No. 676,943. Patented June 25, 1901.

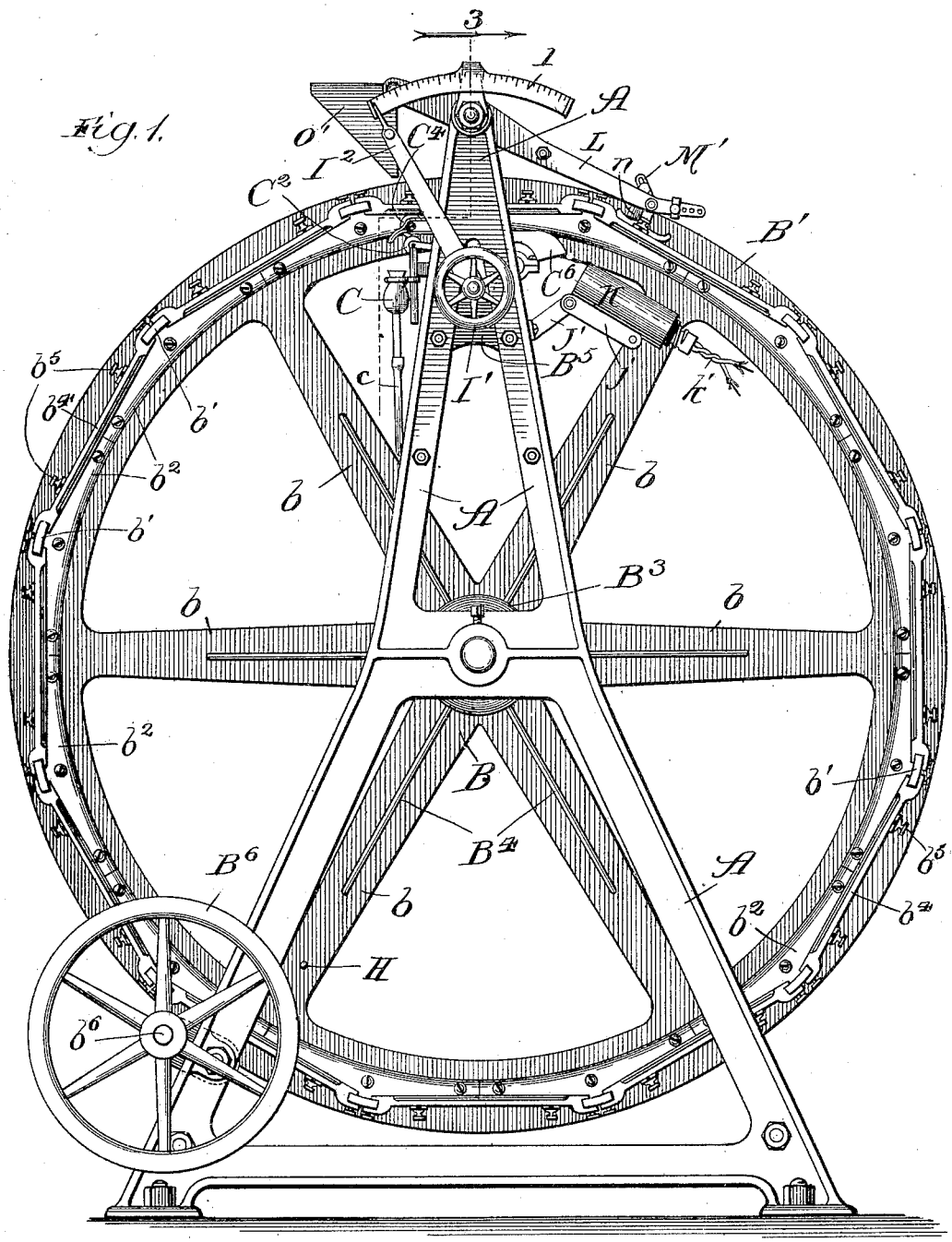
E. E. FLORA.

