

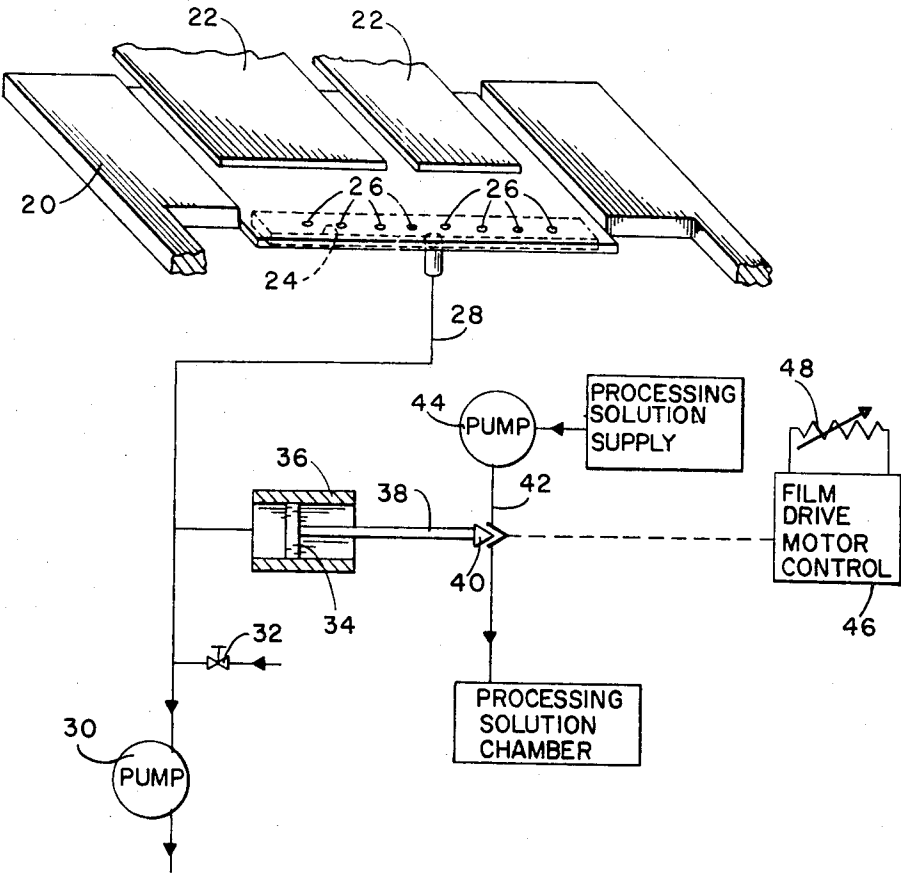
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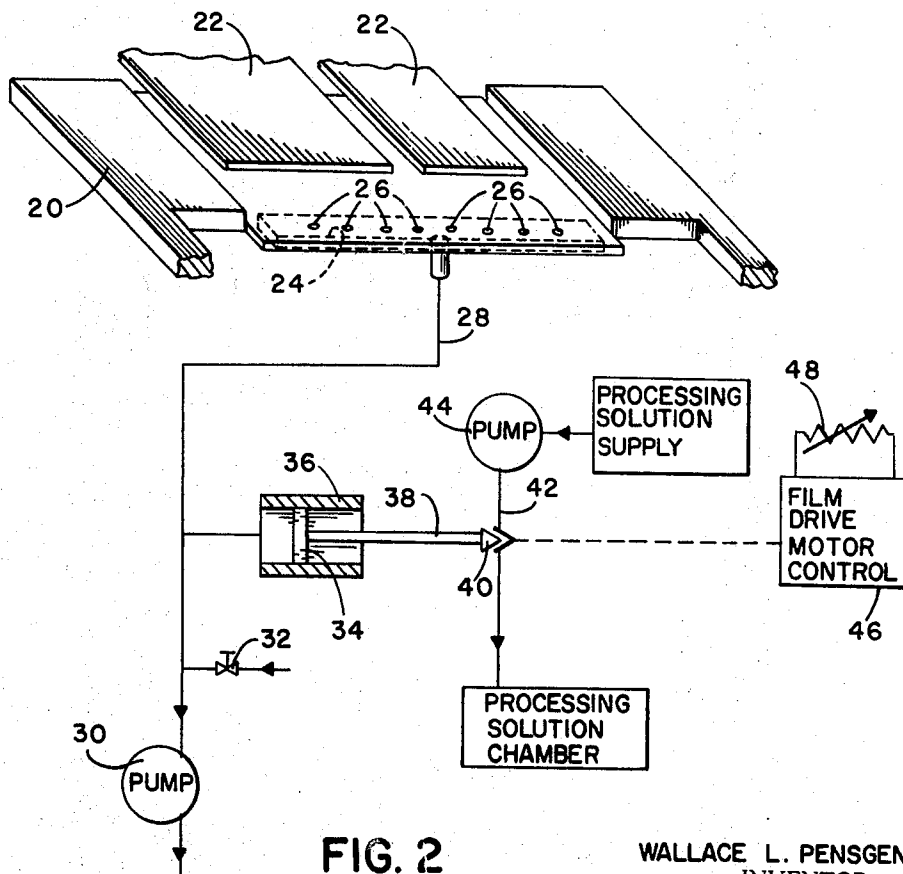
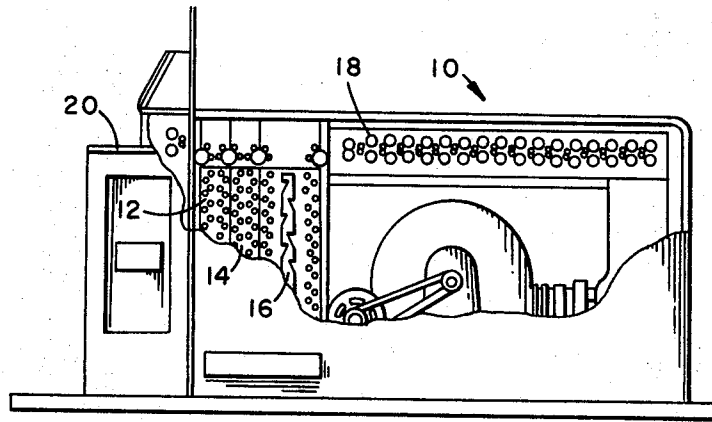
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[54] **REPLENISHMENT SYSTEM FOR A PROCESSING DEVICE**
7 Claims, 2 Drawing Figs.
[52] U.S. Cl..... **95/89**
[51] Int. Cl..... **G03d 3/06**
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89(Lam). 94: 118/2, 8: 68/(Inquired);
137/(Inquired); 222/(Inquired)

