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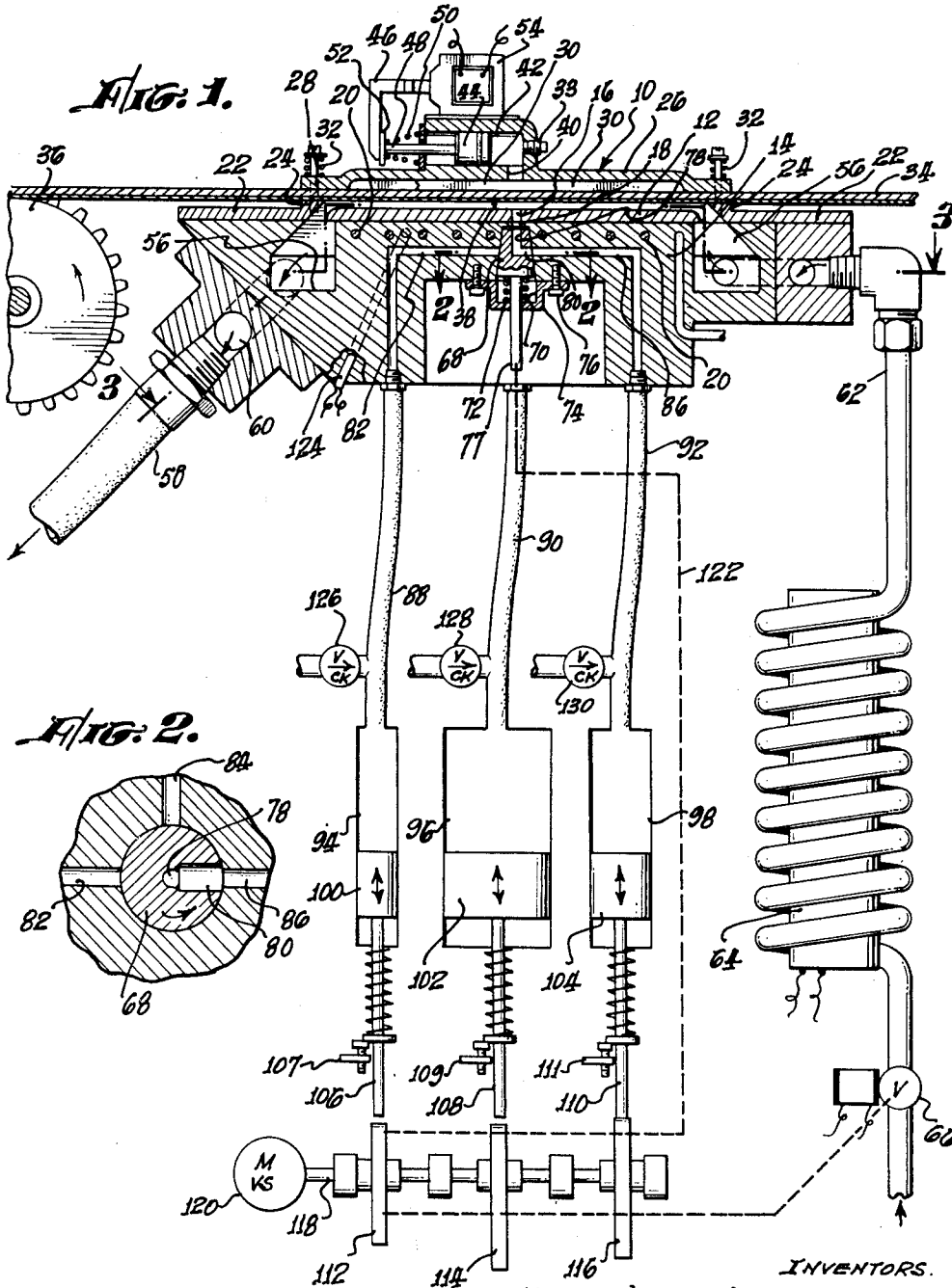
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APPARATUS AND TECHNIQUE FOR FILM DEVELOPING

