Sept. 26, 1967 P. ROSENBERG 3,343,472

PHOTOGRAPHIC PROCESSING MACHINE

Filed Jan. 21, 1965 4 Sheets-Sheet 1

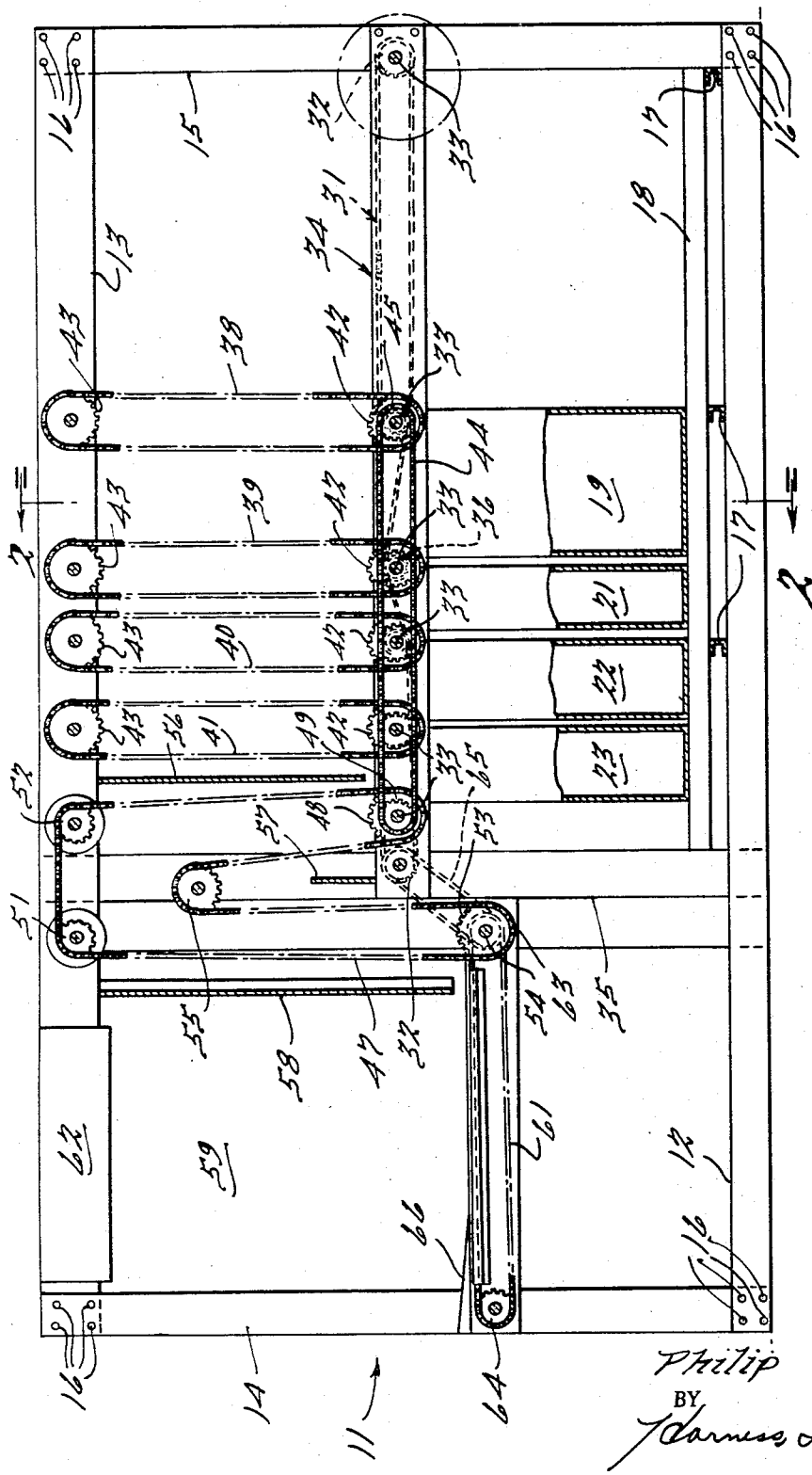

FIG. 1.

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PHOTOGRAPHIC PROCESSING MACHINE

