

R. C. NEFF.
 AUTOMATIC PHOTOGRAPHIC PRINTING MACHINE.
 APPLICATION FILED APR. 24, 1915.

1,200,753.

Patented Oct. 10, 1916.

2 SHEETS—SHEET 1.

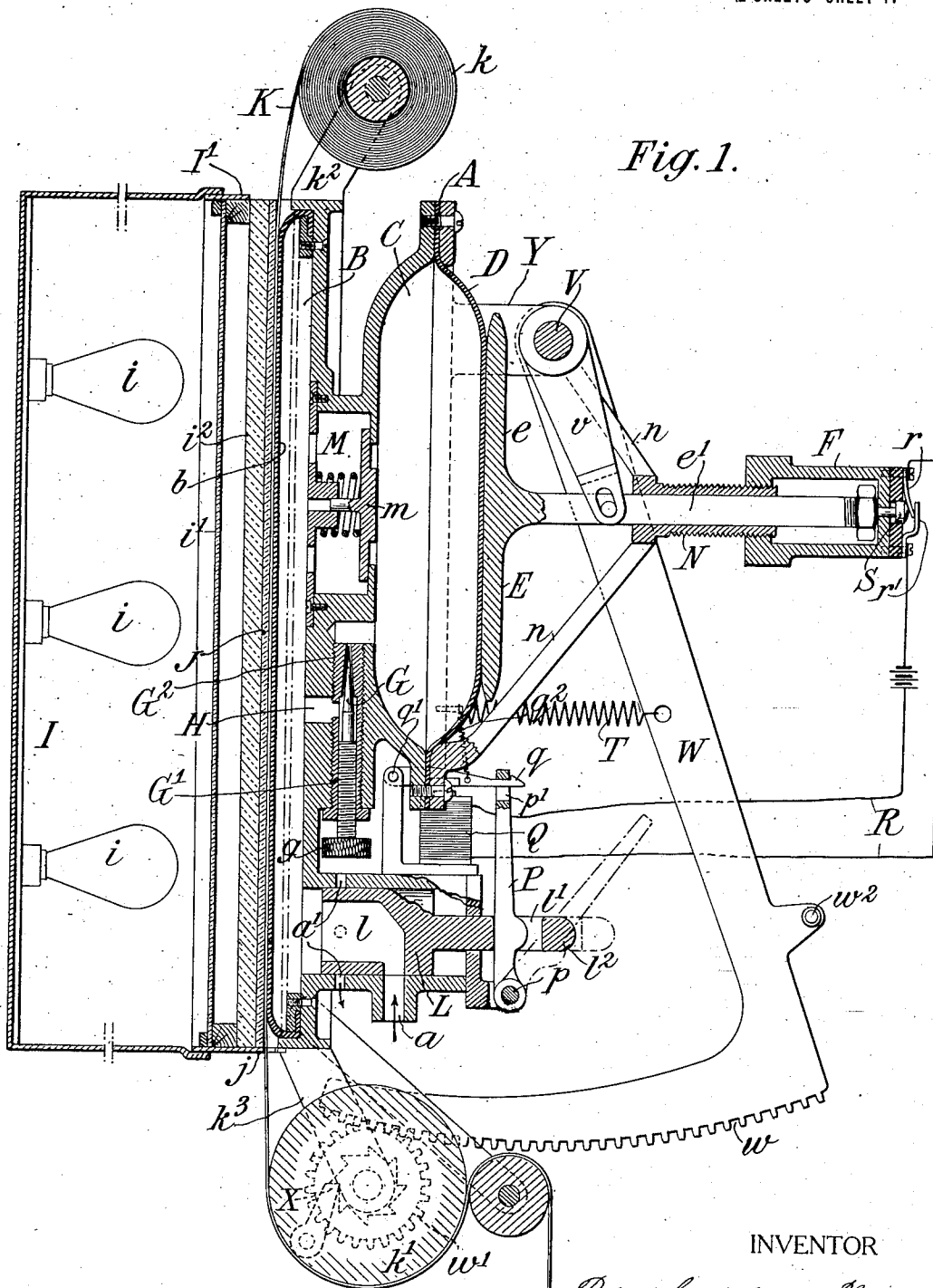


Fig. 1.

