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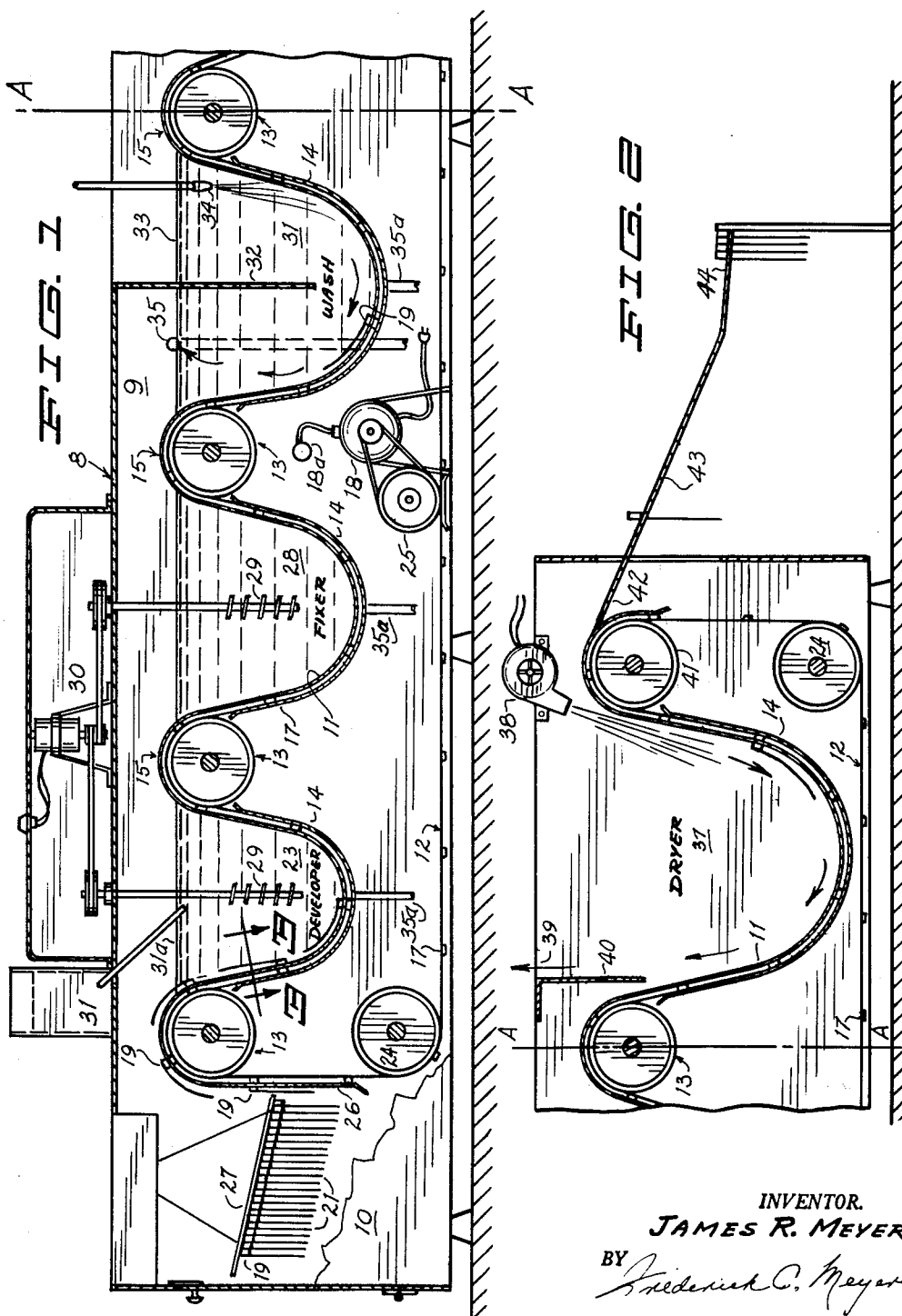
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AUTOMATIC FILM PROCESSING APPARATUS

