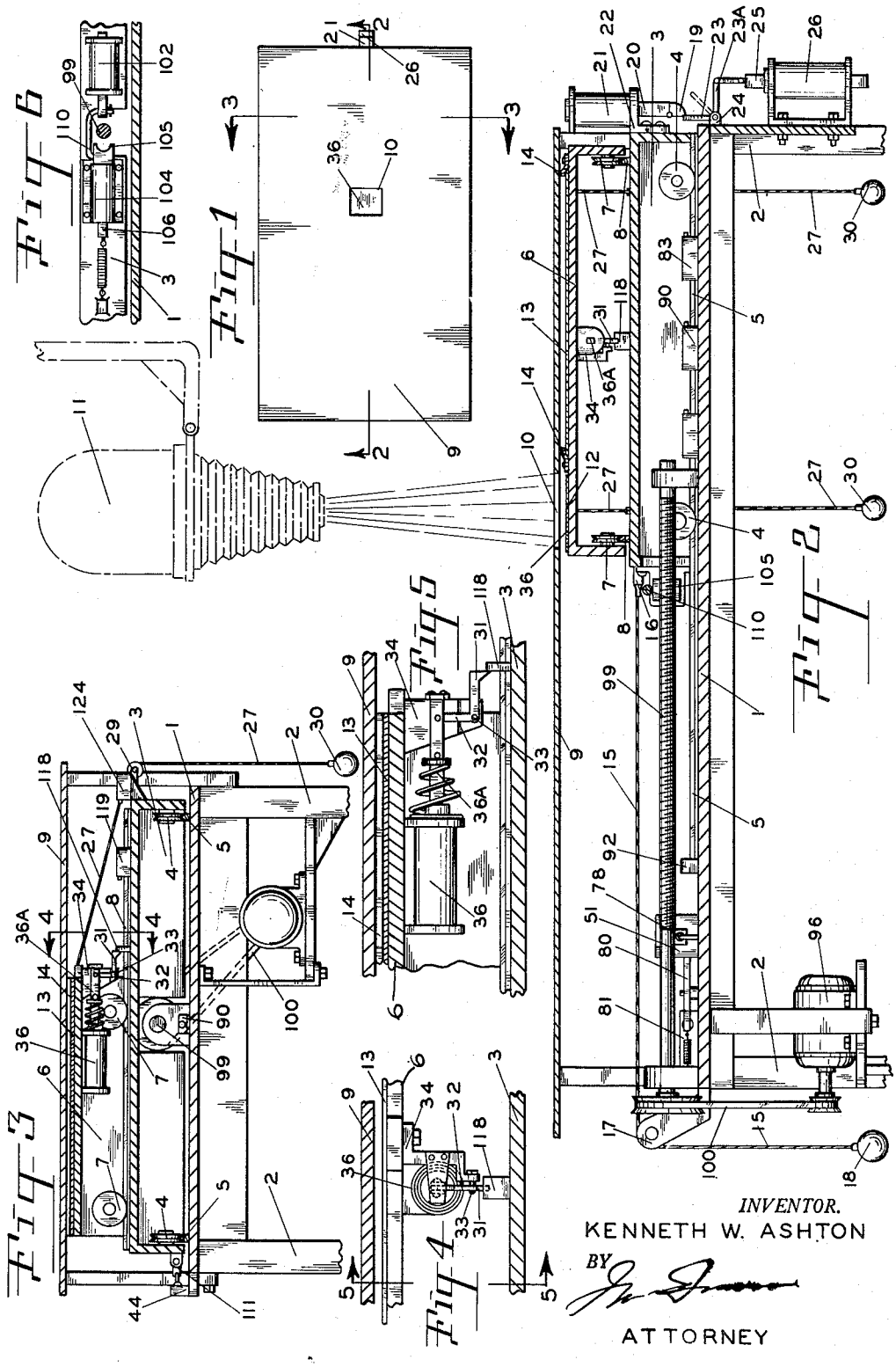
Oct. 5, 1954 K. W. ASHTON 2,690,696

AUTOMATIC PROJECTION PRINTING MACHINE

