July 19, 1938. G. M. DYE 2,124,106

APPARATUS FOR DEVELOPING FILMS

Filed Dec. 31, 1934 6 Sheets-Sheet 1

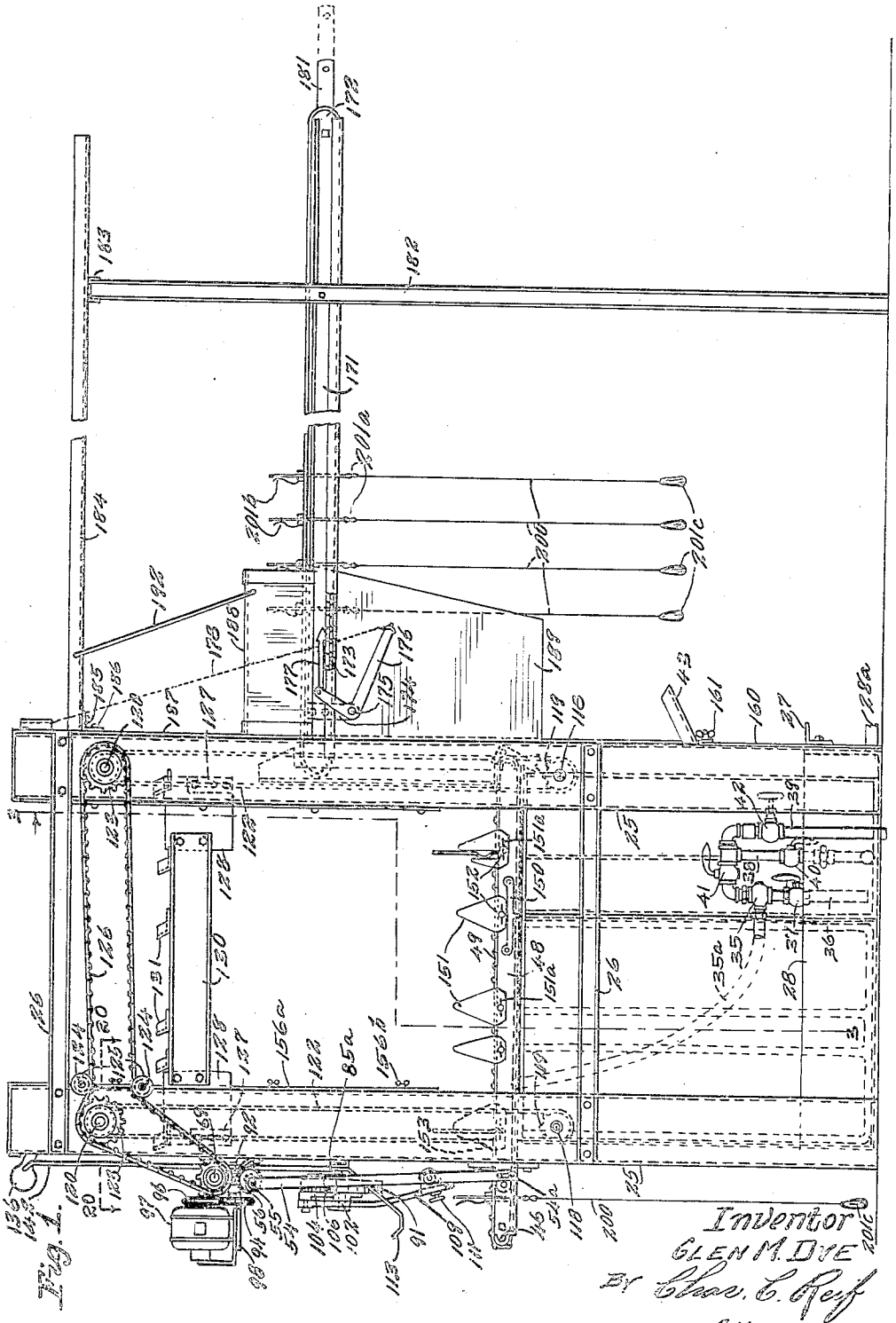


Fig. 1.

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APPARATUS FOR DEVELOPING FILMS

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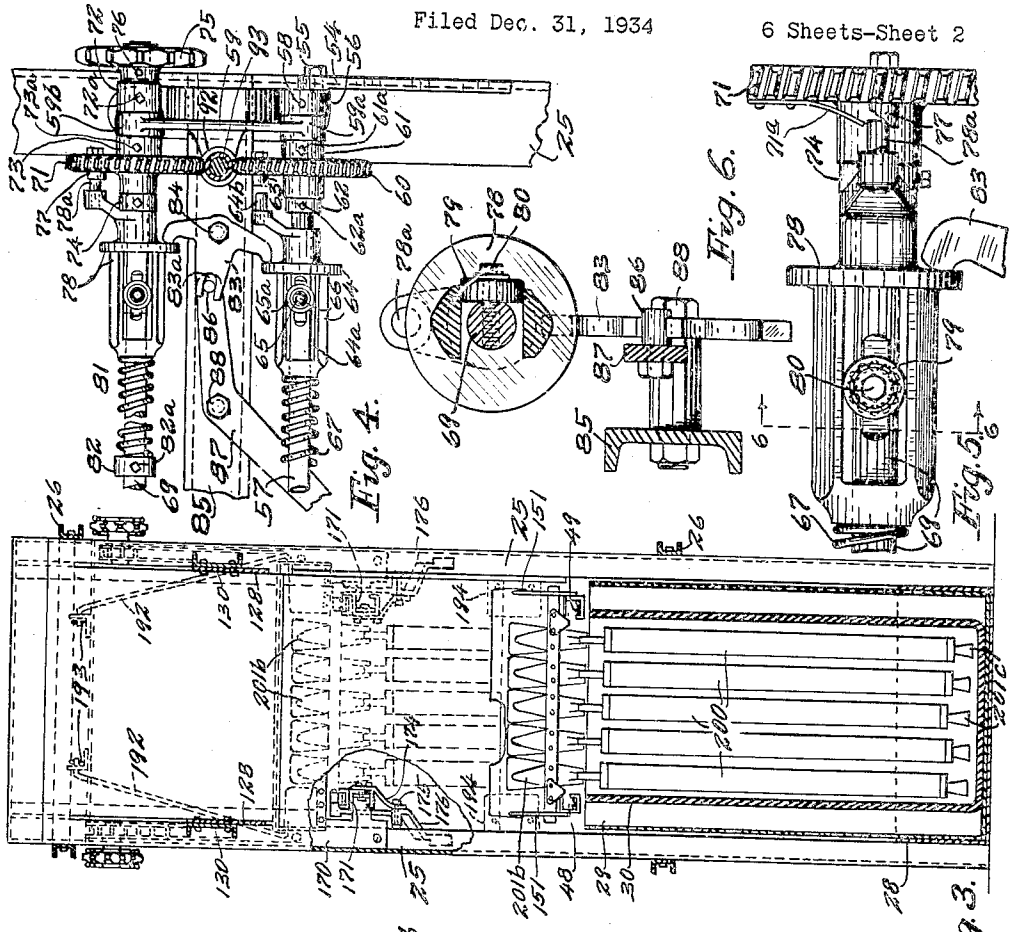


Fig. 4.

Fig. 6.

Fig. 5.

Fig. 3.

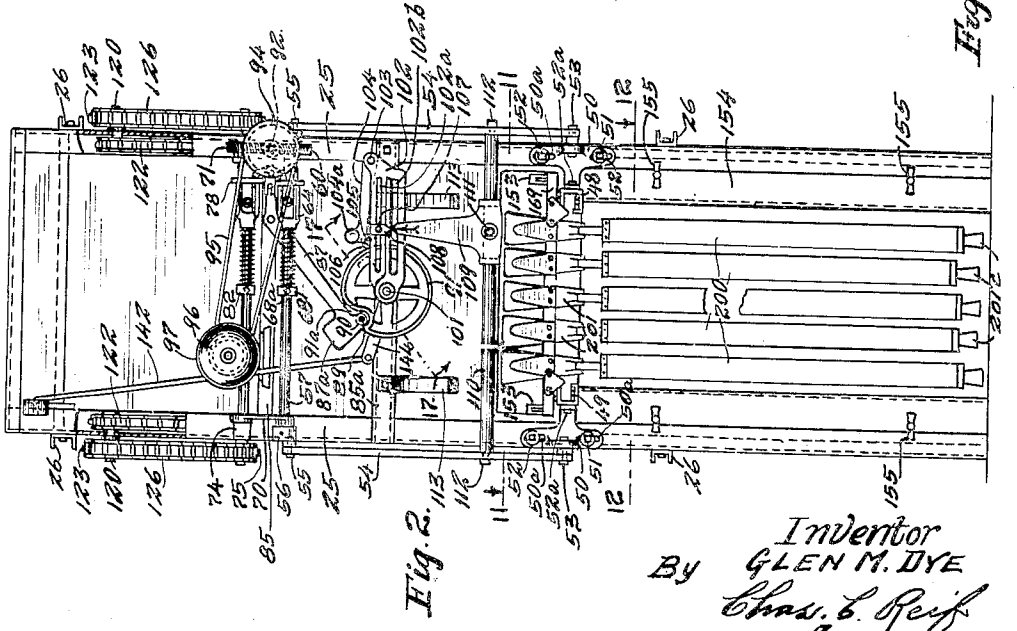


Fig. 2.