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2 Sheets-Sheet 1



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2 Sheets-Sheet 2

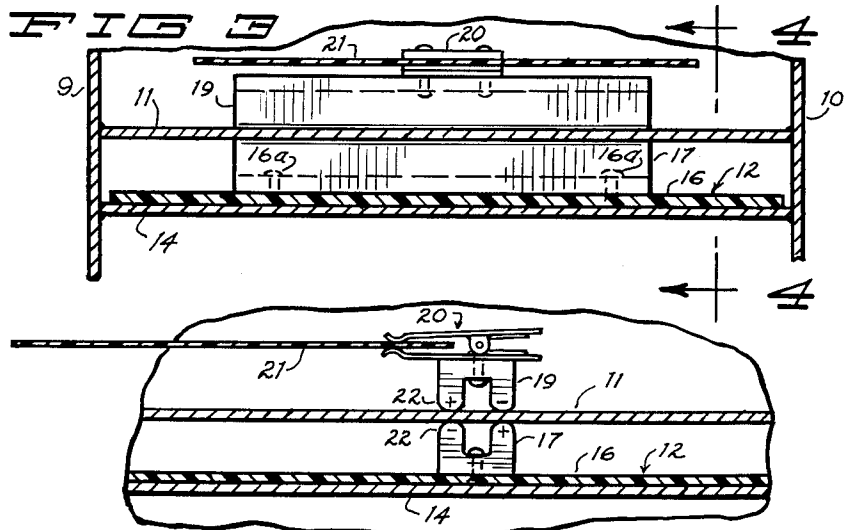


FIG. 4

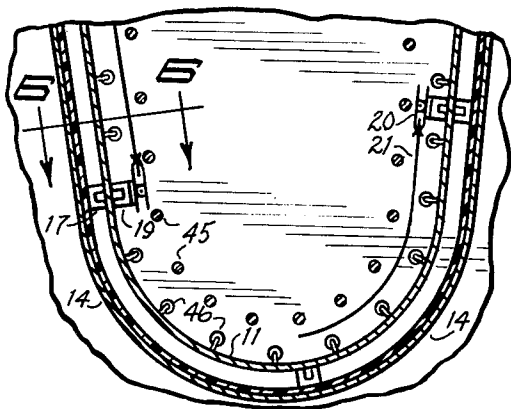
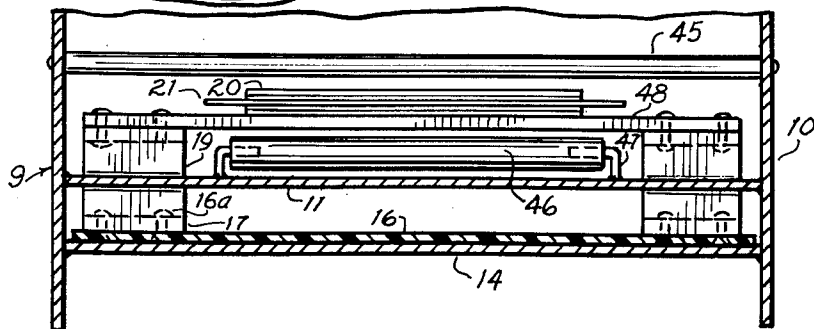


FIG. 5

FIG. 6



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AUTOMATIC FILM PROCESSING APPARATUS

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11 Claims. (Cl. 95—94)

This invention relates to photographic apparatus and more particularly to photographic processing means for film, print paper or other photosensitized material.

An important object of this invention is to provide a film processing apparatus which will have a simple and inexpensive conveyor mechanism for automatically and sequentially treating exposed photographic film to developing solutions.

Another object of this invention is to provide a source of continuous motion which may be used intermittently to pick up and draw film strips through processing solutions with a minimum of travel and requiring only a minimum of headroom.

A further object of this invention is to provide a conveyor system for consecutively dipping exposed film in a series of processing tubs wherein the conveyor system proper lies solely without the tubs and only magnetically attractable clip members responsive to travel of the conveyor are immersed in the processing baths within the tubs, thereby minimizing contamination and intermixing of the processing solutions.

