

### [54] AUTOMATED COLOR PRINT PROCESSOR

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[58] Field of Search .... **95/89 R, 95, 93, 89 D; 118/7**

### [56] References Cited

#### UNITED STATES PATENTS

|           |        |              |         |
|-----------|--------|--------------|---------|
| 3,000,288 | 9/1961 | Winnek.....  | 95/89 R |
| 3,435,748 | 4/1969 | Cannon ..... | 95/89   |
| 2,922,353 | 1/1960 | Berley.....  | 95/89   |
| 3,453,944 | 7/1969 | Craig .....  | 95/89   |

### FOREIGN PATENTS OR APPLICATIONS

1,549,183 12/1968 France.....95/93

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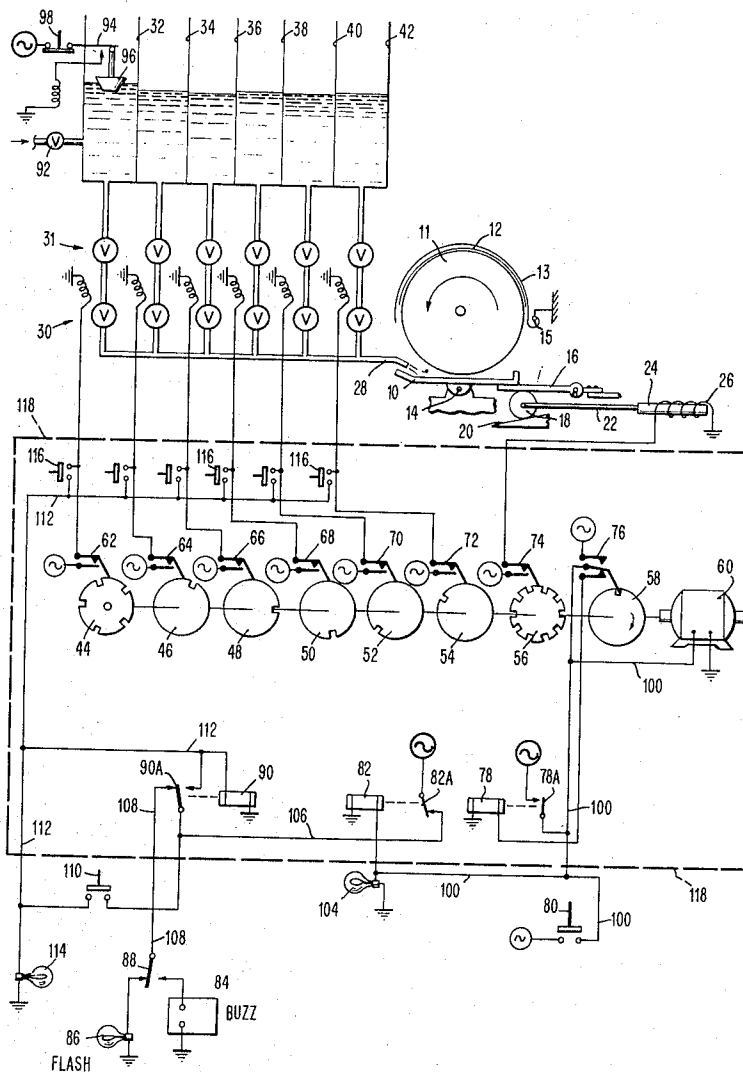