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APPARATUS FOR DEVELOPING FILMS

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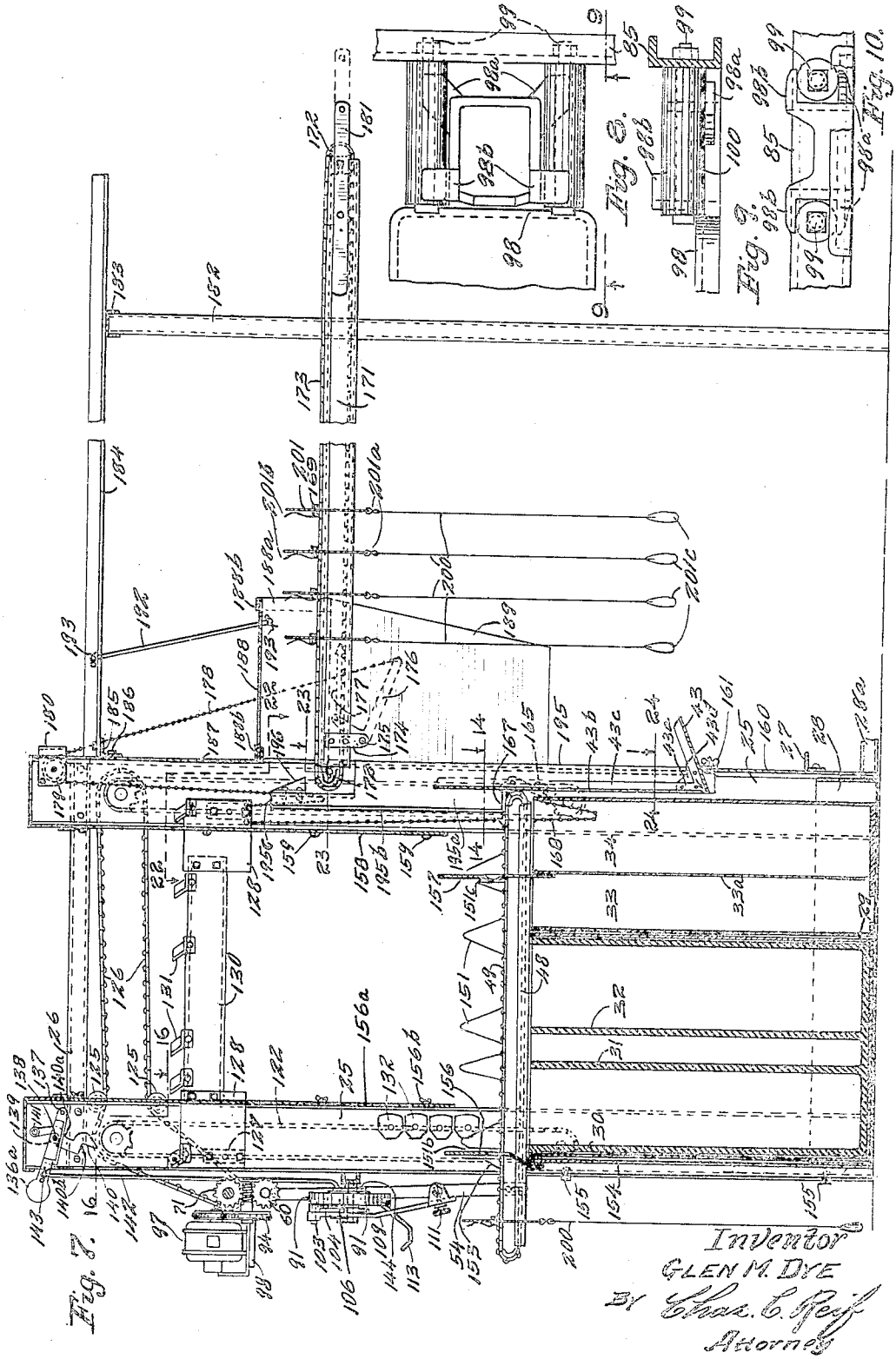


Fig. 8.

Fig. 9.

Fig. 10.

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APPARATUS FOR DEVELOPING FILMS

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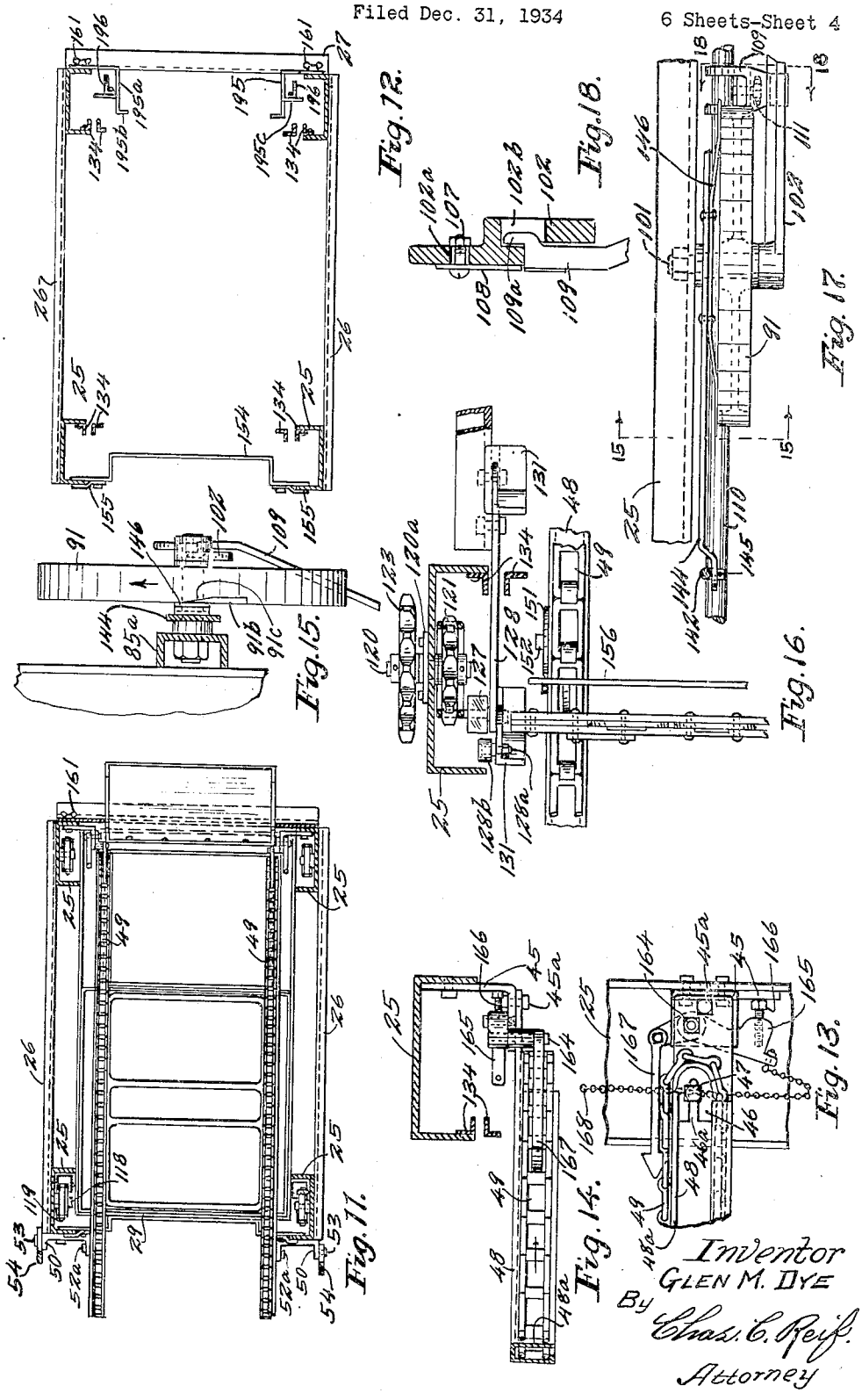


Fig. 11.

Fig. 12.

Fig. 13.

Fig. 14.

Fig. 15.

Fig. 16.

Fig. 17.

Fig. 18.

