

[54] PORTABLE RADIOGRAPHIC FILM
PROCESSING APPARATUS

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[51] Int. Cl.²: G03D 9/02

[58] Field of Search: 354/304, 85, 86

[56] References Cited

UNITED STATES PATENTS

2,638,828	5/1953	Bachelder et al.	354/304
3,364,834	1/1968	Erikson	354/304
3,604,329	9/1971	Land	354/304

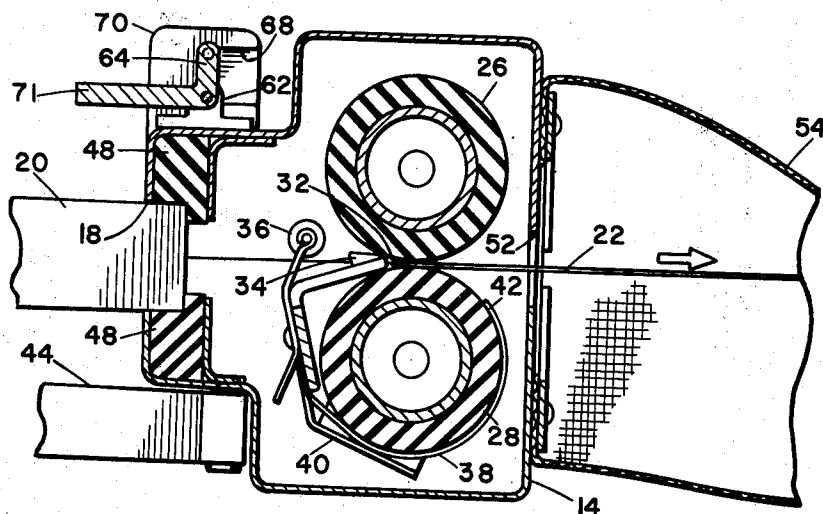
Primary Examiner—Richard L. Moses

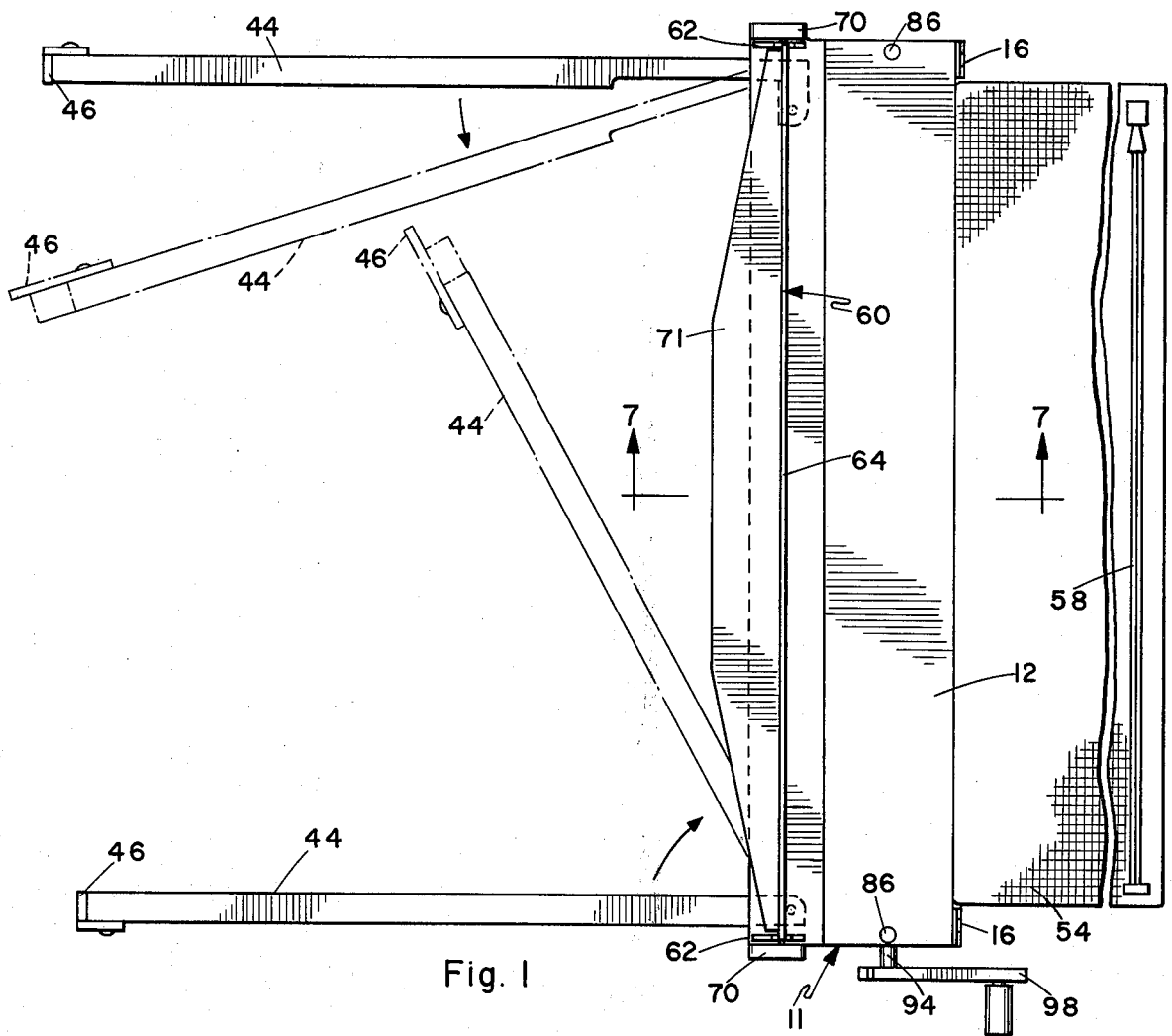