RULING MACHINE.

(Application filed Apr. 18, 1898. Renewed Nov. 17, 1900.)

(No Model.) 7 Sheets—Sheet 1.

Fig. 1.



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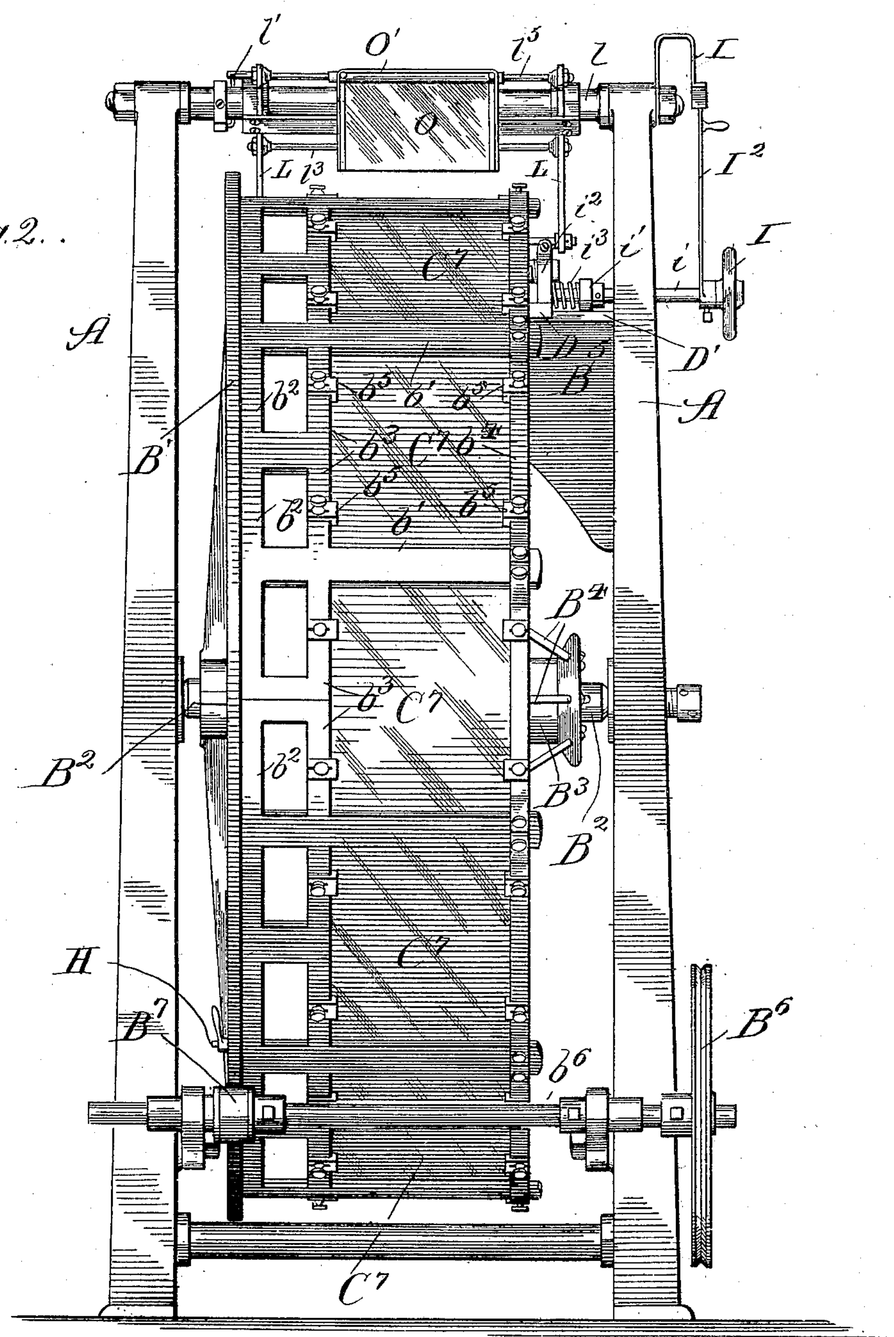
(No Model.) 7 Sheets—Sheet 2.