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APPARATUS FOR DEVELOPING FILMS

Filed Dec. 31, 1934 6 Sheets-Sheet 5

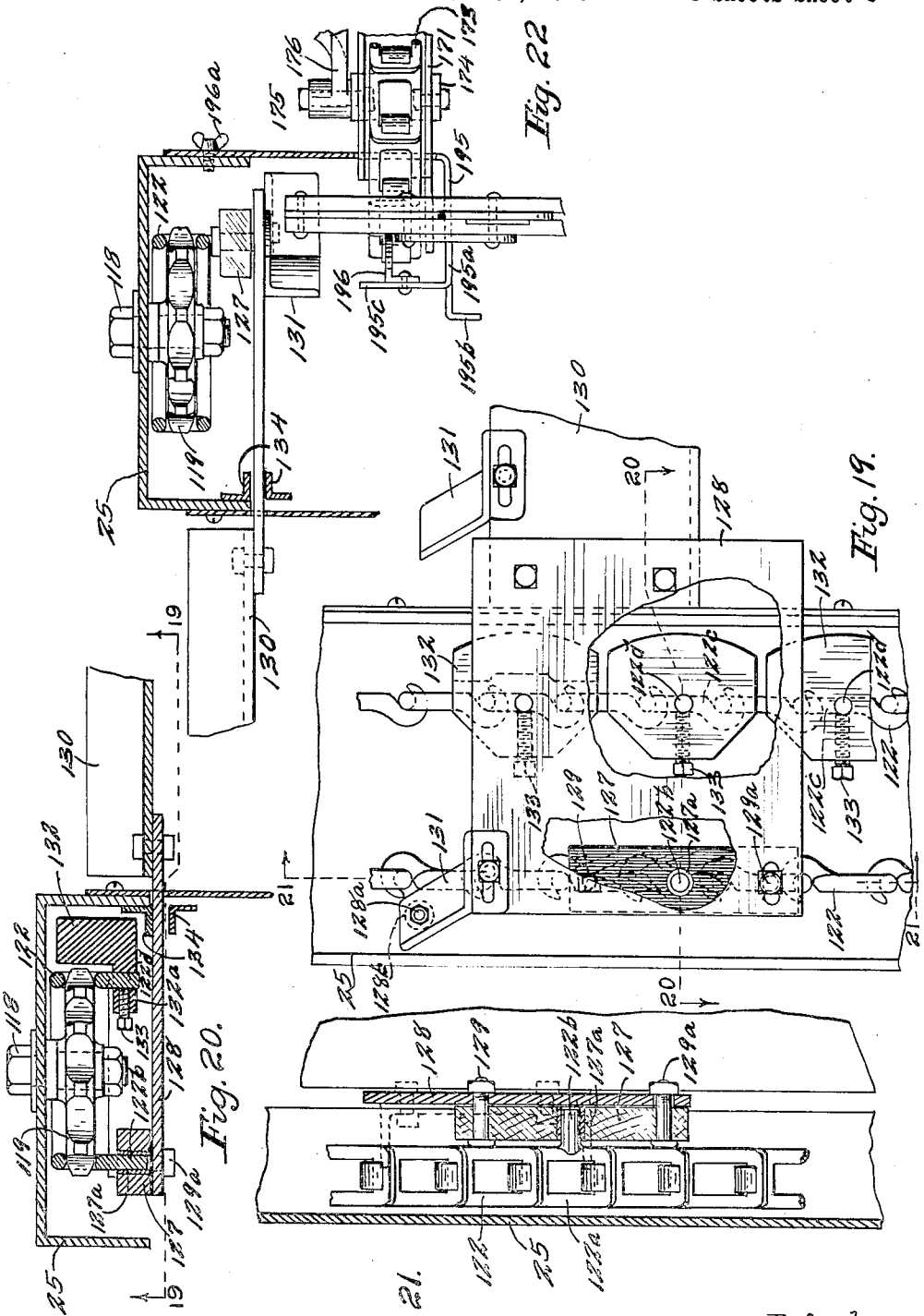


Fig. 22

Fig. 19.

Fig. 20.

Fig. 21.

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APPARATUS FOR DEVELOPING FILMS

Filed Dec. 31, 1934 6 Sheets-Sheet 6

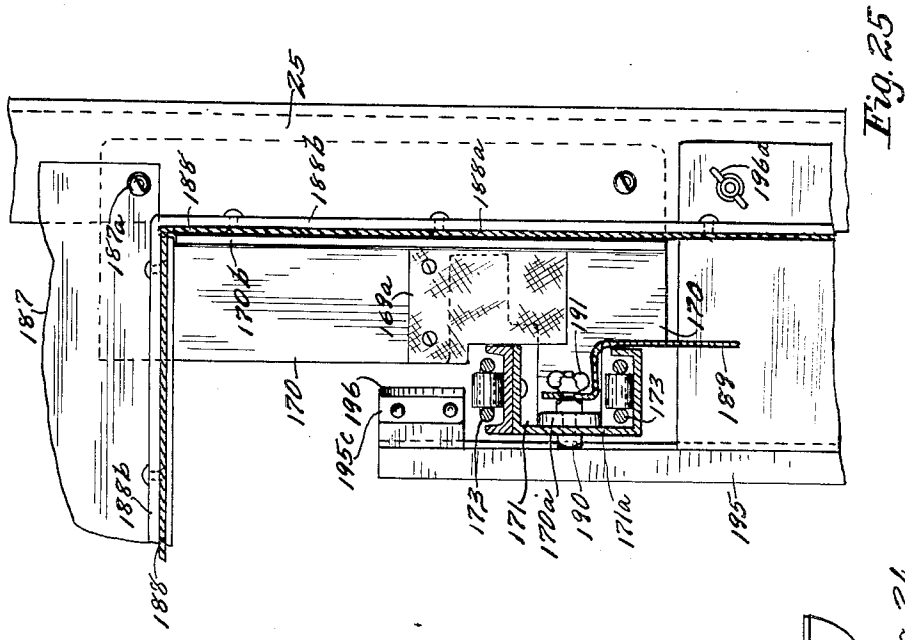


Fig. 25

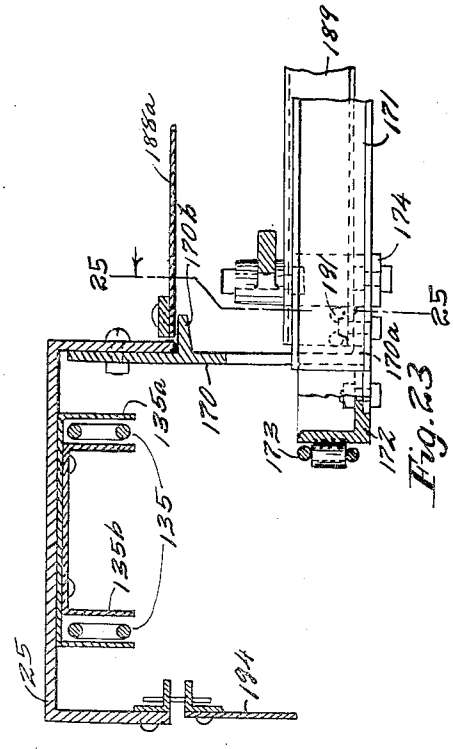


Fig. 23

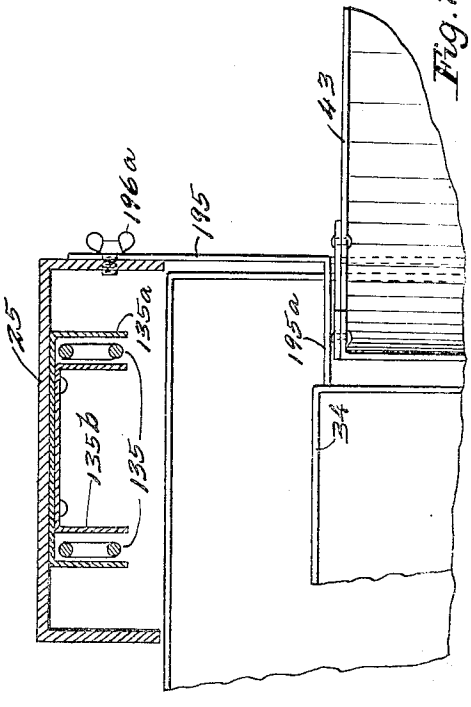


Fig. 24

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Patented July 19, 1938

2,124,106

UNITED STATES PATENT OFFICE

2,124,106

APPARATUS FOR DEVELOPING FILMS

Glen M. Dye, Minneapolis, Minn.

Application December 31, 1934, Serial No. 759,887

21 Claims. (Cl. 95—89)

This invention relates to an apparatus for automatically handling articles requiring treatment in various liquids and while the same may have various applications, it particularly is designed for use with sensitized sheets or plates used in photography. As is well known to those skilled in the art, most pictures are now taken on films and the common photographic films are now furnished in rolls which are several feet in length and these films are usually developed while in one piece. The films are first placed in a receptacle having a developing liquid therein, are then commonly placed in another receptacle having what is called a short-stop solution, are then progressed through one or more receptacles containing hypo solution and are then moved through one or more receptacles containing water or a washing solution.

It is an object of this invention to provide an apparatus which will automatically convey the film or films used on a suitable holder into the first receptacle and which will successively move said film or films through the various receptacles, transferring the same from one receptacle to another at the desired times and which will also agitate the film or films in the various receptacles, a plurality of said holders being handled simultaneously.

It is a further object of the invention to provide an apparatus as set forth in the above paragraph in which the films are transferred from one receptacle to another at certain times and to provide means by which the intervals between these times can be varied.

It is another object of the invention to provide an apparatus comprising a plurality of receptacles placed side by side and containing the treating liquids, a conveyer movable adjacent said receptacles upon which holders are mounted from which the films depend into said receptacles, means being provided to lift said holders at certain times, advance the same and lower the same to transfer them into the next receptacle together with means for reciprocating said holders and films to agitate the films in the liquids between said times.

It is still another object of the invention to provide an apparatus as set forth in the preceding paragraph which includes a driving means, a clutch for operating said last mentioned means, a clutch for operating said first mentioned means and means operating at fixed intervals for connecting one of said clutches to said driving means and disconnecting the other whereby said two means are alternately operated.

It is still another object of the invention to provide an apparatus as set forth in the last paragraph save one which will be disposed in a dark room and move said films out of said dark room, together with means comprising stationary plates for shielding said films from direct light during their movements in said apparatus.

