

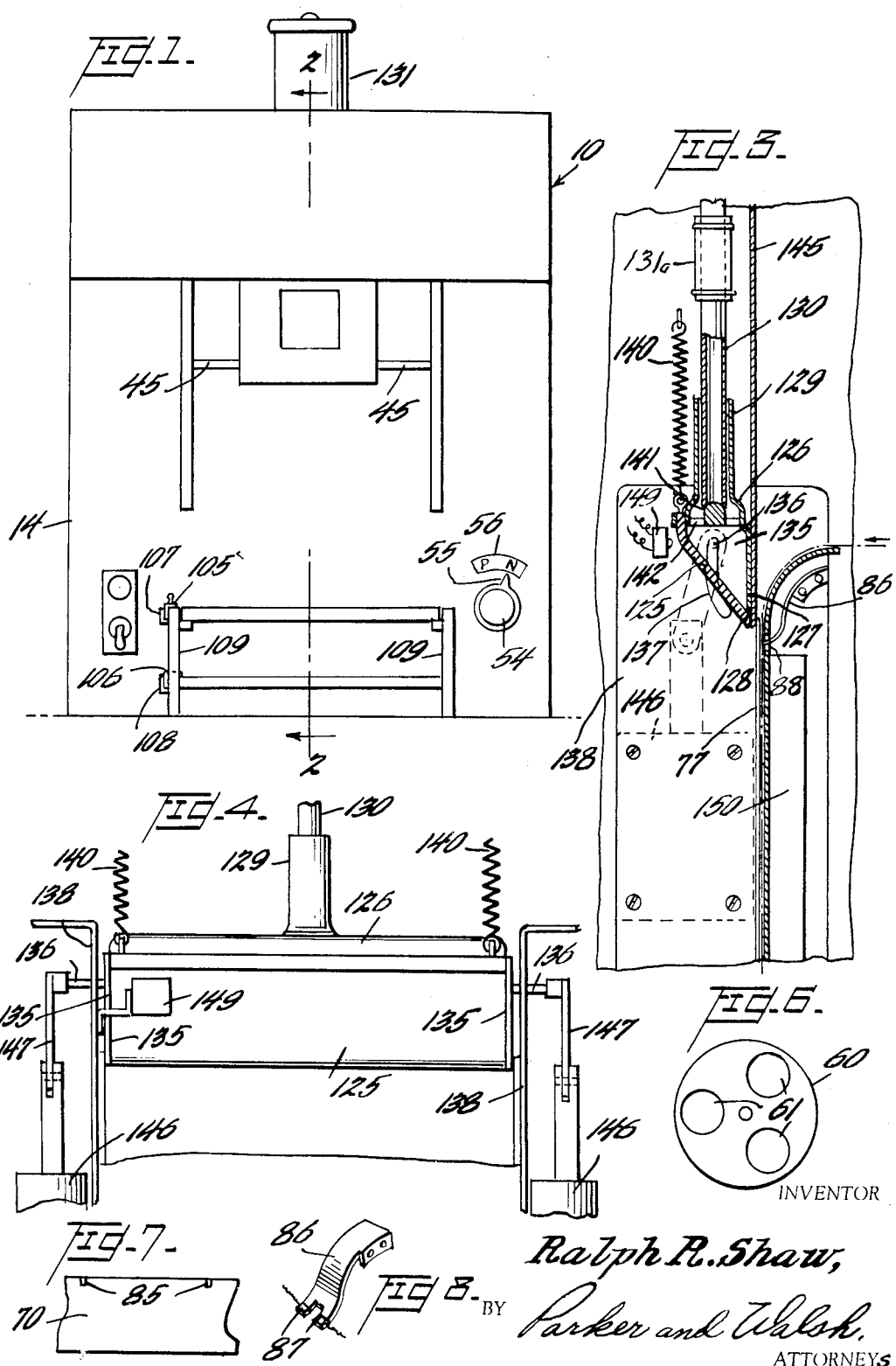
Feb. 21, 1956

R. R. SHAW
PHOTOGRAPHIC APPARATUS

2,735,335

Filed Aug. 15, 1952

3 Sheets-Sheet 1



Ralph R. Shaw,
Parker and Walsh,
ATTORNEYS

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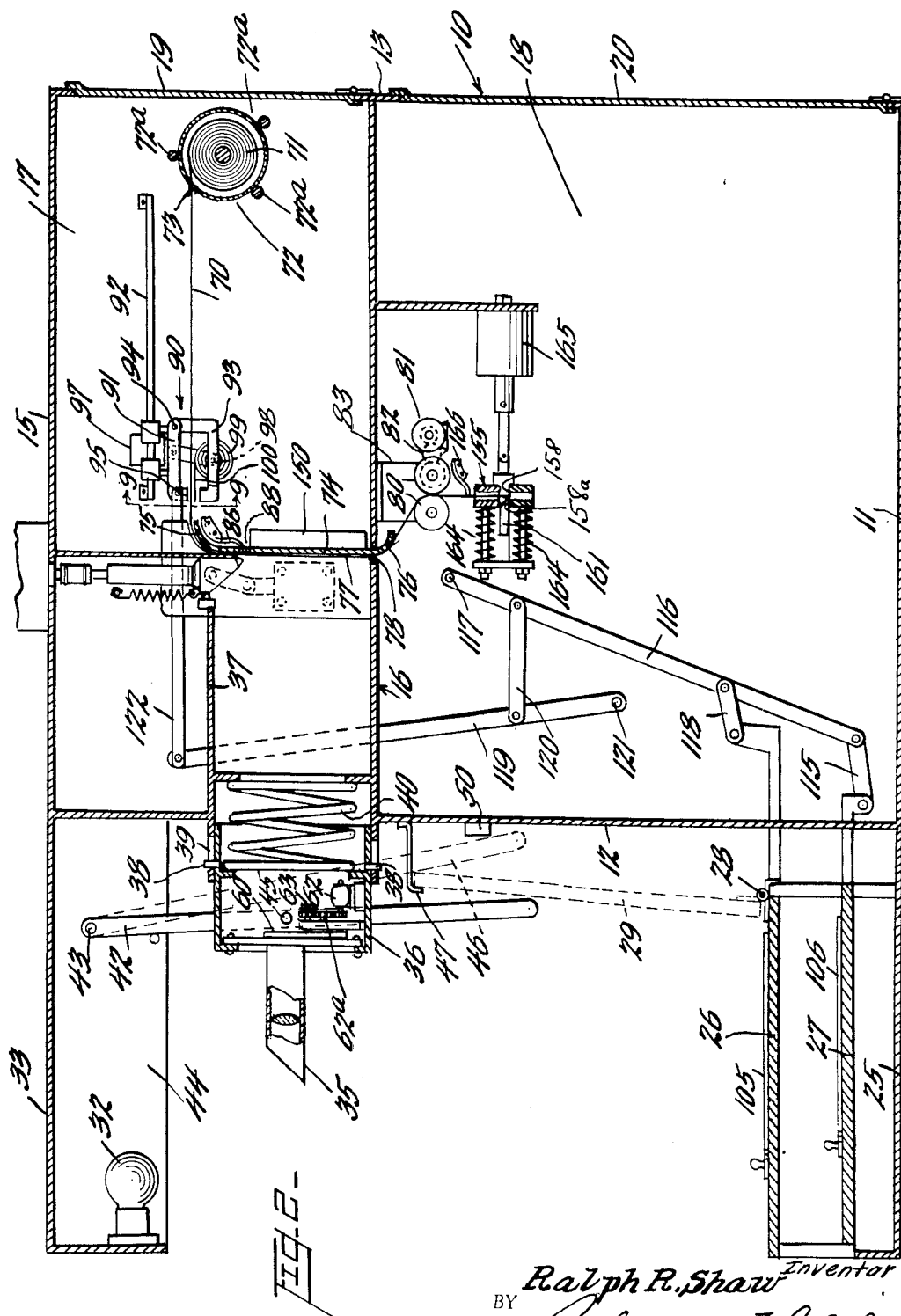
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3 Sheets-Sheet 2