Filed Jan. 21, 1965 4 Sheets-Sheet 2

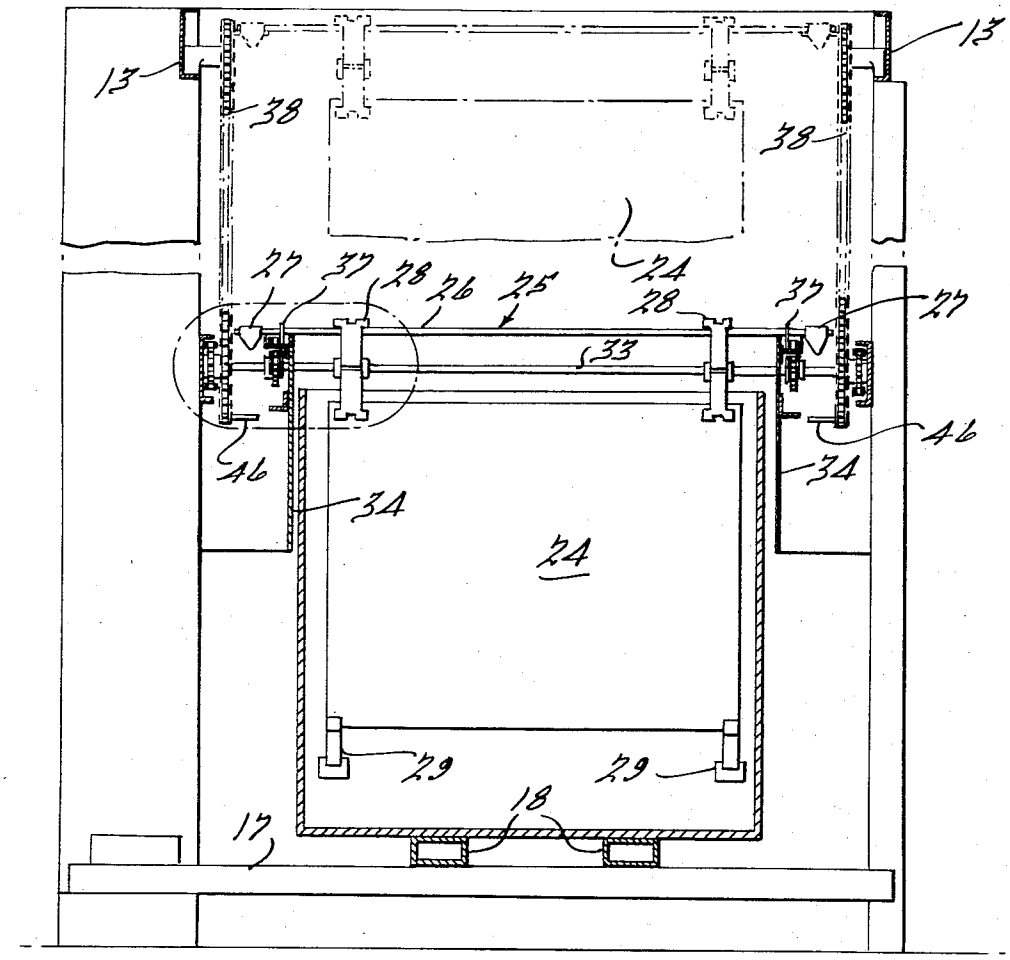

FIG. 2.

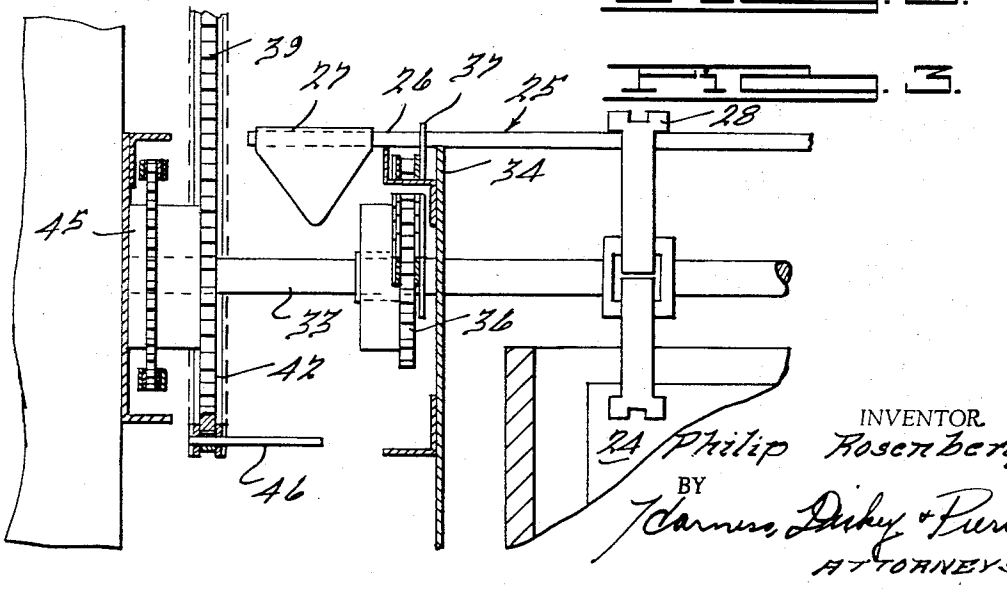

FIG. 3.

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PHOTOGRAPHIC PROCESSING MACHINE

Filed Jan. 21, 1965 4 Sheets-Sheet 3

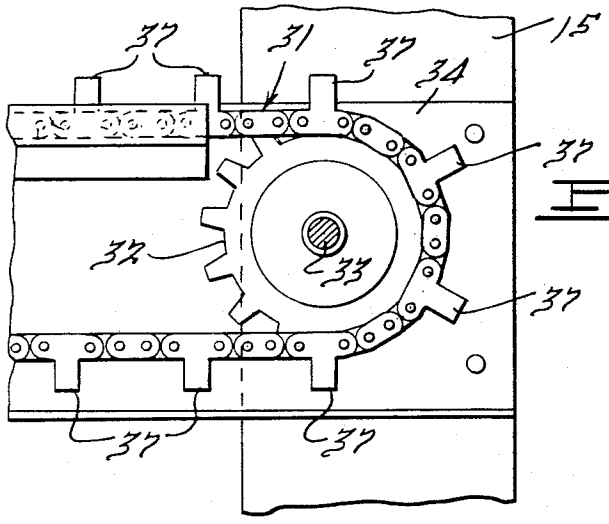

Fig. 4.