ABSTRACT: A replenishment system for replenishing a substance such as a solution in a processing device such as a photographic processing device in which the rate of substance replenishment is controlled by a sensing mechanism. The sensing mechanism senses the sheet or web material and produces a fluid pressure output that is responsive to the width of the material being processed. The output produced, in turn, actuates a device for controlling the rate of substance replenishment.



3,532,047



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REPLENISHMENT SYSTEM FOR A PROCESSING DEVICE

BACKGROUND OF THE INVENTION

This invention relates generally to processors, and more specifically to an improved processing device having a substance replenishment system and means for producing an output proportional to the width of a material transported through the processor. Control means are actuated in response to the output for controlling the substance replenishment system.

In photographic processing operations that do not utilize throwaway processing solutions, it is difficult to maintain the concentration of the various processing solutions at proper strength. This is particularly a problem with developer solutions which during processing reduce light exposed grains of silver halide in the film emulsion to metallic silver. This chemical reduction or development process must be carefully controlled with respect to a number of variables. In the usual practice, the initial exposure is controlled so as to give a latent image which, when processed under standard conditions, will develop to the proper density. Obviously, if the conditions are other than standard, the image will be either over or underdeveloped, and the image quality correspondingly poor. The most important variables in the processing operation are time, temperature and the concentration of the solution. The time of development is easily controlled by a variety of well known mechanical means, or may be controlled manually by the operator with the aid of a timer. Similarly, control of the processing temperature ordinarily presents no particular difficulty. The remaining variable, namely control of the concentration of the processing solution, however, is more of a problem. Being reducing agents, the solutions are subject to oxidation by the atmosphere, and such oxidation consumes the reducing agents, lowering the effective concentration of the solutions. Also, each portion of photographic material (film, paper, etc.) that is processed consumes a portion of the reducing agents in the processing solutions so that the solutions gradually become exhausted.

