

- [54] **FLOATING FILM PHOTOGRAPHIC DEVELOPING APPARATUS**
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- [52] U.S. Cl. **95/89 R, 95/95**
- [51] Int. Cl. **G03d 3/00**
- [58] Field of Search **95/89 R, 93, 94, 89 F, 95**

[56] **References Cited**

UNITED STATES PATENTS

- 3,344,729 10/1967 Kittosser **95/89**

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[57] **ABSTRACT**

Developing apparatus for the rapid development of photographic silver halide elements, e.g., sheets or plates having a series of spaced solution-applying plates having (1) rows of spaced orifices of small diameter for supplying photographic treating solutions to the surface of the applying plates and to the surface of the elements passed across the applying plates, and (2) alternate rows of spaced orifices of greater diameter for removing excess solution; characterized in that between the applying plates are pressure or squeegee rolls for removing excess solutions, drip pans for the solutions, cover plates extending over the applying plates and flexible sealing strips at the entrance and exit ends of the cover plates, which strips are adapted to press against the back surface of the photographic elements. The apparatus can have an associated drying chamber adjacent the final solution-applying plate.

4 Claims, 6 Drawing Figures

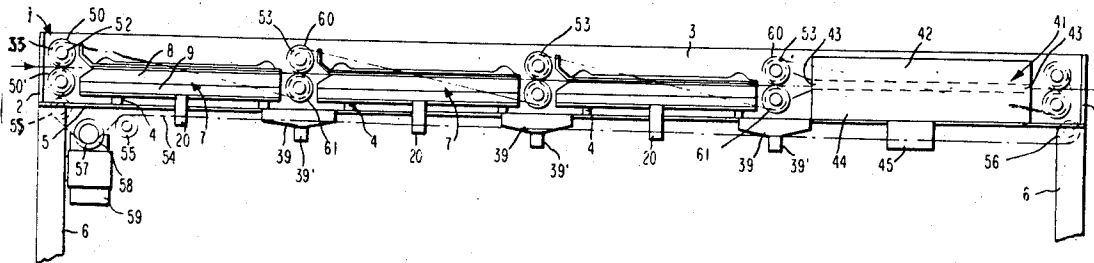


FIG. 1

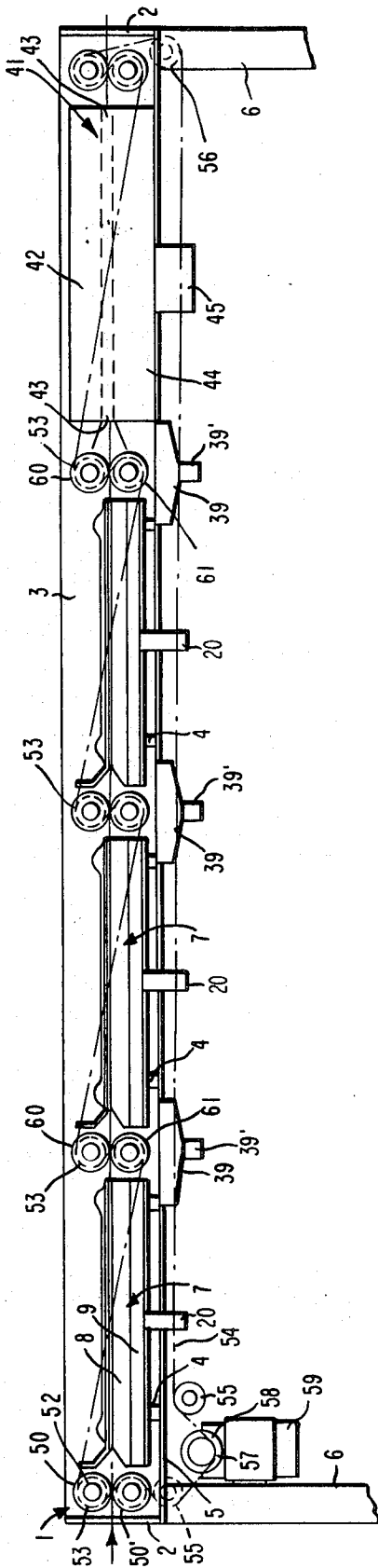
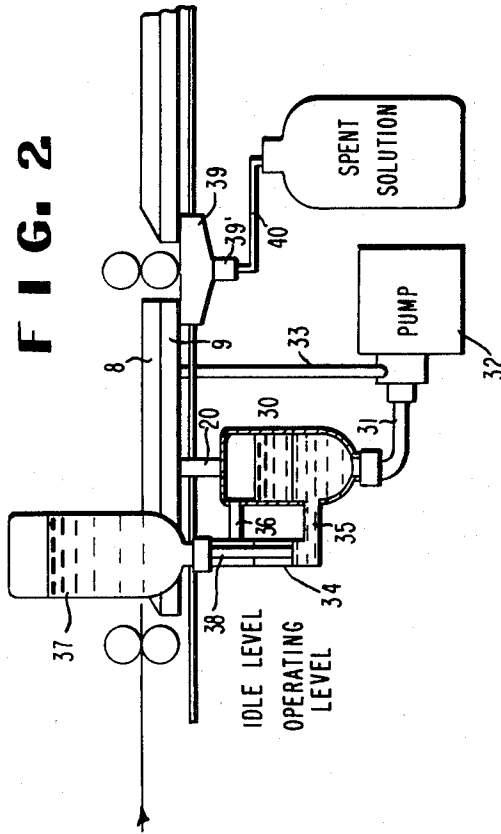