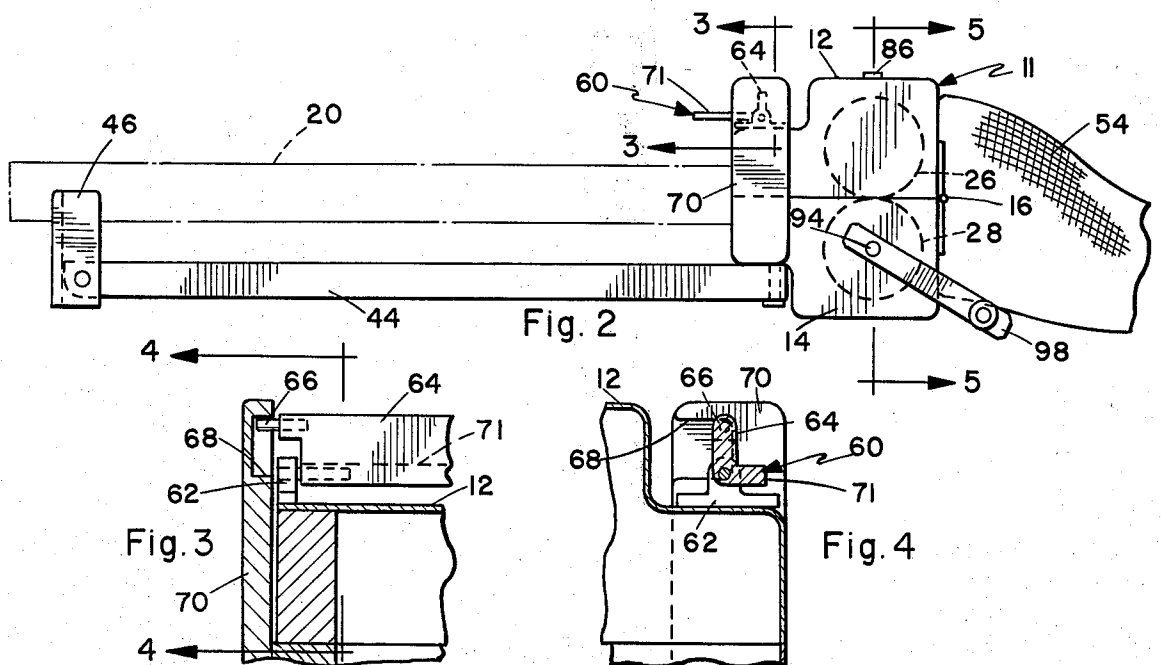
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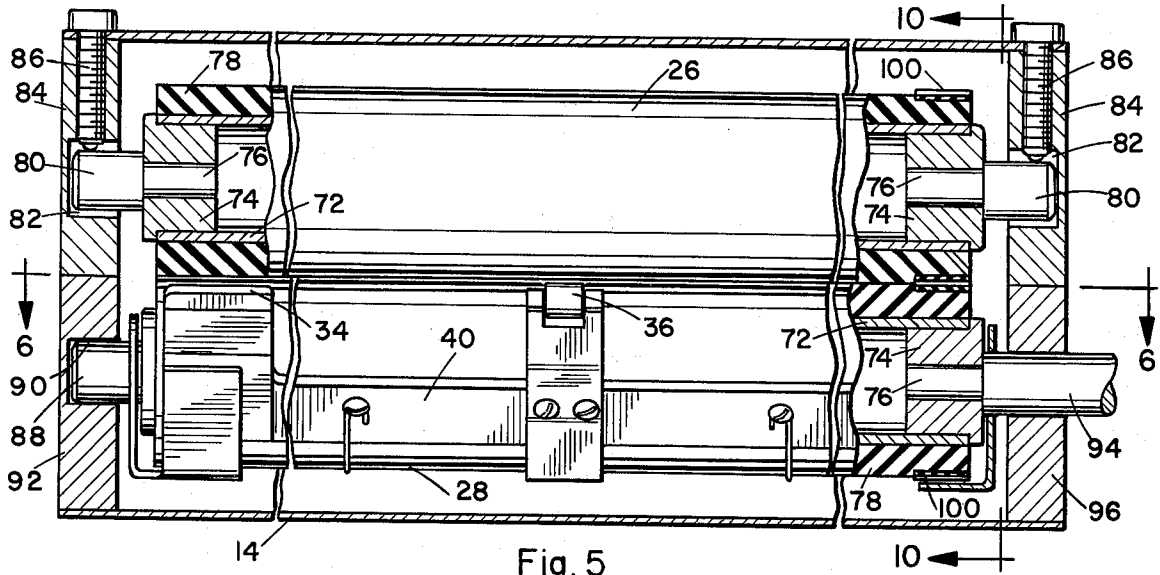
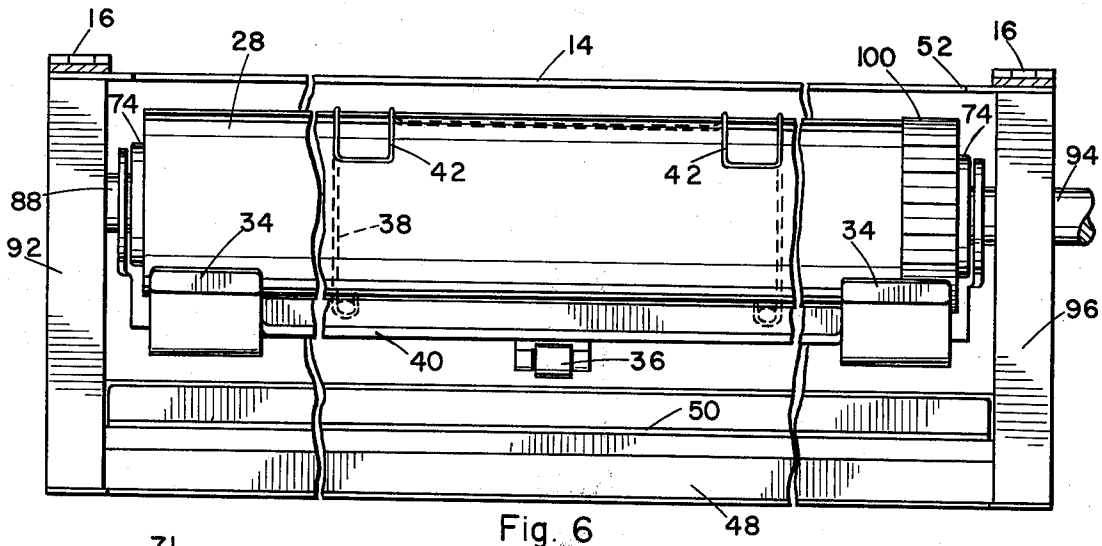
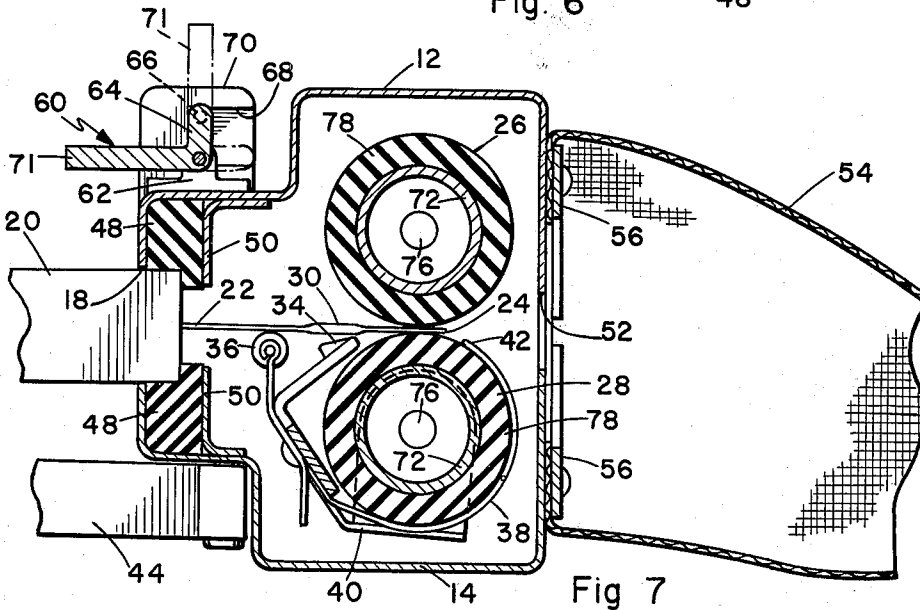
[57] ABSTRACT