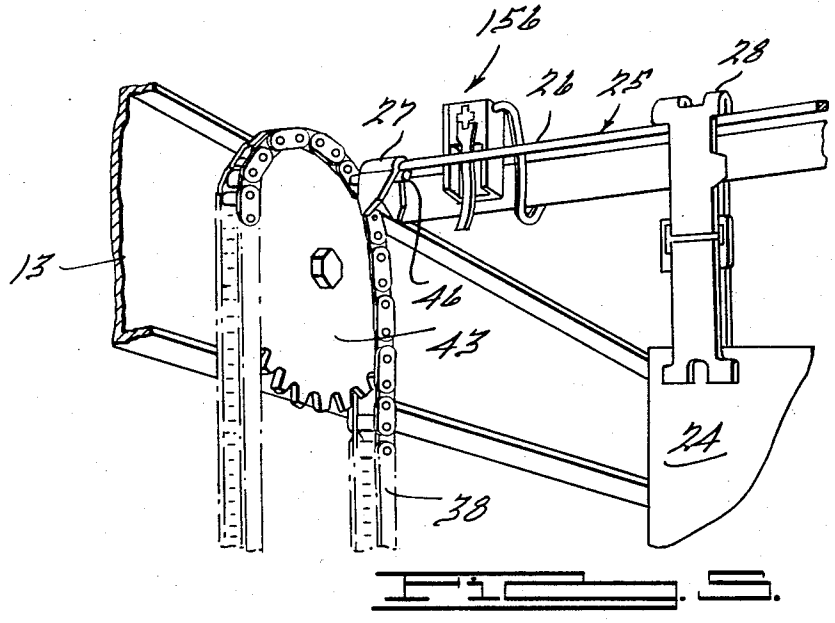

Fig. 5.

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PHOTOGRAPHIC PROCESSING MACHINE

Filed Jan. 21, 1965 4 Sheets-Sheet 4

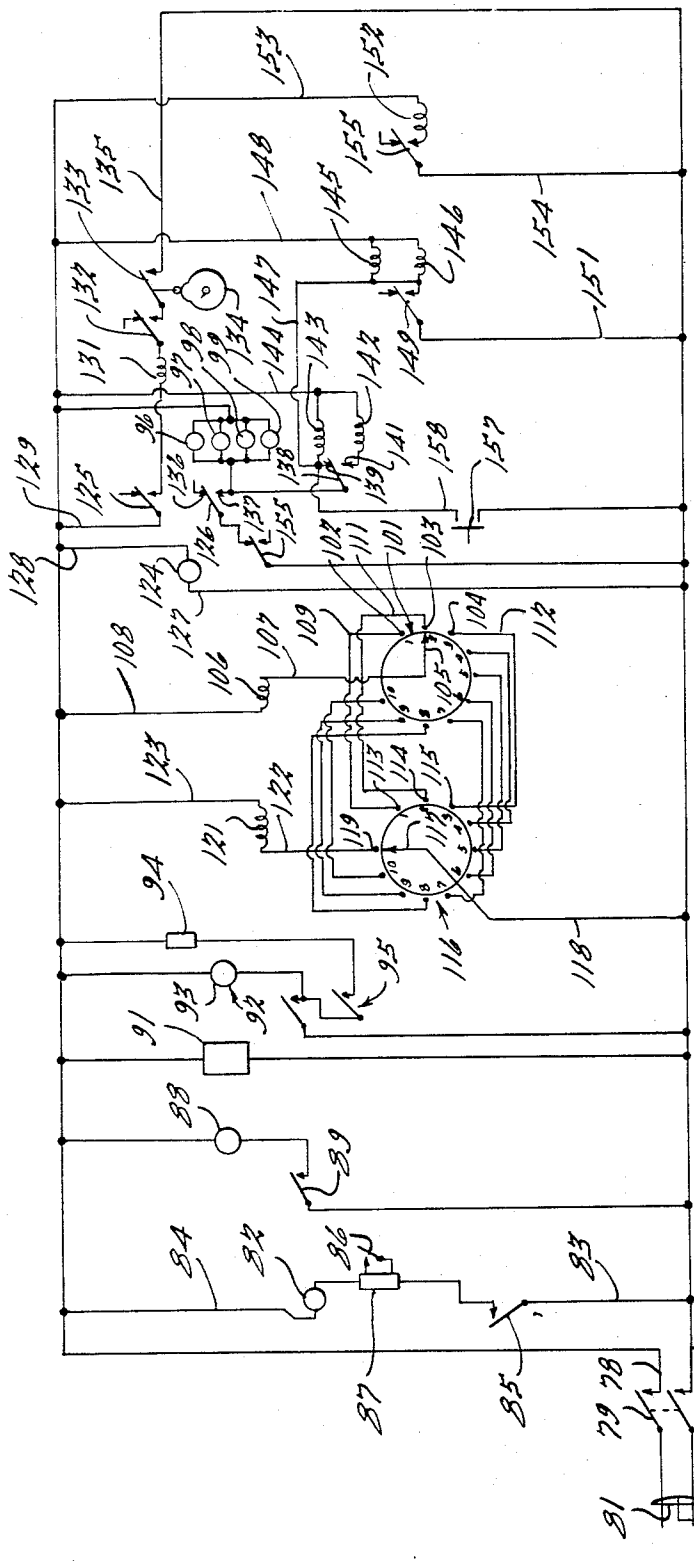

FIG. 6

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3,343,472

PHOTOGRAPHIC PROCESSING MACHINE

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Filed Jan. 21, 1965, Ser. No. 426,759
6 Claims. (Cl. 95—94)

ABSTRACT OF THE DISCLOSURE

This application discloses a machine for developing exposed films through sequential insertion in aligned, horizontally disposed tanks containing different chemicals. A horizontal transverse drive transports the film in a horizontal direction through each tank for controlling the time the film is present in each tank. Vertical transfer means are positioned between the respective tanks for lifting the film from one tank and depositing it in the next tank as the film reaches the end of the first tank. A common driving motor is coupled to the horizontal transfer means and to the vertical transfer means for intermittently driving each transfer means. The vertical transfer means is driven through a complete cycle during each operation of the motor and travels at a much higher rate of speed than the horizontal transfer means. A structure is disclosed for controlling the time delay between the intermittent operation of the driving motor so as to permit adjustment of the overall time the film spends in each tank. In addition, a mechanism is provided for periodically replenishing the mixture in the tanks dependent upon the number of films processed and for maintaining an agitating stream of gas in at least one of the tanks as long as film is being processed in this tank.