These and other objects and advantages of the invention will be fully set forth in the following description made in connection with the accompanying drawings, in which like reference characters refer to similar parts throughout the several views and in which:—

Fig. 1 is a view in side elevation of a machine embodying the present invention;

Fig. 2 is a view in front elevation of said machine;

Fig. 3 is a vertical section taken on line 3—3 of Fig. 1 as indicated by the arrow;

Fig. 4 is a partial view in front elevation shown on an enlarged scale;

Fig. 5 is a partial view of Fig. 4 shown on an enlarged scale;

Fig. 6 is a vertical section taken on line 6—6 of Fig. 5;

Fig. 7 is a substantially central longitudinal section through the machine;

Fig. 8 is a partial plan view of the motor support;

Fig. 9 is a vertical section on line 9—9 of Fig. 8 as indicated by the arrows;

Fig. 10 is a view in front elevation as seen from the left of Fig. 9;

Fig. 11 is a horizontal section taken substantially on line 11—11 of Fig. 2;

Fig. 12 is a horizontal section taken substantially on line 12—12 of Fig. 2, some parts being omitted;

Fig. 13 is a view in side elevation of the parts shown in Fig. 14;

Fig. 14 is a horizontal section taken substantially on line 14—14 of Fig. 7 as indicated by the arrow;

Fig. 15 is a vertical section taken on line 15—15 of Fig. 17 as indicated by the arrows;

Fig. 16 is a horizontal section taken substantially on line 16—16 of Fig. 7 as indicated by the arrow;

Fig. 17 is a section taken substantially on line 17—17 of Fig. 2 as indicated by the arrows, Figs. 14 to 17 being shown on an enlarged scale;

Fig. 18 is a vertical section taken substantially

on line 18—18 of Fig. 17, as indicated by the arrows;

Fig. 19 is a partial view in elevation of the front part of the machine shown in Fig. 7 as indicated by line 19—19 in Fig. 20;

Fig. 20 is a horizontal section taken on lines 20—20 of Figs. 1 and 19 as indicated by the arrows;

Fig. 21 is a vertical section taken on line 21—21 of Fig. 19 as indicated by the arrows;

Fig. 22 is a horizontal section taken on line 22—22 of Fig. 7 as indicated by the arrows;

Fig. 23 is a horizontal section taken on line 23—23 of Fig. 7 as indicated by the arrows;

Fig. 24 is a horizontal section taken on line 24—24 of Fig. 7 as indicated by the arrow; and

Fig. 25 is a vertical section taken on line 25—25 of Fig. 23 as indicated by the arrow.

Referring to the drawings, the machine comprises a frame formed by corner posts 25 and while these posts might be variously formed, in the embodiment of the invention illustrated they are shown as made of channel bars having their channel sides directed inwardly. Posts 25 are connected adjacent their tops at both sides of said frame by smaller channel bars 26. Similar channel bars 26 connect the posts 25 somewhat adjacent their lower ends and an angle bar 27 also extends between and is secured to rear posts 25 adjacent their bottoms. A rigid frame is thus produced. Within the posts 25 at the bottom thereof resting on the floor or other support for the machine is a sink or tank 28 which is of comparatively small height, this tank in practice being approximately 12 inches high. Within the tank 28 at one end thereof is another tank 29, the front end of which is disposed against the front end of tank 28, this tank 29 being of considerable length and extending for the greater part of the length of tank 28. Within tank 29 and substantially occupying the whole length thereof are three tanks designated respectively 30, 31 and 32. Said latter three tanks are of considerably less width than tank 29 as shown in Fig. 3. Tank 29 in practice serves as a water jacket and cool water is circulated about the tanks 30, 31 and 32. While tanks 30, 31 and 32 might be variously made, in the embodiment of the invention illustrated they are shown as being integrally formed with a common wall and bottom, being separated by partitions and in practice they preferably are formed of a rubber composition. In the rear of tank 29 and disposed closely adjacent thereto is a fourth tank 33 and in the rear of tank 33 is still another tank 34. While tanks 33 and 34 can be variously formed, in the embodiment of the invention illustrated they are shown as having a common wall and bottom and as being divided by a partition 33*a*. The rear end of tank 34 is spaced some distance from the rear of tank 28 as shown in Fig. 7. A tank filling or fluid removing means is provided for tank 29 indicated as a conduit 35*a* having an open end entering the upper end of tank 29 and communicating with a pipe 36 which has an open end adjacent the bottom of the tank 28 and at one side of tank 33. A valve 37 is shown disposed in pipe 36 by means of which flow through said pipe may be shut off or permitted. An ejector 35 is disposed in pipe 36. Another pipe 38 forming a supply pipe for tanks 33 and 34 is shown and this is connected to the bottom of said tanks. Pipe 38 is supplied through a pipe 39 connected to pipe 38 by a suitable T. Pipe 38 is also shown as having a valve 40 therein similar to valve 37. A valve 41 is shown as disposed between overflow pipe 36 and the pipe 38 and another valve 42 illustrated as of the globe type is disposed in the water supply pipe 39. Pipe 39 will be connected to some suitable water supply such as the city mains. A drain board or plate 43 extends from a point adjacent the rear of tank 34 outwardly some distance and has its inner end disposed over the inner end of tank 28. Tank 28 is provided with a drain spout 28*a* which will be connected by suitable means to a sewer or other disposal means.

Secured to the inner side of the rear flange of each rear post is a bracket 45 which extends inwardly and forwardly and has pivotally secured thereto by the headed and nutted bolt 45*a* one end of a track member 46. An end member 46 has a longitudinal slot 46*a* therein through which passes a headed and nutted bolt 47 adjustably securing said member to track member 48. Member 46 has a flange with a semi-cylindrical end which alines with a top horizontal flange 48*a* on member 48. Member 48 has a vertical web portion and a lower horizontal flange with an upturned flange at its edge forming a trough as shown in Figs. 2 and 3. An endless open-link chain 49 extends around the end of bracket 46 and has its upper run traveling on flange 48*a* and its lower run traveling in trough or channel 48*b*. A pair of brackets 50 are disposed at the front of the machine and carried on studs 51 secured in the front sides of the forward posts 25. Brackets 50 have slots 50*a* therein through which studs 51 pass and washers 52 are disposed between the heads of studs 51 and brackets 50, said washers preferably being of fibre. Brackets 50 have laterally and inwardly extending arms provided with flanges engaging the sides of the forward ends of members 48 and secured thereto by the bolts 52*a*. The forward ends of the members 48 are therefore carrier by brackets 50. Brackets 46 such as already described are also secured to the front ends of members 48 and have semi-cylindrical ends about which pass chains 49. Brackets 50 also have forwardly extending lugs from which extend studs 53, the outer ends of which extend through slots 54*a* in the lower ends of links 54 which extend upwardly at each side of the machine and are connected at their upper ends by studs 55 to crank disks 56. Crank disks 56 are secured to the outer ends of a shaft 57 by any suitable means such as the pins 58. Shaft 57 is journaled in a bearing 59*a* carried by a bracket 59 secured to one of the forward posts 25. A worm wheel gear 60 is journaled on shaft 57 and held in position thereon by collars 61 and 62 disposed at either side thereof and secured to said shaft in any suitable manner as by the set screws 61*a* and 62*a* shown. Worm wheel gear 60 has projecting from its inner side one end of a stud 63. A clutch member 64 is slidably mounted on shaft 57. This member has an elongated opening or slot 64*a* therein in one side of which is disposed a collar 65*a* forming the outer race of a ball bearing 65 through the inner race of which extends a stud 66 threaded into shaft 57. Shaft 57 is flattened somewhat at the part engaged by ball bearing 65. Member 64 is thus slidable longitudinally of shaft 57 and movable very freely thereon due to the ball bearing 65. Member 64 has an outwardly extending arm from one end of which projects longitudinally of shaft 57 a pin 64*b*. Pin 64*b* is the same radial distance from shaft 57 as stud 63 and adapted to engage said stud to be driven thereby when