Filed Oct. 13, 1960

2 Sheets-Sheet 1



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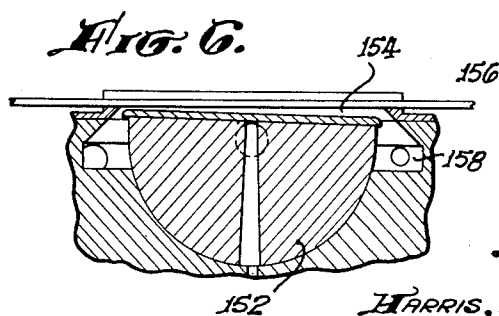
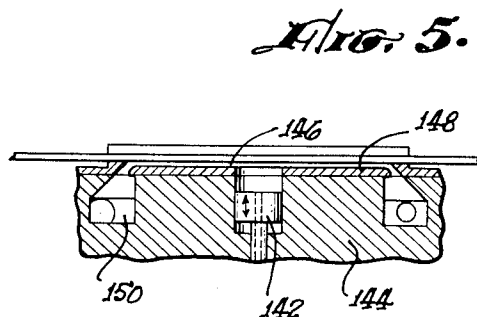
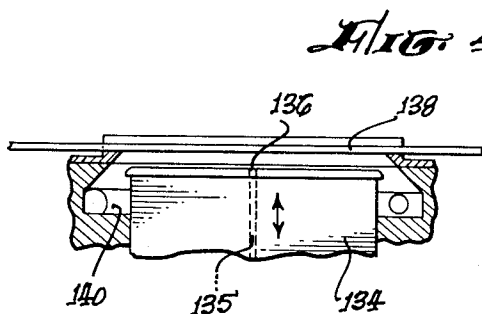
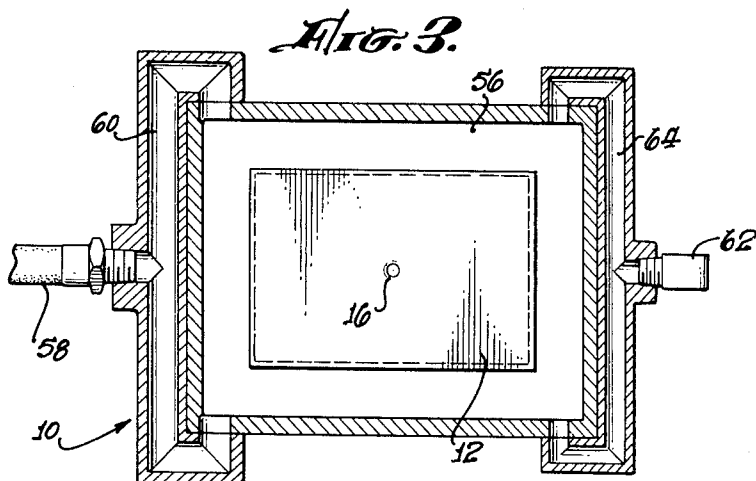
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3,149,550 APPARATUS AND TECHNIQUE FOR FILM DEVELOPING

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9 Claims. (Cl. 95—89)

This invention relates to film processing and more particularly provides apparatus and an improved technique for the rapid processing of an exposed photographic film.

Equipment and processes are presently available for the rapid development of photographic film. Two of the more commonly used rapid processing techniques involve respectively a spray processing and a two-chamber solution recirculating process. Spray processing requires an intricate nozzle design to give an even spray pattern which is necessary to uniform processing. Filtration of processing fluids is practiced to remove impurities and precipitated crystals, if there be any, and thereby avoid clogging of the spray nozzles. Spray processing is commonly carried on at elevated pressures, leading to problems of leakage at connections of the system. For proper film development uneconomical amounts of processing solutions are required and for best operation preheating of vessels and connecting lines is practiced. It is important in employing the spray technique that entrapment of gas in the processing solutions be avoided, otherwise objectionable foaming may occur.

The so-called two-chamber solution recirculating process is limited to the development of continuous film strips. It is not suitable to development of film strips in the form of individual film frames. The process employs squeegees for contacting film surfaces and this feature sometimes leads to scratching of the film surfaces because of foreign matter clinging to the squeegees. Chemical waste products are recirculated and in time the processing solutions deteriorate unless a method of solution replenishment is provided. For this reason the photographic quality is not uniform. The high velocity recirculation of processing solutions often results in air bubbles which are particularly troublesome when trapped in the processing chambers.

It is possible with process and apparatus of the invention to rapidly develop photographic film without incurring many of the shortcomings of the presently available techniques. In the process of the invention, there is provided a minute processing chamber defined by the emulsion side of an exposed photographic film and a platen closely spaced in parallel relationship thereto. The spacing between the platen and film is preferably sufficiently close so that the processing liquids introduced therebetween are held within the chamber by capillary force. The preferred embodiment of the process employing the capillary force permits processing to be carried on without leveling of the processing chamber. There is no reliance on gravity to insure adequate contacting of film and processing liquids. Successively small amounts of processing fluids are passed to the processing chamber, with each succeeding fluid serving to supplant the preceding fluid in the chamber. Because of the capillary force, the processing chamber may be open, i.e. there is no need to close the sides of the chamber.