This invention relates generally to processing machines and more particularly to an improved, fully automated processing machine and a transport system for moving processed pieces through various chemical baths of the machine.

It has been proposed to provide an automatic mechanism for treating a piece in successiveo chemical baths. Such machines may be used for developing exposed photographic and X-ray films or for plating pieces of metal. In the first mentioned use film is transported by a conveying system through the various chemical baths required for the developing process. The machines heretofore proposed for this purpose have not been completely satisfactory for several reasons. In many of the machines that previously have been proposed, the conveying system is immersed in the chemical baths. As the exposed film is transported between the various tanks, the chemical baths in them is depleted by the conveyor since it carries the solution from the tanks. The solution is also transmitted by the conveyor to the next successive tank resulting in alteration of the chemical composition in adjacent tanks. It is additionally necessary to rapidly immerse and withdraw the individual films from the various baths, particularly when large films are being developed, to insure that the entire surface of the film is exposed within the bath for substantially the same length of time. It is necessary, however, to immerse the film in the various baths for different lengths of time. The conveying mechanisms heretofore proposed have been incapable of rapidly inserting and withdrawing the film as well as controlling the time it remains within the bath. Periodically the solutions within the individual baths must be replenished to increase their strength. Heretofore, this has been done manually, decreasing the degree of automation of the machine.

In accordance with this invention, a processing machine comprises a plurality of adjacent, spaced tanks in which various chemical baths are contained. A horizontal transfer drive is provided for transporting pieces in a horizontal direction when immersed in the individual tanks. A vertical transfer system is additionally provided for inserting and withdrawing the pieces from the individual tanks. The vertical transfer system is operated at a much higher rate of speed than the horizontal transfer mechanism. Means are provided to transfer the pieces from the horizontal transfer mechanism to the vertical transfer mechanism so that they may be successively transferred between the chemical baths.

Accordingly, an important object of this invention is a fully automated processing mechanism.

A further object is an improved mechanism for transporting pieces between the individual baths of an automatic chemical processing machine.

Another object of the invention is a transporting system for a processing machine that rapidly inserts and withdraws the pieces into and from successive chemical baths and accurately times the immersion of the piece within the individual baths.

Other objects and advantages of the invention will be apparent when considered in conjunction with the appended claims, detailed description, and drawings, wherein:

FIGURE 1 is a side elevational view with portions broken away of an automatic film developing machine embodying this invention;

FIGURE 2 is a cross-sectional view taken substantially along the line 2—2 of FIGURE 1;

FIGURE 3 is an enlarged view of the encircled portion of FIGURE 2;

FIGURE 4 is an enlarged view of the encircled portion of FIGURE 1;

FIGURE 5 is an enlarged, perspective view showing one of the limit switches of the developing machine; and

FIGURE 6 is a partial, schematic wiring diagram of the developing machine.

In the drawings an automatic film developing machine is shown as a preferred embodiment of this invention. It is to be understood, however, that the disclosed machine may be used to treat any type of piece in successive chemical baths.

Referring now in detail to the drawings, a developing machine embodying this invention comprises a frame, indicated generally by the reference numeral **11**. The frame **11**, which is substantially the same at each side of the machine and, therefore, only one side will be described in detail, includes a channel shaped base member **12** and a channel shaped top member **13**. The base member **12** and top member **13** are fixed relative to each other by upright channel members **14** and **15** that are fixed to the members **12** and **13** by rivets, bolts or the like, **16**. Transverse, channel shaped members **17** extend across the base members **12** at each side of the frame **11** and are affixed thereto as by welding. A pair of longitudinally extending box-shaped members **18** are affixed to the tops of the channel shaped members **17**. A developer tank **19**, a short stop tank **21**, a fixer tank **22** and a wash tank **23** are positioned in side-by-side relationship upon the box-shaped members **18**. The tanks **19**, **21**, **22** and **23** have generally rectangular cross-sectional shape although their lengths in the direction of the box-shaped members **18** are different for reasons which will become apparent as this description proceeds. It is to be understood that the illustrated tank arrangement is exemplary only since other types or numbers of tanks containing other solutions may be employed.

Individual exposed films **24** are supported upon a film hanger bar, indicated generally by the reference numeral **25** and shown in more detail in FIGURES 2, 3 and 5. The film hanger bar **25** comprises a transverse rod of

square cross section **26** having inverted V-shaped sheet metal members **27** affixed to each end thereof. Film hangers or clips **28** are fixed to each side of the rod **26** adjacent to the V-shaped members **27**. The clips **28** grippingly engage the film **24** at the upper corners thereof. If desired, clips having weighted ends **29** may be affixed to the lower edges of the film **24** (FIGURE 2) to insure that the film **24** will hang straight and in a vertical direction.

The films **24** are moved horizontally along the developing machine by a pair of horizontal transfer chains **31** that are supported at each side of the developing machine. The transfer chains **31** encircle a pair of sprockets **32** that are supported at each side of the developing machine upon shafts **33** that extend transversely across the machine. The ends of the shafts **33** are supported by guide rails **34** that are affixed to the vertical channel shaped members **15** and a similar channel shaped member **35** positioned adjacent the left hand side of the machine as viewed in FIGURE 1. Other similar shafts **33** are positioned at the ends of the tanks **19, 21, 22** and **23** in a position that will not interfere with the passage of the film **24**. Drive sprockets **36** engage the underside of the transfer chains **31** between the longitudinal ends thereof to drive the chains **31**. The drive sprockets **36** are keyed or otherwise fixed to the shaft **33** upon which they are supported while the sprockets **32** are journaled for rotation on their respective shafts **33**. The drive sprockets **36** are driven in any suitable manner as will be described.

