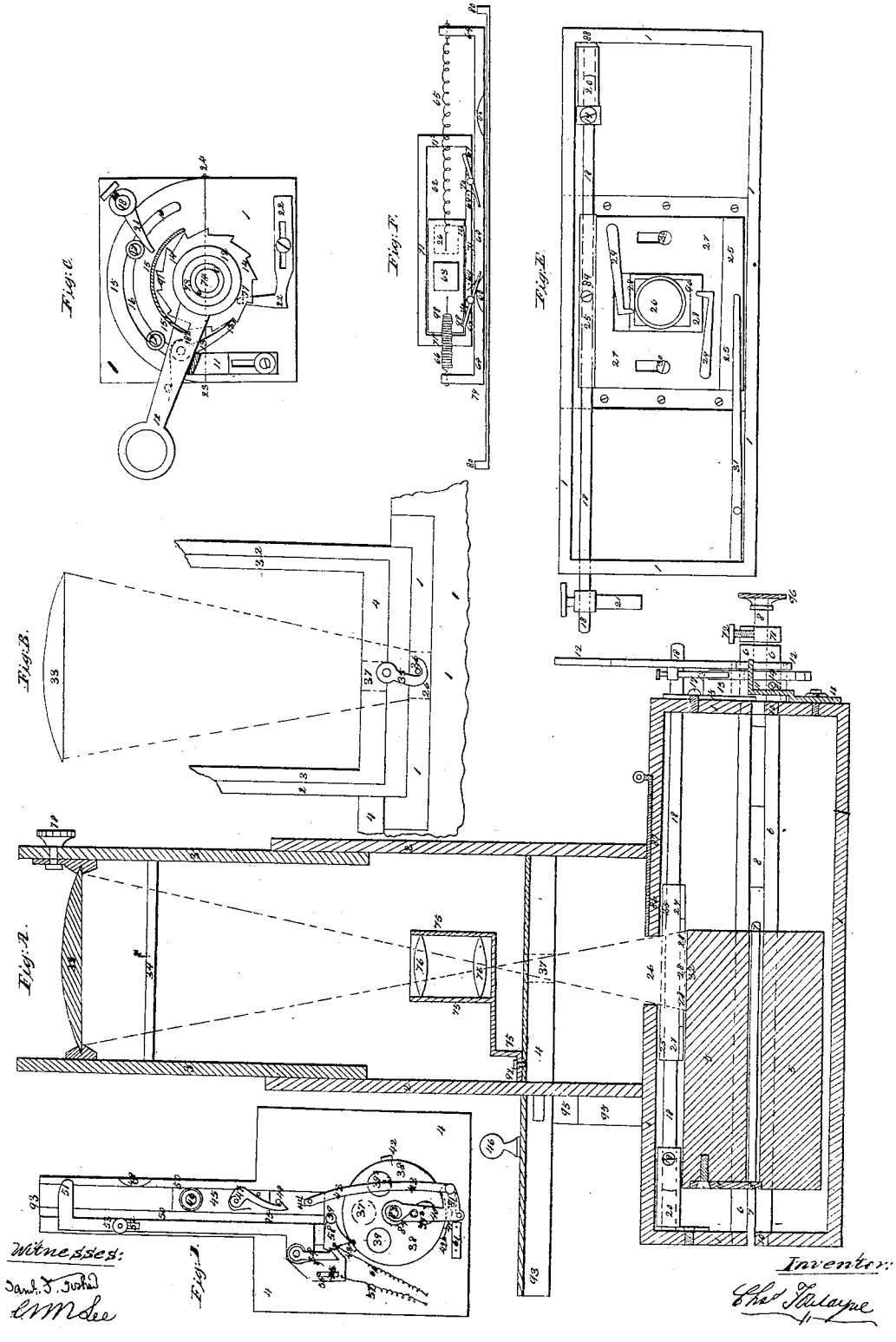
C. FONTAYNE.

PHOTOGRAPHIC PRINTING.

No. 25,540. Patented Sept. 20, 1859.



UNITED STATES PATENT OFFICE.

CHARLES FONTAYNE, OF CINCINNATI, OHIO.