A radiographic film processing apparatus for effecting the development of cassette-enclosed Poloroid type film packets having rupturable pads containing developing chemicals which are released by compression and spread over the exposed film. Rupturing of the pods and distribution of the enclosed chemicals is accomplished by a pair of driven rollers, the rotation of which is automatically stopped by a wedge mechanism which wedges between the rollers just prior to entry therebetween of the trailing edge of the film packet, thereby preventing fouling of the rollers by chemicals squeezed from the trailing edge of the film packet. The wedge mechanism is activated by the trailing edge of the film packet itself so that the apparatus operates properly regardless of the packet length.

15 Claims, 10 Drawing Figures







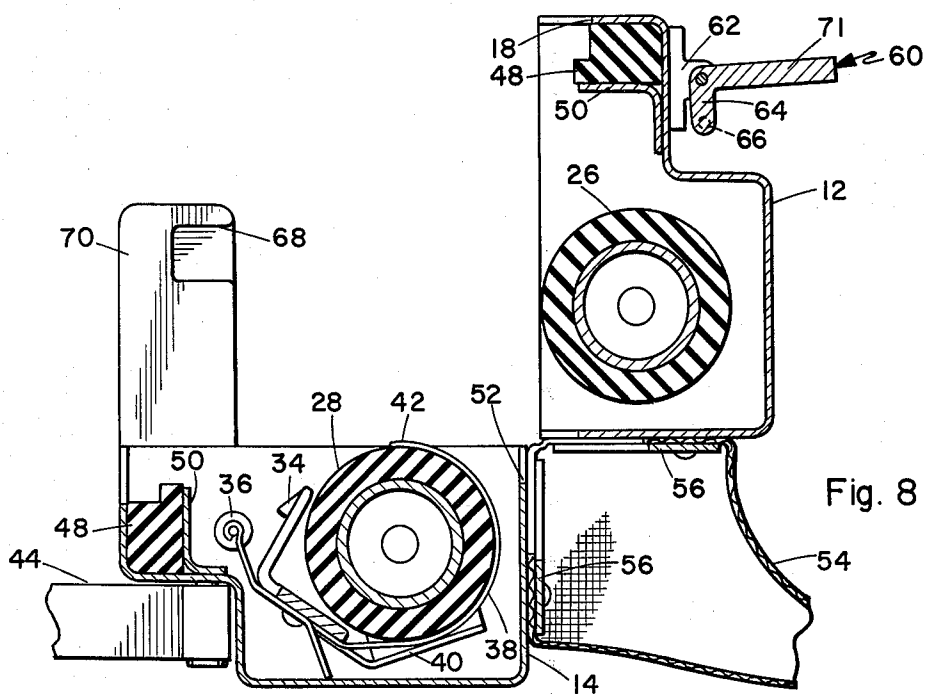


Fig. 8

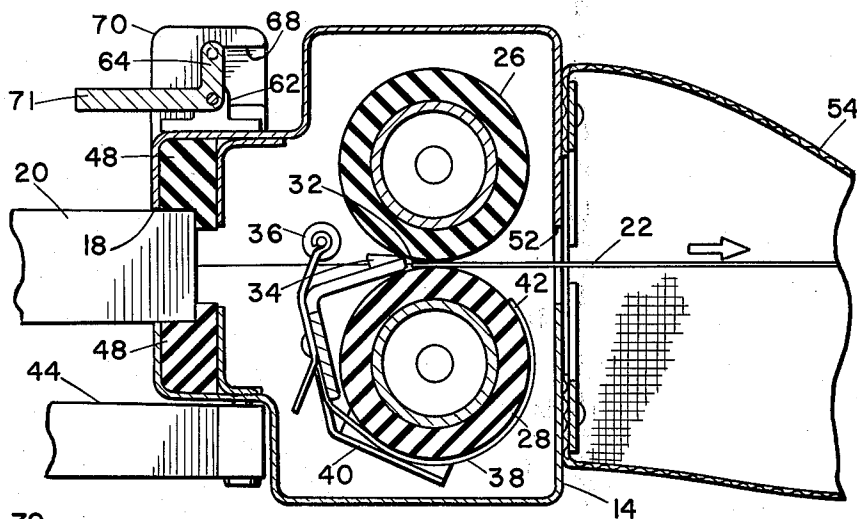


Fig. 9

