Feb. 13, 1951 P. S. ALLEN 2,541,016

APPARATUS FOR TAKING AND DEVELOPING A SERIES OF PICTURES IN SEQUENCE ON A FILM STRIP

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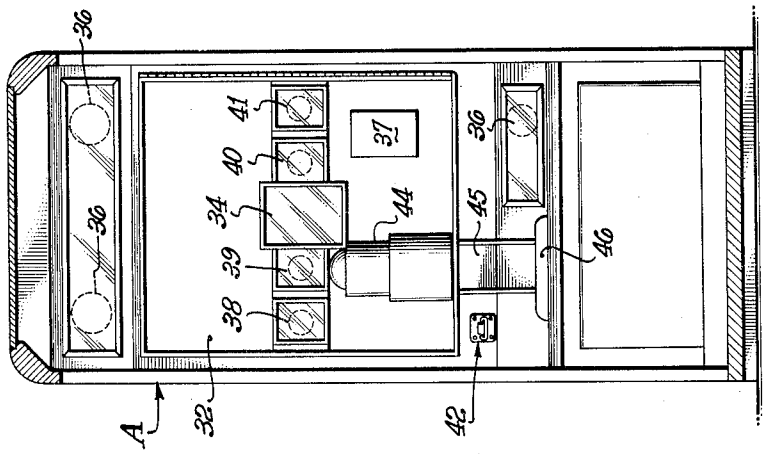
Fig. 2.



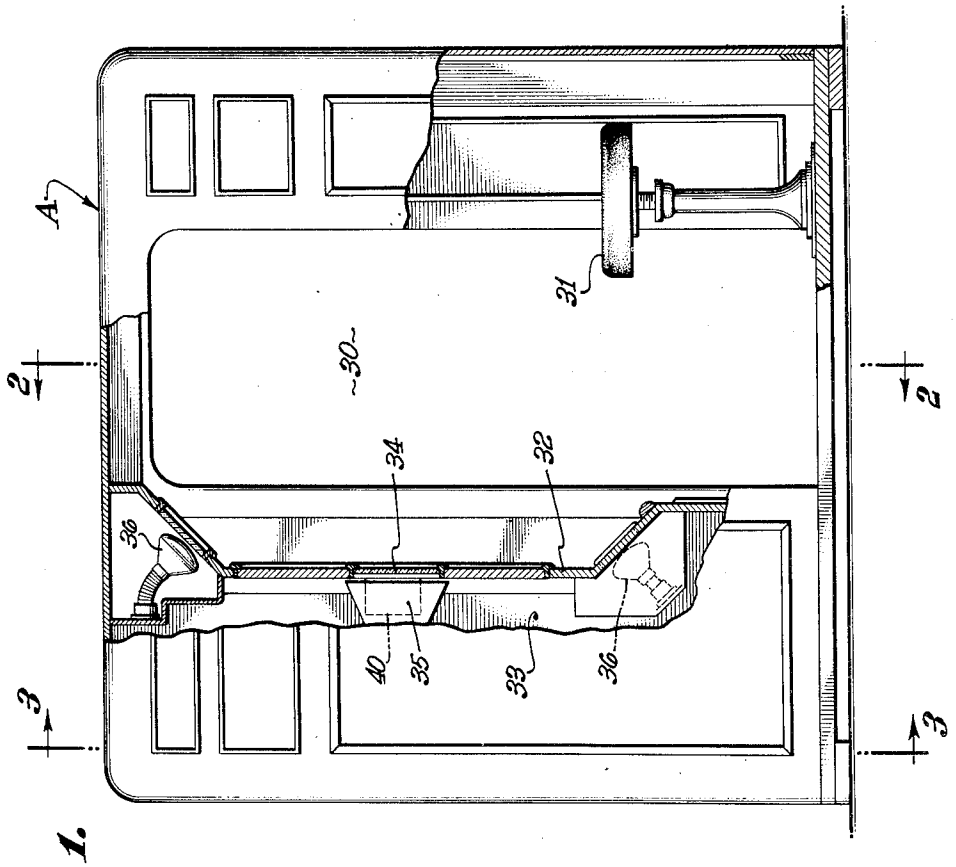


Fig. 1.

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Fig. 3.

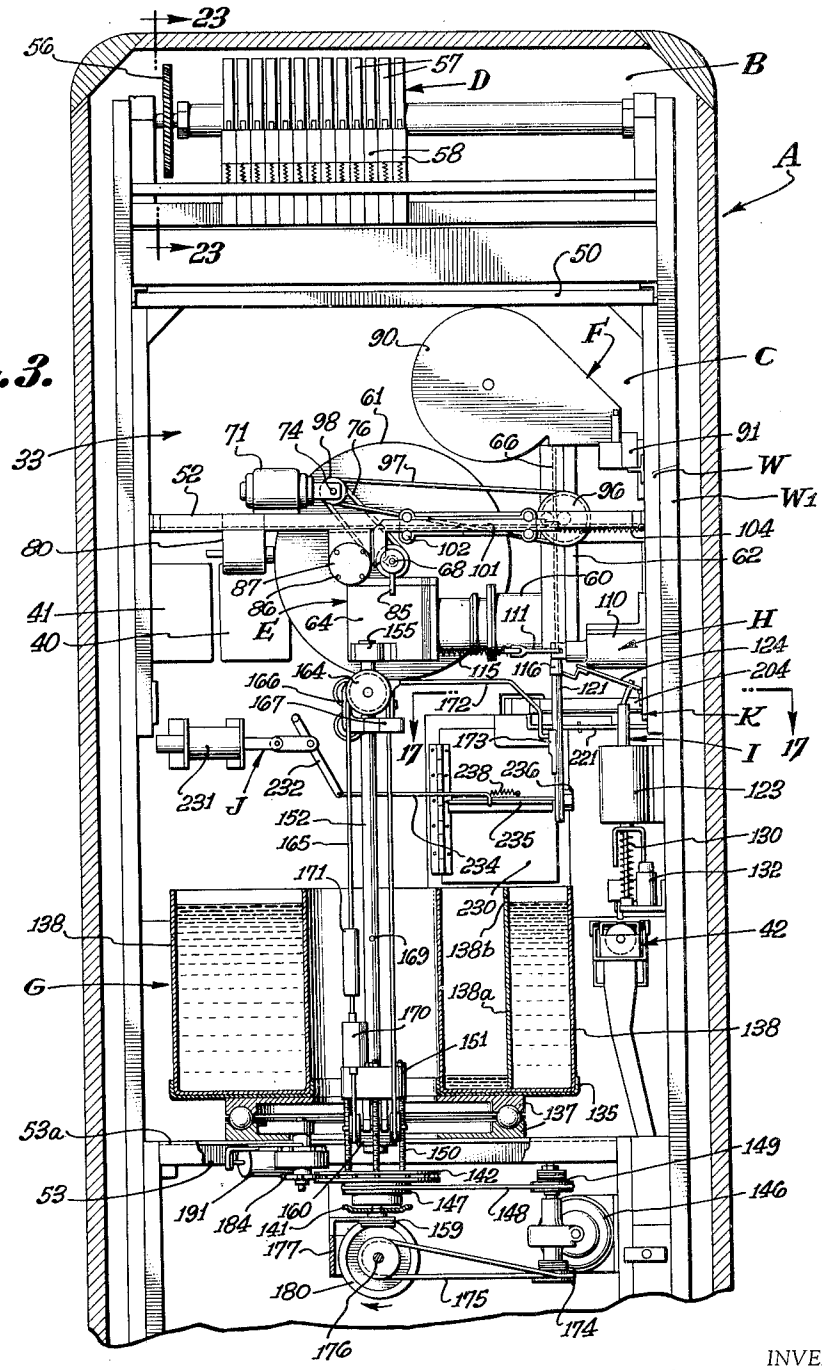

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Fig. 4.