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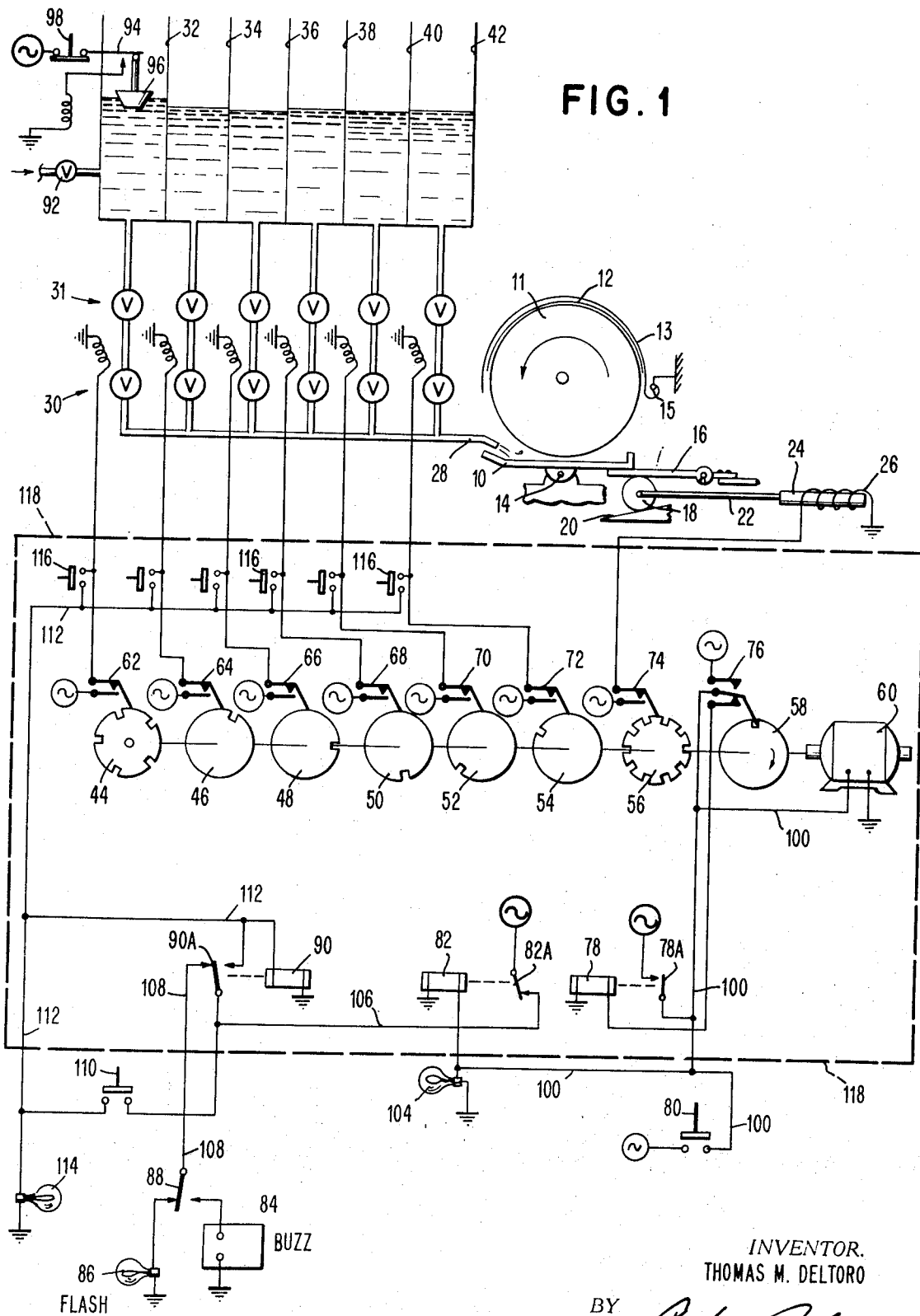
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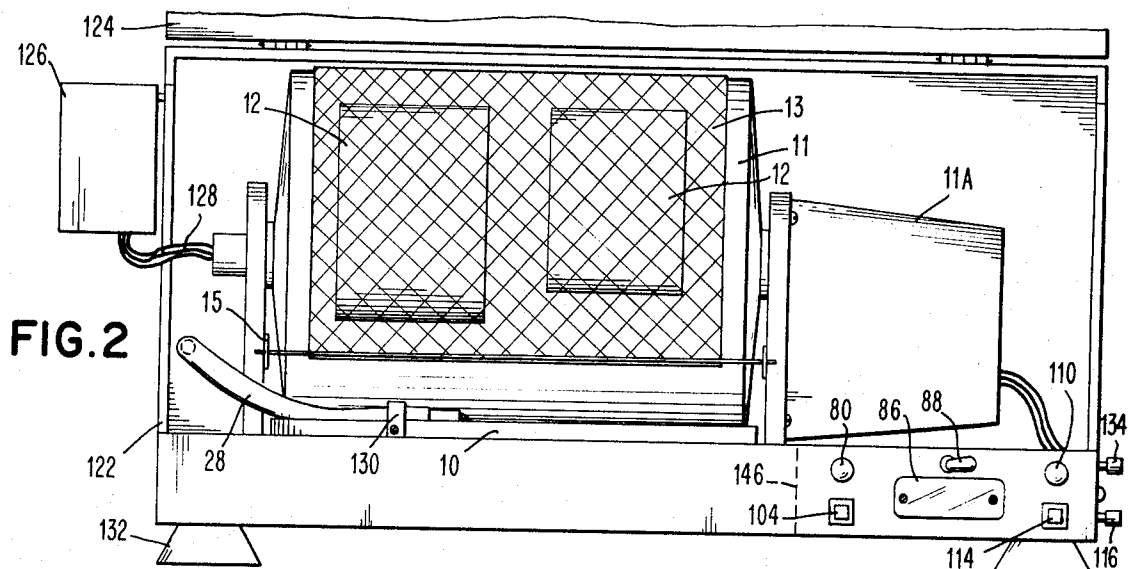
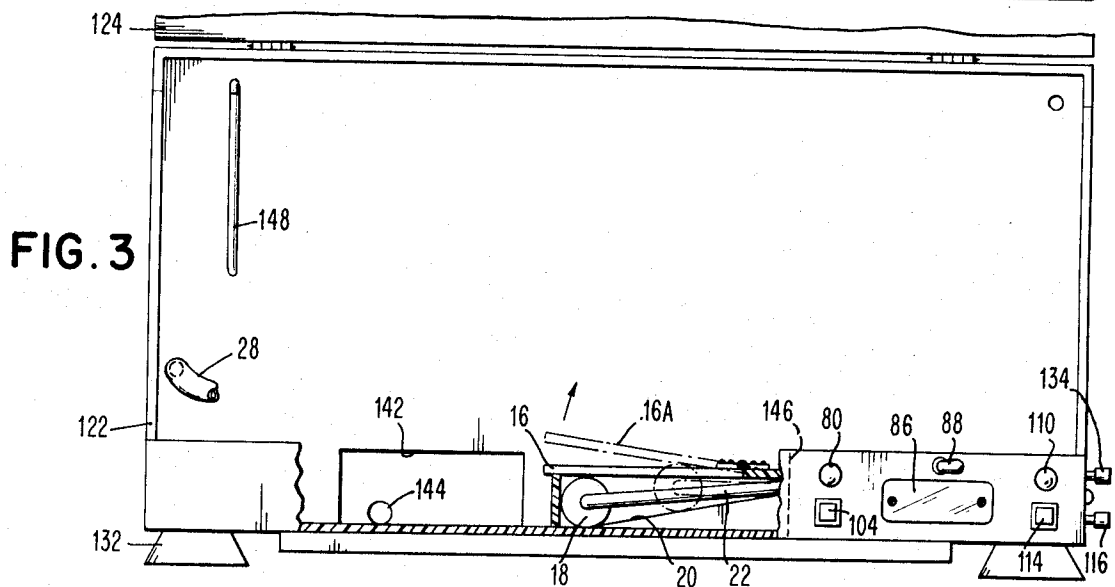
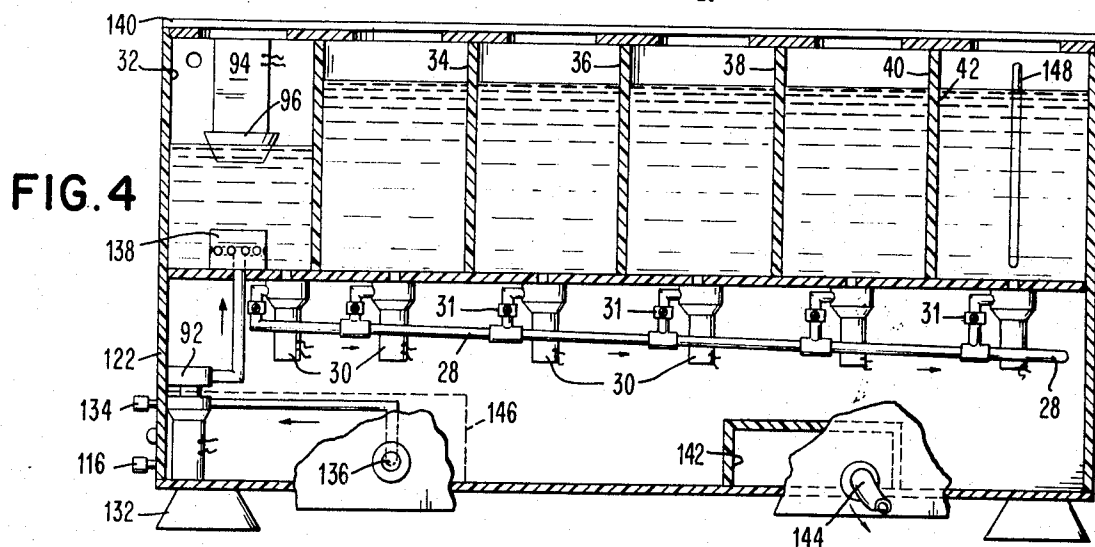
### ABSTRACT