In a preferred embodiment of the process, the non-emulsion side of the film is backed by a pressure plate closely spaced in parallel relationship to the platen. The pressure plate is provided with several grooves in its film engaging surface to which a vacuum is applied, to hold the film in flat engagement. The use of the vacuum assures that the perpendicular dimension of the capillary space is precisely maintained. This feature is especially

important where larger film sizes are processed by the capillary processing technique of the invention.

In a preferred process, the processing fluids successively supplied to the processing chamber include a developing solution, a fixing solution, a water wash, and an air stream. The drying air cleans the chamber of all waste processing liquids and dries the film emulsion as well as the chamber. The processing liquids are those commonly employed in photographic film development.

While the process of the preferred embodiment employs separate developing and fixing solutions, it is possible to use a commercially available monobath solution having both developing and fixing characteristics, followed preferably by a water wash and lastly by an air stream. The upper surface, that is, the non-emulsion side of the film during the processing may be subjected to a varying air pressure. This feature, while not absolutely necessary, lessens processing time through agitation of the liquid and further minimizes the quantities of processing solutions used. It will be noted that it is possible with the process of the invention to use precise, metered quantities of the processing fluids. Typical amounts of processing liquids used for development of, for example, a 35 mm. frame are: 0.3 to 0.8 ml. of developing solution, 0.5 to 1.5 ml. of fixing solution and 2.0 to 4.0 ml. of wash solution, normally water. The quantities used are not critical, however, for solution economy minimum consumption is practiced. A typical timing cycle is for example: 1.5 seconds for development, 0.5 seconds for fixation, 1.5 seconds for washing, and 1.5 seconds for drying. The total processing time will usually be in the range of 3 to 10 seconds, depending on film, chemicals employed, temperatures, etc. Longer and shorter cycles are possible.

Heated air is usually employed for the drying step of the process although other means of drying, e.g. an organic liquid material having strong water repellent characteristics, may be employed to displace the wash solution, followed by a solvent which readily evaporates.

It has been mentioned before that in the preferred process the processing liquids are held within the processing chamber by capillary force. This feature obviates the need for exact leveling of the apparatus. Parallel spacing of the platen and film is of great importance in obtaining an effective capillary processing chamber. The exact dimension of the capillary spacing is optimized to suit the processing solution or solutions, but normally will be in the range of 0.010 to 0.030 inch. The use of the capillary processing technique permits employment of very small volumes of processing liquids. Capillary action, in addition, assures good liquid contact of the film and permits low pressure liquid introduction. The rapid processing technique is particularly suitable to the development of square or rectangular film.

Broadly speaking, the apparatus of the invention is made up of a platen with an opening in its upper surface and a frame adjacent the platen, with a film engaging surface of the frame placed in a plane close to the plane of the upper surface of the platen. The frame is adapted to receive on its film engaging surface a photographic film, which film, together with the upper surface of the platen, defines the aforementioned minute processing chamber. Means are provided for delivering processing fluid to the processing chamber through the opening in the platen. The distance between the plane of the platen surface and the plane of the film engaging surface of the frame is in the preferred embodiment from about 0.01 to 0.030 inch. The apparatus is preferably provided with a heater block supporting the platen and carrying a fluid passage which is in communication with the central opening of the platen. The heater block may or may not be integral with the platen. A heating element preferably is embedded within the heater block. In the preferred de-

sign there is provided a movable valve within the heater block with the outlet port of the valve in alignment with the fluid passage of the block and with the inlet port of the valve being movably aligned with at least two fluid supply passageways contained within the heater block. A fluid overflow well encircles the platen and is adapted to receive spent processing fluid from the platen surface. The apparatus is provided with a fluid discharge line interconnected preferably by several openings to the overflow well and in its preferred embodiment with an air passage line opening, again preferably through several openings, into the overflow well at a point remote from the fluid discharge line.

It will be noted in this preferred embodiment of the apparatus that air is not admitted to the processing chamber through the central opening of the platen but rather is supplied to the encircling overflow well. In an alternative design, air is supplied to the central opening of the platen through the aforementioned movable valve of the heater block. Means are provided for delivering processing fluid to the fluid supply passageways connecting with the movable valve of the heater block. The fluid supply passageways within the heater block are of a sufficient length to preheat the processing fluids, whether it be a developing solution or a fixing solution in quantities required to process a single film frame.