BY *Ralph R. Shaw* ^{Inventor}
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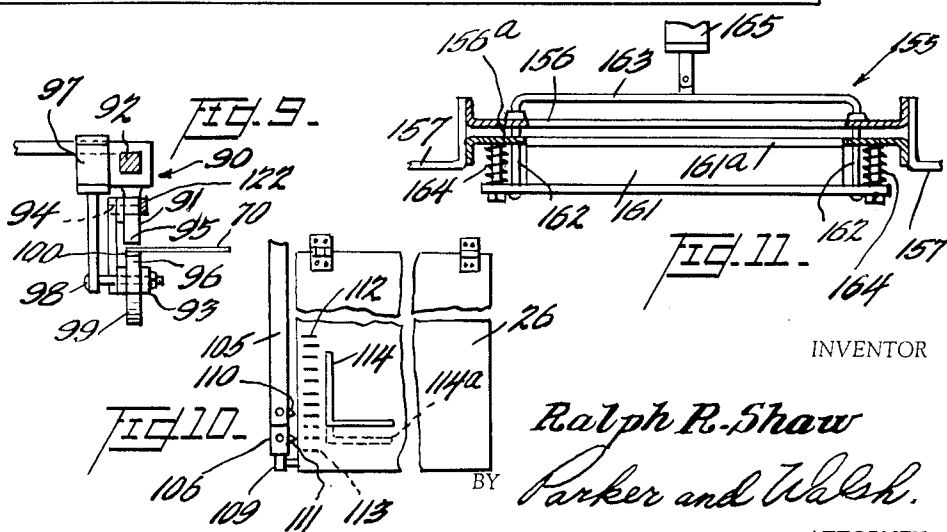
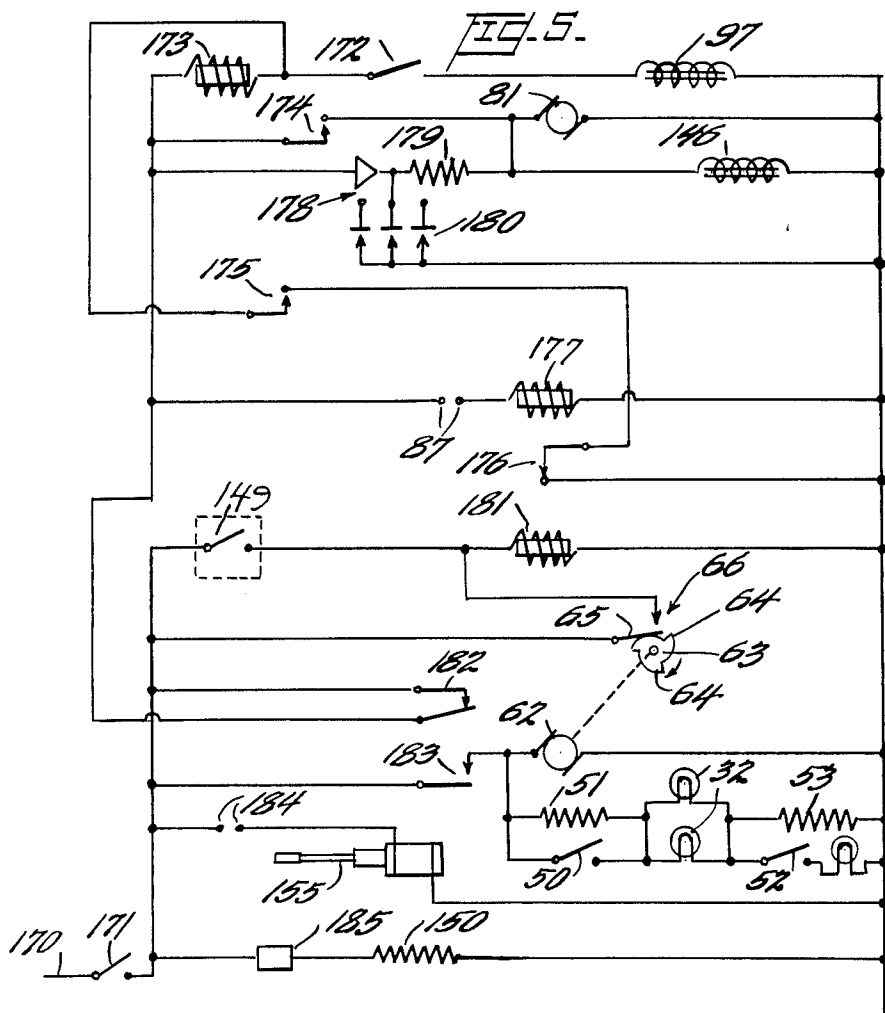
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3 Sheets-Sheet 3



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1

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PHOTOGRAPHIC APPARATUS

Ralph R. Shaw, Washington, D. C.

Application August 15, 1952, Serial No. 304,550

17 Claims. (Cl. 88—24)

This invention relates to photographic apparatus.

An important object of the invention is to improve and simplify photographic apparatus of the type wherein a sensitized strip of standard photographic paper, usually in roll form, is intermittently fed to expose, develop, cut-off and deliver successive portions thereof in the form of finished prints.