clutch member 64 is in engaging position. A coiled compression spring 67 surrounds shaft 57 and bears at one end against member 64 and at its other end against a collar 68 secured to shaft 57 by any suitable means such as the set screw 68a shown. A shaft 69 is journaled in the bearing 59b of bracket 59 and shafts 57 and 69 are journaled at their opposite ends in a bracket 70 secured to the other front post 25. Another worm wheel gear 71 is journaled on shaft 69, being held thereon by collars 72 and 73 secured to shaft 69 in any suitable manner as by the set screws 72a and 73a shown. Another collar 74 is secured to the shaft 69 outside of bearing 59 by the set screw shown and a sprocket wheel 75 is secured to the outer end of shaft 67 in any suitable manner as by the pin 76. A similar sprocket 75 is secured to the other end of shaft 69 being spaced from bearing 70 by another collar 74 similar to the one already described. Worm wheel gear 71 has a stud 77 secured thereto and projecting from its inner side, one side of which is beveled as shown in Fig. 5 thus having a surface inclining away from said gear at one circumferential side thereof. Gear 71 also has a plate spring 71a secured to its inner side extending circumferentially of said gear and inclining away from the same to a point substantially in line with the end of stud 77. Another clutch member 78, similar in all respects to the member 64 already described, is slidably mounted on shaft 69 and has a slot receiving another ball bearing 79 identical with ball bearing 65 already described and which is secured to shaft 69 by a stud 80, shaft 69 also being flattened at the part engaged by said ball bearing. Clutch member 78 has a radially extending arm from which projects longitudinally of shaft 69 a pin 78a which is adapted at times to engage with stud 77. A coiled compression spring 81 surrounds shaft 69 bearing at one end against clutch member 78 and at its other end against a collar 82 secured to shaft 69 by any suitable means such as the set screw 82a shown. Clutch members 64 and 78 have collars adjacent one end thereof, which collars are engaged by the ends of a lever or dog 83 pivoted by a stud 84 to a bar 85 which extends across and between the front sides of forward posts 25. Member 83 has a central arm in which is formed an open-ended slot 83a adapted to receive a pin 86 projecting from one side of a trip lever 87 pivoted on a stud 88 secured in bar 85. Lever 87 extends downwardly at an angle and has a lower weighted portion 87a and said lever has a stud 89 on which is journaled a roller 90, which roller is adapted to engage the periphery of a wheel 91, which wheel has a recess 91a in its periphery one side of which inclines to said periphery and the other side of which forms a decided angle with said periphery. Worm wheel gears 60 and 71 are constantly in mesh with a worm gear 92 secured to a shaft 93 journaled in a bearing carried by bracket 59. Shaft 93 has secured to its outer end a grooved pulley 94 over which runs a belt 95 also running over a grooved pulley 96 secured to the armature shaft of a motor 97. Motor 97 is secured to a supporting plate or bracket 98. Plate 98 has a projecting portion substantially rectangular in plan having lower flanges 98a at its inner corners which project at each side thereof, and said portion also has projecting flanges 98b at its outer corners which project at each side thereof. A pair of studs 99 are secured in and project from bar 85 and have disposed thereon rubber rollers or cylinders 100. Bracket 98 is disposed so that the inner flanges 98a are beneath the rollers 100 respectively while projecting flanges 98b are on top of said rollers respectively. Bracket 98 is thus supported on these rollers and the weight of the motor 97 retains the bracket in place, the friction of the rollers preventing outward movement of said bracket.

Wheel 91 is journaled on a stud 101 secured in a bar 85a and a lever arm 102 is also journaled on stud 101. Lever arm 102 has a stud 103 secured in one end thereof on which is pivoted an arm 104. Arm 104 carries a stud 105 on which is secured a rubber block or roller 106. Arm 104 has a weighted portion 104a at the end which carries stud 105. Lever 102 has a slot 102a extending longitudinally thereof adjacent its upper side adapted to receive one or more studs 107 carrying indicating members 108 formed of thin sheet material and having their lower ends pointed. Lever 102 has another slot 102b in its lower side into which extends the upper end of an arm 109. Arm 109 has a pointed upper end adjacent slot 102b adapted to aline with the adjacent end of the indicators 108 and has a portion 109a extending into slot 102b and forming a shoulder which engages and lifts arm 102. Said arm may also have an arrow thereon adjacent its upper pointed end. Arm 109 has lugs projecting from its lower side bored to receive a cylindrical rod 110 so that said arm is slidable on said rod and may be held in any desired position thereon by means of the hand screw 111. Rod 110 extends between links 54 already described and is secured to said links by the studs 112.

A pair of brackets 113 formed of strip material are secured to bar 85 adjacent each end thereof and extend outwardly and downwardly in a forward direction, their lower portions having horizontal and upwardly inclined parts.

Secured to the inner side of each of the posts 25 just above lower bar 26 is a stud 118 on which is journaled a sprocket 119. Studs 120 are journaled in bearings 120a secured in posts 25 adjacent the upper ends thereof and sprockets 121 are secured to studs 120 at the inner sides of said posts. Endless chains 122 run over the vertically alined sprockets 119 and 121 in each of the posts 25. The studs 120 extend to the outer sides of the posts 25 and have secured thereto the sprockets 123. Studs 124 are carried in small brackets secured to the inner flanges of the forward posts 25 and have journaled thereon grooved rollers 125. An endless chain 126 at each side of the machine runs over sprockets 123 under the upper roller 125 which is adjacent the forward sprocket 123, over the lower roller 125 and over sprockets 75 secured to the shaft 69. A block 127 is secured to each chain 122 and said block is also connected to a plate 128, which plate extends along the inner side of the adjacent post 25, there being four of these plates. A link 122a of each chain 122 has a pin 122b projecting therefrom on which is oscillatably mounted the block 127, a bushing 127a being secured in said block and receiving said pin. A headed and nutted bolt 129 extends through the upper end of block 127 and plate 128 and a headed and nutted bolt 129a extends through the lower portion of block 127 and plate 128, the same passing through an arcuate slot extending transversely thereof and formed in plate 128. Blocks 127 and plates 128 are thus vertically movable with chains 122. Plates 128 move

along the inner edges of the flanges of the posts 25 and small angle bars 134 extend vertically at each side of said plates respectively. One bar 134 is secured to one post 25 and the other angle bar 134 is secured at its top and bottom to a plate (not shown) which is also secured to post 25. Chains 122 in the rear posts 25 move in guideways 135 formed by a channel bar 135a and a smaller channel bar 135b secured to the inner side of said posts 25. A rail 130 extends between plates 128 at each side of the machine and is secured thereto by bolts 130a, said rails being shown as of channel form in cross section having their flanges directed outwardly. Carriers 131 are secured in definite spaced relation to the top of each rail 130, one of these carriers being secured to the outer end of each plate 128. Also secured to chains 122 at some distance from the block 127 are several counterweights 132. Chains 122 have certain links 122c from which project pins 122d. Counterweights 132 are of the shape shown in Fig. 19 and have flanges 132a extending alongside of chains 122, which flanges are apertured to receive the pins 122d. A set screw 133 extends through each of said flanges to hold counterweight 132 in position on pin 122d. A weighted arm or lever 136 is pivoted on a stud 137 at the inner side of one of the forward posts 25, said arm extending forwardly of said post where it has the weighted portion 136a. Said arm has a stud 138 therein which projects at one side thereof and carries a small roller 139. A trip arm 140 is also pivoted to said post by a stud 141 disposed above arm 136 and the same has a step portion or recessed portion 140a adapted at times to receive roller 139 and hold arm 136 in elevated position as shown in Fig. 7. A stud 128a projects from the upper forward corner of one carrier 131 at the outer side thereof and carries a small roller 128b adapted to engage in the upward movement of said plate 128 with the under side of lever 136. Arm 140 has a lower offset portion 140b disposed adjacent the top of one chain 122 in position to be engaged by the forward counterweight 132. A rod 142 has its upper end bent substantially at a right angle and pivoted in the forward end of arm 136, the same being held therein by a split key 143. Rod 142 extends downwardly and has its lower end also bent substantially at a right angle and pivoted in the end of an arm 144, said end being held therein by the split key 145. Arm 144 is journaled on stud 101 which carries wheel 91 and has secured thereto a flat spring 146. Spring 146 extends across the rear of wheel 91 and said wheel rotates in engagement with said spring. Wheel 91 has a slot 91b in the rear side of its rim, one end of which is formed substantially on a right angle and the other end of which has a rather long inclined portion 91c. Spring 146 is adapted to enter slot 91b when wheel 91 is in a certain position.

The rails 48 have secured to their outer sides an indicating bracket 150 having a downwardly directed point designating the inner ends of tanks 32 and 33. Said rails also have secured thereto carrier-moving cam plates 151. Plates 151 have slots 151a extending horizontally at their lower portions through which extend the studs 152 securing them to the rails 48 so that said plates may be moved and held in different positions longitudinally of rails 48. A small bracket 153 is secured to the side of each track member 48 and extends upward at one side of the chain 49. Said brackets have forwardly and downwardly inclined ribs which act as cams for a purpose to be later described.

It is desired to protect the films passing through the various tanks from as much light as possible and for this purpose plates are provided shielding the films from direct light. A plate 154 extends across the front of the machine below track members 48 having its central portion substantially against the front of tank 28 and said plate is offset outwardly at its sides and has portions overlapping the inner sides of the front flanges of forward posts 25. Said plate has buttons 155 thereon adapted to engage the outer sides of said flanges to hold said plate in position. Plate 154 is removable when released by turning buttons 155. A plate 156 has its bottom reversely bent to form a bight or groove portion which engages over the top of plate 154, said plate 156 extending upwardly between rails 48 and into a vertical slot 151b in the forward plate 151. A plate 156a extends between and engages the rear sides of forward posts 25 being secured to said posts by thumb screws 156b, said plate extending from the top of said posts to a line some distance below the top of plate 156. Another plate 157 extends between the members 48 having its lower edge just in front of partition 33a and having side portions extending into a vertical slot 151c in rear plate 151, plate 157 having a curved intermediate portion disposed in slot 151c and frictionally held therein. A plate 158 extends between the forward sides of rear posts 25 from the top thereof to a line some distance below the top of plate 157, the same being held in place by screws 159 secured to said rear posts. A plate 160 extends transversely across the rear of the rear flanges of the rear posts 25, the same extending vertically to the drain plate 43. Drain plate 43 has upwardly extending flanges 43a at each side thereof and said plate has secured thereto a vertically extending plate 43b having rearwardly extending flanges 43c at each side. Flanges 43a and 43c are secured to small triangular plates 43d having a rectangular portion extending in front of and below the top of plate 160. Plate 43b extends upwardly between rear posts 25 to a line slightly above the bottom of plate 158. Plates 43 and 43b are supported on top of plate 160 and wing nuts 161 are threaded on studs projecting from plate 160, which studs pass through a portion depending from plate 43. Plates 43 and 43d are thus firmly and removably held in place.

