March 13, 1951 A. IZZI 2,545,031

PHOTOGRAPH DEVELOPING MACHINE

Filed Nov. 22, 1946 4 Sheets-Sheet 1

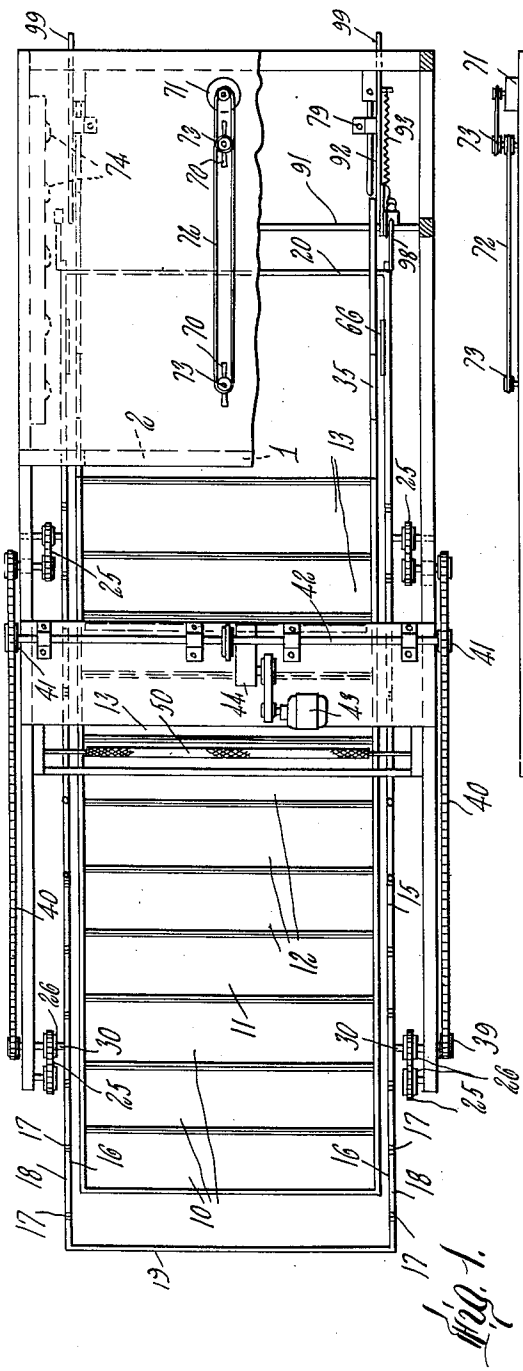

Fig. 1.

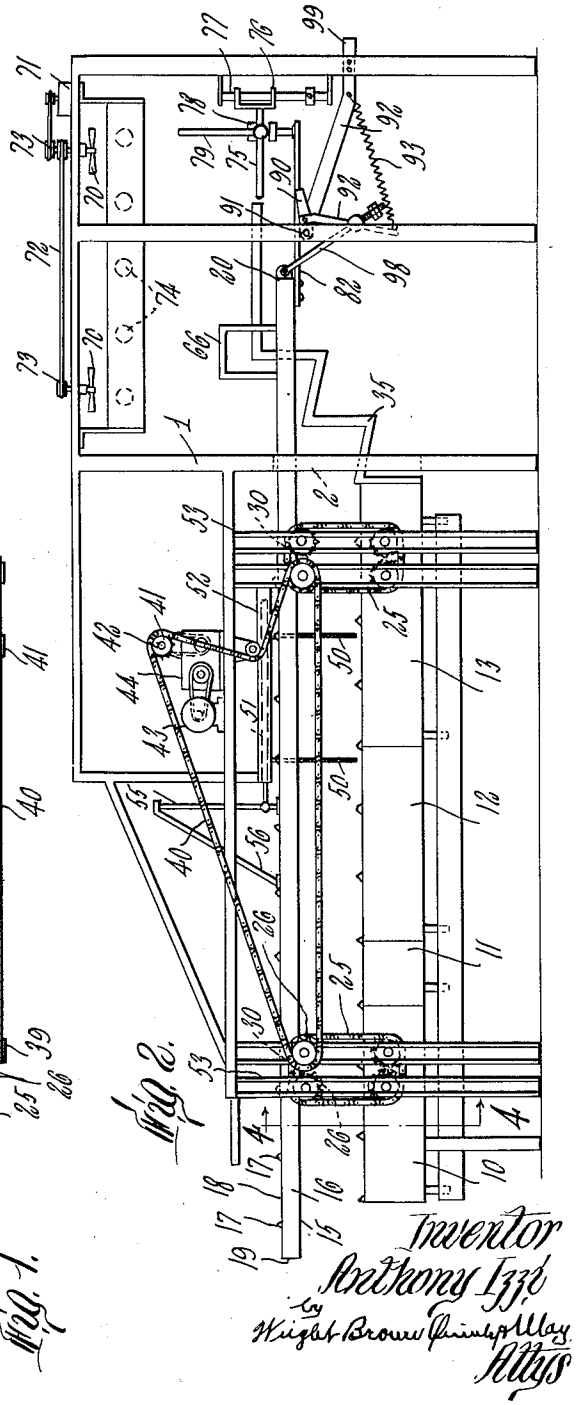

Fig. 2.

