April 27, 1948. C. R. TURNER 2,440,314

METHOD AND MEANS FOR PHOTOGRAPHIC DEVELOPING OR THE LIKE

Filed March 6, 1944 3 Sheets-Sheet 1

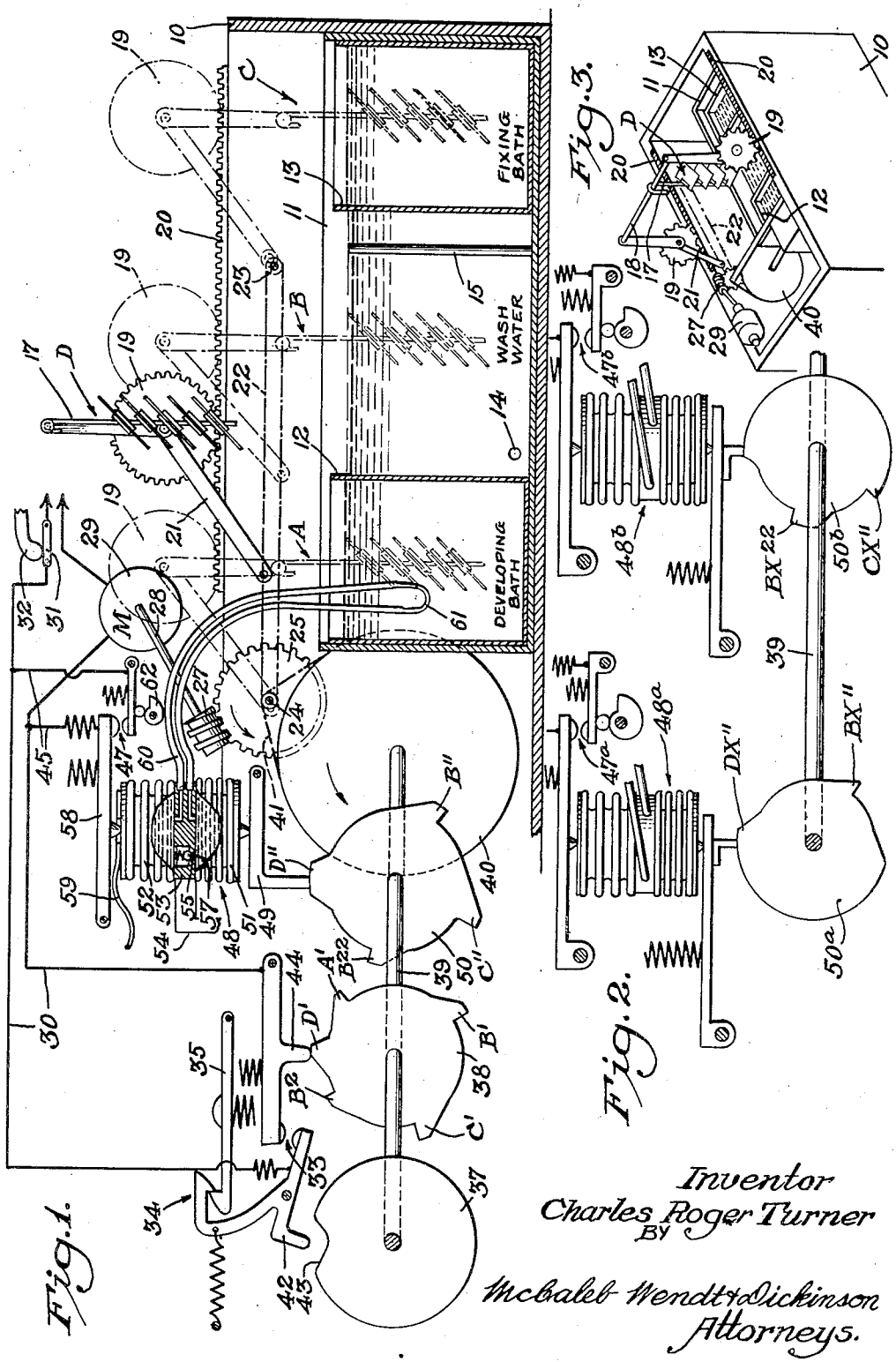


Fig. 1.

Fig. 3.

Fig. 2.

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Fig. 4.