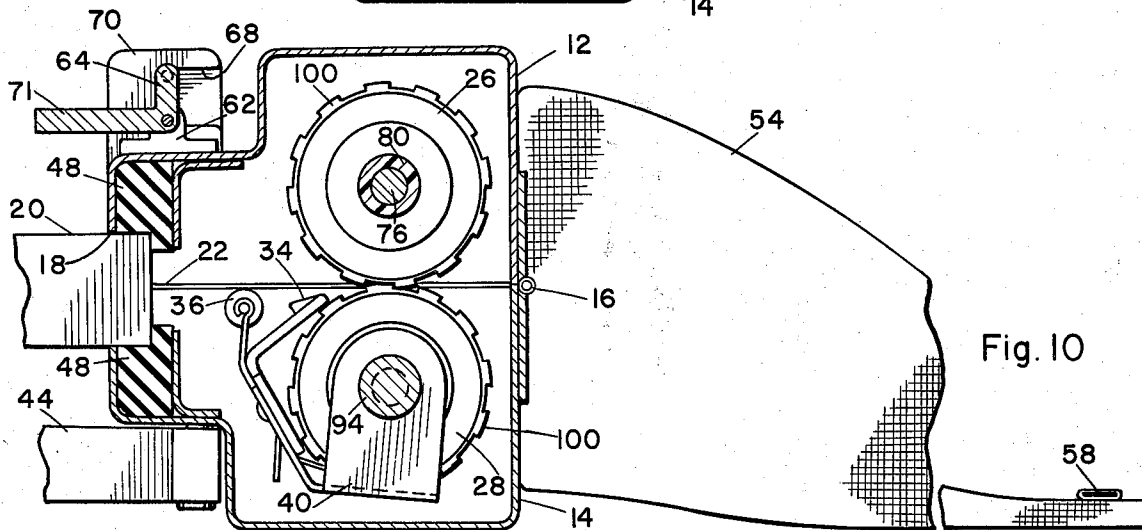


Fig. 10

PORTABLE RADIOGRAPHIC FILM PROCESSING APPARATUS

BACKGROUND OF THE INVENTION

1. Field of the Invention

The invention relates to portable Polaroid type film developing devices, and particularly those adapted for use in developing x-ray film in the field.

2. Description of Prior Art

Cassette enclosed film packets containing photosensitive film, a print receiving sheet, and pods of a developing agent spaced therebetween, for example of the type disclosed in U.S. Pat. No. 2,726,337 are in wide use and utilize what is generally known as the Polaroid process. Development of these packets is effected by rupturing the pods by the application of external pressure and spreading the developing agent thereby released between the photographically exposed film and the print receiving sheet, whereby within a pre-determined time interval an image is transferred from the former to the latter.