Inventor
Anthony Izzi
by
Wright Brown Quinby & May
Attys

March 13, 1951 A. IZZI 2,545,031

PHOTOGRAPH DEVELOPING MACHINE

Filed Nov. 22, 1946 4 Sheets-Sheet 2

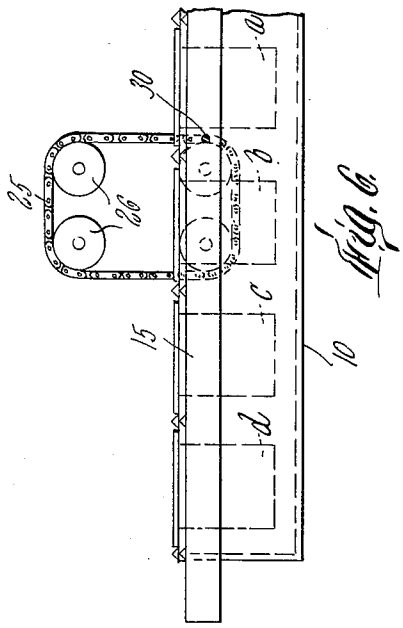

Fig. 6.

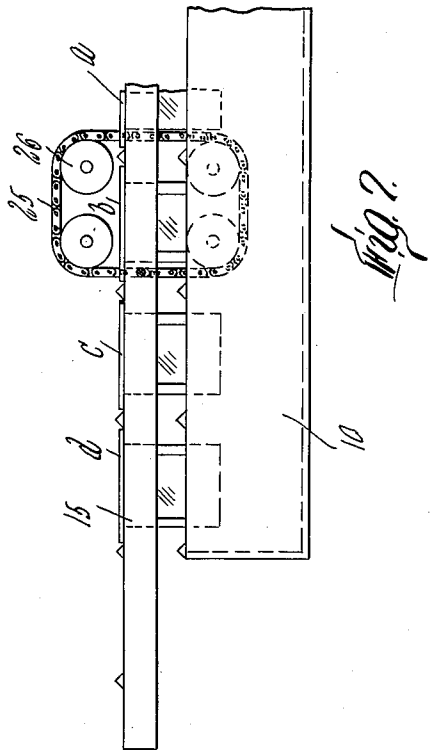

Fig. 2.

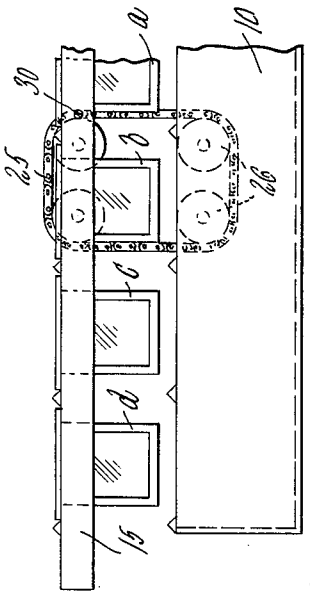

Fig. 5.

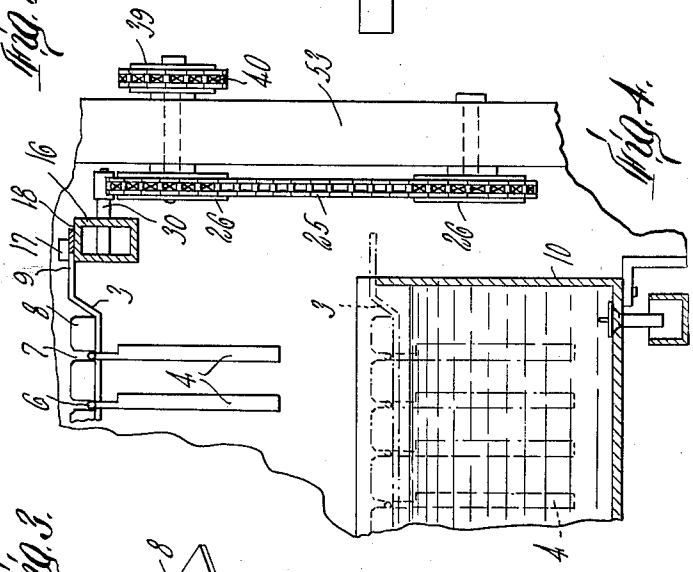

Fig. 4.