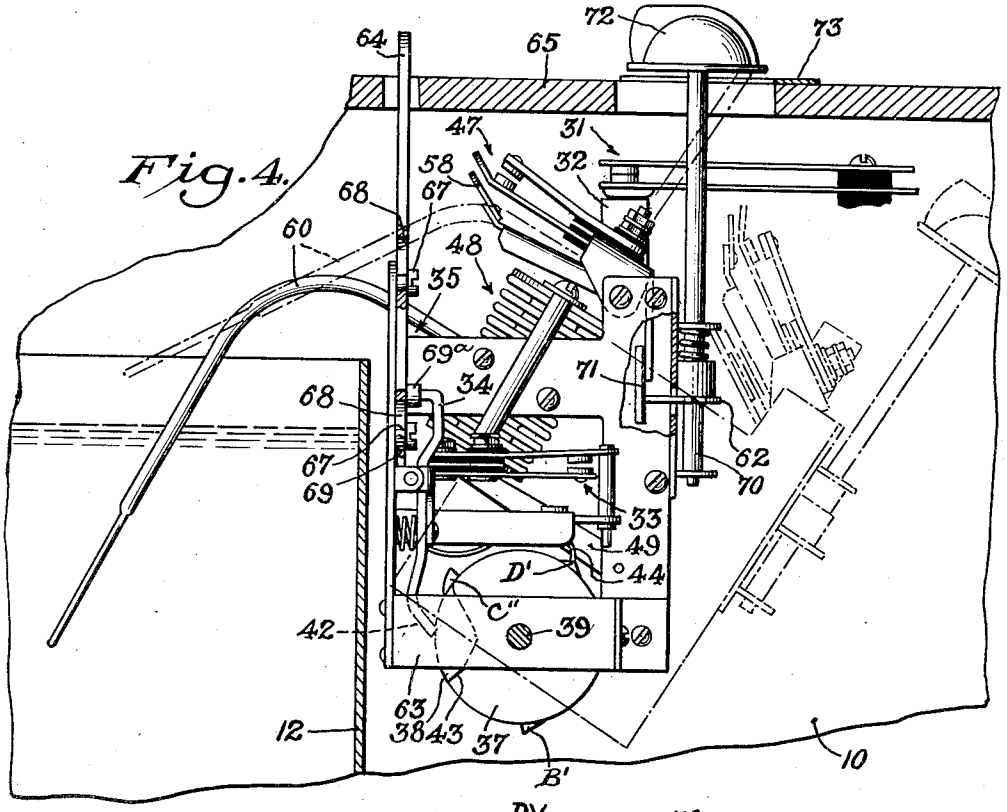
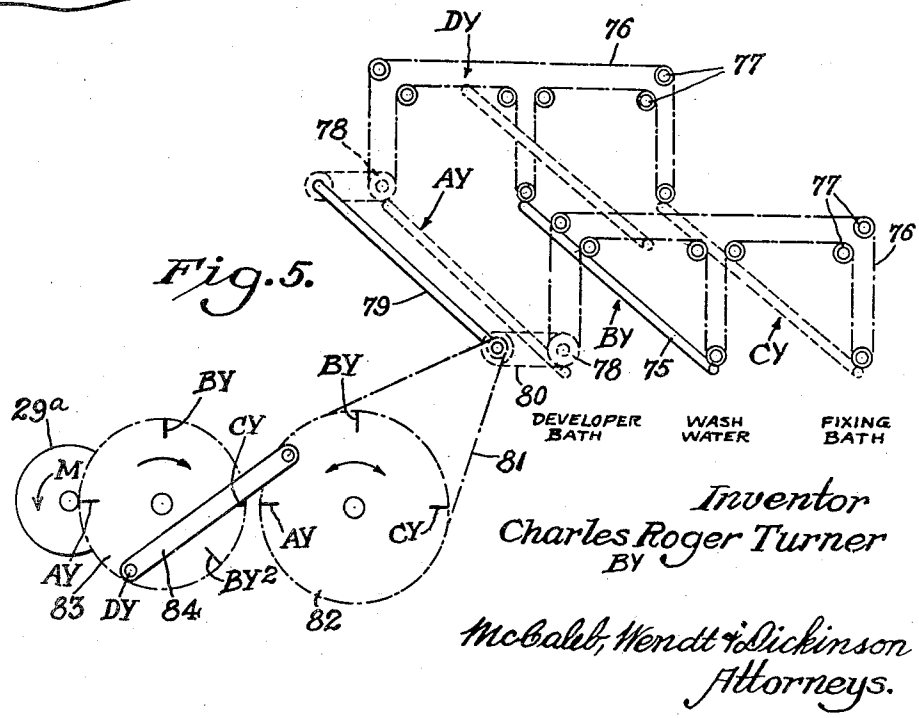


Fig. 5.



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Fig. 6.

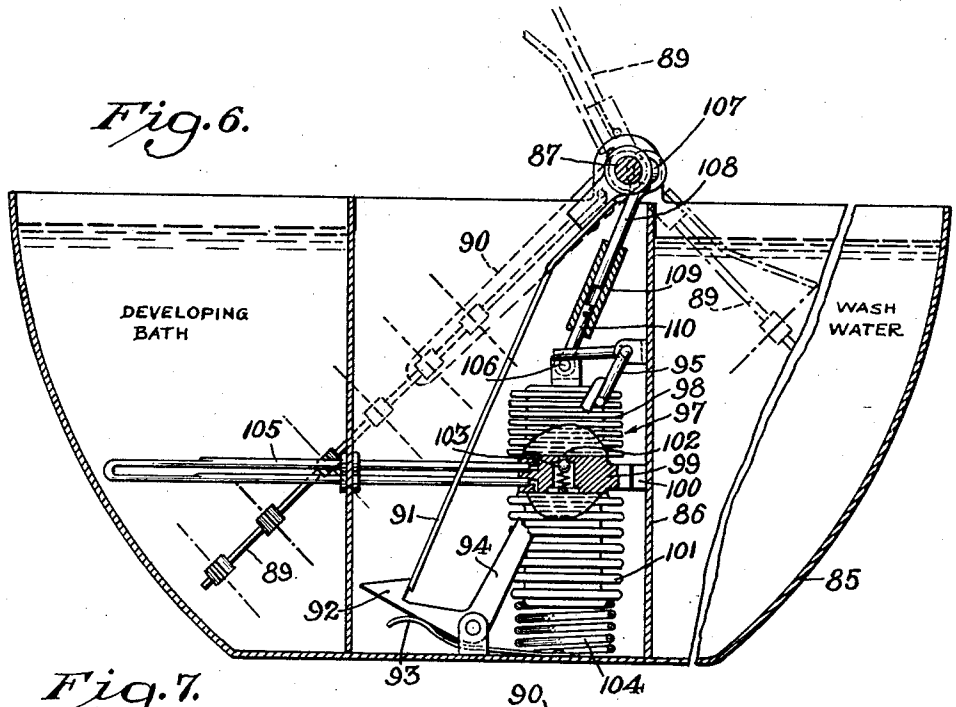
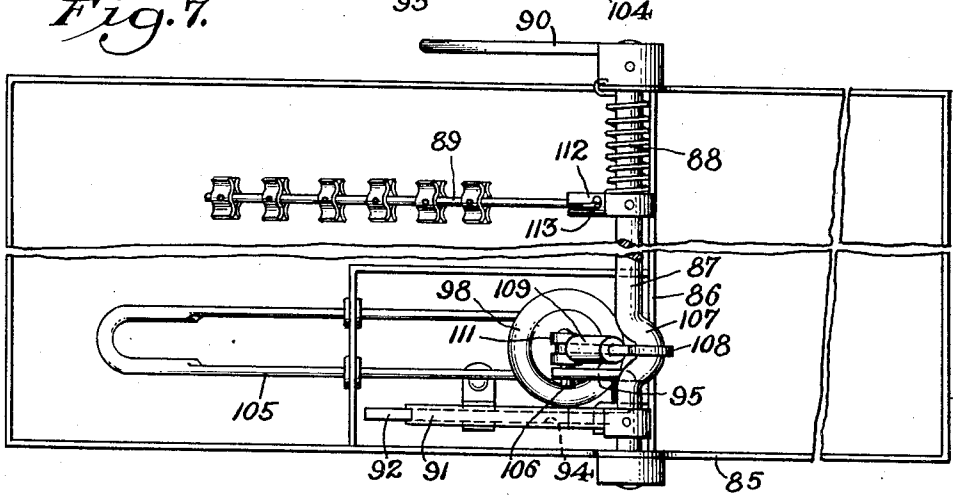