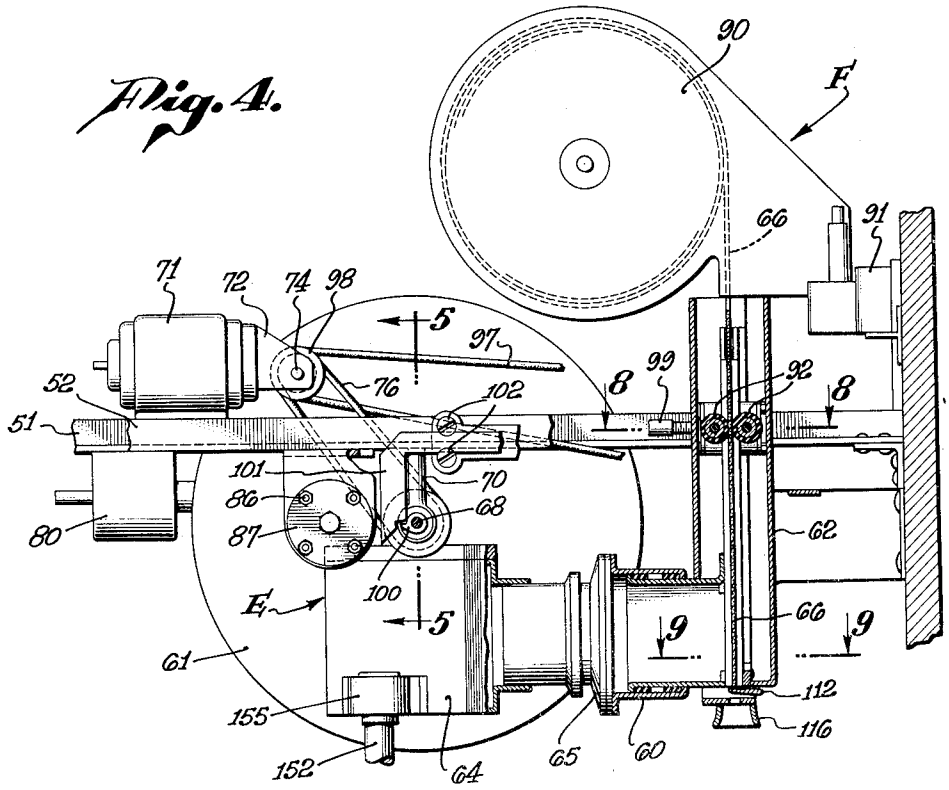

Fig. 5.

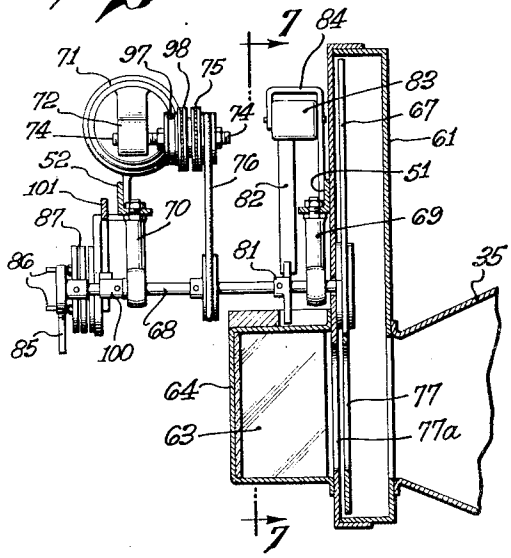

Fig. 6.

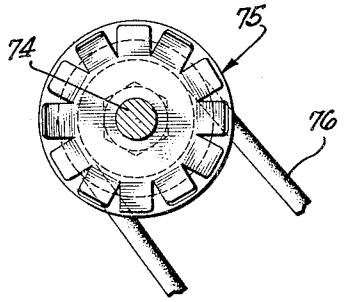

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Fig. 7.

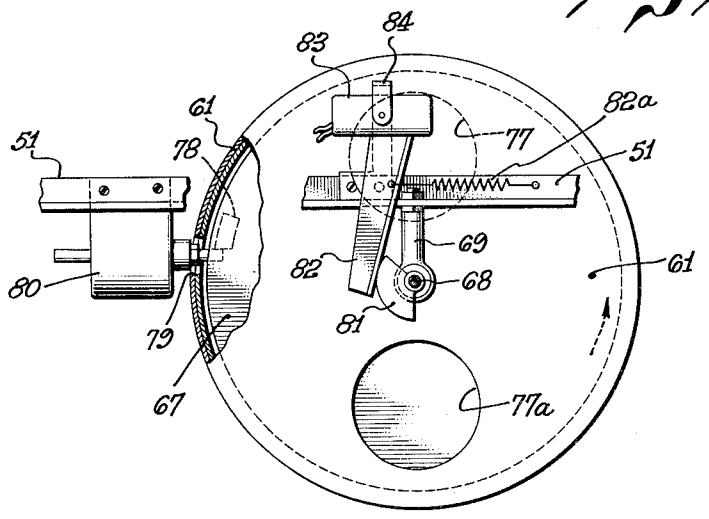

Fig. 8.

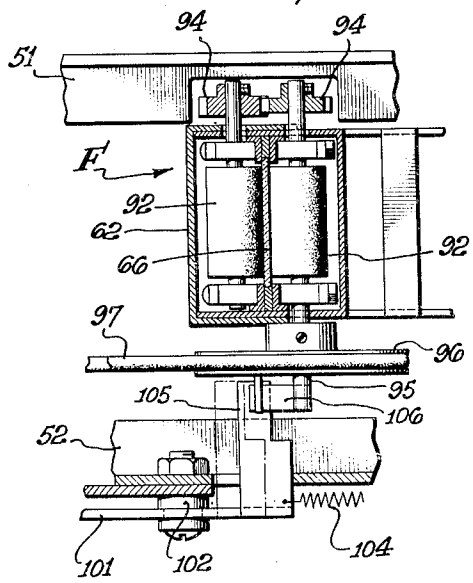

Fig. 9.

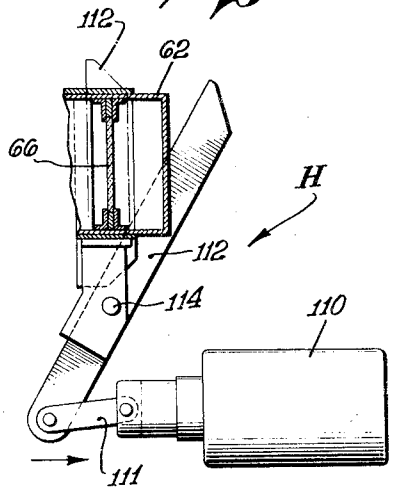

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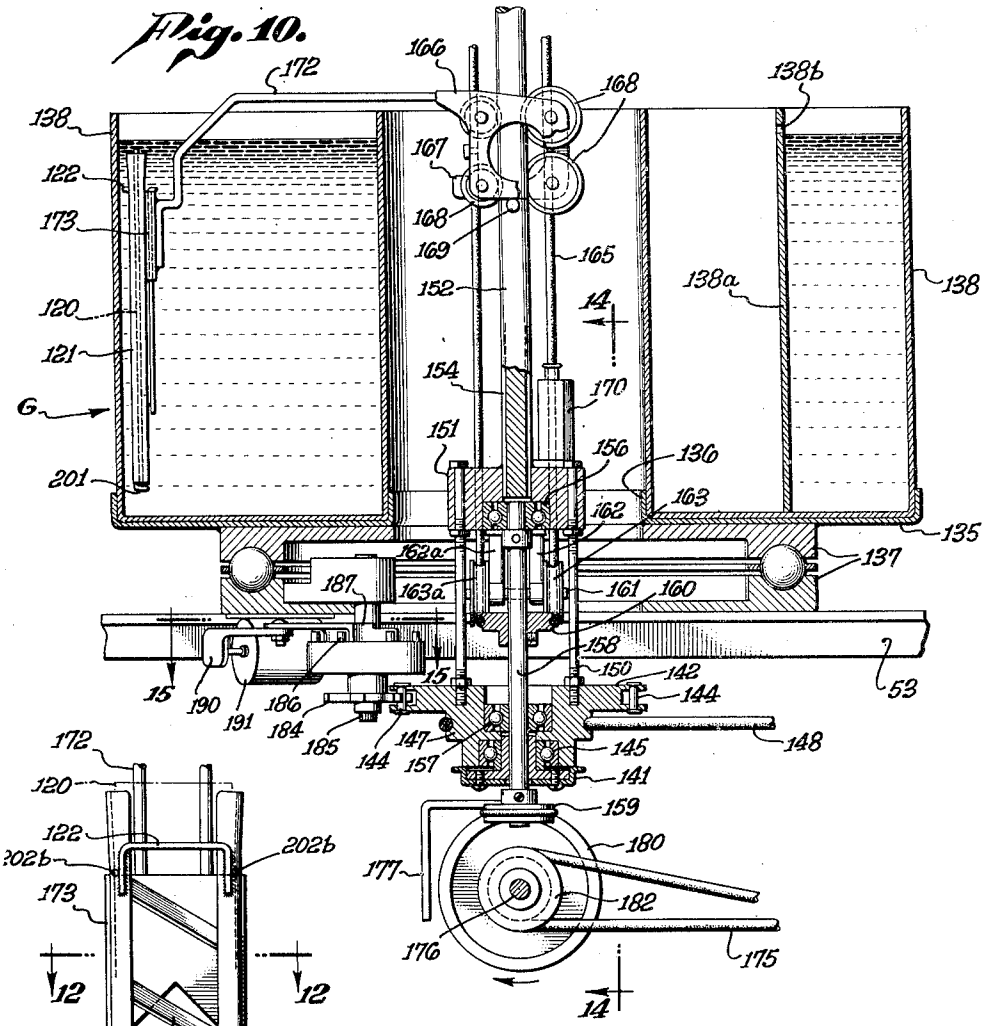
Fig. 10.