PHOTOGRAPHIC-PRINTING MACHINE.

Specification of Letters Patent No. 25,540, dated September 20, 1859.

To all whom it may concern:

Be it known that I, CHARLES FONTAYNE, of the city of Cincinnati, Hamilton county, Ohio, have invented a new and useful Machine for Rapid Photographic Printing, of which the following specification contains a full, clear, and exact description, reference being had to the accompanying drawings, in which like figures represent like parts of my invention.

Photographic impressions are commonly printed in two ways. First, the prepared material is exposed to light until the impression is fully made; or, second, it is so exposed until an invisible or latent impression has been made which is afterward fully revealed to the eye or developed by chemical means. I shall call the first method "Printing by the direct action of light;" the second method, "Printing by development."

Printing by direct action of light, by the method in use before my invention is comparatively a very slow process, requiring considerable time to perform the necessary manipulations, such as the removal and replacing of the "negative" or glass matrix, the adjustment of springs and other portions of the apparatus, and the length of time required to obtain a good impression, varying as it does from five to twenty minutes of strong sun-light. There is also a waste of marginal material, and a want of uniformity in the results as the judgment of the operator is the only guide as to the length of time to be allowed for each exposure.

Printing by development, is not much practiced, because of the great difficulty in determining the proper length of time for exposure. In this process the action of light is usually very rapid, and there is nothing very definite, by which the eye can fully determine the proper duration of the printing process. Where very sensitive surfaces are used in photographic processes, their exposure by hand to the light, for periods of time varying from seconds to halves, quarters or eighths of seconds, is difficult if not impossible; and yet, to surfaces of this character, these divisions of time bear the same relation that ten, five, two and a half or one and a quarter minutes, do, to less sensitive materials used in slower processes, and the one must be as accurately measured as the other to secure a successful result in the practice of the photographic art.

For the purpose of obviating these, and many other difficulties not mentioned; the accurate movements of machinery combined with the known and applied principles of optics, have been substituted, in my invention, for the uncertain process of hand printing; and the result is the production of photographic pictures with a certainty and a rapidity hitherto unknown.

In general terms, my invention consists in confining, in a dark chamber, or space, or camera obscura, the photographic material prepared to receive the impressions, and causing, by mechanical means, every part of its surface to traverse an aperture through which the light or photographic impression is received, this light being admitted and shut off by a perforated, straight, sliding, or circular revolving disk, which passes over another disk having a similar opening, and whose rebound or momentum is overcome by spring checks, this moving disk being so constructed as always to move at a uniform rate, which rate can be made faster or slower by means of springs, as desired. A condensing lens or lenses, is applied, when required to increase or diminish the intensity or quantity of light required to produce the pictures with certainty or rapidity.

In the drawings, Figure A is a general, longitudinal, sectional view of the instrument showing all its parts as arranged for photographic printing, or taking photographic impressions, either larger or smaller than the negative employed. The tube containing the condensing lens is extended, and the bed (upon which rests the sliding or revolving disk for admitting and shutting off the light,) with the lenses attached to it, is elevated for the purpose of obtaining the proper distance between the sensitive material upon which the impression is to be made, and the lenses which are used for producing pictures differing in dimensions from the negative used as a matrix. Fig. B, is a sectional view of the tubes arranged for printing pictures the same size as the negative, which is now brought in close contact with the sensitive material during their exposure to the light. To effect this the bed with the sliding or revolving disk is lowered, until it rests upon or near the box containing the sensitive material. The lenses and tube attached to this bed, are removed, leaving only the larger tubes containing the condensing

lens. Fig. D, exhibits the bed upon which is placed the revolving or sliding disk by which the light is admitted and shut off. Fig. F, represents a straight sliding disk for the same purpose. Fig. C, is an end view of the box 1, showing the lever and ratchet by which the roller upon which the sensitive material is placed, is moved, together with the lever for bringing the glass negative in close contact with the sensitive material. Fig. E, represents the inside of the top of the box 1, arranged with springs and bed to hold, slots to shift and lever and rod to press the glass negative from which impressions are taken.