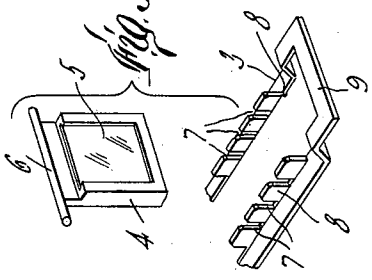

Fig. 3.

Inventor
Anthony Izzi
by Wright Brown Quinby & Macy
Attys.

March 13, 1951 A. IZZI 2,545,031

PHOTOGRAPH DEVELOPING MACHINE

Filed Nov. 22, 1946 4 Sheets-Sheet 3

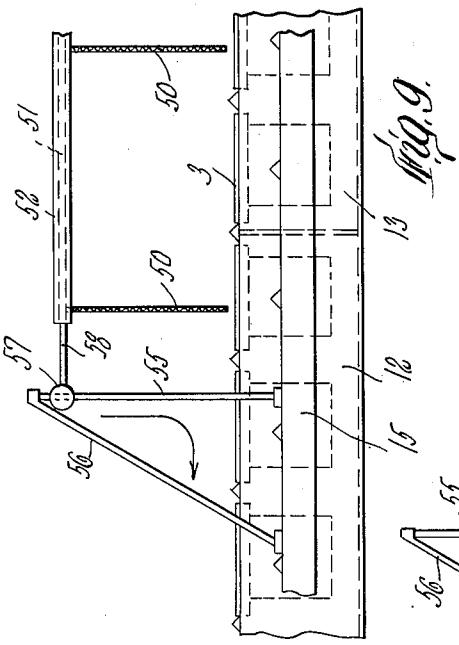

Fig. 9.

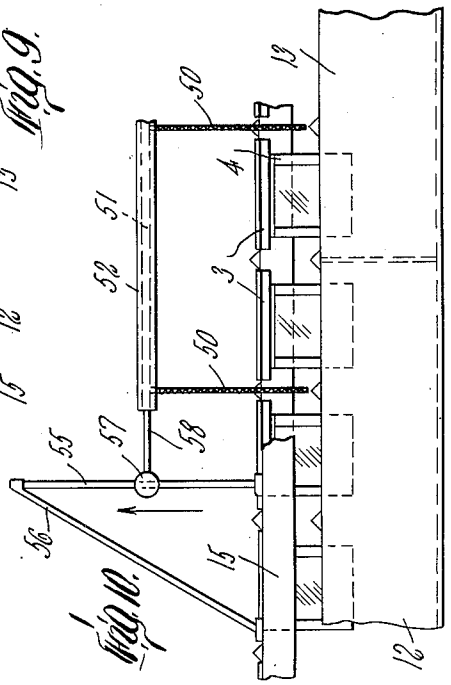

Fig. 10.

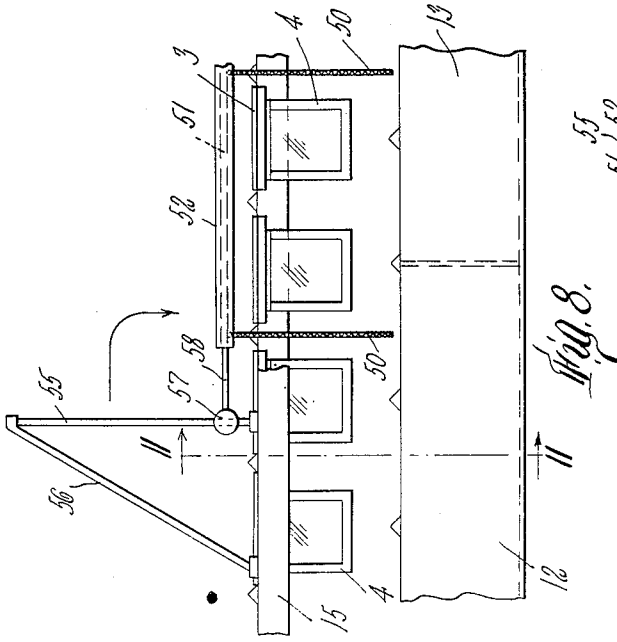

Fig. 8.

