Nov. 9, 1965 G. W. MERGENS 3,216,342

PHOTOGRAPHIC PROCESSOR

Filed Feb. 5, 1962 2 Sheets-Sheet 1

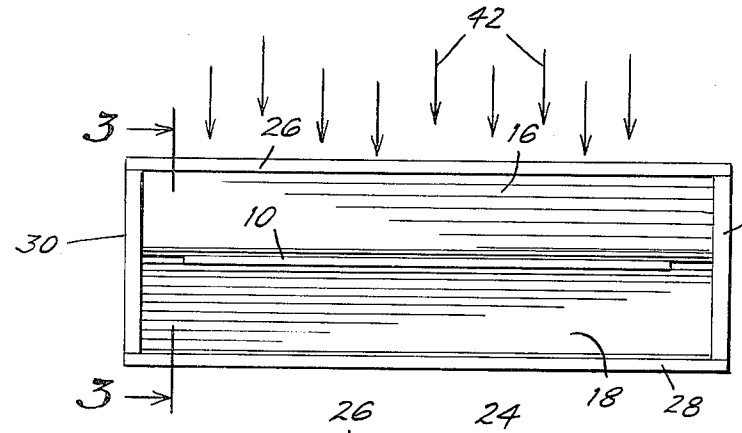


Fig. 2

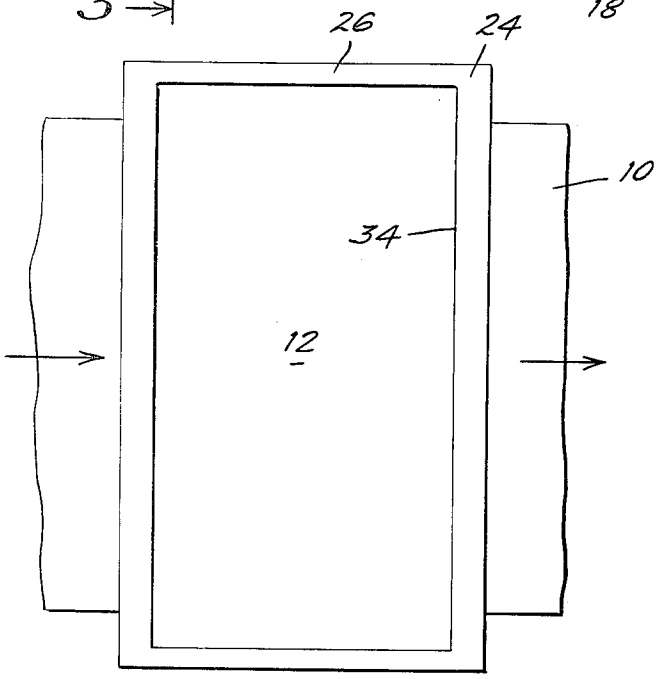


Fig. 1

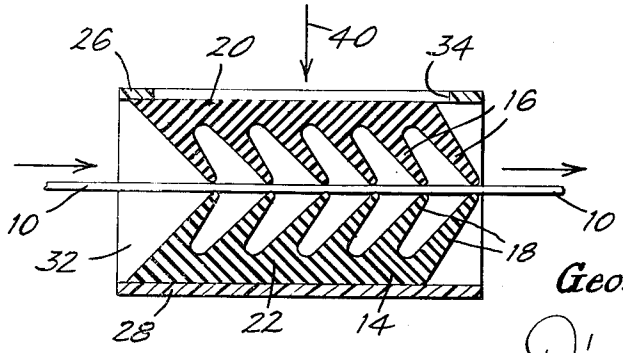


Fig. 3

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PHOTOGRAPHIC PROCESSOR

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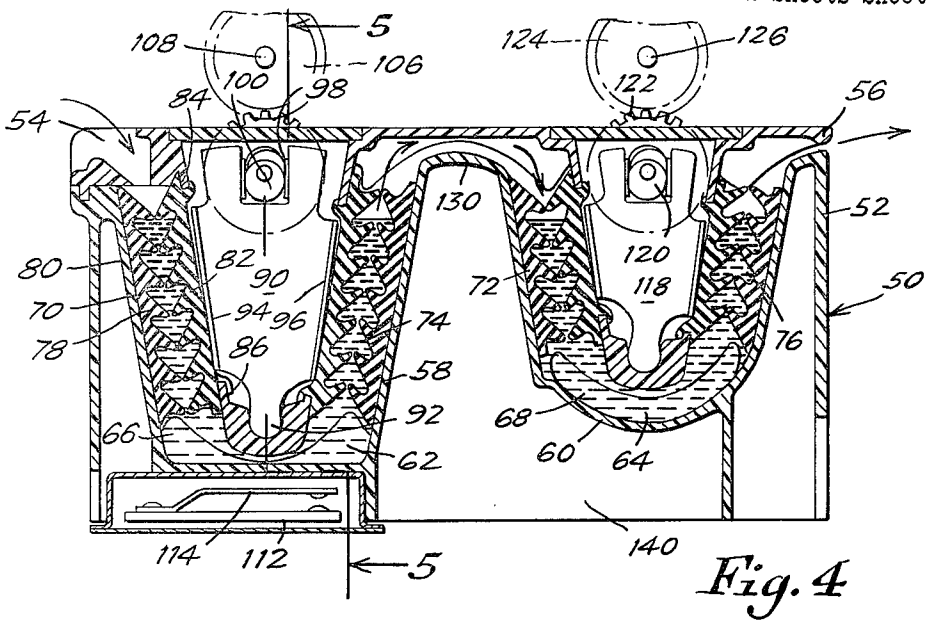


Fig. 4

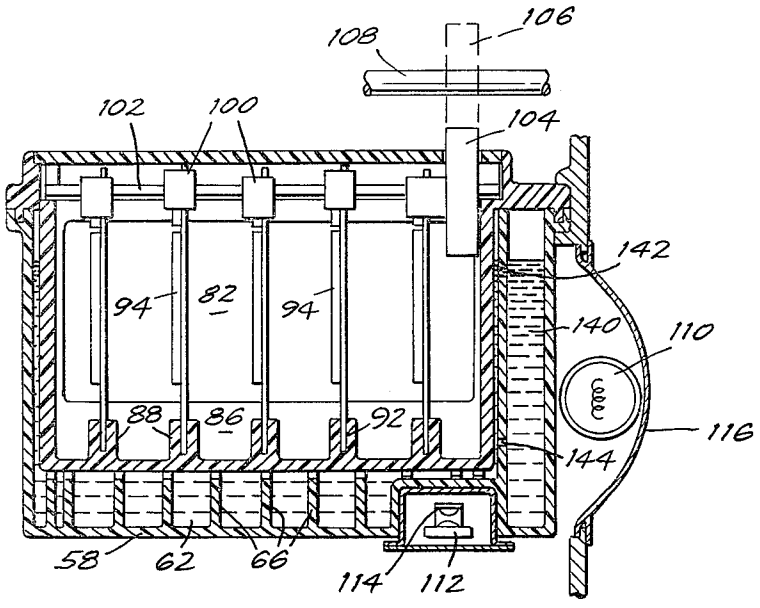


Fig. 5

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United States Patent Office 3,216,342 Patented Nov. 9, 1965

3,216,342

PHOTOGRAPHIC PROCESSOR

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Filed Feb. 5, 1962, Ser. No. 170,886
18 Claims. (Cl. 95—94)

This invention relates to a novel photographic processor and more particularly to a processor incorporating a novel feed arrangement for feeding either web material or individual sheets such as photographic film or photographic prints.

Although a wide variety of photographic developing and processing units are known, none is particularly suited for use as a small portable processor for rapidly processing photographic materials. The known devices are generally bulky and complicated units and because of their high cost are not suited for use for anything other than fairly large quantity production. Furthermore, the devices are subject to one or more disadvantages such as slow speed, non-uniform development of an image, excessive consumption of processing solution or the necessity for elaborate drive and feed arrangements.