A still further object is to provide a means of film developing wherein all increments of the film are submerged in each solution for an equal amount of time and the length of travel within each solution determines the time of treatment therein.

A still further object is to provide a fully automatic self-feeding system for film development, in addition to automatic rack storage of the developed film after it has traversed the consecutive baths.

Of common knowledge to the art of film developing are various conveyor systems designed for developing film strips or plates by way of several independent dipping processes. Such dippings are accomplished by attaching the film strips to a conveyor system which immerses the film alternately into several solutions by raising and lowering the film in a vertical manner. In the actual process of dipping the film strip into the solution, the lower end is submerged for a time substantially greater than that of the end clamped to the conveyor system. Because of this, the film remains in the solution longer than need be merely to allow the clamped end to receive its proper exposure to the solution.

Through my invention, I have devised a greatly simplified means whereby complex elements required to raise and lower the film into, and out of, the solutions are eliminated. In addition, other undesirable features such as contamination of solutions are eliminated or minimized.

These and other objects and advantages of my invention will more fully appear from the following description, made in connection with the accompanying drawings, wherein like reference characters refer to the same or similar parts throughout the several views and in which:

FIGURE 1 shows a side view of my photographic film development apparatus in a somewhat diagrammatic form with the fore panel cut away;

FIGURE 2 shows a side view of an optional film dryer which may be incorporated as an extension after the wash process in the film development layout of FIGURE 1, line A—A being common to both FIGURES 1 and 2;

FIGURE 3 is an enlarged fragmentary cross-sectional view of FIGURE 1 taken at 3—3;

FIGURE 4 is a cross-sectional fragmentary view of FIGURE 3 at 4—4;

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FIGURE 5 is an enlarged and detailed vertical sectional view of a portion of an alternate form of tub; and FIGURE 6 is an enlarged cross-sectional view of FIGURE 5 taken at 6—6.

Referring now more particularly to the drawings, FIGURE 1 represents a side view of the film processing system located generally in enclosure 8 having a remote side panel 9 and a fore side panel 10. This system, in turn, is comprised of three basic elements, namely, a continuous tub forming sheet 11, a power driven belt 12 and idler pulleys 13.

The tub sheet 11, as shown in FIGURE 1, is constructed of a thin structural material such as sheet plastic and may be formed in individual tub units or by one continuous formed sheet whereby a smooth surface juncture 15 between tubs is provided. Formed on the underside of the tub sheet 11 are guide channels 14 which guide the continuous power driven belt 12 around the underside of the tub sheet 11. A more detailed view of the channel and belt may be seen in FIGURES 3 and 4 which will be more fully explained later.

Located immediately below the tub junctures 15 are idler pulleys 13 which turn freely under the frictional force of the power driven belt 12. These pulleys provide a low friction means for maintaining the belt 12 in close proximity to the underside of the tub junctures 15 for purposes which will be explained.

Referring now to FIGURES 3 and 4, the power driven belt 12 is comprised of one continuous loop of flexible belt material 16 substantially the same width as the tub and has mounted on it by way of fasteners 16a several magnetic influencers such as magnetized metallic blocks 17 evenly spaced throughout the entire length of the belt. As a drive force is supplied by the drive motor 18, the belt is drawn over the tops of the idler pulleys 13 and in sliding contact with the underside of the processing tubs 11 within the channels 14 as described above. In this manner, the small magnetic influencers 17 are caused to follow the contour of each of the tubs and in turn provide a source of magnetic attraction for magnetic blocks or travelers 19. The drive motor 18 may be electrically wired to a hand operated rheostat 18a so that precise control can be exercised over the speed of the motor 18 and thus the duration of time in which the film is submerged in the respective solutions.

After the belt element has traversed the tub structures, it is drawn around guide pulley 24 (FIGURES 1 and 2) whereupon it then comes in contact with power driven pulley 25 connected to drive motor 18. Thereafter, the belt follows around guide pulley 24 and then up along the plastic guide 26 and then through the tube structure again.