The horizontal transfer chains **31** have a plurality of equally spaced upstanding bars **37** affxed to or formed integral with its inner links, that is the links that are adjacent to the tanks **19, 21, 22** and **23**. The bars **37** are positioned inwardly of the sprockets **32** so that they will not interfere with the operation of these sprockets or that of the drive sprocket **36**.

Four pairs of vertical transfer chains **38, 39, 40** and **41** are positioned adjacent the leading edges of the tanks **19, 21, 22** and **23** at each side of the machine. The vertical transfer chains **38, 39, 40** and **41** engage sprockets **42** at their lower ends and sprockets **43** at their upper ends. The lower sprocket **42** that engages the transfer chain **38** is fixed to the ends of its respective shaft **33** while the other sprockets **42** are journaled for rotation on the outer end of the shafts **33**, one of which also supports the drive sprockets **36**. The sprockets **43** are journaled upon the top channel members **13**. The remaining sprockets **42** rotate relative to the shafts **33** and sprockets **36**, however, since the vertical transfer chains **38, 39, 40** and **41** move at a greater linear rate than the horizontal transfer chains **31**. Timing chains **44** engage smaller sprockets **45** that are affixed to the outer ends of the sprockets **42** at each side of the machine to insure that the vertical transfer chains will all move at the same rate of speed. The vertical transfer chains **38, 39, 40** and **41** may be driven from any suitable power source and may be driven from the same power source that drives the horizontal transfer chain **31** so that all of the chains will be moved in unison. It is important, however, to note that the vertical transfer chains **38, 39, 40** and **41** move at a considerably higher rate of speed than does the horizontal transfer chain **31** as will become more apparent as this description proceeds.

A single pick-up pin **46** is affixed to each of the vertical transfer chains **38, 39, 40** and **41** (FIGURES 2, 3 and 5). The relative rate of travel between the horizontal transfer chains **31** and the vertical chains **38, 39, 40** and **41** is such that the pick-up pin **46** will be aligned with the leading edge of the horizontal transfer chains **31** each time a bar **37** is presented to the vertical transfer chains **38, 39, 40** and **41**. The reason for this will become more apparent as this description proceeds.

Vertical unloading chains **47** are positioned at the left hand end of the machine at each side of the frame **11**. The unloading chains **47** are wound around sprockets **48** that are driven by smaller sprockets **49**. The sprockets **49** are driven by the timing chains **44** that correlate the movement of the vertical transfer chains **38, 39, 40** and **41**. The vertical unloading chains **47** therefore move at the same rate of speed as the vertical transfer chains. The upper end of the vertical unloading chains **47** engage sprockets **51** and **52** that are journaled upon the channel members **13** of the frame **11**. The lower end of the vertical unloading chains **47**, which are positioned below the horizontal transfer chain **31**, engage sprockets **53** that are journaled upon a shaft **54** that extends transversely across the machine. Idler sprockets **55** that are journaled on the members **35** also engage the vertical unloading chains **47**. The length of the vertical unloading chains **47** divided by the length of the vertical transfer chains is a whole integer and a number of bars similar to the bars **37** that are positioned upon the vertical transfer chains **38, 39, 40** and **41** and equal to this integer are equally spaced along the length of the vertical unloading chain **47**.

A light shield in the form of three spaced vertically extending baffles **56, 57** and **58** is provided at the left hand or unloading side of the developing machine. The baffle **56** is affixed between the top members **13** of the frame **11**, depends over the tank **23** and terminates just slightly above the liquid level in it. The baffle **57** extends upwardly from the base member **12**. The baffle **57** is spaced above the bottom of the baffle **56** so that light cannot be transmitted either directly or by reflection from the exterior of the machine into the developing area. The baffle **57** is sufficiently low, however, to permit the film **24** to pass over it. The baffle **58** depends from the channel shaped members **13** and is positioned adjacent to an unloading and drying area, indicated generally by the reference numeral **59**.

Horizontal unloading chains **61** extend across the unloading and drying area **59** at each side of the frame **11** below a fan and heater assembly **62** that is positioned at the upper end of the left hand end of the frame **11**. The horizontal unloading chains **61** engage sprockets **63** and **64**. The sprockets **63** are driven by chains **65** which are driven by sprockets that are affixed to the sprockets **32** at the left hand end of the horizontal transfer chain **31**. The horizontal unloading transfer chain **61**, therefore, will be moved at the same rate of speed as the horizontal transfer chain **31**. The chains **61** also are provided with bars that project from their links similar to the bars **37** of the chains **31** for transporting the film through the unloading area **59**. An inclined unloading ramp **66** is positioned at each side of the frame **11** in the unloading area **59**.

In operation, films **24** which have been clipped to the hanger bars **25** are positioned upon the horizontal transfer chain **31** at the right hand or loading side of the machine. A number of films may be loaded at one time due to the length of the chain **31** in the loading area. The bars **37** of the horizontal transfer chain **31** engage the rod **26** and transport it and the film **24** horizontally along the machine (solid line view of FIGURE 2 and FIGURE 3) intermittently and at a low rate of speed. When a hanger bar **25** reaches the first vertical transfer chains **38**, the pins **46** carried thereby will be in position to engage the inverted V-shaped sheet metal members **27** and lift the film **24** and hanger bar **25** from the horizontal transfer chain **31**. Because of the V-shape of the sheet metal members and the more rapid movement of the vertical transfer chains **38** no interference will occur during this transfer. After the film hanger bar **25** is carried over the upper sprockets **43**, it will be deposited upon the rails **34** and immersed into the developer tank **19**. The hanger bar **25** will remain stationary upon the rail **34** until contacted by a bar **37**. It then will be transferred from the vertical transfer chains **38** to the horizontal transfer chain **31**. The film moves horizontally through the developer tank **19** until the vertical transfer chain **39** is