Bracket 45 has a stud 164 secured therein on which is pivoted a lever 165. Said lever has a weighted lower end in which is carried a headed screw 166 adapted to engage the lower part of bracket 45. Screw 166 can be adjusted to determine the normal position of lever 165. Lever 165 has pivoted to its upper end a hook or dog arm 167 which overlies chain 49. Arm 167 has an arrow-shaped head forming a hook adapted to engage in the links of chain 49 and move the same when said arm is moved longitudinally thereof. A small chain 168 is secured to the weighted end of lever 165 and has its other end secured to the lower side of rear plate 128. It will be understood as above stated that there is a lever 165 and connected parts at each side of the machine.

A bracket 170 of plate-like form extends along the inner side of the rear flange of each rear post 25, said bracket extending inwardly and having a lug 170a thereon. Lug 170a is secured to the vertical flange 171a of a track member 171 similar

to track members 48. Track members 171 each have an outwardly extending horizontal top flange on which is disposed a shallow channel bar and each has an outwardly extending horizontal bottom flange having a short vertical flange at its outer end forming a trough. Members 171 have secured at their ends brackets 172 similar to members 46 having cylindrical end portions and an endless chain 173 extends around said end portions on each track member 171, the top run of said chain running in said shallow channels on the top flange of members 171 and the bottom run traveling in the trough formed by the lower flange. Bracket 170 is cut away as shown at 170c just above the top run of chain 173 to permit the passage of the ends of the film-carrying bars 169 and said cut away portion is covered by a small piece of fabric 169a such as felt for the purpose of shutting out light. A bracket 174 is secured to the inner side of each member 171 extending downwardly and outwardly to receive a stud 175. A lever 176 of bell crank form is pivoted at its angle portion on each stud 175, said lever having an arm extending along the outer side of track member 171 and having pivoted thereto a hook or dog 177 which overlies the bottom run of chain 173. Member 177 has an arrow-shaped head portion forming a hook adapted to extend into the links of chain 173 so as to move said chain when said member is moved longitudinally thereof. The end of the other arm of lever 176 is weighted as shown in Fig. 3 and has connected to the end thereof a small chain 178 which extends upwardly over a sheave 179 mounted in a small bracket 180 secured to the upper end of each rear post 25. The other end of chain 178 is secured to the lower rear corner of rear plates 128. Bars 181 are secured to the rear ends of track members 171 respectively and project therefrom. Track members 171 are supported adjacent their rear ends by vertical posts 182 disposed at the outer sides thereof. Posts 182 are of channel shape and are connected at their upper ends to a cross channel bar 183. Channel bar 183 supports a pair of longitudinally extending angle bars 184 having their horizontal flanges directed inwardly. Bars 184 are supported at their inner ends on an angle bar 185 extending transversely across the rear flanges of rear posts 25 and secured thereto by screws 186. A plate 187 extends across and between said rear posts 25 inside of angle bar 185, being secured to rear posts 25 at its bottom by screws 187a. Plate 187 has a narrow portion at its lower end bent rearwardly in a horizontal plane which forms a support for the inner end of a hood 188, said hood being of rectangular form in vertical cross section and having side portions 188a bent downwardly and extending in vertical planes. Said side portions 188a at their inner ends extend downwardly along the outer side of a fan-like projection 170b on bracket 170. Said hood is shown as having reinforcing straps 188b at its front and rear ends.

Side plates 189 extend downwardly from the inner sides of track members 171, the same being secured to bolts 190 which secure said track members to brackets 170. Wing nuts 191 are threaded on said last mentioned bolts to hold plates 189 in position, said plates thus being removable upon removal of said wing nuts. Rods 192 extend from the angle bars 184 respectively to the rear part of hood member 188 to support the latter. Said rods have their end portions bent at right angles and extending through said angles 184 and the side portions 188a of said hood as shown in Figs. 1 and 7, said end portions being held by cotter pins 193.

In addition to the plates already described for excluding light small plates 194 are secured to the small angle bars 134 at the front and rear of the frame just above the track members 48 and extend a short distance inwardly and vertically. A plate 195 has a portion extending along the outer side of the rear flange of each rear post 25 said plates being secured to said posts respectively by the wing screws 196a. Said plates 195 are bent at right angles and have a portion 195a extending forwardly some distance inside of rear posts 25, the same extending substantially to the rear tank 34. Just above the rear portion of chain 49 said forwardly extending portion 195a extends farther forwardly and has its terminal portion again bent at right angles and extending inwardly as shown at 195b. Portion 195a just below rear track member 171 is cut away and from said cut away portion to its top is bent outwardly at a right angle as shown at 195c, said portion 195c being disposed just in front of rear conveyer 173. A small cam bracket 196 is secured to the rear side of portion 195c adjacent its top and has a downwardly and rearwardly inclining edge disposed at the outer side of rear conveyer 173 for a purpose to be later described.

In operation, the films 200 are suspended on the holders 201 having clips 201a at their bottoms for grasping said films. Said holders 201 are secured to the carrier bar 169 and said holders also have a clip 201b at the upper end which may hold an identification card for the particular film or set of pictures being developed. Weights 201c are secured to the bottom of each film 200 to insure that it will be retained in vertical depending position. One bar 169 has several holders 201 secured thereto, in the embodiment of the invention illustrated said bar being shown as carrying five holders. The bars 169 with the films thereon are brought to the machine and the films can be moved rearwardly in between track members 48 and conveyers 49 and the ends of bar 169 dropped against the front of brackets 153. The bars will slide down the front inclined portions of brackets 153 and rest on alined links of chains 49. With the bar in such position it is in position to be picked up by the front carriers 131 on the rails 130 and plate 128. Tank 30 will contain a developing solution, tank 31 will contain a short stop solution and tank 32 will contain a hypo solution. Tanks 33 and 34 will contain water forming a washing fluid. It is desired to keep the developing and other solutions at a certain temperature and ordinarily water will be circulated in tank 29 to keep said solutions at the desired temperature. Said water can overflow into sink 28 and pass out through the drain pipe 28a. The motor 97 will be operated and worm gear 92 will be driven from said motor through belt 95 and pulley 94. Both worm wheel gears 60 and 71 will be constantly driven. It will be seen that lever 87 and clutch operating member 83 are in one of two positions and that one or the other of clutch members 64 and 78 are in engaging position. Assuming that clutch member 78 has its pin 78a engaging stud 77 of worm wheel gear 71, said worm wheel gear will rotate member 78 and through said member and the ball bearing 79 and its connection to shaft 69 will drive shaft 69. Clutch member 78 is held in engaging position by spring 81. Shaft 69 being driven drives sprocket wheel 75 and chain 126 is

thus driven. Sprocket wheels 120 and 123 are rotated and these in turn rotate sprockets 121 and chains 122 are driven, the forward runs of these chains moving upwardly. Blocks 127 are carried upwardly and with them plates 128 and rails 130. As the tops of said rails and plates rise from their lowest position the forward carriers 131 engage the ends of bar 169, said bar thus being lifted and sliding rearwardly on the inclined portions of said carriers 131 to the horizontal portions thereof. Said bar is lifted and carried upwardly and when blocks 127 move around the upper sprockets the rails 130, plates 128 and carriers 131 are moved rearwardly. Said parts and the carrier carrying the film now begin to descend and the film is lowered into the forward portion of tank 30. It will be understood that the rails 130, plates 128 and parts carried thereby are counterbalanced by the weights 132. As plates 128 moved upwardly the roller 128*b* engaged lever 136, raising the same so that its roller 139 was raised above the step portion on arm 140 and said arm 140 swings forward so that roller 139 is supported on arm 140 and arm or lever 136 held in elevated position. Lever 136 carried with it in its upward movement rod 142 and arm 144. As arm 144 is moved upwardly spring 146 slides along the rear side of the rim of wheel 91 and slot 91*b* is in position so that spring 146 snaps into said slot substantially engaging the straight side thereof. Counterweights 132 move up the front side of chains 122 as rail 130 descends and when the uppermost weight passes over the top of sprockets 121 it engages arm 140 moving the same rearwardly so that the step portion thereof is moved from engagement with roller 139 and lever or arm 136 drops due to its weighted portion 136*a*. Said arm drops with considerable force and rod 142 is pushed downwardly and arm 144 rotated downwardly as shown in Fig. 2. Spring 146 engages the straight side of slot 91*b* and wheel 91 is rotated through a certain distance. It will be noted as shown in Fig. 2 that roller 90 on arm 87 is in the recess 91*a* when clutch member 78 is engaged as above described. When wheel 91 is partially rotated by the descent of arm 136 it is rotated sufficiently to move said wheel so that roller 90 moves out of recess 91*a* along the inclined side of said recess and onto the periphery of wheel 91. This oscillates lever 87 and oscillates clutch dog 83 pushing back and disengaging clutch member 78 against the tension of spring 81 and permitting spring 67 to move clutch member 64 into engaging position. Shaft 69 thus ceases to be driven and the rails 130 and plates 128 come to rest with the carriers 131 below the top run of chains 49. As carriers 131 descend the ends of bars 169 which may be thereon engage the rear inclined edges of the cam plates 151 and are moved rearwardly somewhat by these cam plates coming to rest on the links of chain 49. It will be seen that the end bar 169 which was lifted by the front carrier 131 will be lifted so that the weights at the bottoms of the films will be lifted over the top of plate 151*b* and as stated will be lowered so that it comes into the front portion of tank 30.