Developing and conditioning solutions, and wash water, are automatically delivered in sequence through a single supply conduit to a tray for application to an exposed photographic medium. The conduit has inlet connections arranged at spaced positions therein for the introduction of the different liquids in sequence, with an inlet opening at the extreme end opposite to the conduit outlet end for the introduction of water. The tray is automatically tilted and emptied before each introduction and use of a new liquid.

**9 Claims, 4 Drawing Figures**







## AUTOMATED COLOR PRINT PROCESSOR

This invention relates to automatic photographic development apparatus, and particularly to apparatus of this type which is adapted for the development of color photographic media.

The conventional hand methods for development of exposed photographic media such as prints present many problems and disadvantages. For instance, the temperature of the chemical solutions should preferably be carefully controlled, and this is difficult for small batch operation. Also, the various chemical solutions are subject to progressive dilution and aging as successive prints are produced. These factors make it difficult to maintain uniform processing conditions. Furthermore, in the processing of color prints, the problems are aggravated by the requirement of five different chemical solutions together with intermediate water washes, which require a large number of separate processing trays.

Many of the above-mentioned disadvantages have been overcome by a product of the Eastman Kodak Company of Rochester, New York called the Kodak Rapid Color Processor. This device is produced in several sizes, the smallest of which is referred to as the Model 11. The Rapid Color Processor consists essentially of a drum rotated by an electric motor and having an outer cylindrical surface which is embossed to entrain liquids and which is arranged to be wetted by a liquid solution in a tray beneath the drum as the drum rotates. A photographic medium such as a color print is held upon the upper surface of the drum, with the emulsion surface of the photographic medium facing towards the cylindrical surface of the drum so that solutions and washing water are both carried to the emulsion by the rotating drum. The apparatus is designed so that the solution tray may be tilted for emptying without any need for stopping the rotation of the drum. Small amounts of fresh solutions are introduced in sequence into the tray and thus to the photographic print being developed. The tray is successively dumped and after each solution wash water is introduced to the tray.

Perfect temperature control is provided by heating the interior of the drum so that heat is transmitted through the surface of the drum to the solutions as they are in use. By preparing and pre-measuring quantities of developing solutions, and by introducing those solutions in timed sequence into the tray, excellent color prints may be produced with a processing time of only 7½ minutes.

As good as it is, this machine presents certain problems and disadvantages. For one, a human operator must be present and in attendance upon the machine at all times, setting his timer for each step, manually tilting the tray to spill its contents, pouring in water, or the next solution, at the prescribed times. Since most of this work must be carried out in a dark room, the operator cannot read while he is attending the machine, and while only 7½ are required for each print, operating the Rapid Color Processor is a dull job which produces only eight prints per hour. Furthermore, because of the possibilities of human error, it is necessary to provide a larger quantity of processing solution for each step of the processor than would be absolutely essential in the presence of automated operation.

Accordingly, it is an important object of the present invention to provide a new and improved automatic rapid photographic processor which does not require the constant attention of a human operator.

Another object of the invention is to provide an automatic photographic processor which requires only a minimum quantity of each of the various chemical solutions and which thereby saves on the cost of processing chemicals.

Another object of the invention is to provide an automatic photographic color processor which produces perfect results on every print by providing precisely timed process steps and solution quantity measurements which are free of human error.

Further objects and advantages of the invention will be apparent from the following description and the accompanying drawings.

In carrying out the invention, there may be provided apparatus for the development of an exposed photographic medium including a tray for successively receiving developing and other conditioning solutions for application to the exposed photographic medium. The apparatus includes a supply conduit arranged for conveying the solutions to said tray and having an outlet end arranged at said tray, said conduit having inlet connections arranged at spaced positions therein for the introduction of the different liquid solutions in sequence. Said conduit also includes an inlet opening positioned at the extreme end of said conduit opposite to said inlet end for the introduction of water into said conduit and thereby into said tray, and means is provided for tilting and thereby emptying said tray before each introduction and use of each liquid.

In the accompanying drawings:

FIG. 1 is a schematic diagram of an apparatus in accordance with the present invention.

FIG. 2 is a front view showing a preferred physical arrangement of the parts of the apparatus of the invention.

FIG. 3 is another front view partially in section and further illustrating the preferred physical arrangement of the apparatus of FIG. 2.

And FIG. 4 is a sectional rear view further illustrating the preferred physical arrangement of the apparatus of FIG. 2.

Referring more particularly to FIG. 1, there is provided a tray 10 for successively receiving developing and other conditioning liquids for application to an exposed photographic medium. The tray 10 is pivotally supported at 14 so that it can be tilted, as by counterclockwise rotation about pivot 14 to easily empty the tray. The exposed photographic medium, such as, for instance, an exposed but undeveloped color print, may be placed in the tray 10 with its emulsion side up so that the various conditioning liquids introduced into the tray are caused to wet the photographic medium. The photographic medium may be maintained in the tray by means such as a suitable clip (not shown). However, in the preferred form of the invention, the exposed photographic medium 12 is supported upon the upper surface of a rotating drum 11, as illustrated in the drawing. At its bottom edge, the cylindrical surface of the rotatable drum 11 is arranged to be immersed in the liquid contained in the tray 10. The cylindrical surface may consist, for instance, of stainless steel which is embossed with a regular pattern of indentations which cause a substantial entrainment of the liquid from the tray, carrying the liquid to the emulsion side of the photographic medium 12, the emulsion side being arranged to face the cylindrical surface of the drum. A sheet of textile cloth or netting 13 is preferably provided which overlays the photographic medium 12 to retain the photographic medium on the drum 11 as it rotates. The sheet 13 is restrained from rotating with the drum 11 by means of a pivoted fixed support at its "leading" edge at 15. The tray 10 is arranged so that when it is tilted about the pivot 14 for emptying, it does not interfere with or touch the cylindrical surface of the drum 11. The drum 11 and its electric driving motor (not shown), the tray 10 with its pivotal support 14, and the sheet 13 with its pivotal mounting 15 may be provided as a part of a product called the Rapid Color Processor manufactured and sold by the Eastman Kodak Company of Rochester, New York, and further identified as the Model 11. A larger model of a similar apparatus available from the same source is identified as Model 16.

An electromagnetic actuator is provided for tilting the tray 10 consisting of a pivoted lever 16 supporting the right end of the tray, and a solenoid actuated cam 18 having a cam axle supported upon an inclined plane 20. Cam 18 is connected by a rod 22 to a solenoid armature 24 which moves to the right when the associated winding 26 is energized. This causes the cam 18 to ride up to the right upon the inclined plane 20, raising the lever 16 and tilting and thereby emptying the tray 10.