In Fig. A, 1, 1, 1, 1, is a box so made as to exclude all light, and opening below its center upon hinges (23 and 24 Fig. C). Over the middle of this box the center of the tube 2, 2, is placed, the two being attached by the hooks and pins shown in Fig. B, 35 and 36. In this tube is a longitudinal opening to permit the arm 93 of the bed 4 to slide up and down, the portion of the opening not occupied by the arm being closed by two wedges 94, 95 or by other means, so as to exclude light. 3 is a second tube sliding in 2 and carrying a condensing lens 33 and the glass negative picture 34. 4 is the bed carrying the sliding or revolving disk (Figs. D, and F) which admits and shuts off the light. 5, 5, is a roller covered by some soft material, upon which is placed the sensitive substance which is to receive the impressions, which must be attached to it by some suitable fastening. The surface of the roller may be circular, if the negative is so small that by pressure both surfaces can be brought fully in contact, if not then the roller must be a prism of any number of sides of suitable size. Its length should not vary much from one half of the length of the inside of the box 1. 6, 6, 6, is a hollow iron shaft revolving on the journals 10, 10, slotted as at 7, 7, for half of its length within the box. Passing through this shaft is a gage rod 8, 8, 8, whose end screws into nut 9 which is firmly screwed to roller 5. 11, 11, is a slotted stop, the upper lip of which is bent so as to stop the lever 12, 12, and gage the distance which it moves. The bend just above the slot permits the side of the shield 15 to move when required. The lever 12 by means of the spring-catch 13 attached to it, moves the ratchet wheel 14 and with it the hollow shaft, the gage rod and roller. It is also used to press down the lever 21. 15 is a shield, part of which projects at right angles over ratchet 14, adjustable by means of slot 16 and screw 17, 17. 18, 18, 18 is a rod with revolving bearing 20 and set screws 19 to adjust its position. 25, 26, 27 and 28 are explained under Fig. F. 32 shows the end of the roller 5 covered with the sensitive material adjusted to receive the first print or impression. 46 is a handle by which the slide 45 may be moved. 71 and 72 represent a gage and screw on the rod 8, by which the distance to which the roller is drawn forward or backward on the hollow shaft may be determined.

75, 75, 75, is the tube and support the lenses 76, 76, attached by screw 92 to the bed 4. 81 is a set screw to the ratchet 14 on the hollow shaft 6. 86 is a slide with its handle 87 by which the opening 26 may be closed; 94, 95, wedges to close the slotted space in the tube 2 under the arm 93. 96 is a knot to rod 8. 33 is the condensing lens, which in order to obtain the proper distance for its adjustment, slides in the upper tube 3, 3, being fixed by the screw 78 which moves up and down in slots in the tubes 2 and 3.

Fig. B shows the arrangement of the tubes 2, 2, and 3, 3, carrying the lens 33, when the impressions are taken by superposition. 4, 4, is the bed carrying the revolving or sliding disk. 35 is a hook and 36 a pin by which the tube 2 is attached to box 1.

Fig. C represents an end view of box 1. 6, 6, is the end of the hollow shaft and 12, 12, a lever bearing by spring-catch 13 upon ratchet wheel 14, 14. This ratchet wheel has a lip 73 around which lever 12 turns; it is attached to shaft 6 by the set screw 81, Fig. A. 15, 15 is the shield attached to the end of the box, having a projecting lip 82, to relieve the spring catch 13 from the ratchet 14 when the lever 12 passes over to press against 21. 22 is a slotted spring whose point falling into hole 77 in ratchet 14 determines one revolution of the roller. 74 is the hollow space in shaft 6 through which gage rod 8 passes. 91 is a cog, or space on ratchet 14 gaged to the width of a wedge inserted into roller 5, Fig. A, to confine the ends of the sensitive paper. If this is attached by other means, it may not be necessary to use 91.