Fig. 2.



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(No Model.) 7 Sheets—Sheet 3.

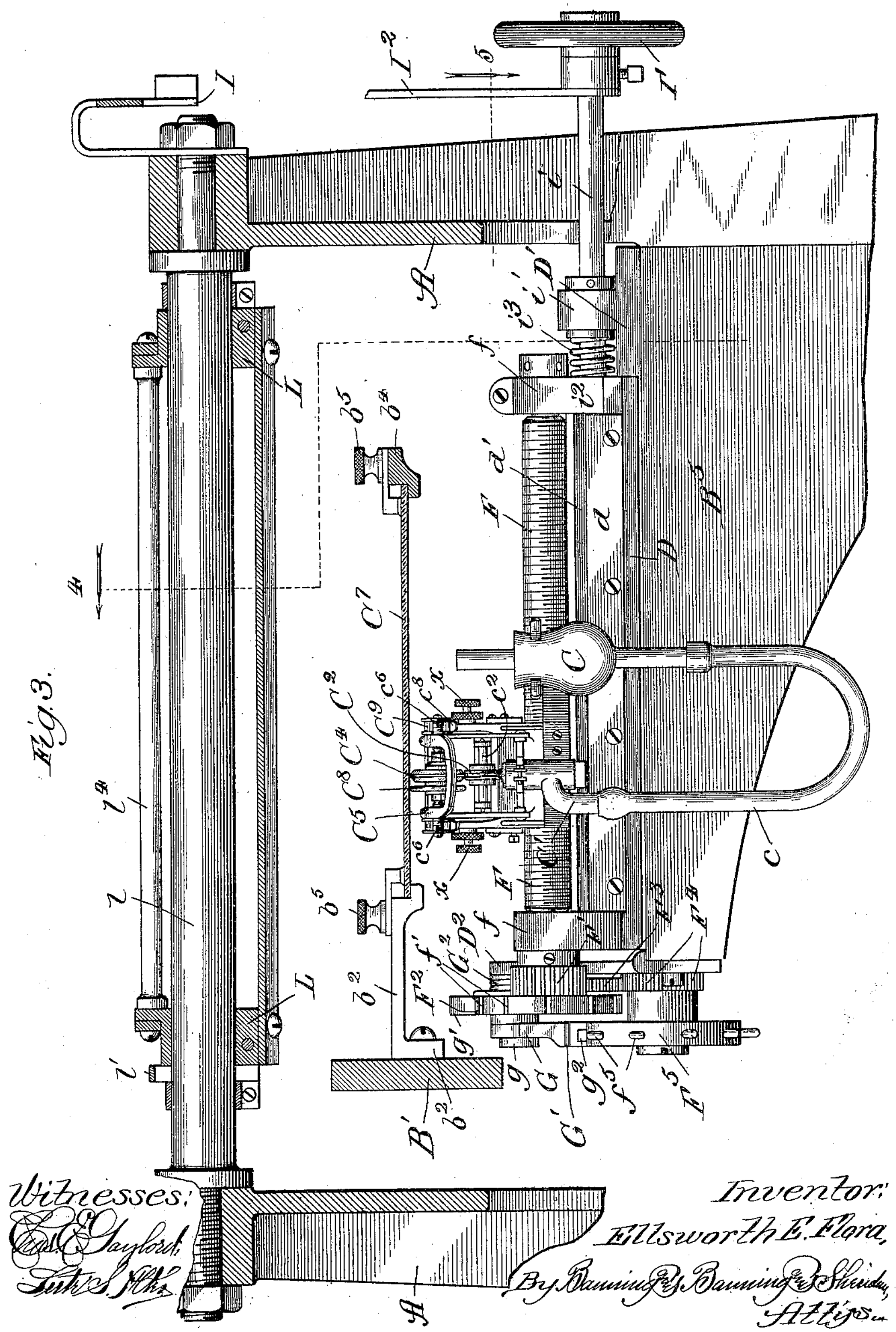

Fig. 3.