reached. It should be readily apparent that the time the film **24** spends in the developer tank **19** will be dependent upon the rate of travel of the horizontal transfer chain **31** and the width of the developer tank **19**. When the hanger assembly **25** reaches the vertical transfer chain **39** it will again be transferred to vertical movement as it was at the vertical transfer chain **38**. Because of the more rapid movement of the vertical transfer chains, the film is withdrawn and inserted much more rapidly than its movement in the horizontal direction. The progress of the film down the remainder of the developing machine appears to be obvious and will not be described in detail. At the end of the wash tank **23** the hanger assembly **25** is lifted by the pins upon the vertical unloading chain **47** and passed through the light shield formed by the baffles **56**, **57** and **58**. Adjacent to the baffle **58**, the hanger assembly **25** is deposited upon the horizontal unloading chain **61** where it will be contacted by one of its bars and carried to the left hand side of the machine. If an operator is not present to unload the film and hanger assemblies **25**, they will stack upon the inclined unloading ramp **66**.

The machine provides an automatic mechanism for periodically adding to the chemicals in the tanks **19**, **21** and **22** to strengthen their mixture and replenish any chemicals that may be dissipated therefrom and for intermittently driving the various transfer chains. Means are additionally provided to periodically release nitrogen in the form of small bubbles in the tank **19** to agitate the developer when a film **24** is present in the tank **19**. The control system also includes a mechanism for counting the number of films that are developed by the machine. FIGURE 6 illustrates a schematic circuit diagram of the control system for accomplishing the aforementioned objects.

Referring now to FIGURE 6, the numerals **77** and **78** identify a pair of conductors that are connected by means of a double pole switch **79** to a source of line current **81**. A drive motor **82** for intermittently driving the horizontal and vertical transfer chains through a suitable speed reducing mechanism is wired across the conductors **78** and **79** by conductors **83** and **84**. A master control switch **85** for the motor is positioned in the conductor **83** to disable the circuit, if desired. The motor **82** is driven intermittently so that a practical size machine will be possible. The motor **82** operates continuously for a complete cycle of the vertical transfer chains **38**, **39**, **40** and **41**, however, so that the films will be rapidly inserted and withdrawn to and from the tanks **19**, **21**, **22** and **23**.

The intermittent drive for the motor **82** is accomplished by a microswitch **86** that is connected in circuit with a time delay mechanism **87**. The time delay mechanism **87** is adjustable to vary the period during which the motor **82** is at rest. The motor **82** operates in the following manner: When the switch **85** is closed the motor **82** begins to operate and will drive the chains for a period of time until a pin that is carried by the vertical transfer chain **38** engages the microswitch **86**. Preferably the microswitch **86** is engaged just prior to the time that the hanger assemblies **25** are deposited upon the horizontal transfer chain **31**. When the switch **86** is engaged the current to motor **82** is stopped. The motor **82** will decelerate and slowly drop the hanger assembly **25** upon the guide rails **34**. The time delay circuit **87** is then set in motion and the motor **82** remains idle for a period of time depending upon the setting of the time delay mechanism **87**. The motor **82** is again driven after the time dwell set by the time delay mechanism **87**.

It should be clear, therefore, that the chain which transports the film **24** is driven intermittently. The intermittent operation permits a shorter length of the tanks **19**, **21**, **22** and **23** than would be possible if the film were transported continuously. The motor **82** operates, however, during one complete cycle of the vertical transfer chains **38**, **39**, **40** and **41** so that the films will be rapidly withdrawn and inserted from the various chemical baths.

A water control mechanism **88** is also wired across the conductors **77** and **78** and a switch **89** is provided for an on and off control for the water. The device **88** controls and maintains a circulation of cold tap water through the wash tank **23** at all times when the machine is in operation.

Temperature control devices and circulating pumps, schematically shown at **91**, are also wired in circuit across the conductors **77** and **78**. The temperature control devices and pumps **91** maintain a uniform temperature of the solutions within the tanks **19**, **21** and **22** and continuously circulates the solutions through them in any known manner.

The fan and heater assembly **62** positioned in the unloading area **59** is also wired in circuit across the conductors **77** and **78** as indicated generally by the reference numeral **92**. The fan motor is identified by the reference numeral **93** and the heater coil is indicated by the reference numeral **94**. A switch mechanism, indicated by the reference numeral **95**, is provided so that the fan **93** may be operated independently of the heater **94**. The heater **94**, however, cannot be operated without concurrent operation of the fan **93**.

As has been noted, it is necessary to periodically replenish the solution within the tanks **19**, **21** and **22**. The tank **19**, which contains the developing fluid, has two separate types of developers. It is preferable to defer mixture of these developers until they are actually dispensed into the developer tank **19**. Therefore, two separate controls are provided for the tank **19**. The replenishing controls for the developer are indicated by the reference numerals **96** and **97** in FIGURE 6. The control for replenishing the short stop tank is indicated by the reference numeral **98** and the control for replenishing the fixer tank **22** is indicated by the reference numeral **99**. The devices **96**, **97**, **98** and **99** are three-way valves which coact with a reservoir (not shown) measured containers (not shown), and the tanks **19**, **21** and **22**. When the valves are in a first position, the measured containers are filled from larger reservoirs. When the valves are in a second position, the measured containers are emptied into the tanks **19**, **21** and **22**. Means are provided so that the containers may be emptied any given number of times into the tanks in a given cycle and thus the amount of replenishment may be adjusted. This adjustment means includes a multiple position switch, indicated generally by the reference numeral **101**. The multi-position switch **101** has contacts **102**, **103**, **104**, and so on. A wiper arm **105** may be manually set at one of the contacts **102**, **103**, **104**, etc., to alter the number of replenishing cycles as will become apparent. The wiper switch **105** is connected in circuit with a relay coil **106** by a conductor **107**. The other side of the relay coil **106** is connected in circuit with the conductor **78** by a conductor **108**. The terminals **102**, **103**, **104**, etc., are connected by conductors **109**, **111** and **112**, etc., with corresponding terminals **113**, **114**, and **115** of a stepping switch assembly, indicated generally by the reference numeral **116** and having a wiper arm **117**. The wiper arm **117** is wired in circuit with the conductor **77** by a conductor **118**. At its home terminal **119** the wiper **117** is connected in circuit with a relay coil **121** by a conductor **122**. The other side of the relay coil **121** is in circuit with the conductor **78** by a conductor **123**.

