May 5, 1964 R. R. MURRAY 3,131,621

PHOTOGRAPHIC FILM OR PAPER PROCESSING MACHINE

Filed Nov. 17, 1960 4 Sheets-Sheet 1

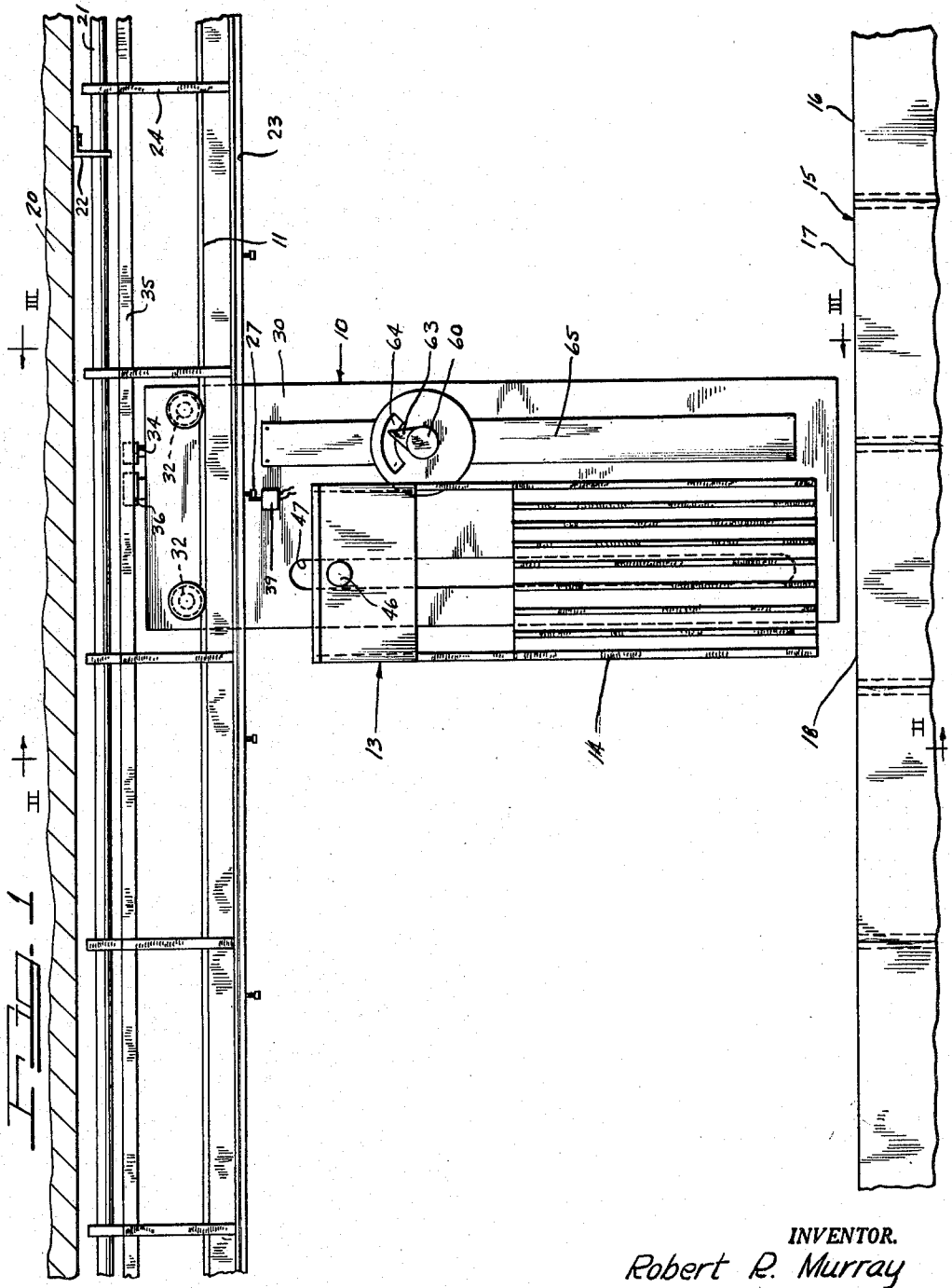