In Fig. D, 4 is the bed plate having an opening 37 to admit light. Upon this the circular disk 38 with its openings 39^1, 39^2, 39^3, revolves around the pin 83. To this pin a spring 84 is attached communicating with the arm 40 to which is attached a spring-catch 41. 42^1, 42^2, 42^3, are projections on disk 38. 43 a rod containing arm 40 and slide 44. 45 another slide with its handle 46, upon which is spring catch 47 intended to seize pin 48 on slide 44. 49 is a stud to relieve catch 47 from pin 48. 50, 50 are guides to confine the motion of slides 44 and 45. 51 an arm to move spring catch 54, having its motion determined by slot 52 and pin and washer 53 and slot 55 and pin 56; and when drawn out, returned to its place by spring 57. 58 is the check ratch moving upon pin 59 with spring 60 to confine it against projections 42.

In Fig. E, representing the inside of the top of box 1, 18 is the rod running through one end of the box and having its bearing in a hollow tube 20, at the other end. This tube is movable in its support 88. Around rod 18 is bent a portion of flat plate 25 and the two are screwed together at 89, so that when lever 21 which is firmly attached to rod 18 is pressed by lever 12 the plate 25 moves with it. Upon this plate and carried by it, is fixed plate 27, slotted and adjusted by screws 30. 26 is an opening through the top of box 1 and through plates 25 and 27. 28 is the glass negative, when the printing is by superposition and the use of the condenser only as in Fig. B. This negative is held in place by the springs 29, 29. 31 is a spring bearing upon plate 25 to raise it from the roller when the pressure is removed from lever 21. A piece of cloth sufficient to prevent the entrance of light into box 1, except through the apertures in plates 25 and 27, is attached to the top of box 1 and between the edges of plates 25 and 27, so loosely as not to interfere with the motion of the latter, when pressed down upon roller 5 by lever 21 and rod 18. The size of the aperture for the passage of light can be regulated by a sheet of opaque paper placed between the back of the negative 28 and its support 27 having a perforation of the required size; or the back of the negative itself can be blackened.

Fig. F, represents a straight sliding disk, which may be placed upon the bed 4 and substituted for the circular revolving disk 38. 62 here represents bed 4. 26 is the opening in it, corresponding to 37 in Fig. C. 71 is a frame attached to bed 62 to keep the sliding disk 98 in its place and to serve as guides to its motion. 63 is an opening in disk 98, to which spiral springs 65 and 66 are attached, the one communicating with one end of arm 64, the other with the other end. 68, 68, are projections upon arm 64 to relieve springs 69, 69, from notches 99 and 100 in order to release the sliding disk 98. 70 are stop pins and 80 stops to confine the arm in its motion. This disk operates in the following manner. By moving one end of the arm 64, say the end 79 toward the end of the frame 71 the spring 65 is stretched and the spring 66 compressed. Spring catch 67 in notch 99 prevents the disk from moving until it is relieved by projection 68, when spring 65 pulls it toward the end of frame 71^2 under spring 65, while it is prevented from rebounding by notch 100 being caught by spring catch 70. Thus, opening 63 in disk 98 has passed over opening 26 in bed 62, admitting and shutting off the light. The same thing is then repeated in the opposite direction.

The mode of operating my machine is as follows. I first adjust the surface of the negative 28 to the planes of roller 5, by pressing lever 12 until the two are in close contact. The rest 11 is then brought to lever 12 and screwed tight. I then adjust the shield 15 so that the spring catch 13 of lever 12 will move ratchet 14 a distance sufficient to remove one plane of roller 5 from under the negative and replace it with the next. This distance being determined is fixed by the position of rest 11 and nose 82 of shield 15. Such other adjustments of negative, material, &c., as may be necessary will suggest themselves to any one accustomed to use photographic instruments. It has already been remarked that the box containing the sensitive material must be so made as to exclude light. Suppose we are now about to print or multiply pictures by superposition, using the negative 28, and the tubes and condensing lens as in Fig. B. The box 1 is detached from tubes 2 and 3, and carried to a dark room. It is opened by bringing lever 12 to stop 11 in order to free the spring catch 13 from the nose or lip of the shield 15 and then raising the upper half, hinged, as shown in Fig. C, 24. I then take a sheet of paper or other material rendered sensitive by any of the usual photographic processes. I place this around the roller 5, confining the ends by a wedge-shaped slot, springs, or other means. The tubes 2 and 3 are then attached to the box 1 and the whole is so placed that the light of the sun passes directly down the center of the tubes through the condensing glass 33 which is adjusted at such a distance from the negative 28, that the ring of the condensed light will cover the portion of the negative to be printed from. The proper bearing of the sensitive material having been fixed as above described, by the lever 12, that lever is turned back and pressed against lever 21. This slightly turns rod 18 pressing negative 28 down upon and in close contact with the sensitive material upon the roller. Up to this time no light has been admitted, the revolving disk 38, Fig. D, effectually closing the only opening, (shown by dotted lines 37, Figs. D and B) through which light could pass. I then take hold of handle 46 of slide 45 and push the slide forward toward the tubes, until its spring catch closes upon and seizes pin 48 on slide 44. Then drawing handle 46 back I draw out slide 44 and with it the connecting rod 43 giving motion to arm 40. This arm turns upon pin 83, and, moving from its stop 61, slides over disk 38. The spring catch 41 attached to it passes around the edge of disk 38 until it has passed one of the projections 42^1. By this time the spring catch 47 on slide 45 strikes against stop 49. The catch moves back and liberates pin 48 and therefore slide 44 also. The spiral spring 84 attached to pin 83 then forces the arm 40

