No. 731,282. PATENTED JUNE 16, 1903.

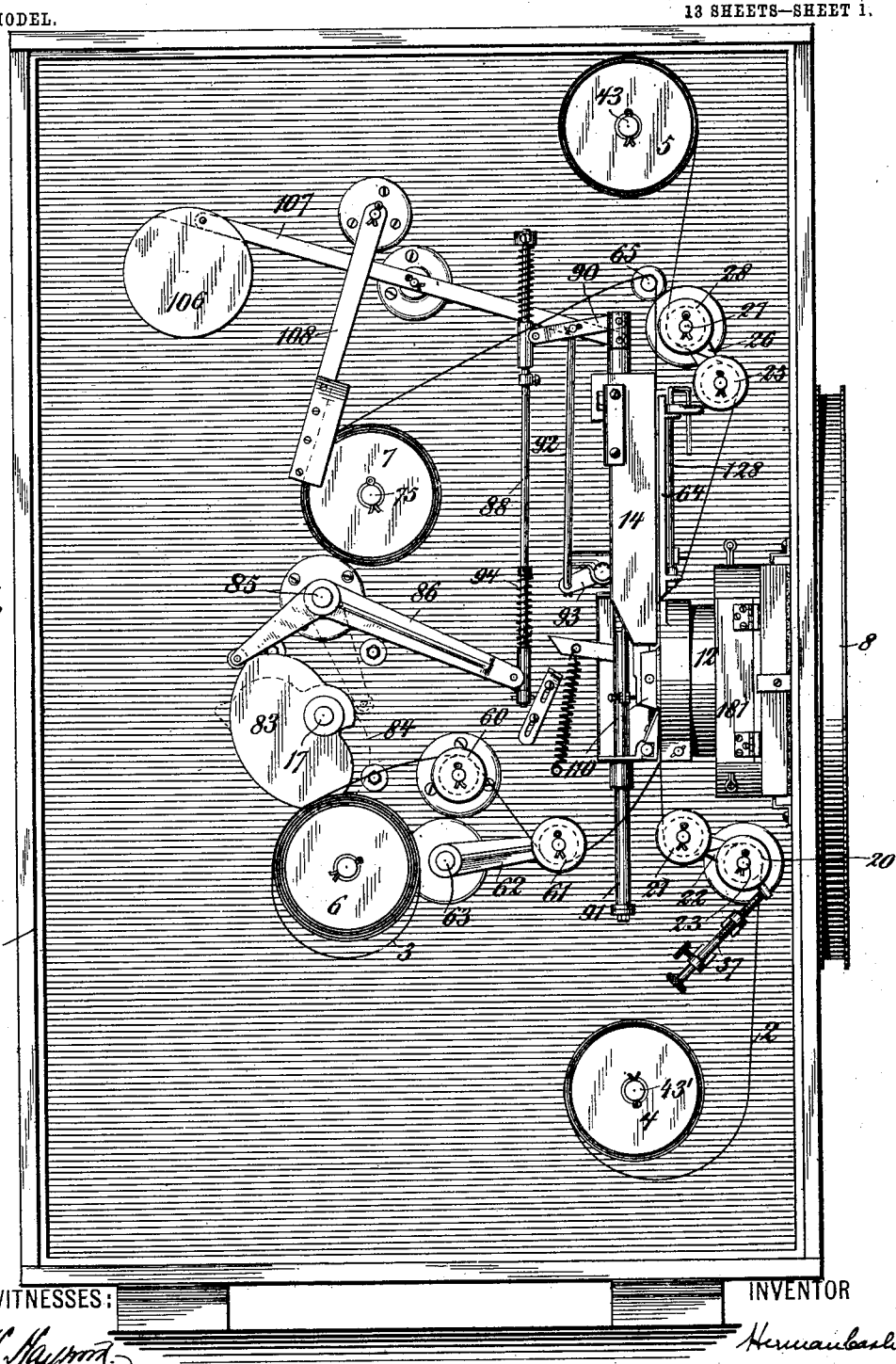
H. CASLER.

PHOTOGRAPHIC PRINTING MACHINE.

APPLICATION FILED MAY 21, 1898. RENEWED JAN. 2, 1903.

NO MODEL. 13 SHEETS—SHEET 1.

Fig. 1.



WITNESSES:

D. H. Hayward

H. A. Lee

INVENTOR

Hermann Casler

BY

E. M. Marble & Son

ATTORNEYS

THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

No. 731,282. PATENTED JUNE 16, 1903.

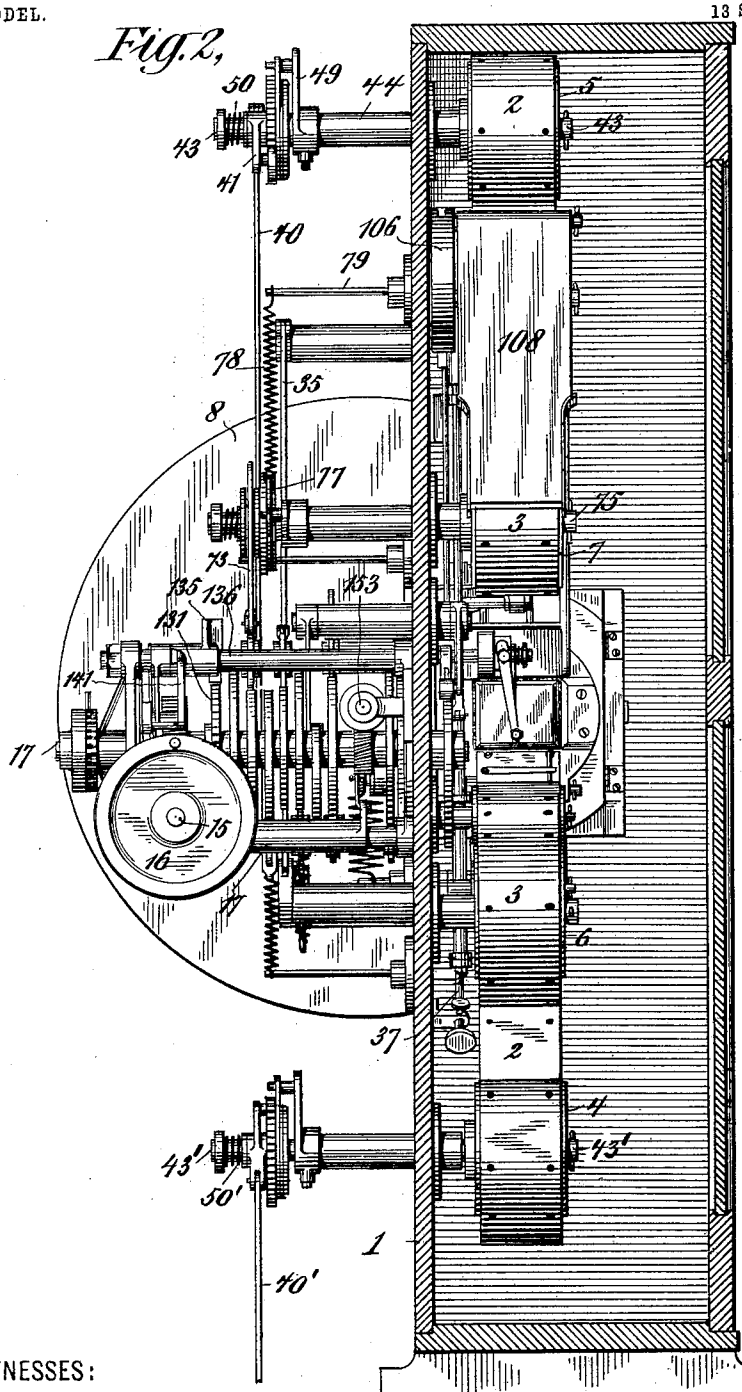
H. CASLER.

PHOTOGRAPHIC PRINTING MACHINE.

APPLICATION FILED MAY 21, 1898. RENEWED JAN. 2, 1903.

NO MODEL. 13 SHEETS—SHEET 2.

Fig. 2.



WITNESSES:

D. K. Raymond

H. A. Cook

INVENTOR

Hermann Casler

BY

E. M. Marble & Son

ATTORNEYS

THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

No. 731,282. PATENTED JUNE 16, 1903.

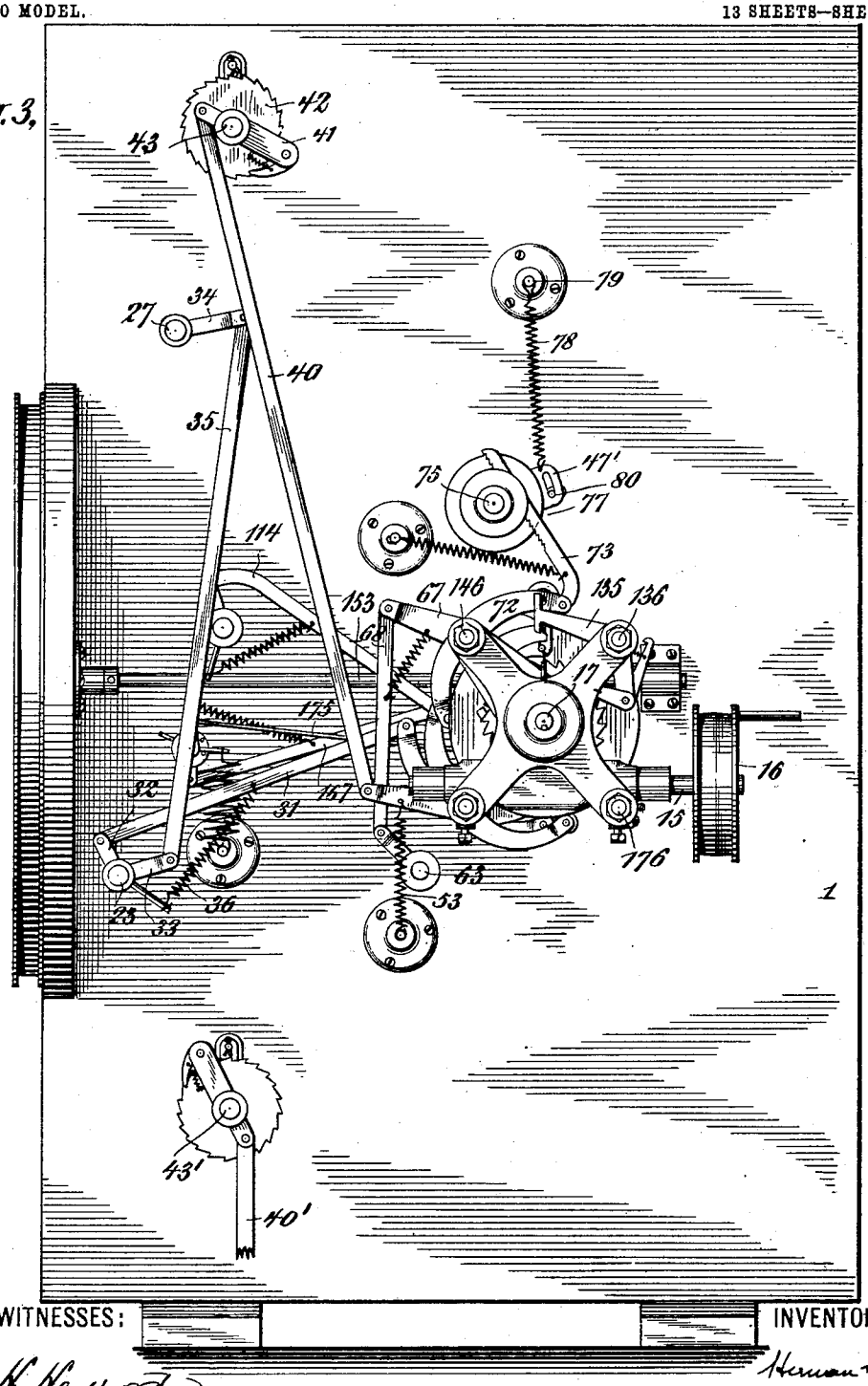
H. CASLER.

PHOTOGRAPHIC PRINTING MACHINE.

APPLICATION FILED MAY 21, 1898. RENEWED JAN. 2, 1903.

NO MODEL. 13 SHEETS—SHEET 3.

Fig. 3.



WITNESSES:

D. N. Naylor.

H. A. Lee.

INVENTOR

Herman Casler

BY

E. M. Marble & Son

ATTORNEYS

THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

No. 731,282. PATENTED JUNE 16, 1903.

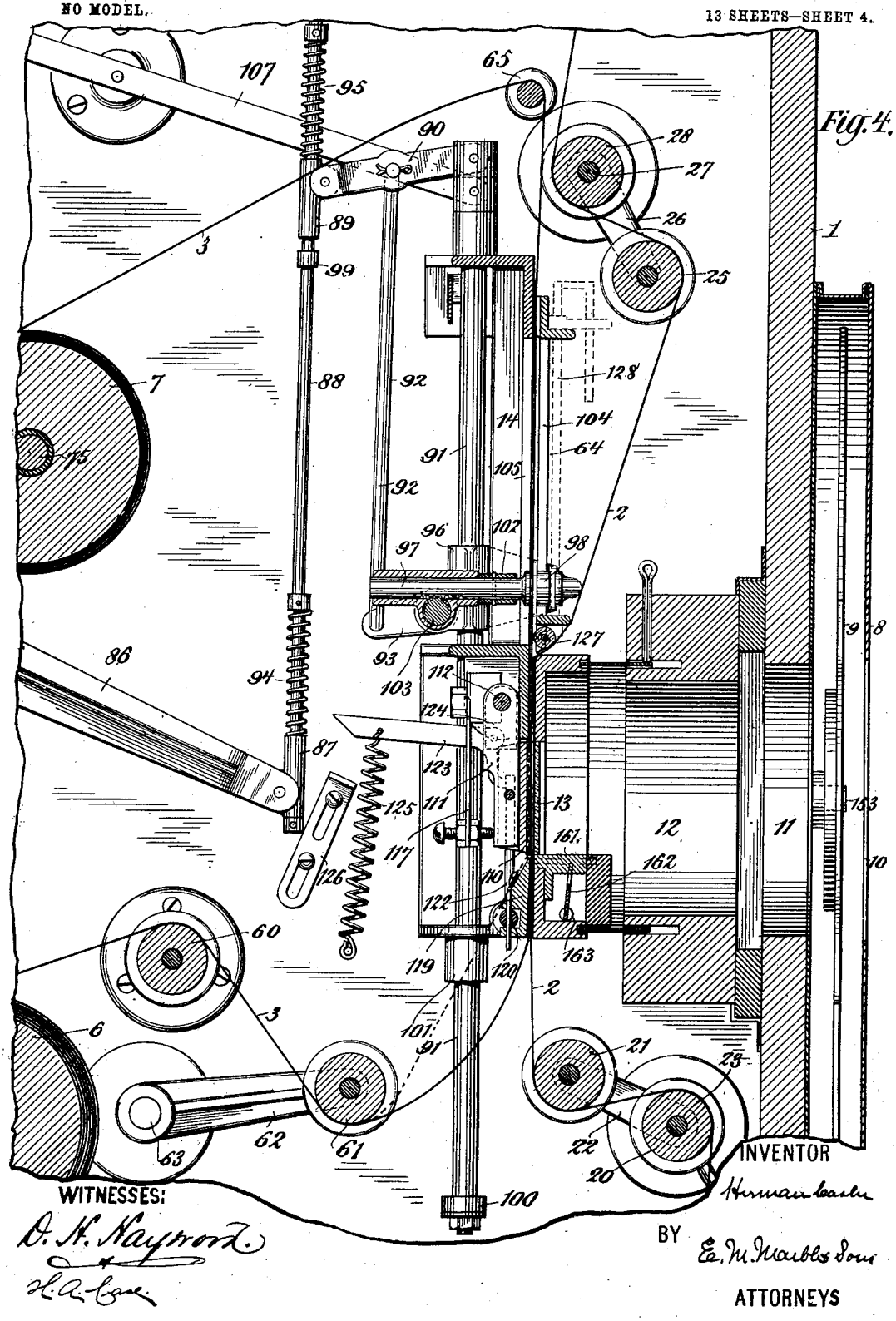
H. CASLER.

PHOTOGRAPHIC PRINTING MACHINE.

APPLICATION FILED MAY 21, 1898. RENEWED JAN. 2, 1903.

NO MODEL. 13 SHEETS—SHEET 4.