Portable developing devices for use with these film packets of the type utilizing a pair of pressure-applying rollers have been developed and are represented in U.S. Pat. Nos. 3,364,834 and 3,411,423. Inherent in the use of these devices is the problem of preventing the expulsion of the developing agent from the open trailing edge of the film packet and the fouling of the rollers therewith as the film packet completes its passage through the developer. Solutions to this problem to date have variously involved the use of spacers associated with the trailing edge of the film packet to separate the rollers prior to entry of the trailing edge therebetween, and a complex cam mechanism which automatically separates the rollers upon completion of a pre-determined number of rotations gauged to the length of the film packet to be processed. Both of these methods have their drawbacks, the first being tedious and the latter requiring complex, and therefore relatively heavy and expensive, cams, cam followers and resilient biasing means, the latter method also being incapable of properly processing film packets of lengths other than that length for which the machine was specifically designed.

SUMMARY OF THE INVENTION

As claimed, the processor utilizes two pressure-applying rollers, one mounted in each of two shells which are pivoted together to form an openable housing. Two collapsible arms extend from the front of the housing to hold a film cassette with the leading edge thereof inserted into a slot in the front of the housing. The tab of a film packet projecting from the leading edge of the cassette is engaged between the rollers, which are interengaged for simultaneous rotation and preferably crank-driven. The rollers are operated to draw the film packet therebetween, rupturing the developer chemical containing pods disposed near the front margin of the packet and spreading the chemicals throughout the film packet, the emerging packet entering a light-tight bag having a zippered opening therein for removal of the processed film packet. As the trailing edge of the packet nears the pressure line between the rollers, a stop means arrests the motion of the rollers to prevent expulsion and spillage of the developing chemicals from the trailing edge. The stop means preferably comprises a pair of spaced wedges biased be-

tween the rollers by a friction clutch riding on one of the rollers and operated by the passage of the trailing edge of the film packet beyond a station adjacent the pressure line between the rollers. The two shells are then opened to release the processed film packet which can then be easily removed from the apparatus from the front or through the zippered opening in the developing bag. The processor is simple, lightweight, inexpensively produced, and can be used with equal facility for developing film packets of various sizes.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a top plan view of the film processor;

FIG. 2 is a side elevation view of the processor with a film cassette in place;

FIG. 3 is an enlarged sectional view taken on line 3—3 of FIG. 2;

FIG. 4 is a sectional view taken on line 4—4 of FIG. 3;

FIG. 5 is an enlarged sectional view taken on line 6—6 of FIG. 5;

FIG. 6 is a sectional view taken on line 6—6 of FIG. 5;

FIG. 7 is an enlarged sectional view taken on line 7—7 of FIG. 1;

FIG. 8 is a sectional view similar to FIG. 7, but with the unit open for insertion of a cassette;

FIG. 9 is a sectional view similar to FIG. 7, but with the stop engaged; and

FIG. 10 is a sectional view taken on line 10—10 of FIG. 5.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

General description and operation

The processor includes a housing 11 having an upper shell 12 and a lower shell 14 hinged together at opposite ends of the rear or exit side as indicated at 16, so that the housing has an open position and a closed position as shown in FIG. 8 and 9 respectively. The front edges of the shells are relieved along a major central portion thereof to define a rectangular entry slot 18 to accommodate the inserted leading edge of a radiographic film cassette, illustrated diagrammatically at 20, in FIG. 7, 9, and 10, when the housing is closed.

As illustrated in FIG. 7, the film cassette contains a film packet 22 having a tab 24 which projects from the cassette prior to withdrawal of the film packet and extends into the housing.

An upper, preferably spring loaded, roller 26 and a lower roller 28 are mounted in the upper and lower shells such that when the housing is closed the rollers are biased together, and when a cassette is inserted into the housing and the shells thereafter closed, the rollers grip the tab 24. Upon rotation of the rollers, the film packet is drawn therebetween, rupturing pods 30 disposed within the film packet near the leading edge thereof, and smearing the developing agent contained therein between the two layers of the film packet.

The film packets for which the unit is designed each have an intensifying screen sandwiched between the film and the print receiving layer when the film is in the cassette. The intensifying screen remains in the cassette as the film packet is withdrawn, so that the trailing edge 32 of the packet is necessarily open. To prevent the expulsion of excess developer agent from the open trailing edge, the apparatus is provided with a stop means,

sensitive to the passage of the trailing edge beyond a point which will be called the terminal station, which positively engages at least one of the rollers and arrests the motion of the rollers, just prior to entry therebetween of the trailing edge.