A timer **124** having a pair of contacts **125** and **126** that are operated by cams of the timer **124** is wired across the conductors **77** and **78** by conductors **127** and **128**. The timer **124** has a cam that closes the contact **125** for a given time interval and opens it for a given time interval and also has a cam that closes the contact **126** for a given time interval and opens it for a given time interval. One side of the contact **125** is in circuit with the conductor **78** by means of a conductor **129** and the other side is adapted to contact a contact that is in circuit with

a solenoid valve **131** that periodically releases a nitrogen burst into the developer tank **19** to insure agitation of the developer within the tank **19**. Solenoid valve **131** is in series with a switch **132** that provides an on and off control for the nitrogen burst. Another switch **133** that is controlled by a cam mechanism **134** is also wired in circuit with the solenoid valve **131**. The switch **133** is in circuit with the conductor **77** by means of a conductor **135**.

The three-way valves of the replenishers **96**, **97**, **98**, **99**, are actuated by an electrical means that has a first open terminal **136** and a second closed terminal **137**, each of which is adapted to be engaged by the contact **126** that is driven by the timer **124**. The terminal **137** is also connected to a contact **138** that is actuated by the relay coil **106**. The contact **138** is adapted to engage a terminal **139** or a terminal **141**. The terminal **141** is wired in circuit with a reset solenoid **142** that has the function of returning the wiper **117** of the stepping switch **116** to its home terminal **119**. The terminal **139** is in circuit with a stepping solenoid **143** that is operative to advance the wiper contact **117** on a step-by-step basis through any suitable ratchet mechanism as will become more apparent as this description proceeds.

The solenoids **142** and **143** are wired in circuit with the conductor **78** by a conductor **144**. The terminal **139** is also connected in circuit with a counter solenoid **145** and a subtracting solenoid **146** by a conductor **147**. The other ends of the counter **145** and the subtracting solenoid **146** are wired in circuit with the conductor **78** by a conductor **148**. One contact of a microswitch **149** is wired in circuit with the conductor **77** by a conductor **151**. The contact **149**, which is normally open, may engage the conductor **147** to provide current to the terminal **139**.

An add solenoid **152** is wired in circuit with the conductor **78** by a conductor **153** and in circuit with the conductor **77** by a conductor **154** in which a normally open microswitch **155** is positioned. The add and subtract solenoids **152** and **146** step the cam **134** in opposite directions as will become more apparent.

Operation of the electrical controls

When a system is operating, hanger bar assemblies **25** will transport film along the machine. The individual hanger bar assemblies **25** move from the loading area to the vertical transfer chain **38**. When a hanger bar assembly **25** is carried over the sprocket **43** by the vertical transfer chain **38**, it will contact a microswitch, indicated generally by the reference numeral **156** in FIGURE 5, and by the contact **155** in FIGURE 6. When the contact **155** is closed, current will flow through the add solenoid **152** to advance the cam mechanism **134** away from its home position. When this occurs, the switch **133** will be closed so that the solenoid valve **131** may be energized if the switch **132** and contact **125** are closed. The timer mechanism **124** which has been continuously operating, will periodically close the contact **125** to permit current to flow through the solenoid valve **131** so that nitrogen may be bubbled through the developer tank **19**. The nitrogen burst in the developer tank will be intermittent in operation because of the periodic opening and closing of the contact **125** by the timer **124**.

If additional films pass into the developer tank **19**, the microswitch **155** will be closed the same number of times as the number of films that are deposited. The cam mechanism **134**, therefore, will be stepped the number of times equal to the number of films that pass into the developer tank **19**. When the films and hanger bar assemblies **25** are withdrawn from the developer tank **19** by the vertical transfer chain **39**, another microswitch having the contact **149** is contacted. The microswitch may be the same as that shown in FIGURE 5. When the contact **149** is closed, current will flow through the counter solenoid **145** to indicate that a film has been developed and current will flow through the subtract solenoid **146**. The subtract solenoid **146** steps the cam **134** backward one step through a suitable ratchet mechanism (not shown). If only one film has entered the developer tank **19**, the cam mechanism **134** will be returned to its home position and the switch **133** will be opened and the nitrogen burst will stop. If more than one film has entered the tank, the cam mechanism **134** will not be returned to its home position until all of the films have passed the developer tank. Therefore, the nitrogen burst will continue through the developer tank **19** as long as films are present in it.

The microswitch **149** is also utilized to replenish the solutions within the tanks **19**, **21** and **22**. The solutions in these tanks require replenishment each time a film is passed through them. The amount of replenishment may be adjusted by altering the volume of the containers that are operated by the replenishing devices **96**, **97**, **98** and **99** and by changing the setting of the multi-position switch **101**. The multi-position switch **101** varies the number of times that the measured containers are emptied into the tanks **19**, **21** and **22** in a given cycle. For the purposes of description, it will be assumed that it is desired to empty the containers twice into the tanks.