Another object of the invention is the provision of apparatus of the indicated type in which a plurality of optionally useable stages are provided for photographing objects and producing prints of the same at various predetermined ratios of size of print to size of object, and wherein means are provided for automatically focusing the camera and simultaneously varying the light intensity in accordance with the particular stage being used.

An auxiliary object of the invention is the provision of manually operable means for further varying the light intensity to compensate for variations in light reflecting characteristics of different objects, for example, negative and positive prints and the like.

A further object of the invention is the provision of apparatus of the indicated type wherein means are provided for infinitely varying the advance of the photographic paper for each successive exposure, and for accurately feeding the exact amount of paper from the roll as predetermined by such means, thereby eliminating the necessity for external programing and avoiding wastage of paper due to slippage of feed rolls and the like.

A still further object of the invention is the provision of apparatus of the indicated type wherein developing of the print is initiated at the time the exposure is made, or slightly before, and is completed before the print leaves the camera for subsequent cutting off.

Another object of the invention is the provision of apparatus of the indicated type wherein means are provided for developing the paper by the simultaneous application of heat and developing solution thereto, the solution being added to the emulsion on the paper in quantities sufficient to develop the same, but insufficient to substantially wet the paper behind the emulsion, thereby eliminating the costly and time-consuming operation of drying the paper as required when it is immersed in a hot developing solution to develop the same.

A further object of the invention is the provision of apparatus of the indicated type wherein the photographic paper is provided with marks, printed thereon or otherwise applied thereto at the time of manufacture or during passage through the machine, for cooperation with suitable sensing devices, such as electrical contacts, photocells, bridge-type selectors and the like, to meter and control the advance of the paper.

A still further object of the invention is the provision of photographic apparatus of the indicated type which will produce copies of any desired length, within the limits of the maximum size of any particular model, and which will process the copies automatically and deliver prints ready to use in approximately fifteen seconds or

2

less, using standard photographic papers instead of water resistant base papers.

These and other objects and advantages of the invention will become more apparent from the following description, taken with the accompanying drawings, wherein:

Figure 1 is a front elevational view of an apparatus constructed in accordance with the invention,

Figure 2 is a vertical cross-sectional view of the apparatus taken on line 2—2 of Figure 1,

Figure 3 is an enlarged vertical cross-sectional view of a portion of the apparatus,

Figure 4 is a front elevational view of the mechanism for applying the stabilizer-developer solution looking from the left in Figure 3,

Figure 5 is a wiring diagram showing the hook-up of the various electrical components of the apparatus,

Figure 6 is a front elevational view of the shutter,

Figure 7 is a plan view of a portion of the paper strip showing the marks applied thereto,

Figure 8 is a perspective view of the sensing device,

Figure 9 is a cross-sectional view of a portion of the apparatus taken on the line 9—9 of Figure 2 and showing the paper marking device in end view,

Figure 10 is a plan view of the stages and associated mechanisms for resetting the marking device, and

Figure 11 is a horizontal cross-sectional view of the paper cutting device.

Referring to the drawings, the numeral 10 designates a casing mounted on a base 11 and comprising front and rear walls 12 and 13, side walls 14, and a top 15. The casing 10 is provided with a horizontal partition 16, secured to the walls thereof in any suitable manner, and forming an upper light-proof exposure chamber 17 and a lower print receiving chamber 18. Doors 19 and 20 are hingedly mounted on the rear wall 13 to permit access to the respective chambers 17 and 18.

The base 11 is provided with a forward extension 25 on which is mounted a plurality of stages 26 and 27 for supporting the matter to be photographed. The upper stage 26 is hinged at its rear end, as at 28, and may be swung upwardly and rearwardly to the broken line position shown at 29 to permit matter to be photographed on the lower stage 27. In the illustrated embodiment of the invention, the upper stage 26 is designed for placement of copy to be photographed at full size, while the lower stage 27 is designed for placement of copy to be photographed at two-thirds of full size. It will be appreciated, of course, that the stages 26 and 27 may be positioned or preset for any desired magnification or reduction and that the figures given are by way of example only.

The stages 26 and 27 are illuminated by one or more lamps 32 mounted in a hooded extension 33 of the top 15. The lamps 32 are connected in a light circuit and means, hereinafter described, are provided for automatically varying the intensity of light in accordance with the particular stage being used.

A lens assembly 35 projects from the front of the casing and is carried by a sleeve 36 having a slidable light-tight connection with a housing 37. The housing 37 is mounted on the horizontal partition 16 and extends through the front wall 12 of the casing, as clearly shown in Figure 2. Sliding movement of the sleeve 36 and lens assembly 35 in the housing 37 is limited by pin and slot connections comprising pins 38, secured to the sleeve 36, and cooperating slots 39 formed in the housing 37. The lens assembly 35 is urged to its extreme forward position by a spring 40 and when so positioned is correctly focused for photographing copy on the upper stage 26.

Means are provided for automatically focusing the camera on the lower stage 27 when the upper stage 26 is swung to the broken line position shown by the numeral

29. Such means consist of levers 42 pivoted at their upper ends, as at 43, to lateral flanges 44 depending from the hooded extension 33, and at their intermediate portions to the sleeve 36, as at 45. The lower ends of the levers 42 extend downwardly into the path of the upper stage 26 for movement thereby to the broken line position shown at 46. The upper stage 26 is retained in the broken line position by a spring catch 47 secured to the front wall 12 of the casing. The levers 42, in turn, are retained in the broken line positions by the stage 26, and when so positioned, the lens assembly 35 which moves rearwardly with the levers 42, is correctly focused on the lower stage 27. It will thus be apparent that the camera is automatically focused on the particular stage being used and that it is impossible to operate the apparatus unless the camera is correctly focused on one stage or the other. For example, if stage 26 is not pushed back far enough to engage the catch 47, the spring 40 causes it to move forwardly and drop to normal position so that the camera comes back to focus on it automatically. Thus the camera is always in focus either at stage 26 or stage 27 and can never be out of focus.

Since the lower stage 27 is somewhat larger and hence reflects more light than the upper stage 26, some adjustment of the apparatus is necessary in order to assure that the effective exposure remains constant regardless of whether light is gathered from the larger surface of 27 or the smaller surface of 26. In accordance with the invention, and as previously indicated, such adjustment is automatically made by the provision of means for varying the light intensity. Such means comprise a microswitch 50 mounted on the front wall 12 of the casing, and connected in the light circuit in parallel with a resistance 51 (see the wiring diagram of Figure 5). The microswitch 50 is positioned in the path of one of the levers 42 for actuation thereby when the same is in its broken line position. When the stage 26 is down, the microswitch 50 is closed and short circuits the resistance 51 for increased illumination. When the stage 26 is moved upwardly and rearwardly to its broken line position, the lever 42 actuates the switch 50 to open same, thereby throwing the resistance 51 into the light circuit and cutting the illumination. The illumination is thus automatically adjusted for the particular stage being used and it is unnecessary to change the time of exposure or the lens aperture to secure the desired uniformity of results.