The traditional approach to the problem of keeping the processing solution strength constant within reasonable limits has been to use large volumes of solution, protecting them so far as possible against atmospheric oxidation, and to limit the square footage of film processed by a given quantity of solution so that the effective concentration of the solution does not vary appreciably between the first and the last portions of film processed. This approach, however, is wasteful since if the concentration of the solution when discarded is substantially the same as its concentration when fresh, large quantities of relatively unused processing solution are necessarily discarded. Applicant's invention involves a different approach in which the processing device contains a predetermined quantity of processing solution, and fresh processing solution is automatically added to the original solution as it is depleted during the processing operation to build up and maintain the strength of the solution at a relatively constant value.

It is, of course, generally well known in the art to provide mechanisms such as motion picture projectors and tape recorders capable of detecting the presence or absence of a web, and in response thereto to actuate web reversing mechanisms. It is also known in the art to provide a processing solution replenishment system in which a test strip of film as it is being processed is subjected to a light-sensing device which gives an electrical indication of the degree of processing, and hence the strength of the processing solution, and produces an output proportional to such indication for controlling the rate of solution replenishment. However, applicant is unaware of any substance replenishment system such as a processing solution replenishment system for a processing device for controlling the rate of substance replenishment by a pressure output produced by a material sensing mechanism that is responsive to the width of the material, such output in turn actuating means for controlling the rate of substance replenishment.

SUMMARY OF THE INVENTION

This invention includes within its scope a substance replenishment system such as a processing solution replenishment system for a processing device such as a photographic processing device. A material sensing mechanism in the processing device is responsive to the width of the material in sheet or web form as it is transported through the processing device for producing a pressure output. The pressure output is produced by a pressure system such as a negative pressure system in which the amount of negative pressure generated is proportional to the width of the material and increases as the width of the material increases. This pressure output actuates control means for controlling the rate of substance replenishment.

One object of the present invention is to provide a processing substance replenishment system for a processing device having a material sensing mechanism that is responsive to the width of the material as it is transported through the processing device for producing a pressure output, such output in turn actuating control means for controlling the rate of substance replenishment.

Objects and advantages other than those set forth above will be apparent from the following description when read in connection with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWING

In the drawing:

FIG. 1 is a schematic view of a processing apparatus such as a photographic processing device showing the developing, fixing, washing and drying chambers thereof; and

FIG. 2 is a schematic view partially in perspective and partially in block diagram form of a processing solution replenishment system for a processing device, in which portions of the processing device have been omitted for purposes of clarity.

DETAILED DESCRIPTION

Referring to the drawing, this invention is shown schematically in connection with a processing device 10 of any known type such as a photographic processor having developing, fixing, washing and drying chambers 12, 14, 16 and 18 respectively. The processing device 10 has a pressure means for sensing sheet or web material comprising a feed table 20 over which the material such as a film 22 is transported. The film feed table 20 has a recess extending laterally thereof as shown dotted in FIG. 2 to form a chamber 24, and a plurality of small spaced openings 26 extending from the top of table 20 into chamber 24. Although chamber 24 is shown integral with table 20, it may be a separate unit secured to the table or to any other portion of the processing device 10 provided the film 22 to be processed is transported over it. A conduit 28 has one end connected to the bottom of chamber 24, and the other end thereof connected to a pump 30 for drawing air through openings 26 and chamber 24. The conduit 28 is provided with a negative pressure or partial vacuum adjustment bleed valve 32 for controlling the amount of negative pressure generated or developed in conduit 28 and chamber 24.

The control means which is responsive to the pressure film sensing mechanism comprises a movable mechanism of any known type such as a piston 34 connected to conduit 28 and movable in a cylinder 36 by the negative pressure generated in conduit 28 when the film covers one or more of the openings 26 in chamber 24. The amount of negative pressure developed is proportional to the number of openings covered, and hence the width of the film, and becomes greater as more of the openings are covered. The movement of piston 34 is proportional to the amount of negative pressure generated, and controls a valve 40 in a processing solution supply conduit 42 by means of a rod 38 interconnecting piston 34 and valve 40. A pump 44 pumps processing solution from any suitable source or supply of processing solution through conduit 42 and valve 40 to one of the processing solution chambers 12, 14 for replenishing same. A similar supply, pump and valve system,

now shown, preferably operated by rod 38 may be utilized to replenish the remaining chamber. Naturally, as the width of the film being processed increases, the negative pressure generated increases resulting in valve 40 being increasingly opened with a corresponding increasingly higher rate of solution replenishment. The replenishment continues as long as film 22 covers the openings, and when the openings are uncovered, valve 40 is immediately returned by piston 34 to its normal preset position for providing a standby rate of replenishment or for turning off the replenishment completely, depending upon how it is initially set.