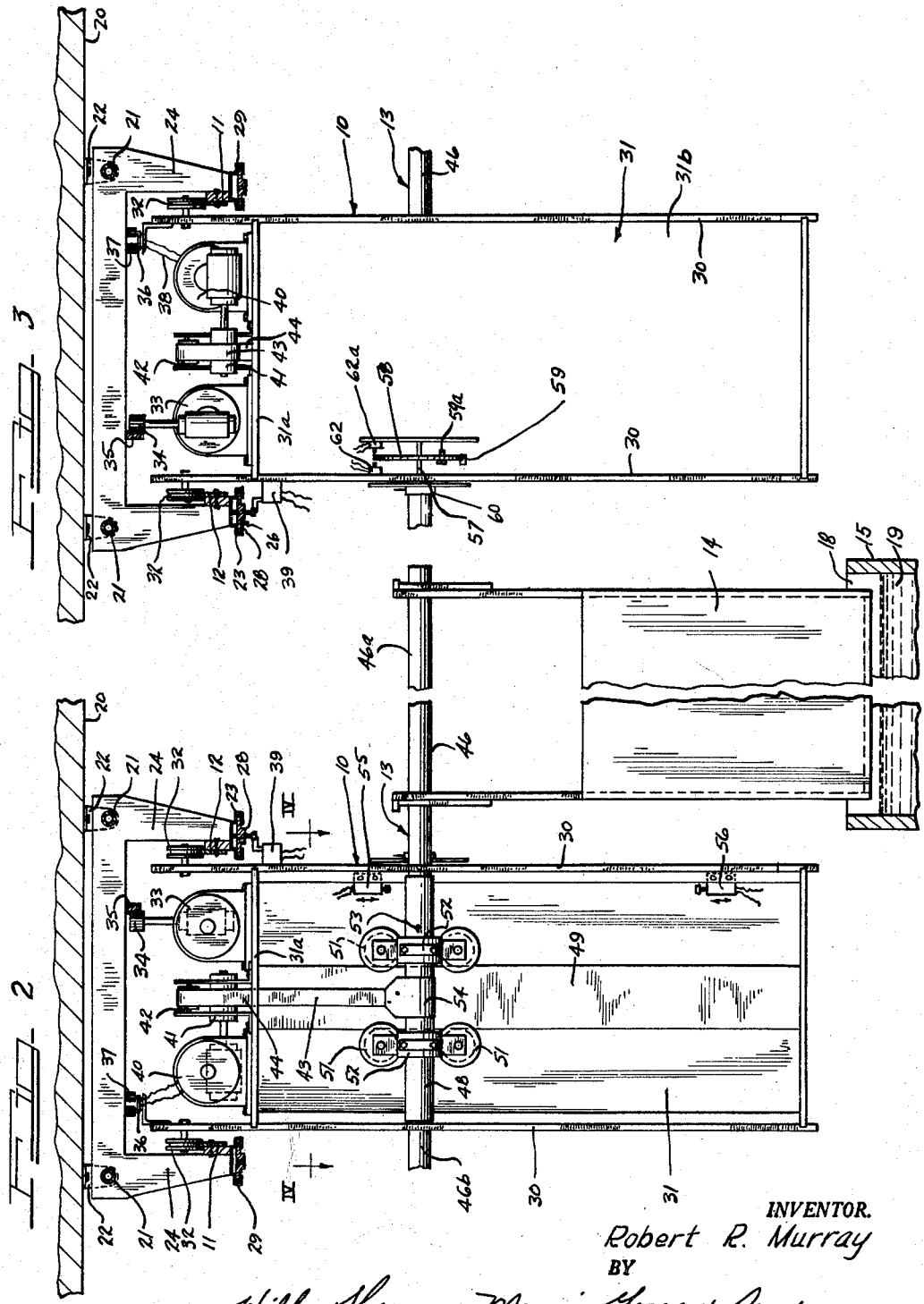
Fig. 1

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FIG. 4

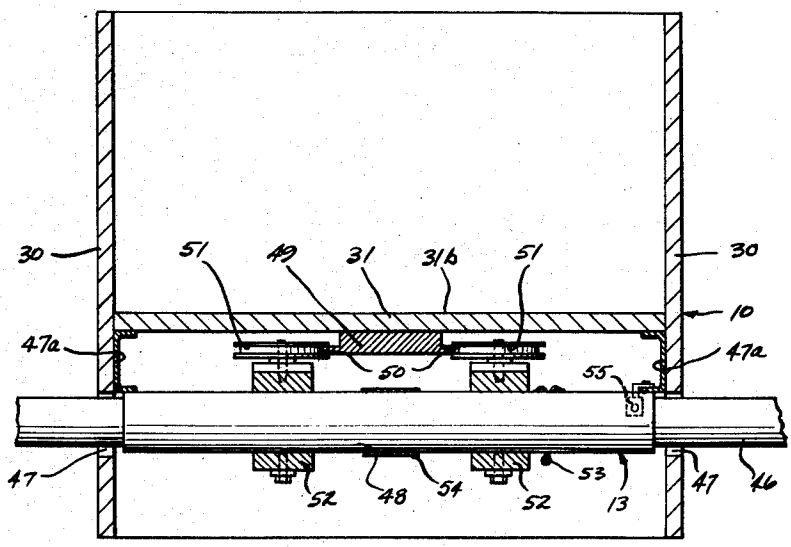
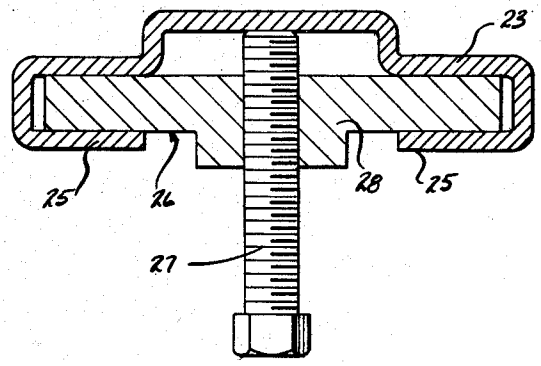