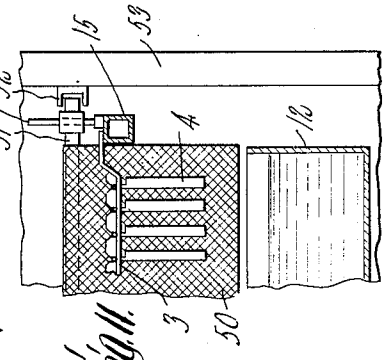

Fig. 11.

Inventor
Anthony Izzi
by
Wright Brown Quinby & May
Attys.

March 13, 1951 A. IZZI 2,545,031

PHOTOGRAPH DEVELOPING MACHINE

Filed Nov. 22, 1946 4 Sheets-Sheet 4

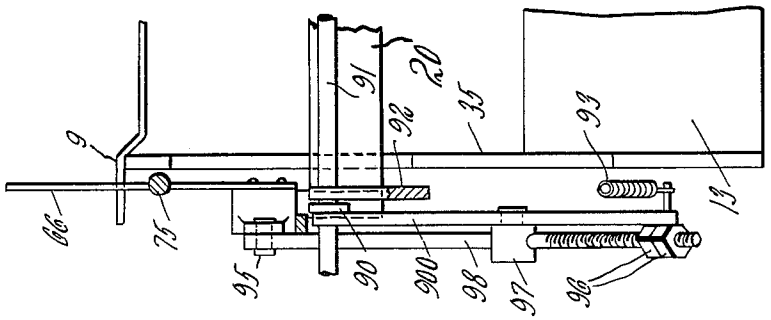

Fig. 14.

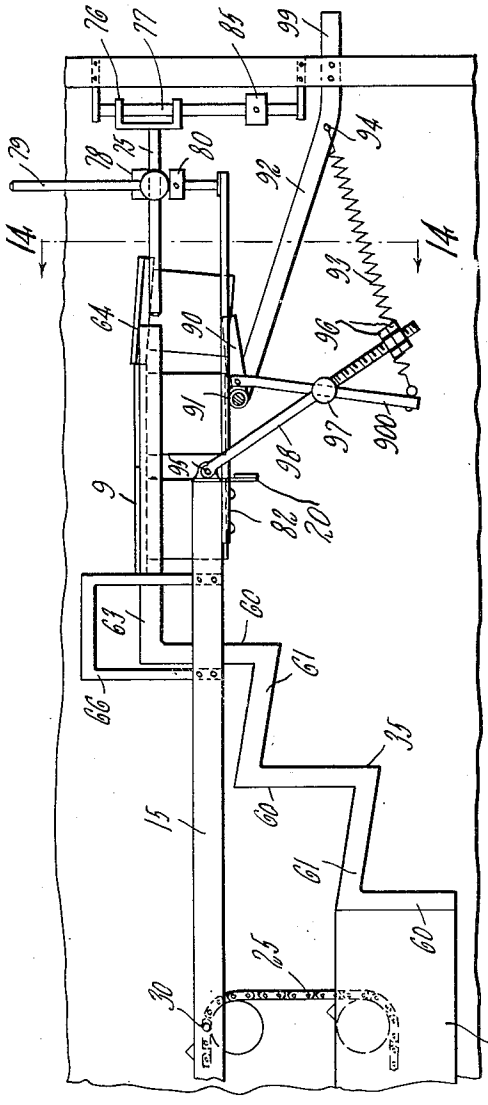

Fig. 12.

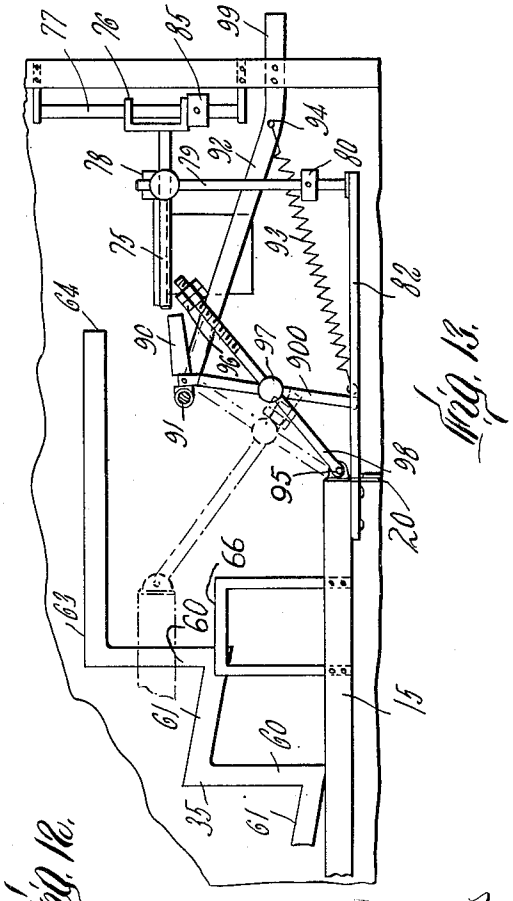

Fig. 13.