When rails 130 and plates 128 move upwardly the small chains 168 are moved upwardly so that they pull upon arms 165, swinging the upper ends of said arms rearwardly and moving rearwardly the members 167. Members 167 have their end portions engaged in links of chains 49 and the top runs of said chains are thus moved rearwardly the distance of one link or a distance equal to the distance between the centers of adjacent link pivots. It will be seen that bars 169 resting on chains 49 will thus be intermittently moved rearwardly through the various tanks in which they are disposed. When a bar is moved so that it is adjacent the rear wall of its tank it will be picked up by a carrier 131 in the movement of rails 130, lifted, moved forwardly and lowered into the front portion of the next adjacent tank. The cam plates 151 are provided to give a slight rearward movement to the bars 169 just before they come to rest on chains 49 so that there will be assurance of plenty of clearance for the next bar that is lowered onto the chains 49.

As above stated when wheel 91 was moved by arm 144 shaft 69 ceased to be driven and clutch member 64 was engaged so that shaft 57 is driven. Shaft 57 rotates the crank disks 56 at its ends and links 54 are raised and lowered by the rotation of crank pins 55. Brackets 50 are vertically reciprocated as are also the track members 48 secured to these brackets. These track members pivot about the bolts 45*a* at their rear ends. This raising and lowering of track members 48, of course, raises and lowers chains 49 and the bars 169 resting thereon. The films in the tanks are therefore vertically reciprocated and agitated in the liquids while being disposed therein between the movements of rails 130.

As link 53 are reciprocated rod 110 is reciprocated thus reciprocating arm 109. This oscillates arm 102 about the center of wheel 91 and arm 104 is reciprocated. Roller or block 106 is pressed against the periphery of wheel 91 and reciprocated and this roller or block acts as a pawl frictionally engaging said periphery and intermittently moving or rotating wheel 91. As arm 102 moves upwardly wheel 91 is thus rotated and in the downward movement of arm 102 roller 106 rolls along the periphery of wheel 91, arm 104 being in position to swing about its pivot 103. Wheel 91 is thus rotated step by step and the recess 91*a* will in substantially one rotation of the wheel again come under roller 90. When this occurs said roller drops into recess 91*a* again oscillating arm 87 and moving clutch operating member 83. Clutch member 64 is now moved back to disengaged position against the pressure of spring 67 and spring 81 moves clutch member 78 into engaging position. Shaft 69 and sprockets 75 are again driven and rails 130 and plates 128 again start on their upward movement to lift the bars 169 at the rear of each tank, move them forwardly and lower them into the next tank. Chains 49 are given another rearward movement as said rails reach their high point. The stud 77 is made with an inclined side so that should any obstruction get in the way of rails 130 or plates 128 said stud will force back pin 78*a* and member 78 against the pressure of spring 67 and the clutch will be disengaged thus preventing damage. Spring 72 is provided to prevent pin 78*a* from moving away from stud 77. When counterweights 132 are descending at some times there is a tendency for shaft 69 to run ahead of the worm wheel gear 71. This is prevented by spring 71*a*.

The ball bearings 65 and 79 are provided so that there will be no binding on the clutch members 64 and 78 in their movement longitudinally of shafts 57 and 69. Such binding might occur due to the circumferential strain on said clutch members. It will be seen that arm 109 can be moved longitudinally of rod 110 so as to be at dif-

ferent distances from the center of wheel 91, thus giving different effective lengths of arm 102 and moving wheel 91 a greater or lesser distance at each impulse of roller 106. The pressure of spring 146 on the rear of wheel 91 prevents any overrun of said wheel or any backward movement thereof when roller 106 moves thereon. Spring 146 thus acts as a stop pawl. The indicators 108 of which there will be several on arm 102 are preferably marked with a numeral indicating the minutes that it will take to rotate wheel 91 which is the time between transferring and advancing movements or said numeral may represent the time in minutes which it takes for a film to move through all of the tanks. The time that the films will be in the various solutions can thus be accurately seen and can be varied as described. If there are some bars 169 for which there is no place on chains 49 they can be placed on brackets 113.

When the films have been progressed by chains 49 and reach the rear of tank 34 the bar 169 carrying them will be lifted by the rearmost carrier 131, moved rearwardly and lowered. Said bar will in its descent engage cam plates 196 and said bar will be moved rearwardly off of carriers 131 and will be deposited on alined links in the top runs of chains 173. Each time that plates 128 descend to their lowest position they pull upon the small chains 178 swinging levers 176 and moving members 177. Members 177 engage links in the lower run of chains 173 and these runs are given a forward impulse thus moving the top runs of said chains rearwardly. Arm 176 is of considerable length and the movement given to chains 173 is substantially equal to the distance of the length of three links of said chains. The bars 169 will thus be more widely separated on chains 173 than on chains 49. This is desirable as the films are being dried while on chains 173 and more spacing is desirable.

The part of the machine forward of the rear sides of rear posts 25 will be disposed in a dark room while the portion of the machine in the rear of said sides will be disposed in an ordinary lighted room. The partition between the dark room and the lighted room will ordinarily be disposed substantially in the plane of plates 160 and 187. It is necessary to shield the films from light which would enter from the room in the rear thereof. For this purpose the hood 188 and side plates 189 are provided as well as the plates 43b, 187, 158, 157, 156a and 156. It will be noted that the lower ends of plates 158 and 156a are disposed below the tops of plates 43b, 157 and 156 so that said lower ends and tops overlap respectively. It is thus obvious that no direct light can shine upon the films while in the various receptacles and that very little light will penetrate beyond plate 158. The light is further excluded by plates 156a and 156 at the front of the machine. It will be seen that the films in their progress are lifted over plate 156, moved under plate 156a by conveyers 49, are later lifted over plate 157, moved under plate 158 by conveyers 49, the films then being lifted over the top of the plate 43b. The plates are then transferred to conveyers 173 and moved within hood 188 and plates 189 for some distance. This hood and plates 189, as stated, act to exclude light. The bars 169 eventually reach bars 181 on which they are deposited from the rear ends of chains 173 and said bars and films will be lifted from these bars for further operation. The films as they are on the front part of chains 173 will drain and any water dripping therefrom will be deposited on drain board 43 and will be directed back into tank 28.

Liquid may be supplied to the tanks 30, 31 and 32 by disposing the free end of conduit 35a therein, closing valves 37 and 40 and opening valves 41 and 42. Liquid may be supplied to tanks 33 and 34 by closing valve 41 and opening valves 40 and 42. Pipe 38 is connected to both of said tanks and will supply both tanks. Tanks 33 and 34 overflow into tank or sink 28. The ejector 35 can be used to withdraw liquid from tanks 30 to 34. The end of conduit 35a will be disposed adjacent the bottom of the tanks, valve 40 will be closed and valves 37, 41 and 42 opened. Water passes from pipe 39 through the ejector 35 downwardly in pipe 36 and a suction is created so that the liquid is drawn through conduit 35a and also passes down through pipe 36 into tank 28 at the side of tank 33 and the same can drain out through pipe 28a.

The cam plates 151 will, of course, be properly adjusted so that the descending group of films will be positioned as desired in the various tanks.

From the above description it is seen that applicant has provided a most ingenious and efficient machine for handling films. After the films are placed on the conveyers 49 they are not again manipulated until taken from the bars 181. They are successively moved through the various solutions and liquids and are agitated while disposed therein. The machine can readily be set for a faster or slower movement of the films as is desirable. Very accurate and satisfactory developing of the films can thus be had. The machine is comparatively small and takes up a comparatively small space in a commercial establishment where it is used. The device has been amply demonstrated in actual practice and found to be very successful and efficient and is being commercially made.

It will, of course, be understood that various changes may be made in the form, details, arrangement and proportions of the apparatus without departing from the scope of applicant's invention, which, generally stated, consists in an apparatus capable of carrying out the objects above set forth, such as disclosed and defined in the appended claims.

What is claimed is:—

1. A film treating machine having in combination, a receptacle for holding treating liquid, a conveyer adjacent said receptacle movable longitudinally thereof, a carrier on said conveyer for holding a film, which film extends into said receptacle, means for intermittently moving said conveyer to progress said film through said receptacle, means operated at regular times for raising, advancing and lowering said film to position it in said receptacle and remove it therefrom and means operated between said times and while said conveyer is not being moved by said first mentioned means for imparting a multiplicity of vertical reciprocations to said conveyer and film between its movements to progress said film.

2. A film treating machine having in combination, a series of receptacles for holding liquids, a conveyer movable adjacent said receptacles, carriers on said conveyer for holding films, which films extend into said receptacles, means for intermittently moving said conveyer rectilinearly and longitudinally of said receptacles to progress said film through said receptacles, means for periodically lifting said carriers and films, advancing the same and then lowering the same to

transfer said films from one receptacle to another and means for imparting a multiplicity of vertical reciprocations to said conveyer to agitate said films in said liquids between the operations of said last mentioned means and between the movements of said conveyer to progress said films through said receptacles.