Filed Jan. 31, 1951 3 Sheets-Sheet 1



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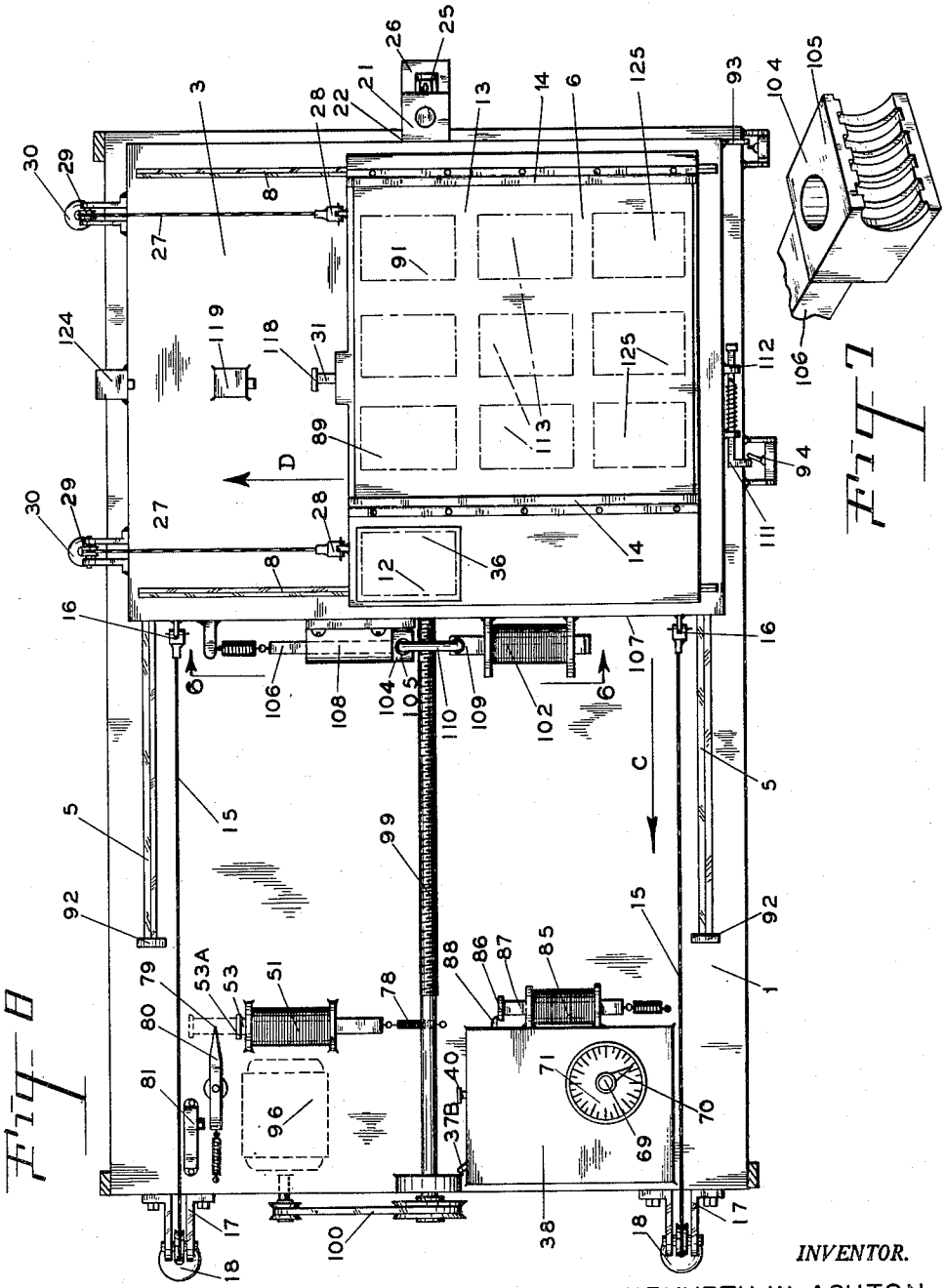

