

March 13, 1951

P. S. ALLEN
FILM STRIP CARRIER ACTUATING MECHANISM FOR
AUTOMATIC PHOTOGRAPHIC APPARATUS

2,544,644

Filed Aug. 9, 1947

4 Sheets-Sheet 1

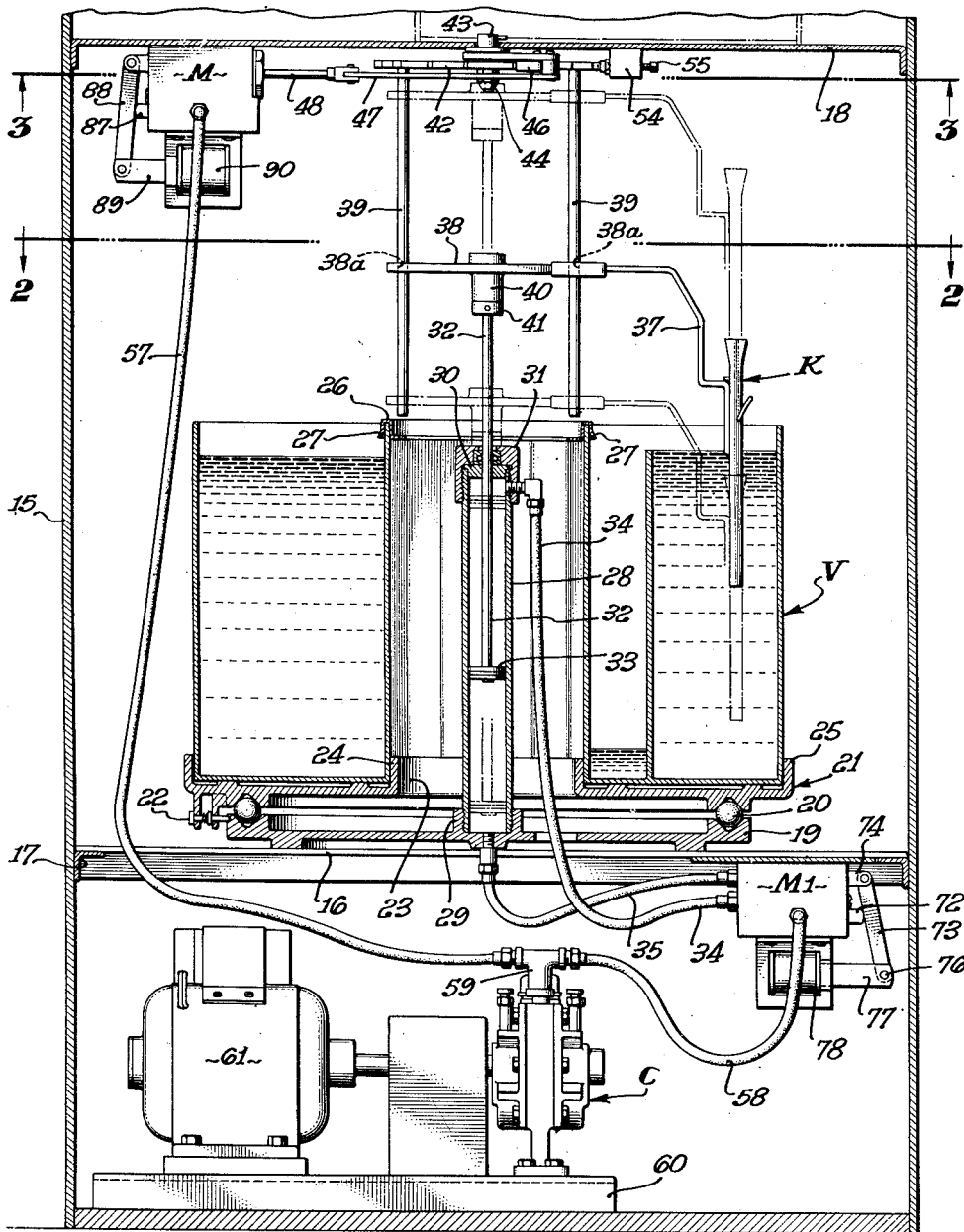


Fig. 1.

INVENTOR.
Philip S. Allen
BY
Samuel D. Jones
ATTORNEY

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Fig. 2.