3. A film treating machine having in combination, a series of receptacles for holding liquids, a conveyer movable adjacent said receptacles, carriers on said conveyer for holding films, which films extend into said receptacles respectively, means for intermittently moving said conveyer longitudinally of said receptacles to progress said films horizontally through said receptacles, means for lifting said carriers and films, advancing the same and then lowering the same to transfer said films from one receptacle to another, driving means for operating said last mentioned means during certain spaced periods, means for vertically reciprocating said conveyer to agitate said films in said receptacles and means for operating said last mentioned means from said driving means while said first mentioned means is at rest between said periods and between the longitudinal movements of said conveyer.

4. A film treating machine having in combination, a series of receptacles for holding liquids, a conveyer movable adjacent said receptacles, carriers on said conveyer for holding films, which films extend into said receptacles respectively, means for moving said conveyer to progress said films through said receptacles, means for lifting said carriers and films, advancing the same and then lowering the same to transfer said films from one receptacle to another, means for reciprocating said conveyer to agitate said films in said liquids, a driving means and means acting at regular intervals for alternately connecting said driving means to one of said first mentioned means and last mentioned means and simultaneously disconnecting it from the other of said means.

5. A film treating machine having in combination, a series of receptacles for holding liquids, a conveyer movable adjacent said receptacles, carriers on said conveyer for holding films, which films extend into said receptacles respectively, said conveyer being movable to progress said films through said receptacles, means for lifting said carriers and films, advancing the same and then lowering the same to transfer said films from one receptacle to another, means for reciprocating said conveyer to agitate said films in said liquids, a driving means, means acting at regular intervals for alternately connecting said driving means to one of said first mentioned means and last mentioned means and simultaneously disconnecting it from the other of said means and means for varying the length of said intervals.

6. A film treating machine having in combination, a plurality of receptacles arranged side by side and adapted to contain treating liquids, one end of said machine being exposed to light at one side of one endmost receptacle, a carrier for films, means for supporting said films and moving the same forwardly through said receptacles, means for lifting forwardly, advancing and lowering said carriers and films to transfer the same from one receptacle to another and out of said endmost receptacle, a plate at said end extending from the top of said endmost receptacle to a line some distance above said top of said endmost receptacle, a second plate spaced rearwardly from said plate extending from a height above that to which the films are lifted to a line below the top of said first mentioned plate and a third plate spaced rearwardly from said second plate and extending from said receptacle to a line above the bottom of said second plate, said films being lifted over said first and third plates and being moved under said second plate.

7. A film treating machine having in combination, a plurality of receptacles arranged side by side and adapted to contain liquids, a conveyer adjacent said receptacles, carriers on said conveyer for holding films, which films depend into said receptacles respectively, means for lifting a carrier and films held thereby, advancing it a certain distance and then lowering the same to transfer said films into one receptacle and from said one receptacle into another, a partition at the outer side of said one receptacle extending transversely thereof and to a line some distance above the top of said receptacle and a second partition spaced from said first partition a distance inwardly of said endmost receptacle substantially the same as said first mentioned distance and extending from a line below the top of said first mentioned partition to a height above that to which said films are raised, said films being lifted by said last mentioned means over said first partition and moved under said second partition by said conveyer.

8. A film treating machine having in combination, a receptacle for holding a treating liquid, a holder for films, means for supporting said holder with said films in said liquid, means for intermittently moving said means to progress said films through said receptacle longitudinally thereof and means for imparting a multiplicity of vertical reciprocations to said holder and films between their movements longitudinally through said receptacle to agitate said films in said liquid.

9. A film treating machine having in combination, a receptacle for holding a treating liquid, a holder for films, means for supporting said holder with said films in said liquid, means for moving said means rectilinearly longitudinally of said receptacle to progress said films through said receptacle and means for imparting a multiplicity of vertical reciprocations to said holder and films between their movements longitudinally of said receptacle to agitate said films in said liquid.

10. A film treating machine having in combination, a series of receptacles for holding liquids, means for holding films, means for supporting said last mentioned means with said films disposed in said receptacles respectively, means for moving said first mentioned means to lift, advance and lower said films to transfer the same from one receptacle to another at intervals, means for moving said second mentioned means intermittently to progress said films through said liquid longitudinally of said receptacles and means for imparting a multiplicity of short vertical reciprocations to said films between their longitudinal movements thereof through said receptacles.

11. A film treating machine having in combination, a plurality of receptacles for holding liquids, means for holding films, means for supporting said last mentioned means with said films disposed in said receptacles, means for moving said first mentioned means to lift, advance and lower said films to transfer the same from one receptacle to another at intervals, means actuated by said last mentioned means for moving

said second mentioned means longitudinally of said receptacles to move said films therethrough and means for imparting a multiplicity of vertical reciprocations to said films in said receptacles and liquids while disposed therein and between the operations of said last mentioned means.

12. A film treating machine having in combination, a series of adjacent receptacles for holding liquids, an endless conveyer movable adjacent said receptacles, carriers on said conveyer for holding films, which films are disposed in said receptacles respectively, means for intermittently moving said conveyer longitudinally of said receptacles to progress said films through said receptacles and liquids therein and means for imparting a multiplicity of short vertical reciprocations to said conveyer, between its movements longitudinally of said receptacles to agitate said films in said receptacles and liquids.

13. A film treating machine having in combination, a receptacle for holding a treating liquid, a conveyer movable adjacent said receptacle and longitudinally thereof, a carrier on said conveyer for holding a film, which film extends into said receptacle, means for intermittently moving said conveyer longitudinally of said receptacle to progress said film through said receptacle and liquid therein and means for imparting a multiplicity of vertical reciprocations to one end of said conveyer to agitate said films in said liquid while said conveyer is not being moved longitudinally of said receptacle.

14. A film treating machine having in combination, a receptacle for holding a treating liquid, a conveyer movable adjacent said receptacle and longitudinally thereof, a carrier on said conveyer for holding a film, which film extends into said receptacle, means for lifting said film, advancing the same and lowering the same to position it in said receptacle and remove it therefrom, means for moving said conveyer longitudinally of said receptacle at intervals and means for imparting a multiplicity of vertical reciprocations to said film between said longitudinal movements of said conveyer.

15. A film treating machine having in combination, a series of receptacles for holding liquids, a conveyer movable adjacent said receptacles, carriers on said conveyer for holding films, which films extend into said receptacles respectively, means for lifting said carriers and films, advancing the same and then lowering the same to transfer said films from one receptacle to another, means for moving said conveyer longitudinally of said receptacles at intervals to progress said films through said receptacles, a mechanism for operating said first mentioned means, a second mechanism for operating said second mentioned means, a driving means, clutches for respectively connecting and disconnecting said mechanisms to and from said driving means, and a rotatable means rotated step by step during the operation of said second mentioned means whose period of rotation determines the intervals between the operations of said first mentioned means.

16. The structure set forth in claim 15 and means for varying the magnitude of said steps to vary said period and intervals.

17. The structure set forth in claim 15 and means operated by said last mentioned means for engaging one of said clutches and disengaging the other.

18. A film treating machine having in combination, a series of receptacles for holding liquids, a conveyer movable adjacent said receptacles, carriers on said conveyer for holding films, which films extend into said receptacles respectively, means for moving said conveyer to progress said films through said receptacles, means for lifting said carriers and films, advancing the same and then lowering the same to transfer said films from one receptacle to another at regular intervals including a member rotated step by step to effect a complete cycle of rotation which determines said intervals and means for varying the length of said individual steps to vary said period and intervals.

19. A film treating machine having in combination, a series of receptacles for holding liquids, a conveyer movable adjacent said receptacles, carriers on said conveyer for holding films, which films extend into said receptacles respectively, means for moving said conveyer to progress said films horizontally through said receptacles, means intermittently operated for lifting said carriers and films, advancing the same and then lowering the same to transfer said films from one receptacle to another, means for intermittently operating said last mentioned means at regular intervals including a rotatable member, a complete rotation of which determines the time of operation of said lifting, advancing and lowering means and means for rotating said member in step by step manner to effect a complete rotation thereof, and means for varying the distance said member is rotated at each step for varying the time of a complete rotation of said member.

20. A film treating machine having in combination, a plurality of receptacles placed side by side adapted to contain treating liquids, carriers for films, means for supporting said carriers with said films disposed in said receptacles, means for lifting, advancing and lowering said films to transfer the same from one receptacle to another and a plurality of stationary substantially vertical plates spaced in the direction of movement of said films through said receptacles, said plates having respectively upper and lower overlapping edges disposed a substantial distance above the tops of said receptacles, said films being lifted over said upper edges and moved under said lower edges whereby direct light from the end of said apparatus is prevented from reaching said films and a hood extending from said end of said apparatus having a top and side portions extending downwardly below the overlapped edges of said plates some distance at either side of said carriers and films to further shut out the light.

21. A film treating machine having in combination, a receptacle for holding a treating liquid, a holder for films, a conveyer for intermittently moving said holder in a horizontal line to move said films through said liquid from one end of said receptacle to the other, means for supporting said conveyer and holder with said films in said liquid, a crank, and links operatively connected to said crank for vertically reciprocating said supporting means and said conveyer through a small amplitude to agitate said films in said liquid when said conveyer and said holder are stationary.

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