Fig. 4.



THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

No. 731,282. PATENTED JUNE 16, 1903.

H. CASLER.

PHOTOGRAPHIC PRINTING MACHINE.

APPLICATION FILED MAY 21, 1898. RENEWED JAN. 2, 1903.

NO MODEL. 13 SHEETS—SHEET 5.

Fig. 5a,

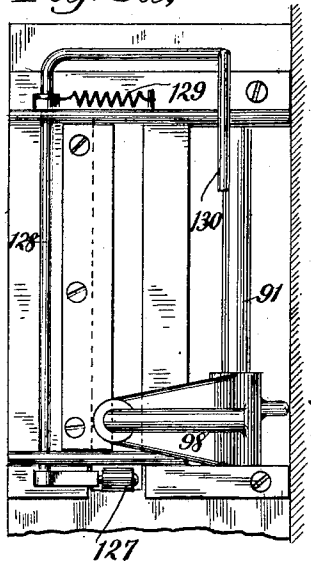
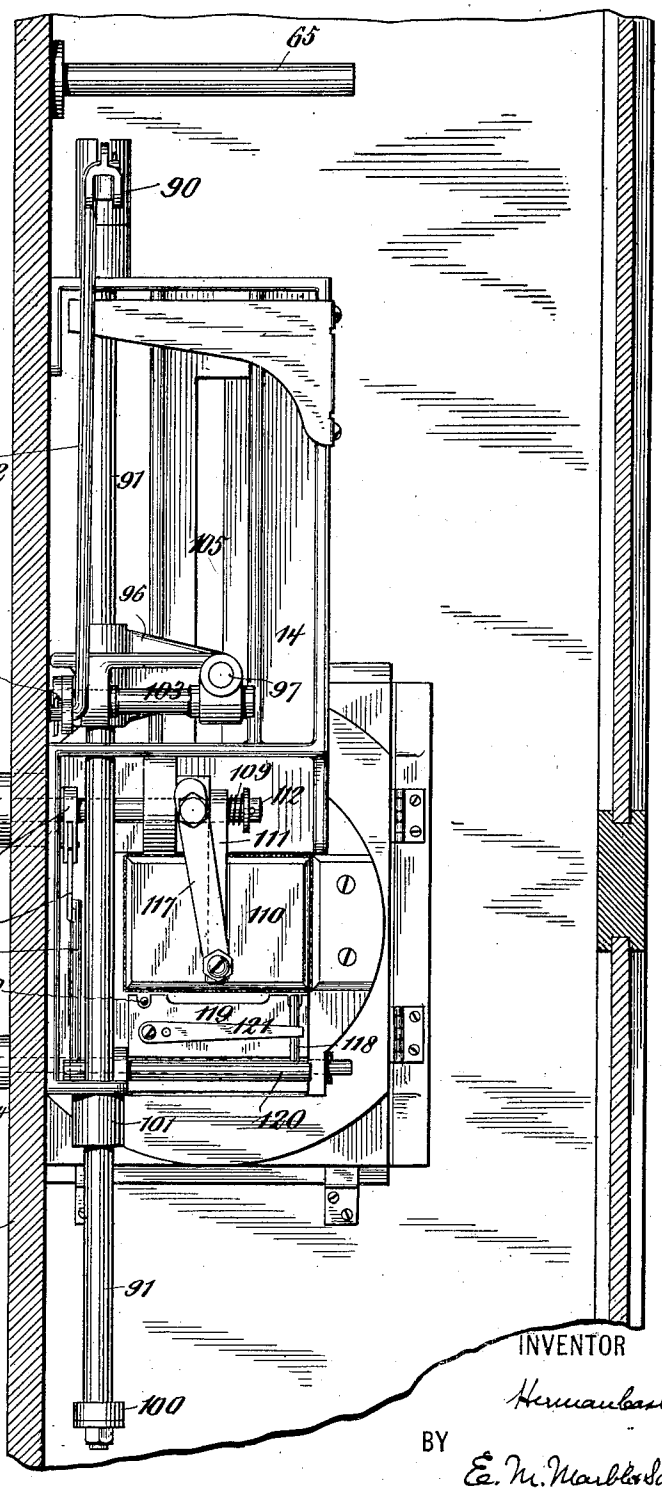


Fig. 5,



WITNESSES:

D. N. Kaysor

H. A. Lee

INVENTOR

Hermann Casler

BY

Ed. M. Marble & Son

ATTORNEYS

THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

No. 731,282. PATENTED JUNE 16, 1903.

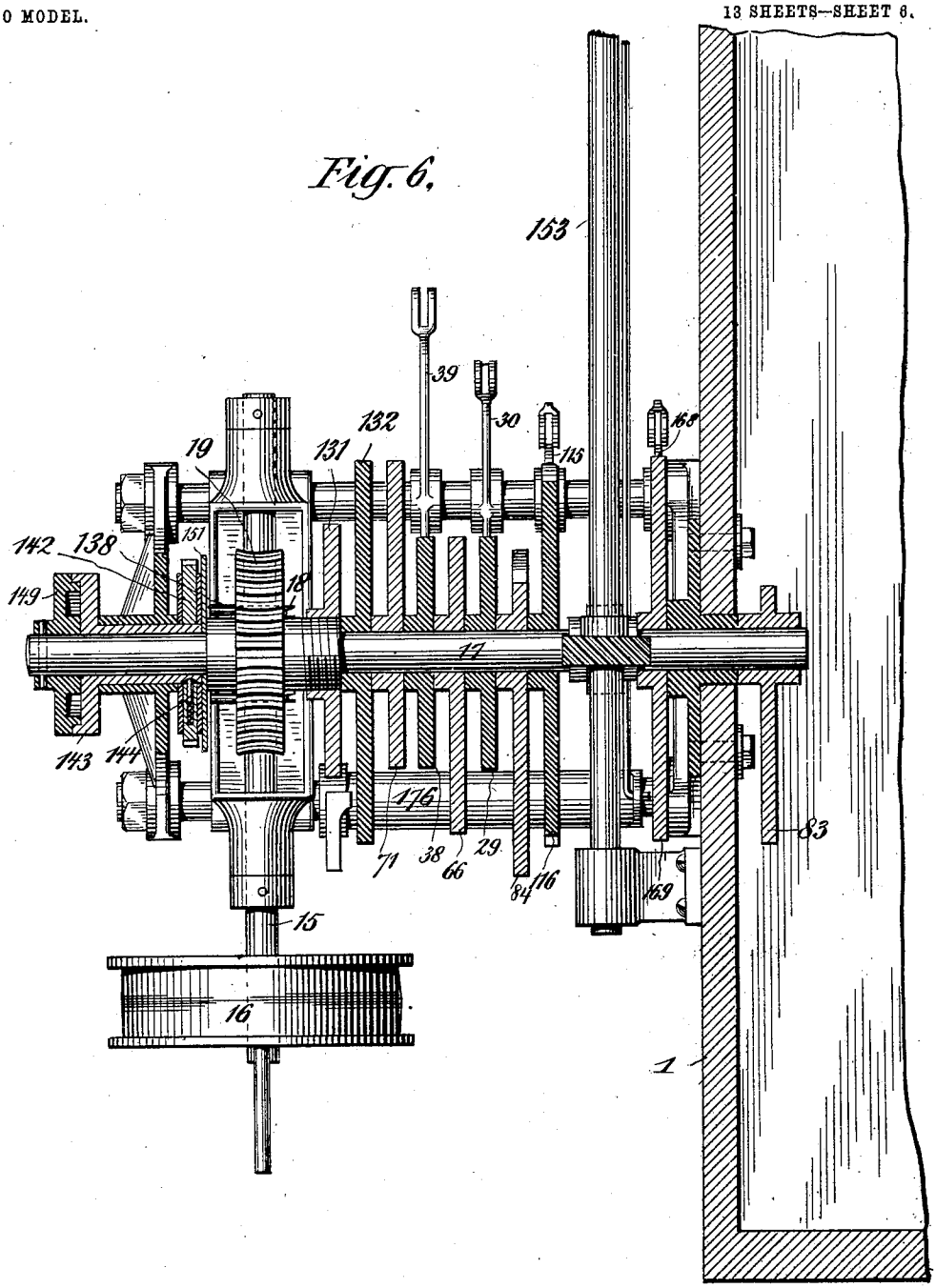
H. CASLER.

PHOTOGRAPHIC PRINTING MACHINE.

APPLICATION FILED MAY 21, 1898. RENEWED JAN. 2, 1903.

NO MODEL. 13 SHEETS—SHEET 6.

Fig. 6.



WITNESSES:

D. H. Haywood

H. A. Lee

INVENTOR

Herman Casler

BY E. M. Marblestone

ATTORNEYS

THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

No. 731,282. PATENTED JUNE 16, 1903.

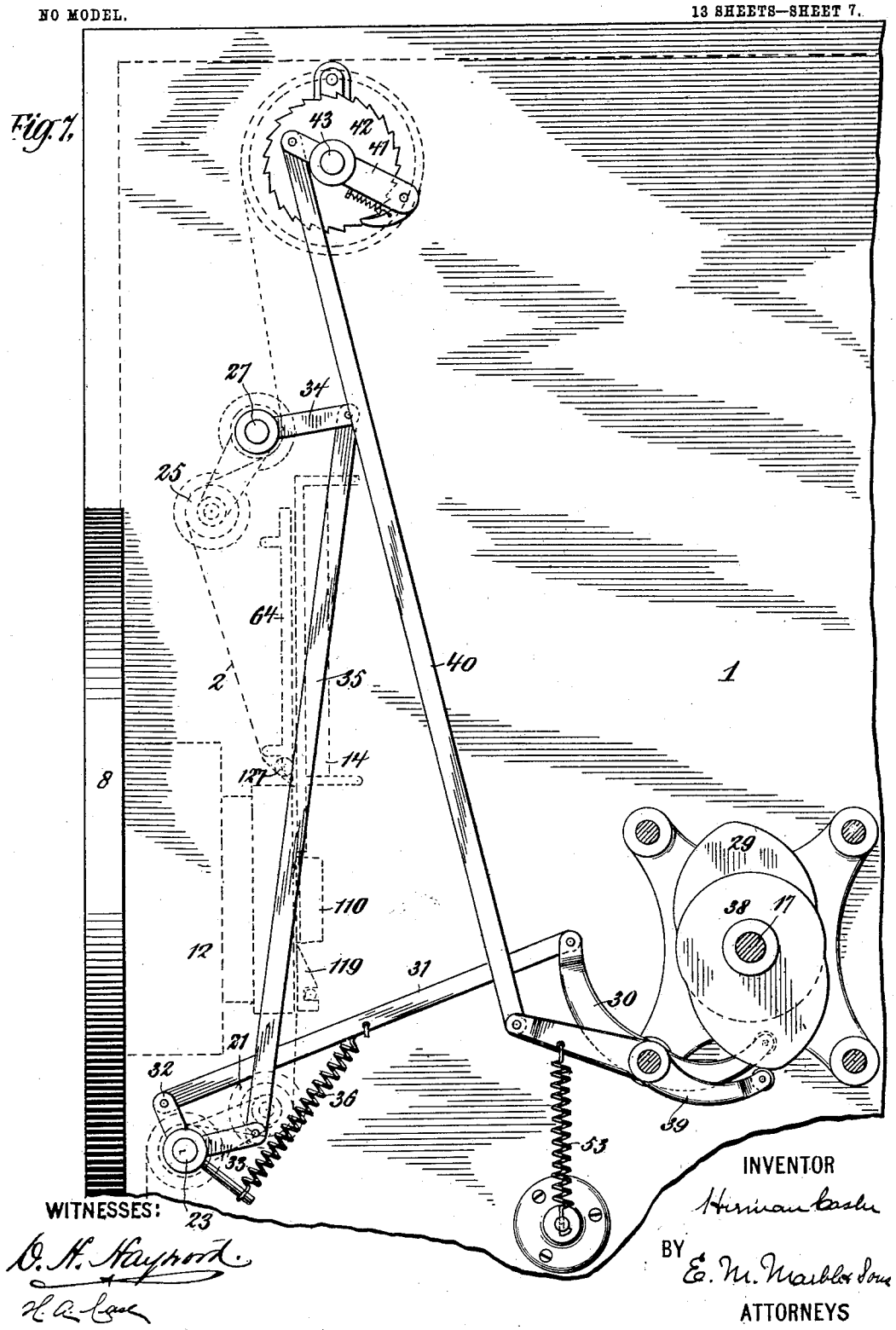
H. CASLER.

PHOTOGRAPHIC PRINTING MACHINE.

APPLICATION FILED MAY 21, 1898. RENEWED JAN. 2, 1903.

NO MODEL. 13 SHEETS—SHEET 7.

Fig. 7.



WITNESSES:

D. H. Hayford.

H. A. Lane

INVENTOR

Hiram Casler

BY E. M. Marble & Son

ATTORNEYS

THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

No. 731,282. PATENTED JUNE 16, 1903.

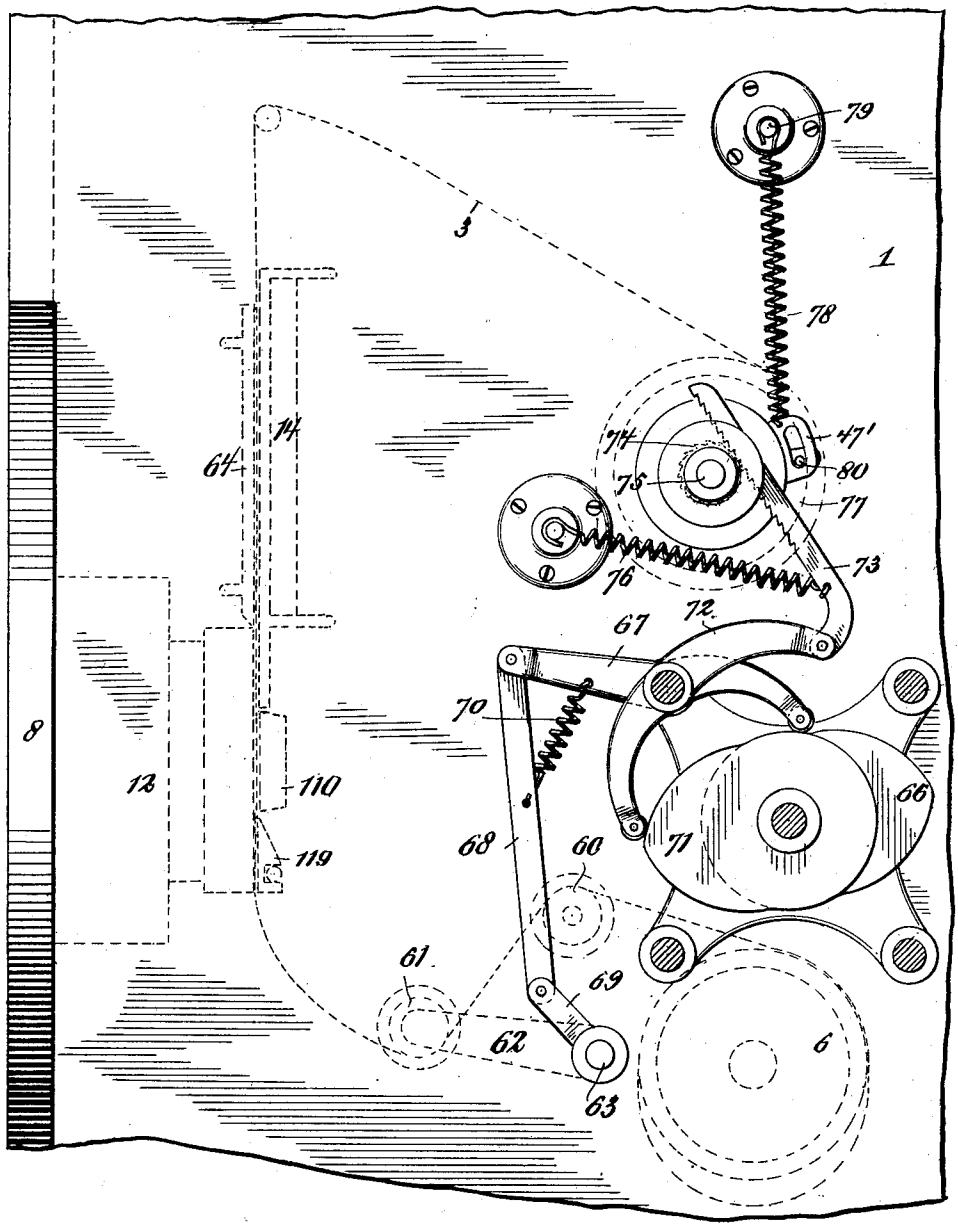
H. CASLER.