INVENTOR

Robert Casselman Neff

By Attorneys,

Fraser, Turk & Myers

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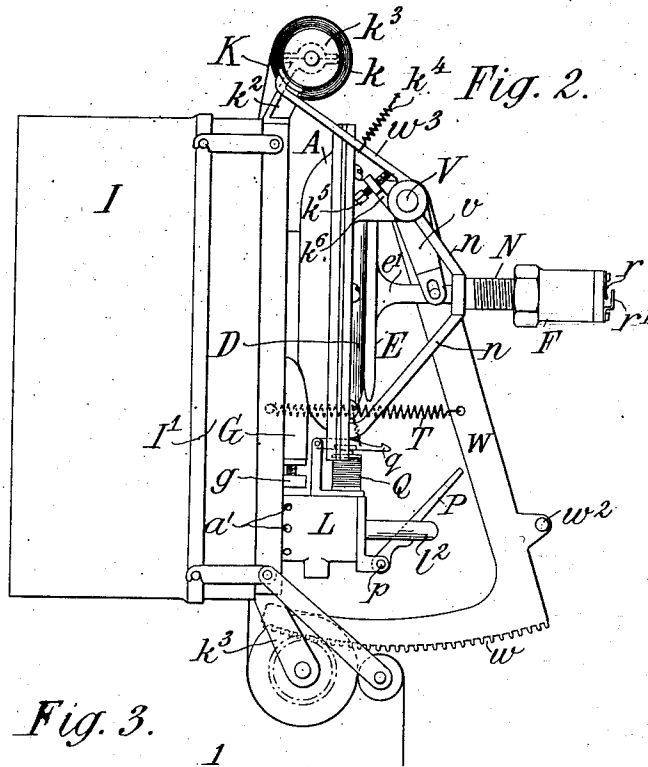
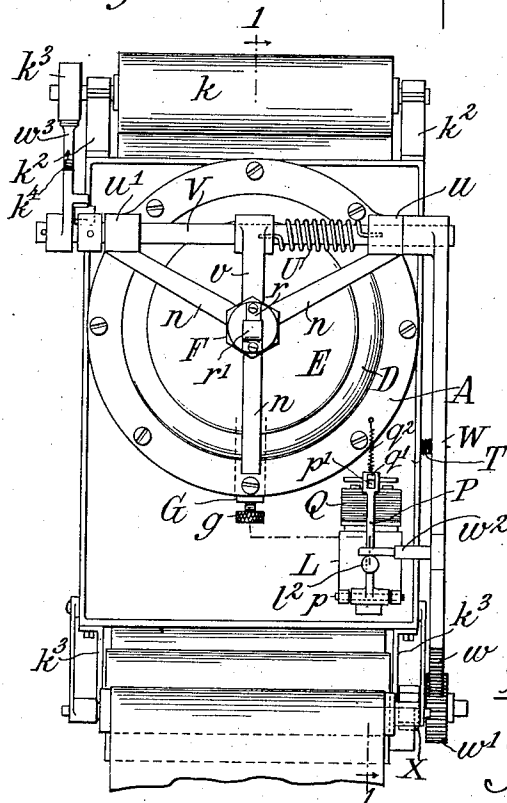


Fig. 3.



INVENTOR

Robert Cassellman Neff

By Attorneys,

Fraser, Turk & Myers

UNITED STATES PATENT OFFICE.

ROBERT CASSELLMAN NEFF, OF NEW YORK, N. Y., ASSIGNOR, BY DIRECT AND MESNE ASSIGNMENTS, TO NEFF & LUMLEY, INC., A CORPORATION OF NEW YORK.

AUTOMATIC PHOTOGRAPHIC-PRINTING MACHINE.

1,200,753.

Specification of Letters Patent.

Patented Oct. 10, 1916.

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To all whom it may concern:

Be it known that I, ROBERT CASSELLMAN NEFF, a citizen of the United States of America, residing in the borough of Brooklyn, county of Kings, city and State of New York, have invented certain new and useful Improvements in Automatic Photographic-Printing Machines, of which the following is a specification.

My invention relates to automatic photographic printing machines and has for its object to produce a machine which can be used for automatic printing from negatives, or for the automatic production of enlargements, and which in use is susceptible of such adjustments for varying the length of time of exposure, that satisfactory prints or enlargements are automatically produced, notwithstanding that various times of exposure are required. In carrying my invention into effect I have provided a controlling device for controlling the time of exposure, which is capable of adjustment to as exact a point as is found necessary or desirable, and upon the termination of the interval which has been selected as the proper time for exposure, the apparatus is automatically restored to a condition for a fresh exposure, and this restoration includes automatic operation of the feeding devices whereby the sensitive material last exposed is removed from the point of exposure and a fresh supply of sensitive material is advanced to such point and means for adjusting such devices to vary the feed.

Many advantageous results are accomplished by means of my invention, and these will not here be repeated at length, but are set forth in the accompanying description and claims.

A desirable form in which the invention may be embodied is illustrated in the accompanying drawing, wherein—

Figure 1 is a vertical section of an apparatus constructed according to my invention. Fig. 2 is a side elevation thereof, and Fig. 3 is an elevation of the side opposite the exposure, and which I shall call the rear.

In carrying my invention into effect I preferably employ fluid under pressure as the means for controlling the extent or duration of the exposure, and accordingly, I provide a fluid receptacle A to which fluid under pressure is admitted through an inlet port a , and from which it is exhausted

through an outlet port a^1 . The passage of the pressure fluid into the receptacle A causes the expansion of an expansible portion D, and this expansible portion continues to expand under the effect of the constantly admitted pressure fluid flowing in through the inlet, until it reaches the limit of expansion, and the rate of expansion is regulated by a needle valve G to control the period of exposure. The extent of the expansion of this portion D is made adjustable by a suitable adjusting means F to control the extent of feed through suitable connections, and upon the receptacle having expanded to its limit devices are operated which tend to open the outlet a^1 and relieve the pressure from the receptacle A. Thereupon the pressure from the said receptacle being relieved, other devices which I term restoring devices are set to work, and these include a so-called connector E which engages the expansible portion of the receptacle and is spring-held thereagainst so that upon the exhaustion of the pressure in the said receptacle it is reduced to its normal or contracted position by the spring pressure of the connector. At the same time the restoring devices actuate a feed whereby the sensitive material, which may be film or sensitive paper, is shifted so as to wind up or remove the recently exposed part and advance to the point of exposure a fresh supply. This having been accomplished, the restoring devices thereupon, and as a part of the same operation, close the outlet from the receptacle and simultaneously open the inlet, and this is accomplished by shifting a valve L.