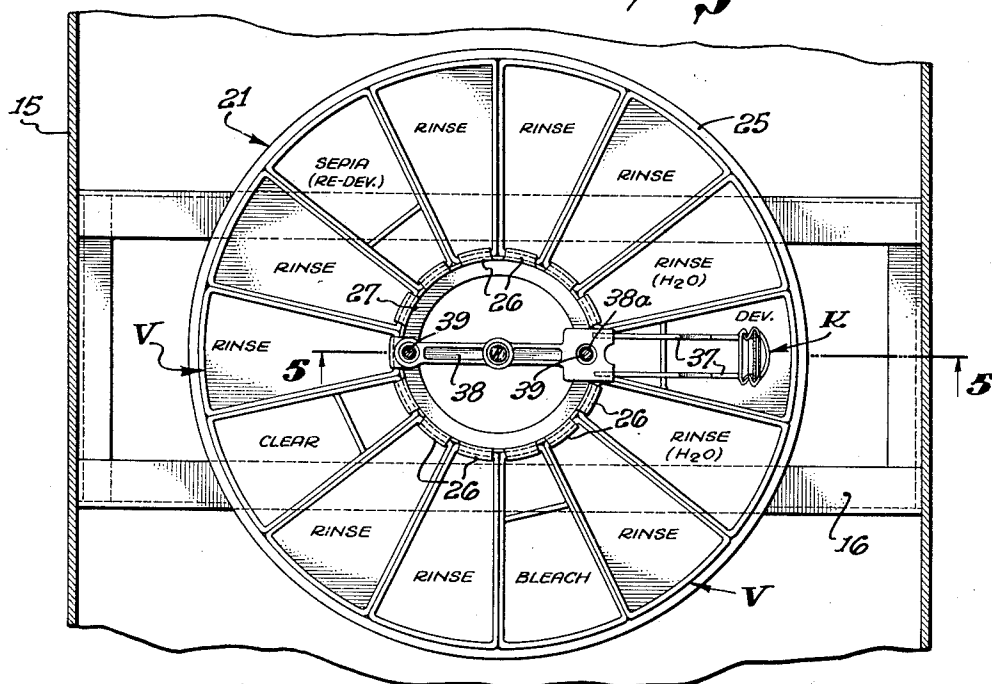
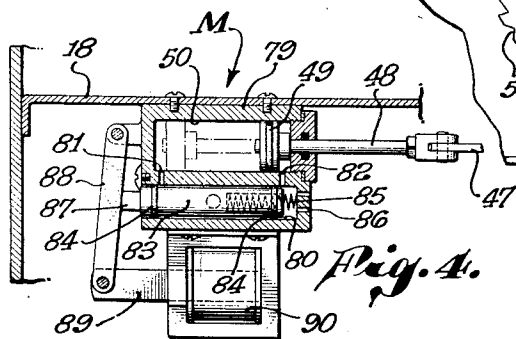
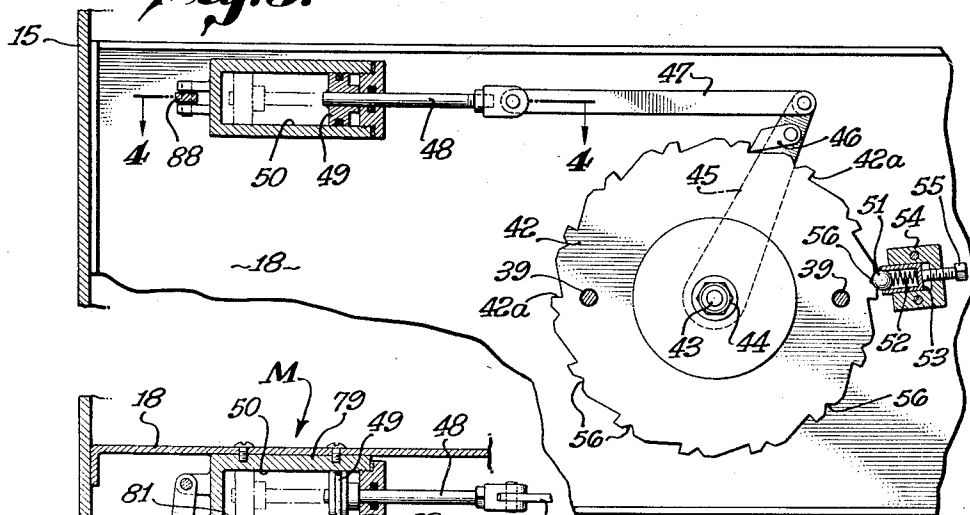


Fig. 3.