In photographing objects having different light reflecting characteristics, it will be appreciated, of course, that best results will be obtained if the illumination is adjusted to the particular object being photographed. For example, it requires about 50% more light to photograph a negative than to photograph an original black on white copy. In accordance with the invention, adjustment of the illumination for the particular object being copied is provided by a switch 52 connected in the light circuit in parallel with a resistance 53. The switch 52 is preferably controlled by a knob 54, mounted on the front wall 12 of the casing, and having a pointer 55 cooperating with indicia 56, for example, "P" for positive print and "N" for negative print, to indicate the setting of the switch. Thus when the pointer 55 is positioned opposite the "N" the switch 52 is set to provide the increased illumination necessary for copying a negative print. With such setting the switch 52 will, of course, be closed to short circuit the resistance 53 to provide the increased illumination necessary. When the pointer 55 is opposite the "P" the switch 52 is open and the resistance 53 is in the circuit to decrease the illumination. It will be appreciated, of course, that any desired further variation of illumination may be obtained by the provision of any suitable means for successively cutting in increasing increments of resistance.

Exposure of the photographic paper is controlled by a circular shutter 60, rotatably journaled in the sleeve 36

adjacent the open end of the lens assembly 35, and provided with three equally spaced openings 61 adapted to be brought in successive alignment with the opening in the lens assembly. The shutter 60 is rotated by an electric motor 62 thru suitable gearing 62a. The motor 62 is automatically energized and deenergized during the cycle of operation of the apparatus, as will appear more clearly hereinafter. In this connection, the shaft of the shutter 60 is provided with a cam 63 having three projections 64 thereon (see Figure 5), for engagement with one arm 65 of a switch 66. The purpose of the cam 63 and switch 66 will be described in more detail hereinafter.

The sensitized material 70, which may be ordinary photographic paper since no specially treated paper is required, is fed to the apparatus from a roll 71. The roll is rotatably journaled in the chamber 17 and is preferably enclosed in a square or cylindrical casing or tube 72 having a light excluding slot 73 in the wall thereof through which the sensitized sheet may be withdrawn from the roll. The use of such a casing makes it possible to ship or transport the sensitized sheets in roll form to the user in a container which may be inserted in the apparatus without any danger of accidental exposure. An edge of the sheet projects from the light excluding slot 73 and may be readily drawn out by hand to connect with the operating parts of the apparatus. The apparatus is constructed to hold the container or casing against movement as by rods 72a removably secured to the side walls of the casing and in a position to cooperate with the feeding mechanism of the apparatus. Such construction is well known and hence is not further illustrated or described.

The paper 70 passes horizontally across the chamber 17 to and around a sheet supporting plate 74 having upper and lower curved guiding surfaces or flanges 75 and 76. The plate 74 extends transversely of the chamber 17 for substantially the full width of the paper strip 70 and is supported in position by suitable attachments to the side walls 14 of the casing 10. At opposite side edges thereof, the plate 74 is provided with U-shaped guides 77 for receiving the side edges of the paper strip 70 to guide and hold the same in proper position across the face of the plate. The lower curved edge 76 of the plate 74 extends through a light fast slot 78 in the horizontal partition 16 and serves to guide the paper out of the chamber 17 and into the chamber 18.

The strip of paper 70 is advanced through the apparatus by a pair of rolls 80 driven by an electric motor 81 through a suitable gear train 82. The rollers 80 are rotatably journaled in brackets 83 secured to the partition 16 and the motor 81 and gears 82 are suitably supported and journaled in brackets secured to a side wall 14 of the casing. The operation of the motor 81 is entirely automatic and is controlled during the cycle of operation of the apparatus in a manner to be more fully described hereinafter.

In accordance with the invention, the length or amount of paper advanced is controlled by a suitable sensing device or devices which cooperate with marks on the paper to stop the drive motor 81 when the desired length of paper has been advanced. Such marks are preferably applied to the back of the paper 70 adjacent a side edge thereof, and may be placed thereon at the time of manufacture of the paper or during passage through the apparatus in a manner presently to be described. The marks and cooperating sensing devices may take various forms. For example, in the illustrated embodiment, the marks, herein designated by the numeral 85, may desirably consist of conductive material such as silver ink for cooperation with a contact member 86. The contact member 86 has spaced contacts 87 thereon aligned with the marks on the paper and adapted to be electrically connected by a mark 85 when the same is aligned therewith. For this purpose, the contact members 86 are positioned so that the contacts 87 thereon project through

5

an opening 88 in the plate 74 into engagement with the paper 70.

Alternatively, the marks 85 may consist of opaque marks for cooperation with photo cells. In this event, a photocell is used in place of the contact member 86 and is positioned opposite the opening 88 in the plate 74 for actuation by the mark when it reaches this position. The marks 85 may also consist of resistance marks for use with bridge-type selectors, the arrangement of the sensing device being similar to those previously described.

As previously indicated, the marks 85 may be applied to the paper strip 70 during passage thereof through the apparatus. In general, the mechanism for accomplishing this consists of a mark applying device 90, slidably mounted in the chamber 17 for movement lengthwise adjacent one edge of the strip 70, and manually operable means associated with each of the stages 26 and 27 for adjusting the marking device 90 to a desired position depending on the length of paper required for a particular exposure. The marking device 90 may assume a variety of forms and is shown as consisting of a stationary arm 91, slidably mounted on a squared rod 92, secured to a side wall of the casing, and a movable arm 93 pivotally connected to the stationary arm 91 as at 94. The arms 91 and 93 are provided with opposed hammer portions 95 and 96, positioned on opposite sides of the strips 70 adjacent an edge thereof, and movable toward each other by a solenoid device 97 connected to the movable arm 93 as at 98. The arm 93 carries a roll 99 of strip material 100 which is automatically fed between the hammer portions 95 and 96 beneath the paper 70 in any suitable manner. The strip material 100 is provided with a coating of any suitable conductive material, for example, silver ink, a portion of which is transferred to the strip 70 in the form of a transverse mark 85, whenever the hammer portions 95 and 96 are brought together by actuation of the solenoid device 97.