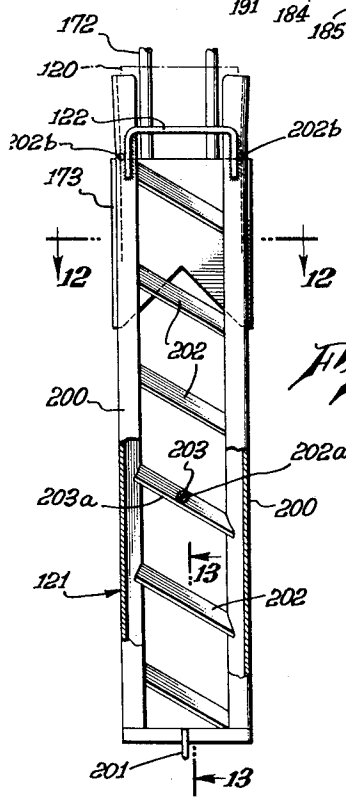


Fig. 11.

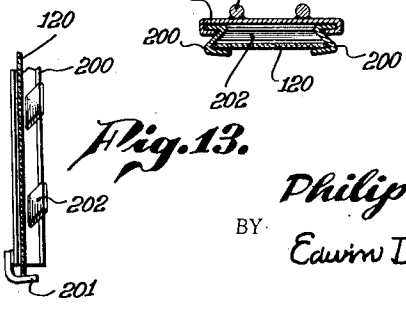


Fig. 13.

Fig. 12.

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Fig. 14.

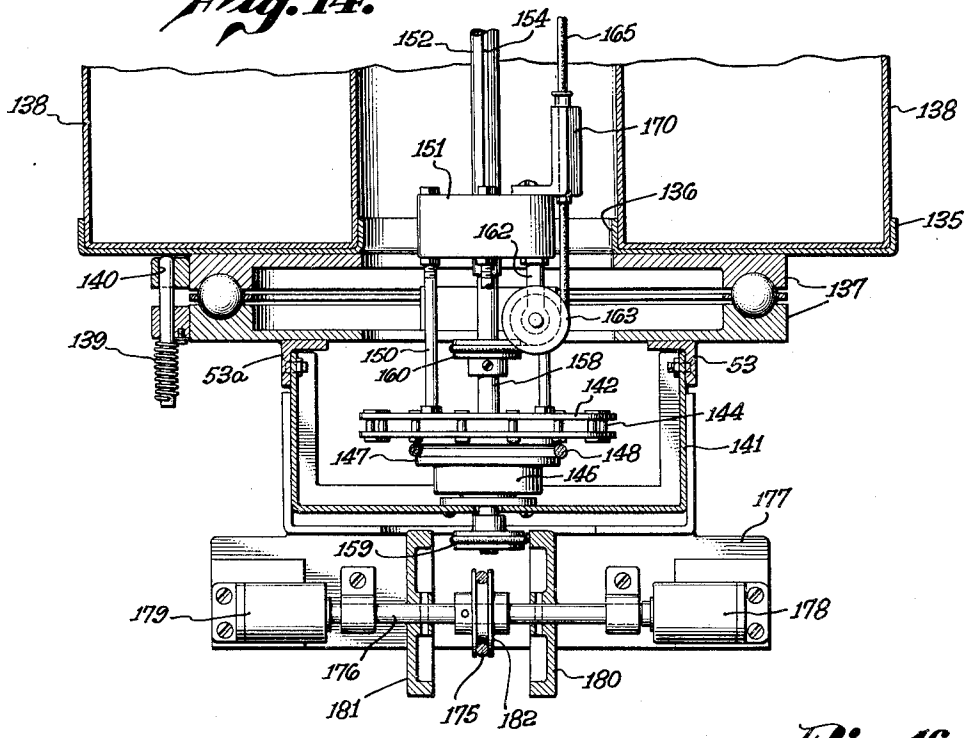

Fig. 16.

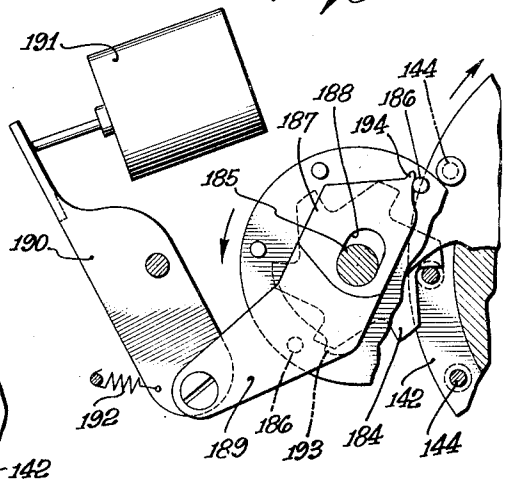

Fig. 15.

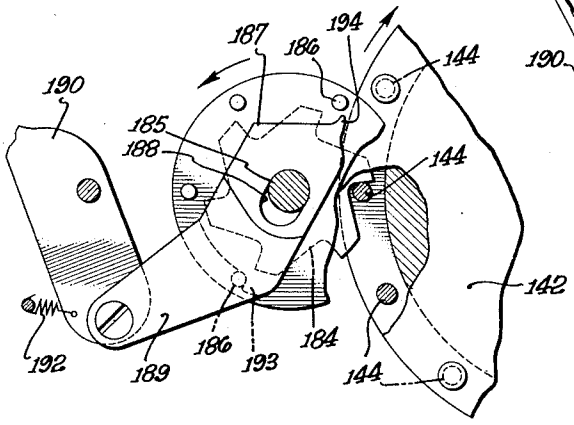

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Fig. 17.

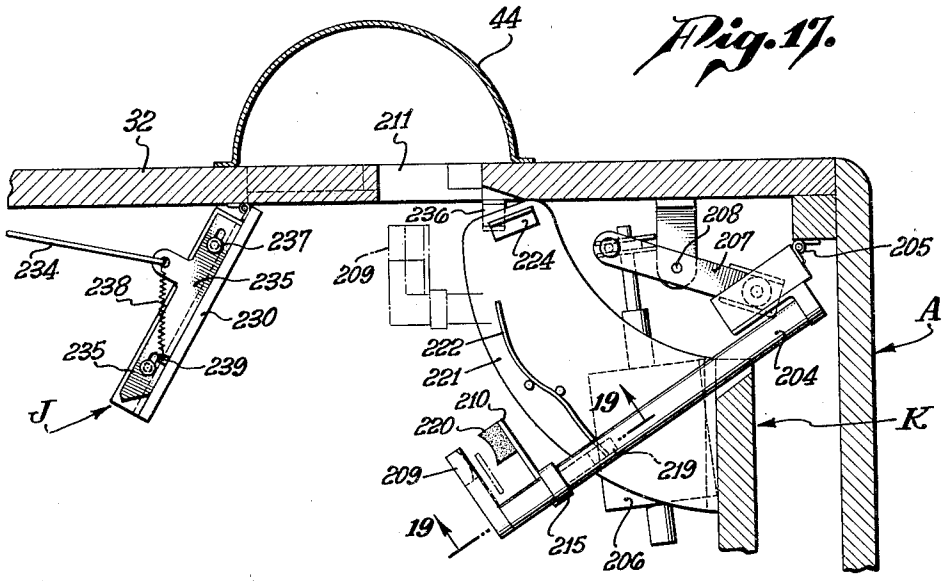

Fig. 18.