INVENTOR.
Philip S. Allen
BY
Carroll D. Jones
ATTORNEY

March 13, 1951

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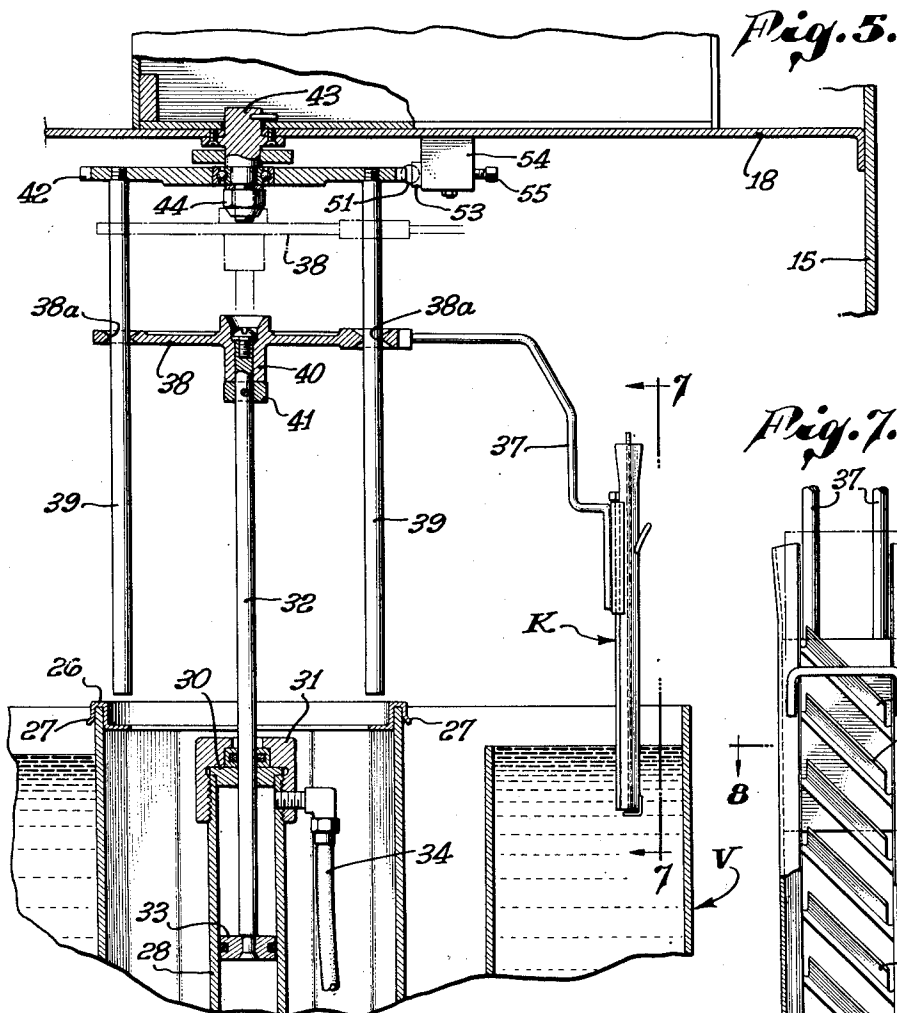


Fig. 7.

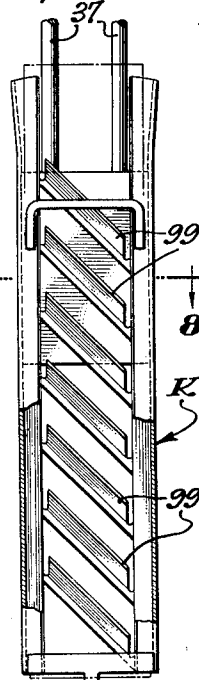


Fig. 6.