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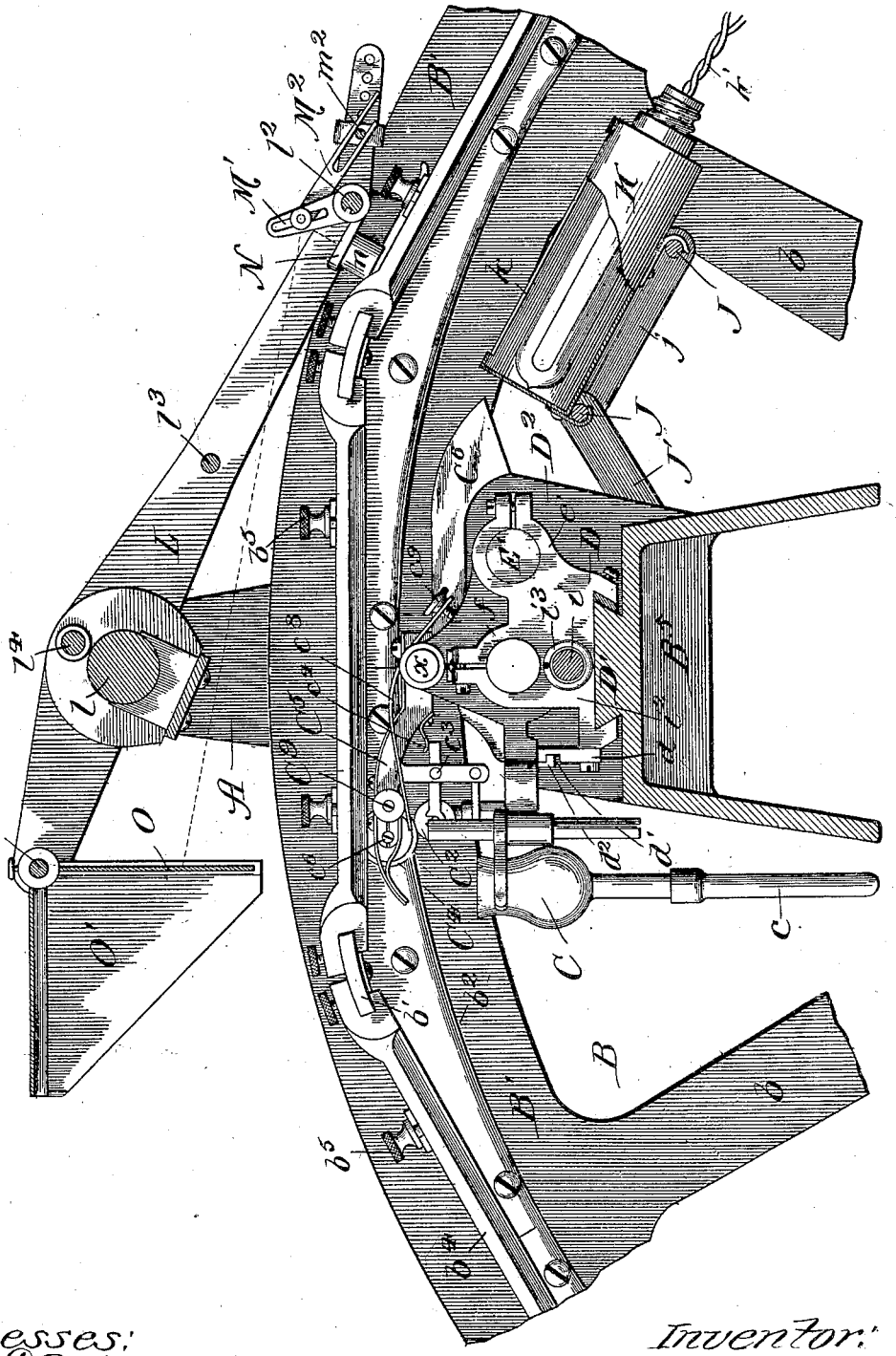
(No Model.) 7 Sheets—Sheet 4.