These and other advantages of the improved film processing and of the apparatus and method for its manufacture will become more apparent from the following specification and the accompanying drawings which are for the purpose of illustration only, and in which:

FIG. 1 is a sectional view of a preferred embodiment of the film processing apparatus of the invention, with some of the equipment being shown schematically;

FIG. 2 is a sectional view taken along line 2—2 of FIG. 1;

FIG. 3 is another sectional view taken along line 3—3 of FIG. 1 in part through a film processing chamber immediately above a platen member and directly below a film strip being processed;

FIG. 4 is a fragmentary sectional view illustrating an alternative embodiment of the film processing apparatus of the invention, utilizing a movable platen having a centrally disposed opening and passageway for supplying processing liquids to the film surface;

FIG. 5 is a fragmentary sectional view illustrating another embodiment of the film processing apparatus of the invention, utilizing a fixed platen having a movable piston within a centrally located fluid passageway of the apparatus;

FIG. 6 is a fragmentary sectional view illustrating still another embodiment of the film processing apparatus of the invention utilizing a rocking platen.

There is illustrated in FIG. 1 one embodiment of the apparatus 10 of the invention suitable for the fast development of a photographic film. The film processing apparatus 10 has a platen 12 of rectangular cross section supported on a heater block 14 which may be fabricated separately or integrally fabricated with the platen. The platen has a central opening 16 in its upper surface, which opening is aligned with a very short vertical fluid passage 18 of the heater block 14. The platen 12 preferably has a highly polished stainless steel surface. The heater block 14 is manufactured from solid steel and has embedded in it heating elements 20. The large mass of the heater block 14 assures maintenance of an even processing temperature.

A steel sealing frame 22 having a rectangular opening enclosed by a film engaging surface or lip 24 is placed around the platen 12. A strip of 35 mm. film 34 (or other size film), is held in tight engagement against the steel lip 24 by an overlying fiat pressure plate 26. The pressure plate 26 has a film engaging, rectangular outer edge 28, its bottom surface within the rectangular edge being provided with several parallel, longitudinally

extending grooves 30. The pressure plate 26 is spring-loaded downwardly by coil springs 32, providing a means for releasably holding the photographic film in tight engagement between the film engaging lip 24 of the frame 22 and the overlying pressure plate 26. The film strip 34 may be released by lifting the pressure plate 26 upwardly against the compression of the coil springs 32. With the pressure plate 26 in its raised position, the film strip 34 is moved by a sprocket drive 36 as illustrated or by a gripper drive to position the next succeeding film frame within the apparatus for processing.

As best seen in FIG. 1, the top surface of the processing platen 12 forms with the underside (the emulsion side) of the film strip 34 a capillary processing chamber 38. The parallel spacing of the platen in relation to the film strip 34 is of great importance in the proper working of the capillary chamber. With the correct spacing of the platen from the film, the processing liquids introduced therebetween are held within the chamber by capillary force. The distance from film surface to platen is generally within the range of about 0.010 to 0.030 inch. The capillary spacing is optimized to suit the particular processing liquids employed. In order to maintain the close tolerances of the capillary chamber, the film engaging lip 24 of the frame 22 is preferably made of steel. Rubber or plastic materials which are normally used for sealing purposes tend to compress, thus reducing the chamber size. If rubber or plastic is used, stops formed of steel or other noncompressible materials are provided to maintain proper spacing while sealing with the flexible material. The underside of the film engaging lip 24 slopes sharply in a downwardly and outwardly direction. The slanting of the underside of the lip 24 promotes a clean lip edge during processing and also results in continuing the capillary processing space slightly beyond the lateral edge of the frame 22.

The several grooves 30 of the pressure plate 26 are connected through a corridor 40 to the interior of an air cylinder 42 containing a piston 44. Movement of the piston 44 to the left of FIG. 1 places a partial vacuum (though very slight) on the upper surface of the film strip 34, holding it flat against the bottom surface of the pressure plate 26. Alternatively, a plug 33 in the end wall of cylinder may be removed and a vacuum line connected. With this modification, there would be no need for the movable piston 44.

It is sometimes desirable to agitate the processing fluids to further accelerate processing. This may be done by movement of the piston 44 back and forth within the air chamber 42, which results in a variation of the air pressure at the surface of the film strip 34. The pulsation effect thus provided upon the film strip 34 promotes more thorough contacting of the film by the processing fluid than within the processing chamber 38. In those instances where it is advantageous to use the varying air pressure technique, the effectiveness of the pulsation effect may be heightened by substituting a large recessed area in the bottom surface of the pressure plate 26 for the several grooves 30. The film strip 34 is positioned within the device with its exposed emulsion side facing downwardly. The piston 44 is moved to the right of FIG. 1 by a solenoid arm 46 engaging the outer end of a piston arm 48. The piston 44 is returned to the left of FIG. 1 under the compression of a coil spring 50 which is contained between an end flange 52 of the piston arm 48 and the exterior end of the air cylinder 42. The solenoid arm 46 is actuated by a solenoid 54 of conventional design.