Various liquids are supplied to the tray 10 through a conduit 28 through various inlet connections controlled by solenoid valves 30 from separate reservoirs 32-42. Adjustable metering valves 31 are provided at each reservoir to control the desired rate of liquid flow. The electromagnetic valves 30 are con-

trolled to provide the desired sequence for the introduction of the various liquids into the tray 10 by means of a timing and control mechanism consisting of a plurality of cams 44-58 driven by an electric motor 60, and controlling a plurality of associated cam-operated switches 62-76. This mechanism may be referred to hereinafter as a "cam timer." One of the cams, 56, controls the operation of the tray tilting solenoid 24, and one of the cams, 58, operates to automatically turn off the cam timer at the end of a full cycle.

A relay 78 is provided to start the operation of the apparatus upon the actuation of a start pushbutton 80. A relay 82 is provided for causing the energization of a buzzer 84 or a flashing light 86, as selected by the setting of a switch 88, to signal the end of the timing cycle. A relay 90 is provided for turning off the buzzer 84 or the flasher 86 and for indicating that the machine is ready to proceed with the next cycle. Relay 90 also provides an interlock function for manual operation of the solenoid valves 30 by means of switches 116, as will be described more fully below.

The reservoir container 32, which empties into the end of the conduit 28 most remote from the tray 10, contains water. Since considerable quantities of water are used, the reservoir 32 is automatically filled from a source of tap water through a solenoid valve 92 under the control of a switch 94 actuated by a float 96. Thus, if the water level within reservoir 32 drops below the desired maintenance level, the float 96 is lowered, causing the contacts 94 to close to energize the solenoid valve 92 and to admit more water until the float rises to open the switch 94. A disconnect switch 98 is provided for disabling the water filling control system so that the reservoir 32 may be emptied for cleaning or storage.

Throughout the diagram of FIG. 1, in order to simplify the circuitry, the power supply connections are shown by means of a ground symbol as illustrated at the lower end of the winding for solenoid valve 92, and by an ungrounded power input terminal as shown to the left of the disconnect switch 98.

The cam switch timer is illustrated in the "at rest" position achieved at the end of one cycle and before the beginning of the next succeeding cycle. A cycle is initiated by closing the momentary pushbutton switch 80. This action applies power to conductor 100 thereby supplying power to the timer motor 60 and also supplying power through the two lower contacts of the cam switch 76 to conductor 102 causing energization of the winding of relay 78. This causes closure of the normally open contacts 78A of relay 78 to maintain power upon conductor 100 after the operator releases the pushbutton 80. After the motor 60 rotates the cam 58 to a point where the middle contact (the cam follower) of switch 76 moves out of the cam notch, the connection is broken between the middle contact and the lower contact of switch 76, and a connection is established from the middle contact to the upper contact of switch 76. Power is thus supplied through the upper contact and middle contact of switch 76 to maintain power upon the connection 100 and to continue the supply of power to timer motor 60. The disconnection of the lower contact of switch 76 removes power from connection 102 thereby deenergizing relay 78 and opening relay contacts 78A. The timer switch 76 is designed so that the switching of the center contact from connection to the lower contact to connection with the upper contact is accomplished substantially instantaneously, preferably with a "snap" action so that there is no chance that the timer motor will be de-energized and stalled by a mid-position condition of switch 76 in which the middle contact is disconnected from both the upper and lower contacts. The initiation and maintenance of power upon connection 100 also causes the energization of relay 82 and a signal light 104 which preferably has a distinctive color such as green. Signal light 104 indicates that the machine is operating on the automatic cycle, and the operation of relay 82 opens normally closed contacts 82A to thereby remove power from a connection 106 to maintain the relay 90 and the flasher and buzzer units 86 and 84 de-energized.

The motor 60 and the cams 44-58 are preferably designed to operate in one full revolution for each automatic cycle of operation of the apparatus. In a preferred embodiment of the apparatus, the elapsed time for a full cycle of operation is 7½ minutes. The motor 60 preferably incorporates suitable reducing gears to provide the 7½ period for one revolution. Thus, the cam 58 requires only one notch, the apparatus continuing its operation until the middle lever of switch 76 drops into the notch again as illustrated in the drawing.

Almost immediately after a new cycle of operation is commenced, the first notches in the cams 44 and 56 are effective to close the associated switches 62 and 74, initiating a flow of water through the conduit 28, and tilting the tray 10 to discharge any liquid remaining from prior operation of the system. The tray tilting operation controlled by cam 74 is then discontinued while the water flow controlled by cam 44 and switch 62 is continued to provide an accumulation of water in the tray 10. Meanwhile, the drum 11 is rotating and carries the water to the photographic medium 12 to thoroughly pre-wet the photographic emulsion.