The marking device 90 may be adjustably positioned at any desired point along the squared supporting rod 92 by manually operable slides 105 and 106, connected with the device 90 by any suitable means such as the system of levers presently to be described. The slides 105 and 106 are slidably mounted in grooved members 107 and 108 secured to an upright 109 mounted on the extension 25 of the base 11, and are positioned adjacent the lateral edges of the upper and lower stages 26 and 27, as clearly shown in Figures 1 and 10. The slides 105 and 106 are provided with pointers 110 and 111 which cooperate with scales 112 and 113. The scales 112 and 113 are positioned on the stages 26 and 27 adjacent the paper guides 114, 114a and are graduated to indicate the amount of paper advanced corresponding to an adjusted position of the marking device 90, as set up by either of the slides 105 and 106.

The slide 106 is connected by a link 115 to the end of a lever 116, pivotally mounted at its opposite end, as at 117, to a wall of the casing. The slide 105 is pivotally connected to an intermediate portion of the lever 116 by a link 118. Under the assumed conditions, namely, where the upper stage 26 is designed for taking pictures in a ratio of 1 to 1 and the lower stage 27 in a ratio of $\frac{2}{3}$ to 1, the point of connection of the slide 105 with the lever 116 should be spaced from the pivot 117 by a distance which is substantially $\frac{2}{3}$ the distance between the pivot 117 and the point of connection of the slide 106 to the lever 116. The lever 116, in turn, is connected to a lever 119 by a link 120. The lever 119 is pivotally mounted on a wall of the casing, as at 121, and is connected to the stationary arm 91 of the marking device by a link 122. It will be apparent from the above description that when either of the slides 105 or 106 is moved the marking device 90 will be correspondingly moved and will assume a position along the supporting rod 92 in accordance with the adjusted positions of the slides. The movement imparted to the marking de-

6

vice for a given displacement of either slide, will, of course, vary depending upon the particular slide which is actuated. This follows because of the different points of connection of the slides with the lever 116 which is necessary to compensate for the variation in the ratio of image size to picture size between the upper and lower stages.

In accordance with the invention, development of the photographic paper is preferably initiated during its advance to exposure position and prior to exposure thereof. As shown more clearly in Figure 4, the apparatus for accomplishing this comprises a scraper or doctor blade 125, preferably formed of rubber or similar material, and secured to one side of an inverted channel-like member 126. The blade 125 is substantially coextensive in width with the paper strip 70, and extends downwardly and rearwardly toward the plate 74. A closure member 127 is secured to and extends downwardly from the opposite side of the inverted channel-like member 126 but stops somewhat short of the blade 125 to provide an elongated discharge opening 128 for the discharge of developing fluid. Substantially centrally thereof the inverted channel-like member 126 is provided with an upwardly extending sleeve 129 which is slidably mounted on a depending pipe or conduit 130 connected with a reservoir 131 for the developing fluid by a flexible connection 131a. The reservoir 131 may desirably be mounted on the top 15 of the casing so that it will be readily accessible for refilling when required.

At opposite sides thereof the inverted channel-like member 126 is provided with downwardly extending end portions 135 carrying pins 136. The pins 136 are slidably mounted in curved slots 137 formed in flanged supports 138 secured to the side walls of the casing. This permits downward movement of the member 126 and plate 125 for a purpose to be described.

The member 126 is held in its upper inoperative position by springs 140 and carries a valve member 141, which serves to close the end of the conduit 130, when the member 126 is so positioned. The valve member 141 is supported by the spider 142 secured in the mouth of the inverted channel member 126.

In the upper position of the inverted channel-like member 126 the elongated discharge opening or slot 128 is positioned against and adjacent the lower edge of an aperture plate 145. The aperture plate 145 depends from the top of the casing and extends transversely thereof between the opposite side walls to define the upper edge of the exposure aperture.

The member 126 and associated parts are moved downwardly to operative position by solenoid devices 146 mounted on the brackets 138 and connected to the pins 136 by links 147. When the member 126 and associated parts move downwardly in response to energization of the solenoids 146 the cooperating pins 136 and slots 137 cause the blade 125 to move into engagement with the strip of paper 70 as it advances downwardly over the plate 74. Simultaneously with such downward movement the valve 141 moves away from the end of the conduit 130 permitting developing fluid to flow onto the blade 125 and downwardly through the discharge opening 128 onto the paper. The developing fluid is applied to the paper as long as it continues to advance. When the paper is stopped the solenoids 146 are simultaneously de-energized and the spring 140 pulls the member 126 and associated parts upwardly to discontinue the application of the developing solution to the paper.

In its upward movement the member 126 engages a momentary contact switch 149 and closes same momentarily to complete a circuit for a purpose later described. The member 126 also engages the switch 149 during its downward movement but does not close same since it is designed to be closed on alternate actuations only, namely, when the member 126 moves upwardly to its inoperative position.

In accordance with the invention, the developing fluid

is at normal atmospheric temperature when applied to the paper. This is a departure from prior practice wherein high-speed developing is generally accomplished by the use of hot solutions. A further departure consists in the application of heat to the paper itself which not only assists and speeds up the developing action, but in addition, also assists in preventing the paper from becoming wet and saturated with developing fluid. In fact, it has been found that with the present arrangement for applying the developing solution and simultaneously heating the paper, the paper does not become wet but only slightly damp.

While various heating devices may be used, it has been found that an electric heating element 150, secured to the plate 74 in any suitable manner, functions very satisfactorily. The heating element 150 is connected in the electrical circuit of the apparatus and is normally in operation whenever the main switch for the apparatus is closed. The heating element 150 is controlled by a thermostat 185 which may be adjusted to regulate the amount of heat supplied.

The cutting device 155 preferably comprises spaced jaws 156 and 156a between which the strip of paper passes, these jaws being secured in fixed positions by brackets 157 mounted on the side walls of the casing. The jaws 156 and 156a are provided with elongated slots 158 and 158a which are slightly longer than the width of the strip and in which a cutting knife 161 having a cutting edge 161a is adapted to reciprocate to cut the strip of paper. The cutting knife 161 is carried by the arms 162 of a yoke-shaped member 163 slidably mounted in suitable openings in the fixed jaws 156 and 156a. The cutting knife 161 is urged to a retracted inoperative position by springs 164 positioned between the fixed jaw 156a and the base of the cutting knife and adapted to be compressed when the latter is actuated.

The cutting knife 161 is actuated by a solenoid device 165 connected to the yoke member 163. The solenoid device in turn is actuated by a sensing device 166, similar to the sensing device 86 previously described, and positioned closely adjacent the cutting mechanism. In operation, when a mark 85 on the strip of paper 70 is positioned opposite the sensing device 166, the circuit to the solenoid device 165 is completed which causes actuation thereof to cut the paper. By virtue of this arrangement, the paper is accurately and correctly cut to the proper length.