Inventor
Anthony Izzi
by
Wright Brown Quinby & May
Attys.

Patented Mar. 13, 1951

2,545,031

UNITED STATES PATENT OFFICE

2,545,031

PHOTOGRAPH DEVELOPING MACHINE

Anthony Izzi, Boston, Mass.

Application November 22, 1946, Serial No. 711,721

4 Claims. (Cl. 95—89)

1

This invention relates to machines for developing photographs, and more particularly for developing photographic negatives.

One object of the invention is to provide improved mechanism for passing the negatives successively through the various operative steps, such as developing, fixing, washing, draining, and drying.

A further object is to provide improved means for shielding the negative from access by light thereto during those portions of the treatment where light would be detrimental.

A further object of the invention is to provide automatic manipulation of the negatives whereby the negatives to be developed are loaded and automatically fed into and through the machine, and the completely treated negatives are automatically delivered therefrom.

For a complete understanding of this invention, together with further objects and advantages, reference may be had to the accompanying drawings in which

Figures 1 and 2 are top plan and side elevational views, respectively, of a machine embodying the invention, the outer enclosure being omitted.

Figure 3 is a fragmentary perspective view showing the supporting means for individual negatives.

Figure 4 is a detail vertical sectional view to a larger scale on line 4—4 of Figure 2.

Figures 5, 6 and 7 are fragmentary side elevations to a larger scale than Figure 2 showing one of the endless carriers in position to hold the feed frame at its upper and lower positions, and at an intermediate position, respectively.

Figures 8, 9 and 10 are fragmentary side elevations to a larger scale than Figure 2 of an intermediate portion of the machine and showing the light trap and related parts in different positions.

Figure 11 is a fragmentary vertical sectional view on line 11—11 of Figure 8.

Figures 12 and 13 are fragmentary side elevations similar to a portion of Figure 2, but to a larger scale and showing the discharging portion of the machine in different positions.

Figure 14 is a detail sectional view on line 14—14 of Figure 12.

Referring first to Figures 1 and 2, the machine comprises a suitable casing having an end wall or partition 1 slotted at 2 for the passage therethrough of cages 3 (see Figure 3) which are arranged to support a series of negative holders 4. This partition 1 forms the boundary between a

2

dark room and a lighted exterior, everything to the left of the wall 1 being within the dark room. The negative holders 4 are of well known construction and are provided with means for holding the negatives 5, such as plates or films, and each holder is provided at its upper edge with a transverse hanger 6 which may be engaged in any of a plurality of notches 7 in side wall members 8 of the cages 3. Each cage may have end extensions, one being shown at 9, which are adapted to rest on various supporting members, as the cage with its load of negatives is transported through the machine.

To the left of the partition 1, the machine is provided with a plurality of tanks 10, 11 and 12 arranged in series. As shown, there are three tanks 10 which are intended to contain the developer, one tank 11 which is intended to contain wash water, and three tanks 12 intended to contain the fixing bath. Beyond the fixing bath there are other tanks 13 for containing washing water by which the fixing chemicals are removed from the negatives. The cages with their negatives to be developed are transported step by step into the various tanks, being allowed to remain in each tank for a period and then transferred to the next adjacent tank, and from the final tank to suitable supports on which the negatives are first drained and then dried to complete the operation.

The negatives are so transported step by step through the machine by a four-motion feed mechanism comprising a feed frame 15 which is moved in a four-motion feed path. This frame 15 has a pair of side rails 16 provided with upward projections 17 spaced to provide between them seats 18 for supporting the end portions 9 of the cages, as shown best in Figures 5, 6 and 7 and 8, 9 and 10.