The entire heater block 14 is surrounded by an overflow well 56 as best seen in FIG. 3. The processing solutions overflowing the edge of the platen 12 collect in the overflow well 56 and from there the liquid can move freely to a fluid discharge line 58 via two openings of a separate passage 60. As best seen in FIG. 3 the passage 60 parallels the width of the platen 12 and is connected

at its opposite ends to the overflow well 56. The air provided for the drying and cleaning of the processing chamber (as well as the drying of the film) is supplied by an air line 62 which opens into a passage 64 paralleling the aforementioned passage 60 at the opposite side of the apparatus 10. The opposite ends of the passage 64 open into the overflow well 56.

A portion of the air line 62 externally of the processing apparatus proper is coiled around an electric heating element 64. A solenoid operated air valve 66 controls the flow of air through the air line 62. The coiled section of the air line 62 permits rapid heating of the drying air. Normally an air temperature of 250° F. is used. The exact permissible temperature employed depends, among other things, upon the velocity of the drying air. Air pressure will normally be in the range of 5 to 15 p.s.i.g. For one second drying, a considerable higher pressure is required. The drying air from the platen surface and the overflow well 56 leaves the apparatus through the aforementioned drain line 58. Other methods of air preheating may be used in place of that illustrated, e.g. preheating of an air storage container or the incorporation of exposed heating wires within a locally enlarged portion of the air line 62.

In order to minimize the intermixing of the processing solutions, a liquid valve 68 having the shape of a truncated cone is disposed in a cavity 70 of corresponding shape located adjacent the bottom of the heater block 14. The conical shape of the valve affords a good seal. For the same reason, the valve is urged upwardly within the cavity 70 by a coil spring 72 which is contained in a housing 74 secured to the underside of the heater block 14 by screws 76. The liquid valve 68 is fixed at its central underside to a rod 77 which extends through the coil spring 72, through an aperture in the bottom of the housing 74 to a point below the processing apparatus proper. It is desirable that the length of the vertical passage 18 of the heater block 14 be as short as possible, because the fluid held within this passage 18 between successive steps of the process is wasted as it is supplied without being used for processing. It is also beneficial to reduce to a minimum the dead space above the valve 68 to lessen contamination of chemicals. This may be achieved by increasing the angle of the cone of the valve 68.

The liquid valve 68 has a vertical passage 78 which extends from the top central portion of the valve downwardly about one-third the height of the valve where it terminates in a laterally extending passage 80. The laterally extending passage 80 of the valve is placed at the same level as three fluid supply passages 82, 84 and 86 and has preferably a slightly larger diameter than the three fluid supply passages, in order that the valve 68 may continue to function even though there may be some slight misalignment because of thermal expansion. In the position illustrated in FIGS. 1 and 2 the lateral passage 80 of the valve 68 is aligned with the fluid supply line 86. Rotation of the cone-shaped valve 68 will place it in alignment with the fluid supply passages 82 and 84 respectively. The fluid supply passage 82 connects to a developing solution supply line 88 formed preferably of a flexible Teflon tubing. The fluid supply passages 84 and 86 are respectively connected to a water supply line 90 and a fixing solution supply line 92. The latter two supply lines may also be fabricated of Teflon tubing. The other ends of the supply lines 88, 90 and 92 are respectively connected to a developing solution pump 94, a water pump 96, and a fixing solution pump 98.

As illustrated, the pumps are of different diameters in order to permit equal piston travel for each pump to deliver the various quantities of processing liquids required. For instance, the amount of water required is larger than the quantity of liquid required for either the developing or fixing solution and for that reason the water pump has the largest diameter in order that its piston travel may equal that of the other two pumps. Pistons 100, 102 and 104 of the three pumps are respec-

tively connected to cam followers 106, 108, and 110. Adjustment of piston stops 107, 109, and 111 permits lengthening and shortening of the respective piston strokes. The respective cam followers 106, 108 and 110 are actuated by corresponding cams 112, 114 and 116 carried by a cam shaft 118 of the variable speed motor 120. At a preselected proportionate timing cycle, the total cycle time, maintaining proportionate times, can be changed by altering the speeds of the cams. The rod 77 of the liquid valve 68 is actuated positioning the respective fluid supply passages with the lateral passages 80 of the valve 68, through rotation of the rod in response to a linkage 122 of conventional design connected to the cam shaft 118.