In order to obtain the desired exact adjustment of time of exposure, I provide means for regulating the admission of fluid to the receptacle A and the adjusting device is illustrated as the valve G. The fluid pressure receptacle A is illustrated in its preferred form as divided into two chambers B and C, and the passage of the pressure fluid, for which purpose I prefer to use air, to the chamber C which contains the expansible wall D, is controlled by the needle valve G which is preferably situated in a passage H which leads from the chamber B, into which the ports open, to the chamber C. This needle valve extends through to the outside of the casing where its head g is exposed for adjustment of the said valve.

The chamber B is preferably provided with a front wall or diaphragm *b* of flexible material. This material forms an apron which presses against the rear of the sensitive material and holds the same firmly and with the desired smoothness and evenness against the plate in front of the same. By reason of the fact that it has no tendency to adhere to the sensitive material employed, I very much prefer rubber for the material forming this flexible apron. Upon the beginning of pressure in the pressure chamber A, the flexible apron *b* will be caused to press against the back of the sensitive material sufficiently to hold the same firmly and evenly, and upon the exhaustion of the pressure after the expiration of the proper time of exposure, the rubber apron permits the sensitive material to be freely moved.

The expansion of the pressure receptacle A controls the length of the period of exposure, and this period may be made longer or shorter according to the adjustment of the needle valve G whereby the rate of admission of air or other pressure fluid employed to the expansible chamber C is controlled. The termination of the period of exposure is caused when the chamber C has expanded to the full allowed extent. This allowed extent may be varied, if desired, by adjusting devices shown, and this adjustment, as will be hereinafter described, is for the purpose of varying the extent of feed of the sensitized material past the point of exposure. It will be seen, therefore, that the time of exposure is dependent solely upon the rate of admission of pressure fluid to the pressure chamber C, and is entirely disconnected from the extent to which the said chamber is permitted to expand. The extent to which the said chamber is permitted to expand is determined by the amount of feed of the sensitized material required. If an increased feed is desired an increase of expansion in vessel C is required and there will consequently be an increased degree of movement of the restoring devices which return the expanded chamber to its original form, and at the same time operate the feed and the amount of sensitized material fed will be increased. Therefore the feed is operated at the termination of the period of exposure and serves to remove the exposed material and to bring a fresh supply.

The invention is capable of employment either in the making of prints from a photographic negative or in the production of enlargements. In its employment for one or the other of these purposes, modifications may be made in the mechanism illustrated and other or equivalent devices employed, but the principle of the invention as set forth in the appended claims, is applicable for either of these uses.

I will now proceed to describe the manner in which I have illustrated my invention in the accompanying drawing, and which, although it is the best form now known to me in which the invention may be embodied, I realize full well may be modified in many respects, and the devices which I illustrate for accomplishing certain of the movements are only one way of accomplishing that result, and others might easily be substituted by any skilled person.

I have shown the invention as applied to a printing apparatus wherein a light box I which is removably supported on a frame I¹ is provided with a suitable number of light producing apparatus such as the electric lamps *l*, and the frame is well provided with a suitable light diffusing material such as the removable translucent or opalescent glass *i*. The frame may advantageously be equipped with a substantial sheet of clear glass *i*² which may quite well be of $\frac{5}{16}$ or $\frac{3}{8}$ inch thickness and is removable. Upon this the negative J is supported by suitable means, as for instance, by the overhanging ledge *j* of the frame. The sensitive material K is contained upon a supply roll *k* from which it is fed to the point of exposure in front of the frame, and thence it is drawn by feeding roll *k*¹ suitably operated as by means hereinafter described, and thence suitably disposed of, as for instance, by being conveyed to a developing or toning bath, etc. The rolls *k*, *k*¹ are suitably supported in arms *k*², *k*² (Fig. 3). The receptacle A is divided, as stated, into two chambers B, C connected by the passage H which contains the needle valve G; whereby the passage of the pressure fluid from the chamber B to which the same is admitted, to the chamber C which contains the expansible portion, is controlled, and regulated as desired and thereby the period of exposure is regulated. The front chamber B contains the flexible apron *b* which presses against the sensitive paper. When a larger opening than that provided by the needle valve G is required, the threaded bushing G¹ in which the needle valve is mounted may be unscrewed past port H to the desired extent, providing an inlet passage from B to C adjustable to the full size of the passage G² in which the bushing is threaded if desired. The inlet passage *a* and the outlet passage *a*¹ are controlled by a valve L which has a passage *l* through it having a port adapted to register with the inlet port *a* when it is desired that the pressure fluid should be admitted. There are a number of outlet ports *a*¹ for the purpose of quickly exhausting the receptacle A, and at the time the pressure fluid is being admitted to the receptacle through the valve L, the body of the said valve closes all of the said outlet ports. The valve slides longitudinally in its casing and

is adapted to be moved so as to uncover all of the outlet ports and exhaust the pressure from the receptacle A, and at this time the inlet port a is closed, so that the supply of pressure fluid is shut off. The passage H is the only communication between the two chambers B and C of the receptacle A when the pressure fluid is being admitted at a , but when the said pressure fluid is shut off and the exhaust ports a^1 are open, another passage M is provided between the said chambers for the purpose of quickly exhausting the pressure fluid from each of them. This passage M is closed by the spring-pressed check valve m which engages against a valve seat in the said passage and opens away from the chamber C, so that while it will yield under the pressure in C to open the said passage upon a sudden reduction of pressure in the chamber B, it will close the said passage upon an increase of pressure in the said chamber B.