FIG. 5

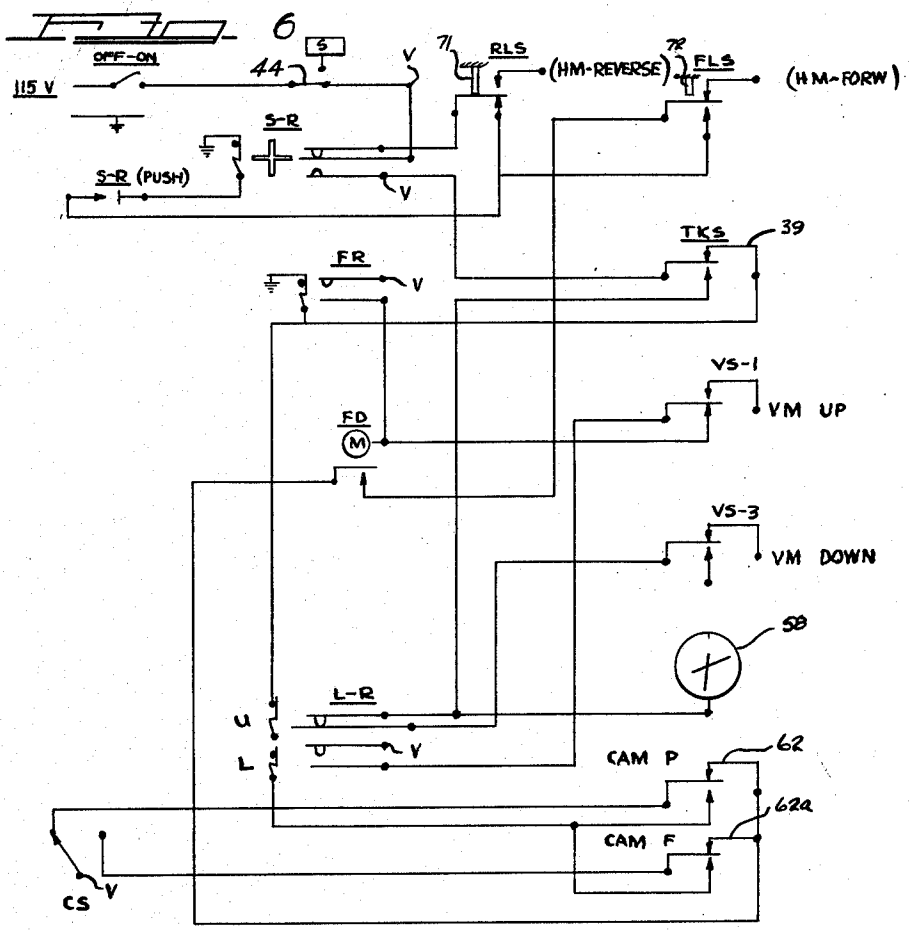


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PHOTOGRAPHIC FILM OR PAPER PROCESSING MACHINE

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1 Claim. (Cl. 95—89)

The present invention relates to improvements in photographic processing or developing machines.

More particularly the invention contemplates the provision of an automatic developing machine which will carry either paper or film over a set of processing tanks and insert either the paper or film into each one of successive tanks for a presettable time to automatically complete the developing process. A preferred embodiment of the invention incorporates a carriage horizontally movable on tracks along a developing path. On the carriage is a carrier which on one side supports film or on the other side supports paper so that the mechanism can selectively develop either film or paper. Stops are provided for automatically stopping the carriage at successive developing stations along the path with a container with developing fluid located at each station. The carrier automatically descends at each station to dip the paper or film into a tank and can be automatically moved up or down at the station to agitate the fluid in the tank. At the end of a preset time the carrier lifts the paper or film out of the tank, and moves it to the next station to lower it into the container at that station.

A general objective of the invention is to provide an improved automatic machine of the type described which is more reliable and simple in construction and operation, and which is less expensive to construct than machines heretofore available.

Another object of the invention is to provide a photographic developing machine which can be preset to establish the times that film and paper are to be subjected to successive fluids for developing processes with the preset times retained and the machine alternately used for either film or paper without disturbing said preset times.

A further object of the invention is to provide a developing machine in which either film or paper can be handled and parts of the machine serve dual purposes for developing.

A still further object of the invention is to provide an automatic developing machine wherein unique and simplified timing and control elements are provided for determining the handling and treatment of the material being developed.

A still further object of the invention is to provide a developing machine which is easily preset as to the time for various development steps of a process and wherein the development times can be readily changed and further wherein once the machine is set for a particular process it automatically resets itself for that process.