FIG. 2



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FIG. 3

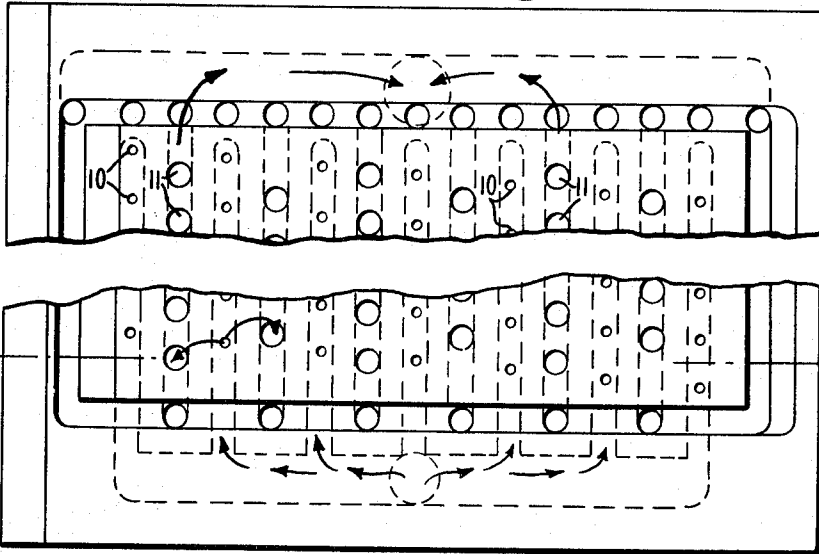


FIG. 4

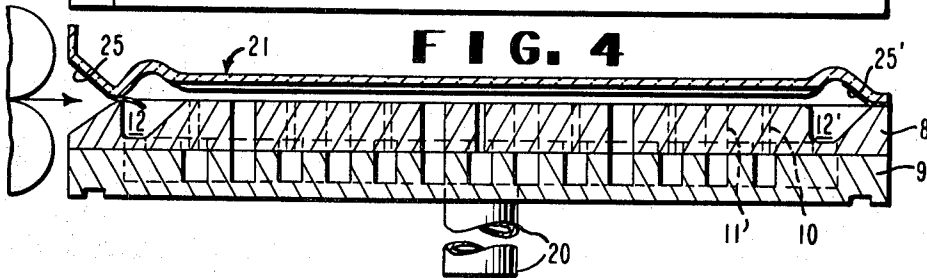
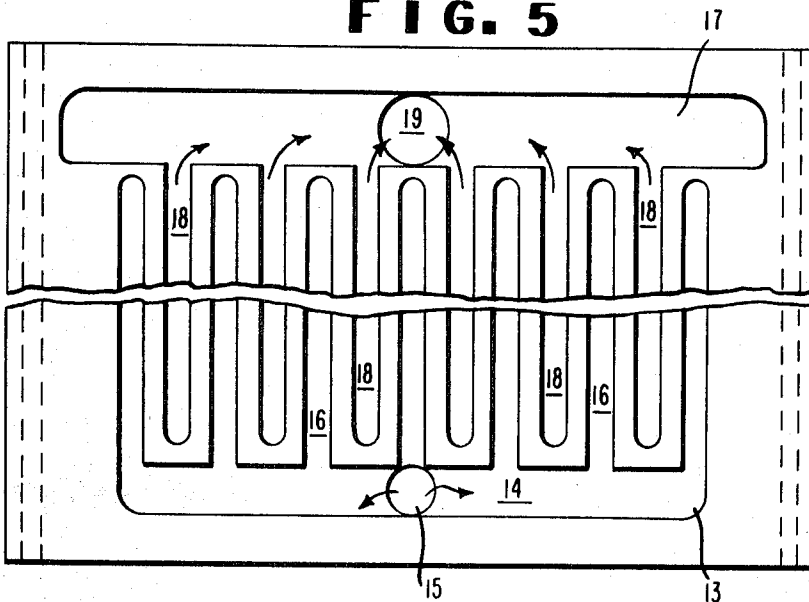
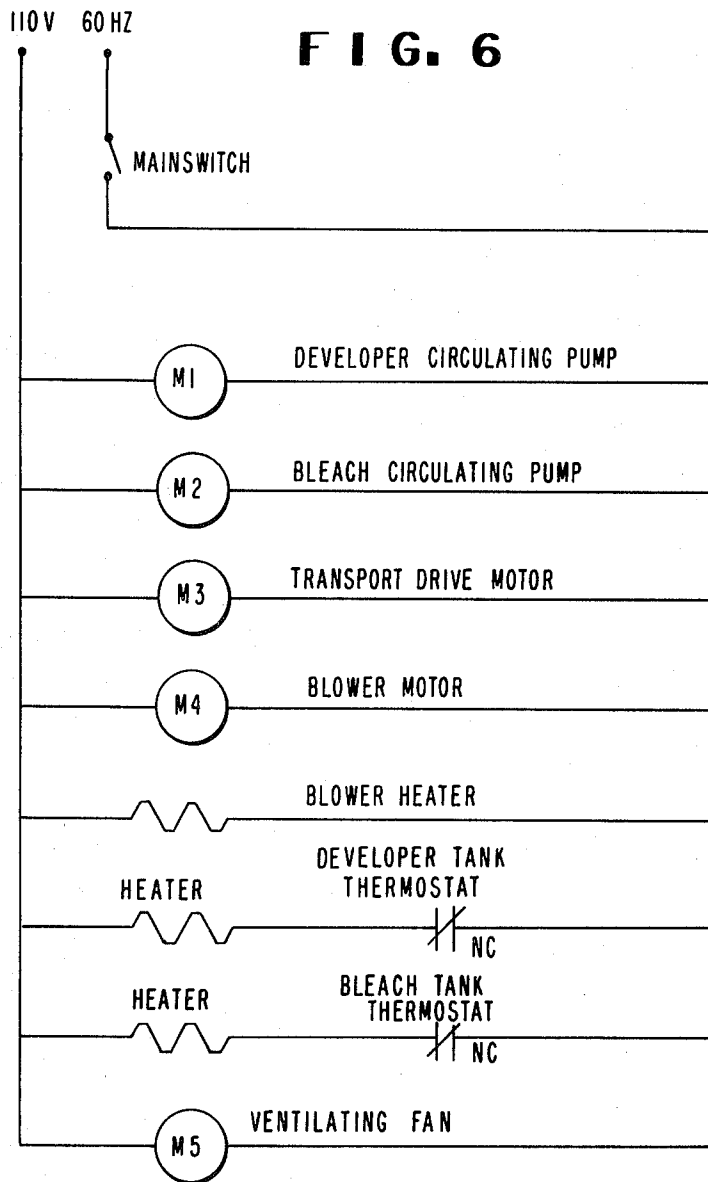


FIG. 5



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FLOATING FILM PHOTOGRAPHIC DEVELOPING APPARATUS

DESCRIPTION OF THE PRIOR ART

There are many types of photographic developing and fixing apparatus known for the intermittent and continuous processing of exposed photographic films and papers. They differ widely in construction. Many have developing, fixing, and washing tanks, and their use requires considerable time.