Operation

The operation of the apparatus will best be understood following a consideration of the wiring diagram shown in Figure 5. In this diagram the numeral 170 denotes a power line for supplying A. C. current to the apparatus from any suitable source. This line is provided with a main switch 171 to control the supply of current to the apparatus.

Referring to the top of the diagram the numeral 172 denotes a switch, preferably foot operated, which is adapted to be momentarily closed to initiate a cycle of operation. Closure of the switch 172 actuates the solenoid device 97 of the marking device 90 and also actuates a relay 173 having contacts 174 and 175. Contact 174 controls the motor 81 for driving the rolls 80 and the solenoids 146 for actuating the mechanism for applying the developing solution to the paper. The contact 175 is part of a holding circuit which also includes the normally closed contact 176 of a relay 177 and serves to hold the circuit to the motor 81 and solenoid 146 after the switch 172 is opened. The numeral 178 denotes a rectifier circuit, including a resistor 179 and condensers 180, which is designed to act as a dynamic brake on the drive motor 81 when the AC current thereto is cut off.

The numeral 149 denotes a momentary contact switch of the type which is momentarily closed on alternate actuations. It is momentarily closed when the mecha-

nism for supplying the developing solution returns to its upper normal position and actuates a relay 181 having a normally closed contact 182 and a normally open contact 183. Actuation of the relay 181 causes the normally closed contact 182 to open thus breaking the circuit through the motor 81 and solenoids 146 and the normally open contact 183 to close thus completing the circuit to the shutter drive motor 62 and the lights 32.

The numeral 155 designates the cutting device for the paper which is rendered operative when the contacts 184 of the sensing device 166 are bridged by a mark on the paper.

The numeral 150 designates the heating element which is rendered operative whenever the main switch 171 is closed. A thermostat 185 is provided for regulating the heating element.

To render the apparatus operative it is, of course, necessary that a strip of photographic paper be in place as shown in Figure 2. This is very easily accomplished by opening the doors 19 and 20, inserting a roll of photographic paper in the chamber 17 and then pulling the paper from the roll and threading it between the hammers 95 and 96 of the marking device, around the plate 74, and between the rolls 80. The doors 19 and 20 are then closed and the device is ready to be used.

To better illustrate the operation of the device, let us assume that it is desired to photograph an object of the maximum size which the lower stage 27 is designed to handle and at a ratio of $\frac{3}{4}$ to 1. Let us further assume that the various parts of the apparatus occupy the positions shown in Figure 2. Since the object to be photographed must be placed on the lower stage 27 the upper stage 26 is swung rearwardly and upwardly to the broken line position 29 until it is engaged and held by the spring catch 47. This moves the levers 42 and the lens assembly 35 rearwardly and automatically focuses the camera on the lower stage 27.

The object to be photographed is then placed on the lower stage 27 in the proper position as determined by the guide members 114a and the slide 106 moved rearwardly or inwardly toward the camera to its extreme position at the end of the scale 113. This moves the marking device 90 rearwardly or to the right, as shown in Figure 2, to a position in which a mark subsequently to be applied to the paper thereby is spaced from the sensing device 86 a distance, measured along the paper, which is two-thirds of the dimension of the object to be photographed measured from front to rear of stage 27. The switch 172 is then actuated to initiate the cycle of operations. It is assumed, of course, that the main switch 171 has been previously closed and that the heating element 150 has reached the desired temperature.

Closure of the switch 172 completes the circuit through the solenoid device 97 of the marking device 90 and actuates the movable arm 93 thereof to place a mark on the paper. Since closure of the switch 172 is only momentary the solenoid 97 is immediately deenergized to release the paper for movement as hereinafter described.

Closure of the switch 172 also energizes the relay 173 which closes the contacts 174 and 175. Closure of the contact 174 energizes the motor 81 and simultaneously energizes the solenoid 146. The motor 81 drives the rolls 80 and the latter in turn advance the paper through the machine. Simultaneously with such initiation of the movement of the strip 70 the solenoid 146 moves the inverted channel-shape member 126 downwardly which by virtue of the pin and slot connections 136 and 137 moves the blade 125 downwardly into contact with the paper. At the same time, the valve 141 moves away from the end of the conduit 130 to permit developing solution to be discharged downwardly on the blade 125. Such solution moves downwardly and laterally across

the blade 125 through the discharge opening 128 and onto the paper. The solution tends to build up slightly above the discharge opening 128 thus insuring adequate distribution across the full width of the paper. As the paper moves downwardly across the plate 74 past the edge of the blade 125, the developing solution is uniformly applied thereto and spread thereon in quantities sufficient to react with the emulsion but insufficient to substantially dampen or wet the paper.

The developing solution is applied to the paper as long as it continues to advance. It is applied at normal atmospheric temperatures and by gravity flow thereby eliminating the necessity for pumping a hot developing solution throughout the apparatus.

As the paper passes downwardly over the plate 74 it is subjected to heat from the heating element 150. Such heating assists in developing the emulsion and further assists in maintaining the paper itself in a comparatively dry state. This eliminates the necessity for any subsequent drying of the paper with the result that the print is substantially dry and ready for use as soon as it passes from the chamber 17 and is cut off by the cutting device 155.

The paper strip 70 continues to advance until the mark 85 applied thereto by the marking device 90 moves into engagement with the spaced contacts 87 on the sensing device 86. This completes the circuit to the relay 177 (see Figure 5) causing the normally closed contact 176 thereof to open and break the circuit through the relay 173. The contacts 174 and 175 of the relay 173 are thereupon immediately opened thereby breaking the circuits to the motor 81 and the solenoids 146. As soon as the contact 174 is opened the rectifier 178 exerts a dynamic braking action on the motor 81 to stop the same almost instantly and avoid any over-run of the paper strip.

When the circuits to the solenoids 146 are broken the spring 140 returns the developing solution applying mechanism to its upper inoperative position with the discharge opening 128 positioned against and adjacent the lower end of the aperture plate 145. Simultaneously therewith the valve 141 moves into engagement with the lower end of the conduit 130 to cut off the flow of developing solution. During the return movement of the developing solution applying mechanism the blade 125 moves upwardly along the paper and spreads developing solution evenly therealong.

During its return movement, the developing solution applying mechanism engages the momentary contact switch 149 and closes the same to complete the circuit through the relay 181. This causes the normally closed contact 182 thereof to open so that the circuit to the motor 81 and solenoid 146 cannot be completed during the subsequent phase of the cycle of operations. Actuation of the relay 181 also causes the normally open contact 183 thereof to close and complete the circuit through the shutter drive motor 62 and the lights 32.