The fluid supply passages 82, 84 and 86 are sized to permit preheating of their respective liquids. A thermal sensor 124 such as a thermistor or a thermocouple is embedded in the heater block and connected with an automatic heater control unit (not shown) for the heating elements 20. The thermal sensor 124 control unit, and heating elements 20 maintain the processing temperature constant. The processing temperature is normally chosen between ambient and 150° F. A particularly desirable temperature range is from 100° F. to 130° F. The exact temperature selected is based principally on the film used and the developing solution employed. The energizing of the solenoid controlling the air valve 66 is regulated from the cam shaft 118.

Each of the supply lines 88, 90 and 92 has associated with it one of the pumping valves 126, 128, and 130. The three valves permit liquids from the storage containers (not shown) to enter the respective pumps when the pumps are in their suction strokes. The respective valves close when the pressure stroke of each pump is pushing liquid through the respective supply line.

In a typical cycle, the pressure plate 26 is raised and the film strip 34 moved by the sprocket drive the length of one frame to place a new film frame within the apparatus for processing. The liquid valve 68 has its lateral passage 80 aligned with the developing solution supply passage 82 of the heater block 14. The developing solution pump 100 in response to cam 112 of the cam shaft 118 delivers a small amount of developing solution to the capillary processing chamber 38 via the fluid passage 18 and the central opening 16 of the platen 12. The amount of developing solution normally delivered will be in the range of 0.3 to 0.8 ml. The developing solution will normally have a contact time of about 1.5 seconds within the processing chamber 38. The cam shaft 118 of the variable speed motor 120 now moves the cam 116 into contact with the cam follower 110 which is affixed to the piston 104 of the fixing solution pump 98. Simultaneously the liquid valve 68 of the heater block 14 is moved to align the fluid supply passage 86 with the lateral passage 80 of the valve. This alignment with the valve permits pumping of fixing solution by the pump 98 through the fixing solution supply line 92 to the supply passage 86, through the valve 68 and vertical fluid passage 18 of the heater block to the central opening 16 of the platen 12. More correctly speaking, the small amount of fixing solution supplied to the capillary processing chamber 38 in this portion of the developing cycle is a quantity of fixing solution previously held within the fluid supply passage 86 and heated to the desired temperature. It will be appreciated that the fixing solution supplied to the capillary processing chamber 38 will displace the developing solution which will overflow into the overflow well 56. The amount of fixing solution supplied will generally be in the range of 0.5 to 1.5 ml. Further movement of the cam shaft 118 brings the cam 114 into contact with the cam follower 108 which is attached to the piston 102 of the water pump 96. Again simultaneously, the liquid valve 68 of the heater block 14 is moved, this time to align with the water supply passage 84. In this fashion the water displaces the fixing solution from the processing cham-

ber 38. The time the fixing solution is in the chamber is normally about 0.5 seconds and the length of washing is usually about 1.5 seconds. The wash water is supplied in the amount of 2.0 to 4.0 ml. The last portion of the cycle is the drying which is achieved by supplying heated drying air via air passage line 62 of the overflow well 56. The air serves to dry the film and simultaneously clear the apparatus, including the capillary processing chamber 38, of liquid. Drying is normally carried on for 1.5 seconds with an air temperature of about 250° F.

In one embodiment of the process as described earlier, liquid contacting of the emulsion side of the film frame is facilitated by applying air pulsations to the upper side of the film. In FIG. 4 there is illustrated a movable platen 134 having a vertical fluid passage 135 through which processing solutions may be supplied to the top of the platen through a central opening 136. In this apparatus, when the platen is in its down position the developing solution is supplied to the platen surface in a small amount. The developing solution forms a very small drop on the top of the central top of the platen and is then pressed against the film, thus giving a very even development while the platen 134 moves up. The platen 134, as in the other embodiment, is provided with an encircling overflow well 140.

The apparatus of FIG. 5, instead of employing a movable platen as in FIG. 4, utilizes a movable piston 142 within a heater block 144 to supply processing liquids to a capillary chamber 146. The fixed heater block and its integral platen 148 are surrounded by an overflow well 150. Although rapid processing is possible in the capillary chamber without agitation as supplied through the pressure pulsations of the embodiment of FIG. 1, such agitation is a desirable feature. The apparatus of FIG. 6 provides another manner of furthering contact of the film with the processing liquid through agitation. A platen 152 is pivotally supported within the apparatus and thus in effect provides a rocking platen which with movement forces the processing fluids to-and-fro within a processing chamber 154. This manipulation of the underside of film 156 further hastens the processing. The movement of the rocking platen, while changing somewhat the shape of the capillary space, does not change its volume. The rocking platen 152 is surrounded by an overflow well 158. In the alternate designs of FIGS. 4, 5 and 6 it is practical to close two opposing sides of the capillary space.