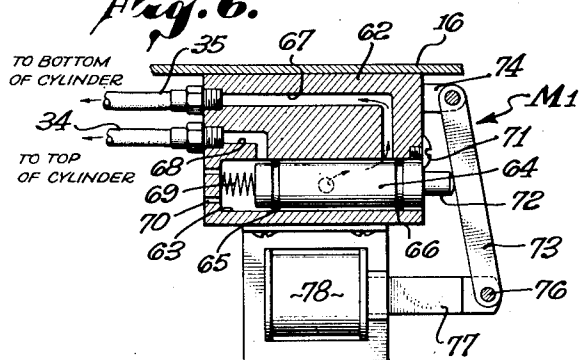
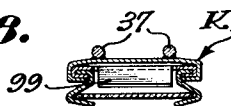


Fig. 8.



INVENTOR.
Philip S. Allen
BY *Emilio S. Allen*
ATTORNEY

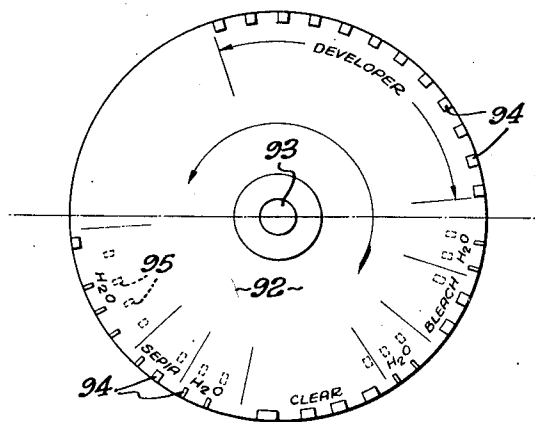
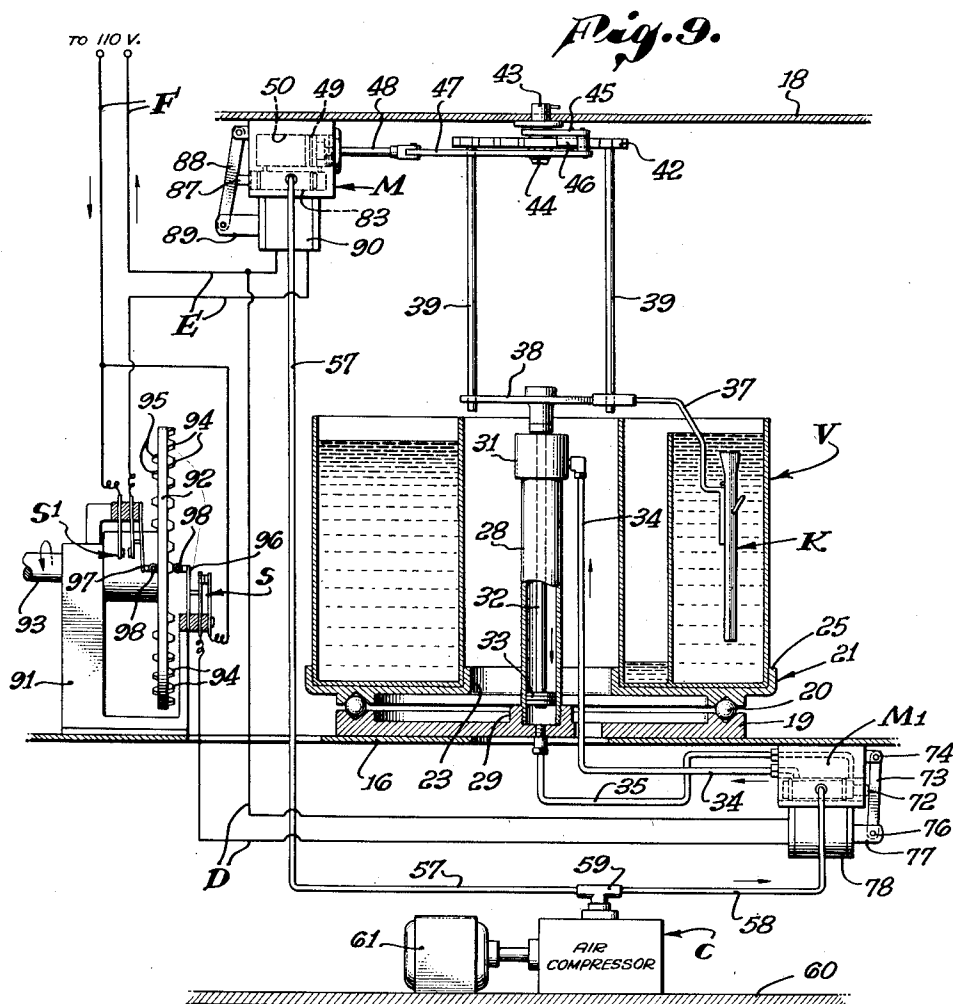
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INVENTOR.
Philip S. Allen
BY *Edwin S. Jones*
ATTORNEY

UNITED STATES PATENT OFFICE

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FILM-STRIP CARRIER ACTUATING MECHANISM FOR AUTOMATIC PHOTOGRAPHIC APPARATUS

Philip S. Allen, Long Beach, Calif.