Fig. 8

Fig. 4

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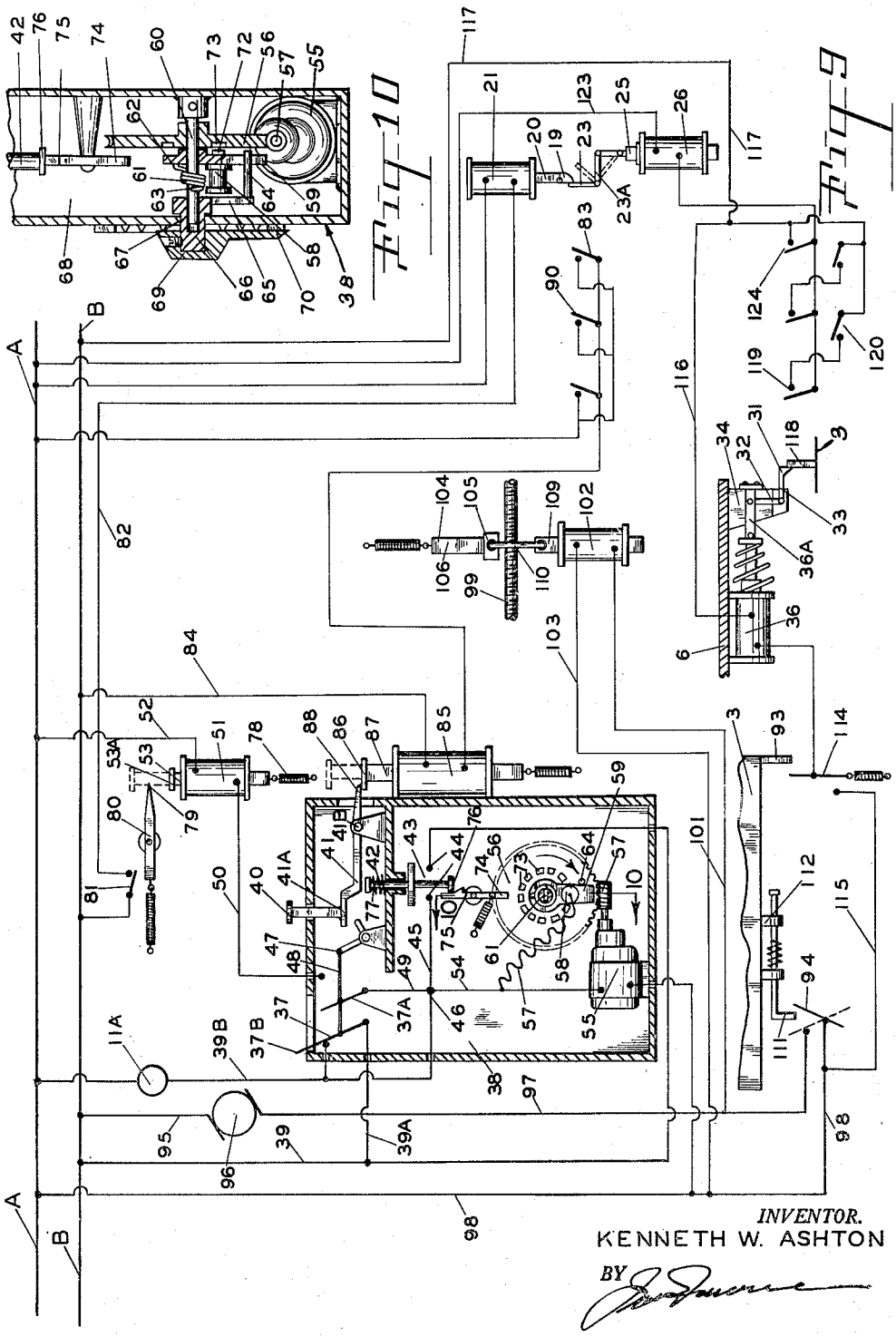

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AUTOMATIC PROJECTION PRINTING MACHINE

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2 Claims. (Cl. 88—24)

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This invention relates to improvements in automatic projecting printing machines, which are particularly adapted for making photographic prints from projected images.

The primary object of the invention is to provide an automatic printing machine wherein a series of prints can be automatically made, one after the other from a projected image on a single large sheet of photographic paper.

This machine is so designed as to receive a large sheet of photographic paper so that a series of exposures can be made throughout the width of the sheet. Then by moving the sheet transversely of the line of printing the width of a single exposure, the paper can be moved across under the projected image exposing still another row of pictures for any desired number of rows of prints, or until the entire sheet has been exposed to the projected image.