Fig. 4.



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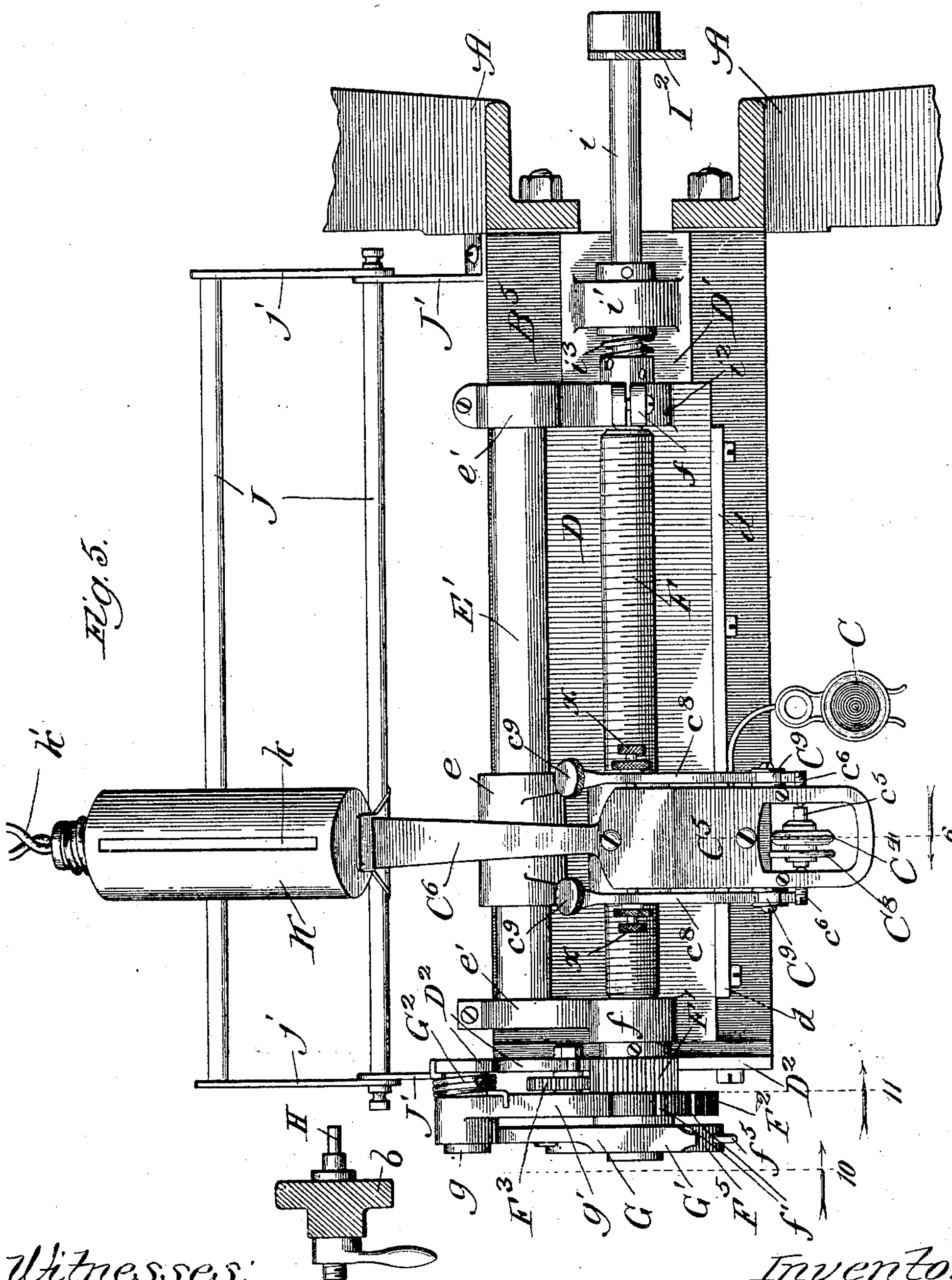
(No Model.) 7 Sheets—Sheet 5.