Next, the tray is again tilted by the operation of switch 74 and then switch 72 is actuated by cam 54 to open the associated solenoid valve to admit a developer liquid to the tray 10 through conduit 28 from reservoir 42. After the developer is permitted to remain in the pan and to be introduced to the photographic medium for the desired period of time, the tray 10 is again tilted by operation of switch 74, water is introduced by operation of switch 62, the tray is again tilted by a subsequent operation of switch 74, and then switch 70 is actuated by cam 52 for the introduction of a fixer liquid from reservoir 40 through the conduit 28 to the tray 10.

Again, after a desired period of operation with the fixer, the apparatus goes through the sequence of tray tilt, introduction of water, tray tilt, and then introduction of a bleach liquid from reservoir 38 by actuation of switch 68 by cam 50. At the end of the bleach cycle, the system repeats the sequence of tray tilt, introduction of water, and tray tilt followed by the introduction of a formalin fixer from reservoir 36 by the operation of switch 66 by cam 48. Finally, after the formalin fixer cycle, the system again repeats the tray tilt, introduction of water, tray tilt, and then a stabilizer is introduced from reservoir 34 by operation of switch 64 by cam 46. Since the stabilizer is not to be rinsed off, the last step is not followed by a water rinse and the stabilizer is simply permitted to remain in the tray 10 as the machine is turned off by operation of the cam 58 and the switch 76. The presence of the stabilizer in the tray 10 is not harmful to a subsequent print or photographic medium 12 which is introduced for processing.

The notches in the cams 44-54 are each arranged to be wide enough to provide for closure of the respective switches for a period which is sufficient to permit the desired amount of liquid to be passed through the conduit 28 to the tray 10. The mechanically adjustable valves 31 permit a fine adjustment of the quantity of liquid which is actually permitted to flow to the tray 10 by adjusting the rate of flow during the period when each of the associated electromagnetic valves 30 are open. In the case of each of the active liquid solutions controlled by cams 46-54, the liquid is admitted to the tray, and then the associated electromagnetic valve is closed and that liquid is permitted to remain in the tray for the desired processing time before the tray is emptied and the photographic medium is rinsed. The processing steps described above are summarized in the following table:

TABLE I.

| Step No. | Action or liquid introduced | Period before next Step |
|----------|-----------------------------|-------------------------|
| 1        | Tilt tray, start water      |                         |
| 2        | Continue water              |                         |
| 3        | Tilt tray                   |                         |
| 4        | Developer                   | 2½ minutes              |
| 5        | Tilt tray                   |                         |
| 6        | Water                       |                         |

|    |                |          |
|----|----------------|----------|
| 7  | Tilt tray      |          |
| 8  | Stop—fixer     | ½ minute |
| 9  | Tilt tray      |          |
| 10 | Water          |          |
| 11 | Tilt tray      |          |
| 12 | Bleach         | 1 minute |
| 13 | Tilt tray      |          |
| 14 | Water          |          |
| 15 | Tilt tray      |          |
| 16 | Formalin fixer | ½ minute |
| 17 | Tilt tray      |          |
| 18 | Water          |          |
| 19 | Tilt tray      |          |
| 20 | Stabilizer     | ½ minute |
| 21 | Stop           |          |

As the cam 58 actuates the switch 76 to the off position, the switch 76 is operable to snap over quickly so that power to connection 100 is interrupted without causing a transfer of power from the upper lever of switch 76 to the bottom lever of switch 76 so as to avoid picking up the start relay 78. The release of power from connection 100 stops the timer motor 60 and also releases relay 82 and turns off indicator lamp 104. The release of relay 82 causes the closure of switch contact 82A applying power through connection 106 and the normally closed side of a relay contact 90A, through a connection 108 and switch 88 to either the flashing indicator light 86 or to buzzer 84 to thereby signal the operator that the cycle is completed and that the developed print is to be removed from the machine. The operator will have previously selected which type of signal he wishes to receive by means of the selector switch 88. The operator may stop the flasher or buzzer signals by operating a pushbutton 110 to connect power to a connection 112 and thereby energizing relay 90. This causes the movable relay contact 90A to shift to the closed position, interrupting power through connection 108 to the flasher or buzzer 86 and 84 and establishing a holding circuit for the relay 90 to maintain power directly from connection 106 and independent of pushbutton 110. The establishment and maintenance of power upon connection 112 by means of pushbutton 110 and relay 90 energizes another indicator lamp 114 which may have a distinctive color, such as red, and serving to remind the operator that the machine is not in its operating cycle and should be unloaded if it has not been unloaded already. This red indicator also serves as a dark room safe light.

The energization of connection 112 also provides power to pushbutton switches 116 to permit direct manual operation of the electromagnetic drain valves 30 to provide for draining of residual liquids from the reservoirs 32-42 and cleaning of those reservoirs prior to the introduction of fresh liquids and solutions to those reservoirs. As soon as an automatic cycle of operation is again initiated by the operation of pushbutton 80, the application of power to connection 100 operates relay 82, opening the relay contact 82A and removing all power from connection 106 and the associated apparatus including the flasher 86, the buzzer 84, the relay 90, the indicator lamp 114, and the drain pushbutton switches 116. Thus, the drain pushbutton switches 116 are electrically interlocked with the automatic timer so that the reservoirs cannot be inadvertently drained and the solenoid valves associated with particular reservoirs cannot be actuated out of the desired sequence by inadvertent operation of the pushbuttons 116.