The magnetic blocks 19 are small blocks of material capable of attraction to the magnetic influencers 17. Attached to the upperside of the magnetic block 19 is a small snap clip 20 for holding one end of a film sheet or strip 21 (see FIGURES 3 and 4). The bottom or riding side of the magnetic block 19 may have a split configuration as may the magnetic influencers 17 mounted on the belt. In this manner, the two magnetic poles (+ and —, see FIGURE 4) are formed on each of the magnetic members to provide the necessary magnetic attraction of one to the other through the thin tub material. The riding surfaces 22 are somewhat rounded to provide a higher concentration of flux density, or magnetic force, as well as to provide a surface which will tend to ride over particles or protuberances on the bottom surface of the tubs.

Located to the left of the developer tub 23 is a feed rack 27 dependent upon gravitational forces for operation. Positioned on the feed rack 27 and in sliding contact therewith are the magnetic blocks 19 which hold the unde-

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veloped film strips 21 by the clip means 29. When the feed rack is tilted, as shown, at a declining angle, the magnetic blocks will slide toward the plastic guide 26 thereby positioning them for "pick off" by the next magnetic influencer 17 as it approaches the end of the rack.

Located in the developer tub 23 and fixer tubs 28 and submerged in their respective solutions are agitator paddles 29 which are driven in oscillation or rotation by an upwardly located drive system 30. The function of these agitator paddles 29, of course, is to provide agitation of the solution to maintain a homogeneous mixture. Also located above the developer tub 23 in a convenient location is a reservoir supply 31 of developer solution which is readily available for maintaining the solution at the predetermined tub level 31a.

Located within the wash tub 31 is a vertical light baffle 32 of tub width, formed as a continuous structure with enclosure 8, which confines the washing water 33 to a circular motion from the clean water supply spout 34, down under the baffle 32, around the bottom of the tub, and up on the opposite side of the baffle where it is drawn off by way of the high water outlet 35. This baffle 32 also serves as a restraint on light from reaching the film before it is washed free of the fix solution.

Leading off from the bottom of each tub is a drain 35a for emptying any one of the tubs individually of its contents.

With my film developing system in operation, the magnetic blocks 19 with film 21 attached thereto are fed toward the plastic guide 26 and power driven belt 12. As a magnetic influencer 17 mounted on the belt approaches the magnetic block 19 resting in the feed rack, the magnetic field of the magnetic influencer 17 will cause the magnetic block 19 to move from the feed rack 27 to the outside of the plastic guide 26 opposite the magnetic influencer 17. As the drive belt 12 and attached magnetic influencer 17 move upward and over the top of the idler pulley, the magnetic block, being attracted through the plastic material by the magnetic field of the magnetic influencer 17, follows along on the opposite side of the tub. After the belt has passed over the top of the idler pulley, it enters the guide channel 14 formed around the bottom of the developer tub 23. As the magnetic influencer 17 follows the lower contour of the developer tub, the magnetic block 19 will likewise follow, however, as stated above, on the inside of the tub. In this manner, the film will be completely exposed to the developer solution. As the magnetic influencer 17 travels through the guide channels 14 under the tubs and then over the idler pulleys, the individual associated magnetic blocks 19 will likewise be drawn in the same route but on the opposite side of the tubs 11 and rounded tub junctures 15 whereby the film 21 will be drawn out of the developer tub 23 into the fixer tub 28, out of the fixer tub, through the wash tub 32, and then out. The precise time duration that the film is in each solution will, of course, be dependent upon the length of the tub being traversed by the film and the speed at which the drive motor 18 is adjusted through its rheostat 18a.

It will be noted that as the magnetic block 19 with the film 21 is drawn through the developer tub 23, another magnetic influencer 17 will approach the end of the feed rack 27. If there is a magnetic block 19 resting on the end of the feed rack, it will be attracted to the approaching magnetic influencer 17 and subsequently drawn through the developing tubs. If there is no magnetic block 19 resting on the end of the feed rack, then the magnetic influencer 17 will inoperatively traverse its route along the tubs 11.