Fig. 7.



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UNITED STATES PATENT OFFICE

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METHOD AND MEANS FOR PHOTOGRAPHIC DEVELOPING OR THE LIKE

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Application March 6, 1944, Serial No. 525,166

19 Claims. (Cl. 95—89)

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This invention relates to a new and improved method and means for handling articles under conditions of treatment where temperature variations in certain respects are vital to the results desired, such as in the art of photographic developing, or like chemical treatment.

A principal object of the present invention is to gain more uniform and accurate control than with prior expedients over the time-temperature relationship in such processes as employ a fluid of variable temperature, as for example the chemical solutions used in the development of photographic or X-ray films, plates and prints, or in such other instances where the end results are entirely dependent upon the action or reaction of a fluid, or rather the active ingredients in the fluid, the activity of which is accelerated or decelerated in response to temperature variations.

Another object is to provide a cyclical method and means for conducting the articles to be treated into a treating zone or series of such zones subject to temperature variations of such character as to have an effect upon the end result of the treatment, and to condition the duration of the cycle or various intervals in the cycle relative to the prevailing zone temperature.

Another object is automatically to progress articles to be treated through a plurality of treating zones which may be subject to the same or respectively different temperature conditions during the intervals of treatment to which the articles are subjected in such zones, and varying the intervals of treatment in the zones to compensate for temperature variations.

Another object is to provide a novel method and means for timing an operating interval or processing step involving the action of a fluid subject to temperature variations of such character as to influence the results of the fluid action, which includes a hydraulic timing system featured by the conducting of timer fluid directly through the fluid of variable temperature to attain correlation of the timing interval with the temperature-influenced action of the variable fluid.

A further object is to provide a novel article treating apparatus utilizing power motivated mechanical and hydraulic features for attaining uniform results in the treatment accurately compensated for variations in temperature which would otherwise have an undesirable effect upon the results of the treatment.

Still another object is to provide improved temperature-compensated hydraulic timing control for combined mechanical and electrical apparatus.

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Another object is to provide novel hydraulic operation-timing and movement braking means.

Other objects, features and advantages will become apparent in the description and from the accompanying drawings in which:

Figure 1 is a diagrammatic representation of a hydraulically timed, intermittently operable power-actuated photographic developing apparatus according to the invention;

Fig. 2 is a diagrammatic showing of a modified organization of a portion of the apparatus disclosed in Fig. 1;

Fig. 3 is a diagrammatic perspective view on a small scale to afford a better understanding of the article carrying and conveying structure of the apparatus in Fig. 1;

Fig. 4 is a side elevational view of an operation-controlling and timer unit including the features of the apparatus diagrammatically shown in Fig. 1;

Fig. 5 is a diagrammatic illustration of a modified apparatus;

Fig. 6 is a fragmental side elevational view partly in section, of another modified form of apparatus embodying features of the invention, and

Fig. 7 is a top plan view of the apparatus shown in Fig. 6.

By way of example, the invention may be applied to the processing of photographic units or articles such as films, plates or prints and involving subjecting the sensitized emulsions of the articles to the action of various chemical and washing baths within a treating zone. All of the steps of the process in the treating zone are adapted to be carried out intermittently in timed sequence in an automatic operating cycle. Each step in the cycle is properly timed hydraulically in a novel manner which accurately compensates for variations in temperature in the treating zone. To this end the controlling fluid of a hydraulic timing system is conducted directly through the treating zone, such fluid being of a viscosity that is sensitive to temperatures of the range encountered in said zone so that the duration of the time intervals of treatment of the articles in the zone will accurately reflect the temperature existing at any given time in the zone or a selected portion of the zone. Thus, as the viscosity of the timing fluid varies with temperature changes in the treating zone, there is a corresponding lengthening or shortening of the interval of treatment for which the system is initially set.

In photographic processing, of course, a certain interval can be predetermined during which

the photographic article must remain, for example, in the developing bath at an optimum temperature. A lower temperature than optimum requires lengthening of the development interval, a higher temperature requires that such interval be correspondingly shortened. It is quite difficult, if not impossible, to maintain the developer solution at the predetermined optimum temperature. For that reason, the present invention, which attains minutely accurate compensation for deviation from the predetermined optimum temperature, is particularly valuable for obtaining substantially perfect results in development.

As shown in Figs. 1 and 3, a photographic developing apparatus embodying the features of the invention may include a relatively large receptacle 10 containing an elongated solution tank 11. At one end of the tank is a smaller tank 12 adapted to contain developer bath and at the other end is a second smaller tank 13 for fixing bath. The space intervening between the tanks 12 and 13 may be utilized for wash water that may be maintained clean and in circulation by a fresh supply entering through an inlet 14 while the used water is carried away through an overflow drain 15.