It should be readily apparent that other forms of movable mechanisms other than a piston system may be utilized in this invention such as a transducer responsive to the variable pressure generated to provide a variable electrical output connected to a variable speed motor driving a solution pump, the output of which is proportional to the speed at which it is driven. A film transport motor control 46 of known type for processor 10 has a potentiometer 48 for controlling the speed at which film 22 is transported through the processor, normally by pairs of opposed rollers, and this motor control may be connected to valve 40 for automatically adjusting the valve opening relative to piston 34 to correspond to the speed of film transport. The greater the speed of film transport, the greater the valve opening thereby increasing the solution replenishment rate to compensate for the shorter period of time piston 34 is actuated and solution pump 44 is operated.

In the operation of this invention, when a material such as a photographic film is introduced into the processing device 10 of a width capable of covering one or more openings 26 in chamber 24, the negative pressure generated in the system moves piston 34 and valve 40 to adjust the solution replenishment rate in proportion to the width of the film. Solution replenishment will continue as long as film 22 covers openings 26. As soon as the openings are uncovered, valve 40 will return to its normal position causing the solution replenishment rate to return to its normal nominal rate for standby operation, or to be turned off entirely depending on the preset position of valve 40.

The invention has been described in detail with particular reference to one embodiment thereof, but it will be understood that variations and modifications can be effected within the spirit and scope of the invention as described hereinabove.

I Claim:

1. In a photographic processing device having a processing solution replenishment system, the combination comprising:
 - means containing a processing solution;
 - means for transporting a photographic film material through the processing device for processing;
 - means for replenishing solution to the containing means at a varying rate to maintain the strength of the solution at a predetermined value;
 - fluid pressure means for sensing film transported through the processing device and producing a fluid pressure output proportional to the width of the film that is processed; and
 - control means for said solution replenishing means responsive to the fluid pressure output of said film sensing fluid pressure means for controlling the rate of solution replenishment whereby the strength of the solution is

maintained at said predetermined value.

2. The invention according to claim 1 wherein said pressure sensing means comprises a chamber having openings therein across which the film is transported, and a pump connected to said chamber and to said solution replenishing means for producing a negative pressure output proportional to the width of the film transported across said openings.

3. The invention according to claim 1 wherein said solution replenishing means comprises an adjustable valve, and said control means comprises a piston connected to said valve and responsive to the fluid pressure output of said pressure sensing means for controlling said valve and the rate of solution replenishment.

4. The invention according to claim 1 wherein said fluid pressure sensing means comprises a chamber having openings therein across which the film is transported, and a pump connected to said chamber and to said solution replenishing means for producing a negative pressure output proportional to the width of the film transported across said openings; said solution replenishing means comprises an adjustable valve for controlling the rate of solution replenishment; and said control means comprises a piston connected to said valve and responsive to the pressure output of said pressure sensing means for adjusting said valve and the rate of solution replenishment.

5. In a processing solution replenishment system for a photographic processing device containing a processing solution through which an exposed photographic film material is transported for processing, the combination comprising:

- fluid pressure means for sensing a film transported through the processing device and producing a fluid pressure output proportional to the width of the film that is processed; means for replenishing the processing solution at a varying rate to maintain the strength of the solution at a predetermined value; and
- control means for said solution replenishing means and responsive to said fluid pressure film sensing and pressure output producing means for controlling the rate of solution replenishment.

6. The invention according to claim 5 wherein said film sensing and pressure output producing means comprises a chamber having openings therein, said chamber being connected to said solution replenishing means, and a pump connected to said chamber for producing a negative pressure in said chamber when a film is transported across said openings causing an increase in the rate of solution replenishment proportionate to the number of openings covered.

7. In a material handling device having substance containing means and means for transporting the material through the device and into contact with the substance, the combination comprising:

- means for replenishing the substance at a varying rate as it is used by the material;
- fluid pressure means for sensing material transported through the device and producing a fluid pressure output proportional to the width of the material; and
- control means for said replenishing means responsive to the fluid pressure output of said material sensing pressure means for controlling the rate of substance replenishment.