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RULING MACHINE.

(Application filed Apr. 18, 1898. Renewed Nov. 17, 1900.)

(No Model.) 7 Sheets—Sheet 6.

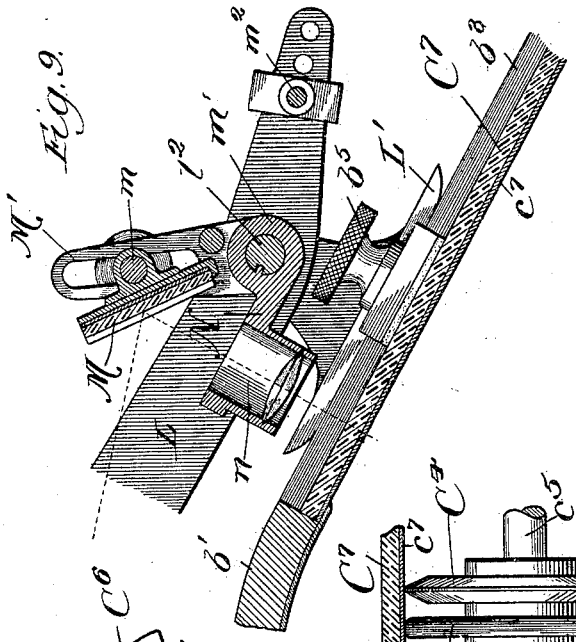
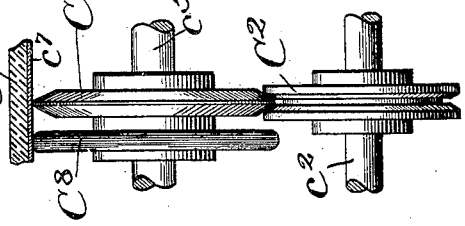


Fig. 9.



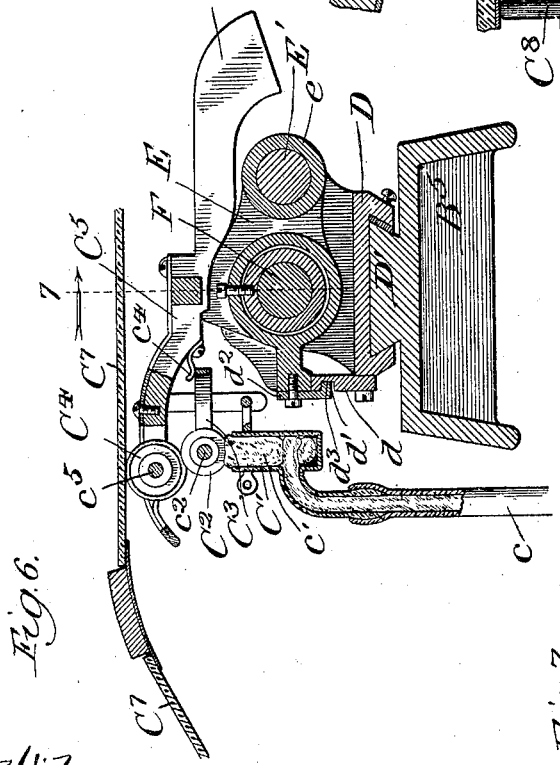


Fig. 6.