The expansible portion of the receptacle A is illustrated as formed as the rear wall of the chamber C, and for this purpose I have preferably employed a flexible diaphragm D or wall of leather. The expansion of the said diaphragm is against the enlarged disk-shaped head e of a connector or slide E. This connector has a stem e^1 which slides in a suitable guide N secured at the rear of the apparatus by arms n . An abutment F is threaded upon the threaded exterior of the guide N and provides a movable stop by adjustment of which the extent of travel of the connector E may be determined and the extent of sensitive material to be withdrawn may be regulated as desired. In the apparatus illustrated the withdrawal of the sensitized material from the point of exposure terminates the exposure.

The valve L is illustrated in Fig. 1 in a position, in which it is adapted to admit pressure fluid through the inlet valve a . In this position the valve is exposed to the effect of the pressure of the fluid in the receptacle A, which would have the effect of forcing the said valve toward the rear, or so as to cover the inlet port a . To prevent this I provide means for maintaining the said valve in position, and these means, as illustrated, take the form of a swinging bar P which is pivoted to the frame at p and passes through a slot l^1 in the guiding tail-piece l^2 of the said valve. The bar P is maintained in locked position by a latch q that passes through a small slot p^1 in the end of the said bar and is pivoted at q^1 to a fixed point and is maintained in locking position by a spring q^2 . The bar q is the armature bar of a magnet Q which is in electric circuit R that is closed when the connector E reaches the full limit of its travel caused by the expansion of the wall D as determined by the adjustment of the abutment F. At this time the stem e^1 engages against a sliding switch closer S and makes contact between the spring switch member r and switch member r^1 closing the circuit.

An important part of my invention is the means above referred to, by which, when the receptacle A is exhausted of its pressure at the end of the period of time determined upon for the exposure, the apparatus is automatically put in condition for a fresh operation by the removal of the exposed paper from the point of exposure and the feeding of a fresh supply of sensitive paper to such point, and by the renewal of the pressure in receptacle A. The means for performing these functions are controlled primarily by the pressure in the receptacle A, and are operated upon the reduction of such pressure. The pressure in the said receptacle maintains the head e of the slide or connector E in position against the resistance of certain springs, but upon the exhaustion of the said pressure the springs operate the restoring devices. The pressure is exhausted from the chamber A when the connector E has reached its desired limit of travel by the opening of the exhaust ports through the shifting of valve L upon circuit R being closed, and such exhaustion is assisted by means to be described. A rock shaft V is mounted in bearings u , u^1 , on posts Y, forming brackets for carrying the arms n . Upon this shaft V is fixed a swinging arm v which has a pin and slot connection with the stem e^1 , and the end of which is pressed by torsion spring U toward the wall D. This spring is coiled around the shaft V and has one end fixed in the bearing u on one of the arms n , and the other end is fast in the hub of the arm v . The torsion of the said spring maintains the head e constantly in contact with the diaphragm D, and upon a reduction in pressure in the vessel C the spring actively assists in expelling the said pressure fluid and in rendering the apparatus prompt and efficient in action. Coincidentally with the operation of the exhausting means, the operation of devices which terminate the exposure is also begun. In the apparatus illustrated such termination is accomplished by the sensitized material feed. When the feed is accomplished the pressure renewal means operate, beginning a fresh exposure. As illustrated, the operation of these restoring means is effected by a restoring arm W which is fixed upon an end of the shaft V and is under the influence of the spring U assisted if desired by a coiled spring T that tends to pull the same toward the front of the machine. The restoring arm W provides a means whereby the feed is accomplished and the exposure terminated and the pressure is restored to

the receptacle A. Upon the lower end of the said restoring arm is a sector w of a rack which engages in a pinion w^1 upon the lower feed roll k^1 . As the rack is moved to the right in Fig. 1 upon the expansion of the chamber C to an extent determined by adjustment of abutment F, it moves the pinion idly by reason of the pawl and ratchet mechanism X, but when it is moved to the left in the said figure under the influence of the springs T and U, the pawl and ratchet mechanism engage and consequently the rack w ; through its pinion w^1 , turns the roll k^1 counter-clockwise in said figure and feeds the exposed sensitive material away from the point of exposure and draws a fresh supply of sensitive material K from the supply roll k , the amount so fed and withdrawn being determined by the adjustment of the abutment F.

When the restoring arm W moves forward, an inwardly projecting arm w^2 engages against the pivoted valve arm P which then occupies the position shown in dotted lines in Fig. 1 and carries the same forward, and with it the valve L until it reaches the position shown in full lines in said figure, in which position it is held by the latch q .

A brake arm w^3 mounted to turn upon the end of the shaft V opposite the restoring arm W engages a brake drum k^3 near the end of the roll k at substantially the completion of the forward or feeding movement of the restoring arm W and prevents the upper roll k from overrunning at the cessation of the feed. This brake exerts a constant friction upon the drum by reason of spring k^4 at all times. It is caused to press with a positive braking effect upon the drum by an adjustable screw k^5 threaded in arm k^6 fixed on shaft V.