If it is so desired, a fourth unit comprising a dryer 37 (see FIGURE 2) may be included in the processing system of FIGURE 1. Such a unit includes a fan 38, with its air stream directed to follow the contour of the tub, and an exhaust port 39 coupled with a baffle 40 to allow

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escape of the drying air. After the film 21 and magnetic block 19 have traveled over the final idler pulley 41, a pick-off arm 42 is encountered which releases the magnetic block 19 from the magnetic force of the magnetic influencer 17 by merely increasing the distance between the two blocks. Thereafter, the magnetic block 19, with its film attached, is free to slide down the inclined dryer rack 43 (also made of non-magnetic material) to the resting position shown at 44 of FIGURE 2.

Oftentimes in the process of developing a film, curling of the film itself will cause incomplete and uneven development. A suggested retaining means for avoiding such film curling as by incorporating in the bottom of the tubs 13 a plurality of rods 45 and rollers 46, is shown in FIGURE 5. The rods 45, as shown in FIGURES 5 and 6, extend the full width of the tub and are secured to sides 9 and 10. The rollers 46, however, being rotatably mounted on the bottom of the tub by roller mounts 47 are short enough to allow passage of a short piece of magnetic block 19 along the bottom between the roller mounts 47 and the sides of the tub. In this manner, the clip support 48, extending between the two magnetic blocks 19 whereby to hold the clip and film, will form a bridge over the rollers 46 but under the rods 45. As the magnetic attraction of the magnetic influencers 17 draws the magnetic blocks 19 through the tubs, the film will be drawn between the rods 45 and rollers 46 and any curling tendencies will be restricted.

It may readily be seen from the above that through my invention, I have devised an improved and simplified means for processing film wherein unnecessary conveyor structure and movement has been eliminated, and wherein positive and uniform treatment of the film is maintained from beginning to end.

Through the above, it is seen that the only moving parts in my developing system are the idler pulleys and the power drive belt with its power source. If desired, these items may be completely enclosed within the under part of the developer system whereby moving parts are covered and guarded.

It will, of course, be understood that various changes may be made in the form, details, arrangements and proportions of the parts without departing from the scope of my invention as set forth in the appended claims.

What I claim is:

1. A film processing apparatus comprising a plurality of liquid containing contiguous tubs, said tubs having a continuous thin sheet wall, an endless conveyor mounted for traveling along the outer surface of said continuous sheet wall, a plurality of spaced magnetic influencers mounted on said endless conveyor, magnetically attractable blocks lying in contact with the inner surface of said sheet, clip means mounted on said blocks adapted to hold photographic films, and means continuously driving said conveyor whereby to exert traveling magnetic fields through said sheet wall and to effect corresponding positioning and traveling of said magnetically attractable blocks and film strips attached thereto.

2. A film processing apparatus set forth in claim 1 having a peripheral guide channel on the underside of said continuous sheet for a portion of the length thereof and containing said endless conveyor therein.

3. A film processing apparatus comprising a plurality of liquid containing contiguous tubs complementary in number with the operations to be performed, a continuous flexible power driven belt, a low friction means for maintaining a portion of said flexible belt immediately adjacent the underside of said tubs, a plurality of magnetic influencers secured in spaced relation longitudinally along said flexible belt, and a plurality of magnetic blocks receptive of the magnetic influencers and co-operatively functioning therewith whereby film will be drawn through said tubs on the side opposite of said flexible belt by means of the motivating force of said magnetic influencers.

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4. A film processing apparatus as set forth in claim 3 wherein said low friction means is a freely rotating idler pulley.

5. A film processing apparatus comprising a rear wall, a fore wall, a continuous thin sheet interposed therebetween in abutting contact with said walls, and further having concave and convex portions whereby said concave portion will form a solution container and the convex portion will provide a smooth continuous surface joining one tub to the next, an endless conveyor mounted for travel along the outer surface of said continuous sheet, a plurality of spaced magnetic influencers mounted on said endless conveyor, magnetically attractable blocks lying in contact with the inner surface of said sheet, clip means mounted on said blocks adapted to hold photographic film, and means continuously driving said conveyor whereby to exert traveling magnetic fields through said sheet and to effect corresponding positioning and traveling of said magnetically attractable blocks and film strips attached thereto.