The feed frame 15 has end walls 19 and 20 which hold the side rails 16 in proper spaced relation. This feed frame is supported for motion in its four-motion path by being secured on each side at two points to endless chains 25, four of these chains being shown, two on each side, each supported on four sprocket wheels 26 arranged in rectangular array, each side frame 16 being fixed to one of these chains at a single point as at 30 (see Figures 1, 2, 4, 5, 6 and 7). The locations of these points 30 are such as to maintain the frame 15 substantially horizontal at all times, but it is given a motion as these chains are moved, forwardly in its uppermost position, then downwardly, then rearwardly, and then upwardly to complete the cycle of motion. When the

frame 15 is in its lowered position, as shown in Figure 6, it is entirely below the upper edges of the end walls of the tanks, so that any cages which may have been supported thereby over the tanks are left supported by the tank during the time that the feed frame is being given its backward motion so that the negatives do not partake of this backward motion of the feed frame. When the feed frame is lifted, it engages the end portions 9 of the cages which are supported on the ends of the tanks and lifts these cages up out of the tanks, moves them forwardly one step and then downwardly to lower the cages into a succeeding tank or onto a support beyond the last tank of the series. This support is shown at 35 on Figures 2, 12 and 13 and will be further described later.

The sequence of feed of the cages with the negatives carried thereby is shown in Figures 5, 6 and 7 in which four cages *a, b, c, d* have been illustrated. In the position shown in Figure 5, all of these cages are in lifted position with their negatives lifted out from the various tanks, the feed frame shown at the forward limit of its feed motion. The feed frame then descends to the position shown in Figure 6, lowering the cages *a, b, c* and *d* into the various tanks, and while the cages are so supported by the tanks, the feed frame moves rearwardly out of contact therewith and then starts its upward motion as shown in Figure 7. The cages are then lifted from the tanks, but it will be noted that the seats which supported the cages in Figure 1 have now been removed one step to the left so that the cages are one step further to the right with respect to the feed frame than they were previously. The feed frame then completes its cycle to the position shown in Figure 5, moving each of the cages one step forward so that when the feed frame next descends, each of the cages has been moved to the next tank in the series or to the support 35. The negatives to be developed are placed in a cage upon the feed frame just to the left of the first tank 10, the feed frame at this portion constituting a cage support, and as the feed frame is given its first feed motion the cage is carried over the first tank after which it and the preceding cages are advanced step by step to be treated sequentially in the proper manner by the developing, washing and fixing solutions, and the final washing in the right hand tank 13. Suitable means may be provided, of course, for establishing a flow of washing water through the tanks 11 and 13, but as this is old and well known in the art, no description of it is necessary.

The motion of the feed frame is produced by driving one of each set of sprocket wheels 26, and as shown in Figure 2, the adjacent pair of each set on one side of the machine is connected through sprocket wheels 39 fixed to the shafts which carry the driven sprocket wheels with the drive chain 40, which also passes about the driving sprocket wheels 41 fixed to a drive shaft 42 which extends across the frame of the machine and may be rotated as by a motor 43 through a suitable gear box 44 by which the rate of rotation of the shaft 42 and thus the rate of motion of the feed frame may be regulated as desired.

As before noted, the wall 1 has to be apertured so that the negatives can be passed therethrough from the dark room portion of the machine to the outside, but it is important that light be prevented from leaking in through this aperture or slot 2 into those portions of the apparatus where light would be harmful to the negatives. A light trap is therefore employed, which is shown best in Figures 8 to 10. It comprises a pair of opaque curtains 50 spaced lengthwise of the machine and suspended from a frame 51 which is slidably guided in horizontal ways 52 (see Figure 11) carried by the side frame members 53 of the machine. These curtains are positioned in line with the aperture 2 and are of sufficient size to extend beyond the margins of the aperture so as to effectively shield portions back of the first curtain from light passing through the slot 2. The lower edges of the curtains 50 extend down almost to the upper edges of the tanks and they are arranged for simultaneous motion with the cages in the direction of feed so as to permit the cages with their negatives to be moved through the machine without interference thereby, but they are held against vertical motion with the feed frame or with the cages. The means for so moving the curtains is actuated from the feed frame. As shown best in Figures 8, 9 and 10, the side walls of the feed frame support a pair of triangular uprights, each comprising a vertical rod 55, and an inclined brace rod 56, which is secured at its upper end to the top of the rod 55 and at its lower end to the feed frame 15 spaced from the lower end of the vertical rod 55. The vertical rod 55 has slidably mounted thereon a slide formed as a ball 57, which is connected to the curtain support 51 by the rod 58. The feed frame can thus move vertically without corresponding movement of the curtains as may be seen by a comparison of Figures 8, 9 and 10, but forward and backward movement of the feed frame 15 is imparted to the curtains.