A still further object of the invention is to provide a development processing machine which will accommodate different methods of agitation of the fluid in which the material is developed.

Other objects and advantages will become more apparent with the teaching of the principles of the invention in connection with the disclosure of the preferred embodiment in the specification, claims and drawings, in which:

FIGURE 1 is an elevational view shown in somewhat schematic form of a developing mechanism constructed in accordance with the principles of the present invention;

FIGURE 2 is a vertical sectional view taken substantially along line II—II of FIGURE 1;

FIGURE 3 is a vertical sectional view taken substantially along line III—III of FIGURE 1 and with portions of the electrical control mechanism removed to simplify the illustration for clarity;

FIGURE 4 is a horizontal sectional view taken substantially along line IV—IV of FIGURE 2 with portions of the electrical control circuitry removed;

FIGURE 5 is an enlarged detailed sectional view showing one of the stops of FIGURES 2 or 3; and

FIGURE 6 is a wiring diagram showing the control circuit for the machine in simplified form.

As shown on the drawings:

A carriage **10** is guided for horizontal movement along a developing path, being guided on tracks **11** and **12**. The mechanism is used for developing either film or paper and a carrier **13** is supported on the carriage with means in the form of a hanger **14** on the carrier for dipping the elements into tanks or containers **15** positioned along the developing path. Individual tanks are shown at **16**, **17** and **18** which may be referred to as developing stations along the path. The tanks or containers are shown with a liquid **19** and, as will be appreciated by those skilled in the art, the successive tanks which constitute successive developing stations along the path contain different liquids for completing and carrying out the developing process. Other fluids such as gases may be placed in the containers depending upon the process used. The row of tanks **15** is positioned along one side of the developing path and another row of containers may be positioned along the other side with one row provided with chemicals for developing film and the other for developing paper. A selector switch, as will be described, is set to control the operation and determines the process used dependent upon whether film or paper are handled.