Operation: Starting with the apparatus shown in the full line position of Fig. 1 wherein an exposure has just been completed and the expansible vessel C has its wall D in fully expanded position, in this position the connector E has closed the circuit R and the magnet Q is energized. Thereupon the armature of the magnet will be attracted against its spring q^2 and will release the valve retaining bar P. Under the pressure of the fluid contained in the fluid receptacle A, the valve L will be forced rearwardly or to the right of Fig. 1 until it covers the inlet port a and uncovers the outlet ports a^1 , whereupon the parts will assume the dotted line position of Fig. 1. Thereupon the pressure will be exhausted from the receptacle A, both from chamber B as well as from chamber C through passage M, and finally out through exhaust ports a^1 , and this operation will be expedited by the pressure of the springs T and U exerted through the arm v upon the con-

necting head e . The exhaustion of pressure from the receptacle A will permit the restoring arm W, under the influence of its springs T and U, to be drawn forward or to the left in Fig. 1, and its rack w acting upon the pinion w^1 and through the pawl and ratchet X, will turn the lower paper feed roll k^1 counter-clockwise, as seen in Fig. 1, and will thereupon terminate the exposure by withdrawing from its former position the sensitive material that has been last exposed, and will, at the same time, draw a fresh supply of material into such position from the supply roll k . The amount of sensitized material so fed and withdrawn will be determined by the adjustment of the abutment F which permits an increased or diminished amount of travel of the connector E and arm W as it is adjusted back or forward and consequently as the arm W travels back farther its effective feeding movement toward the front of the machine will be increased, and the amount of sensitized material fed will be adjusted to the requirements of each case. The brake w^3 will at this time prevent any overrunning of material from the supply roll k . In its forward movement the arm w^2 on the restoring arm W will hit against the valve arm P and will carry the valve to the position shown in full lines in Fig. 1, where it will be locked by its latch and in which position the outlet valves will be closed and the inlet valve opened, so that a fresh supply of pressure fluid may be admitted.

The means for regulating the feed of pressure fluid from chamber B to chamber C forms an important part of my invention, as by the aid thereof I am enabled to determine the time of expansion of the receptacle A regardless of its limit of inflation as regulated by F to as close limits as are necessary, notwithstanding slight fluctuations in the supply of pressure fluid. The adjustable character of the said means enables me to control the timing of the exposure, and the adjustable abutment F, provides a substantially exact control over the paper feed.

The inlet port a is illustrated as communicating directly with the atmosphere, but it will be understood, of course, that this is intended to be connected to a fluid pressure tank or pump, or other proper source of fluid pressure supply, preferably I use a pressure blower.

In the use of my invention in the production of enlargements, the flexible apron b is not used to press against the sensitive material K but this material is passed in front of the glass i^2 which is moved to the place now occupied by the negative and the negative and glass i^1 are omitted, whereupon the glass i^2 will act as a platen for the sensitive material K and will be in contact with

the back or unsensitized part thereof. The sensitive material will be passed through the same opening in the frame I¹ as illustrated. The enlargement will then be projected by the use of an enlarging camera in the ordinary manner. The said camera forms no part of this invention and as its construction is well known it is not illustrated. The light box I will then be omitted and the apparatus will act in the manner described for the timing of the enlargements and feeding the sensitive material.

The period of exposure is illustrated in the foregoing application as being terminated by the withdrawal of the exposed sensitized material and the feeding of a fresh supply to the point of exposure. But I do not wish to be understood as limiting myself to this mode of terminating the period of exposure. Such period of exposure is frequently terminated by shutting off the light or interposing a shutter between the light and the sensitized material (in case the print is small enough to render this feasible), and my invention is to be considered in connection with these well known equivalents.

Although I have illustrated the paper feed as controlled by the action of the restoring devices, this is not essential to the automatic action of the apparatus, as the feed might be otherwise controlled or it might be intermittent.

Although I have illustrated the most advantageous manner of constructing my invention now known to me, it will be obvious that portions thereof are capable of separate use and that it will be within the ability of those skilled in the art to substitute other and equivalent devices for those illustrated, within the limits of the appended claims.

What I claim is:—

1. In a machine of the character described, means for exposing sensitized material combined with automatic means for controlling the length of exposure thereof and means to vary the time of such exposure as desired, means for terminating the exposure, and a connection between such controlling means and the exposure terminating means, whereby such last named means is operatively associated therewith.

2. In a machine of the character described, means for exposing sensitized material combined with a plate, a fluid pressure receptacle adapted to press such material against the plate at the point of exposure, adjustable means for relieving such pressure at variable intervals to vary the time of exposure as desired, and a connection between such pressure relieving means and the feed whereby the feed is operatively associated therewith.

3. In a machine of the character described,

means for exposing sensitized paper combined with automatic means for regulating the length of exposure, comprising a receptacle containing a fluid pressure chamber, a device for relieving the pressure in such receptacle, and means for causing the same to operate at variable intervals, as desired, and means for terminating the exposure operatively associated with said pressure relieving means.