PHOTOGRAPHIC PRINTING MACHINE.

APPLICATION FILED MAY 21, 1898. RENEWED JAN. 2, 1903.

NO MODEL. 13 SHEETS—SHEET 8.

Fig. 8,



WITNESSES:

D. H. Haywood

H. A. Lee

INVENTOR

Hiram Casler

BY

E. M. Marble & Son

ATTORNEYS

THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

No. 731,282. PATENTED JUNE 16, 1903.

H. CASLER.

PHOTOGRAPHIC PRINTING MACHINE.

APPLICATION FILED MAY 21, 1898. RENEWED JAN. 2, 1903.

NO MODEL. 13 SHEETS—SHEET 9.

Fig. 9.

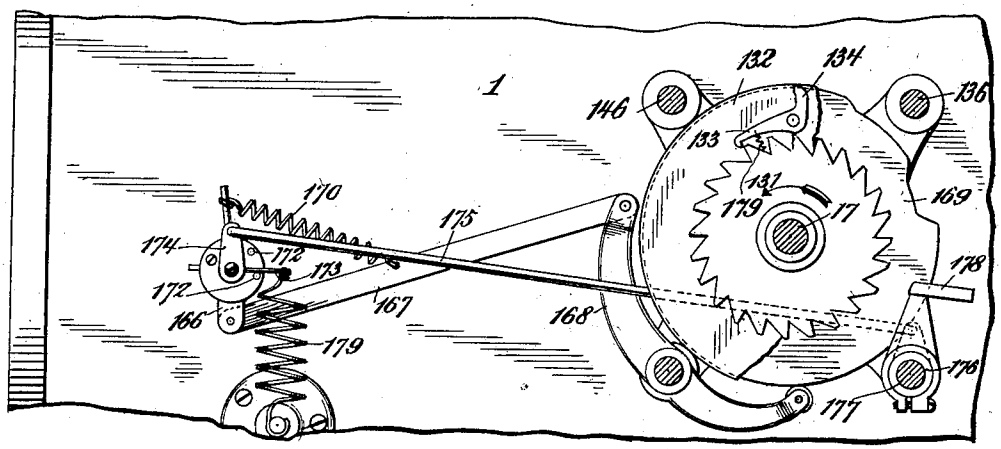


Fig. 10.

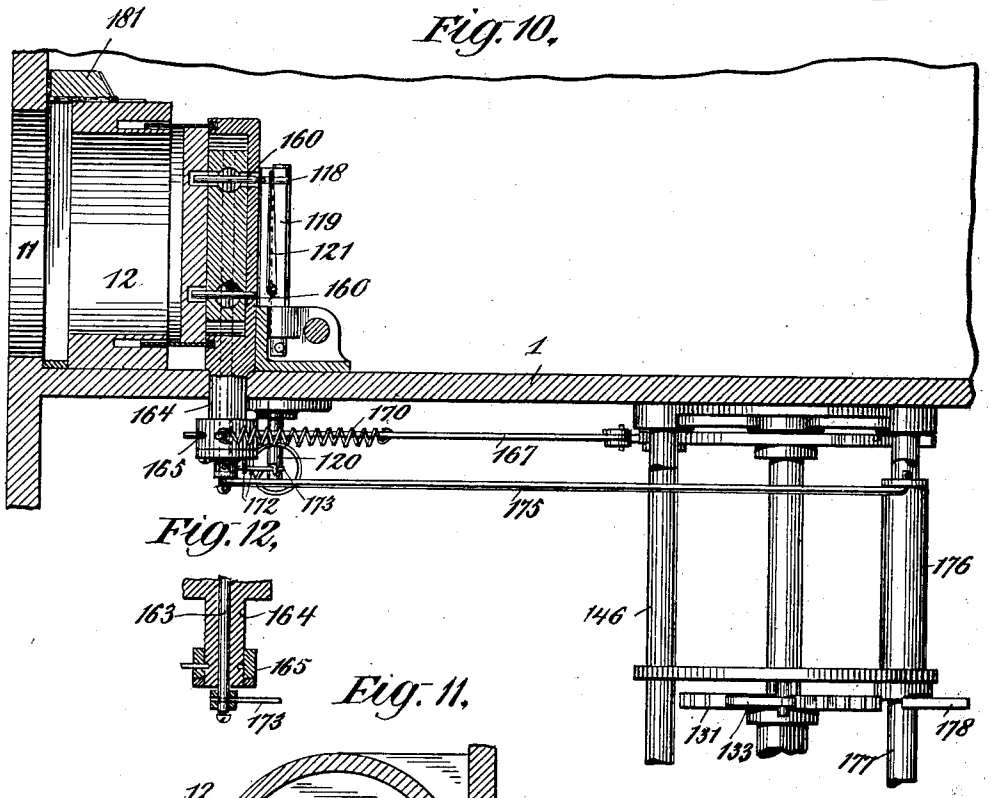
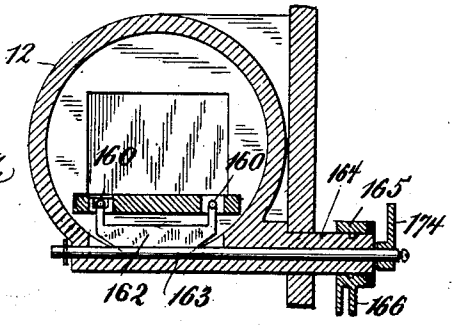


Fig. 12.

Fig. 11.



WITNESSES:

D. H. Kaysworth

L. A. Lee

INVENTOR

Herman Casler

BY E. M. Marble & Son

ATTORNEYS

THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

No. 731,282. PATENTED JUNE 16, 1903.

H. CASLER.

PHOTOGRAPHIC PRINTING MACHINE.

APPLICATION FILED MAY 21, 1898. RENEWED JAN. 2, 1903.

NO MODEL. 13 SHEETS—SHEET 10.

Fig. 13.

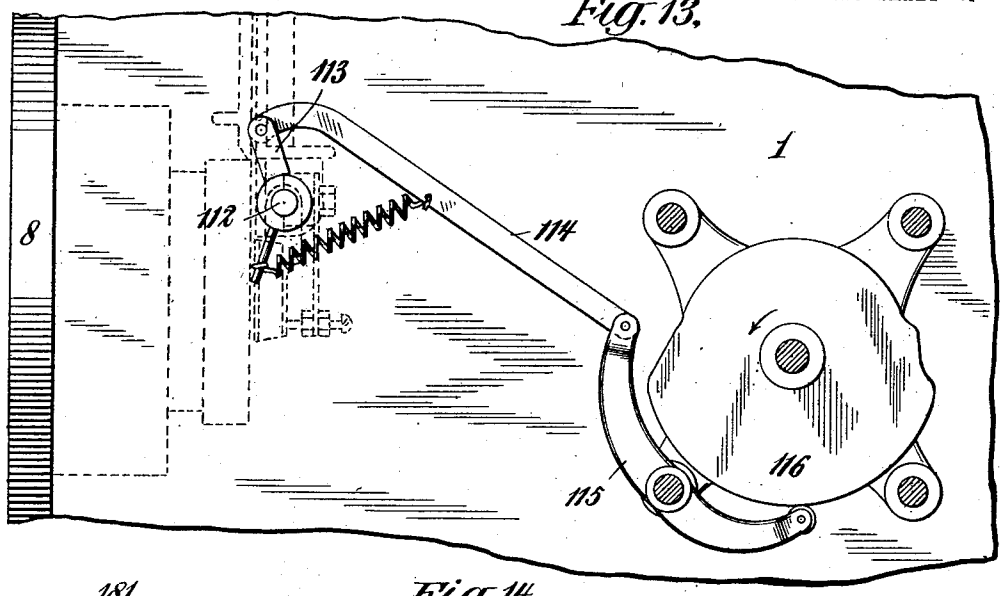


Fig. 14.

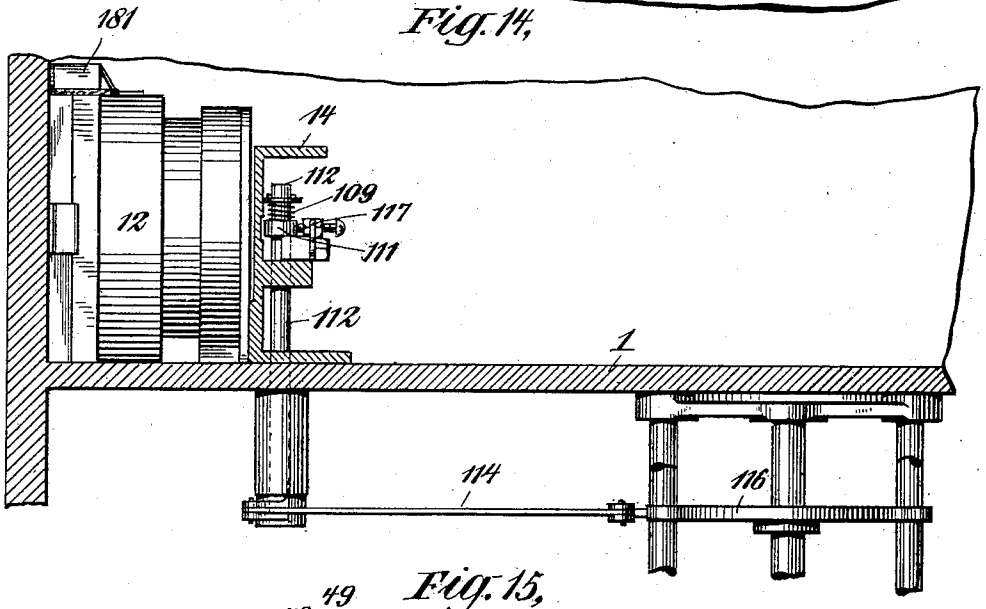
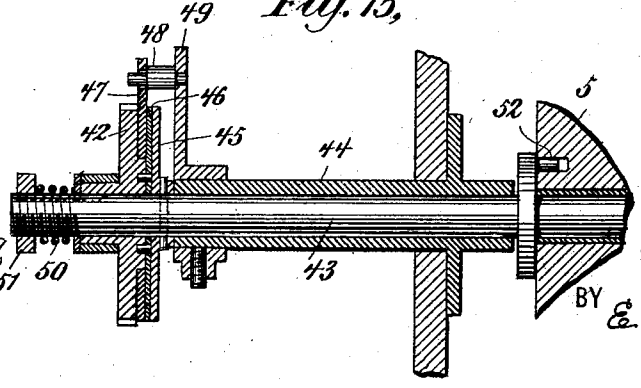


Fig. 15.



WITNESSES:

D. N. Kaymond

H. A. Casler

INVENTOR

Herman Casler

BY E. M. Marble & Son

ATTORNEYS

THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

No. 731,282 PATENTED JUNE 16, 1903.

H. CASLER.

PHOTOGRAPHIC PRINTING MACHINE.

APPLICATION FILED MAY 21, 1898. RENEWED JAN. 2, 1903.

NO MODEL. 13 SHEETS—SHEET 11.

Fig. 16,

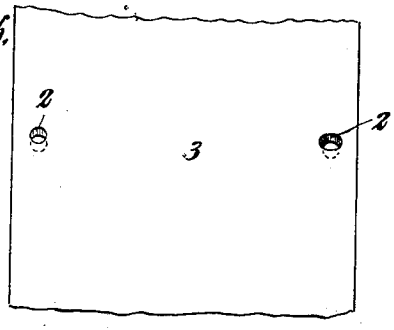


Fig. 17,

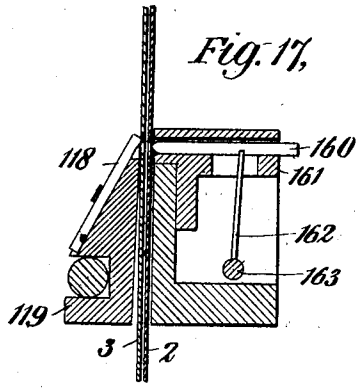


Fig. 18,

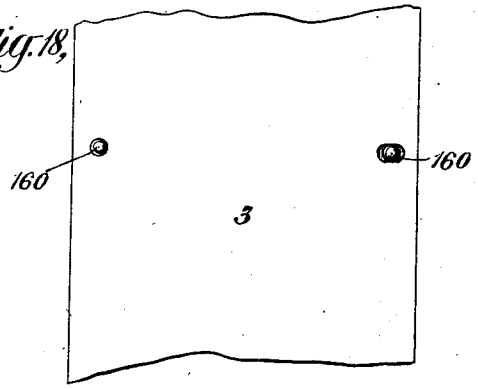


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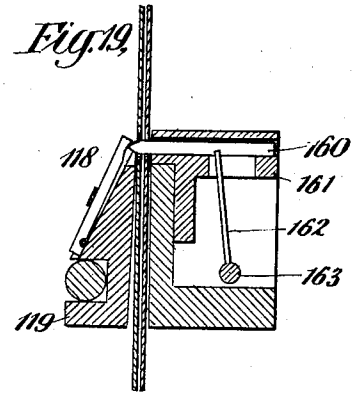


Fig. 20,

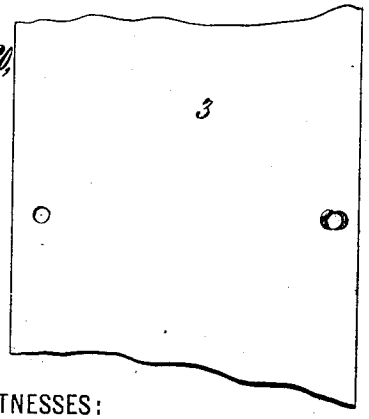
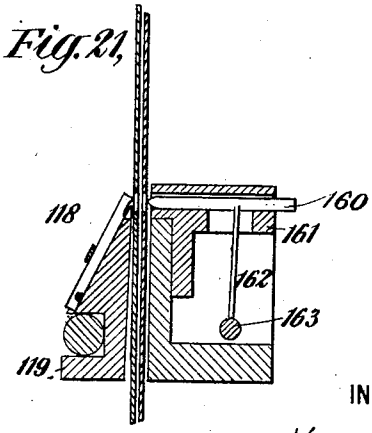


Fig. 21,



WITNESSES:

D. K. Hayward

H. A. Fox

INVENTOR

Human Casler

BY

E. M. Marble & Son

ATTORNEYS

THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

No. 731,282. PATENTED JUNE 16, 1903.

H. CASLER.

PHOTOGRAPHIC PRINTING MACHINE.

APPLICATION FILED MAY 21, 1898. RENEWED JAN. 2, 1903.

NO MODEL. 13 SHEETS—SHEET 12.

Fig. 22.

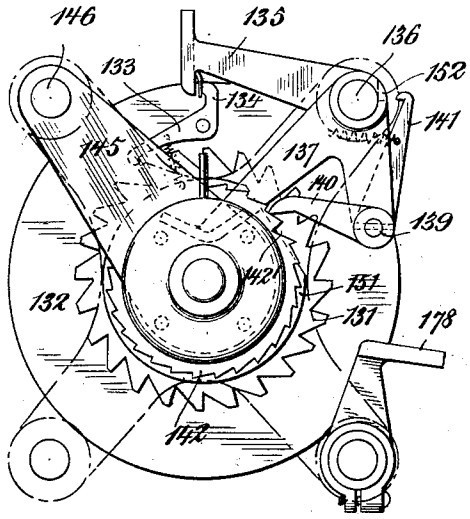


Fig. 23.

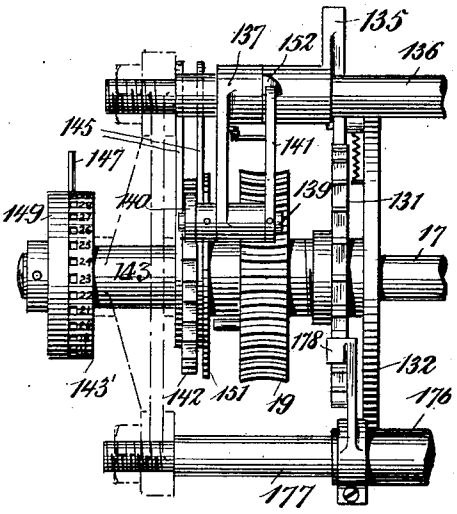


Fig. 24.