The present invention avoids the above-mentioned difficulties by providing a small leaderless processing device for the rapid processing of photographic materials. The unit is completely portable and provides for the rapid processing of photographic films and print papers utilizing a novel flexible vane feed. The processor of the present invention insures a uniform development of the processed material at a sufficient speed to insure proper agitation of the processing solution.

It is therefore a primary object of the present invention to provide a novel photographic processor.

Another object of the present invention is to provide a small, inexpensive and portable processor for processing photographic films and prints.

Another object of the present invention is to provide a novel feed arrangement for webs or sheets of material.

Another object of the present invention is to provide a leaderless feed arrangement for film processors.

These and further objects and advantages of the invention will be more apparent upon reference to the following specification, claims and appended drawings wherein:

FIGURE 1 is a plan view of a feed device constructed in accordance with the present invention;

FIGURE 2 is an end elevation of the feed device of FIGURE 1;

FIGURE 3 is a cross-section taken along line 3—3 of FIGURE 2;

FIGURE 4 is a vertical cross-section through a processor constructed in accordance with the present invention incorporating the vane feed arrangement of FIGURES 1–3; and

FIGURE 5 is a vertical cross-section of the processor taken at right angles along line 5—5 of FIGURE 4.

The advent of rapid processing of photographic materials has required the development of small leaderless processing devices to take advantage of the portability and speed inherent in the processes. A simple form of device of this type heretofore proposed consists of an arrangement of several round bottom shallow tanks to hold the processing chemicals and an arrangement of drive rollers to move the sensitized material through the several solutions. When such a device is reduced to a minimum size, several disadvantages are evidenced. First, since the time in any solution is more or less fixed, reducing the size of the processor requires reduction of the speed of movement of the sensitized film so that time

in solution remains constant. However, at slow speeds, the agitation due to motion by the film becomes too small to provide uniform development of the image, particularly in multi-layer materials used in color photography.

Second, the distance between adjacent sets of drive rollers along the film path must be somewhat less than the shortest length of material to be processed so that the material is engaged by at least one set of drive rollers at all times. Since it is desirable to place the drive rollers above the solution level, the depth of the tank is limited to something less than one-third the length of the shortest film or print to be processed. Tanks of this type can be easily spilled and present a large air to solution surface which leads to rapid consumption of the developer or other processing solution by aerial oxidation.

Third, in known devices, multiple drive rollers require a complicated train of drive gears to maintain synchronism between the individual roller pairs.

The present invention overcomes these difficulties by providing a novel feed arrangement for small photographic processors.

Referring to the drawings, FIGURES 1–3 show the basic elements of the novel feeder of the present invention. A web or sheet of material indicated at **10** passes in the direction of the arrows between a pair of resilient strips **12** and **14**. Resilient strips **12** and **14** may be formed of any suitable resilient material such as natural rubber but are preferably formed of a synthetic rubber-like material such as neoprene. Each of the resilient strips is provided with a series of transverse vanes **16** and **18**. These vanes extend from the body portions **20** and **22** inwardly in a direction generally perpendicular to the sheet **10** and are inclined in the direction of travel of the sheet. In the normal unstressed condition, the tips of the vanes **16** and **18** just contact each other as is best seen in FIGURE 4.

The resilient strips **12** and **14** are suitably secured as by gluing or the like to a rigid frame generally indicated at **24** comprising upper and lower rectangular plates **26** and **28** and side plates **30** and **32**. Lower plate **28** is completely solid but upper plate **26** has its center cut away to form a large rectangular aperture **34**.

As can be seen in FIGURES 2 and 3, the first set of vanes **16** is opposed by a second set of vanes **18** with both sets of vanes inclined in the direction of travel of sheet **10**. If a downward force in the direction of the arrow in FIGURE 3 is applied to upper resilient strip **12**, the opposing pairs of vanes are alternately compressed and then relaxed when the force is removed. Under the action of a repeated application of force to strip **12**, the sheet **10** is periodically moved forward by the deflection of the vanes. Of course, the strip **22** may also be flexibly supported and actuated either in conjunction with or independently of strip **12**.