4. In a machine of the character described, means for supporting sensitized paper at the point of exposure adapted to feed same past such point, automatic means for regulating the length of exposure comprising a receptacle containing a fluid pressure chamber, means for admitting fluid pressure therein, means for relieving such pressure, and means for controlling said pressure relieving means adjustable to act at variable intervals as desired, and said controlling means adapted to variably control the operation of said feed.

5. In a machine of the character described, means for regulating the length of exposure, comprising a receptacle containing a fluid pressure chamber and provided with inlet and outlet ports, port controlling means adapted to cause one or the other of said ports to be opened, and a device for operating the same adjustable to cause such operation at variable intervals as desired, and means for terminating the exposure, said operating device variably controlling the operation of said exposure terminating means.

6. In a machine of the character described, means for supporting sensitized material at the point of exposure adapted to feed same past such point and automatic means for regulating the length of exposure comprising a receptacle containing a fluid pressure chamber and provided with inlet and outlet ports, a valve adapted to open one or the other of said ports according to position and at the same time to close the other port, valve operating means adjustable to cause such operation at variable intervals as desired, said valve operating means controlling the operation of said feed and having an adjustment to control the amount thereof.

7. In a machine of the character described, means for supporting sensitized paper at the point of exposure adapted to feed same past such point and means for regulating the length of exposure and feed comprising an expansible receptacle containing a fluid pressure chamber and provided with inlet and outlet ports, a valve adapted to open one or the other of said ports according to position and at the same time to close the other port, valve operating means comprising an abutment for said receptacle, and means operated by contact of said receptacle with said abutment to cause said valve

operation, means for contracting said expandible chamber upon the release of pressure, and means whereby said sensitive material feed is caused to operate upon the operation of said contracting means.

8. In a machine of the character described, means for supporting sensitized paper at the point of exposure adapted to feed same past such point, means for regulating the length of exposure comprising an expandible fluid pressure receptacle, a connector adapted to be moved by the expansion of said receptacle, an abutment for such connector adjustable to vary the movement thereof, said receptacle having an inlet for fluid and an outlet, means for opening said outlet automatically actuated by the travel of said connector to its limit, and means for retracting said connector adapted to open the pressure inlet and to operate said paper feed.

9. In a machine of the character described, means for supporting sensitized paper at the point of exposure adapted to feed same past such point, means for regulating the length of exposure comprising an expandible fluid pressure receptacle, a connector adapted to be moved by the expansion of said chamber, an abutment for said connector adjustable to vary the movement thereof, said receptacle having inlet and outlet ports, a valve controlling said ports and adapted to alternately open one and close the other and vice versa, means for operating said valve to open said outlet port controlled by said connector at its extreme travel, and means for retracting said connector adapted to open the pressure inlet and to operate said paper feed, the variation in adjustment of said abutment controlling the extent of said paper feed.

10. In a machine of the character described, means for supporting sensitized paper at the point of exposure and adapted to feed variable distances, means for regulating the length of exposure comprising an expandible fluid pressure receptacle having inlet and outlet ports, means to close one valve as the other one opens and vice versa, means actuated by the expansion of said receptacle to open the outlet valve and close the inlet, and a spring actuated restoring device operable upon a release in pressure in said receptacle to collapse the same, and having connections whereby the same is adapted to actuate the paper feed and at the same time to automatically close the outlet and open the inlet to said receptacle.

11. In a machine of the character described, means for supporting sensitized paper at the point of exposure adapted to feed same past such point, means for regulating the length of exposure comprising an expandible fluid pressure receptacle, a connector adapted to be moved by the expansion

of said chamber, an abutment for said connector adjustable to limit the travel thereof, said receptacle having an inlet port communicating with a source of fluid under pressure and an outlet port, a valve adapted to open either of said ports according to position and at the same time close the other, means for moving said valve to open the outlet, caused to operate by the connector having reached the limit of its travel, and a spring actuated restoring device adapted to retract said connector, thereby collapsing said receptacle and at the same time to operate the feed and shift the valve, the variation in adjustment of said abutment controlling the extent of said paper feed.

12. In a machine of the character described, a plate support, a support for sensitized paper and feeding devices for said paper, a receptacle having a fluid pressure chamber and having a flexible apron adapted to press said paper against said plate, said receptacle having inlet and outlet ports and adapted to expand upon the admission of pressure, means adapted to be operated upon the expansion of said receptacle to vent the pressure from said receptacle, said means adjustable to vary the time of exposure, and length of feed, and means for restoring the receptacle to unexpanded condition, which operate the paper feed and restore pressure to said receptacle.

13. In a photographic printing machine, a support for sensitized material at the point of exposure and a feed for said sensitized material, a receptacle having a fluid pressure chamber and a flexible apron adapted to press said sensitized material against the negative, said receptacle having inlet and outlet ports and an expansion chamber and having a passage leading to said expansion chamber, adjustable controlling means for said passage, a movable connector adapted to be moved by the expansion of said chamber, an abutment for said connector adjustable to vary the extent of its movement, and amount of feed, means adapted to be operated upon the movement of said connector to its limit to exhaust both chambers of said receptacle, and spring actuated restoring means adapted to restore said expansion chamber to unexpanded condition and to operate said feed and admit pressure fluid to said receptacle.