back toward 61 until its spring catch stops at 42^1. The handle 46 is drawn still farther out until it presses upon arm 51 and draws it out also. This moves spring catch 54 and releases catch 58 from the projection 42^3. The disk 38 is now free and the spring 84 acting upon it through the arm 40 and the spring catch 41 forces it to revolve until arm 40 is stopped by 61. This removes the force of spring 84 from the disk but it would still revolve by its momentum, but it is stopped by catch 58 which being liberated from spring catch 54, is drawn by its spiral spring 60, close against the edge of disk 38 in time to catch the projection 42^2 and stop the revolution of the disk. The arm 51 is also drawn back by spring 57 and the spring-catch 54 again seizes catch 58. This portion of the apparatus is then ready for a repetition of the movement just described, the whole of which, in practice, may occupy less than a second. It will be seen that the result of this has been that one of the openings 39^1 in the disk 38, has passed rapidly over the aperture in the bed 4 shown by dotted lines 37 and the light has been admitted to the negative below and shut off again by a movement which may be made almost instantaneous and yet uniform in its duration over the exposed surface, commencing and shutting off on one side of the aperture precisely as it commences and shuts off on the other. By the passage of the disk just described and the admission of the light the sensitive material receives the impression of the negative and we are prepared to print another picture. I move the lever 12 forward releasing it from lever 21; the pressure being thus removed the negative is raised by the spring 31, and the roller is free to move. Continuing to move the lever 12 forward, the spring-catch 13 sliding from the nose 82 of shield 15, falls into the ratchet wheel 14, and turns it and with it roller 5 and the sensitive material until the lever 12 is checked by stop 11. By this means the next unprinted plane of the sensitive material is brought under the negative to receive its impression. Lever 12 is moved back to lever 21, pressed against it and the operation of admitting light repeated as above described, until the roller 5 has made one revolution. This is ascertained by the spring 22 falling into its hole on ratchet wheel 14. The roller 5 is then drawn along the shaft 6, the distance required, by means of gage rod 8 which is marked with a suitable scale. The gage 71 is then set by the screw 72 at the proper point on rod 8 so that it may be pressed against the end of hollow shaft 6. When the whole or required portion of the surface of the sensitive material has received impressions, the aperture 26 is closed by slide 86 and its handle 87 thus excluding the light. Box 1 is detached as before, removed to the dark room and the paper being taken off the pictures are developed by any of the usual means known and practiced by the trade.

Where the process is slower the sliding disk may be managed by hand without the catches and springs I have described, and practice might enable the operator to work the machine in this way with considerable rapidity and accuracy. Neither is it necessary that the light thrown upon the negative should be merely that formed by the converging rays of the condenser. The negative 28 may be removed and placed as in 34, Fig. A, and the daguerreotype tube 75—75 with its lenses 76, 76 used, so as, by adjustment, to make a picture either larger or smaller or of the same size as the negative, the lever 21 and the plates 25 and 27 being still pressed down as before to steady and smooth the sensitive material or the negative being at 28 and the condenser in use as in Fig. B, the latter may be raised so as to print by rays of light diverging after they have passed their focus which may be in the aperture 37, and the bed 4 may be placed in any convenient position for this purpose. It is not necessary to have a separate roller for every size of picture as the length of one picture will frequently be the width of a larger size. The ratchet 14 if the teeth are not too coarse may be so adjusted as to answer for different sizes of pictures. Thus if the slotted shield with nose 82 be moved so that the spring-catch of lever 12 shall fall into every second, third or fourth tooth, a portion of the roller proportionably great will be moved at each movement of the lever.