The carriage is supported on its tracks from an overhead support such as a ceiling **20** and horizontal rods **21** are supported from the ceiling brackets **22**. Yokes **24** are mounted at spaced intervals along the rods **21** for supporting the tracks **11** and **12**. Along one of the tracks is a rail **23** having adjustable stops **26** mounted thereon which determine the locations at which the carriage **10** is stopped for lowering the film or paper into the developing tanks **15**.

The rail **23**, FIGURES 2, 3 and 5, is substantially U-shaped and has lower inwardly turned edges **25** to slidably support stop plates **28**. Each of the individual plates has a locking bolt **27** threaded therethrough and which when tightened bears against the base of the rail **23** to lock the stop **26** in place. The bolts are engaged by a switch **39** mounted on the carriage and connected to stop the carriage when actuated. Containers or tanks **15** may be placed along one side of the developing path for developing film and along the other side for developing paper. The spacing of the tanks is the same so that the same rail **23** will serve as a stop control for either film or paper. However, another rail **29** may be positioned on the other side of the carriage having its own individual stops if different spacing is to be used for the tanks on the other side of the carriage. If the rail **29** is used another control switch, not shown, is positioned on the other side of the carriage and will have to be incorporated into the control circuit, as will be apparent from the later description of the control circuit of FIGURE 6.

The carriage, supported from the tracks **11** and **12** includes side plates **30** secured to the edges of a cross plate **31**, and at the upper ends of the side plates are rollers for riding on the tracks.

The carriage **10** is intermittently propelled along the developing path by a carriage motor **33** mounted on a support plate **31***a*, FIGURES 2 and 3. The carriage motor **33** drives a pinion gear **34** in mesh with a rack

35 which is supported on the yokes 24 and extends along the developing path above the carriage.

Electrical energy for driving the motor 33 is derived from a sliding brush 36 riding against a conducting overhead track 37 also mounted on the yokes 24. Suitable leads 38 connect to the motor 33 and to a carrier motor 40 which lowers and raises the carrier at developing stations. The carriage is stopped at each of these stations by the switch 39 which engages the adjustable stops 26 at each station. Each of the motors 33 and 40 incorporates a dynamic brake to prevent overtravel.

The carrier motor 40 drives a winch drum 41 over which is wound a belt or cable 43 that passes over an idler pulley 42 and depends downwardly, as shown in FIGURE 2, to support the carrier thereon.

The weight of the carrier holds the belt 43 taut and in engagement with a safety switch 44. This switch stops the operation of the machine and activates a signal, shown at S in FIGURE 6 when the movement of the carrier 13 is blocked so that the belt becomes loose. This will prevent the hanger 14 from resting on the top of the tanks as it is lowered in the event the tank becomes displaced. It also prevents damage to any of the mechanism as would be caused if a positive drive were employed.

The carrier 13 includes a horizontal carrier rod 46 having laterally extending portions 46*a* and 46*b*. As illustrated, the portion 46*a* supports the hanger 14 which is pivotally suspended therefrom so that it freely depends downwardly and can be slid off of the rod. The hanger 14 is adapted for carrying paper and the portion 46*b* of the carrier rod is adapted for a similar carrier for supporting film. The rod extends through slots 47 in the plates 30 at the side of the carriage and U-shaped bearing plates 47*a*, FIGURE 4, are also mounted to aid in guiding the carrier 13.

A vertical plate 49 is mounted on the plate 31 on the carriage and has vertical guide edges 50 over which are straddled grooved rollers 51 for positively guiding the carrier rod 46. The grooved rollers are rotatably supported on members 52 clamped to the carrier rod 46, and for convenience pillow blocks may be employed for this purpose, clamped over a sleeve 48 through which the rod 46 is slid. A pin 53 extends through aligned holes through the sleeve 48 and rod 46 for locking it in place, FIGURE 4. The belt 43 is secured to the sleeve by a clamp 54.

The vertical movement of the carrier 13 is limited at the upper end by an upper limit switch 55 and at the lower end of its travel by limit switch 56, FIGURE 2. The switches are vertically adjustable on the carrier. The operation of these switches will become clear in the description of FIGURE 6.