14. In a machine of the character described, a support for sensitized material at the point of exposure and a variable feed therefor, a fluid pressure receptacle, a partition separating same into two chambers, one of the chambers having an inlet and an outlet port and the other chamber having a flexible wall, and a passage being provided between said chambers with an adjustable valve therein for varying the period of exposure, devices controlled by the expansion

of said wall to exhaust pressure from said receptacle, and restoring means for restoring said expansible chamber and for operating said feed and admitting pressure to

5 said receptacle, said restoring means adapted to operate upon the release of pressure in said chamber, and exposure terminating means operated by said restoring means.

10 15. In a machine of the character described, means for supporting sensitive material at the point of exposure and a feeding device therefor, means for regulating the exposure period comprising a fluid pressure receptacle having inlet and outlet ports,

15 a flexible wall for said receptacle, a connector adapted to be moved by the expansion of said wall, means for exhausting pressure from said receptacle operated by said connector at its extreme movement, means

20 for varying the speed of said connector and thereby controlling said exposure period, spring retracting means for said connector whereby upon the exhaustion of said pressure said connector restores said receptacle

25 to its unexpanded condition, and means operated by said restoring means for actuating the feed and admitting pressure to said receptacle.

30 16. In a machine of the character described, means for supporting sensitized material at the point of exposure, means for regulating the exposure period comprising a fluid pressure receptacle having inlet and outlet ports and a valve adapted to close one

35 and at the same time open the other and vice versa, said fluid pressure chamber having an expansible portion, adjustable means for limiting the rate of expansion of said portion and thereby varying the time of exposure, a locking catch adapted to hold said

40 valve in position to admit pressure fluid, and electro-magnetic means for releasing said locking catch, and an electric circuit closed by said receptacle at its full allowed expansion for operating said electromagnetic

45 means, whereby the fluid pressure in said receptacle causes said valve to unlock and to close the inlet and open the outl.

50 17. In a machine of the character described, means for supporting sensitive material at the point of exposure and a variable feeding device for said material, a fluid pressure receptacle having inlet and outlet ports and an expansible portion, adjustable means for varying the rate of expansion and thereby varying the time of exposure, adjustable means for varying the

55 limit of such expansion and thereby determining the amount of feed, means operated upon the expansion of said portion to its limit for exhausting pressure from said receptacle, and spring actuated means for restoring said receptacle to unexpanded condition upon such exhaustion, said restoring

60 means actuating said feed and closing said

outlet and opening the inlet to said receptacle, and means for terminating the period of exposure actuated by said restoring means.

18. In a machine of the character described, means for supporting sensitive material at the point of exposure and an adjustable feeding device for said material, a fluid pressure receptacle having inlet and outlet ports and a valve adapted to close one

75 and at the same time open the other and vice versa, and an expansible portion and means controlled by the said expansion for exhausting the pressure from said receptacle adjustable to vary the sensitive material

80 feed, and a spring retracted restoring slide engaging said expansible portion and pressing the same to unexpanded condition upon exhaustion of pressure, and operating connections from said restoring slide to said

85 valve, whereby the valve is shifted at the same operation, and exposure terminating means operated by said restoring means.

19. In a photographic printing machine, a fluid receptacle having two chambers, one

90 of said chambers having inlet and outlet ports and having a flexible apron adapted to press against sensitive material, the other chamber being expansible, means for exposing sensitized material, means operated upon

95 the expansion of said chamber for terminating the period of exposure, an adjustable means for regulating the passage of fluid from one chamber to the other, thereby controlling the degree of expansion of said

100 chamber and consequently the length of exposure, and means for admitting pressure fluid to said receptacle.

20. In a machine of the character described, means for feeding sensitized material past the point of exposure, a fluid receptacle having two chambers, one of said

105 chambers having inlet and outlet ports and the other chamber being expansible and contractible, means operated by said expansible chamber when expanded to its full allowed amount for actuating said feeding means, means for varying the extent of expansion

110 of said expansible chamber and thereby varying the feed, adjustable means for varying the passage of fluid to said expansible chamber and thereby varying the period of exposure, and means for supplying said receptacle with pressure fluid.

21. In a photographic printing machine,

120 means for supporting sensitized material at the point of exposure and feeding it past said point, means for controlling the exposure period comprising a fluid receptacle having two chambers, one of said chambers

125 having inlet and outlet ports and the other chamber being expansible and contractible, means for controlling the extent of expansion and thereby controlling the extent of feed, and adjustable means for controlling

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the passage of fluid from one chamber to the other and thereby controlling the period of exposure, and a device controlled by the expansion of said chamber for venting the pressure from said receptacle, and means actuated by the expansion of said expansible chamber to its full adjustment for feeding the sensitized material and thereby terminating the exposure and at the same time admitting pressure fluid to said receptacle.

22. A machine of the character described, comprising a plate, means for supporting sensitized material relative thereto, comprising a flexible apron adapted to contact with said sensitized material and press same against said plate, a fluid pressure receptacle having an expansible compartment and a receiving compartment, said flexible apron forming one side of said receiving compartment, an adjustable valve for admitting fluid from the receiving compartment to the expansible compartment, means for admitting pressure fluid to said receptacle and means for relieving the pressure therefrom, both said means being operated by the expansion of said expansible compartment, said adjustable valve providing means for varying the period of exposure by varying the time of expansion of said expansible chamber, and means for terminating said exposure actuated by said expansible chamber at its full allowed expansion, according to adjustment.