If vertical forces are applied to one or both of the strips, a positive drive is imparted to the sheet in the direction of the arrows in FIGURES 1 and 3. It has been found that a much more positive and faster feed is obtained, particularly in conjunction with wet materials, if the forces are applied in discrete loctations transversely across the strip **12** in the manner of the forces indicated by the arrows **42** in FIGURE 2 such that the individual forces represented by arrows **42** are out of phase.

Referring to FIGURES 4 and 5, there is shown a novel portable photographic processor constructed in accordance with the present invention generally indicated at **50**. The processor comprises a supporting frame **52** of any suitable material, preferably plastic, having a feed inlet **54** and outlet **56** so that web or sheet materials such as film or photographic prints move through the processor in the direction of the arrows in FIGURE 4.

Frame 52 defines a pair of shallow tanks 58 and 60 containing processing solution such as developer as indicated at 62 and 64. Suitably secured to the bottom of each tank and preferably formed integral therewith are a plurality of guide vanes 66 and 68.

Positioned within each of the tanks 58 and 60 are resilient inlet feed units 70 and 72 and resilient outlet feed units 74 and 76. Each of these units is constructed in accordance with FIGURES 1–3 and comprises a series of opposing resilient vanes. As can be seen, the liquid level of the process solution indicated at 62 and 64 is adjacent the upper ends of the resilient feed units.

One set of vanes 78 of input feed unit 70 is secured to side wall 80 of tank 58. The other set of vanes 82 has one end secured to a flange 84 of the frame 52 and its other end secured to a generally U-shaped core 86 supported from the frame. The other feed units 72, 74 and 76 are similarly mounted.

Each of the cores such as core 86 is provided with a series of bosses 88 constituting pivot bearings for a series of flat sheet-like drive blocks 90. Each of the drive blocks is provided with a circular head 92, pivotably received in the bosses 88. The vertical edges of the drive blocks 90 are turned over, as at 94 and 96, to provide driving flanges for engagement with the resilient feed units 70 and 74.

Each of the drive blocks 90 is provided at its top with a slot 98 receiving an eccentric cam 100 mounted on a drive shaft 102. Drive shaft 102 carries at one end a gear 104 engaging a second gear 106 carried by a drive shaft 108. Drive shaft 108 may be suitably energized by an electric motor or other power source.

Mounted on one side of the frame 50 is a heating lamp 110 for heating the solution in tanks 58 and 60. The heating lamp 110 is controlled by a thermostat 112 comprising a heat sensitive bimetallic strip 114 which closes in response to a change in temperature in the tanks to energize lamp 110. The lamp is preferably surrounded by a suitable reflector 116.

Tank 60 is in all respects identical to tank 58 except for its smaller size and includes similar sheet-like driving blocks 118 driven by eccentric cams such as 120 through gears 122 and 124 from a second drive shaft 126. If desired, shafts 108 and 126 may be driven from a common motor or other suitable power supply.

In operation, rotation of drive shafts 108 and 126 cause eccentric cams such as 100 and 120 to oscillate drive blocks 90 and 118 so as to alternately compress one set of vanes in each of the feed units 70, 72, 74 and 76. The action of the drive blocks causes the opposing vanes to be periodically compressed together. With the eccentric cams 100 and 120 suitably set to different positions about their respective shafts so as to be out of phase with each other as illustrated, for example, at 100 in FIGURE 5, more positive and more rapid drive is imparted to the material passing through the tanks 58 and 60. The film or other sheet material passes through inlet 54, through resilient feed unit 70, and into the processing liquid 62 and is guided beneath core 86 by guide vanes 66. The leading edge of the material then engages outlet feed unit 74 and passes upwardly over bridge 130 into the input feed unit 72 of tank 60. The processed material is guided through tank 60 by guide vanes 68 and is carried by resilient feed unit 70 through the outlet opening 56 from the processor.