In order to work this instrument by sunlight most effectively and continuously, it should be so placed as always to keep the light directly over aperture 26. The best way of doing this is to use a heliostat so placed that its axis of motion points to the pole, and by its equatorial motion the hand can with ease so follow with the instrument the sun's apparent motion as to keep the sunlight constantly over aperture 26. For the purpose of illustration I have taken the photographic impression upon paper, but I do not confine myself to any particular kind of sensitive material or any particular process of development that can be made available upon my machine. Neither do I confine myself to the use of a roller, for when glass or daguerreotype plates or other nonyielding substances are used as sensitive materials, a roller can not be used. But they may be used by attaching them to a straight or plane sliding surface carried by another sliding disk, the two having motions at right angles to each other, and thus permitting every part of the sensitive material to traverse the aperture. This was my original

idea, but as it was necessary to use a shield to keep the material from the light of four times the area of the material itself, and this with the slides was large and cumbersome, I have adopted the dark box with its roller as occupying less space and requiring less time and labor for adjustment; nor, again, do I confine myself to the use of the circular revolving disk. This may be worked by a reciprocating motion or it may be a straight sliding disk as I have described and as the larger size of pictures may probably require.

Having thus fully described my apparatus, what I claim therein as new and desire to secure by Letters Patent, is:

1. The above described machine for printing or multiplying photographic pictures.

2. The above described art of multiplying positive photographic pictures or impressions from the same negative upon the same sheet of sensitive paper or other material.

3. Causing the sensitive material used for the reception of photographic impressions, latent or otherwise, made by the agency of solar or other light passing through a negative, to traverse the aperture or negative employed.

4. The traversing bed, whether cylindrical or plane, confined within a dark chamber, whose surface may be moved by ratchets, screws, cranks or their equivalents, for the purpose of carrying the sensitive material, when the same is used in connection with a negative from which it receives positive impressions, substantially as described.

5. The employment of continuous sliding or revolving disks, (with springs and spring stops, or their equivalents, to give them a uniform motion and overcome the momentum or rebound), for admitting and shutting off light uniformly to and from all parts of the surface to be acted upon, in printing positive photographic pictures from a negative, substantially as described.

6. The application of a lens or lenses for the purpose of condensing light when used in combination with negative 28, the sensitive material and slide or cut off for admitting and shutting off light for the purpose of photographic printing.

7. The combination of condensing lens 33, negative 34, daguerreotype tube 75, with its lenses 76, the sensitive material and slide or cut off for photographic printing substantially as described.

8. The combination of the sensitive material negative 28 (as distinguished from negative 34) and slide or cut off for the purpose of photographic printing.

9. The method of raising the glass negative or other matrix 28 from the sensitive material to permit the motion of the latter, and the method of lowering it again, substantially as described.

10. The method of supporting and adjusting negative 28 substantially as described.

11. The use of the glass negative (when negative 28 is used) or the use of a piece of plain glass in the place of it, (when negative 34 is used), or the use of a skeleton frame for the purpose of pressing the sensitive material smoothly and evenly on roller 5 or the traversing bed, while the photographic impression is being made.

12. The alternate admission and exclusion of light passing through a negative to act upon a traversing sensitive material confined in a portable dark chamber, substantially as described.

13. The rod 8 working through hollow slotted shaft 6 and affixed to roller 5 by plate 9 for the purpose described.

14. The combination of the lever 12, with its spring catch 13, with the ratchet wheel 14. nose 82 of shield 15 and slotted stop 11, substantially as and for the purposes described.

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Witnesses:

SAML. S. FISHER,

W. M. LEE.