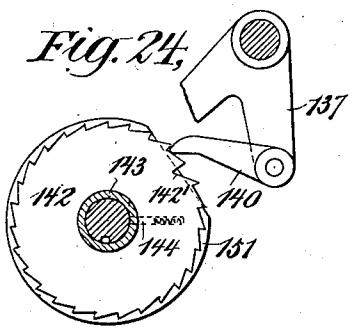


Fig. 25.

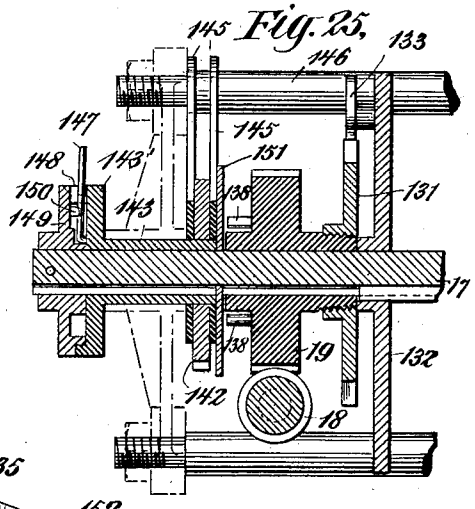
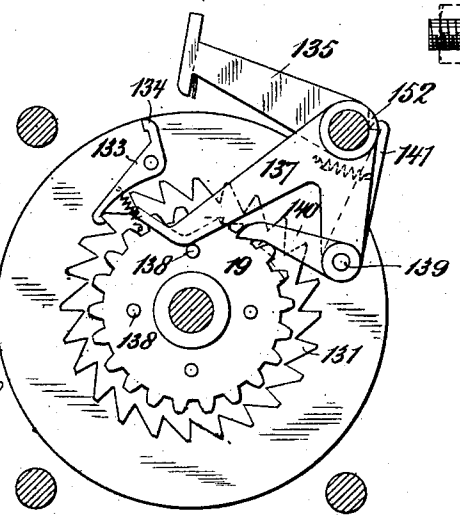


Fig. 26.



WITNESSES:

D. H. Maynard

H. A. Toy

INVENTOR

H. Casler

BY

E. M. Marble & Son

ATTORNEYS

THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

No. 731,282. PATENTED JUNE 16, 1903.

H. CASLER.

PHOTOGRAPHIC PRINTING MACHINE.

APPLICATION FILED MAY 21, 1898. RENEWED JAN. 2, 1903.

NO MODEL. 13 SHEETS—SHEET 13.

Fig. 27.

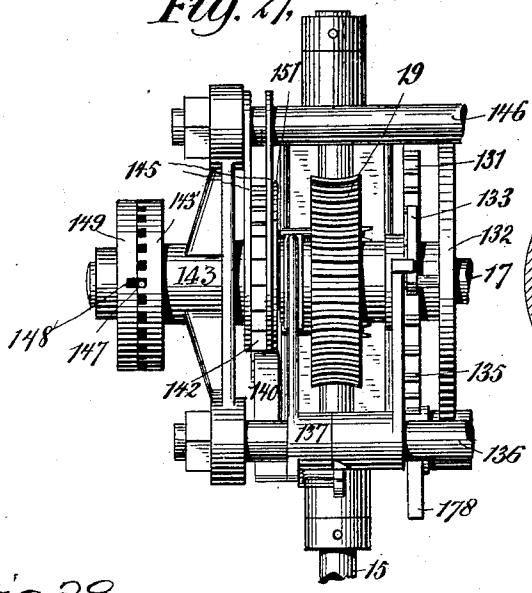


Fig. 36.

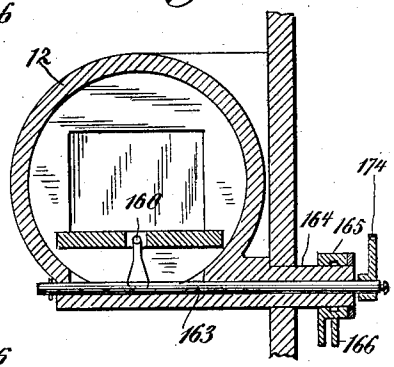


Fig. 28.

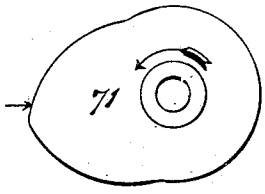


Fig. 29.

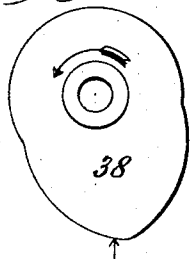


Fig. 30.

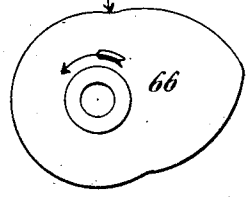


Fig. 31.

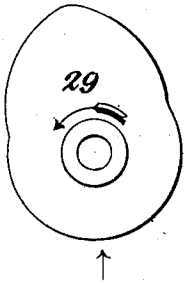


Fig. 32.

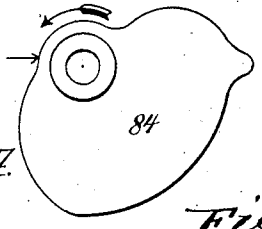


Fig. 33.

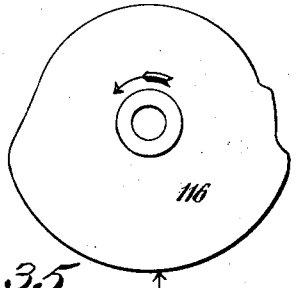


Fig. 34.

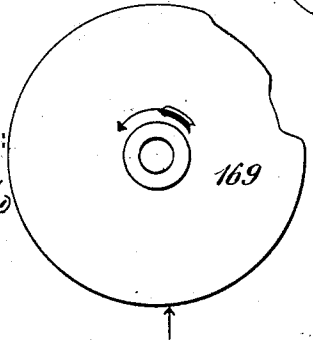
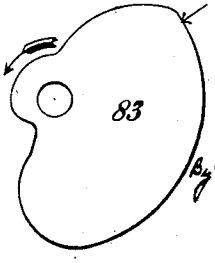


Fig. 35.



WITNESSES:

O. H. Raymond

H. A. Lee

INVENTOR

H. Casler

By E. M. Marble & Sons

ATTORNEYS

THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

No. 731,282. Patented June 16, 1903.

UNITED STATES PATENT OFFICE.

HERMAN CASLER, OF CANASTOTA, NEW YORK, ASSIGNOR TO THE AMERICAN MUTOSCOPE COMPANY, OF NEW YORK, N. Y., A CORPORATION OF NEW JERSEY.

PHOTOGRAPHIC-PRINTING MACHINE.

SPECIFICATION forming part of Letters Patent No. 731,282, dated June 16, 1903.

Application filed May 21, 1898. Renewed January 2, 1903. Serial No. 137,569. (No model.)

To all whom it may concern:

Be it known that I, HERMAN CASLER, a citizen of the United States, residing at Canastota, in the county of Madison and State of New York, have invented new and useful Improvements in Photographic-Printing Machines; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

My invention relates generally to consecutive-view apparatus, and particularly to a photographic printing or copying machine designed to reproduce automatically, from suitable negative strips or films, the series of positive pictures which are employed in consecutive-view-reproducing apparatus for producing what are known as "moving" pictures.

My invention consists in the novel strip-feeding, presser-plate, strip-adjusting, stop-motion, timing, and shutter mechanisms employed, in the combination of these mechanisms with each other, and in the novel combination, construction, and arrangement of the parts.

The objects of my invention are, first, to provide a machine or apparatus for making from suitable negative strips or films the positive strips or films employed in consecutive-view-reproducing apparatus and which shall be entirely automatic in its action; second, to provide improved strip-feeding mechanisms for feeding the strips or films; third, to provide means for adjusting the strips in position and insuring uniformity in the spacing of the views printed upon the positive strip; fourth, to provide means for automatically stopping the operation of the feeding mechanisms and preventing the opening of the shutter in case for any reason a view on the negative strip fails to register perfectly with the exposure-opening after it has been moved into position for exposure and in case the adjusting device fails to adjust its position properly; fifth, to provide adjusting devices for regulating the length of exposures, and, sixth, to make the machine positive in action, thoroughly reliable, and easy of operation. These objects are attained in the invention herein described, and illustrated in the drawings which accompany and form a part of this specification, in which the same reference-numerals indicate the same or corresponding parts, and in which—

Figure 1 is a front view of the machine, the front of the inclosing case having been removed, showing particularly the positive and negative strip feeding mechanisms. Fig. 2 is an end elevation from the left of Fig. 1 of the mechanism of the machine, the inclosing case having been sectioned, showing particularly the relative location of the various mechanisms and of the cams which operate them. Fig. 3 is a rear elevation of the machine. Fig. 4 is a detail elevation and partial section of the principal portions of the feeding mechanisms shown in Fig. 1 upon a larger scale. Fig. 5 is a detail end elevation, upon a larger scale, of the central portion of the mechanism shown in Fig. 1, showing particularly the principal portions of the clamp-feeding mechanism for the positive-strip and the presser-plate operating mechanism. Fig. 5ª is a detail view showing the parts of the feeding-clamp as they appear looking from the rear of Fig. 5 and showing also a roller 127, which is employed to prevent reverse movement of the positive strip. Fig. 6 is a central horizontal section of the various cams by which the mechanisms of the apparatus are operated and of the parts of the apparatus in proximity thereto. Fig. 7 is an elevation, taken from the rear side of the apparatus, of the cams, followers, links, and rachet mechanism of the negative-strip-feeding mechanism, the other parts on the rear side of the machine being omitted. Fig. 8 is a similar view of the corresponding parts of the positive-strip-feeding mechanism. Fig. 9 is an elevation of the cam, follower, links, and other external parts of the strip-adjusting and stop-motion mechanism. Fig. 10 is a detail horizontal section of a portion of the apparatus, showing said strip-adjusting and stop-motion mechanism. Fig. 11 is a detail sectional view of the end piece of the barrel 12 upon the line of the shaft which operates the dowel-pins. Fig. 12 is a

detail horizontal section of the sleeve forming a part of this end piece projecting through the case 1, showing the collar 165 mounted thereon. Fig. 13 is a detail view of the cam, follower, link, and connected external parts of the presser-plate-operating mechanism, taken from the rear of the machine. Fig. 14 is a detail horizontal section of this portion of the machine, showing only the presser-plate-operating mechanism. Fig. 15 is a detail vertical section of the friction driving device and connected parts by which the receiving-reel 5 of the negative strip is driven. Figs. 16 to 21, inclusive, are detail views showing how the sections of the negative strip are caused to register perfectly in the field of exposure by means of the spacing or dowel holes and dowel-pins and showing also how the positive strip is held by the pawl 118, Figs. 16, 18, and 20 being corresponding views, the first of which shows the spacing-holes of the negative strip out of registry with the dowel-pins, the second showing the spacing-holes in registry with said pins, with the pins projecting through the same, and the third showing the spacing-holes in registry, the dowel-pins having been withdrawn. Figs. 17, 19, and 21 are corresponding detail sections of the portion of the end piece of the barrel 12 in which the dowel-pins are mounted and connected parts in the vicinity of the dowel-pins, the first of which views shows the spacing-holes of the negative strip out of registry with the dowel-pins and the dowel-pins about to enter the same, the second of which shows the spacing-holes in registry with the dowel-pins, which latter project through the holes, and the third of which shows the holes in registry, the dowel-pins having been withdrawn. Fig. 22 is a detail end elevation of the timing mechanism, the spider which connects and braces the studs surrounding the cam-shaft being shown in dotted lines. Fig. 23 is a side elevation of this timing mechanism, the said spider being also shown in dotted lines. Fig. 24 is a detail view of the ratchet-wheel 142 of the timing mechanism with the guard-plate 151 and the operating pawl and lever shown in connection therewith. Fig. 25 is a central vertical section of the timing mechanism. Fig. 26 is a detail elevation of the worm-wheel 19, the ratchet-wheel 131, mounted upon the hub of the said worm-wheel, the plate 132, mounted upon the cam-shaft 17 and carrying a pawl engaging this worm-wheel, and the tripping-lever 135 and the parts connected therewith. Fig. 27 is a detail top view of the timing mechanism. Figs. 28 to 35 are detail views showing the various cams of the machine grouped together side by side, so that the order of the operation of the various mechanisms of the apparatus may be apparent, arrows adjacent to the faces of the various cams showing the positions of the followers of said cams when the parts are in the positions shown in the general figures; and Fig. 36 is a view similar to Fig. 11, illustrating the use of a single dowel-pin for adjusting the position of the strips and operating the stop mechanism.

The mechanism of the apparatus comprises the following submechanisms: a mechanism for feeding the negative strip or film and which may be termed the "negative-strip-feeding" mechanism; a mechanism for feeding the positive strip or film and which may be termed the "positive-strip-feeding" mechanism; guides for these strips or films and a presser-plate and operating mechanism for holding the films in contact during exposure; a shutter-operating mechanism; an adjustable timing mechanism for regulating the duration of exposure, and a strip-adjusting stop mechanism which brings each view-section of the negative strip into exact registry in the field of exposure, if this be possible, when it has been moved into position for exposure prior to the opening of the shutter and prevents the opening of the shutter or the further feeding of either strip if said view-section is not brought into registry.

Referring now to the drawings, and more particularly at first to Figs. 1 to 6, inclusive, 1 is an inclosing case which contains the two strips or films and the mechanism which directly acts upon the strips.

2 is the negative strip or film, and 3 the positive strip or film.

4 and 5 are the supply and receiving reels, respectively, for the negative strip, and 6 and 7 the supply and receiving reels, respectively, for the positive strip. The negative strip is divided into sections by spacing or dowel holes, as shown in Figs. 2 and 16 to 21, which must always occupy the same relation with respect to their respective views, even though their distance along the strip may vary, and hence are or may be made in the camera in which the negative strips are first exposed and the pictures taken by suitable punches at the instant of exposure of each picture, as is described in my application for Letters Patent for a consecutive-view camera, filed February 26, 1896, Serial No. 580,811. The positive strip may be similarly perforated, though it is not necessary to have the positive strip perforated if it is intended to be used in reproducing apparatus adapted to employ long continuous strips or films. If the positive strip is perforated, the perforations are preferably made before the strip is placed in the printing-machine by any suitable punching apparatus capable of punching the holes the same distance apart throughout the strip.

8 is a cylindrical case inclosing a shutter-disk 9, Fig. 4. In the front of the case 8 is an opening 10 for the admission of light to the interior of the case 1 through a suitable opening in the shutter, and in the wall of the case 1 there is a corresponding opening 11. A barrel 12, surrounding the opening 11, prevents the diffusion of the light throughout the interior of the case 1, and the end of this barrel forms a support against which the two

strips may be pressed by the presser-plate and has in it a window 13, through which light passes to these strips.

In close proximity to the end of the barrel 12, but with a narrow slot sufficient for the passage of the two strips separating it from the end of the barrel, is a frame-plate 14, secured to the back of the case 1, as shown in Fig. 5. This plate 14 supports various portions of the mechanism, as will be hereinafter described.

The several submechanisms of the apparatus are all driven through a worm-gear and a cam-shaft 17 from a single driving-shaft 15, Figs. 2, 3, and 6, having on it a belt-wheel 16 or other means for rotating it. The worm 18, Figs. 6 and 25, is fast on the shaft 15; but the worm-wheel 19 is loose upon the shaft 17. The motion of the shaft 15 is continuous; but the motion of the shaft 17 is intermittent, being controlled by the timing and stop-motion mechanisms illustrated particularly in Figs. 9 to 12 and 22 to 27, inclusive, and which will be hereinafter described. It is sufficient for present purposes to understand that the shaft 17 is driven, though intermittently, from the shaft 15.

The strip-feeding mechanisms, the presser-plate-operating mechanism, and the strip-adjusting and stop-motion mechanisms are all operated by cams upon the cam-shaft 17, which operate when said shaft revolves and are stationary when said shaft is stationary.

The several submechanisms of the apparatus may now be described.