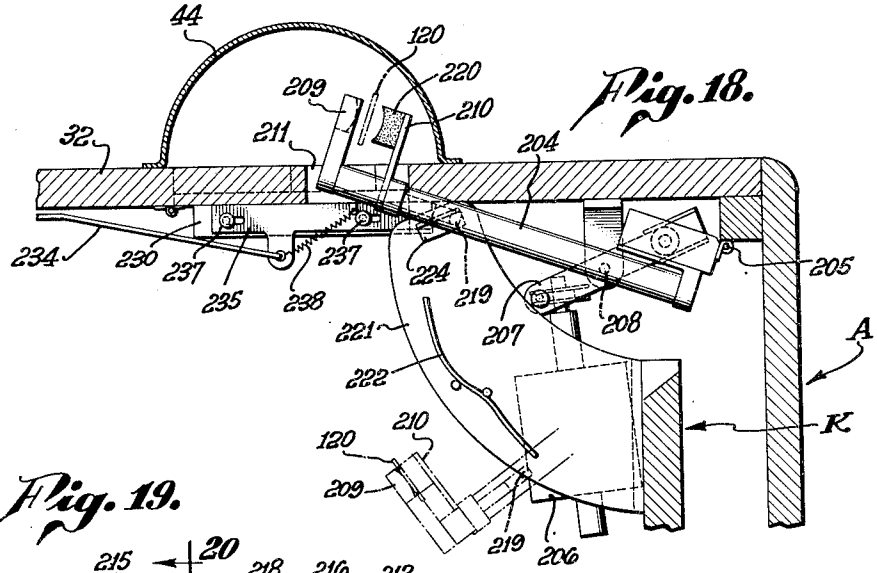

Fig. 19.

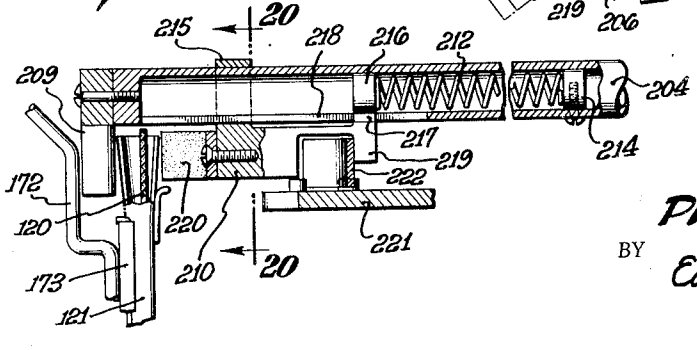

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Fig. 20.

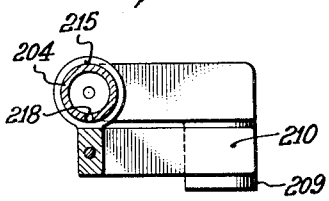


Fig. 21.

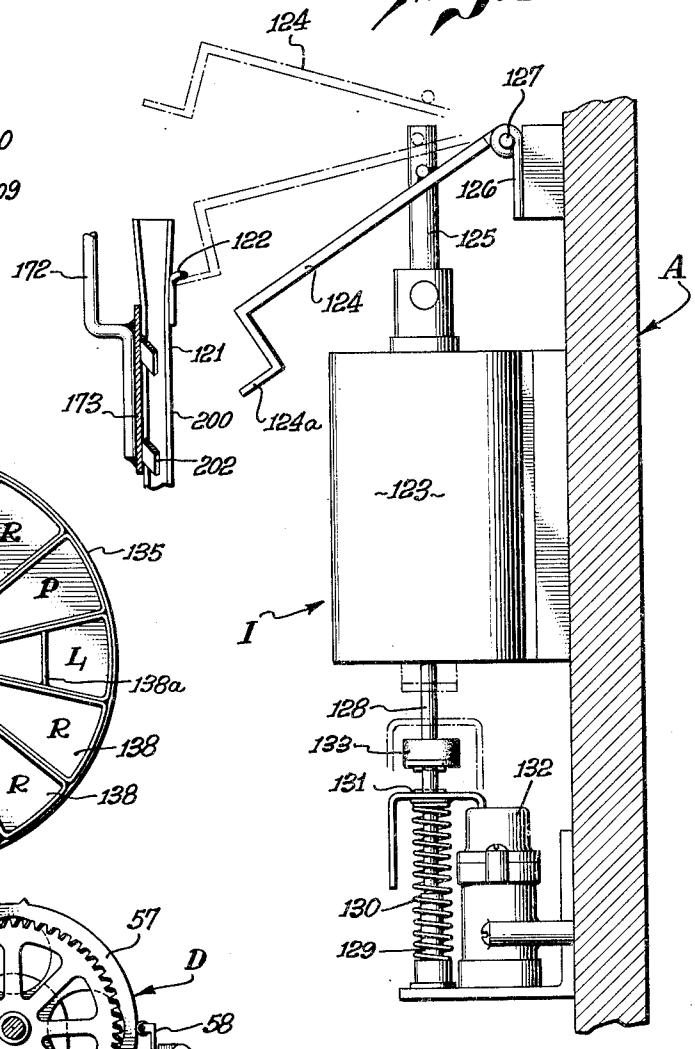
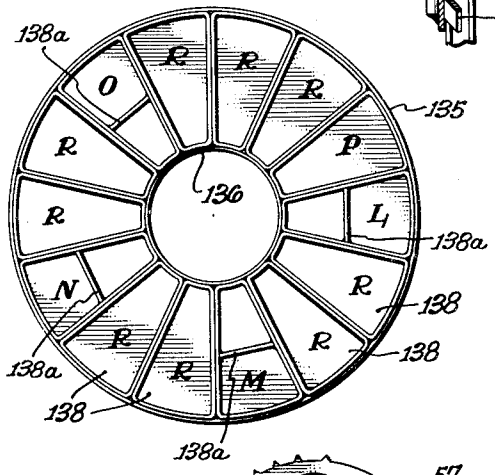


Fig. 22.



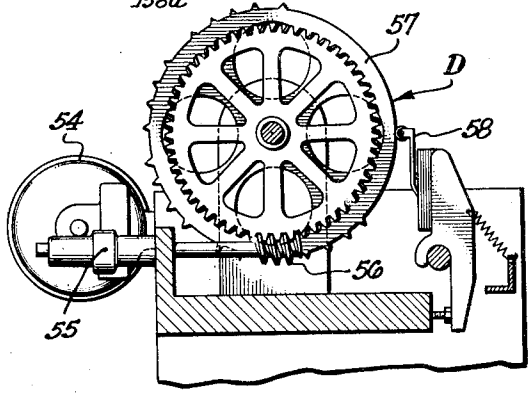


Fig. 23.

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Patented Feb. 13, 1951 2,541,016

UNITED STATES PATENT OFFICE

2,541,016

APPARATUS FOR TAKING AND DEVELOPING A SERIES OF PICTURES IN SEQUENCE ON A FILM STRIP

Philip S. Allen, Long Beach, Calif.

Application February 19, 1946, Serial No. 648,737

9 Claims. (Cl. 95—14)

1

My invention relates to photographic apparatus for automatically taking and developing photographs and delivering them in the form of finished positives. More particularly, my invention relates to apparatus adapted to act automatically, upon performance of an act such as the insertion of a coin, to take a series of photographs of a subject upon a sensitized strip at short time intervals suitable for changes of posture, and to then develop and deliver the strip.

In my United States Letters Patent No. 2,380,378, dated July 31, 1945, I have disclosed apparatus of the above described character in which the sensitized strip, after exposure, is dipped into a succession of developing and washing baths held in the compartments of a tank which rotates at timed intervals while the strip is held above it, and remains stationary while the strip is dipped into each of the successive baths. In my present invention, the tank containing the bath compartments is stationary, while the strip holder not only reciprocates vertically but revolves to each of the baths in turn. Other changes and improvements, in part resulting from this principal change and in part independent thereof will also appear in this present disclosure, but insofar as mechanism fully described in my above referred to patent is included in the embodiment of my present invention it will be described in broad and functional terms, reference being made to my earlier disclosure for exact details.

A purpose of my invention is to provide an automatic camera which will expeditiously produce a series of clear unfogged photographs in a variety of poses upon a unitary strip.

Another object is the provision of efficient and rapid developing means in which the various chemicals and rinses are caused to actively wash the strip of film immersed therein, this action being entirely automatic with the dipping of the strip in the baths and requiring no extra moving parts.

Yet another purpose of my invention is to provide in such a photographic apparatus strip carrying means which are positive in their action, to the end that damp strips of film cannot become lodged in any part of the apparatus but are carried bodily but nevertheless loosely and without disfiguring clamps from one bath to another and then, when sufficiently dried, are forcibly gripped and ejected to the delivery orifice.