Albin 2,570,627, Oct. 9, 1951, described such an apparatus and a related apparatus having means for applying developing solution to a moving film, including a drum around which the film passes, emulsion side out, a pair of jet blocks surrounding the drum, the blocks have alternately disposed inlet and outlet orifices closely adjacent the film and means for circulating developer over the film between inlet and outlet orifices.

The jet blocks prevent observation of film during development and there are no sealing strips as in the apparatus of the present invention.

German Pat. application 1,802,781, Offenlegungstag May 14, 1969, discloses a developing apparatus having a developer-applying plate with rows of orifices for supplying developer solution and adjacent rows of orifices for removing excess solution. The apparatus differs from applicant's, in that there are no sealed cover plates nor squeegee roller to remove excess solution after development.

SUMMARY OF THE INVENTION

The photographic treating apparatus of this invention comprises series of spaced photographic treating solution-applying plates having

1. rows of spaced orifices of small diameter for supplying a treating solution to the surface of the plates and onto the surface of a photographic element passing over the plates, and

2. alternate rows of orifices of greater diameter for removing excess solution, the apparatus being characterized in that between the applying plates are pressure rollers and drip pans for removing excess solution, sealed covers (preferably transparent) attached to the sides of the applying plates, and having flexible sealing strips at the entrance and exit ends thereof. There are provided solution tanks for the treating solution and means for recirculating treating solution from the drip trays to the supplying orifices. As any treated elements pass from the final treating solution and pressure rollers, they can pass into a suitable drier through which heated air flows or is applied by means of air jets.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is an elevation with parts in section of the photographic treating apparatus.

FIG. 2 is an elevation of a pair of solution-applying plates showing solution tanks, pump, drip trays, and a recovery tank.

FIG. 3 is a plan view of the upper section of a solution-applying plate with solution channels in dashed outline.

FIG. 4 is a cross section taken along the line 4-4 of FIG. 3 showing the cover and sealing strips.

FIG. 5 is a plan view of the lower section of the solution applying plate.

FIG. 6 is a schematic view of a suitable electrical circuit for the apparatus.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

With reference to the drawings, wherein the same reference numerals are used throughout the several FIGS., the apparatus has a horizontal frame 1 with end rails 2, side rails 3, crossbars 4 and a suitable angle iron or lengthwise bracket 5 and legs 6 as illustrated in FIG. 1.

Supported by the angle irons near their side edges are solution-applying plates 7, illustrated in FIGS. 3-5. These plates have an upper section 8 and a lower section 9. The upper section has spaced rows of inlet orifices 10 of small diameter and adjacent rows of outlet orifices 11 of greater diameter. The

upper surface of the plates 7 has end troughs 12 and 12' for receiving excess solution. Means can be provided for leading the solution to a collecting tank.

The lower section 9 of the plate 7 has in its upper surface a comb-shaped trough 13 with a longitudinal channel 14 and an inlet 15 which can be centrally disposed. Lateral channels 16 extend from the longitudinal channel 14 and under the respective rows of supply orifices 10. There is also provided a longitudinal exit channel 17 provided with lateral outlet 18 and connecting with lateral outlet channels 18 under the respective rows of outlet orifices.

A suitable return tube 20 is connected to the outlet 19.

A cover 21 which, preferably transparent, has a slightly raised central portion, the side edges being flat (not shown) and resting on the surface of plate 7, has a deflecting front portion to direct passage of photographic film over the surface of plate 7. The rear end of the cover has a similar deflecting rear portion. Attached to the deflecting front and rear portions, respectively, are flexible sealing strips 25 and 25'. These sealing strips extend across the entire width of the cover plates 21. The bottom part of the sealing strips is free and contact the back surface of any photographic element passing through the apparatus.

As shown in FIG. 2, the apparatus is provided with suitable photographic solution supply tank 30 which has a suitable outlet to which is attached outlet pipe 31. Solution passes from the outlet through pump 32 and pipe 33 which is connected to inlet 15 in plate section 9.

Adjacent to tank 30 is liquid level sight gauge 34 which has a vertical tube 38, lateral tube 35 extends from the lower portion of the tube 34 and lateral tube 36 from the upper portion of the tube to establish communication with solution tank 30.