The negative-strip-feeding mechanism, Figs. 1, 2, 3, 4, 6, 7, and 15.—The negative strip 2 passes from its supply-reel 4 over an idler guide-roller 20 and thence over a friction-roller 21, mounted upon a swinging arm 22, itself secured to a rock-shaft 23. From thence the strip passes through the slot between the end of the barrel 12 and the frame-plate 14, and so through the field of exposure, thence over a friction-roller 25, mounted upon a swinging arm 26, itself secured to a rock-shaft 27, and over an idler guide-roller 28 to the receiving-reel 5. The feeding devices are the rollers 21 and 25 upon the arms 22 and 26. These rollers and the receiving-reel 5 are operated by the cam mechanism shown particularly in Fig. 7. The cam 29 on the shaft 17 operates the pulleys 21 and 25. A follower-lever 30, pivoted to the frame of the apparatus near its middle, has at one end a friction-roller adapted to bear against the edge of the cam 29 and at the other end is connected by a link 31 with a lever 32 on the lower rock-shaft 23. The upper rock-shaft 27 is connected with shaft 23, so as to move in unison therewith, by levers 33 and 34 and a link 35. A spring 36, connected to the link 31, tends to hold the friction-roller of the follower 30 in contact with the cam 29. When this cam operates its follower, the roller 25 is moved to the right of Figs. 1 and 4 and the left of Fig. 7, thus drawing the film upward from the field of exposure, and the roller 21 is moved downward, thus drawing a fresh length of film from the supply-reel 4. The return movement of the rollers leaves the film above and below the field of exposure slack; but as the film begins to get slack dowel-pins 160 (shown in Figs. 10 and 17, 19 and 21) are thrust through spacing-holes in the film, so preventing it from moving backward. The travel of the roller 21 is limited by a stop-screw 37, Fig. 1, engaging a projection upon the rear of the arm 22. By adjusting this screw the length of film drawn from the spool 4 and fed upward each time the feeding mechanism operates may be varied.

The receiving-reel 5 is rotated by means of the cam 38, which has a follower 39, connected by a link 40 with a pivoted ratchet-arm 41, having a pawl engaging the teeth of a ratchet-wheel 42. This ratchet-wheel 42 is mounted upon the same shaft 43 upon which the reel 5 is mounted and has a driving connection therewith through a friction device. (Shown in Fig. 15.) This figure shows the shaft 43 revolubly mounted in a sleeve 44. A disk 45 is secured to the shaft 43, and between the disk 45 and the ratchet-wheel 42 is a disk 46, connected by pins to ratchet-wheel 42, as shown. Another disk, 47, separates the outer portion of the disk 46 from the ratchet-wheel 42, and the disk 47 is held stationary by a pin 48, projecting from an arm 49, secured to the boss 44. A spring 50 is pressed by a nut 51 against the ratchet-wheel 42, and by varying the pressure exerted by this spring the adhesion between disks 46 and 45 may be varied. The reel 5 is caused to revolve with the shaft 43 by an eccentric-pin 52, carried by the shaft 43 and fitting into a corresponding socket in the end of the reel.

The purpose of the frictional connection between the ratchet-wheel 42 and the shaft 43 is to permit the ratchet-wheel to slip without revolving the reel 5 as soon as all the slack in the film has been taken up. Such a device is required, because in order to insure that all of the slack film shall be wound up the cam 38 is arranged to give the ratchet-arm 41 a slight amount of overtravel. When the loose film has been wound up, therefore, so that the shaft 43 and disk 45 are held stationary, the ratchet-wheel 42 and disk 46 slip until the ratchet-arm 41 ceases its forward movement.

The friction between the disk 47 and ratchet-wheel 42 and disk 46 prevents the ratchet-wheel from moving backward after the ratchet-arm 41 has begun to move back.

As shown in Figs. 2 and 3, the shaft 43′ of the supply-spool 4 has a similar ratchet mechanism, the link 40′ of which may be connected to the follower 39 instead of the link 40. In the figures this link 40′ is shown as broken off on account of its length. Link 40 is disconnected and link 40′ connected with the follower 39 when it is desired to print a series of views in reverse order upon the positive strip. The pressure-spring 50 or

50′ on that shaft 43 or 43′ which is to be idle during the operation of the apparatus is relieved before the operation begins, so that there is no driving connection between said shaft and the ratchet-wheel upon it. A spring 53 tends to hold the follower 39 against the cam 38.

The positive-strip-feeding mechanism, Figs. 1, 2, 3, 4, 5, 6, and 8.—The positive strip 3, upon which the pictures of the negative strip 2 are to be printed, passes from its supply-spool 6 over a guide-pulley 60 and around a friction-pulley 61 on a swinging arm 62, itself mounted on a rock-shaft 63. From thence, if it be provided with spacing-holes, it passes between a presser-plate 119 and the barrel 12, as indicated in full lines in Fig. 4, or if it be not provided with spacing-holes it passes over the presser-plate 119, as indicated in dotted lines in Fig. 4. It then passes through the slot between the barrel 12 and the frame-plate 14, back of the negative strip 2, and between the plate 14 and another plate 64, which holds it flat while it is being pushed upward by the clamp feeding mechanism, as hereinafter described, thence over a guide 65, and thence to its receiving-reel 7. The feeding device which draws the strip from its supply-reel 6 is the roller 61 upon the arm 62. This arm is vibrated by a cam 66, Fig. 8, having a follower 67, connected by a link 68 to an arm 69 on the shaft 63, and a spring 70 tending to hold the follower in contact with its cam.

The receiving-reel 7 is rotated by a cam 71, Fig. 8, having a follower 72 and a ratchet-arm 73, held in contact with a ratchet-wheel 74 on the shaft 75 of the reel 7 by a spring 76. This ratchet-wheel has a driving connection with its shaft 75 through a friction driving device 77, Fig. 2, similar to that by which the ratchet-wheel 42 drives the shaft 43. The stationary disk 47′ of this driving device, corresponding to the disk 47 of Fig. 15, is held by a spring 78, secured at one end to a stud 79, its motion being limited, however, by a stud 80. The spring allows the receiving-reel 7 to turn back slightly an instant before the clamp feed, hereinafter mentioned, releases the strip, so that the tendency of the strip to curl up may not draw more strip forward, and so vary the distance between pictures.

The mechanism which feeds the positive strip through the field of exposure operates by grasping the strip in a clamp, which then moves upward, drawing the strip upward. Such a feeding device is to be preferred to any other for the feeding of the positive strip, because of the great accuracy with which it operates, slipping of the strip in the feeding device being impossible. It is important that the pictures printed on the positive strip shall be printed at the same distance apart throughout the strip. Hence the necessity for accuracy in the operation of the feeding mechanism.

The clamp feeding mechanism is illustrated particularly in Figs. 1, 4, and 5. This feeding device is actuated by two complementary cams 83 and 84, the latter being shown in dotted lines in Fig. 1, having follower-levers connected to the same shaft 85, and which by opposing each other give the feeding mechanism a positive motion in both directions. An arm 86, which is an extension of the follower of the cam 83, is connected to a collar 87 upon a rod 88. Another collar 89 on this rod 88 is pivotally connected to an arm 90, itself pivotally connected to a vertically-sliding rod 91, having guides in the frame-plate 14, and which forms a carriage for the strip-feeding clamp. To the arm 90 is also connected at an intermediate point a link 92, connected to a swinging arm 93. Upon the rod 88 are springs 94 and 95, against which the collars 87 and 89 bear. Upon the rod 91 is secured a bracket 96, in which the shaft 103 of the arm 93 has a bearing and in which a sliding bolt 97, adapted to be moved toward or away from the positive strip 3, is mounted. Upon the shaft 103 of the arm 93 are teeth meshing with the teeth of a rack on the bolt 97. This bolt forms the movable element of the clamp by which the strip is grasped. The other element of the clamp is an extension 98 of the bracket 96, which extends around to the front side of the positive strip.

When the cams 83 and 84 are revolved, the arm 86 moves upward, communicating a similar movement to the rod 88 through the spring 94, and by means of a shoulder 99, which abuts against the collar 89, raising the end of the arm 90, which swings about its point of connection with the rod 91 as a pivot. A corresponding movement is communicated to the arm 93 by the link 92, thus moving the bolt 97 outward, so as to cause it to clamp the positive strip 3 against the stationary piece 98 of the clamp. When the bolt 97 can move outward no farther, the movement of the arms 93 and 90 about their pivots is arrested, and the arm 90, rod 91, and the parts connected therewith are lifted bodily, thus drawing the positive strip upward. The extent of this upward movement is determined by a ring or washer 100 on the lower end of the rod 91, which comes in contact with a shoulder 101 on the plate 14, after which further upward movement of the arm 86 simply compresses the spring 94.

When the cams 83 and 84 cause the arm 86 to descend, the arms 90 and 93 are swung downward about their pivots, thus moving the bolt 97 backward and releasing the positive strip. The cams 83 and 84 are so shaped that after the arm 86 has been moved upward to the fullest extent it is moved down again for a short distance, sufficient to open the clamp and release the positive strip. The arm 86 is then held stationary for a time by the cams and then is caused to descend to the limit of its travel. A collar 102 on the bolt limits the backward movement of the bolt 97 occasioned by the downward movement of the arm 86,

and when it can move backward no farther the rod 91 and the parts thereon move downward. The downward movement of the rod 91 is limited by a shoulder on the upper end of the rod, which strikes the plate 14, after which further downward movement of the rod 88 simply compresses the spring 95.

The bolt 97 and extension 98 work in slots 104 and 105 in the plates 14 and 64, as shown in Figs. 4 and 5. The vertically-moving parts of the clamp feeding mechanism are balanced by a weight 106 on the end of a pivoted lever 107, Fig. 1, connected to the rod 91 by a pin working in a slot in the end of said lever. This feeding mechanism grips the film or strip so tightly that no slipping of the film is possible. At the same time no injury whatever to the strip can be caused by the clamp. The strip is fed upward the same distance each time the feeding device operates with great accuracy.

It is frequently desirable to have the pictures upon the positive strip spaced at a less or greater distance apart than those on the negative strip. This can be done in this apparatus, for the feeding mechanism of the two strips are quite distinct and operate separately. The length of positive strip fed forward by the clamp feed may be regulated by using washers 100 upon the lower end of the rod 91 of different lengths. No adjustment of the length of travel of the arm 86 is required where the travel of the rod 91 is thus changed, because the springs 94 and 95 permit considerable overtravel of this arm. A pivoted arm 108, Figs. 1 and 2, presses against the positive strip as it is wound upon the reel 7 with enough force to cause the strip to be wound upon this reel evenly and tightly.

In order to prevent the positive strip from falling backward when released by the clamp feed mechanism, a pawl 118, Figs. 5 and 17, and a roller 127, Figs. 4 and 5[a], are provided. If the positive strip be perforated with spacing-holes, the pawl engages these holes and so holds the strip stationary. If the strip is not provided with spacing-holes, it is prevented from falling back by the roller 127, mounted upon an arm carried by a rock-shaft 128. A spring 129, carried upon an arm projecting from this rock-shaft, tends to hold the roller 127 against the picture-strip. When a perforated positive strip is employed, the clamp feeding mechanism is arranged to overfeed the strip slightly at each operation. The pawl 118 drops into the spacing-hole as soon as said hole is opposite the pawl, and when the feeding-clamp is opened the strip drops back until it rests upon the pawl. In order that the roller 127 may not interfere with this slight backward movement of the strip, the shaft 128 is provided with an arm 130, which is engaged by a rounded web on the back of the portion 98 of the feeding-clamp, and when said clamp has nearly reached the end of the travel required for the feeding of the perforated strip the arm 130 is pushed out, thus moving the roller 127 away from the strip. This does not interfere with the action of the roller 127 in preventing backward movement of the strip when it passes, as shown in dotted lines in Fig. 4, because, since the pictures on imperforated strips are spaced more closely than on perforated strips, it being unnecessary to provide room between the pictures for the spacing-holes, the web on the part 98 does not come into contact with the arm 130 during the feeding of an unperforated strip. When an unperforated positive strip is fed through the apparatus, the pawl 118 is usually removed, the positive strip being carried over the beveled plate 119, which carries said pawl, as indicated in dotted lines in Fig. 4.

The presser-plate-operating mechanism, Figs. 1, 2, 3, 4, 5, 6, 13, and 14.—In order to hold the positive and negative strips in contact during exposure, so as to insure clear and well-defined images on the positive strip, a presser-plate 110 is employed, which presses these strips against the window 13 in the end of the barrel 12 during the period of exposure and then moves backward out of contact with the strips, so as to leave them free to move upward. This presser-plate consists of a block or plate 110 of about the size of the window 13, pivoted to an arm 111 and covered with felt or some other soft elastic material on the face which comes in contact with the positive strip, as shown in Fig. 4, so as to insure uniform pressure. The arm 111 is mounted upon a rock-shaft 112, having suitable bearings, and which at the other end is provided with an arm 113, Fig. 13, which is connected by a link 114 to the follower 115 of the cam 116. A spring (shown in Fig. 13) tends to hold this follower in contact with the cam. The arm 111 is loose upon the shaft 112 and serves merely to support the presser-plate. A leaf-spring 117, Figs. 4 and 5, is secured at one end to the shaft 112 and presses against the arm 111 at the other end. A coiled spring 109 is secured at one end to a collar on the shaft 112 and at the other end to the arm 111. These springs oppose each other. When the shaft 112 is rotated in one direction, the spring 117 presses the presser-plate downward against the strips, and when the shaft 111 rotates in the other direction the spring 109 presses the presser-plate upward, causing it to follow the spring 117.

Beneath the presser-plate 110 is a second presser-plate 119, which carries the pawl 118. It is mounted upon a shaft 120, which has bearings in the frame-plate 14 and is keyed to said shaft. It is pressed against the strip during the greater portion of each cycle of operations by a bell-crank lever 123, pivoted to an arm 124, mounted upon the rock-shaft 112. To one end of the bell-crank lever is connected a spring 125. The other end of the bell-crank lever normally presses against an arm 122 projecting from the rock-shaft 120. The arrangement of the parts is such that normally the spring 125 causes the bell

crank lever 123 to press upon the arm 122, and so to force the second presser-plate 119 against the strips. When the presser-plate 110 moves outward, the outer arm of the bell-crank lever 123 swings downward under the influence of the spring 125, the other arm of the bell-crank lever still pressing against the arm 122 until the bell-crank lever reaches a stop 126, after which further movement of the presser-plate and arm 124 causes the bell-crank lever to move away from the arm 122. When the presser-plate 110 begins to move down, the bell-crank lever 123 is moved away from the stop 126 and immediately presses against the arm 122, thus again pressing the lower presser-plate against the strips.

The primary function of the presser-plate 119 is to prevent the negative strip from slipping down during the interval between the withdrawal of the dowel-pins 160 and the bringing of the presser-plate 110 down upon the strips. As hereinafter described, when a new section of the negative strip has been moved up into position for exposure (which movement takes place while the presser-plate 110 is raised, so that neither it nor the presser-plate 119 exert any pressure upon the strips) the dowel-pins 160 are thrust through the spacing-holes so as to register the view-section accurately in the field of exposure. These dowel-pins must be withdrawn, however, before the presser-plate 110 comes down upon the strips, and the presser-plate 119 is employed to hold the negative strip when the dowel-pins have been withdrawn. The presser-plate 119 is pressed against the film almost instantly after the presser-plate 110 begins to move down.

The pawl 118 lies within a groove in the outer face of the second presser-plate 119 and is held in place by a spring 121, Fig. 5.

The timing and shutter-operating mechanism, Figs. 2, 3, 6, and 22 to 27.—It has heretofore been stated that the cam-shaft 17, upon which are mounted the cams by which the mechanisms heretofore described are operated, revolves intermittently, its revolution being controlled by a timing mechanism. The purpose of this timing mechanism is to regulate the length of the interval of time during which the shutter is open in order to obtain the proper exposure.