Photographic articles to be processed are loaded upon one or more preferably multi-clamp carrying racks 17 adapted to be removably hooked over a conveyer bale 18 which has its ends fixedly assembled with respective axially aligned traveler gears 19 riding in tracks provided at the upper side edges of the receptacle 10 and having racks 20 engaged by the gears. By driving the traveler gears 19 along the racks 20, the conveyer bale 18 is caused to swing about the axis of the gears 19 and dip down toward the tank 11 and emerge above the receptacle 10 alternately, thus carrying the article rack or racks 17 into and out of the tank 11.

The construction and cooperative relationship of parts are such that two full revolutions of the traveler gears 19 will swing the bale 18 to dip it alternately into and out of all of the alternate baths in the tank 11. Thus, from a starting or loading position D, the bale 18 is successively swung into developing position A, next, by one full revolution of the traveler gears 19 into washing position B, followed by another full revolution of the gears to swing into fixing bath position C; then one revolution reversal of the gears to return it to washing position B; and finally, by a half revolution return of the traveler gears to return it to the starting position D for unloading and reloading.

Cyclical operation of the conveyer may be accomplished through the medium of a driving link 21 connecting the conveyer structure as shown in Figs. 1 and 3 to an endless type flexible driving element such as a chain 22 running over a pintle gear 23 defining one end of an elongated run and a driving gear 24 defining the opposite end of its run and keyed to or otherwise connected to a worm gear 25 driven by a worm 27 which is motivated through a shaft 28 by a motor 29. In this way, although the motor 29 drives in but one direction, the link 21 following the endless chain 22 nevertheless drives the conveyer back and forth through the various operating positions of each cycle.

Means for controlling and timing operation of the motor 29 preferably comprises a combination of mechanical, electrical and hydraulic features. Electrical energy from any suitable source is supplied for operating the motor 29 through a primary circuit 30 containing a normally open type of master switch 31 which, during operation of the apparatus, is adapted to be held closed by a switch closer 32. In control of the primary circuit 30 is an intermittently operable switch 33 which is adapted to be maintained open by a trigger type of latch 34 during periods of inactivity of the apparatus. Manual release of the latch 34 to initiate a cycle of operation of the apparatus is effected through the medium of a digitally operable release member 35. Thereafter automatic intermittent opening and closing of the switch 33 is accomplished by means of a set of actuating cams 37 and 38 carried by a cam shaft 39 mounted to be driven counterclockwise as seen in Fig. 1 by a rotary driving element 40. The latter may be a gear drivingly connected as by means of an endless transmission element such as a chain 41 engaging over or meshing with a driven element or sprocket adjacent to and permissibly forming part of the sprocket 24 which rotates with the worm wheel 25.

When the switch 33 is initially closed by release of the trigger latch 34, a cam follower 42 on the latch trigger enters a starting notch 43 in the cam 37. This overcomes the open condition of the switch 33 existing at the termination of the preceding operating cycle, coincident with which a lobe D' on the cam 38 engages and holds in switch-opening position a switch-controlling cam follower 44. Now, with the switch initially closed, the primary circuit 30 energizes the motor 29 and drives the apparatus to move the article carrier 17 into the developing position A. In the course of this movement, the cam follower 42 leaves the starting notch 43 and rides onto the periphery of the cam 37 whereby to reset the latch 34. But while this is taking place, the cam follower 44 leaves the lobe D' and the switch 33 as a result remains closed, being opened again at the proper point in the cycle by engagement of the switch-controlling follower 44 by a lobe A' on the cam 38. This then breaks the primary circuit 30, the motor 29 is de-energized and the article carrier 17 becomes stationary while developing of the articles carried thereby proceeds.

After a sufficient interval for developing to be completed, a secondary circuit 45 is closed by the closing of a switch 47 to energize the motor again to drive the apparatus through the next step in the cycle, that is, to move the article carrier 17 from the developer solution into the washing water at position B. The switch 47 is under the control of a timing unit 48 which is arranged to be cocked or set for each timing interval by a cam follower 49 riding a cam 50 in the set carried by the cam shaft 39. At start of a cycle of operation the cam follower 49 is engaged by a lobe D'' upon the cam 50 and thus is set for the developing phase of the cycle, the secondary circuit switch 47 being open. Then, after the apparatus has come to rest in the developing position A, the timer 48 completes its development timing cycle, allowing the switch 47 to close and initiate the second phase in the operating cycle of the apparatus. In this second phase the switch-controlling follower 44 leaves the lobe A' of the cam 38 to close the primary circuit switch 33, the timer-cocking follower 49 is engaged by a lobe B'' to set the timer for the washing interval that follows development and open the secondary switch 47, and closely following this the switch controlling follower 44 is engaged by a tripping lobe B' on the cam 38 and the

apparatus comes to rest with the article carrier 17 in the washing position B.

After the washing interval has run out, the timer 48 again allows the secondary switch 47 to close so that the motor 29 drives the apparatus through the next phase in the operating cycle during which the timer 48 is again cocked by engagement of the cocking follower 49 by a lobe C'' on the cam 50, and closely thereafter a lobe C' on the cam 38 again trips the switch controlling follower 44 to open the switch 33, the apparatus coming to rest with the article carrier 17 in the fixing bath position C. Since the fixing bath requires a longer interval in the processing of the article than developing, the lobe C'' is preferably higher than the other lobes of the cam 50 so as to cock the timer 48 for a longer timing cycle, thereby increasing the length of the fixing interval over the developing and washing intervals of the cycle of operation.