My new and improved printing machine provides an automatic printer for the photographer wherein he can use a large sheet of paper making a series of exposures thereon instead of using small sheets with one exposure being made on each sheet. This eliminates the handling of individual prints in exposing, developing, drying and sorting. By using a large sheet having a series of exposures thereon, no more handling is necessary than was required when one exposure was made on a small sheet by the old method.

These and other incidental objects will be apparent in the drawings, specification and claims.

Referring to the drawings:

Figure 1 is a plan view of my new and improved automatic printing machine.

Figure 2 is a side sectional view, taken on line 2—2 of Figure 1, looking in the direction indicated.

Figure 3 is an end sectional view, taken on line 3—3 of Figure 1, looking in the direction indicated.

Figure 4 is an enlarged fragmentary view of the secondary carriage locking device, taken on line 4—4 of Figure 3.

Figure 5 is a side view of Figure 4, taken on line 5—5 of Figure 4.

Figure 6 is a fragmentary end sectional view of the feed mechanism for moving the carriage, taken on line 6—6 of Figure 8.

Figure 7 is a fragmentary perspective view of part of the platform feed mechanism shown in perspective for conveience of illustration.

Figure 8 is a plan view of the machine, having its cover or light shield removed therefrom for convenience of illustrating the various parts.

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Figure 9 is a diagrammatical wiring layout of the electric control system.

Figure 10 is a sectional view of the automatic timer mechanism taken on line 10—10 of Figure 9.

Referring more specifically to the drawings:

My new and improved automatic printing machine comprises a table including a platform 1, mounted on supporting legs 2. A primary carriage 3 is mounted upon the platform 1 by way of trunnion wheels 4 running on V-shaped rails 5 fixed on said platform 1 and extending longitudinally thereof. These trunnion wheels are securely journalled on the carriage 3 so that there will be no looseness or side play developed in the movement of the carriage over the rails.

A secondary carriage 6 is mounted upon the primary carriage 3 by way of the trunnion wheels 7 running on transverse V-shaped rails 8. The said rails 8 are fixedly secured to the primary carriage 3, best illustrated in Figures 2 and 8. These trunnions and rails are also of precision design for preventing any side movement of the secondary carriage 6 in operation.

The carriages 3 and 6 operate underneath a cover 9 acting as a light shield, which completely covers the machine excepting that an opening 10 is located in the said shield through which the image being projected from the projection lamp 11 passes, best illustrated in Figures 1, 2 and 8, on to the upper surface of the secondary carriage 6 as indicated by the broken lines 12. The printing paper is indicated at 13 and is held in place on top of the secondary carriage 6 by the guideways 14, which are secured to the top of the secondary carriage.

Cables 15 are dead-ended to the carriage 3 at 16 at one of their ends and trained over the sheaves 17, best illustrated in Figures 2 and 8, having counterweights 18 affixed to their opposite ends. These counterweights pull the primary carriage in the direction of the arrow C (Fig. 8) at all times.

A holding dog 19 is associated with a core 20 of the solenoid 21 which is fixedly secured at 22 to the carriage 3. The dog 19 engages the locking latch 23 and holds the carriage 3 in the position shown in the drawings, best illustrated in Figure 2. The said latch 23 is in the form of a bell crank 23A and is pivotally connected to the platform 1 at 24. The bell crank 23A is also connected to the core 25 of the solenoid 26. The operation of which will be more fully described later on.

The secondary carriage 6 has cables 27 secured

thereto at 28 and passing over the sheaves 29 with counterweights 30 affixed thereto. These cables and counterweights pull the secondary carriage in the direction of the arrow D (Fig. 8). This carriage is held against the pull of these weights by the locking pawl 31, referring to Figures 3, 4 and 5, which forms part of the bell crank 32, the said crank is pivotally mounted at 33 to the bracket 34. The said bracket 34 is fixedly secured to the carriage 6 as best illustrated in Figures 4 and 5. The operation of this pawl is controlled by the solenoid 36, which will be more fully described later on.

I will now describe the operation of my new and improved automatic printing machine, referring to Figure 9. The carriages 3 and 6 are positioned as illustrated in the drawings. The image of the negative within the enlarger 11 is projected through the opening 10 on to a piece of paper 36, which is secured to the secondary carriage and has the same thickness of the print paper 13. The image is indicated by the broken lines 12. This allows the photographer to focus the image without destroying any of the print paper 13.