23. A machine of the character described, comprising a plate having a smooth surface, means for supporting sensitized paper relative thereto comprising a flexible apron adapted to contact with said sensitized paper and press same against said plate, said apron forming one side of a fluid pressure chamber, means for admitting the pressure fluid to said chamber, automatic means for relieving the pressure in said chamber, and variable timing means for controlling the operation of said pressure relieving means adjustable to vary the length of exposure.

24. A machine of the character described, comprising a plate having a smooth surface, means for supporting sensitized paper relative thereto comprising a flexible apron adapted to contact with said sensitized paper and press same against said plate, said apron forming one side of a pressure fluid chamber, means for admitting the pressure fluid to said chamber, automatic means for relieving the pressure in said chamber, and variable timing means for controlling the operation of said pressure relieving means adjustable to vary the length of exposure, combined with an automatic variable feed for said sensitized paper operating in conjunction with said pressure relieving means.

25. A machine of the character described, comprising a support for sensitized material, means for feeding said material past

the point of exposure, an expansible fluid pressure chamber, adjustable means for regulating the admission of pressure fluid thereto, adjustable means for limiting the expansion of said chamber, a valve for controlling the admission of pressure fluid to said expansible chamber, a lock for holding said valve in position to admit such pressure fluid, and electro-magnetic means operated by the expansion of said expansible chamber to its limit for releasing said lock, and means for operating said paper feeding means actuated by the expansion of said chamber.

26. In a device of the character described, an expansible fluid pressure chamber having inlet and outlet ports, a valve adapted to alternately open one of said ports and close the other, a lock for holding said valve in position to open the inlet port and close the outlet port, and electro-magnetic means operated by the expansion of the fluid pressure chamber for releasing said lock.

27. In a device of the character described, paper feed devices, an expansible fluid pressure chamber having inlet and outlet ports, a valve adapted to open one of said ports and close the other according to adjustment, means for regulating the admission of pressure fluid to said expansible chamber, means adapted to control the operation of said paper feed devices and thereby to control the exposure, an adjustable device for limiting the extent of expansion of said adjustable chamber and controlling the said paper feed, and restoring devices for exhausting pressure from said chamber upon the completion of the exposure and for renewing said pressure for a fresh exposure, and said feeding devices and restoring devices automatically operated when said expansible chamber has reached the limit of its travel.

28. In a device of the character described, an expansible fluid pressure chamber having inlet and outlet ports, a valve adapted to close one of said ports and open the other according to adjustment, means for regulating the exposure period comprising an adjustable valve for regulating the admission of fluid pressure from said inlet port to said expansible chamber, a movable part moved by the expansion of said expansible chamber, an adjustable abutment for limiting the extent of said movement, means for shifting said valve to uncover the outlet ports when the expansible chamber has reached its limit of travel, an automatically acting restoring arm operable coincidentally with the shifting of such valve for variably feeding the sensitive material and terminating the exposure, the extent of such feed being regulated by the amount of expansion of said expansible chamber, said restoring arm adapted upon the completion of its feeding move-

ment to shift the inlet valve for a fresh operation and means for holding said valve in position to admit pressure fluid until it is again released.

29. In an automatic printing machine, means for regulating the exposure period comprising a fluid pressure expansion chamber, means for regulating the rate of expansion of said chamber, and so regulating the time of exposure, a traveling controlling device operated by the expansion of said chamber, means for regulating the supply and release of pressure fluid to and from said chamber, means operated by the said traveling controlling member at its limit of travel for terminating the exposure and for operating said pressure fluid regulating means.

30. In an automatic printing machine, means for regulating the period of exposure comprising a traveling controlling device, and adjustable regulating means for varying the speed of travel of said device, an abutment, a sensitized material feed and means operated by the contact of the traveling device with said abutment for operating the said feed, and means for regulating the position of said abutment and thereby regulating the extent of said feed.

31. In an automatic printing machine, means for regulating the exposure period comprising a fluid pressure expansion chamber, means for regulating the rate of expansion of said chamber and so regulating the time of exposure, a traveling controlling device operated by the expansion of said chamber, means for regulating the supply and release of pressure fluid to and from said chamber, an abutment, a sensitized material feed

and means operated by the contact of the traveling device with the abutment for operating said feed.

32. In an automatic printing machine, means for regulating the exposure period comprising a fluid pressure expansion chamber, means for regulating the rate of expansion of said chamber and so regulating the time of exposure, a traveling controlling device operated by the expansion of said chamber, means for regulating the supply and release of pressure fluid to and from said chamber, an abutment, a paper feed and means operated by the contact of the traveling device with said abutment for operating the paper feed and for returning the traveling member to starting position, and means for regulating the position of said abutment and thereby regulating the extent of said feed.

33. In a photographic printing apparatus, means for maintaining sensitized material at the point of exposure, and means for controlling the period of exposure, comprising an expansible fluid pressure chamber, an adjustable device for controlling the supply of pressure fluid thereto whereby the rate of expansion of said chamber is regulated, and means operated upon the expansion of said chamber to its limit for terminating the exposure.

In witness whereof, I have hereunto signed my name in the presence of two subscribing witnesses.

ROBERT CASSELLMAN NEFF.

Witnesses:

THOMAS I. WALLACE,
FRED WHITE.