It will be appreciated that a plurality of the capillary processing chambers may be provided to simultaneously develop a corresponding number of film frames. In the developing of an X-ray film which has an emulsion on both sides, two back-to-back capillary processing chambers may be employed.

Although an exemplary embodiment of the invention has been disclosed herein for purposes of illustration, it will be understood that various changes, modifications, and substitutions may be incorporated in such embodiment without departing from the spirit of the invention as defined by the claims which follow:

We claim:

1. An apparatus suitable for the fast processing of a photographic film using processing fluids, comprising: a platen with a central opening in its upper flat surface; means for receiving spent processing fluid from the surface of said platen; a frame adjacent the platen with its upper surface placed in a slightly higher plane than the plane of the surface of said platen, said frame being adapted to receive on its upper surface a photographic film having an exposed emulsion with the emulsion of the film faced downwardly, said film when positioned on the upper surface of the frame, together with the upper surface of the platen, defining a small film processing chamber with the spacing between the film and platen being sufficiently close to permit processing liquids introduced therebetween to be held within the processing chamber by capillary force,

said distance between the plane of the platen and the plane of the upper surface of the frame being from 0.010 to 0.030 inch; and means for delivering processing liquid to the processing chamber through the opening in the platen, said delivery means having a capacity to deliver sufficient liquid to allow capillary action to exist in the area defined by the film and platen.

2. An apparatus suitable for the fast processing of a photographic film using processing fluids, comprising: a platen with a central opening in its upper flat surface; a heater block supporting said platen and having a passageway in communication with said central opening in the platen; a heating element embedded in said heater block; means for introducing air to said surface of said platen; a heating means associated with said air introduction means for heating the air flowing therethrough; a frame adjacent the platen with its upper surface placed in a slightly higher plane than the plane of the surface of said platen, said planes being parallel, said frame being adapted to receive on its upper surface a photographic film having an exposed emulsion with the emulsion of the film faced downwardly, said film, when positioned on the upper surface of the frame, together with the upper surface of the platen, defining a small processing chamber with the spacing between the film and platen being sufficiently close to permit processing liquids introduced therebetween to be held within the processing chamber by capillary force, said distance between the plane of the platen surface and the plane of the upper surface of the frame being from 0.010 to 0.030 inch; means for supplying processing liquid through the passageway of the heater block to the upper surface of said platen, said supplying means having a capacity to deliver sufficient liquid to allow capillary action to exist in the area defined by the film and platen; and means for receiving spent processing liquid from the surface of said platen.

3. An apparatus suitable for the fast processing of a photographic film using processing fluids, comprising: a platen with a central opening in its upper flat surface; means for receiving spent processing fluid from the surface of said platen; a frame adjacent the platen with its upper surface placed in a slightly higher plane than the plane of the surface of said platen, said frame being adapted to receive on its upper surface a photographic film having an exposed emulsion with the emulsion of the film faced downward, said film, when positioned on the upper surface of the frame, together with the upper surface of the platen defining a small film processing chamber with the spacing between the film and platen being less than 0.030 inch and sufficiently close to permit processing liquid introduced therebetween to be held within the processing chamber by capillary force; and means for delivering processing fluid to the processing chamber through the opening in the platen, said delivery means having a capacity to deliver sufficient liquid to allow capillary action to exist in the area defined by the film and platen.

4. An apparatus suitable for the fast processing of a photographic film using processing fluids, comprising: a platen having a central hole in its upper flat surface; a heater block supporting said platen and possessing a passageway in communication with said opening in said platen; a heating element embedded in said heater block; a frame adjacent the platen with its upper surface placed in a slightly higher plane than the plane of the surface of said platen, said frame being adapted to receive on its upper surface a photographic film having an exposed emulsion with the emulsion of the film faced downwardly, said film, when positioned on the upper surface of the frame, together with the upper surface of the platen defining a small film processing chamber with the spacing between the film and platen being less than 0.030 inch and sufficiently close to permit processing liquid introduced therebetween to be held within the processing chamber by capillary force; means for delivering processing liquid through the passageway of the heater block to the opening

in the upper surface of said platen, said delivery means having a capacity to deliver sufficient liquid to allow capillary action to exist in the area defined by the film and platen; and means for receiving spent processing liquid from the surface of said platen.