The image from the negative located in the enlarger lamp 11 is focused on the test paper 36 by closing the switch 37 within the timing unit 38. An electric circuit will be completed from the supply line B, conductors 39, 39A switch 37, conductor 39B, lamp 11A within the enlarger and back to the main line A.

The printer is next set into automatic operation by pressing the button 40 manually. The button 40 will cause the lever 41 to pivot about its pivot support 41B engaging the plunger 42 of the switch 43, closing the contacts 44 completing an electric circuit from the main line B, conductor 39, switch 43, conductor 45, conductor 46, conductor 39B, projection lamp 11A back into the line A.

When the lever 41 was pushed down by the bottom 40 the end 41A of the lever contacted the bell crank 47, which is connected to the switch bar 37 and the switch bar 37A by way of the link 48. This opened the switch 37 and closed the switch 37A completing an electric circuit through the switch 43, conductor 45, conductor 49, switch 37A, conductor 50, solenoid 51, conductor 52 back to the main line A. Energization of the solenoid 51 raises its core 53 to the dotted position where it will remain.

Electric energy also is delivered from the switch 43, conductor 45, conductor 54 to the motor 55, which will begin to rotate the worm wheel 56 by way of the worm 57 in the direction of the arrow. Electric energy also is delivered from the conductor 54 by way of the flexible conductor 57 to the solenoid 58. The solenoid 58 is mounted to the circuit breaker arm 59, best illustrated in Figures 9 and 10.

Referring to Figures 9 and 10, the circuit breaker arm 59 is rotatably mounted on the stationary stub shaft 60. A coil spring 61 has one of its ends connected to the arm 59 at 62, while its opposite end passes through the shaft 60 at 63. This spring is so mounted so as to rotate the breaker arm 59 in the opposite direction of rotation to that of the worm gear 56. The position of the breaker arm 59 will be determined by the stop pin 64, which is fixedly secured to the crank arm 65. The hub 66 of the crank arm 65 rotates on the shaft 60 and within the bearing 67 of the case 68 of the timing unit. A hand knob 69 is keyed to the hub 66 and has a pointer 70 forming part thereof, referring to Figures 8 and 10. The position of the stop pin 64 is determined by the operator revolving the hand knob 69 and the pointer 70 over the dial 71.

In the operation of the timer, the operator revolves the knob 66 so as to position the stop pin 64, as for instance in the position illustrated in Figures 8, 9 and 10. This will allow the spring 61 to rotate the breaker arm 59 to the position shown against the stop 64. When the solenoid 58 was energized it caused its core 72 to engage the notches or depressions 73 formed on the side of the worm wheel 56, therefore when the motor 55 was started by being energized it will rotate the gear wheel 56 in the direction of the arrow, together with the breaker arm 59.

When the breaker arm 59 reaches the trigger lever 74 it will unlatch the dog 75 from the end 76 of the plunger 42 of the switch 43, allowing the spring 77 to raise the switch 43 to the open position shown in the drawing, breaking the electric circuit through the contacts 44, turning off the enlarging lamp 11A and stopping the motor 55 and releasing the tip of the core 72 of the solenoid 58 from the depressions 73, which allows the spring 61 to return the breaker arm 59 to its starting position against the stop pin 64. The position of the stop pin 64 will determine how long it will take for the breaker arm 59 to reach and open the switch 43, thereby governing the time of exposure.

Returning back now to when the switch 43 was closed and the solenoid 51 was energized, I will describe what happens when the switch 43 was opened as above described. When the switch 43 was opened the solenoid 51 was demagnetized, allowing the spring 78 to return the core 53 to the position illustrated in the drawings. When the head 53A of the core engaged the tip 79 of the pivotally mounted switch operating bar 80, it caused the said bar to close the switch 81 momentarily. This delivered electrical current from the main line conductor B through the switch 81, conductor 82 into the solenoid 21 causing its core 20 to disengage the holding dog 19 from the locking latch 23. This permitted the carriage 3 to be moved in the direction of the arrow until the locking dog 19 engaged the switch 83.