Application August 9, 1947, Serial No. 767,797

6 Claims. (Cl. 95—89)

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My invention relates to automatic photographic apparatus of the character embodied in my copending application, Serial No. 648,737, filed February 19, 1946, and it has particular reference to the mechanism embodied therein for actuating the film-strip carrier to immerse the previously exposed film successively into a series of liquid containing vessels for developing and fixing the film.

It is a purpose of my present invention to provide a film-strip carrier actuating mechanism which embodies fluid pressure devices for reciprocating the carrier in vertical paths corresponding to the vessels so that the film-strip will be successively immersed and reciprocated in each of the various liquids in the vessels, and in a sequence to effect the complete development and fixing of the photographs on the film-strip. My invention includes valves for the fluid pressure devices and electro-responsive devices for actuating the valves in a predetermined sequence as defined by a circuit controller to effect the intended operation of the film carrier. The mechanism is characterized by its mechanical and electrical simplicity, low cost of manufacture and maintenance, and surety of operation to at all times effect the complete development and fixing of the photographs on the film strip.

I will describe only one form of film-strip carrier actuating mechanism embodying my invention for use in automatic photographic apparatus, and will then point out the novel features thereof in claims.

In the accompanying drawings:

Fig. 1 is a view showing in vertical section and partly in elevation one form of film-strip carrier actuating mechanism embodying my invention.

Fig. 2 is a horizontal sectional view taken on the line 2—2 of Fig. 1 and looking in the direction of the arrows.

Fig. 3 is a horizontal sectional view taken on the line 3—3 of Fig. 1 and looking in the direction of the arrows.

Fig. 4 is a vertical sectional view taken on the line 4—4 of Fig. 3.

Fig. 5 is a vertical sectional view taken on the line 5—5 of Fig. 2.

Fig. 6 is an enlarged vertical sectional view of the valved means for controlling the supply of fluid pressure to the cylinder for reciprocating the film-strip carrier.

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Fig. 7 is an enlarged elevational view of the film-strip carrier shown in the preceding views.

Fig. 8 is a horizontal sectional view taken on the line 8—8 of Fig. 7.

Fig. 9 is a view showing the entire mechanism schematically.

Fig. 10 is an enlarged elevational view of the cam wheel of the circuit controller.

Similar reference characters refer to similar parts in each of the several views.

Referring specifically to the drawings and particularly to Fig. 1, a housing 15 is provided to contain the mechanism of my invention, and to this end it is provided interiorly with a shelf 16 supported on beams 17, while above the shelf 16 is a transverse partition 18 from which part of the mechanism depends. On the shelf 16 is suitably secured a platform 19, and rotatably supported on this platform by means of balls 20 is a table 21. This table is normally secured against rotation by means of a latch 22 as in the apparatus embodied in my aforesaid copending application.

The table 21 is provided with a central opening 23, and the wall of this opening as well as the periphery of the platform are provided with upstanding annular flanges 24 and 25 respectively, which coact to confine on the platform a circular series of vessels V each of which, as best shown in Fig. 2, is of sector form with its inner and outer end abutting the flanges. A retaining collar 26 of annular form is peripherally provided with a circular series of clamping fingers 27, which engage the upper inner edges of the several vessels to coact with the flanges 24 and 25 in securing the vessels against movement on the platform.

A pneumatic cylinder 28 is located centrally within the opening 23 with its lower end screw-threaded in a collar 29, while its upper end is closed by a plug 30. Housing the plug and provided with a suitable stuffing box is a cap 31. The rod 32 of a piston 33 extends through the plug and cap, with the piston operating within the cylinder. Air pressure from a source to be described hereinafter is supplied to either end of the cylinder and to either side of the piston through hoses 34 and 35, and whereby the rod 32 can be caused to reciprocate in the operation of a carrier K for a film-strip 36 illustrated in broken lines in Fig. 7.