As shown the curtains are spaced apart sufficiently to permit two cages to be positioned therebetween, though the precise number may be varied as desired. When the feed frame is in lifted position, as shown in Figure 8, a pair of these cages may be positioned between the curtains 50. When the feed frame is moved forwardly, these cages and the curtains move therewith so that this relationship between the cages and curtains is not disturbed. When the feed frame descends, the cages are lowered below the lower edges of the curtains and as the feed frame is thereafter retracted, the curtains are retracted with it to the left, as shown in Figure 9 by the arrow, so that the curtains move back to a position so that the cage previously just back of the forward curtain 50 is now beyond this curtain, and the second cage which was previously just forward of the rear curtain 50 is moved up to a position just rearwardly of the forward curtain 50. Thus the cages with the negatives are moved forward without hindrance by the curtains, the curtains themselves moving backward and forward with the corresponding motion of the feed frame, but remaining always in position to block off light from the aperture 2.

When the cages have been lifted from the last rinsing tank 13 they are fed onto the supports 35 as previously mentioned. Each support 35, there being such a support on each side of the machine, is specially formed however to facilitate the draining of the wash water from the negatives. As shown best in Figures 2, 12, and 13 each of the supports 35 is stepped, having riser portions 60 with tread portions 61 between adjacent riser portions 60. These tread portions 61 are inclined to the horizontal lengthwise and are arranged to support the end portions 9 of the cages thereon in such inclined relation as to present the forward lower corners of the negative

holders 4 in the lowest positions being in planes substantially parallel with the supports 35 so as to facilitate the draining of the wash water to these corners from which it will drip off. These step supports 35 are progressively higher, the last one 63 of the series having a horizontal tread portion and being extended for a substantial distance terminating at 64. This portion 63 is above the highest position of the feed frame 15 so that this feed frame has no effect to raise and lower the plate holders after they reach this step. They are merely moved forward by the feed motion of the frame 15, and for this purpose it is shown as provided with a pushing element 66 shown as in the form of an upstanding loop. The loop 66 has a flat top which, when the feed frame is in its lowered and retracted position, is beneath the cage on the highest inclined step or tread 61, and on lifting and forward motion of the frame this cage is lifted and carried over the first horizontal portion 63 on the elevated support. On lowering of the feed frame this last cage is deposited on the lifted portion 63 in position to be engaged and pushed forwardly by the front face of the loop 66 on the next forward motion of the feed frame. The feed frame cross connection 20 is sufficiently low so as not to interfere with the passage of the cages and the parts carried thereby. By the time the cages reach the portions 63, the negatives have been substantially drained. They may also be subjected to a drying current of air which may be derived from one or more fans 70 (see Figure 2) which may be driven from a motor 71 through suitable belts 72 and driving pulleys 73. The complete drying may be accelerated by the use of a series of infra-red lamps at 74, the rays of which are directed downwardly toward the cages but so that the drying proceeds without undue temperature rise of the negatives or of the surrounding atmosphere.

By the time the cages have reached the end 64 of the upper step 63, they are dried and in condition to be removed. Means are therefore provided for transferring the cages with their dried negatives from the supports 35 and feeding them out from the machine. As shown there is provided a transfer mechanism comprising a pair of laterally spaced rods 75 which form substantial extensions of the supports 35, these rods being held by brackets 76 vertically slidable on guide rods 77. Slidable axially of the rods 75 are ejector blocks 78 through which are vertically slidable rods 79. These rods 79 are provided with collars 80 fixed thereto at a height from the lower ends of the rod 79 such that when the feed frame 15 is in its uppermost position, the rods 75 are maintained in substantial alinement with the supports 35 by reason of extensions 82 from the feed frames 15 underlying the lower ends of the rods 79, and holding the collars 80 at the desired elevation. This is shown in Figure 12. In this position of the parts the forward motion of the feed frame 15 may feed one of the cages off of the supports 35 and on to the rods 75, as shown in Figure 12 in dotted lines. Subsequent lowering of the feed frame 15 permits the rods 75 to descend to the position shown in Figure 13 where the brackets 76 rest upon collars 85 adjustably fixed to the rods 77. This brings the transfer rods 75 into substantial alinement with platform side members 90 pivoted at 91 at the upper end of an inclined slideway 92. These platform members 90 have fixed thereto downwardly extending bars 900, the lower ends of which are connected by springs 93 with a fixed pin 94, which, as shown may be secured to the slide 92. Intermediate to the ends of the bars 900 there are pivoted thereto guide bosses 97 through which slide rods 98. The rear end of each rod 98 is pivoted as at 95 to the forward end of the feed frame 15. A pair of nuts 96 are adjustably secured to the opposite end portions of the rods 98. These parts are so arranged that as the feed frame retracts, it pulls the ejector blocks 78 rearwardly, which moves out a cage which may be carried by the transfer rods 75 onto the platform members 90. Then, as the feed frame 15 lifts to a sufficient extent, the nuts 96 engaging on the bosses 97, pull the arms 900 rearwardly into the dotted line position shown in Figure 13, tilting the platform members 90 downwardly and depositing the cage onto the inclined slide 92 along which it descends by gravity to its forward straight end portion 99 where it can be removed from the machine by the operator, the negatives being then in fully developed and dried condition.