At the end of the fixing interval, the apparatus is again actuated by repetition of the intermittent operation through closing of the secondary switch 47 so that as the motor 29 then drives the apparatus to return the article carrier 17 to the washing position B, the timer 48 is again cocked by engagement of a lobe B^{22} with the cocking follower 49, whereafter a lobe B^2 on the cam 38 trips the switch-tripping follower 44 and brings the apparatus to rest in the washing position. After termination of the final washing interval, the motor 29 is again energized by closing of the secondary switch 47. Then the lobe D'' and the lobe D' engage and actuate their repsective followers, cock the timer 48 and open the secondary switch 47 and open the primary switch 33, thus terminating the cycle of operation and bringing the apparatus to rest with the article carrier 17 at the starting position D to be unloaded and replaced by another carrier or carriers with unprocessed articles.

Another cycle of the operation can then be initiated by the attendant or user releasing the starter trigger release 35 at will, as previously explained.

The timing unit 48 is preferably of the kind broadly covered in my copending application Serial No. 329,452, filed April 13, 1940, now Patent No. 2,343,347, dated March 7, 1944, and operates hydraulically on the principle of displacing liquid rapidly from one portion of a hydraulic circuit to another portion and then controlling the return of the liquid under conditions wherein the liquid will take a given length of time for the return under certain predetermined factors of orifice, viscosity, and temperature. To this end the timer unit includes a pair of similar metallic bellows 51 and 52 hermetically sealed and secured to respective opposite sides of a base plate 53 fixedly supported by a supporting frame or bracket 54. Within the chambers defined by the bellows 51 and 52 is such a quantity of a liquid, such as an oil of predetermined viscosity, as will but fill the chambers equally when the bellows are in balance.

The bellows 51 is cooperatively related to the cocking cam follower 49 in such manner that when the cam follower is engaged and actuated by the lobes of the cam 50, the liquid within the bellows 51 is driven through an orifice 55 in the base plate 53 into the bellows 52, thus compressing the bellows 51 and expanding the bellows 52. Return of the liquid through the orifice 55 is prevented by a one-way check valve 57. As a result of this action of the bellows, a switch arm 58

is motivated to open the secondary circuit switch 47. At the same time, the inherent resiliency of the bellows tends to resist the unequal distribution of liquid and this resistance may be increased by means such as a tensioning spring 59. Therefore, as soon as the cocking force is released from the bellows unit, the liquid will be driven from the bellows 52 to the belows 51 through a bleeder duct 60 which, as shown, has communication at its respective ends through suitable orifices in the base plate 53.

The cross-sectional flow area of the bleeder duct 60 is such, at least in a portion thereof, that at a given hydraulic pressure and at a given temperature, it will take a given volume of the liquid a determinable length of time to pass through the duct. Should the temperature be increased or decreased, however, there will be a corresponding acceleration or deceleration in the flow of the liquid through the duct 60, and this phenomenon is taken advantage of to attain automatic and self-compensating adjustment in the timing cycle of the unit closely and continuously responsive to variations in temperature in the operating or treating zone of the apparatus. For example, the bleeder duct 60 may be of sufficient length to form a loop adapted to dip into the developer bath in the tank 12 so that the returning liquid during the timing cycle is conducted directly through the liquid of the bath and is thus brought to the same temperature as the bath. As a result, where the timing interval has been adjusted normal to an optimum temperature of the developer bath, the lower temperature will cause the liquid in the duct 60 to become sluggish and thus slow its travel whereby to prolong the development interval, whereas, should the developer bath be of a higher temperature than the optimum, travel of the timer liquid through the duct 60 will be accelerated correspondingly and appropriately shorten the time of the interval. Such temperature responsiveness of the timer is thus at all times quite accurately reflected throughout the complete range of possible variances in the developer bath.

In order to improve the temperature responsiveness of the timer fluid, the most restricted portion of the bleeder is preferably so disposed as to be immersed in the developer bath as indicated at 61. Such flow restriction may be accomplished in a round duct by flattening the same.

It may be noted that in the present instance, although the bleeder duct 60 is disposed merely to be temperature responsive to the developer bath, the developer bath is disposed to be of a temperature closely corresponding to that of the washing water which contacts the developer tank 12. Likewise, the fixing bath tank 13 is contacted by the washing water so that the fixing bath will be of approximately the same temperature. Thus, temperature adjustments effected in the bleeder duct 60 in the developer bath will be equally applicable to the temperatures in the washing water and in the fixing bath.

Predetermined major adjustments in the timing interval for various purposes are preferably effected by setting the secondary circuit switch 47 by means such as an eccentric cam adjuster 62.

All of the features of the intermittent operating control and timer unit are incorporated in the exemplary, compact, unitary assembly shown in Fig. 4, wherein the visible parts which correspond to the elements diagrammatically shown in Fig. 1, are identified by identical reference

numerals, certain special details of slight structural differences being disregarded as mere matters of engineering choice. Certain environmental details shown in Fig. 4 will, however, be described for a clearer understanding of the structure. For example, the entire assembly is carried by a framework 63 which in turn is rockably carried by the cam shaft 39 so as to be tiltable from the full line operative position to the broken outline position wherein the bleeder duct loop 60 clears the developer bath. The shaft 39 may be suitably journaled upon the sides of the receptacle 10. The master switch 31 may also be mounted upon the side of the container 10 while the switch closer 32 is carried by the frame 63 so that when the assembly is in the full line operating position, the switch is closed while when the assembly is tilted back to inoperative position, the switch is opened.

In Fig. 4, the latch releasing member 35 is shown as being in the form of an upstanding bar 64 arranged to project above a cover 65 for easy manipulation and guided for vertical reciprocation by screws 67 extending through respective slots 68 in the bar and secured to the frame 63. A spring 69 acts normally to urge the bar upwardly so as to interpose a lug 69*a* on the bar into the path of the pivotally mounted latch trigger 34.

The adjusting cam 62 is shown as carried by a vertical, rotatable shaft 70 for engagement with a switch adjusting follower 71 associated with the switch 47. The shaft 70 conveniently projects upwardly to clear the cover 65 and has an operating knob 72 which is adapted to be turned with respect to a calibrated plate or dial 73 on top of the cover which may carry suitable indicia showing various adjustment settings.

