintaining the exposed photosensitive element in a lighttight environment during at least a portion of the time required to develop the visible image, said processing means includes a drawer translationally reciprocable from a position within the photographic apparatus and having a rack carried thereby cooperating with said pressure-applying means for moving at least a portion of said processing means from the photographic apparatus to an extreme of movement and sequentially back to a second position within the photographic apparatus, said drawer having at least two side walls, a bottom wall connecting said side walls, and a front wall, the side walls and front wall being progressively bridged by a curtain as said processing means translationally reciprocates to maintain a volume within said drawer in a lighttight condition, said processing means further includes means carried by said bottom wall for changing the planar disposition of an exposed photosensitive element, said means engaging the exposed photosensitive element as it passes on one side of said pressure-applying means and alters the angular disposition thereof relative to said bottom wall so that the photosensitive element can be repositioned within the photographic apparatus during movement of said processing means by passing on an opposite side of said pressure-applying means.

40. Photographic apparatus comprising:

means for supporting a stacked array of film units in position for exposure;

means for exposing each of said film units in sequence to light from a scene;

means for translationally moving each such exposed film unit between its exposure position after exposure thereof and a second position within said apparatus on the opposite side of said array from said exposure position, said last-mentioned means includes translationally reciprocable means for moving an exposed film unit sequentially between said exposure position to an intermediate position on a first plane and back to said second position wherein said exposed film unit is moved to a second plane; and

engagement means carried by said translationally reciprocable means and adapted to engage an exposed film unit as said film unit reaches said intermediate position and shifts its planar disposition, said engagement means being driven toward said second plane as said film unit is moved toward said second position.

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