The time for which the films or paper are immersed in each of the containers is controlled by a circular timing plate or disk 58 having notches along its edges for switch operating clips 59 and 59*a*. The timing disk 58 is rotatably mounted on a shaft 57 which is suitably driven by a timing motor, not shown, and which can be manually set by a knob 60, FIGURE 1. The knob 60 has a pointer 63 movable over a dial 64 mounted on a control panel 65, which may also provide a mount for a starting switch and indicator lights. The timing disk 58 rotates uniformly and the clips 59 and 59*a* are mounted on the disk so that they project to either side to engage and operate switches 62 or 62*a* respectively, with one of the switches being provided for the process for developing film and the other switch being provided for the process for developing paper.

Each of the switches in FIGURE 6 is shown in the starting position of the carriage. Letter designations are given each of the electrical components of the circuit and where they appear in FIGURES 1 through 5 they are also indicated by numerals for identifying their locations on the machine. For simplifying the drawing, one side of the circuit is indicated as being grounded and

the wires for this side of the circuit are omitted. Also, the letter V is shown at the ends of several leads to indicate that these leads are connected to the positive side of the line. Each of the switches RLS, FLS, TKS, VM-Up and VM-Down are spring biased and operated by stops. The switch RLS is moved to the position shown by a stop 71 when the carriage reaches the beginning end of the tracks. Similarly, the switch FLS is moved out of the position shown and against the other contact when the carriage reaches the completion end of the tracks to thereby stop the motor. To move the carriage from the end of the track back to starting position, a push button S-R(Push) is closed thus moving the step relay switch S-R so that the switch arm moves against the upper contact, as shown, to complete the circuit to the reverse side of the motor HM-Reverse through switch RLS. Before again running the machine through its forward cycle the push button S-R is pushed to move the step contact so that the switch arm is moved against the lower terminal.

In starting the machine the selector switch CS is turned to a position depending upon whether film or paper are to be processed. This closes a circuit through either the switch labeled CAM P (switch 62) or the switch labeled CAM F (switch 62*a*). These cam switches are shown in the machine as embodied in a unit apparatus in the form of the timing disk 58 with the clips for operating switches 62 or 62*a* and the switches are identified in both FIGURES 3 and 6.

For purposes of the explanation, the selector switch CS is shown set to complete the circuit through CAM P, switch 62, for processing paper.

In starting the machine, an Off-On switch is closed to complete the circuit through the switch of CAM P, through a delay switch FD, and through a switch FLS to HM-Forward to start moving the carriage horizontally forward. The FD time delay switch will have been closed by the closure of a relay switch FR through a switch TKS. HM-Forward is the lead for operating the carriage motor 33 in a forward direction and HM-Reverse is the lead for operating the motor 33 in a reverse direction.

As the carriage moves forwardly, the switch TKS is actuated by engaging the first of the adjustable stops 28 on the rail and this locates the carriage over the first tank 16. The engagement of the switch TKS immediately starts the Timer through a switch LR. The bar 46 is lowered to lower the paper being developed into the first tank by completion of the circuit through switches LR and VS–3. As the bar descends and when the paper is lowered into the tank the limit stop switch VS–3 will be opened. Switch VS–3 connects to lead VM-Down which connects to the motor 40 operating it in a direction to lower the carrier 13. Switch VS–1 connects to a lead VM-Up which operates the motor 40 in a direction to raise the carrier 13.

The length of time that the paper will be immersed in the tank is determined by the Timer setting or, in other words, by the selective positioning of the clips 59 on the timing disk.

If mechanical agitation is used, an agitation circuit may be provided connected to the circuit of FIGURE 6 to raise and lower the bar 46 for agitating the liquid in the tanks. Agitation timer motors are connected to be actuated when the carriage is stopped at a developing station and agitation cam switches are also connected for timing or controlling the raising and lowering of the carrier. As will be appreciated by those skilled in the art various agitation arrangements may be employed.

Thus, during agitation the bar 46 will be raised and lowered several times at a rate and frequency and for a distance which is predetermined and dependent upon the process and the chemicals used. This circuit is of course incorporated in the circuit of FIGURE 6 but is omitted for the sake of clarity from FIGURE 6. Other arrangements may also be added or substituted if gas is used.