The carrier K is mounted on a pair of extensions 37 depending from a cross arm 38, this arm being preferably of the construction shown best in Fig. 2, and provided with suitable openings 38a by which it is mounted for vertical sliding movement on a pair of rods 39. The arm is operatively connected to the upper end of the piston rod 32 by a sleeve 40, with a collar 41 pinned to the rod, this connection allowing rotation of the arm on the rod and yet maintaining the arm connected to the rod to be reciprocated thereby.

Suitable mechanism is provided for rotating the rods 39 in a step-by-step movement to, in turn, impart a corresponding movement to the arm 38, and whereby the carrier K can be reciprocated vertically in different paths through operation of the piston. This mechanism may comprise a ratchet wheel 42 to which the upper ends of the rod 39 are secured at diametrically opposed points. This ratchet wheel is journaled on a stub axle 43 secured to and depending from the partition 18 (see Fig. 5), ball bearings being employed, and the wheel confined on the axle by means of a nut 44.

Rotatable on the axle 43 is an arm 45, which carries a pawl 46 positioned to engage peripheral teeth 42a of the wheel 42 under swinging movement of the arm to rotate the wheel in a step-by-step movement. The arm 45 is actuated by a link 47 connected to a rod 48 of a piston 49 operating in a cylinder 50. For steadying the ratchet wheel when at rest and while the carrier K is being reciprocated, a suitable latch is provided. As shown in Fig. 3, this latch may comprise a ball 51 pressed into engagement with the periphery of the wheel 42 by a spring 52 contained within a cup 53 adjustable within a block 54 by means of a screw 55. The ball engages recesses 56 between the teeth 42a of the wheel 42 so as to steady the wheel as aforescribed, this ball does not interfere with the normal step-by-step rotation of the wheel under the action of the pawl 46.

Compressed air is adapted to be supplied to the cylinder 50 through a valve mechanism designed generally at M connected to a hose 57. Similarly, compressed air is adapted to be supplied to the hoses 34 and 35 by a valve mechanism M1, to which the air is supplied by a pipe 58. As shown in Fig. 1 the mechanism M1 is suspended from the shelf 16, and beneath the sleeve the hoses 57 and 58 are connected to a T pipe 59 mounted on and communicating with a conventional form of air compressor C secured on a base 60. This compressor is adapted to be driven by an electric motor 61 likewise supported on the base 60.

The valve mechanism M1 is shown in detail in Fig. 6, and it may comprise a casting 62 secured to the shelf 16 and constructed to provide a cylinder 63 in which operates a piston valve 64. The valve carries sealing rings 65 and 66 adjacent the opposite ends thereof, and the casting 62 is formed with ducts 67 and 68 each leading from the cylinder 63 to the hoses 34 and 35. The entrance ends of these ducts are so situated that in one extreme axial position of the piston 64 the cylinder is placed into communication with one of the ducts, while in the other extreme position the cylinder is placed into communication with the other duct, the sealing rings 64 and 65 serving to block off one duct or the other depending upon the axial position of the piston. The hose 58 is connected to the cylinder 63 at a point between the entrance ends of the duct 67 to 68 (see circle in broken lines

in Fig. 6) so that compressed air from the compressor will flow into the cylinder 63, around the piston 64 and into one duct 67 or 68 according as the piston occupies one extreme axial position or the other.

The piston valve 64 is normally urged to the right hand extreme position shown in Fig. 6 by means of a spring 69 interposed between one end wall of the cylinder 63 and the piston valve. This end wall of the cylinder is provided with breather ports 70 to allow free operation of the piston valve, and a screw 71 limits outward movement of the piston valve under the action of the spring 69. The outer end of the piston valve is provided with a stem 72 engaged by a link 73 pivoted as at 74 on ears 75 fixed on the casting 62. The other end of the link is pivotally connected as at 76 to an extension 77 of the core of a solenoid 78 secured to the casting 62.

In the operation of this valve mechanism the piston valve 64 is normally urged to the position shown by means of the spring 69, and wherein air is free to flow from the cylinder 63 into the duct 67 to supply air pressure to the bottom of the cylinder 28. When the solenoid 78 is energized its core is moved to actuate the link 73 and force the piston valve 64 inwardly to place the cylinder 63 in communication with the duct 68, and whereby compressed air is supplied to the top of the cylinder 33.