A further purpose of my invention is to provide simple and effective means for producing from a single power source in alternate repetitive sequence two types of intermittent motion for a film carrier, in one of which it is vertically reciprocated with a relatively long pause while at the lower end of its vertical travel, and in the other of which it is horizontally angularly swung during the relatively short pause at the upper end of its vertical movement.

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Still another purpose is to provide means for accurately aligning the strip carrier with the strip which it is to receive. As this alignment need occur but once in each cycle of operations, the provision of special means for that purpose at that point in the cycle obviates the need of careful alignment and undue length of travel at other points.

It is also one of my purposes to provide a setting for the developing baths by which they may be rotated to a convenient replacement and replenishing station without interference with, or requirement of operation of, other parts of the apparatus.

To attain the above purposes and others which will become apparent hereinafter, I have embodied my invention in a preferred form of which the following is an illustrative description taken in connection with the accompanying drawings, in which:

Fig. 1 is a side elevation of the cabinet in which my apparatus is mounted, with parts broken away and in section to disclose the general arrangement;

Fig. 2 is a sectional view inside the cabinet on the line 2—2 of Fig. 1, as a person being photographed sees it;

Fig. 3 is a sectional view on an enlarged scale on the line 3—3 of Fig. 1, illustrating the arrangement of the operating mechanism within the cabinet housing;

Fig. 4 is a further enlarged detail of the view of Fig. 3, with parts in section, showing the camera, shutter, and film feeding mechanism;

Fig. 5 is a transverse vertical section on the line 5—5 of Fig. 4, showing the shutter drive;

Fig. 6 is a still further enlarged detail showing the type of slip clutch pulley used wherever required in my apparatus;

Fig. 7 is a view on the line 7—7 of Fig. 5, illustrating the stop and start mechanism of the shutter and the correlated flood-light control;

Fig. 8 is a horizontal section on the line 8—8 of Fig. 4 and on a further enlarged scale, giving details of the film-advancing drive and the interrupting control therefor;

Fig. 9 is an enlarged detail in horizontal sec-

tion on the line 9—9 of Fig. 4, showing the film cutter and its operating means;

Fig. 10 is a view partly in section and partly in elevation of the developing apparatus housed in the lower part of the cabinet;

Fig. 11 is an enlarged view of the film immerser shown in Fig. 10, taken at right angles thereto;

Figs. 12 and 13 are fragmentary sections taken respectively on lines 12—12 and 13—13 of Fig. 11;

Fig. 14 is a view partly in section and partly in elevation of the driving mechanism shown in Fig. 10, taken at right angles thereto on the line 14—14 thereof;

Fig. 15 is an enlarged plan view with parts broken away taken on the line 15—15 of Fig. 10, and showing the interrupting control for the rotary drive of the film immersing assemblage;

Fig. 16 is a view similar to Fig. 15, but with the parts in an altered position.

Fig. 17 is a fragmentary horizontal section on the line 17—17 of Fig. 3, illustrating the film ejecting mechanism;

Fig. 18 is a view similar to Fig. 17, the parts being shown in other stages of their cycle of operation;

Fig. 19 is an enlarged sectional view on the line 19—19 of Fig. 17, showing the ejecting mechanism about to seize a strip of film from the film carrier;

Fig. 20 is a detail in section on the line 20—20 of Fig. 19, showing the mounting of the film ejector jaws;

Fig. 21 is an elevational view of the immerser lifting mechanism;

Fig. 22 is a plan view of the developing and rinsing tank; and

Fig. 23 is a vertical section on an enlarged scale on the lines 23—23 of Fig. 3, showing the timing cams controlling the operation of the various motors and solenoids.

Referring now to the details of the drawings and with particular reference to Figs. 1 and 2, A indicates in general a cabinet for housing the operating mechanism of my invention and for providing a booth 30 furnished with a seat 31. A person posed on the seat 31 for photographing sees before him a panel 32 behind which is a compartment 33 enclosing the automatic apparatus to be presently described and serving as a photographic dark room for the developing of finished photographs. Directly before the sitter is the orifice 34 of a light passage 35 leading to a camera, and above and below the orifice 34 are flood lamps 36 for illuminating the booth. An instruction sheet 37 may be posted on the panel 32, informing the sitter that by looking at lights 38, 39, 40, and 41, which will flash on in sequence during the sitting, he may obtain photographs in four poses. A coin receiver 42 is provided, and a cover 44 conceals film delivery mechanism above a delivery chute 45 and chute stop 46.

Within the cabinet A the compartment 33 is divided by a horizontal partition 50 into upper and lower chambers B and C, the latter being further subdivided by upper cross-supports 51 and 52 and lower cross-supports 53 and 53a. All of these supports are supported by a vertical inner framework W in turn supported on an outer frame W1. The upper chamber B houses a master current distributor D, while the lower chamber C houses, as major units, a camera, shutter, and light reflecting assembly E and a film supply unit F supported by the supports 51 and 52 and by the side-walls of the chamber, and a film-carrying and developing unit G, supported by the lower support 53 and 53a; and as units of lesser size generally supported by the side-walls of the cabinet a film cutter H, an immerser lifting mechanism I, door-opening mechanism J, and film-ejecting mechanism K, to be described in detail in suitable order hereinafter.

A control motor 54, housed in the upper chamber B, is electrically in circuit with a current supply passing through the coin receiver 42, of which numerous suitable types are commercially available. Deposit of a suitable coin in the receiver 42 closes the circuit and starts the motor 54 which, as shown in Fig. 23, is connected by reduction gears 55 and worm gear 56 to the master current distributor D. The distributor D is similar in general plan and function to the similar device described in my U. S. patent hereinbefore referred to, and it is believed sufficient herein to describe it as comprising a number of cam wheels 57 which as they revolve act upon cam followers 58 to close and reopen the circuits to the various solenoids and motors in appropriate sequence. The distributor D revolves throughout the entire cycle of automatic operations, its final act being to break the circuit to the control motor 54 and thus bring the mechanism to a stop.

A camera 60, as illustrated in Figs. 4 and 5 is supported from the cross-support 51 in part by a shutter housing 61 and in part through a housing 62 which is part of the film supply unit F. The light passage 35 directs the light from the orifice 34 upon a mirror 63 set in a hood 64 so as to deflect the light beams at a right angle through adjustable focusing lenses 65 upon a sensitized paper strip or film 66. By this arrangement the sensitized strip 66 receives a reversed image and, when developed and fixed as a positive print, presents a true image of the sitter. The shutter housing 61 intervenes between the light passage 35 and the mirror 63 and encloses a rotary shutter 67 mounted on a shaft 68 supported from supports 51 and 52 by hangers 69 and 70. A motor 71, supported by the cross-support 52, drives through intermediate bevel gears 72 a jack-shaft 74, and thence by a slip clutch pulley 75, of the type shown in Fig. 6, drives the shaft 68 by means of a belt 76. It will be seen that because of the slip clutch pulley 75, the shaft 68 may be stopped by a resistance imposed thereon while the motor 71 continues to turn the jack-shaft 73.

The shutter 67 has an orifice 77 alignable by the rotation of the shutter with the light passage 35 and mirror 63 to cause a photographic exposure of the sensitized strip 66. Adjacent the perimeter of the shutter 67 is a lug 78, engageable through a hole 79 in the shutter housing 61 by the core of a spring-returned solenoid 80 mounted on the cross-support 51. When the lug 78 is engaged by the solenoid 80, as shown in Fig. 7, the orifice 77 is stopped in the position shown in broken lines, and the shaft 68 is, of course, also stopped. When the energized solenoid 80 momentarily releases the lug 78 and then returns to the position illustrated, the shutter 67 and shaft 68 will be whirled one revolution with the orifice 77 causing a photographic exposure as it passes the opening 77a on shutter housing 61 and being stopped again at the broken line position. The shaft 68 has a cam 81 mounted thereon in line with a lever 82 connected to a mercury switch 83 rotatable in a bracket 84 upon the cross-support 51 and controlling the flood lamps 36. As

the shaft 68 revolves, the cam 81 makes contact with the lever 82 and causes the flood lamps 36 to be lighted during the period in which the orifice 77 is rotating through the lower half of its orbit. When the cam passes out of contact with the lever 82, the latter is moved by a spring 82a to open the switch 83.