Design of the stop means could include a number of various arrangements to engage one or both of the rollers and remain within the scope of the invention as conceived but in the preferred embodiment it comprises wedges 34, a bearing 36, and a bias means comprising a friction clutch 38, all carried on a bracket 40 pivotally mounted coaxially with the lower roller 28. The particular arrangement of these parts will be clear from the operation of the apparatus, which is as follows. In the open mode, best illustrated in FIG. 8, the stop means is inoperative, and the friction clutch 38, which in the illustrated embodiment is a wire member shaped to conform with and frictionally contact a portion of the surface of the roller 14, defines a pair of lobes 42 on the sides thereof which extend to a point immediately between the rollers as shown in FIG. 6. In this position, the wedges are clear of the rollers. When the leading edge 20 of a film cassette is inserted into the slot 18, the tab 24 of the film packet contained therein lies between the rollers, straddled by the wire lobes 42. When the upper shell 12 is closed and the rollers are rotated, as in FIG. 7, the clutch 38 rides on the lower roller, pivoting the bracket 40 until the bearing 36 is brought into rolling contact with the body of the film packet 22 as shown in FIG. 7. Being thus blocked from further rotation, the clutch slides on the roller 28 as the latter continues to rotate. Simultaneously, the film packet is drawn between the rollers, the pods 30 are crushed, and the developing agent contained therein is spread evenly throughout the film packet. Upon passage of the trailing edge 32 beyond the terminal station, defined by the position of the bearing 36, the stop means resumes its pivotal motion and the wedges 34 are driven between the rollers as in FIG. 9, and further motion of the apparatus is prevented. The rollers can now be separated and the processed packet removed.

Other equally operable configurations of the stop means could be employed. For example, biasing of the wedge could be accomplished by a spring or otherwise, or considerably modified without sacrificing its function. The wedges 34 could be other than two and relocated, and mounting of the entire stop assembly directly to the shell 14 is possible.

Turning to other features of the invention and details of the construction, pivotally mounted to the opposite ends of the front of the lower shell 14 are two extending arms 44 which define, in their extended position illustrated in FIGS. 1 and 2, a cassette holding rack. Each arm is provided at its distal end with a shoulder 46 which supports the outer end of the cassette substantially level with the forward end of the cassette when inserted into the slot 18. When not in use, the arms are pivotable inwardly, as shown in phantom in FIG. 1, to a compact position adjacent the housing 10.

The front edge of each of the shells 12 and 14 is preferably provided, adjacent slot 18, with a pad 48 of L-shaped cross-sectional surface for engaging the leading edge of the cassette, each pad being maintained in position by a backing plate 50 which is brazed or otherwise secured within its respective shell as illustrated. The pads are fabricated of felt, rubber, or other resilient material and are preferably dark in color to aid in the

exclusion of actinic light from the housing. The pads are spaced from the rollers a pre-determined distance such that the tab projecting from the cassette inserted into the slot extends between the rollers.

The rear of the housing is provided with an exit slot 52 between the hinges 16 through which the film packet emerges during processing, as seen in FIG. 9, and enclosing the exit slot from the outside is a film-receiving container which is preferably in the form of a light-tight flexible developing bag 54 mounted to the rear of both of the housing shells by means of mounting plates 56 screwed or otherwise attached thereto. The rear of the developing bag 54 may be provided with a zippered opening 58 to facilitate removal of film packets received therein. When a cassette is inserted into the entry slot 18 and the housing is in its closed position and the zipper is closed, a completely light-tight environment is provided for the film packet from the time it is withdrawn from the cassette until it is removed from the developing bag.

A lock mechanism, detailed in FIGS. 3 and 4, is provided for firmly securing the shells together in the closed position and comprises a bar 60 axially pivoted to two studs 62 which are mounted at the extreme opposite ends of the upper shell 12. The bar has a pin-bearing lip 64 having oppositely projecting pins 66 which, when the bar is pivoted forwardly, engage in slots 68 provided in posts 70 which are upstanding from the lower shell 14. A flange 71 is provided along the length of the bar to facilitate manipulation of the lock.

The particular structural details of the rollers as disclosed herein are not critical and are subject to modification. As illustrated in FIG. 5, each roller comprises a rigid inner cylinder 72 mounted on two hubs 74 having projecting stub axles 76. Each of the cylinders 72 carries a second, outer, cylinder 78, preferably composed of rubber or other slightly resilient frictional material. The stub axles 76 of the upper roller 12 are journaled in bearing cups 80, which may be of vinyl, and the bearing cups are received in elongated mounting sockets 82 in the end walls 84 of the upper shell. The bearing cups are biased away from the top of the upper shell by means of the spring-loaded plunger-tipped bolts 86 secured in threaded bores in the end walls 84. The spring-loaded bolts enable the rollers to separate slightly in order to accommodate the thickness of a film packet.