As the feed frame 15 moves upwardly and then forwardly, the platform members 90 are returned to their upwardly inclined positions and the transfer rods 75 are moved up into substantial alinement with the supports 35 to receive the next cage in the series.

It will be seen from the foregoing description of the embodiment of the invention that the negatives are fed step by step through the various treating portions of the machine and are finally delivered in fully treated condition automatically, while during the necessary time, they are protected against the effects of light, and that the machine is fully automatic from the placing of the cages with the undeveloped negatives thereon until the negatives are delivered from the machine fully developed, fixed, washed and dried. It also will be apparent from the foregoing description that various changes and modifications might be made without departing from its spirit or scope, the embodiment herein shown being by way of example and not of limitation.

I claim:

1. In combination, a support having a series of stepped portions having their upper faces inclined to the horizontal lengthwise, a plurality of cages each having portions for supported engagement by said stepped portions, said cages having walls for supporting plate elements with their planes substantially parallel with the sides of said support and means for moving said cages successively from stepped portion to stepped portion, said stepped portions supporting said cages tilted to cause a corner of each plate element carried by said cages to be positioned lowest to localize drainage from said plate element of liquid previously picked up by said plate element.

2. A support along which articles may be moved, a downwardly inclined slide having its upper end adjacent to one end of said support, a four-motion feed mechanism for raising and then moving forwardly articles on said support and thereafter lowering and then retracting out of contact with such articles to thereby move such articles intermittently toward said support end, the upper end of said slide being below said support, a transfer mechanism movable between a lifted position to receive articles from said support and a lower position adjacent to the upper end of said slide, connections between said transfer mechanism and feed mechanism causing the up and down motion of said feed mechanism to move said transfer mechanism in the corresponding direction, a platform hinged to the upper

portion of said slide and movable between an upper angular position to receive articles from said transfer mechanism and a lowered angular position to deposit such articles on said slide, an ejector movable along said transfer mechanism to eject articles moved thereonto from said transfer mechanism onto said platform, connections between said ejector and said feed mechanism causing forward and backward motion of said feed mechanism to actuate said ejector, and operative connections from said feed mechanism to said platform causing said platform to tip downwardly when said feed mechanism approaches fully retracted lifted position.

3. In combination, a support having a series of stepped portions having their upper faces inclined to the horizontal lengthwise, a plurality of cages each having portions for supported engagement by said stepped portions, said cages having walls for supporting plate elements with their planes substantially parallel with the sides of said support, said stepped portions supporting said cages tilted to cause a corner of each plate element carried by said cages to be positioned lowest to localize drainage from said plate element of liquid previously picked up thereby, an elevated support, a four-motion feed frame positioned to feed cages successively from one stepped portion to the next, said frame having an upwardly extending portion engageable when said frame is lowered beneath a cage on the highest stepped portion to raise it therefrom when said frame is lifted and deposit it onto said elevated support, said upwardly extending portion being positioned to push cages deposited on said elevated support therealong as said frame is moved forwardly.

4. In combination, a support having a series of stepped portions, a plurality of elements each having portions for supported engagement by said stepped portions, an elevated support, a four-motion feed frame positioned to feed elements successively from one stepped portion to the next, said frame having an upwardly extending portion engageable when said frame is lowered beneath an element on the highest stepped portion to raise said element therefrom when said frame is lifted and deposit said raised element onto said elevated support, said upwardly extending portion being positioned to push elements deposited on said elevated support therealong as said frame is moved forwardly.

ANTHONY IZZI.

REFERENCES CITED

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

UNITED STATES PATENTS

Number	Name	Date
1,061,667	Gerhard	May 13, 1913
1,434,859	Taylor	Nov. 7, 1922
1,840,238	Long	Jan. 5, 1932
1,842,890	Williams	Jan. 26, 1932
1,939,426	Wilcox et al.	Dec. 12, 1933
1,974,890	Long	Sept. 25, 1934
2,004,410	Houch et al.	June 11, 1935
2,124,106	Dye	July 19, 1938
2,245,673	Huenerfauth	June 17, 1941
2,379,911	Kottman	July 10, 1945

FOREIGN PATENTS

Number	Country	Date
19,934	Great Britain	of 1890