5 5. An apparatus suitable for the fast processing of a photographic film using processing fluids, comprising: a platen with a central opening in its upper flat surface; a heater block supporting said platen and having a passage-
10 way in communication with said central opening in the platen; a heating element embedded in said heater block; means for supplying processing liquid through the passage-
15 way of the heater block to the upper surface of said platen; means for introducing air to said surface of said platen; a heating means associated with said air means for heating the air flowing there-
20 through; a frame adjacent the platen with its upper surface placed in a slightly higher plane than the plane of the surface of said platen, said planes being parallel, said frame being adapted to receive on its
25 upper surface a photographic film having an exposed emulsion with the emulsion of the film faced downwardly, said film, when positioned on the upper surface of the frame, together with the upper surface of the platen, defining a small film processing chamber with the spacing between the film and platen being less than 0.030 inch and suf-
30 ficiently close to permit processing liquid introduced therebetween to be held within the processing chamber by capillary force, said means for supplying processing liquid having a capacity to deliver sufficient liquid to allow capillary action to exist in the area defined by the film and the pla-
35 ten; and means for receiving spent processing liquid from the surface of said platen.

6. An apparatus suitable for the fast processing of a photographic film employing several processing fluids, said apparatus comprising: a platen with a central opening in its upper flat surface; a heater block supporting said platen and having a first liquid passageway in communication with said central opening in the platen and having at least two additional liquid passageways, each of said additional liquid passageways within the block being of a sufficient length to preheat the particular processing liquid contained therein in a quantity required to process a single film; a heating element embedded in said heater block; means for delivering processing liquids to the liquid supply pas-
40 sageways of the heater block and to the surface of the platen; means for receiving spent liquid from the surface of said platen; a movable valve carried within said heater block with its outlet port in alignment with said first liquid passageway of the heater block and its inlet port being movably and selectively aligned with said additional liquid passageways contained within the heater block; and a frame adjacent the platen with its upper surface placed in a slightly higher plane than the plane of the surface of said platen, said frame being adapted to receive on its sur-
45 face a photographic film having an exposed emulsion with the emulsion of the film faced downwardly, said film, when positioned on the upper surface of the frame, together with the upper surface of the platen, defining a small film processing chamber with the spacing between the film
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and platen being less than 0.030 inch and sufficiently close to permit processing liquids introduced therebetween to be held within the processing chamber by capillary force and said means for delivering processing liquids having a capacity to deliver sufficient liquid to allow capillary action to exist in the area defined by the film and platen.

7. An apparatus suitable for the fast processing of a photographic film employing several processing fluids, said apparatus comprising: a platen with a central opening in its upper flat surface; a heater block supporting said platen and having a first liquid passageway which is in communication with said central opening of the platen and having at least two additional liquid passageways, each of said additional liquid passageways within the block being of a sufficient length to preheat the particular processing liquid contained therein in a quantity required to process a single film; a heating element embedded in said heater block; a movable valve within said heater block with its outlet port in alignment with said liquid passageway in the block and with its inlet port being movably and selectively aligned with said additional liquid passageways contained within said heater block; means for delivering processing liquids to said liquid passageways of the heater block and to the surface of the platen; means for introducing
25 air to said surface of said platen; a heating means associated with said air means for heating the air flowing there-
30 through; a frame adjacent the platen with its upper surface placed in slightly higher plane than the plane of the surface of said platen, said frame being adapted to receive on its
35 upper surface a photographic film having an exposed emulsion with the emulsion of the film faced downwardly, said film when positioned on the upper surface of the frame, together with the upper surface of the platen defining a small film processing chamber with the spacing between the emulsion side of the exposed film and the platen being less than 0.030 inch and sufficiently close so that a process-
40 ing liquid introduced therebetween is held within the processing chamber by capillary force and said means for delivering processing liquids having a capacity to deliver sufficient liquid to allow capillary action to exist in the area defined by the film and platen; means for releasably holding the photographic film in tight engagement against the frame; and means for receiving spent process-
45 ing liquid from the surface of said platen.

8. A film processing apparatus in accordance with claim 7 wherein the distance between the plane of the platen surface and the plane of the upper surface of the frame is from 0.010 to 0.030 inch.

9. A film processing apparatus in accordance with claim 7 wherein heating control means is provided for maintaining the temperature of the heater block substantially constant.

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UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,149,550

September 22, 1964

Karl-Heinz H. W. Lohse et al.

It is hereby certified that error appears in the above numbered patent requiring correction and that the said Letters Patent should read as corrected below.

Column 4, line 35, for "lateral" read -- literal --;
column 6, line 11, for "passages", second occurrence, read
-- passage --.

Signed and sealed this 9th day of February 1965.

(SEAL)

Attest:

ERNEST W. SWIDER
Attesting Officer

EDWARD J. BRENNER
Commissioner of Patents

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