6. A processing system for photographic film having thin walled contiguous tubs with a continuous thin common wall, a traveling carrier for said film comprising a film clip adapted to ride on the inside surface of a tub wall, said clip being magnetically attractable, and a magnetic influencer adapted to travel along the outside surface of the tub sheet whereby to induce corresponding travel of said clip and its film.

7. A film processing apparatus comprising a plurality of liquid containing contiguous tubs complementary in number with the operations to be performed, a continuous flexible power driven belt, a low friction means for maintaining a portion of said flexible belt immediately adjacent the underside of said tubs, a plurality of magnetic influencers secured to said flexible belt, and a plurality of magnetic blocks receptive of the magnetic influencers and co-operatively functioning therewith whereby film will be drawn through said tubs on the side opposite of said flexible belt by means of the motivating force of said magnetic influencers, said liquid containing contiguous tubs further having a peripheral length proportional to the prorated time for a film submersion duration therein.

8. A film processing apparatus comprising a plurality of liquid containing contiguous tubs, said tubs having a continuous thin sheet wall, an endless conveyor mounted for traveling along the outer surface of said continuous sheet, a plurality of spaced magnetic influencers mounted on said endless conveyor, magnetically attractable blocks lying in contact with the inner surface of said sheet, clip means mounted on said blocks adapted to hold photographic films, and means continuously driving said conveyor whereby to exert traveling magnetic fields through said sheet and to effect corresponding positioning and traveling of said magnetically attractable blocks and film strips attached thereto, and a gravitational feed rack of non-magnetic material for self-positioning of said mag-

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netic blocks in preparation for travel caused by the motivating force of said magnetic influencers.

9. A film processing apparatus comprising a rear wall, a fore wall, a continuous thin sheet interposed therebetween in abutting contact with said walls, and further having concave and convex portions whereby said concave portions will form solution containers and the convex portion will provide a smooth continuous surface joining one concave portion to another, said concave portions further having a plurality of rods extending laterally in proximity thereof, and a corresponding plurality of rollers rotatably mounted at the concave portion of said tubs and in spaced relation beneath said rods for positively retaining film when it is drawn therebetween, an endless conveyor mounted for travel along the outer surface of said continuous sheet, a plurality of spaced magnetic influencers mounted on said endless conveyor, magnetically attractable blocks lying in contact with the inner surface of said sheet, clip means mounted on said blocks adapted to hold photographic film, and means continuously driving said conveyor whereby to exert traveling magnetic fields through said sheet and to effect corresponding positioning and traveling of said magnetically attractable blocks and film strips attached thereto between said rods and said rollers.

10. A film processing apparatus as set forth in claim 3 and a film drying tub contiguous with said other tubs and having a fan and an exhaust port whereby the fan will dry said film as said magnetic blocks travels through said tub.

11. A film processing apparatus comprising a plurality of thin-walled plastic tubs integrally connected, each of said tubs having a lower rounded portion for containing aqueous solutions and raised end portions integrally and smoothly joined, and further having a peripheral guide channel spaced below said lower rounded portion, a continuous flexible belt, a drive system for drawing said belt successively through said guide channels of said tubs, a plurality of idler pulleys positioned immediately adjacent the underside of said integral joinder portions of said tub, said idler pulleys supporting said belt whereby said belt is held in close spaced relation to the underside of said tubs and in alignment with said guide channels, a plurality of magnetic influencers secured to said belt and spaced therealong on one side thereof, and a plurality of magnetic blocks having film-holding fasteners which co-operatively function with said magnetic influencers whereby said magnetic blocks will be drawn through said plurality of tubs in corresponding relation to said magnetic influencers but on opposite sides thereof whereby to treat exposed photographic film sequentially with processing solutions.

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