Where there is a requirement for individual accurate timing of particular intervals in the cycle of operation, wherein each interval may be affected by different variable temperature conditions, separate hydraulic timer units may be provided for each requirement substantially as indicated in the modification of Fig. 2. Here two separate timing units 48*a* and 48*b* are provided so that one of the units may, for example, be utilized to time the developing bath phase of the cycle and the other for timing the fixing bath phase of the cycle where conditions are such that the two baths may be subject to independent temperature variations. For this purpose, the functions of the timer cam 50 are divided amongst two separate cams 50*a* and 50*b* for controlling respectively the unit 48*a* and the unit 48*b*. The cam 50*a* may be formed with an initial cocking lobe DX'' for the developing phase and a lobe BX'' for the washing phase following development. After this, the cam 50*a* maintains the unit 48*a* inactive and the associated secondary circuit switch 47*a* open and the timing unit 48*b* becomes operative by being cocked by lobe CX'' on the cam 50*b* to time the fixing bath phase of the cycle while lobe BX^{22} cocks the unit 48*b* for the washing phase following fixing. Upon return of the apparatus to starting position, the cam 50*b* cocks the unit 48*b* and maintains the associated switch 47*b* open continuously until the fixing bath phase of the next succeeding cycle is reached.

In another modified form of the invention, as shown in Fig. 5, the operation controlling and timing structure may be the same as described in connection with Figs. 1 to 4, inclusive, but the article conveying structure may be of a nature better suited to certain types of treatment. Accordingly, an article supporting bar 75 may be supported at its ends by endless conveyors such as chains 76, the chains being trained over suitable idlers 77 and a set of drivers 78 in such manner as to convey the carrying bar 75 into various positions which, in a photographic development apparatus, may comprise a loading and unloading position DY, a developer bath position AY, a wash water position BY, and a fixing bath position CY. Actuation of the conveyor may be through the medium of a shaft 79 acting upon the drivers 78 through endless driving elements 80 and in turn driven through the medium of an endless driving element 81 trained over an oscillating actuator 82 of relatively large active radius. Motivation of the oscillating actuator 82 is effected by the motor 29*a* acting through a reduced radius rotary crank 83 and a link 84. As the crank 83 is intermittently rotated during an operating cycle, the link 84 successively assumes the several operating positions with respect to the crank 83, and drives the oscillating actuator 82 into the positions, as indicated by the characters DY, AY, BY, CY, corresponding to the various operating positions of the article carrier 75.

Up to this point power actuated apparatus has been described, but for some purposes a less elaborate, hand operated apparatus may be desired. Accordingly, the modified form of the invention shown in Figs. 6 and 7 may be found satisfactory. This comprises a tank or pan 85 which may be subdivided into two sections by a partition 86 with one of the sections, identified by the legend "Developing bath" adapted to receive the developer solution and the other section wash water. Journaled across the top of the tank adjacent the partition 86, is a shaft 87 which is normally biased by means such as a torsion spring 88 to assume an angular position wherein an article holder or rack 89 is within the wash water. A handle 90 is provided upon the shaft 87 for turning the shaft in opposition to the torsion spring 88 to carry the article supporting rack 89 over into the developing bath. When the rack 89 has assumed the developing position, a latch arm 91 fixed upon the shaft 87 engages a trigger 92 normally urged by a spring 93 into latching position. The trigger carries a trip lever 94 which is adapted to be engaged by a trip 95 arranged to be engaged and operated by a timer generally identified at 97.

The timer 97 comprises a flexible bellows unit including a setting bellows 98 hermetically sealed and mounted upon the upper side of a horizontal base member 99 rigidly supported by a bracket 100 while a pump bellows 101 is mounted in hermetically sealed relation upon the opposite side of the base 99. The chamber within the bellows 98 communicates with the chamber within the bellows 101 through an orifice 102 in the base member 99 so that liquid of predetermined viscosity within the chamber of bellows 98 may be discharged by compression of the latter into the bellows 101 to expand it, return of the liquid being prevented by a one-way check valve 103. The normal resiliency of the bellows 98 and 101, plus the force of a spring 104, causes the liquid to be driven through a bleeder duct 105 back to the setting bellows 98.

The bleeder duct 105 extends into the developing bath and the timing liquid passing therethrough is therefore subjected to the same temperature as prevails in the bath, and is corre-

spondingly affected as to viscosity, slowing down in proportion to temperatures below optimum and accelerating in proportion to increases in temperature. When the liquid has returned to the setting bellows 98 in sufficient quantity, a dog 106 at the top of the bellows 98 engages the trip member 95 actuating the same to swing the trip arm 94 and releases the trigger 92 whereupon the loaded torsion spring 88 causes the shaft 87 to rotate and swing the carrier 89 out of the developing bath.

Rotation of the shaft 87 in swinging the carrier 89 out of the developing bath is also effective to set the timer unit for another timing cycle, and the timing unit simultaneously serves as a brake upon the shaft to prevent its unduly rapid rotation under the influence of the loaded spring 88 which might cause the article carrier to flip up dangerously fast. For this purpose, the shaft 87 is formed with a crank 107 with which is associated a piston 108 operating slidably through a sleeve 109 to engage with a cocking member 110 pivotally secured to the top of the setting bellows as shown at 111. The sleeve 109 is fast upon the member 110 while the piston 108 is slidable within the sleeve to afford a lost motion connection. The angle of the crank 107 is such that as the carrier 89 swings around to the dot-dash position shown in Fig. 6, the piston 108 acts to compress the setting bellows 98 which by affording a certain amount of resistance due to the relatively retarded passage of liquid through the orifice 102, creates the braking effect.