The wiper **105** of the multi-position switch **101** is positioned at the terminal **103**, which is the second terminal. When the microswitch **149** is closed, current will flow through the stepping solenoid **143** via the conductor **147**. When the solenoid **143** is energized, the wiper **117** of the stepping switch **116** is moved from its home position **119** to the terminal **113** by a suitable ratchet mechanism (not shown) and current flow through the relay coil **121** will cease. The contact **155** then closes so that the contact **126**, which is actuated by the timer **124**, can then experience current flow when it is actuated by the cam of the timer **124**. When the cam of the timer **124** moves the contact **126** into engagement with the terminal **137** the replenishing devices **96**, **97**, **98** and **99** are operated to empty the measured containers into the tanks **19**, **21** and **22**. When the contact **126** is opened by the timer **124**, the solenoid valves actuated by it will close and the measured containers will be refilled by the reservoir to which they are attached. When the timer **124** again closes the contact **126** into engagement with the terminal **137**, the replenishing devices **96**, **97**, **98** and **99** again are actuated to empty their contents of the measured containers into the tanks. Current will flow through the advance solenoid **143** to move the wiper **117** of the stepping switch **116** into contact with the terminal **114**. Since the contact **114** is wired to the contact **103** of the multi-position switch **101** by the conductor **111** and since the terminal **105** of this switch is in contact with this terminal, a current will flow through the conductor **111**, terminal **105**, conductor **107**, and relay **106**. When the relay **106** experiences current flow, its contact **138** will be moved into engagement with the terminal **141**. Current will then flow through the reset solenoid **142** to return the contact **117** of the stepping switch **116** to its home terminal **119** by means of any suitable mechanism. The current will then flow through the relay coil **121** to open the switch **155** and stop the action of the replenishing device. It should be readily apparent that the setting of the multi-position switch **101** alters the number of cycles through which the replenishing devices **96**, **97**, **98** and **99** are operated in the aforementioned manner.

It may be desired to control the replenishment of the tanks **19**, **21** and **22** manually. For this purpose, a manually operated switch **157** is wired in parallel with the microswitch **149** by a conductor **158**. When the switch **157** is closed, the advancing solenoid **143** will experience current flow in the same manner as if the microswitch **149** has been closed. The replenishing system will then operate in the aforementioned manner for the number of cycles set by the multiposition switch **101**.

While it will be apparent that the preferred embodiments of the invention disclosed are well calculated to

fulfill the objects above stated, it will be appreciated that the invention is susceptible to modification, variation and change without departing from the proper scope or fair meaning of the subjoined claims.

What is claimed is:

1. A chemical processing machine comprising
a plurality of longitudinally spaced tanks for containing chemical baths,
horizontal transfer means for moving a piece horizontally through each of said tanks,
a plurality of vertical transfer means for withdrawing the workpieces from the horizontal transfer means and a respective tank and for inserting the pieces into the next adjacent tank and transferring the pieces back to the horizontal transfer means,
a single driving motor coupled to said horizontal transfer means and to said vertical transfer means for driving said transfer means simultaneously, and
control means for intermittently operating said driving motor for driving said vertical transfer means through a substantially complete cycle simultaneously with driving of said horizontal transfer means.

2. A chemical processing machine comprising
a plurality of longitudinally spaced tanks for containing chemical baths,
horizontal transfer means for moving a piece horizontally through each of said tanks,
a plurality of vertical transfer means for withdrawing the workpieces from the horizontal transfer means and a respective tank and for inserting the pieces into the next adjacent tank and transferring the pieces back to the horizontal transfer means,
a single driving motor coupled to said horizontal transfer means and to said vertical transfer means for driving said transfer means simultaneously and intermittently, said last named means being intermittently operative to drive said vertical transfer means through a complete cycle of their movement and said horizontal transfer means through only a small portion of its movement, and
means for establishing a variable dwell period between successive operations of said last named means.

3. A chemical processing machine as set forth in claim 2 further including means responsive to the transfer of a workpiece by one of the vertical transfer means for adding a selected amount of chemical to at least one of the tanks.

4. A chemical processing machine as set forth in claim 3 further including a means for bubbling a gas through the chemical bath in at least one of the tanks to agitate the bath therein in response to the presence of a workpiece therein.

5. A film developing machine comprising
a plurality fo longitudinally spaced tanks containing developing chemical baths,
horizontal transfer means for moving a film horizontally through each of said tanks,
a plurality of vertical transfer means for withdrawing the film from the horizontal transfer means and a respective tank and for inserting the film into the next adjacent tank and for transferring the film back to the horizontal transfer means,
means for driving said transfer means simultaneously,
first counting means responsive to the insertion of films into one of said tanks by one of said vertical transfer means for counting the number of films inserted into said one of said tanks and for releasing a stream of gas into said tank to agitate the chemical contained therein, and
second counting means responsive to the withdrawal of films from said one of said tanks by one of said vertical transfer means for counting the number of films withdrawn from said one of said tanks and when the numbers counted by said counting means coincide, means for stopping the stream of gas.

6. A chemical processing machine for sequentially inserting and withdrawing a piece to and from successive longitudinally spaced tanks containing treating chemicals comprising
a pair of horizontal transfer chains at opposite sides of said tanks,
means for supporting the treated pieces,
means on said horizontal transfer means for engaging said supporting means and moving said supporting means horizontally along the machine,
pairs of vertical transfer chains at the leading and trailing edges of each of said tanks for withdrawing the pieces from the tanks at the trailing edge thereof and depositing the pieces in the next adjacent tank at the leading edge thereof,
a single pin carried by each of said vertical transfer chains,
means on said supporting means adapted to be interengaged by said pins for vertical transfer of said supporting means by said vertical transfer chains, and
a single driving means for driving all of said chains sequentially and intermittently, said last named means being operative to drive said vertical chains through a complete cycle to stop the pins carried thereby at the same point at the completion of each cycle and to drive said horizontal chains a substantially lesser distance.

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