Also mounted on the shaft 68 and rotating intermittently therewith is a crank lever 85 which makes contact successively with the four pins 86 of a four-place rotary switch 87 suspended from the cross-support 52. The switch 87 controls the signal lights 38, 39, 40, and 41 in a circuit under the general control of the master current distributor D. Each revolution of the shaft 68 will cause the crank lever to make contact with a successive one of the pins 86 and thereby to rotate the switch 87 by a quarter-turn and to turn off one of the signal lights and turn on another. At the end of a cycle of operation, the switch 87 is left in position to turn on, for example, the left hand light 38. When the circuit is energized by the current distributor D, that light will flash on and remain on until after the first rotation of the shaft 68, that is to say, until after the first photographic exposure has been made. Immediately after the first exposure, the lever 85 turns the switch so as to turn off light 38 and turn on light 39, and so through the cycle of four exposures, with the light 38 turned on momentarily at the end of the cycle until the circuit is deenergized by the current distributor D.

Turning now to the film supply unit F, as illustrated in Figs. 3, 4, and 8, a film magazine 90 is supported on a bracket 91 so as to feed the sensitized strip 66 through the housing 62 and the camera 60. To advance the strip 66, it is engaged by a pair of rollers 92 driven through gears 94, one of the rollers having an elongated shaft 95 upon which is a pulley 96 driven from the jack-shaft 74 by a belt 97 and slip clutch pulley 98. The driven roller 92 is adjustable by means of the screw 99 to regulate the pressure exerted between the rollers. It will be seen that the drive of the rollers 92 is not positive but may be stopped by a resistance in the same manner as the drive to the shutter shaft 68. To synchronize the advancement of the strip 66 with the shutter action, the shutter shaft 68 carries a cam 100 which engages the downwardly turned end of an interrupter bar 101 mounted in roller guides 102 upon the cross-support 52. The bar 101 is urged toward the shaft 95 by a spring 104 and has a lateral arm 105 engageable when in its spring-urged position by a finger 106 mounted upon said shaft. Such engagement stops the rotation of the shaft 95, with the slip clutch pulley 98 slipping upon the jack-shaft 74 but keeping tension upon the belt 97 to bring the rollers 92 into action at the instant the stoppage is removed. The cam 100 will rotate once with each revolution of the shutter 67, and will move the arm 105 out of engagement with the finger 106 to allow the finger to pass the arm, and thus will permit one revolution of the shaft 95 for each revolution of the shutter. The circumference of the rollers 92 is, of course, made equal to the length of the frame of the strip 66 which is to be advanced for each exposure.

The film cutter H is mounted upon the side wall of the framework W in operative position to cut the sensitized strip 66 just below the camera 60. It comprises a solenoid 110, as shown in detail in Fig. 9, acting through a linkage 111 upon a blade 112 pivoted on a pivot pin 114 and cutting the strip 66 as it emerges from the film housing 62. A spring 115, shown in Fig. 3, returns the blade 112 to its inactive position, and a guide channel 116 (see Fig. 4) having a slightly flared lower end guides a hereinafter described strip carrier to receive the cut-off portion of the strip 66 as it falls. The solenoid 110 is controlled by the master current distributor D to be activated once in each cycle of operation at the end of a predetermined number of exposures and to be then moved into the cutting position shown in broken lines in Fig. 9.

When the sensitized strip 66 is severed by the blade 112, the exposed portion 120 so severed falls through the guide channel 116 into a strip carrier 121, which may be termed the immerser, as its function is to immerse the severed strip 120 into a sequence of developing and rinsing baths. As it is necessary for this immerser to be aligned accurately to receive the strip 120 and to be mounted so as to clear the partitions between these baths and for the mechanism for holding it and transporting it also to clear these partitions, a handle 122 is attached to the immerser and means are provided, engageable with with the handle, for raising the immerser up to and into the flared end of the guide channel 116 in order to receive the strip 120 and for then returning it to a level at which the immersing operations may be carried on without waste motion. This immerser lifting mechanism I comprises a solenoid 123 mounted on the side wall of the cabinet W1 as illustrated in detail in Fig. 21, and a lifting arm 124 connected to the solenoid 123 for arcuate movement by a linkage 125, and pivoted as at 127 on a bracket 126 fixed to the inner framework W. The core 128 of the solenoid 123 extends downwardly into a guide socket 129, and is urged upwardly by a spring 130 acting upon the guide socket and upon a collar 131. The collar 131 is operatively connected to the piston of a pneumatic retarder or dash-pot 132 which operates to retard upward movement of the core 128, and, hence, the arm 124 so that arm end 124a engages the handle 122 and lifts the immerser 121 once the latter has been rotated into position. The limit of movement of the core 128 is defined and cushioned by a compressible stop 133 fixed to core above the collar 131 to abut the solenoid 123. The solenoid 123 is energized immediately after the solenoid 110 of the film cutter H, at which time the immerser 121 will contain the exposed and cut strip 120.

For developing and fixing the images upon the strip 120, I provide a series of tanks, illustrated in Fig. 22, and carrying mechanism shown in Figs. 10 to 16. A round tray 135 with a central opening 136 is rotatably mounted on ball-bearing rings 137 supported by the lower cross-supports 53 and 53a, and carries a plurality of tanks 133 for developing, fixing, and rinsing solutions. The purpose of the rotatable mounting is to afford easy access to the tanks 138 through a door, not shown in the back of the cabinet A, so that they may be individually removed for emptying and replenishing. The tray 135 is not rotated during the operation of the apparatus but is locked in place by a spring-bolt 139 which passes through eyes 140 on the rings 137, as shown in Fig. 14.

Each tank L, M, N, and O is divided into two compartments by a partition 138a, and this partition adjacent its upper edge is formed with an orifice 138b. (See Figs. 3, 10, and 22).

Suspended from the cross-supports 53 and 53a by a hanger 141 is the driving mechanism

for the film developing and carrying unit G. A sprocket wheel 142, having two discs joined by pins 144 around its periphery, is rotatably mounted, as by the bearing 145, on the hanger 141, and is operably connected to a motor 146 by a pulley 147 and belt 148. The pins 144 are equal in number to the tanks 138 and, as will be presently made clear, afford means for stopping the carrier mechanism at each of said tanks in turn. To permit such stoppage the drive pulley 149 for the belt 148 is of the same slip clutch type as pulleys 75 and 98.

The sprocket wheel 142 supports in the central opening 136 and by means of stud-bolts 150, a block 151 which in turn supports a vertical column 152, which has vertical grooves 154 diametrically opposed, and has its upper end rotatably braced in a pillow-box 155 attached to the hood 64 of the camera 60. The block 151 and sprocket wheel 142 also support in bearings 156 and 157 a shaft 158. It will be seen that the sprocket wheel 142, block 151, and column 152 are rotatable as a unit and that the shaft 158 is rotatable with them or independently of them. The shaft 158 carries on its lower end a friction wheel 159, and between the sprocket wheel 142 and the block 151 a pulley 160. A shaft 161 is suspended from the block 151 in hangers 162 and 162*a* and carries pulleys 163 and 163*a* at right angles to and adjacent to the pulley 160. The column 152 carries adjacent its upper end a pulley 164, and the four pulleys 160, 163, 163*a*, and 164 are traversed by a belt 165 to which is fastened an elevator 166 by a clamp 167. The elevator is tracked in the grooves 154 by wheels 168. Rotation of the pulley 160 in one direction will cause the elevator 166 to ascend, and in the other direction will cause it to descend, the vertical movement of the elevator being limited by the stop 169 and the pulley 164, and the belt 165 being guided in its traverse by a guide 170 mounted upon the block 151. To facilitate raising and lowering of the elevator, a counter-weight 171 is inserted in the circuit of the belt 165.

The elevator 166 has an extension arm 172 of parallel rods bent downwardly at their outer end and there supporting a slideway 173, formed of a plate with inwardly turned marginal channels, within which the immerser 121 is slidably held. It is the function of the elevator to dip the immerser 121 and the exposed strip 120 into each of the tanks 138 and to hold them there for a short period before again raising them, and of the sprocket-wheel 142 to rotate the arm 172 from above one tank to above another adjacent tank and to hold it there while the dipping operation is proceeding; and the mechanism for obtaining these related intermittent motions will now be described.