Fig. 8.

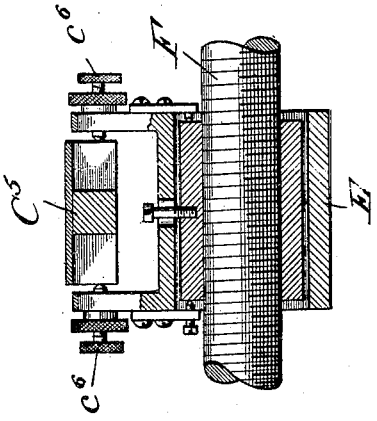


Fig. 7.

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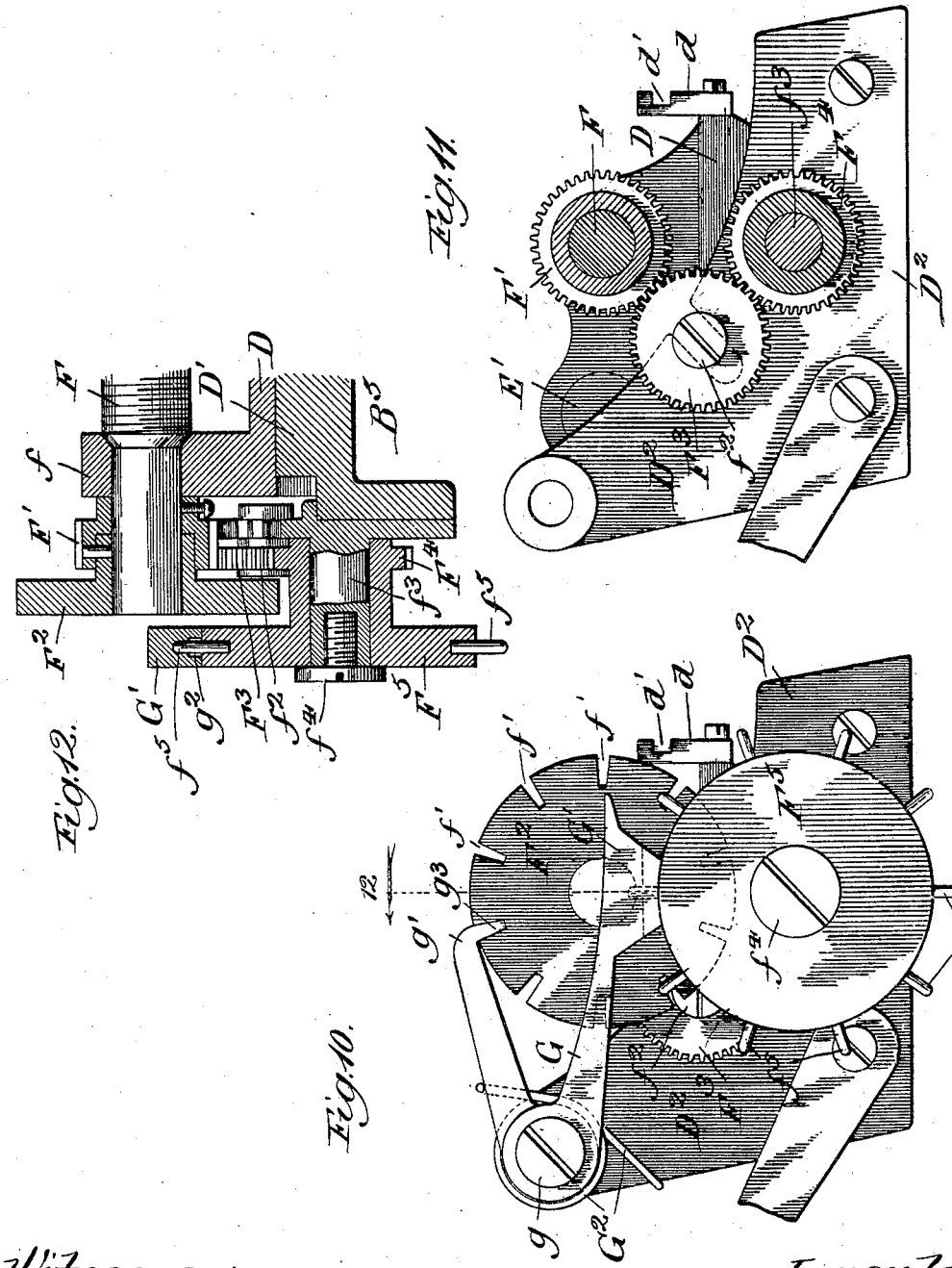
No. 676,943. Patented June 25, 1901.