As soon as the shutter drive motor 62 begins to operate it rotates the cam 63 which by virtue of the cam surface 64 immediately moves the arm 65 of the switch 66 to closed position to hold the circuit to the motor 62 and lights 32 after the momentary contact switch 149 is released. The cam surface 64 is designed to hold the switch 66 closed until the motor 62 has rotated the shutter through one-third of a revolution. This moves one of the openings in the shutter across the open inner end of the lens assembly to expose the portion of the paper which has just been advanced into position over the plate 74. When the shutter completes a third of a revolution the arm 65 of the switch 66 drops into a low portion of the cam 63 thereby opening the switch 66 and breaking the circuit to the relay 181. This causes the contact 183 to return to its normal open position, thereby breaking the circuit to the motor 62 and lights 32, and the contact 182 to its normally closed position,

thereby placing the apparatus in condition for another cycle of operation.

Let us now assume that the second object to be photographed is a negative print and that a full size reproduction is desired. Let us further assume that such object is about half the maximum size which the upper stage 26 is designed to photograph. Upon completion of the previously described cycle of operations, the stage 26 is released from the catch 47 and lowered from its broken line position to its full line position shown in Figure 2. This permits the switch 50 to close, thereby short circuiting the resistance 51 for increased illumination and releases the levers 42 so that the spring 40 moves the lens assembly 35 outwardly until the stops 38 engage the ends of the slots 39. This automatically brings the lens assembly of the camera into focus on the upper stage 26.

The object to be photographed is then placed on the stage 26 in a position such that it is centered transversely thereof with its outer or forward edge aligned with the outer or forward guide member 114 on the stage. The slide 105 is then moved to the right or left, as the case may be, until the pointer 110 thereof is midway of the scale and substantially opposite the rear edge of the object to be photographed. This causes the marking device 90 to assume a position such that the paper may be subsequently marked at the proper point to advance the correct amount of paper. The knob 54 (Figure 1) is then turned to position the pointer 55 thereof opposite the "N" on the indicia 56. This closes the switch 52, thereby short circuiting the resistance 53, and increasing the illumination to the extent required to photograph a negative print. The switch 172 is then momentarily closed to initiate the cycle of operations described hereinabove.

In the meantime, development of the previously exposed portion of the paper, which was initiated prior to exposure thereof, has been substantially completed and, when the switch 172 is actuated to initiate a new cycle of operations, this portion of the strip passes out of the compartment 17 through the light tight opening 78 and between the rolls 80 from which it passes to the cutting device 155. As the mark 85, which has previously been applied, passes the sensing device 166, it bridges the contacts 184 thereof and completes the circuit to the solenoid 165. This actuates the cutter to cut the paper at the exact point as determined by the mark 85 thereon. The severed portion of the paper then falls to the bottom of the compartment 18 in a developed and dry condition, ready for use. The finished prints may be withdrawn from the compartment 18 through the hinged door 20.

It will thus be seen that the present invention provides a simplified and improved photographic apparatus for intermittently feeding, exposing, and processing successive portions of a strip of photographic paper and delivering the same developed and dried in a condition ready for use. The apparatus may be used for photographing objects at any desired size ratio, as determined by the settings of the upper and lower stages 26 and 27, and the camera is automatically focused on the particular stage selected for use. Hence the camera is always correctly focused and the necessity of manual adjustment with attendant possibilities of error are eliminated. In addition, the correct amount of illumination is automatically supplied for whatever stage is being used, thereby making it unnecessary to change the time of exposure or the lens aperture. The amount of illumination may further be varied manually, if desired, to compensate for differences in light reflecting characteristics of various objects to be photographed.

The apparatus operates quite satisfactorily with standard photographic papers and does not require the use of specially treated papers, for example, water-proof papers. The amount of paper advanced in each succes-

11.

sive operation may be accurately determined to fit the particular size ratio desired and the size of the object being photographed, and the correct amount of paper so predetermined will always be advanced regardless of slippage of the paper drive rollers. This insures great flexibility in the operation of the apparatus, reduces to a minimum any wastage of paper, and eliminates the necessity for trimming prints to the desired size (i. e. for filing in 3-inch by 5-inch trays, etc.).

The apparatus greatly speeds up the processing of the paper by (1) initiating the developing and stabilizing of the emulsion prior to exposure, (2) applying only sufficient developing solution to develop the emulsion but insufficient to substantially dampen or wet the paper behind the emulsion, (3) and applying sufficient heat to speed up the developing of the emulsion and the drying of the paper without damaging the same. The developing and stabilizing solutions are applied in a cool as distinguished from a hot state, and need not be mixed until just prior to use. This eliminates the necessity of maintaining mixtures of stabilizer-developer solutions which have a very short shelf life and break down exceedingly fast when kept hot.

The apparatus cuts off the paper at the exact point required as determined by the marks applied thereto and the cooperating sensing device. As previously indicated, the sensing devices may take a variety of forms and the marks, of course, may likewise take a variety of forms for specific cooperation with different types of sensing devices. It is not intended, therefore, that the invention be limited to any particular type of marks or sensing devices as long as they perform the same or equivalent functions in the apparatus.

While it is preferred to apply the marks 85 to the photographic paper during its passage through the machine, the invention is not limited thereto, since such marks could be applied at the time of manufacture. This would, of course, involve advance program planning and would lack the flexibility of the preferred embodiment. Marks placed on the paper at the time of manufacture may be aligned lengthwise of the same in a single column and spaced apart as desired. Somewhat greater flexibility may be obtained if the marks are arranged on the paper in a plurality of columns extending longitudinally thereof, the marks in the various columns being spaced apart at graduated and different distances. With this type of arrangement it would be necessary to employ a plurality of sensing devices, arranged transversely of the paper and in alignment with the various columns, and to selectively control such sensing devices by a switch or switches operative to selectively connect the desired sensing device into the circuit for actuation by the marks of a particular column.

While a specific embodiment of the invention has been disclosed, the invention is not to be construed as limited to the specific details illustrated and described, except as included in the following claims.

I claim:

1. Photographic apparatus comprising a camera body, a stage associated with said camera body for supporting an object to be photographed at a predetermined ratio of size of image to size of object, a camera associated with said camera body including a movable lens assembly and means for moving an image receptive strip in the appropriate plane therewithin, a second stage associated with said camera body for supporting an object to be photographed at a different ratio of size of image to size of object, said second stage being disposed intermediate said first stage and said lens assembly and said lens assembly normally being focused on said second stage, means mounting said second stage for movement away from its position between the lens assembly and first stage to expose the latter to the lens assembly, and means engageable by the second stage only when it is so moved to automatically focus the lens assembly on the first stage.