Upon the carrier 89 reaching the dot-dash position of Fig. 6, a state of equilibrium is attained due to the resistance afforded by the bellows 98 which counterbalances the effect of the spring 88 at that position and the apparatus comes to rest. Then the user may, through the medium of the handle 90, swing the carrier over into the wash water, where due to gravity the carrier will remain until returned to starting position by means of the handle 90. The lost motion connection of the piston 108 permits it to slide within the sleeve 109 away from the member 110 when the device is swung into the wash water as indicated. When the carrier is swung out of the wash water up to the loading position, the piston 108 will again act to cock the timer so that when the carrier is returned to the developing bath, the timer will be set for another developing interval.

The carrier 89 is preferably removably connected into a socket 112 on the shaft by a spring detent and bayonet slot connection as indicated at 113. Through this arrangement, the user may rapidly interchange various carriers as desired, taking a carrier of developed photographic articles away and replacing it with a carrier loaded with articles requiring development. The carrier having developed articles on it can then be placed into a similar machine for further processing such as fixing or it may be otherwise handled.

While I have shown in the drawings and have herein described in detail certain preferred embodiments, it is to be understood that I do not thereby intend to limit the invention to the specific forms disclosed, but intend to cover all modifications and alternative constructions falling within the spirit and scope of the invention as expressed in the following claims.

I claim:

1. The method of timing the length of a treatment which involves use of a processing liquid subject to variable temperature conditions, which

includes directing a timing liquid of predetermined viscosity characteristics through a circuit in which the rate of flow of the timing liquid from one point to another at an optimum temperature and given pressure is known and constitutes the primary adjustment conditioning the length of the timing interval, and in at least a part of the circuit conducting the timing liquid through the processing liquid to subject the timing liquid to said variable temperature conditions and thus alter its viscosity for correlating the rate of flow of the timing liquid with the prevailing temperature condition and thus effect secondary adjustment in the timing interval.

2. The method according to claim 1 further characterized in that the flow of the timing liquid is severely restricted at the point where the timing liquid is in exchange relation to the processing liquid while allowing the timing liquid to flow under relatively less restricted conditions in the remainder of the circuit.

3. The method of timing an operation involving the use of a processing liquid subject to variable temperature conditions, which comprises forcibly directing a timing liquid of a viscosity responsive to said variable temperature conditions from one chamber to another chamber through a severely restricted passage through which at given pressure and temperature the timing liquid flows at a predetermined rate but varies as to flow rate in accordance with variations in temperature by reason of proportionately altered viscosity, and subjecting the timing liquid to heat exchanging intimacy with said processing liquid so as to reflect the variable temperatures of the processing liquid in the viscosity of the timing liquid and accordingly regulate the flow of the timing liquid through said restricted passage.

4. The method of timing an operation involving a processing liquid subject to variable temperature conditions, which comprises conducting a timing liquid of predetermined viscosity characteristics from one point to a second point in a timing circuit, and subjecting the timing liquid to heat exchanging intimacy with the processing liquid so as to effect an adjustment in the rate a given quantity of the timing liquid will complete a timing cycle by flowing from said one point to said second point under a given pressure which under optimum temperature conditions would cause a completion of the flow in a given time.

5. In combination in apparatus of the character described, means defining a processing zone adapted to contain a processing liquid subject to variable temperature conditions, and means for timing a treatment interval in said processing zone including a hydraulic circuit having therein a timing liquid of predetermined viscosity characteristics, and means for conducting the timing liquid from one point to another point in the circuit at a pressure which at at an optimum temperature will cause a given volume of the timing liquid to flow from said one point to the other in a given length of time and thus constitutes the primary adjustment for which the timing circuit is conditioned, said means being so related to said zone as to subject the timing liquid to heat-transference directly from the processing liquid within the zone to condition the viscosity of the timing liquid and thus effect an automatic secondary adjustment of the timing circuit.

6. In combination in apparatus adapted for photographic article treatment, a treating zone of variable temperature equipped for a plurality

of stages of treatment, means for supporting the articles to be treated, intermittently operable means for moving the supporting means into and out of the treating zone while subjecting the articles successively to said plurality of stages of treatment, means for timing the intermittent interval during which said intermittently operable means remains inactive to maintain the article supporting means in each stage of treatment in the treating zone including a hydraulic timing circuit comprising a bellows unit having a bleeder duct within the treating zone, a liquid of temperature responsive viscosity in said circuit so as to be effected by the prevailing treating zone temperature as encountered in passing through said duct, and means operated by said intermittently operable means for cocking the bellows unit before each stage of treatment.

7. Cyclically operating apparatus for treating articles comprising, in combination, means adapted to provide a treating zone subject to conditions directly affecting the character of the treatment, means for conducting the articles into the treating zone, a timer including a bellows adapted to determine the duration of the treating interval by expansion of the bellows from a compressed condition thereof, means arranged to be operated by the timer for controlling said conducting means to remove the articles from the treating zone and terminate the treatment after a predetermined interval of treatment as determined by the timer, and means operable automatically upon termination of the treatment, as determined by the expansion of the bellows, for compressing the bellows and thereby resetting the timer for the next treating cycle.

8. In apparatus for treating articles cyclically, means providing treating zones for a plurality of successive processing fluids which are independently subject to temperature variation, means for supporting the articles successively in each of the zones, means for actuating the article supporting means to enter into active position with respect to said treating zones in sequence, individual temperature compensating timing means associated with each of said zones for determining the treating interval in each of the processing fluids, means for operating said actuating means, and means coordinated by said individual timing means for controlling the activity of said operating means.

9. Apparatus for processing photographic articles or the like comprising in combination, means providing a plurality of treating zones for successively receiving the articles and each adapted to contain a processing fluid subject to variable temperature conditions, said means maintaining the processing fluids separate but in mutual heat exchanging relation so as to effect a common prevailing temperature in all the treating fluids, and timing means including a hydraulic circuit having means for directing into heat exchanging relation with one of the processing fluids a timing liquid of predetermined viscosity characteristics so as to correlate the rate of flow of the timing liquid with the prevailing temperature of the processing fluid and compensate for any deviation from an optimum temperature established as ideal and at which optimum temperature the timing liquid will travel the circuit under identical pressure at a predetermined rate, and means controlled by the timing means for successively conducting the articles into and out of the treating zones.