The mechanism by which the shaft 17 is driven from the shaft 15 is as follows: The worm-wheel 19, which is driven from the worm 18 on the shaft 15, as already stated, is loose upon its shaft 17. Upon the hub of this worm-wheel and secured thereto is a ratchet-wheel 131, Figs. 22 to 27. Adjacent to the ratchet-wheel 131 and mounted on and keyed to the shaft 17 is a disk 132, keyed to the shaft 17 and carrying a pawl 133, which is adapted to engage the teeth of the ratchet-wheel 131. When the pawl is thus in engagement with the teeth of the ratchet-wheel, the disk 132 is caused to revolve with the worm-wheel 19, which revolves continuously, thus causing the shaft 17 to revolve. The pawl 133 has a projection 134, adapted to be engaged by a tripping-lever 135, Fig. 22, revolubly mounted upon a stud 136. Upon this stud 136 is also revolubly mounted a bell-crank lever 137. (Shown particularly in Figs. 22, 24, and 26.) One arm of the bell-crank lever 137 is adapted to be oscillated by pins 138, projecting from the wheel 19. The other arm of the bell-crank lever 137 has revolubly mounted in it a shaft 139, secured to which are two pawls 140 and 141. The pawl 140 is adapted to engage the teeth of a ratchet-wheel 142, mounted upon a sleeve 143, Figs. 23, 25, and 27. In this sleeve 143 is a notch (shown in Fig. 6 and in dotted lines in Fig. 24) with which a pin 144 in a recess of the ratchet-wheel 142 is adapted to engage. This pin is pressed outwardly by a spring, as indicated in Fig. 24. Otherwise the ratchet-wheel is loose upon the sleeve 143, but is held in place by friction-plates 145, which are mounted upon the sleeve 143 and are attached to a stud 146 and which, by pressing against the sides of the wheel 142, offer some resistance to its revolution. The sleeeve 143 is provided with a flange 143′, and in the edge of this flange are a number of notches, as shown in Fig. 23. A pin 147 is adapted to fit into one of these notches and also into a single notch 148, Fig. 27, of a wheel 149, complementary to the flange 143′ and keyed to the shaft 17. A spring 150, Fig. 25, tends to press the pin 147 to the right of Figs. 23 and 25; but the size of the pin and the depth of the notches in the flange 143′ are such that when the pin is at the extreme right-hand position it still forms a key to engage the flange 143′ and wheel 149, so that when the wheel 149 revolves the sleeve 143 also revolves. The notch 148 in the wheel 149 is of such depth, however, that when the pin is pulled to the left it clears the notches in the flange 143′, and this flange and its sleeve 143′ may then be revolved freely.

The bell-crank 137, pawl 140, pins 138, and the parts associated therewith constitute a step-by-step mechanism for advancing the ratchet-wheel 142 on the sleeve 143.

When the worm-wheel 19 revolves, the bell-crank 137 is oscillated by contact with the pins 138, projecting from this worm-wheel. This movement of the bell-crank moves the pawl 140 back and forth. Mounted upon and keyed to the shaft 17 and in close proximity to the ratchet-wheel 142 is a guard-plate 151, of somewhat greater diameter than the ratchet-wheel 142, but which has at one point of its circumference a flattened portion, as shown in Figs. 22 and 24. The pawl 140 rides upon this guard-plate 151 without engaging the teeth of the ratchet-wheel 142 until it reaches the flattened portion of the guard-plate, when it drops into engagement with the teeth of the ratchet-wheel 142.

The normal position of the tripping-lever 135 is that shown in Fig. 22, in which it is shown in the act of tripping the pawl 133. In

the hub of the tripping-lever is a notch 152, with which the pawl 141 may engage. The position of the pawl 141 on its shaft 139 is such that it does not engage the notch 152 when the pawl 140 is riding upon the guard-plate 151 nor when it engages any of the teeth of the ratchet-wheel 142 except one. This tooth 142′, however, is of greater depth than the others, as shown in Figs. 22 and 24, and when the pawl 140 drops into it the pawl 141 engages with the notch 152. When the pawl 141 is thus brought into engagement with the notch 152 and when the pawl 140 moves forward as the bell-crank 137 is moved by a pin 138, the pawl 141 lifts the tripping-lever 135, thus permitting the pawl 133 to drop into engagement with a tooth on the ratchet-wheel 131. The operation of this mechanism is as follows: As shown in Fig. 22, the pawl 133 has just been tripped, so that the worm-wheel 19 revolves idly without revolving the shaft 17. The flat place in the guard-plate 151 is in such position with respect to the pawl 133 that when the pawl is tripped the pawl 140 is permitted to drop into engagement with the teeth of the ratchet-wheel 142, and as the bell-crank 137 vibrates this pawl moves the ratchet-wheel 142 forward step by step. The number of steps so made before the pawl 140 drops into the deep tooth of this ratchet-wheel is determined by the position of the notched flange 143′ of sleeve 143 with respect to its complementary wheel 149. In Figs. 22 and 24 this flange 143′ is shown in such position that the pawl 140 engages but one tooth of ratchet-wheel 142 before it drops into the deep tooth. The length of exposure given is determined by the number of steps which the lever 137 must make after the pawl 133 is tripped before the pawl 140 drops into the deep tooth, since while the pawl 133 is out of engagement with ratchet-wheel 131 the shaft 17 is stationary and the shutter, which is driven from the shaft 17 by a shaft 153, Figs. 3 and 6, and suitable worm-gearing, and is then open, is not moved. As soon as the pawl 140 drops into the deep tooth of the ratchet-wheel 142 the pawl 141 engages the notch in the hub of the lever 135, and upon the next forward movement of the bell-crank 137 raises this tripping-lever 135, so releasing the pawl 133 and permitting it to drop down into engagement with the teeth of the ratchet-wheel 131. Fig. 26 shows the parts in this position. As soon as the pawl 133 is in engagement with the ratchet-wheel 131 the disk 132 and the shaft 17 begin to revolve. The revolution of the shaft 17 and of the wheel 149 thereon revolves the flange 143′, the pin 147 acting as a key. The ratchet-wheel 142 is held stationary, however, by friction with its friction-plates 145 until the blind ratchet-pin 144 is encountered by the notch in the sleeve 143, when the ratchet-wheel is moved forward. As soon as the shaft 17 begins to revolve the guard-plate 151 begins to revolve, and before the pawl 140 has been moved backward out of the deep tooth by the bell-crank 137 this pawl has been lifted out of engagement with the teeth of the ratchet-wheel 142 by the guard-plate 151. When the pawl 140 is thus raised, the pawl 141 is moved out of engagement with the tripping-lever 135, and the latter falls into position to trip the pawl 133 when one revolution of the shaft 17 has been completed.

To adjust the length of exposure, the pin 147 is pulled to the left of Figs. 23 and 25, and the flange 143′ of the adjusting-sleeve 143 is revolved until the pin 147 is opposite the desired number on this flange, when the pin is again released. The effect of the revolution of the adjusting-sleeve in this manner is to change the position of the deep tooth of the ratchet-wheel 142 with reference to the flattened portion of the guard-plate 151, this flattened portion of the guard-plate determining the position at which the pawl 140 is dropped into engagement with the ratchet-wheel 142.

Strip-adjusting and stop-motion mechanism, Figs. 3, 4, 5, 6, 9 to 12, and 16 to 27.—It has been stated that the negative strips intended to be used in this apparatus are divided into sections by perforations, such as are shown in Fig. 16. The perforations in the negative strip are preferably made at the time said negative strip is exposed in the camera and at the instant of exposure of each picture, and hence always bear the same relation with respect to their respective pictures. For various reasons, such as unequal shrinkage during development or slipping of the film in the feeding mechanism of the camera, the distance between pictures on the negative strip sometimes varies. It is necessary, therefore, to provide some device for adjusting accurately the position of each view section or picture on the negative strip in the field of exposure before the exposure begins. This is accomplished by means of the dowel-pins 160, Figs. 10, 11, and 16 to 21, before mentioned, which are forced through these holes in the negative strip by appropriate mechanism. The ends of these pins are conical, so that if, by chance, the holes of the strip do not register perfectly with the dowel-pins these pins in passing through the holes will move the strip into proper position. The manner in which this is done is indicated in Figs. 16 to 21, respectively. In Fig. 16 the negative strip 2 is shown somewhat below its proper position. When the dowel-pins 160 are pushed through the perforations in these strips, they push the negative strip into its proper position. The mechanism by which these dowel-pins are pushed forward operates with sufficient strength to move the film slightly, yet not with sufficient force to tear or otherwise injure the films or to force holes through them should no holes be in registry with the dowel-pins at the instant when these pins are pushed forward. This mechanism is shown particularly in Figs. 9 and 10. The dowel-pins are operated by the cam 169 upon the shaft 17. This cam has a

follower 168, connected by a link 167 with an arm 166, projecting from a collar 165, revolubly mounted upon a sleeve 164. Through the sleeve runs a shaft 163.

The dowel-pins 160 slide in a block 161, set into the barrel 12. They are engaged by an arm 162, mounted upon the shaft 163, so that when this shaft vibrates the dowel-pins are pushed forward or backward, as the case may be. One of the dowel-pins is permitted some lateral movement because, owing to expansion or contraction of the negative film due to atmospheric or other causes, the distance between corresponding spacing-holes may not be the same in different films. For the same reason one of each pair of dowel-holes in the positive strip, if said strip be provided with spacing-holes, is somewhat oval, as shown in Figs. 16, 18, and 20. A spring 170 holds the follower 168 in contact with its cam.

The shaft 163 is loose within the sleeve 164, but from its end projects a pin 173, lying between two pins 172 172, projecting from the end of the collar 165 on the sleeve 164. A spring 179 tends to pull the pin 173 down, and thus to rotate the shaft 163 and push the dowel-pins through the positive and negative strips; but except when the follower 168 is opposite the depression in the cam 169 the lower of the pins 172 holds the pin 173 up, so that the dowel-pins are clear of the negative strip. When the follower enters the depression in the cam 169, however, the collar 165 is moved slightly and the spring 179 draws the pin 173 down, thus moving the dowel-pins against the negative strip. If at this instant two spacing-holes in the negative strip be opposite the dowel-pins, as should be the case, then these dowel-pins will pass through the spacing-holes.

If the spacing-holes of the negative strip be in registry with the dowel-pins, these dowel-pins will pass clear through the spacing-holes. If the holes be sufficiently in registry so that the dowel-pins pass partly through them, then as the follower 168 enters the deeper portion of the depression in the cam 169 the spring 170 will press the upper of the pins 172 against the pin 173 with sufficient force to press the dowel-pins through the perforations in the positive and negative strips, and in so doing the dowel-pins, by reason of the conical shape of their ends, move the strip enough to bring their spacing-holes into exact registry. When the follower 168 leaves the depression in the cam 169, the dowel-pins are drawn out of the spacing-holes in the strips.

If for any reason, such as irregular spacing of the pictures on the negative strip or incorrect adjustment of the negative-strip-feeding mechanism, the spacing-holes in this negative strip are not so nearly in registry with the dowel-pins that these dowel-pins can pass at least partly through, it is important that further operation of the apparatus shall be immediately stopped, so that the negative strip may be properly adjusted by hand before exposure begins. This is accomplished by an arm 174, secured to the shaft 163 and connected by a link 175 to an arm upon a bushing 176, revolubly mounted upon a stud 177 and provided with a tripping-lever 178 in the path of the driving-pawl 133. When the dowel-pins are pushed against the negative strip, the driving-pawl 133 has almost reached the tripping-lever 178. If the dowel-pins pass through the spacing-holes in the negative strip completely or sufficiently so that the further movement of the dowel-pins will properly adjust the strips, the tripping-lever 178 will be moved out of the path of the pawl 133 by the rotation of the shaft 163; but if the dowel-pins are not enabled to pass through the perforations in the negative strip sufficiently the tripping-lever 178 is not moved out of the path of the pawl 133, but trips the same, thus stopping rotation of the cam-shaft 17. The worm-wheel 19 then rotates idly until the strips have been adjusted by hand, when the dowel-pins 160 are forced through the spacing-holes in the strips by the spring 179, thus moving the tripping-lever 178 out of the path of the pawl 133, which pawl then engages a tooth of ratchet-wheel 131, and the operation of the apparatus continues.

Instead of employing two dowel-pins 160 a single central pin may be used, as shown in Fig. 36. If a single dowel-pin be used, the strips will be provided with single rows of perforations.

Method of operation of the apparatus.—In the principal figures of the drawings the parts are shown in the positions which they occupy during exposure, the shutter being open and the driving and cam shafts disconnected, since the pawl 133 is held out of engagement with the teeth of the ratchet-wheel 131 by the tripping-lever 135, as shown in Figs. 3 and 22. The presser-plates 110 and 119 are pressed against the strips. The pawl 140 is in engagement with that tooth of the ratchet-wheel 142 which is next the deep tooth 142′ and the bell-crank lever 137 is about to be engaged by a pin 138 upon the worm-wheel 19, so as to move this pawl forward and advance the ratchet-wheel one tooth. When the pin 138 has passed under the bell-crank 137, this bell-crank drops of its own weight and the pawl 140 moves backward and drops into the deep tooth of the ratchet-wheel 142. This moves the pawl 141 into engagement with the notch 152 in the hub of the tripping-lever 135, and when the pawl 140 is next moved forward, through the engagement of a pin 138 with the bell-crank 137, the tripping-lever 135 is raised so as to free the pawl 133 and permit it to be drawn downward by a spring (shown in Figs. 22 and 26) into engagement with a tooth of ratchet-wheel 131. The cam-shaft 17 immediately begins to rotate and by its rotation causes the guard-plate 151 to raise the pawl 140 out of engagement with the teeth of ratchet-wheel 142. The ratchet-wheel 142 is

held stationary, after the pawl 140 is thus thrown out of engagement, by friction with the friction-plates 145 until its blind ratchet-pin 144 is engaged by the notch in the adjusting-sleeve 143. The rotation of the shaft 17 communicated to the shaft 153 causes the closing of the shutter 9. After the closing of the shutter the operation of the feeding mechanism begins. First the cam 66, Fig. 8, operates its follower 67 so as to cause unwinding of the positive strip 3 from its reel 6, the cam 71 at the same time permitting its follower 72 to move the ratchet 73 upward and the cam 38 causing the ratchet-arm 41 to move upward. The cam 116, Fig. 13, then permits the shaft 112 to rotate, thus causing the spring 109, Fig. 5, to raise the presser-plate 110. When the presser-plate 110 is nearly in its extreme outward position, the bell-crank 123, Fig. 4, which is pulled downward by the spring 125 (shown in Fig. 4) as the presser-plate 110 moves outward, strikes the stop 126, and is thus prevented from moving downward farther. The further rotation of the presser-plate shaft 112, therefore, causes the bell-crank 123 to move backward and away from the arm 122, thus leaving the positive and negative strips entirely free to move upward. Next the roller 61 is permitted to move upward by the cam 66, and the cam 84, Fig. 1, begins to operate its follower and to raise the lever 86 of the clamp feeding mechanism of the positive strip. This raises the rod 88 and moves the arms 90 and 93 about their pivots, thus clamping the positive strip between the bolt 97 and the anvil-piece 98. As soon as the positive strip has been grasped tightly further movement of the arms 90 and 93 about their pivots is prevented and the whole clamp feeding mechanism rises, carrying with it the positive strip. The cam 29, Fig. 7, then begins to operate the negative-strip-feeding mechanism and to feed the negative strip through the field of the apparatus. When the feeding of these strips is completed, the rollers 21 and 25 move back to their first position, slackening the negative strip, the cam 83, Fig. 1, moves the arm 86 downward sufficiently to open the clamp and release the positive strip, which is immediately caught and held by the pawl 118, Fig. 17, or by the roller 127, Figs. 4 and 5[a], and the follower 168 of the cam 169, Fig. 9, entering the depression in the face of this cam the dowel-pins 160 are moved against the strip by the spring 179. The shape of the depression in the face of the cam 169 is such that the upper pin 172 is not at first brought into contact with the pin 173 of the shaft which then operates the dowel-pin, so that at first these dowel-pins are pressed against the strip by the spring 179 only. If the holes of the negative strip register with the dowel-pins at the instant when the pins are moved forward, the pins pass through these holes and the tripping-lever 178 is moved backward out of the way of the pawl 133 an instant before this pawl reaches said tripping-lever; but if for any reason the holes in the negative strip do not register sufficiently to permit the points of the dowel-pins to pass at least partly through the tripping-lever 178 is not moved out of the path of the pawl 133, but immediately trips said pawl, thus stopping the operation of the feeding mechanism. The strip may then be adjusted by hand until the holes register, and as soon as they register the spring 179 forces the dowel-pins through them. The tripping-lever 178 will then be moved away from the pawl 133, the pawl 133 will engage the ratchet-wheel 131, and the shaft 17 will begin to move. After the pawl 133 has passed the tripping-lever 178 the follower 168 reaches the deeper portion of the depression in the face of the cam 169, and the spring 170 is thus permitted to press the pin 172 against the pin 173 with sufficient force to move the negative strip until the spacing-holes are in exact registry if they are not in registry already. The cam 71, Fig. 8, then starts the rotation of the receiving-reel 7 of the positive strip, and the cam 38, Fig. 7, starts the revolution of the receiving-reel 5 of the negative strip, so as to wind up the slack in the strips. The cam 116 begins to move the presser-plate 110 downward, and as this presser-plate begins to move the bell-crank 123, Fig. 4, is moved away from its stop 126 and its spring causes it to press the presser-plate 119 against the strips. The cam 169 then withdraws the dowel-pins 160, and the presser-plate 110 presses the strips tightly against the window 13. The cam 83, Fig. 1, then causes the arm 86 of the clamp feeding mechanism to descend, carrying downward the members of the clamp. Next the shutter opens, (the particular point at which the shutter opens not being material so long as it opens after the pressure-plate 110 has reached the strips,) the pawl 133 engages the tripping-lever 135 and is tripped thereby, thus stopping the rotation of the cam-shaft 17 and the parts thereon until, by the action of the pawl 140 and the step-by-step mechanism operating the same, the ratchet-wheel 142 has been moved until the pawl 140 drops into the deep tooth of the ratchet-wheel, when the operations which have been described are repeated.