12

2. Photographic apparatus comprising a camera body, a plurality of stages associated with said camera body for supporting objects to be photographed at different ratios of size of image to size of object, a lens assembly movably mounted on said camera body and normally focused on one of said stages, means mounting said one stage for swinging movement to expose another of said stages to said lens assembly, and means engageable by said one stage only when it is so moved to automatically focus the lens assembly on said other stage.

3. Photographic apparatus comprising a camera body, a pair of stages mounted on said camera body for supporting objects to be photographed, a camera mounted on said camera body and including a lens assembly normally focused on one of said stages, means mounting said one stage for swinging movement about one edge thereof to expose the other stage to the lens assembly, and means engageable by said one stage only when it is so swung to automatically focus said lens assembly on the other of said stages.

4. Photographic apparatus comprising a camera body, a camera including a lens assembly slidably mounted in said camera body, a plurality of stages mounted on said camera body for supporting objects to be photographed, resilient means urging said lens assembly to a position in which it is focused on one of said stages, means mounting said one stage for upward and rearward swinging movement to expose another stage to the lens assembly, a lever pivotally connected to said camera body and said lens assembly and having a portion thereof projecting downwardly into the path of said one stage for movement thereby to focus said lens assembly on said other stage, and means retaining said one stage in its upward and rearward position.

5. Photographic apparatus comprising a camera body, a pair of stages mounted on said camera body for supporting objects to be photographed, illuminating means for said stages, a lens assembly mounted on said camera body and normally focused on one of said stages, means mounting said one stage for movement to expose the other stage to said lens assembly, and means operable by said one stage during movement thereof to automatically focus the lens assembly on said other stage and to vary the illumination supplied to said other stage.

6. Photographic apparatus comprising a camera body, a pair of stages mounted on said camera body for supporting objects to be photographed, illuminating means for said stages, said illuminating means being set to provide a predetermined amount of illumination for one of said stages, means mounting said one stage for swinging movement to expose a second stage, and means operative by said one stage during such swinging movement thereof to vary the illumination supplied to said second stage.

7. Photographic apparatus comprising a camera body, means for intermittently advancing a sheet of photographic paper through the camera body for successively exposing predetermined portions thereof, means located within the camera body, adjacent the paper for applying marks to said paper, means outside the camera body for actuating the marking device to thereby determine the portion of the paper to be exposed, and switching means rendered operative by the mark on the paper to bring about the exposure of the predetermined portion.

8. Photographic apparatus comprising a camera body, means for intermittently advancing a strip of photographic paper through the camera body for exposing successive portions thereof, means for metering each successive advance of the paper comprising a marking device within the camera body for applying a mark to the paper after each successive advance thereof, means for adjusting the marking device to vary the position of the mark applied thereto to predetermine the amount of the next advance, and switching means made operative by the succession of

13

marks for causing the starting and stopping of the advancing mechanism.

9. Photographic apparatus comprising a camera body, a stage associated with said camera body for supporting an object to be photographed, means for intermittently advancing a strip of sensitized paper through the camera body for photographing objects on said stage, a marking device mounted in said camera body and operable from without said body to apply a mark to said paper after each successive advance thereof, manually operable means associated with said stage for varying the position of said mark applying means as required by the size of the object to be photographed, and means rendered operable by said mark during advance of the paper to stop the advancing means after it has advanced the distance determined by said manually operative means.

10. Photographic apparatus comprising a camera body, an exposure chamber in the camera body having an exposure position for a sheet of sensitized material, means for intermittently advancing the sheet of sensitized material to exposure position, means for selectively predetermining the amount of each such advance including manually adjustable means adapted to apply a mark to the sheet of sensitized material at a selected position thereon, means rendered operative by such a mark during advance of the sheet to stop the advancing means, and means for exposing each successive portion of the sheet in exposure position between each advance thereof.

11. Photographic apparatus comprising a camera body, a plurality of stages associated with said camera body for supporting objects to be photographed, a lens assembly mounted on said camera body, means automatically operative to focus the lens assembly on a particular stage selected for use, an exposure chamber in said camera body for supporting a strip of sensitized material in exposure position, means for intermittently advancing the strip of sensitized material to exposure position, and means for controlling the amount of each successive advance of the sensitized material said controlling means including graduated markings, including a principal reference mark on each of said stages, means within the camera body for applying a mark to the strip outside the image receiving portion thereof, manually operable means associating each respective stage with the marking means in such manner that the operation of the associating means in accordance with the graduated markings will actuate the marking means to measure a portion of the sensitized material proportionate to the location of the associating means on the stage, and a sensing device within the camera body for detecting the mark on the sensitized material to stop the advance of the strip after the advance has been initiated.

12. Photographic apparatus of the type set forth in claim 11 in which the means on said sheet of sensitized material cooperating with said sensing means comprises a mark formed of conductive material.

13. Photographic apparatus comprising a camera body, a pair of stages mounted on said camera body for supporting objects to be photographed, illuminating means for said stages, said illuminating means being set to provide a predetermined amount of illumination for one of said stages, means mounting said one stage for swinging movement to expose a second stage, means operative

14

by said one stage during such swinging movement thereof to vary the illumination supplied to said second stage, and manually operated means for further varying the illumination supplied to the stages in accordance with the light reflecting characteristics of the object to be photographed.

14. Photographic apparatus including a camera body, means for passing an elongated strip of sensitized material through said body in a series of intermittent exposures, means within said body for exposing and developing said material, means within the body for marking the strip outside the area to be exposed, means outside the body for supporting objects of variable dimension, in the direction corresponding to the direction of travel of the strip, means associated with the support for locating in terms of the length of copy to be photographed, the point at which the strip is to be marked, and switching means responsive to the presence of the marks for controlling the advancement, of the strip whereby variable dimension copy can be photographed without advance programming.

15. The structure of claim 14 including means for cutting off the printed strip, switching means for actuating the cutter, said switching means being responsive to the presence of said marks.

16. Photographic apparatus comprising a camera having an exposure position, means for intermittently advancing a strip of sensitized material in said camera to bring successive portions thereof to exposure position, means capable of being positioned adjacent said exposure position for continuously applying a developing solution to said material as it advances past the solution applying point, manually operable means for simultaneously initiating operation of said advancing means and bringing said developing solution applying means into solution applying position, whereby developing solution is applied continuously to said strip of sensitized material during movement thereof to exposure position, means for moving said developing solution applying means to an inoperative position when a predetermined portion of said strip of sensitized material has been advanced to exposure position, means for exposing the portion of said strip of sensitized material which has been moved to exposure position, and means actuated by said developing solution applying means during movement thereof to inoperative position for initiating operation of said exposing means.

17. Photographic apparatus of the type set forth in claim 26 including means to prevent operation of said advancing means while said exposing means is in operation.

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