In FIG. 1, the portions of the apparatus shown within the dotted box 118 are preferably housed in a separate compartment in a preferred physical embodiment of the invention. That compartment may consist of a waterproof housing having a drawer containing the apparatus which may be pulled out for servicing and inspection. This arrangement is described more fully below in connection with FIGS. 2 and 3.

FIG. 2 is a front view showing a preferred physical arrangement of the apparatus of the invention. It includes, in particular, an enclosure case 122, which may preferably be of a generally rectilinear shape, and which includes a light-tight hinged cover, only partially indicated at 124. The cover 124 preferably forms most of the top of the casing 122 and most of

the front of the casing, as indicated in FIG. 2, and the cover generally has an interior which is concave to surround and provide space for the drum 11 and associated parts.

All of the parts previously described in connection with FIG. 1 and specifically illustrated in FIGS. 2, 3, and 4, are similarly numbered in those figures. Accordingly, these parts are not all described again in connection with FIGS. 2, 3, and 4.

Referring again to FIG. 2, the drive motor for the drum 11 is contained within a housing 11A. Since the temperature of the processing solutions is very critical, that temperature is preferably controlled by controlling the temperature of the drum 11. This may be accomplished by filling the drum with water and placing an electric immersion heater in that water inside the drum with a thermostatic control for that heater. A control unit for this purpose may be attached to the exterior of the case 122, as indicated at 126. Power and control wires may be extended, as shown at 128, from control unit 126 through a notch in the edge of the door frame portion of the casing 122, and into the hollow center hub portion of the drum 11.

The end of the conduit 28 which is visible in FIG. 2 is preferably composed of a resilient material, such as rubber, so as to accommodate for the tilting action of the tray 10. The end of the conduit 28 is preferably firmly secured to the front inside edge of the tray 10 by means of a metal spring clip 130. The casing 122 is preferably supported upon feet 132 which are composed of rubber.

FIG. 3 is another front view corresponding to the front view of FIG. 2, but with the drum 11 and associated apparatus removed from the casing 122, and showing parts of the casing in section to reveal certain details of construction. In particular, the lower front wall of the casing is removed at the central portion thereof to reveal the mechanism for lifting the tray 10 including the lever 16, the cam member 18, the inclined plane 20 and the connecting rod 22. The solenoid for this mechanism is located behind the panel including the switches 80, 88, and 110 and the lamps 104, 86, and 114. The cam 18 is shown in phantom in the operated position, and the lever 16 is shown in phantom at 16A in the operated position to tilt the tray 10. Additional switches, including on-off switches, and not previously identified, are indicated at the right side of the casing 122 at 134.

FIG. 4 is a rear view of the casing 122 further illustrating the physical arrangement of the apparatus of FIG. 2. The casing 122 preferably is provided with a double rear wall including an inner rear wall and an outer rear wall with the reservoir compartments 32-42 built between those rear walls. In FIG. 4, the outer rear wall has been removed to reveal the physical arrangement of the built-in compartments as well as the arrangement of the solenoid valves 30 and the metering valves 31 connecting with the conduit 28. A water inlet connection is shown at 136 to provide for the supply of water through solenoid valve 92 to the water reservoir 32. Since the water is admitted at ordinary domestic pressure, a small baffle box 138 is provided in the bottom of the reservoir 32 to prevent the incoming water from impinging upon the float 96 of the water level control to avoid instability in the float switch operation. An opening is provided at the top of each of the reservoirs 32-42. These openings may all be closed by a single hinged cover 140.

Referring back to FIGS. 2 and 3, the front bottom portion of the casing 122, on the left side, forms an enclosed drain sink system which receives and drains the contents of the tray 10 whenever that tray is spilled, or overflows. That portion of the bottom of the casing is in communication with a drain tunnel shown at 142 in FIG. 4 which extends to the outer back wall of the casing, and which is drained by a drain hose connection shown at 144.

As previously explained in connection with FIG. 1, the motor operated cam timer and all of the associated apparatus appearing in FIG. 1 within dotted box 118 are preferably housed within a removable equipment drawer. This drawer is

removable from the side shown at the left of FIG. 4, the switches 134 and 116 being mounted on the front face of that drawer, and the drawer being contained within an enclosure indicated at 146. The inside enclosure 146 protects the drawer and its equipment contents from the drainage liquids contained in the drain sink portion of the bottom of the casing previously described above. Not only is the above mentioned equipment drawer removable, but it preferably is electrically connected to the remainder of the apparatus by means of quick-disconnect plug connectors so that whenever servicing problems may involve the equipment within the drawer, a replacement drawer may be quickly substituted to maintain the equipment in operation.