It will be remembered that the sprocket-wheel 142 is operably connected to the slip clutch pulley 149 driven by the motor 146. The motor 146 also drives a slip clutch pulley 174 from which a belt 175 drives a shaft 176. The shaft 176 is mounted so as to be longitudinally slidable on a panel 177 supported by the hanger 141. The ends of the shaft 176 are operably connected to the cores of solenoids 178 and 179 so that the alternate energizing of these solenoids will thrust the shaft from end to end in a reciprocating movement between them. Friction discs 180 and 181 are mounted upon the shaft 176 so as to be alternatively engageable by the aforesaid reciprocating movement with the friction wheel 159 to turn it first in one direction and then in the other. As illustrated in Figs. 10 and 14, the elevator 166 is at the lower end of its stroke, and the right hand friction disc 180 is in contact with the friction wheel 159 to turn the shaft 158 in a clock-dise direction as it would be viewed from above, thereby causing the pulley 160 to pull on the counter-weight side of the belt 165 and to raise the elevator. The belt 175, which is given a twist by the right-angled positions of the slip-clutch pulley 174 and the shaft pulley 182, will seek a natural alignment of least tension; and the motor 146 is so placed that this alignment will move the shaft 176 to a neutral position in which neither of the friction discs 180 and 181 touches the friction wheel 159 when neither of the solenoids 178 and 179 is energized. The belt 175 is under power applied and is turning the shaft 176 during all the film developing operation, the purpose of the slip clutch pulley 174 being to absorb and neutralize any time delays in the controls of the interrelated mechanisms.

The intermittent movement of the sprocket-wheel 142 and the parts affixed thereto is also solenoid-controlled, as shown in detail in Figs. 15 and 16. A star-wheel 184 is mounted from the lower, or fixed ring 137, by a shaft 185 so as to have its teeth engageable with the pins 144, and has extending upwardly from its upper side a plurality of pins 186 equal in number to its teeth. A double detent 187, having a slot 188 permitting longitudinal movement around the shaft 185, rests upon the upper surface of the star-wheel 184 and has an arm 189 raised to permit passage of the pins 186 therebeneath and connected through a link 190 with the core of a solenoid 191 against which it is urged by a spring 192. The detent 187 is provided with pawl teeth 193 and 194, so spaced as to be able to engage diametrically opposite pins 186 in alternation when moved reciprocatively by the link and solenoid. It will be remembered that the sprocket-wheel 142 is driven from the slip clutch pulley and is, therefore, constantly urged to rotate while the motor 146 is activated. It will be restrained from such rotation by the engagement of a tooth of the star wheel 184 with one of the pins 144 until such time as the star wheel is permitted to rotate. The star wheel is, in turn, prevented from rotating until the pins 186 are freed of engagement with the pawl teeth 193 and 194. When the solenoid 191 is de-energized, the detent 187 is in the position shown in Fig. 15, with the pawl tooth 193 in restraining contact with a pin 186. Another of the pins 186 will just have passed the tooth 194. When the solenoid is momentarily energized, the tooth 193 will be pushed away from the tooth engaged thereby, and neither tooth will for the moment have a restraining effect, the star wheel 184 being free to turn and therefore the sprocket wheel 142 being also free. Movement of the sprocket wheel will cause the star wheel to turn until another of the pins 186 comes in contact with the tooth 194, as shown in Fig. 16. This will stop all rotation. De-energizing the solenoid will bring the detent back to the position of Fig. 15, with the tooth 194 allowing its engaged pin 186 to pass, and the tooth 193 catching the on-coming pin. It will be seen that this action is essentially an escapement movement, permitting first a major and then a minor motion, the object being to prevent a rotation of the sprocket-wheel 142 greater than the spacing between two pins 144—and so greater

than the centers of adjacent tanks 138—by having tooth 194 in a restraining position in the event of delay in the solenoid action.

By having the solenoids 179, 178, and 191 energized in that order the arm 172 and the immerser 121 are made to move in sequence—say from the initial position in which the exposed film 120 has been placed in the immerser—down into the developing tank, up out of that tank, and over to the next tank to repeat the dipping.

It is of great importance to subject the film in the immerser to a thorough washing by the solutions into which it is dipped, and to accomplish this the baths must be agitated to bring fresh chemicals and rinses constantly to the surface of the exposed strip. For that reason the immerser is constructed, as shown in Figs. 11, 12, and 13, of two Z-shaped channel members 200, placed back to back to form a channel in which the exposed strip 120 is confined by its edges and is supported at the bottom by a finger 201, and to provide outwardly directed rails slidable within the channels of the slideway 173. The channel members 200 are slightly divergent at their upper ends to facilitate entrance of the end of the film strip into the immerser, and are held in spaced relation by bars or vanes 202 which connect them on the side towards which the face, or photograph side, of the strip 120 is turned. To limit movement of the immerser upwardly in the slideway a set screw 202a is secured in one of the bars 202, and to maintain the immerser against falling from the slideway two pins 202b are formed on the members 200. The bars 202 are slab-shaped and inclined so as to engage each of the channel members at different levels and are furthermore obliquely placed so as to have an upper edge 203 turned outwardly from the strip 120 and a lower edge 203a turned inwardly thereto, thus presenting downward and outward, and upward and inward, flat sides. This doubly diagonal construction results in great turbulence of the baths, effectively churning and rolling the liquids against the face of the exposed strip on both the downward and upward strokes of the immerser.

The arrangement of tanks 138 which I have found to be most satisfactory is shown in Fig. 22. A series of fourteen tanks is there illustrated, but it is to be understood that this number is merely one of convenience and may be varied, with corresponding changes in other parts of the apparatus, as for instance the fourteen pins 144 in the sprocket wheel 142, and the cams 57 on the current distributor D which control the number and timing of the operations of the solenoids 178, 179, and 191. The tank L, which is directly below the camera 60, is the first into which the immerser 121 is dipped, and contains developing fluid. It is followed in sequence by two tanks R containing water for rinsing, a tank M containing bleaching liquid, two more rinsing tanks R, a tank N containing a clearing bath, two more rinsing tanks R, a tank O containing a fluid for redeveloping and fixing, three more rinsing tanks R, and finally a tank P at which the exposed strip 120 is picked from the immerser 121 and the immerser is dipped in order to rinse the empty frame. It being understood that the immerser moves into and out of the outer compartments 138a of the tanks L to O, only these compartments contain the required liquids, the inner compartments constituting overflow tanks to receive through the orifices 138b excess liquid deposited in the outer compartments as carried by the immerser from the preceding tank.

The means for picking the exposed, and now developed, strip 120 from the immerser 121 and for delivering it, which comprise the door-opening mechanism J and the film ejecting mechanism K, are shown in Figs. 17 to 20. An arm 204 is pivotally supported by the hinge 205 so as to be arcuately movable by a spring-returned solenoid 206 acting through a crank lever 207 pivoted at 208. The free end of the arm 204 is provided with a fixed jaw 209 and a movable jaw 210 and when the solenoid is de-energized the free end of the arm and the said jaws extend outwardly through an opening 211 in the panel 32, as shown in full lines in Fig. 18. When the solenoid is energized the arm will be retracted to the position shown in dotted lines in Fig. 18. The arm 204 is hollow and contains a spring 212, backed by a stop 214, by which the movable jaw 210 is urged toward the fixed jaw 209, the jaw 210 being guided in this movement by a supporting collar 215, slidable upon the arm, and by a plunger 216 operating within the arm and against the spring. The rearward portion of the jaw 210, below the arm 204, terminates in an upwardly extending guide lug 217 which slides in a slot 218 in the arm 204 and with which the plunger 216 is integral, and in a downwardly extending lug 219 by which the jaw may be opened. The opposed gripping portions of both jaws are laterally extended from the arm 204 so as to be able to reach outwardly through the opening 211, and are positioned below the arm so as to grip the strip 120 while permitting the arm to swing thereover; and the face of the jaw 210 has a pad 220 to prevent film strip from slipping edgewise.

A plate 221 is mounted below the arm 204 and carries on its upper surface a cam rail 222 and an angle iron 224. When the arm 204 is retracted by the energized solenoid 206, the lug 219 will pass to the rear, or right side, of the cam rail 222 as seen in Figs. 17 and 18 and will be moved thereby to force the plunger 216 against the spring 212 and to open the jaw 210. At the limit of the retractive movement of the arm, the lug 219 will pass beyond the end of the cam rail and release the compression on the spring, causing the jaws to close upon the strip 120. At this moment, it will be understood, the immerser 121 is caused to dip into the tank P, leaving the strip 120 suspended in the jaws. When the solenoid 206 is de-energized, the arm 204 will be returned by the solenoid spring to the opening 211, with the lug 219 passing freely by the left side of the cam rail 222. Substantially at the end of this swing, the lug 219 will come into contact with the angle iron 224 and be moved thereby to the right, thus forcing the jaw 210 to open and to release the strip 120 to drop through cover 44 and fall onto chute 45.