This switch performs a dual purpose, it provides a stop for holding the further movement of the carriage by the action of the counterweights 18, and also closes an electric circuit from the main line B by way of the conductor 84, into the solenoid 85. This causes the end 86 of the core 87 of the solenoid 85 to strike the end 88 of the bar 41, pivoting it about its pivot point 41B and causing it to force the plunger 42 of the switch 43 down again closing the contacts 44, which will energize the projection lamp 11A starting the motor 55, engaging the core 72 of the solenoid 58 with the notches 73 formed on the side of the worm gear 56, causing the breaker arm to again travel towards the trigger latch 74 when it will reopen the switch 43, at which time the exposure will have been made on the paper 13 indicated by the broken line 89, referring to Figure 8.

When the switch 43 is opened it will again cause the solenoid 51 to close the switch 81 energizing the solenoid 21 unlatching the locking dog 19 from the switch 83, allowing the carriage 3 to again move in the direction of the arrow until the dog 19 engages the switch 90, repeating another cycle of operation.

In regards to the operation of the switches 37 and 37A, the switch bar 37A will remain closed during automatic operation until the operator opens the same by way of the switch arm 37B for further testing and focusing of the images.

Referring to Figure 9, when the carriage 3 has reached the end of its travel, or having completed the last print indicated by the broken lines 91, it will have come against the stops 92 on the tracks 5, stopping its further movement. Simultaneously therewith the switch operating arm 93 will engage the switch bar 94 causing it to take the dotted position indicated in Figure 9, which will close an electric circuit from the main line B through the conductor 95, motor 96, conductor 97, through the switch bar 94, conductor 98 and back to the main line A. The motor 96 rotates the threaded shaft 99 by way of the driving belt 100 and its associated pulleys, referring to Figures 2, 3 and 8.

When the switch 94 was closed another electric circuit was completed from the conductor 97, through the conductor 101, solenoid 102, conductor 103 back to the main line A by way of the conductor 98. The solenoid 102 is connected to a clutch element 104 which consists of an internal threaded head 105, referring to Figure 7, forming part of the plunger 106. This element is mounted to the forward edge 107 of the carriage 3, referring particularly to Figures 7 and 8 by way of the bearing support 108.

The core 109 of the solenoid 102 is connected to this threaded unit by way of the link 110. When the solenoid 102 is energized it pulls the threaded head 105 of this clutch unit into engagement with the threaded shaft 99, and as the shaft 99 is rotated it will move this threaded head along the shaft, moving the carriage 3 in the opposite direction to the arrow C, until the carriage reaches the position illustrated in the drawings, when the dog 19 will engage the locking latch 23, or will re-engage the switch 83 instead.

In the event of continuous operation, the carriage will not be arrested by the locking latch 23, which will be more fully described later on. When the carriage has reached the position illustrated in the drawings, a floating switch operating bar 111 will open the switch 94. The switch operating arm 111 floats on the spring mounting 112, the object of which is to permit the carriage to overrun slightly in its movement after the motor 96 is de-energized.

On the return of the carriage 3 towards its starting position, it is desirable to allow the secondary carriage 6 to move in the direction of the arrow D, referring to Figures 3 and 8, so as to bring the broken line positions 113 under the opening 10 of the light shield and the projected image being printed. This is accomplished by the switch operating arm 93 closing the switch 114, which energizes the solenoid 36 by way of the conductor 115, which is connected to the conductor 98, switch 114, solenoid 36, conductor 116, conductor 117, back to the main line B.

When the solenoid 36 is energized it will pull the core 36A, pivoting the bell crank 32 about its pivot 33 unlatching the pawl 31 from the stop 118, the stop 118 being part of the primary carriage 3. This will allow the carriage 6 to be moved in the direction of the arrow D by its counterweights 36, until the pawl 31 strikes the switch 119, which acts as a stop for the carriage.

When the carriage 3 reaches the end of its return travel in the opposite direction of the arrow by the action of the rotation of the screw thread 99 within the nut 105, it can be held in the position shown in the drawings by the action of the dog 19 against the latch 23, or the same may pass the latch 23 when the latch is in the dotted position, referring to Figure 2, and contact the switch 83 as above described. In case the movement of the carriage is not arrested by the latch 23, the printer will go on printing as indicated by the broken lines 113.