In the barrel 12 is a door 181, Fig. 1, through which dimming-plates—as, for instance, ground-glass plates—may be inserted and interposed in the path of the light admitted through the shutter, so as to vary the intensity of illumination.

Having thus completely described my invention, what I claim, and desire to secure by Letters Patent, is—

1. In a photographic-printing machine, the combination, of two separate feeding mechanisms for feeding positive and negative strips, one mechanism being adjustable as to the length of strip fed at each operation, independently of the other mechanism.

2. In a photographic-printing machine, the combination, with two separate feeding mech-

anisms for feeding positive and negative strips, one mechanism being adjustable as to the length of strip fed at each operation, independently of the other mechanism, of means for holding both strips stationary during the intervals of exposure.

3. In a photographic-printing machine, the combination, with means for exposing a sensitive strip, at intervals, in a field of illumination, of two separate feeding mechanisms for feeding positive and negative strips through said field of illumination, one mechanism being adjustable as to the length of strip fed at each operation, independently of the other mechanism, and means for holding both strips stationary in said field during the intervals of exposure.

4. In a photographic-printing machine, the combination of two separate and independently-adjustable feeding mechanisms for feeding positive and negative strips, both of said mechanisms being adjustable as to the length of strip fed at each operation.

5. In a photographic-printing machine, the combination, with means for exposing a sensitive strip, at intervals, in a field of illumination, of two separate feeding mechanisms for feeding positive and negative strips through said field of illumination, intermittently, and means for holding the portions of said strips which are in said field, in contact with each other during exposure.

6. In a photographic-printing machine, the combination, with means for exposing a sensitive strip, at intervals, in a field of illumination, of two separate feeding mechanisms for feeding positive and negative strips intermittently through said field and adapted to permit said strips to remain stationary in said field during exposure, and a presser-plate and mechanism for operating the same, adapted to press said strips together during the intervals of exposure.

7. In a photographic-printing machine, the combination, with means for exposing a sensitive strip, at intervals, in a field of illumination, of two separate feeding mechanisms for feeding positive and negative strips intermittenly through said field and adapted to permit said strips to remain stationary in said field during exposure, a presser-plate, a shaft supporting the same, means for moving said presser-plate toward and against the strips when the shaft is rotated in one direction and for withdrawing the presser-plate when the shaft is rotated in the opposite direction, and means for rotating said shaft, substantially as described.

8. In a photographic apparatus, the combination, with mechanism for feeding a strip through a field of illumination, of an adjusting device, separate from said feeding mechanism, for adjusting accurately the registry of sections of said strip in said field of illumination.

9. In a consecutive-view apparatus, the combination, with mechanism for feeding a flexible strip intermittently, length by length, past a definite point, of an adjusting device, separate from said feeding mechanism, for adjusting accurately the position of the several lengths of said strip with reference to said point, substantially as described.

10. In a photographic-printing machine, the combination, with means for exposing a sensitive strip, at intervals, in a field of illumination, of two separate feeding mechanisms for feeding positive and negative strips through said field of illumination, and an adjusting device, separate from said feeding mechanisms, for adjusting accurately the position of each section of the negative strip in the field of illumination.

11. In a photographic-printing machine, the combination, with strip-feeding and shutter mechanisms, of a timing mechanism for controlling automatically the duration of the exposure.

12. In a photographic-printing machine, the combination, with strip-feeding and shutter mechanisms, and an arresting device for interrupting the operation thereof, of a timing mechanism controlling said arresting device and adapted to prevent the operation of the strip-feeding and shutter mechanisms for predetermined periods.

13. In a photographic-printing machine, the combination, with strip-feeding and shutter mechanisms, and a driving device for operating the same, of a timing mechanism adapted to throw the driving device out of operative connection with said strip-feeding and shutter mechanisms, and to hold it out of operative connection for predetermined periods, substantially as described.

14. In a consecutive-view apparatus, the combination, with means for guiding a flexible picture-strip through the field of the apparatus, of movably-mounted arms in advance of and beyond said field, arranged when operated to move laterally against the strip, and means for operating said arms, thereby feeding the strip to and carrying it away from the field of the apparatus, substantially as described.

15. In a consecutive-view apparatus, the combination, with guides for passing a flexible picture-strip through the field of the apparatus, of movably-mounted arms located one in advance of and one beyond said field, and adapted when operated to move laterally against the strip, a cam-shaft, a cam thereon, and connecting mechanism adapted to vibrate said arms, at intervals, thereby feeding the strip to and carrying it away from said field, substantially as described.

16. In a consecutive-view apparatus, the combination, with guides for passing a flexible picture-strip through the field of the apparatus, of arms upon opposite sides of said field, mounted upon rock-shafts, and adapted, when vibrated, to move laterally against the strip, a connection between said rock-shafts whereby they are caused to vibrate simulta-

neously, a cam-shaft, a cam thereon, a follower for said cam connected with an arm on one of said rock-shafts and adapted to vibrate said shaft, and a spring tending to hold the follower in contact with said cam, substantially as described.

17. In a consecutive-view apparatus, the combination, with guides for passing a flexible picture-strip through the field of the apparatus, of arms upon opposite sides of said field and mounted upon rock-shafts, adapted, when vibrated, to move laterally against said strip, a connection between said rock-shafts, whereby they are caused to vibrate simultaneously, a cam-shaft, a cam thereon, a follower for said cam connected with an arm on one of said rock-shafts and adapted when vibrated by the cam to vibrate said shaft, a spring tending to hold the follower in contact with said cam, and an adjustable stop limiting the motion of said rock-shafts caused by said spring, whereby the length of strip fed at each operation of the feeding mechanism may be regulated, substantially as described.

18. In a consecutive-view apparatus, the combination, with guides for passing a flexible picture-strip through the field of the apparatus, of supply and receiving reels for said strip, movably-mounted arms located one on each side of said field and adapted, when operated, to move laterally against said strip, a cam-shaft, a cam thereon and connecting mechanism adapted to vibrate said arms, at intervals, thereby feeding the strip to and carrying it away from said field, and a second cam and connecting mechanism for rotating the receiving-reel at intervals, substantially as described.

19. In a consecutive-view apparatus, the combination, with guides for passing a flexible picture-strip through the field of the apparatus, of supply and receiving reels for said strip, movably-mounted arms located one on each side of said field and adapted, when operated, to move laterally against said strip, a cam-shaft, a cam thereon, means operated by said cam for vibrating said arms simultaneously, at intervals, thereby feeding the strip to and carrying it away from said field, and a second cam and driving mechanism connected therewith and operated thereby for rotating the receiving-reel at intervals, said driving mechanism having a frictional connection with the receiving-reel, substantially as described.

20. In a consecutive-view apparatus, the combination, with guides for passing a flexible picture-strip through the field of the apparatus, of supply and receiving reels for said strip, arms located one on each side of said field and mounted on rock-shafts, and adapted, when operated, to move laterally against said strip, arms upon said rock-shafts and a link connecting the same, whereby said rock-shafts are caused to vibrate simultaneously, a cam-shaft, a cam thereon, a follower for said cam connected with one of said rock-shafts and adapted, when vibrated by the cam, to vibrate said shaft, a spring tending to hold the follower in contact with said cam, and a second cam and connecting mechanism for rotating the receiving-reel at intervals, substantially as described.

21. In a consecutive-view apparatus, the combination, with means for passing a flexible picture-strip through the field of the apparatus, of supply and receiving reels for said strip, a cam-shaft, a cam thereon, a follower for said cam, and a ratchet mechanism adapted to rotate the receiving-reel, and connected with and adapted to be operated by said follower as the cam revolves, substantially as described.

22. In a consecutive-view apparatus, the combination, with means for passing a flexible picture-strip through the field of the apparatus, of supply and receiving reels for said strip, a cam-shaft, a cam thereon, a follower for said cam, and a ratchet mechanism adapted to rotate the receiving-reel, but having a frictional connection therewith, and connected with and adapted to be operated by said follower as the cam revolves, substantially as described.

23. The combination, with a reel adapted to receive a flexible picture-strip, and mechanism for rotating the same, of a friction-clamp arranged to hold said reel stationary in any position in which it is left by its rotating mechanism, substantially as described.

24. In a consecutive-view apparatus, the combination, with means for passing a flexible picture-strip through the field of the apparatus, of strip-carrying reels adapted each to serve as a supply or as a receiving reel for said strip, according to the direction in which the strip is fed through the apparatus, a cam-shaft, a cam thereon, a follower for said cam, and a ratchet mechanism for each of said reels, each adapted, when operated, to rotate its reel, and each adapted to be connected with and operated by said follower as the cam revolves, substantially as described.

25. In a consecutive-view apparatus, the combination, with two strip-carrying reels adapted each to serve as a supply or as a receiving reel for a flexible strip, according to the direction in which the strip is fed through the apparatus, a cam-shaft, a cam thereon, a follower for said cam, and ratchet mechanism for each of said reels, each adapted, when operated, to rotate its reel, and each adapted to be connected with and operated by said follower as the cam revolves, of guides and feeding mechanism for the strip, the feeding mechanism comprising movably-mounted arms on each side of the field of the apparatus, arranged when operated to move laterally against said strip, thereby drawing the strip from that one of said reels the ratchet mechanism of which is disconnected, and feeding the strip through the field of the apparatus, substantially as described.

26. In a photographic-printing machine,

the combination of two strip-feeding mechanisms for feeding positive and negative strips, one of said feeding mechanisms comprising a vibrating clamp adapted to grasp the strip and feed the same along, and means for operating said clamp, arranged to cause it to grasp the strip when moving in one direction and to release the strip when moving in the opposite direction, substantially as described.

27. In a photographic-printing machine, the combination of two strip-feeding mechanisms for feeding positive and negative strips, one of said feeding mechanisms comprising strip supply and receiving devices, a feeding device for feeding said strip through the field of the apparatus and consisting of a vibrating clamp adapted to grasp the film when moved in one direction and to release the same when moved in the opposite direction, and means for vibrating and operating said clamp, substantially as described.

28. In a photographic-printing machine, the combination of two strip-feeding mechanisms for feeding positive and negative strips, one of said feeding mechanisms comprising strip supply and receiving devices, a feeding device for feeding said strip through the field of the apparatus, consisting of a clamp adapted to grasp said strip, a movably-mounted arm adapted to open and close said clamp, and a driving device connected with said arm and adapted to move the same in substantially the direction of motion of the clamp, whereby when said arm moves the clamp in one direction the clamp is closed and then moved forward, and when said arm is moved in the other direction, the clamp is opened and then moved back, substantially as described.

29. A feeding device for feeding a flexible strip consisting of a reciprocating carriage, a clamp thereon adapted to grasp the strip, an arm pivoted to the reciprocating carriage and connected to and adapted to open and close the clamp as it is vibrated, and a reciprocating driving device connected with said arm, and adapted to communicate reciprocating motion to the carriage through said arm, whereby the clamp is alternately closed and opened as the carriage is reciprocated first in one direction and then in the other, substantially as described.

30. In a strip-feeding mechanism, the combination of a reciprocating carriage, a strip-clamp thereon comprising a stationary piece and a reciprocating bolt, a pinion revolubly mounted in said carriage and engaging teeth on said bolt, an arm connected to said pinion, and means for vibrating said arm, thereby alternately closing and opening said clamp and vibrating said carriage, substantially as described.

31. In a strip-feeding mechanism, the combination, with strip-feeding devices, and means for regulating the length of strip fed thereby at each operation, of a cam mechanism for operating said strip-feeding devices and arranged to overtravel, and springs interposed between said cam mechanism and said strip-feeding devices, and adapted to compensate for the overtravel of the cam mechanism, substantially as described.

32. In a strip-feeding mechanism for consecutive-view apparatus, the combination, with a vibrating clamp adapted to grasp the strip, means for opening and closing the clamp, and means for limiting the vibratory motion of the clamp, of a cam mechanism for vibrating the clamp, adapted to overtravel, and springs interposed between said cam mechanism and clamp, and adapted to compensate for overtravel of the cam mechanism, substantially as described.

33. In a strip-feeding mechanism for consecutive-view apparatus, the combination, with a reciprocating rod, a strip-clamp thereon comprising a stationary piece and a reciprocating bolt, a pinion revolubly mounted on said rod and engaging teeth on said bolt, and an arm connected to said pinion, of a second arm pivotally connected to said reciprocating rod and likewise connected to the arm of said clamp, complementary cams and followers therefor for vibrating said second arm, said cams being arranged to cause overtravel of their followers, a link connecting said followers to said second arm, means for limiting the vibratory motion of the reciprocating rod, and springs interposed between said link and said second arm, substantially as described.

34. In a strip-feeding mechanism, the combination, with a feeding device for feeding a flexible strip, consisting of a vibrating clamp adapted to grasp the strip and feed the same along, and means for operating said clamp, arranged to cause it to grasp the strip when moving in one direction and to release the strip when moving in the opposite direction, of a pawl adapted to engage with perforations in the strip as soon as the strip is released by the clamp, substantially as described.

35. In a strip-feeding mechanism, the combination, with a flexible strip divided into sections by spacing-holes, and a feeding device adapted to move the strip forward, intermittently, against the action of an opposing force, and then to release it, of a pawl adapted to engage with the perforations in said strip and prevent retrograde movement thereof, substantially as described.

36. In a consecutive-view apparatus, the combination, with a strip-support and means for feeding the strip intermittently across said support, of a presser-plate, for pressing the strip against said support, pivotally mounted upon a swinging arm, a shaft upon which said arm is loosely mounted, having spring connection with said arm for withdrawing and advancing the presser-plate, and a cam mechanism for rotating said shaft, substantially as described.

37. In a consecutive-view apparatus, the combination, with a strip-support and means for feeding the strip intermittently across said support, of a presser-plate, for pressing the

strip against said support, pivotally mounted upon a swinging arm, a shaft upon which said arm is mounted, cam mechanism for rotating said shaft, a spring on said shaft acting upon said presser-plate arm, and adapted to withdraw the presser-plate when said shaft is rotated in one direction, and another spring on said shaft acting upon said presser-plate arm, and adapted to advance said presser-plate when the shaft is rotated in the reverse direction, substantially as described.

38. In a consecutive-view apparatus, the combination, with a delivery feeding device for feeding forward a flexible strip to the field of exposure, and consisting of a movably-mounted arm adapted to press laterally against the strip at intervals, thereby drawing the strip forward, of a presser-plate, and means for pressing the same tightly against the strip while said feeding-arm is operating thereon, substantially as described.

39. In a consecutive-view apparatus, the combination, with a strip-supporting plate in the field of the apparatus, and means for feeding a strip across said field, of a presser-plate adapted to press said strip against said supporting-plate, means for withdrawing and advancing said presser-plate, an adjusting dowel-pin and mechanism for thrusting the same through a registration hole in each section of the strip as soon as said section has been moved into the field of the apparatus, and for withdrawing said pin when said presser-plate moves toward the strip, a second presser-plate, and means operated by the mechanism of the first presser-plate and adapted to press said second presser-plate against the strip when said first presser-plate begins to move toward the strip, thereby holding the strip stationary after the withdrawal of the dowel-pin, and to release said second presser-plate when the first presser-plate is withdrawn, substantially as described.