It will be seen that the opening 211 must have a vertical length equal to the length of the strip 120 to permit the outward passage thereof, and an opening of such size, even though hooded by the cover 44, would admit a dangerous amount of light when the flood lamps 36 are illuminated. The opening is therefore, normally covered by a door 230 except for a small area through which the arm 204 extends, the door being cut away at that point to conform closely to the shape of the arm. A spring-returned solenoid 231, shown in Fig. 3, is connected to the door 230 by a crank lever 232 and a rod 234. Energization

of the solenoid will cause the door to open, and the solenoid spring will cause it to close. The door is normally held in close position by a slide bar 235 to which the rod 234 is attached. The slide bar 235 is guided to a keeper 236 by guide pins 237, and is urged into locking position by a spring 238 attached to a post 239 on the door. The first retractive movement of the rod 234 will withdraw the slide bar 235 from the keeper 236, and further retractive movement will swing the door to open position. When the door is again swung closed, the rod 234 will tend to thrust the slide bar into the keeper, but as the desired motion of the bar is radial to the final arcuate motion of the rod, and as there is lost motion in the linkage, the spring 238 is provided to insure locking.

The sequence of operation of my automatic photographic apparatus is as follows. Upon the deposit of an appropriate coin in the receiver 42, the circuit to the control motor 54 is closed and the master current distributor D is set in operation. The shutter motor 71 is started, and the signal light 38, for which the switch 87 was left closed from the last previous operation, is lighted as an indication to the sitter to look in that direction. Activation of the solenoid permits the shutter to make one revolution, during which the flood lamps 36 are briefly illuminated through the action of the cam 81 on the mercury switch 83; an exposure is made; the cam 100 moves the interrupter bar 101 to permit a new frame of film to be rolled into place; and the crank lever 85 moves the switch 87 to turn on the next signal light. This operation is repeated four times, at the end of which period a strip of four exposed frames of film will be suspended through the guide channel 116 into the immerser 121 which is held in raised position by the lifting arm 124 and spring 130.

The circuit to the shutter motor is now opened, the solenoid 110 is activated to sever the exposed strip 120 and immediately inactivated, and the solenoid 123 is activated to lower the immerser 121 into the slideway 173. The motor 146 is started to put into operation the developing unit G.

When the motor 146 starts, the shaft 176 is held in neutral position by the tension of the belt 175, so that neither of the friction discs 180 and 181 is in contact with the friction wheel 159, and the vertical shaft 158 is accordingly stationary. The sprocket wheel 142 is also held stationary by the star wheel 184. The solenoid 179 is now activated, thrusting the disc 180 against the wheel 159, and causing the elevator 166 to dip the immerser 121 and strip 120 into the first tank L. The solenoid is inactivated as soon as the dipping movement is completed, the shaft 176 then returning to neutral position, and the elevator remaining lowered.

Activation of the solenoid 178 now occurs which causes the elevator to lift the immerser and strip above the top of the tanks, with the bars 202 producing a churning action of the bath against the face of the strip on both the dipping and lifting movements. The solenoid 178 is now released, permitting the shaft 176 to return to neutral position. By alternate activation of the solenoids 178 and 179 the immerser is reciprocated to successively agitate the developing fluid to insure complete development of the film strip. The solenoid 191 is now activated to permit operation of the escapement movement comprising the detent 187 and ratchet wheel 184, so that the sprocket wheel 142 and the attached column 152, elevator 166, and extension arm 172 are moved to place the immerser 121 and strip 120 above the first rinsing tank. This sequence of activation and release of the solenoids 179, 178, and 191 is continued until the immerser has been dipped into all of the tanks and is returned to its position above the tank L. The solenoid 123 is then momentarily energized to allow the lifting arm 124 to raise the immerser into aligned continuity with the guide channel 116, and the motor 146 is stopped.

Prior to this last mentioned step, when the immerser is swung into position above the tank P, the solenoid 231 is activated and the door 230 is opened. The solenoid 206 is activated and the arm 204 is retracted, until the lug 219 passes around the end of the cam rail 222 when the thus-opened jaws 209 and 210 will close on the upper margin of the strip 120. The final activation of the solenoid 179 now occurs and the immerser 121 is dipped into the tank P, leaving the strip 120 suspended between the said jaws. The solenoid 206 is then released, causing the arm 204 to swing the strip 120 outwardly through the opening 211 and then to drop the strip onto the chute 45 as the jaws are opened by contact of the lug 219 with the angle iron 224. The solenoid 231 is then released, causing the door 230 to close.

At the completion of the foregoing operations, the respective cam wheel 57 of the distributor D opens the respective coin follower 58 to disrupt the circuit for the motor 54 and thus bring it to a stop.

Having now described and illustrated a preferred form of my invention which is fully capable of attaining the various useful objects herein set forth, it is to be understood that this description and illustration is by way of example and that changes in form and arrangement may be made by those skilled in the art without departing from the spirit and scope of my invention as defined in the appended claims.

I claim:

1. In an automatic photographic apparatus for taking pictures on a sensitized strip: a cabinet inclusive of a photographic dark room; a plurality of vessels within said dark room for holding baths for developing and rinsing said strip; a carrier adapted to receive said strip after exposure; elevator means for successively dipping said carrier into said baths; means for transporting said strip from said elevator means to a delivery point outside said darkroom; a door between said darkroom and said delivery point; and means for opening and closing said door in timed relation to the movement of said strip transporting means to and from the delivery point.

2. In a photographic apparatus: a vessel for holding a liquid used in the developing process of a film; a carrier for the film; and mechanism for reciprocating said carrier in substantially a vertical path in said vessel; and vanes extending transversely and spaced along the length of the carrier to agitate the liquid in said vessel over the surface of the film according as said carrier moves downwardly or upwardly in said vessel.

3. In combination: a carrier for holding a length of film in extended position therein with the sensitized surface thereof exposed; and vanes bridging the carrier at intervals along the length of the carrier, each vane inclined transversely and extending obliquely of said carrier, whereby

the solution circulated over the film is accelerated under reciprocation of the film.

4. A carrier for a film strip adapted to be reciprocated in liquids in a path parallel to its length, including: longitudinally extending channel members for receiving the margins of a film strip and holding it in extended position; and spaced vanes bridging said members along their length and inclined and obliquely disposed relative thereto, whereby under axial reciprocation vertically of the carrier in a developing solution such solution will be circulated in oblique paths over the surface of the film strip.

5. In combination: a guide member for a film strip; a vertically reciprocable elevator below said member; an extension arm carried by said elevator and having a guiding member mounted thereon; and a film immerser carried by but slidable vertically in said guiding member to occupy an elevated position when said guiding member and arm are in an uppermost position wherein it is extended into said member.

6. In a combination: a guide member for a film strip; an elevator reciprocable in different vertical paths in one of which it is alined substantially vertically with said member; an extension arm carried by said elevator and having a guiding member mounted on the outer end thereof; a film immerser carried by but slidable vertically in said guiding member to occupy elevated and lowered positions; and mechanism operable to move said arm and immerser to elevated position on said elevator only when the latter is at the top of its movement in that path of substantial alinement with said guiding member to move the immerser into said last mentioned member.

7. In an automatic photographic apparatus for taking pictures upon a sensitized strip: carrier means for said strip; severing means for an exposed portion of said strip; elevator means for supporting said carrier means for slidable vertical movement relative thereto; means for lifting said carrier means adjacent said severing means while retaining slidable engagement of said carrier means with said elevator means; and means for aligning said carrier means with said severing means to receive said strip therefrom.

8. In a photographic apparatus; a vessel for holding a liquid for the developmental processing of a film; a carrier for holding a length of film in extended vertical position therein; mechanism for reciprocating said carrier in said vessel; and spaced vanes on said carrier; said vanes being obliquely disposed thereon; and said series of vanes overlying substantially the entire length of said carrier and the film arranged therein for agitating the liquid in said vessel over the surface of the film under movement of said carrier in said vessel.

9. In a photographic apparatus; a vessel for holding a liquid for the developmental processing of a film; a carrier for holding a length of film in extended vertical position therein; mechanism for reciprocating said carrier in said vessel; spaced vanes on and extending transversely of said carrier; said vanes being obliquely disposed thereon; and said series of vanes overlying substantially the entire length of said carrier and the film arranged therein for agitating the liquid in said vessel over the surface of the film under movement of said carrier in said vessel.

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