Referring to Figure 9, in the event of continuous printing operation the manual switch 120 is opened as shown, therefore when the dog 31 contacted the switch 119 in the movement of the carriage an electric circuit will not be completed through the solenoid 26, therefore the latch 23 will remain in the dotted position allowing the dog 19 to pass the same by the action of the counterweights on the carriage 3, the dog 19 engaging the switch 83 which will close an electric circuit through the solenoid 85, causing the arm 41 to start the timing unit as above described, turning on the projection lamp resetting the solenoid 51 and causing the motor 55 to operate the timing unit until the breaker arm 59 releases the switch 63, breaking the circuit therethrough, which will allow the solenoid 51 to close the switch 81 unlocking the dog 19 from the switch 83 and allowing it to contact the switch 99 again completing a cycle of operation.

In the event it is desirable to print but one row of pictures, the switch 120 would be closed so that when the pawl 31 closed the switch 119 electric energy would flow from the main line conductor B through the conductor 117, conductor 121, switch 120, switch 119 through the conductor 122, solenoid 26, conductor 123, back to the main line A. This will move the stop latch 23 from the dotted position to the full line position where it will arrest the movement of the carriage 3 by way of the stop dog 19, as illustrated in the drawings.

So long as the solenoid 26 is not energized the latch will remain in the dotted position out of registry with the dog 19, which will go past the same on the return of the carriage 3 until it strikes the first switch 83, which will arrest the movement of the carriage and cause the timing unit 38 to again go into operation.

When the pawl 31 of the carriage 6 reaches the switch 124 it will operate the solenoid 26, stopping the operation of the machine, which would be the position indicated by the broken lines 125, referring to Figure 8.

While I have illustrated a specific mechanical and electrical apparatus for moving the printing paper under a projected image printing on the paper rows of prints, I do not wish to be limited to this exact mechanical and electrical layout as other methods may be employed to move the sheet under the projected image, but the layout that I have illustrated is admirably adapted to carry out this particular movement of the photographic printing paper for the desired number of prints on the sheet.

Also, the embodiment described comprehends the movement of the projection lamp 11 and cover 9 with its opening 10, or other suitable opaque member having such an opening, and a support or carriage bearing the printing paper and thus, the printing paper itself relatively as described or otherwise, to intermittently present successive rows of sections of the printing paper for exposure and successively expose successive sections of each row for projection and printing of the image on the paper. In the form described, the paper is moved under the exposure

opening in rows covering the entire sheet of paper with exposures on the printing paper, but broadly, the lamp and opening, and the paper, are moved relatively. Thus, the invention comprehends moving the paper relative to or beneath the lamp or lamp and opening, or the lamp and opening relative to or over the paper, so that, fundamentally, the invention really consists of printing a series of exposures over one piece of printing paper so that all exposures can be developed at one and the same time and similarly or otherwise handled or dried.

What I claim is:

1. In an automatic projection printing machine, a projection lamp for projecting an image, a support for a sheet of printing paper of a size embodying a plurality of rows of sections each the size of the projected image to be reproduced on the paper, means over the sheet having an exposure opening through which the image is projected onto the paper, means to automatically turn the lamp on and off, means for producing intermittent relative movement between said support and said exposure opening to intermittently present successive sections for exposure, and means operable in sequence with the intermittent relative movements between said support and opening to energize said lamp between such movements to successively expose successive sections for projection and printing of the image on the paper.

2. In an automatic projection printing machine, a carriage movably supported, means for successively moving the carriage in one direction in degrees equal to one dimension of a projected image to be printed, a second carriage movable across the first carriage and adapted to support a sheet of print paper of a size embodying a plurality of rows of sections the size of the projected image to be printed thereon, means for moving

the second carriage across the first carriage in degrees equal to the other dimension of the projected image and any space between the images to successively expose a plurality of sections of the print paper in a row for printing, means for returning the second carriage to its initial position, and means actuated by said first carriage upon completion of its movement in the one direction for returning the first carriage to its initial position, said means for successively moving said first carriage comprising means for moving said carriage in one direction, a series of spaced means for successively stopping said carriage for each image area of a row on the print paper, a retractible stop device aligned with and spaced from said series of spaced stopping means for stopping said carriage with the exposure area beyond the print sheet area, whereby the image may be projected on a piece of test paper in advance of the print paper to obtain the proper exposure and focus of the image prior to exposure and projection thereof onto the print paper, and means for retracting said stop to release and prevent stopping said carriage during successive passages to permit movement of the first carriage together with the second carriage and print paper thereon to regular exposure position.

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