As best seen in FIGURE 4 the processing solution in each tank is preferably confined to the lower portions of the tanks and to areas housing the feed units so that the drive blocks may freely oscillate. However, with this arrangement the solution is contained in a relatively narrow channel along the path of movement of the processed material and only a relatively small area of solution faces the heat source 110.

In order to avoid waste of heat energy the frame 52 is provided with a separate fluid chamber 140 communicating with the tanks 58 and 60 by means of a plurality of apertures such as 142 and 144. Chamber 140 extends along one entire side of the processor so that the solution in chamber 140 is subjected to the entire heat radiating area of source 110. Source 110 is preferably a conventional infra red lamp which passes heat energy through the material of the frame to heat the processing solution in a manner more fully described in assignee's copending application Serial No. 170,885 filed February 5, 1963, now patent 3,147,366, September 1, 1964. Circulation of the solution between each of the tanks 58 and 60 and the chamber 140 maintains uniform temperature of the solution throughout the processor.

It is apparent from the above that the present invention provides a portable processing unit for processing film or print materials. Incorporated in the processor is a novel resilient feed which completely eliminates the necessity for feed rollers. While the feed is described in conjunction with sheet material generally, it is apparent that the processor is usable both with continuous webs and with individual sheets such as separate prints or negatives. Similarly, while described in conjunction with photographic materials, it is apparent that the feed means of the present invention can be used in conjunction with almost any type of semi-rigid paper-like material, including both glossy finishes and unfinished surfaces. Furthermore, the resilient feed units of the present invention may be used in conjunction with quite flexible materials such as fabrics and the like. However, in the latter instance, it is sometimes necessary to stress the fabric or other flexible material by applying a certain amount of constant tension to the fabric.

The oscillating motion of the drive blocks 90 and 118 of the processor imparts a rapid, almost continuous, feed movement to the material and in addition maintains the processing solution in agitation as the processed material is passing through the tanks. Furthermore, since the drive blocks can be driven from a common source, the entire processor can be driven from a single point, thus eliminating the need for complex synchronizing systems.

The invention may be embodied in other specific forms without departing from the spirit or essential characteristics thereof. The present embodiments are therefore to be considered in all respects as illustrative and not restrictive, the scope of the invention being indicated by the appended claims rather than by the foregoing description, and all changes which come within the meaning and range of equivalency of the claims are therefore intended to be embraced therein.

What is claimed and desired to be secured by United States Letters Patent is:

1. A feed device for unidirectionally advancing sheet materials comprising two sets of opposing resilient vanes, said vanes being inclined in the direction of travel of sheet material passing between said vanes, means rigidly supporting one of said sets of vanes, and means for repeatedly applying force to said other set of vanes to cause adjacent vanes in each set to be compressed against and thereby advance the sheet material.

2. A feed device for sheet materials comprising first and second resilient strips each having a body portion and plurality of elongated parallel vanes, the adjacent edges of corresponding vanes of each strip lying in substantially a common plane, said vanes being inclined in the direction of travel of sheet material passing between said strips, a rigid backing for one of said strips, means for imparting a repeated compressive force to spaced locations on the body portion of the other of said strips.

3. A feed device for sheet materials comprising first and second parallel resilient strips, each of said strips having a body portion and a plurality of parallel vanes, the adjacent edges of corresponding vanes of each strip lying in substantially a common plane, said vanes being inclined in the direction of travel of sheet material passing between said strips, rigid backing means for one of

said strips, a plurality of oscillating drive blocks engaging the back of the other of said strips, and means for energizing said drive blocks out of phase with each other for repeatedly pressing corresponding vanes of said strips together.

4. A device according to claim 3 wherein said drive blocks are eccentrically driven from a common shaft.

5. A photographic processor comprising a processing tank, feed means including at least two sets of unidirectionally inclined resilient vanes for feeding sheet material through said tank, and a feed drive comprising a plurality of oscillating drive blocks engaging and compressing one of said sets of vanes, said drive blocks each having one end pivotally mounted in said tank and each having its other end eccentrically coupled to a common shaft.