A transparent gauge section 148 is provided in reservoir 42, so as to provide a visual indication of the amount of processing solution remaining in that reservoir. Since the solutions in all of the reservoirs 34-42 are used in substantially equal quantity for each operation cycle, an indication from only one of the reservoirs gives a reliable indication as to the remaining liquids in each of the reservoirs. However, if desired, transparent indicator gauges may be provided in each of the reservoirs 34-42.

While this invention has been shown and described in connection with a particular preferred embodiment, various alterations and modifications will occur to those skilled in the art. Accordingly, the following claims are intended to define the valid scope of this invention over the prior art, and to cover all changes and modifications falling within the true spirit and valid scope of this invention.

I claim:

1. Apparatus for the development of an exposed photographic medium comprising
  - a tray for successively receiving developing and other conditioning solutions for application to the exposed photographic medium,
  - a supply conduit arranged for conveying the solutions to said tray and having an outlet end arranged at said tray, said conduit having inlet connections arranged at spaced positions therein for the introduction of the different liquid solutions in sequence,
  - said conduit also including an inlet connection positioned at the extreme end of said conduit opposite to said outlet end for the introduction of water into said conduit and thereby into said tray,
  - a separate liquid inlet control means at each inlet connection,
  - automatic timing and control means operable to actuate said separate inlet control means for said inlet connections in sequence for introducing the different liquid solutions and water into said conduit from said inlet connections in timed sequence,
  - said automatic timing and control means being operable to control the introduction of water into said conduit after the introduction of each liquid solution,
  - means for tilting and thereby emptying said tray before each introduction and use of each liquid,
  - said timing and control means being operable to initiate the operation of said tilting and emptying means for said tray before the introduction of each liquid,
  - a rotatable drum associated with said tray and arranged to have the cylindrical surface thereof immersed in the liquid contained in said tray,
  - a motor connected for rotating said drum,
  - and means for holding an exposed photographic medium to be developed with the emulsion side facing the cylindrical surface of said drum above said tray so that liquids picked up by said cylindrical surface of said drum are carried to the photographic emulsion.
2. Apparatus as claimed in claim 1 wherein said drum includes heating means positioned within the interior thereof for maintaining an elevated processing temperature.
3. Apparatus for the development of an exposed photographic medium comprising

- a tray for successively receiving developing and other conditioning solutions for application to the exposed photographic medium,
  - a supply conduit arranged for conveying the solutions to said tray and having an outlet end arranged at said tray, said conduit having inlet connections arranged at spaced positions therein for the introduction of the different liquid solutions in sequence,
  - said conduit also including an inlet connection positioned at the extreme end of said conduit opposite to said outlet end for the introduction of water into said conduit and thereby into said tray,
  - a separate liquid inlet control means at each inlet connection,
  - automatic timing and control means operable to actuate said separate inlet control means for said inlet connections in sequence for introducing the different liquid solutions and water into said conduit from said inlet connections in timed sequence,
  - said automatic timing and control means being operable to control the introduction of water into said conduit after the introduction of each liquid solution,
  - means for tilting and thereby emptying said tray before each introduction and use of each liquid,
  - said timing and control means being operable to initiate the operation of said tilting and emptying means for said tray before the introduction of each liquid,
  - said automatic timing and control means comprising a motor-operated multiple cam switch having an adjustable cam for each liquid to be controlled,
  - said automatic timing and control means also including a solenoid valve for each conduit inlet operable to the open position in response to an associated cam-operated switch,
  - said tilting and emptying means comprising an electromagnetic solenoid and said motor-operated cam switch including a cam switch element connected to control the operation of said tilting and emptying means solenoid.
4. Apparatus as claimed in claim 3 wherein said tilting and emptying means additionally comprises an operating shaft connected to said tilting and emptying means solenoid,
  - a camming device connected for movement by the pulling of said shaft,
  - an inclined plane associated with said camming device and providing for movement of said camming device up said inclined plane,
  - the resultant upward movement of said camming device being conveyed to said tray for tilting and emptying said tray.
  5. Apparatus as claimed in claim 3 wherein separate reservoirs are provided for each of the liquids to be conveyed to said tray and wherein said solenoid valves are arranged as drain valves for said reservoirs to provide gravity flow of the liquids from said reservoirs through said conduit as said solenoid valves are opened.
  6. Apparatus as claimed in claim 5 wherein the connections from said liquid reservoirs to said conduit inlet openings each include an adjustable metering orifice whereby the rate of flow of liquid may be adjusted to obtain the desired total volume of liquid during the period when the associated solenoid valve is open in the automatic cycle of operation controlled by said cam switch.
  7. Apparatus as claimed in claim 5 wherein said apparatus is housed within a light-tight box and wherein said reservoirs are formed as integral compartments of said box.
  8. Apparatus as claimed in claim 5 wherein there are provided separate manually operable switches for initiating the operation of each of said solenoid valves for the purpose of draining and cleaning the solution from the associated reservoir.
  9. Apparatus as claimed in claim 8 wherein

there is provided an interlock means operable during the operating cycle of said cam switch for disabling the circuits of said manually operable switches to thereby prevent manual operation of the solenoid valves during the cycle of operation of said timing and control means. 5

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