The valve mechanism M for controlling supply of compressed air to the cylinder 50 and to either side of the piston 49 is illustrated in detail in Fig. 4. As here shown, the cylinder is part of a casting 79 secured to the partition 18. Also as a part of the casting 79 is a valve cylinder 80 communicating with the cylinder 50 through ports 81 and 82. A piston valve 83 provided with sealing rings 84 is operable in the cylinder 80 to control the passage of compressed air through the ports 81 and 82 to either side of the piston 49. As in the valve mechanism M1 the piston valve 83 is urged outwardly by means of a spring 85, breather ports 86 being formed in one end wall of the cylinder 80 to allow free movement of the valve. The valve is provided with a stem 87 engaged by a link 88 pivoted on the casting and pivotally connected to an extension 89 to the core of a solenoid 90.

From the description of the valve mechanism M1 it will be clear that the valve mechanism M operates in the same manner to admit compressed air from the hose 57 through the cylinder 80 to either side of the piston depending upon the position of the piston valve 83.

Referring now to Figs. 9 and 10, I have shown one electrical means by which current can be automatically supplied to the solenoids 78 and 90 to energize the latter in the sequence necessary to effect reciprocation of the carrier K in different vertical paths. This means comprises electrical circuit D for the solenoid 78 and a circuit E for the solenoid 90, these two circuits having switches S and S1, respectively, for controlling the supply of current to the solenoids through a current supply circuit F connected in parallel to the circuits D and E. The switches S and S1 are mounted on a frame 91 secured to the shelf 16, and positioned at opposite sides of a wheel 92 fixed to a shaft 93 journaled in the frame and adapted to be driven by a motor (not shown). The wheel 92 has a series of cams 94 on one side thereof and another series of cams 95 on the opposite side thereof. The switches S and S1 have switch opening spring arms 96 and 97, respec-

tively, with rollers 98 disposed in the path of movement of the cams 94 and 95 so that under rotation of the wheel 92 the cams will momentarily close the switches. The arrangement of these cams 94 and 95 is shown in Fig. 10 and from the legends applied thereto it will be clear as to the functions of the cams in respect to closing and opening of the switches to energize the solenoids 78 and 90 in the prescribed manner to immerse the carrier K into the vessels V of the circular series.

In describing the operation of the entire mechanism reference will be had to Figs. 2 and 9. As illustrated in these figures the film carrier K is first immersed in a developing liquid contained in the respective vessel V, and to which position the carrier K has just been moved from an elevated position in which the film strip has just been extended into the carrier following exposure, as will be understood from the photographic apparatus described in my aforesaid application. Under intermittent energization of the solenoid 78 compressed air is alternately supplied to first one side and then the other of the piston 33 to effect reciprocation of the carrier into and out of the developing vessel. The carrier K as in the apparatus of my aforesaid application, is provided with a series of diagonally disposed blades or vanes 99 (see Fig. 7) which cause violent agitation of the developing liquid, as well as the other liquids into which the carrier is subsequently immersed, to effect the thorough and complete development, fixing and washing of the film to produce unblemished photographs on the film strip as it is finally delivered to the vendee.

Following the aforescribed reciprocation of the carrier K in the developing vessel the solenoid 90 is momentarily energized to actuate the pawl and ratchet mechanism and thus turn the rods 39 to partially rotate the arm 38 when the latter is in elevated position. Thus the carrier K is moved laterally to a position above the vessel immediately next to the vessel containing the developing fluid. Manifestly with continued intermittent energization of the solenoid 28 the carrier K will now be reciprocated into and out of the aforesaid vessel to effect a rinsing of the film strip. This mode of operation of the film carrier is continued throughout the circular series of vessels, it being understood that the carrier K is reciprocated successively in the various vessels until the complete fixing and bleaching, etc. of the film is effected.

Although I have herein shown and described only one form of film-strip carrier actuating mechanism embodying my invention, it is to be understood that various changes and modifications may be made therein without departing from the spirit of my invention and the spirit and scope of the appended claims.

I claim:

1. In an automatic photographic apparatus for taking a series of pictures in sequence on a film-strip; a carrier for the film-strip; mechanism for rotating said carrier in a step-by-step movement about a vertical axis, comprising a ratchet wheel mounted for rotation about a vertical axis, rods fixed to said wheel at opposite sides of its axis and depending from said wheel, an arm mounted on said rods and extending laterally therefrom, and to which said carrier is secured, a pawl mounted for oscillation about the axis of said ratchet wheel and engaging the teeth of said wheel, and means for actuating said pawl.