6. A photographic processor comprising a processing tank, inlet and outlet feed means for said tank, each of said feed means including first and second parallel resilient strips, each of said strips having a body portion and a plurality of parallel vanes, the adjacent edges of corresponding vanes of each strip lying in substantially a common plane, said vanes being inclined in the direction of travel of sheet material passing between said strips, one of said resilient strips of each of said feed means being rigidly supported, and a feed drive comprising a plurality of oscillating drive blocks engaging one of said sets of vanes. said drive blocks each having one end pivotally mounted in said tank and each having its other end eccentrically coupled to a common shaft.

7. A photographic processor comprising a processing tank, inlet and outlet feed means for said tank, each of said feed means including first and second parallel resilient strips, each of said strips having a body portion and a plurality of parallel vanes, the adjacent edges of corresponding vanes of each strip lying in substantially a common plane, said vanes being inclined in the direction of travel of sheet material passing between said strips, a feed drive comprising a plurality of drive blocks having their lower ends pivotally supported in said tank, a drive shaft, and a plurality of eccentric cams mounted on said shaft in out of phase relation, said cams driving said drive blocks into engagement with one of said resilient strips of each of said feed means to compress corresponding vanes of each of said strips against each other.

8. A processor according to claim 7 including a separate fluid chamber along one side of said tank, said chamber communicating with said tank and a heat source adjacent said chamber for heating processing fluid in said chamber and tank.

9. A processor according to claim 7 wherein said drive blocks are mounted between said input and output feed means to engage opposite feed means on alternate half cycles of oscillation.

10. A processor according to claim 9 wherein said drive blocks are mounted outside the process solution level in said tank.

11. A processor according to claim 10 including a plurality of guide vanes in the bottom of said tank for guiding sheet material through said tank.

12. A feed device for unidirectionally advancing sheet materials comprising a first set of elongated resilient vanes having substantially coplanar edges, a second set of elongated resilient vanes having substantially coplanar parallel edges adjacent said edges of the corresponding vanes in said first set, said vanes being inclined in the direction of movement of sheet material passing between said sets of vanes, and means for compressing corresponding vanes of said sets together in out of phase relationship at discrete locations along the length of said vanes to advance the sheet material.

13. A photographic processor comprising a processing tank, drive means to carry film through the tank comprising at least two sets of parallel opposing resilient projections on opposite sides of said film each of said sets of projections being inclined in the direction of travel of the film and means for repeatedly pressing said projections to grip and advance the film.

14. A photographic processor comprising a processing tank, means to carry film through the tank comprising two sets of opposing resilient vanes on opposite sides of said film, each of said vanes being inclined in the direction of travel of film passing between said vanes and means for repeatedly applying a compressive force to at least one of said sets of vanes to grip and advance the film.

15. A photographic processor comprising a processing tank, driving means to carry film through the tank comprising two sets of opposing resilient vanes, said vanes being inclined in the direction of travel of film passing between said vanes, means rigidly supporting one of said sets of vanes, and means of repeatedly applying force to the other set of vanes to cause adjacent vanes in each set to be compressed against each other and thereby advance the film.

16. A photographic processor comprising a processing tank, means for unidirectionally advancing film material comprising a first set of elongated resilient vanes on one side of the film, a second set of elongated resilient vanes on the opposite side of the film, said vanes in said first set having their edges adjacent the edges of the corresponding vanes in the second said set, said vanes in the said first set being inclined and in the same direction as the corresponding vanes in said second set whereby a repeated force applied to said vanes causes the film to be advanced by the repeated compression and expansion of said vanes.

17. A photographic processor comprising a processing tank, means to unidirectionally carry film through the tank comprising a set of elongated resilient vanes having substantially coparallel edges on one side of the film, a second set of elongated resilient vanes having substantially coparallel edges adjacent the edges of the corresponding vanes on the opposite side of said film, each of said set of vanes being inclined in the direction of movement of film passing between said sets of vanes and means for repeatedly pressing corresponding vanes of said sets together to advance the film.

18. A device according to claim 17, wherein said compressing means acts at discrete locations along the length of said vanes.

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