A supply tank or bottle 37 is placed above the vertical tube 34 and tube 38 extends from tank 37 to interfit with the vertical tube and supply solution into the gauge 34 and into tank 30.

Between adjacent solution-applying plates 7 are drip trays 39 to which there are attached drain tubes 40 which transport solution to a drain or receptacle or to suitable means for recirculating it.

At the end of the solution-applying section of the apparatus, there can be disposed a drier 41 having an upper plenum chamber 42 provided with exit duct 43. Lower plenum chamber 44 is below the upper chamber and treated photographic elements pass through the space between the adjacent chambers and are thereby dried.

Near the entrance end of the first solution- (e.g., developer solution) applying unit are transport rollers 50 and 50' which contact the photographic film and propel it forward. These transport rollers have shafts 52 on which are fixed suitable sprockets 53 which are driven by chain 54 passing around said sprockets and around idler sprockets 55 and 56 near the respective ends of the apparatus. The chain also meshes with driving sprocket 57 on reducing gear 58 of drive motor 59. The chain also meshes with and drives suitable sprockets which are attached to biased pressure or squeegee rollers 60 and 61 at the end of each solution-applying plate.

With reference to the wiring diagram of FIG. 6, the processing apparatus of this invention can be provided with five motors (M).

Motor M1 activates a pump for circulating developer solution, as shown in FIG. 2.

Motor M2 activates a pump like 32 for circulating a bleaching solution.

Motor M3 corresponds to driving motor 59 of FIG. 1.

Motor M4 (not shown in FIG. 1) drives a blower for supplying hot air through entrance duct 45.

Motor M5 drives a suitable ventilating fan (not shown) for passing air over the processing machine.

Each of the motors are activated by closing the main switch shown in the wiring diagram. The main switch also controls the current for three heaters, one of which heats air that is introduced into drier 41.

Additional heaters (not shown) for raising the temperature of the developing solution and the bleaching solution, respectively, are activated by current controlled by the main switch. By inserting suitable thermostats in the developer and bleaching solution, their respective temperatures can be controlled.

The operation of the apparatus is obvious from the drawings and the above description. When the main switch of the floating film-processing apparatus of this invention is closed, the developer-circulating and bleach-circulating pumps begin to circulate the solutions through the respective solution-applying plates. Simultaneously, air is supplied by means of a blower to the drier. Power is simultaneously supplied to the heaters for the processing solutions.

The drive motor 59 starts the transport rolls and idler sprockets to turn in synchronism. The ventilating fan is activated by its motor and removes heat from the motors and the drier.

After startup, when the solutions and drier are at a suitable temperature, the photographic film or paper can be introduced into the machine. Solution is applied to the surface of the plates through the small diameter orifices and onto the surface of a photographic element passing over the plates, which may float on the surface of the solution. Excess solution is removed from the surface of the plates through the large orifices. If desired, electrical interlocks can be provided so as to delay operation of the transport motor until the temperatures are at the desired degree.

Various parts of the apparatus can be made of stainless steel or other noncorrosive metal alloy, or made of suitable

resins or polymers, e.g., phenol formaldehyde resins, polyethylene, etc., that are resistant to heat and chemicals.

The apparatus of this invention has the advantage that is simple and dependable.

The embodiments of the invention in which an exclusive property or privilege is claimed are defined as follows;

1. A photographic treating apparatus which comprises a series of spaced photographic treating solution-applying plates having:

1. rows of spaced orifices of small diameter for supplying a treating solution to the surface of the plates and onto the surface of a photographic element passing over the plates, and

2. alternate rows of orifices of greater diameter for removing excess solution, the apparatus being characterized in that between the applying plates are pressure rollers and drip pans for removing excess solution, sealed covers attached to the sides of the applying plates, and having flexible sealing strips at the entrance and exit ends thereof.

2. An apparatus according to claim 1 having tanks for photographic treating solutions and pumps for supplying solutions from the tanks to the respective applying plates.

3. An apparatus according to claim 1 having transport rollers for feeding a photographic element into the machine and rollers that rotate in synchronism with the transport rollers for transporting the treated element into a drier unit.

4. An apparatus according to claim 1 wherein the sealed covers are transparent to visible light.

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