The lower roller 14 is journaled by one of its stub-axles in a third bearing cup 88 which is fixed in a cylindrical mounting socket 90 in one of the end walls 92 of the lower shell. The other stub-axle is secured to a shaft 94 which extends through the opposite end wall 96 of the lower shell and is connected to a crank 98 by which the lower roller is driven. The shaft may be prevented from frictionally engaging the end wall 96 by the use of a bushing or bearing inserted over the shaft.

In order to ensure more positive rotative correspondence between the rollers, toothed bands 100 or other gear structures may be coactively mounted at corresponding ends of the rollers, as shown in FIG. 10.

The apparatus as thus disclosed comprises a lightweight, portable film processing apparatus which is collapsible into an extremely compact form and particularly adapted for use in the field. It is economically manufactured and performs its developing function with a minimum number of parts and can be used to process film packets of any desired length.

I claim:

1. Improvements in combination with a film processing apparatus of the type having a pair of opposed pressure-applying rollers in a housing for effecting distribution of a processing agent between a pair of liquid-confining layers of a film packet having a leading edge portion, an agent reservoir portion, a film accomodating portion, and a trailing edge portion, arranged in that order, said apparatus being adapted to receive the leading edge portion and successive portions of said film packet sequentially in pressure-bearing relationship until said trailing edge portion passes a terminal station just short of the point of entry between said rollers, said improvements comprising:

means movable into physical engagement with at least one of said rollers to positively prevent continued motion thereof upon passage of said trailing edge beyond said terminal station and prior to entry of said trailing edge between said rollers whereby expulsion of the processing agent through said trailing edge portion is prevented.

2. Improvements according to claim 1 wherein said engaging means includes a wedge movably mounted in said housing and shiftable from a first position clear of said rollers to a wedging position substantially between said rollers to arrest the motion thereof.

3. The structure according to claim 2 wherein said wedge is duplicated at the opposite ends of the rollers.

4. Improvements according to claim 2 wherein said engaging means includes a bias means operative during rotation of said rollers for biasing said wedge from said first position toward said wedging position.

5. Improvements according to claim 4 wherein said bias means comprises a friction clutch contacting one of said rollers and operatively connected with said wedge.

6. Improvements according to claim 4 wherein said stop means includes a bearing element engaging said film packet at said terminal station to retain said wedge in said first position until the film packet has passed said station.

7. The structure according to claim 6 and including a bracket pivotally mounted coaxially with one of said rollers, said wedge, bias means and bearing element being mounted on said bracket.

8. Improvements according to claim 1 wherein said housing comprises an upper shell and a lower shell piv-

oted together such that said housing has an open position and a closed position, one of said rollers being mounted in each of said shells and so disposed therein as to receive in pressure applying relationship a film packet inserted therebetween when said housing is in the closed position, said rollers being separated in said open position to allow removal of a processed film packet.

9. Improvements according to claim 8 wherein said housing has an entry side with a longitudinal slot therein for receiving the forward end portion of a film cassette, and an exit side remote from said entry side and having an exit opening therein for discharging a processed film packet emerging from between said rollers.

10. Improvements according to claim 9 and including a film cassette holding rack mounted on the entry side of said housing adapted to hold a film cassette with the forward edge portion thereof disposed in said entry slot.

11. Improvements according to claim 10 wherein said rack comprises two arms pivotally mounted to opposite ends of said housing and extending outward from the entry side thereof in parallel relationship when in use and pivotable to positions adjacent said housing for storage.

12. Improvements according to claim 9 and including a film packet receiving container which is opaque to actinic light mounted on the exit side of said housing and enclosing said exit opening, said housing and container, defining a light-tight enclosure with the leading edge of a film cassette when the latter is inserted in said entry slot.

13. Improvements according to claim 12 wherein said container is a flexible bag foldable into compact form.

14. Improvements according to claim 13 wherein said flexible bag has a zippered opening on a portion thereof remote from said housing whereby access through said opening to processed film residing in said bag is possible for removal thereof.

15. Improvements according to claim 1 and including two toothed drive bands, one encircling and secured to each of said rollers at one end thereof for operatively and positively interengaging same for concomitant rotation.

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