40. In a consecutive-view apparatus, the combination, with a strip-supporting plate in the field of the apparatus, and means for feeding a strip across said field, of a presser-plate for pressing said strip against said supporting-plate, a shaft and connecting devices for withdrawing and advancing said presser-plate, means for vibrating said shaft, a second presser-plate likewise mounted upon a shaft, an arm projecting from said shaft, a bell-crank lever pivoted to an arm projecting from the shaft of the first presser-plate, one arm of said bell-crank bearing against the arm of the shaft of the second presser-plate, and the other arm of the bell-crank being connected to a spring which causes the bell-crank normally to press said second presser-plate against the strip, and a stop with which said bell-crank engages when the first presser-plate is withdrawn, thereby releasing the second presser-plate, substantially as described.

41. In a consecutive-view apparatus, the combination, with a flexible strip having a series of perforations dividing it into sections, and means for feeding said strip intermittently through the field of the apparatus, of a movably-mounted pin arranged to register with the several perforations when the corresponding sections of the strip are in approximate registry in the field of the apparatus, and having a tapering end, and means for advancing said pin after a section of the strip has been moved into the field of the apparatus, and for withdrawing the pin before the strip is farther advanced, whereby accurate registry of the sections of the strip in the field of the apparatus is obtained, substantially as described.

42. In a consecutive-view apparatus, the combination, with a flexible strip having a series of perforations dividing it into sections, and means for feeding said strip intermittently through the field of the apparatus, of a movably-mounted pin arranged to register with the several perforations when the corresponding sections of the strip are in approximate registry in the field of the apparatus, and having a tapering end, a spring for advancing said pin, means for causing said spring to advance the pin after a section of the strip has been moved into the field of the apparatus, a second spring and means for causing the same to supplement the action of the first spring if the pin fails to pass completely through a perforation through inexact registry of the perforation with the pin, thereby forcing the pin through the perforation and drawing the strip into registry, and means for withdrawing the pin before the strip is farther advanced, substantially as described.

43. In a consecutive-view apparatus, the combination, with a flexible strip having a series of perforations dividing it into sections, and means for feeding said strip intermittently through the field of the apparatus, of a movably-mounted pin arranged to register with the several perforations when the corresponding sections of the strip are in approximate registry in the field of the apparatus, and having a tapering end, a spring for advancing said pin, means for causing said spring to advance the pin when a section of the strip has been moved into the field of the apparatus, a second spring and means for causing the same to supplement the action of the first spring if the pin fails to pass completely through a perforation through inexact registry of the perforation with the pin, means for preventing the said action of said second spring and stopping the operation of the feeding mechanism if the pin fails to pass at all through a perforation in the strip, and means for withdrawing the pin before the strip is farther advanced, substantially as described.

44. In a consecutive-view apparatus, the combination, with a flexible strip having a plurality of series of perforations dividing it

into sections, and means for feeding said strip intermittently through the field of the apparatus, of a plurality of movably-mounted pins arranged to register with the several perforations when the corresponding sections of the strip are in approximate registry in the field of the apparatus, and having tapering ends, and means for advancing said pins after a section of the strip has been moved into the field of the apparatus, and for withdrawing the pins before the strip is farther advanced, whereby accurate registry of the sections of the strip in the field of the apparatus is obtained, substantially as described.

45. In a consecutive-view apparatus, the combination, with a flexible strip having a series of perforations, dividing it into view-sections, feeding mechanism for feeding said strip through the field of the apparatus, and a driving device for operating the same, of a pin movably mounted and adapted to register with the several perforations when the corresponding sections of the strip are in approximate registry in the field of the apparatus, and a stop mechanism adapted to advance said pin when a section of the strip has been moved into the field of the apparatus, and to withdraw said pin before the strip is again advanced, and to throw the driving device out of operative connection with the said strip-feeding mechanism if said pin fails to pass through the perforations in the strip when advanced, substantially as described.

46. In a consecutive-view apparatus, the combination, with a flexible strip having a series of perforations dividing it into view-sections, feeding mechanism for feeding said strip through the field of the apparatus, a driving device, and a clutch adapted to connect said driving device to the feeding mechanism, of a pin movably mounted and adapted to register with the several perforations in said strip when the several sections thereof are in approximate registry in the field of the apparatus, and a stop mechanism adapted to advance said pin when a section of the strip has been moved into the field of the apparatus, and to withdraw said pin before the strip is again advanced, and to throw the clutch out of gear if said pin fails to pass through the perforations in the strip when advanced.

47. In a consecutive-view apparatus, the combination, with a flexible strip having a series of perforations dividing it into view-sections, feeding mechanism for feeding said strip through the field of the apparatus, a driving device, and a clutch adapted to connect said driving device to the feeding mechanism, of a pin movably mounted and adapted to register with the several perforations when the corresponding sections of the strip are in approximate registry in the field of the apparatus, a rock-shaft adapted to advance and withdraw said pin, a spring tending to move said shaft so as to advance said pin, a movable stop normally preventing the advance of the pin, a cam, a follower therefor, a spring pressing said follower against said cam, and connecting mechanism whereby when the cam revolves said stop is moved so as to permit said spring to advance said pin, and is then moved so as to withdraw said pin, and means operated by said rock-shaft, by throwing the said clutch out of gear when the pin fails to pass through a perforation in the strip, substantially as described.

48. In a consecutive-view apparatus, the combination, with a flexible strip having a series of perforations dividing it into view-sections, feeding mechanism for feeding said strip through the field of the apparatus, a driving device, and a clutch adapted to connect said driving device to the feeding mechanism, of a pin movably mounted and adapted to register with the several perforations when the corresponding sections of the strip are in approximate registry in the field of the apparatus, a rock-shaft adapted to advance and withdraw said pin, an arm projecting from said shaft, movable stops between which said arm lies, a spring tending to move said shaft so as to advance said dowel-pin, a notched cam, a follower therefor, another spring pressing said follower against said cam, means connecting the follower and said stops whereby, when said follower enters the notch in the cam, the dowel-pin is advanced, one of said stops being arranged to press against the arm projecting from the rock-shaft, under the influence of the second spring, if the dowel-pin fails to advance to the full extent of its travel, and means operated by the cam-shaft, for throwing the clutch out of gear if the first spring fails to cause the dowel-pin to pass through a perforation in the strip, substantially as described.

49. In a consecutive-view apparatus, the combination, with a flexible strip having a series of perforations dividing it into view-sections, feeding mechanism for feeding said strips through the field of the apparatus, a shaft, and means operated thereby for operating said feeding mechanism, of a ratchet-wheel and means for rotating the same, a pawl revolving with said shaft and adapted to engage said ratchet-wheel, means for holding said pawl normally in engagement with the ratchet-wheel, a dowel-pin movably mounted and adapted to register with the several perforations when the several sections of the strip are in approximate registry in the field of the apparatus, means for advancing said pin after a section of the strip has been moved into the field of the apparatus and for withdrawing the pin before the strip is further advanced, and a tripping device operated by said pin, and adapted to trip said pawl if the pin fails to pass through a perforation in the strip, substantially as described.

50. In a photographic apparatus, the combination, with a shutter and mechanism for operating the same having driving and driven

members and a clutch connecting the same, of means for throwing the clutch out of gear, at the commencement of each interval of exposure, and a step-by-step mechanism arranged to throw said clutch into gear again after said step-by-step mechanism has operated a definite number of times, substantially as described.

51. In a photographic apparatus, the combination, with a shutter and mechanism for operating the same having driving and driven members and a clutch connecting the same, of means for throwing the clutch out of gear, at the commencement of each interval of exposure, and a step-by-step mechanism operated by the revolution of said driving member and arranged to throw the clutch into gear again after said step-by-step mechanism has operated a definite number of times, substantially as described.

52. In a photographic apparatus, the combination, with a shutter, mechanism for feeding a sensitive surface through a field of exposure, and driving mechanism for operating said shutter and feeding mechanism having driving and driven members and a clutch connecting the same, of means for throwing the clutch out of gear, at the commencement of each interval of exposure, and a step-by-step mechanism arranged to throw said clutch into gear again after said step-by-step mechanism has operated a definite number of times, substantially as described.

53. In a photographic apparatus, the combination, with a shutter, mechanism for feeding a sensitive surface through a field of exposure, and driving mechanism for operating said shutter and feeding mechanism having driving and driven members and a clutch connecting the same, of means for throwing the clutch out of gear, at the commencement of each interval of exposure, and a step-by-step mechanism operated by the revolution of said driving member and arranged to throw said clutch into gear again after said step-by-step mechanism has operated a definite number of times, substantially as described.

54. In a photographic apparatus, the combination, with a shutter and mechanism for operating the same having driving and driven members and a clutch connecting the same, of means for throwing the clutch out of gear, at the commencement of each interval of exposure, a ratchet-wheel revolubly mounted upon a revolubly-mounted arbor which is adapted to engage said ratchet-wheel and carry the same along, and revolves with a driven member, a step-by-step mechanism arranged to engage the teeth of said ratchet-wheel and advance the wheel with respect to the arbor, means, operated by the ratchet-wheel, for throwing said clutch into gear again when said ratchet-wheel has reached a definite position, and means for retarding the ratchet-wheel until engaged by its arbor, substantially as described.

55. In a photographic apparatus, the combination, with a shutter and mechanism for operating the same having driving and driven members and a clutch connecting the same, of means for throwing the clutch out of gear, at the commencement of each interval of exposure, a ratchet-wheel revolubly mounted upon a revolubly-mounted arbor which is adapted to engage said ratchet-wheel and carry the same along, and revolves with the driven member, a step-by-step mechanism arranged to engage the teeth of said ratchet-wheel and advance the wheel with respect to the arbor, means, operated by said ratchet-wheel, for throwing the clutch into gear again when said ratchet-wheel has reached a definite position, a retarding device for retarding the revolution of the ratchet-wheel when not engaged by its arbor, and an adjusting device for varying the angular position of the arbor with reference to the driven member, thereby varying the length of exposure, substantially as described.

56. In a photographic apparatus, the combination, with a shutter and mechanism for operating the same having driving and driven members and a clutch connecting the same, of means for throwing the clutch out of gear, at the commencement of each interval of exposure, a ratchet-wheel revolubly mounted upon a revolubly-mounted arbor which revolves with the driven member, a ratchet and ratchet-tooth by which said arbor may drive said ratchet-wheel, a step-by-step mechanism arranged to engage the teeth of said ratchet-wheel and advance the wheel with respect to the arbor, means, operated by the ratchet-wheel, for throwing said clutch into gear again when said ratchet-wheel has reached a definite position, and means for retarding the ratchet-wheel until the ratchet and ratchet-tooth by which it is driven from its arbor engage, substantially as described.

57. In a photographic apparatus, the combination, with a shutter and mechanism for operating the same having driving and driven members and a clutch connecting the same, of means for throwing the clutch out of gear at the commencement of each interval of exposure, a ratchet-wheel having a deep tooth, revolubly mounted upon a revolubly-mounted arbor which is adapted to engage said ratchet-wheel and carry the same along, and revolves with the driven member, a step-by-step mechanism having a pawl adapted to engage the teeth of said ratchet-wheel and advance the wheel with respect to the arbor, means, operated by said pawl when it enters the deep tooth, for throwing the clutch into gear again, and means for retarding the ratchet-wheel until engaged by its arbor, substantially as described.

58. In a photographic apparatus, the combination, with a shutter, and a ratchet-wheel and pawl by which said shutter is driven, of a detent-lever adapted to trip said pawl, at the commencement of each interval of exposure,

and a step-by-step mechanism operated by the revolution of said ratchet-wheel and arranged to release said pawl from said detent-lever after said step-by-step mechanism has operated a definite number of times, substantially as described.

59. In a photographic apparatus, the combination with a shutter, a ratchet-wheel and pawl, and a driving-shaft arranged to drive said shutter and to be driven through said ratchet-wheel and pawl, of a detent-lever adapted to trip said pawl, at the commencement of each interval of exposure, a second ratchet-wheel revolubly mounted upon a revolubly-mounted arbor which is adapted to engage its ratchet-wheel and carry the same along, and revolves with the driving-shaft, a step-by-step mechanism operated by the revolution of said first ratchet-wheel and engaging the teeth of said second ratchet-wheel, and arranged to advance said second ratchet-wheel, with respect to its arbor, while said arbor is at rest, means, operated by the second ratchet-wheel, for releasing said pawl from the detent-lever after said ratchet-wheel has reached a definite position, and means for retarding the second ratchet-wheel until engaged by its arbor, substantially as described.

60. In a photographic apparatus, the combination, with a shutter, and means for driving said shutter having driving and driven members and a clutch connecting the same, of a tripping device adapted to throw said clutch out of gear, at the commencement of exposure, a ratchet-wheel revolubly mounted upon an arbor revolving with the driven member, having a deep tooth, and having a loose driving connection with its arbor such that it may be revolved thereon in advance of that position in which it has driving connection therewith, a vibrating lever carrying a pawl adapted to engage the teeth of said ratchet-wheel, and so to advance the same upon its arbor when said arbor is stationary, a second tripping device, operated by said pawl when it enters the deep tooth of said ratchet-wheel, for throwing said clutch into gear again, thereby causing the shutter and arbor to revolve, and means for retarding the ratchet-wheel until it is in driving connection with its arbor, substantially as described.

61. In a photographic apparatus, the combination, with a shutter, and means for driving said shutter having driving and driven members and a clutch connecting the same, of a tripping device adapted to throw said clutch out of gear, at the commencement of exposure, a ratchet-wheel revolubly mounted upon an arbor revolving with the driven member, having a deep tooth, and having a loose driving connection with its arbor such that it may be revolved thereon in advance of that position in which it has driving connection therewith, a vibrating lever carrying a pawl adapted to engage the teeth of said ratchet-wheel, and so to advance the same upon its arbor when said arbor is stationary, a second pawl, connected with the first and arranged to engage said tripping-lever when the first pawl enters the deep tooth of the ratchet-wheel, and to move said tripping-lever so as to put said clutch into gear again, thereby causing the shutter and arbor to revolve, and means for retarding the ratchet-wheel until it is in driving connection with its arbor, substantially as described.

62. In a photographic apparatus, the combination, with strip-feeding mechanism for feeding a sensitive strip through a field of exposure, a shutter, and means for driving said shutter and feeding mechanism having driving and driven members and a clutch connecting the same, of a tripping device adapted to throw said clutch out of gear in the event of improper feeding of the strip, a second tripping device adapted to throw said clutch out of gear at the commencement of exposure, a ratchet-wheel revolubly mounted upon an arbor revolving with the driven member, having a deep tooth, and having a loose driving connection with its arbor such that it may be revolved thereon in advance of that position in which it has driving connection therewith, a vibrating lever carrying a pawl adapted to engage the teeth of said ratchet-wheel, and so to advance the same upon its arbor when said arbor is stationary, a guard arranged to hold said pawl away from said ratchet-wheel during the time when the first tripping device may act, but to permit said pawl to engage said ratchet-wheel before the second tripping device acts, a third tripping device, operated by said pawl when it enters the deep tooth of said ratchet-wheel, for putting said clutch into gear again, thereby causing the shutter and arbor to revolve, and means for retarding the ratchet-wheel until it is in driving connection with its arbor, substantially as described.

63. In a photographic apparatus, the combination, with cam-operated mechanism for feeding negative and positive strips through the field of the apparatus, and an exposing mechanism, of a shaft connected with and adapted to operate said exposing mechanism, and having cams for operating said strip-feeding mechanism, a driving device, an automatically-disengaging clutch for connecting said driving device and shaft, and a timing mechanism adapted to disengage said clutch at intervals, and hold the same disengaged for predetermined intervals, and then to permit said clutch to engage and thereby to communicate motion to said shaft.

64. In a photographic apparatus, the combination, with cam-operated feeding mechanism for feeding positive and negative strips through the field of the apparatus, cam-operated presser-plate, adjusting, and automatic stop mechanisms, and an exposing mechanism, of a shaft connected with and adapted to operate said exposing mechanism and having

cams for operating said strip-feeding, presser-plate, adjusting, and stop mechanisms, and a timing mechanism adapted to stop the operation of the shutter and strip-feeding mechanisms, with the shutter open, for predetermined intervals, and then to start said mechanisms into action again, substantially as described.

In testimony whereof I affix my signature in the presence of two witnesses.

HERMAN CASLER.

Witnesses:
FRANK G. BELL,
BENJ. F. ROWE.