10. In apparatus of the character described, an article carrier adapted to move from one position to a second position and return, load and fire mechanism for holding the carrier in the second position, and timing means adapted to operate said load and fire mechanism including a fluid controlled timing circuit having means for gradually bleeding the fluid following setting of the timing means to determine a time interval before the timing means operates said mechanism to release the carrier for return to said one position, said timing means also having an operative connection with said carrier to restrain to a predetermined rate of movement return thereof to the one position.

11. In combination in timing apparatus of the character described, a metallic bellows unit having therein a liquid of predetermined viscosity characteristics, a passage of severely restricted cross-sectional flow area for flow of the liquid from one part of the bellows unit to another under given hydraulic pressure to determine an interval by the length of time required for such flow by a given volume of the liquid, and a member adapted to move from one position to a second position and return having an operative relation with said bellows unit whereby it is retained for said interval in the second position after movement thereto from the one position and then released for return, said bellows unit having another passage of greater but also restricted flow area adapted for return of the liquid to said one part coincident with return movement of said member and serving as a brake to restrain said member for relatively slow movement in said return.

12. In combination in apparatus for processing articles in a processing liquid of variable temperature characteristics and in which the temperature is a vital factor in the duration of the processing for any desired result, means providing a receptacle for the processing liquid, means for conducting the article into the liquid, and load and fire means for controlling the length of time said conducting means will maintain the article in the processing liquid, said controlling means including an interval timer operating with a liquid of predetermined temperature responsive viscosity characteristics at a given hydraulic pressure and temperature and having a conduit of high heat transfer efficiency and of such restricted flow area that at a given basic temperature a given quantity of the timing liquid under such pressure will travel through the conduit in a certain time interval, said conduit being immersed in said processing liquid to bring the timing liquid therein into intimate heat transfer relation to the processing liquid so as to be responsive in its viscosity to the prevailing temperature of the processing liquid.

13. Apparatus for treating an article, comprising in combination, a structure affording a treating zone for the article and having means therein for supporting the article during treatment, means operable to commence an interval of treatment in said zone, means for timing the duration of the treatment interval including a pair of chambers and means for conducting a timing liquid of predetermined viscosity characteristics from one chamber to the second chamber, said conducting means providing a passage permitting the liquid to travel only at a slow rate so that a predetermined quantity of the liquid will require a predetermined length of time at a predetermined pressure to travel therethrough, means acted upon by the timer after a predeter-

mined quantity of the liquid has traveled through said conducting means from the one chamber to the second chamber to terminate the treatment interval, and means, operative coincident with said treatment terminating means in terminating the treatment interval, for acting upon the timer for returning the timing liquid rapidly from the second chamber to the one chamber in readiness for the next succeeding timing operation.

14. In combination in apparatus for treating articles in a plurality of successive stages in a cyclical process, means defining a treating zone accommodating said successive stages of treatment, means for conducting the articles through said treating zone, means for controlling the operation of said conducting means to maintain the articles for a predetermined time interval in each successive stage of treatment in said zone, said means including a timer unit for controlling the interval of operation for each of said stages of treatment, and means including a resetting element movable during action of said controlling means and an element carried by the timer unit, said elements acting together automatically following each stage of treatment to reset the timer unit to operate for the succeeding stage of treatment.

15. Apparatus as defined in claim 14 wherein at least one stage of treatment is subject to temperature variations of a nature to affect the character of treatment of the articles, and the timer unit operates with a timing liquid of temperature-sensitive viscosity to compensate for said temperature variations, the timer unit being so related to the treating zone that the timing liquid is subject to the treatment-affecting variable temperatures therein.

16. In combination in a photographic developing device of the character described, means defining a treating zone and providing a receptacle for developer solution, means for supporting photographic articles to be immersed in the developer solution and movable into and out of article-immersing relation to said receptacle, means for effecting the operative movement of said supporting means comprising a timer including a bellows unit having a pair of flexible bellows providing chambers carrying a temperature-sensitive timer liquid and from one of which chambers the liquid is adapted to be displaced rapidly into the other chamber, and a duct of restricted flow area connecting said chambers for timed return of the displaced liquid to said one chamber, said duct being in the form of a loop extending into said receptacle to be immersed in the developer solution so that the timer liquid will be constantly subjected to the temperature conditions prevailing in the solution.

17. A photographic developing device as defined in claim 16 wherein the timing unit is mounted for movement to carry said duct at will into and out of the receptacle.

18. In combination in apparatus of the character described, means defining a treating zone subject to variable temperature conditions, means for supporting an article to be treated in said

zone, means for driving said supporting means into and out of article treating relation to said zone and including an intermittently operable actuating motor, and means for controlling the operation of said motor including a timing device having means acting under predetermined ideal temperature conditions to afford a given operational time interval and sensitive to and self-adjustable with respect to the prevailing temperature in said zone for determining the length of time the supporting means may remain in treating relation to said zone by accelerating or decelerating operation of the timing device to control the operational intermittencies of the motor, said article supporting means including an endless-type conveyor arranged to be intermittently motivated cyclically by the motor for recurrently carrying the article supporting means into and out of treating relation to the treating zone.

19. In combination in apparatus of the character described, a supporting structure, cyclically operating means including an electrical motor for intermittently actuating a member, controlling cam structure including a cam shaft mounted rotatably on said supporting structure, an electrical circuit including electrical switch means actuated by the cam structure for determining the operation of said motor, a master control switch for said circuit carried by said supporting structure, and a carrying frame supporting said electrical switch means, said carrying frame being rockably mounted upon said cam shaft and adapted in one position to close said master control switch for rendering the apparatus active, said frame being adapted to be rocked upon said cam shaft to open said master control switch to render the apparatus inactive.

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