2. In an automatic photographic apparatus for

taking a series of pictures in sequence on a film strip; a carrier for the film strip; pneumatic means for reciprocating said carrier; means for rotating a part of said pneumatic means in a step-by-step movement to cause said carrier to be reciprocated successively in vertical paths; pneumatic means for actuating said rotating means; valved means for supplying air pressure to both of said pneumatic means; and electrical means for so actuating said valved means that said carrier is reciprocated a predetermined number of times in each of said vertical paths.

3. In an automatic photographic apparatus, a film carrier; pneumatic means to reciprocate carrier; means pneumatically controlled to rotate said film carrier sequentially with the completion of movement thereof in one direction; a valved means for each said rotating means and reciprocating means; a source of pressure supply for said valved means; a solenoid connected to said valved means; an electrical circuit including said solenoids and switches, and rotating means to open and close said switches, respectively to control the reciprocation and rotation of said pneumatic means.

4. In an automatic photographic apparatus, a rotary member mounted to turn on a vertical axis, rods fixed to and depending from said member so as to turn therewith, an arm mounted for reciprocation on said rods, a film carrier supported by said arm, means for rotating said member in a step-by-step movement to dispose the carrier in predetermined positions, a fluid pressure cylinder fixed beneath said member, a piston operable in said cylinder in line with the axis of said member and to which said arm is connected for reciprocation therewith and rotation relative thereto, and means for effecting and controlling the operation of said piston so that said arm and carrier will be reciprocated when said carrier is disposed in said predetermined positions.

5. In an actuating mechanism for the film strip carrier of automatic photographic apparatus, a rotary member mounted to turn on a vertical axis, rods mounted on said member to turn therewith, a film strip carrier-supporting element mounted on said rods to turn therewith and reciprocate thereon, a fluid pressure cylinder mounted in line with the axis of said member, a piston operable in said cylinder and to which said element is connected for reciprocation therewith and rotation relative thereto, operating means for turning said member in a step-by-step movement to dispose said element in predetermined positions, and means operating in timed relation to said operating means, for applying pressure fluid to said cylinder so as to reciprocate said piston and said element when said element is disposed in said predetermined positions.

6. In an actuating mechanism for the film strip carrier of automatic photographic apparatus, a rotary member mounted to turn on a vertical axis, a cylinder and piston unit mounted in line with the axis of said rotary member, a film carrier-supporting element mounted on the piston of said unit for reciprocation therewith and rotation relative thereto, means carried by said rotary member on which said element is reciprocable and which will turn with said rotary member, means for turning said rotary member in a step-by-step movement including a piston and cylinder unit, and means for directing pressure fluid to and from said units in such timed relation that the element for supporting the film

carrier will be reciprocated following each step-by-step movement of said rotary member.

PHILIP S. ALLEN.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date	
432,903	Sacco	July 22, 1890	
781,377	Springer	Jan. 31, 1905	
897,251	Graves	Aug. 25, 1908	
1,075,905	Drosser	Oct. 14, 1913	
1,135,111	Hansch	Apr. 13, 1915	15
1,233,109	Nesbit	July 10, 1917	
1,429,270	Barber	Sept. 19, 1922	
1,512,804	Roucka	Oct. 21, 1924	
1,637,154	Mark	July 26, 1927	
1,825,709	Bacino	Oct. 6, 1931	20

Number
1,842,890
1,863,689
1,867,190
1,877,364
1,958,791
1,982,936
2,129,463
2,149,141
2,224,147
2,325,120
2,341,197
2,380,378

Number
8,801
626,727

Name	Date
Williams	Jan. 26, 1932
Dye	June 21, 1932
Stout	July 12, 1932
Schoenberg	Sept. 13, 1932
Kalbfleisch et al.	May 15, 1934
Stukenborg	Dec. 4, 1934
Bullard	Sept. 6, 1938
Hunsicker	Feb. 28, 1939
Ehlers	Dec. 10, 1940
Forse	July 27, 1943
Weiskopf	Feb. 8, 1944
Allen	July 31, 1945

FOREIGN PATENTS

Country	Date
France	Apr. 17, 1908
(Addition to 373,782)	
Germany	Mar. 5, 1936