When the proper time has elapsed, the switch 62 of CAM P is actuated energizing the relay coils L and U to operate switches LR. When the lower contact of switch LR is closed, the circuit through switch VS–1 is completed to raise the bar 46 and when the bar reaches its uppermost limit the switch VS–1 is automatically moved to the position shown in FIGURE 6 to stop the vertical motor 40 and complete the circuit through the time delay switch FD. After a time delay, switch FD closes completing the circuit through switch FLS to again move the carriage forwardly to the next stop. The delay permits the paper to drip. When the carriage reaches the next stop, switch TKS is actuated and the cycle then repeats itself.

As a brief summary of operation, the operator starts the machine by turning on the On-Off switch of FIGURE 6. The carriage 10 automatically begins travelling along the rails 11 and 12 until the first stop 26 is reached to actuate the switch 39 which is carried on the carriage. At that point the carrier 13 descends to dip the hanger 14 into the first tank 16 and its descent is stopped by the switch 56, FIGURE 2. The carrier will move up and down to agitate the liquid 19 in the tank while the carriage is stopped, and after a predetermined time, as controlled by the setting of the clip 59 on the timing disk 58, the carrier will lift the hanger from the tank, pausing to let the liquid drip therefrom, and the carriage will then move onto the next developing station. At the end of the path it will stop with the developing process having been completed and the operator will unload the hanger 14 and run the carriage back to the starting end of the path.

Thus it will be seen that I have provided an improved photographic developing machine which meets the objectives and advantages hereinabove set forth. The mechanism is simple and reliable in operation and is inexpensive to construct, being fully adaptable to different processes and different materials with a minimum of adjustment. Additional tanks or larger tanks may be employed with additional hangers so that greater volumes of film or paper may be handled for each operation of the machine. The electrical control system is relatively uncomplicated and is positioned for easy servicing with the elements being mounted on the face 31*b* of the plate 31. The individual electrical elements are omitted for simplifying the drawings.

The machine may be equipped to accommodate three different methods of agitation of the developing fluid, namely gas, mechanical up and down, and drain-tilt. The agitation stroke of course can be varied as to its height in frequency. In all types of agitation, the film and paper are preferably agitated for fifteen seconds immediately after immersion into the solutions. As will be apparent from the foregoing description, where gas agitation is already installed, mechanical agitation need not be incorporated in the machine.

The machine can be produced as a standard unit readily adapted to requirements of individual film or paper

processing locations. For example, the vertical switches 55 and 56 are mounted vertically adjustable so that adjustment to the height of support for the tanks can be simply and quickly made and the overhead supports can be firmly secured without necessity of further adjustment of these parts.

As will be apparent to those skilled in the art, while the machine is illustrated as being used interchangeably for two processes, it could be readily adapted for additional processes by the addition of another timing plate having clips set for the additional processes and operating separate individual switches which are selectively connected into the circuit by a selector switch. This of course provides a machine which can be used for black and white, for color, for films, for paper, and for plates, and a single machine could easily be used for all of the different processes available on the market and the different materials.

The drawings and specification present a detailed disclosure of the preferred embodiments of the invention, and it is to be understood that the invention is not limited to the specific forms disclosed, but covers all modifications, changes and alternative constructions and methods falling within the scope of the principles taught by the invention.

I claim as my invention:

A photographic developing machine comprising in combination, a carriage, means moving said carriage along a developing path stopping the carriage at each one of a succession of developing stations arranged along said path, a frame on said carriage, a winding drum on the carriage, a reversible motor having driving connection with said winding drum, a flexible belt wound in and paid off of said drum, a carrier guided in said frame for vertical movement therealong and connected with said belt and raised and lowered with respect to said frame by said belt and adapted to carry photosensitive material in depending relation with respect thereto, a pair of vertically spaced limit switches engaged by said carrier in extreme limits of the up and down movement thereof and limiting raising and lowering movement of said carrier, a third limit switch, an engaging connection between said belt and said third limit switch maintaining said limit switch closed to maintain an energizing circuit to said motor when said belt is taut, and opening to deenergize said motor upon slackening of said belt due to engagement of said carrier with an obstruction.

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