E. E. FLORA.

RULING MACHINE.

(No Model.) (Application filed Apr. 18, 1898. Renewed Nov. 17, 1900.)

7 Sheets—Sheet 7.



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UNITED STATES PATENT OFFICE.

ELLSWORTH E. FLORA, OF CHICAGO, ILLINOIS, ASSIGNOR TO DWIGHT K. TRIPP, OF SAME PLACE.

RULING-MACHINE.

SPECIFICATION forming part of Letters Patent No. 676,943, dated June 25, 1901.

Application filed April 18, 1898. Renewed November 17, 1900. Serial No. 36,863. (No model.)

To all whom it may concern:

Be it known that I, ELLSWORTH E. FLORA, a citizen of the United States, residing at the city of Chicago, in the State of Illinois, have invented certain new and useful Improvements in Machines for Ruling Screens or Plates for Photographic Purposes, of which the following is a specification.

The object of my invention is to make a machine by which colors used in color photography or for other purposes may be ruled or placed on a screen, plate, or other surface to which they are to be applied readily, accurately, rapidly, economically, and with the fineness and delicacy required in such work; and my invention consists in the features and details of construction hereinafter described and claimed.

In the drawings, Figure 1 is a side elevation of my improved ruling-machine; Fig. 2, an end elevation of the same; Fig. 3, a vertical section of a portion of the machine, taken in the irregular line 3 of Fig. 1; Fig. 4, a vertical section of a portion of the machine, taken in the irregular line 4 of Fig. 3; Fig. 5, a sectional plan view of a portion of the machine, taken in the line 5 of Fig. 3; Fig. 6, a vertical sectional view taken in the line 6 of Fig. 5; Fig. 7, a vertical sectional view taken in the line 7 of Fig. 6; Fig. 8, an enlarged end view of the inking mechanism; Fig. 9, a sectional side elevation of the projecting mechanism, by which the lines being ruled are thrown onto a plate where they can be viewed and examined and any inaccuracy noted and corrected; Fig. 10, an end view taken in the line 10 of Fig. 5, showing the mechanism for shifting the ruling mechanism; Fig. 11, a vertical section on line 11 of Fig. 5, showing further details of the mechanism illustrated in Fig. 10; and Fig. 12, a vertical section taken in the line 12 of Fig. 10, further showing the construction and arrangement of the mechanism illustrated in Fig. 10.

In making my improved ruling-machine as I have the same constructed and in use I make a frame A, which I shall term the "supporting-frame," preferably cast and of the desired size, height, and strength. This supporting-frame is intended to be placed and rest upon any desired solid foundation, preferably as free from shock, movement, and vibration as practicable, as the work intended to be done requires great delicacy and accuracy, so that it is desirable to have as little movement or vibration as possible. The position and arrangement of the supporting-frame will be readily understood from an inspection of Figs. 1 and 2 of the drawings.

As the object of my ruling-machine is, as already said, to apply or rule the colors—as, for instance, such as are used in color photography—upon screens, plates, or other surfaces, it is necessary to have mechanism to hold such screens, plates, &c., in proper position to be ruled. For this purpose I arrange in the supporting-frame a skeleton frame B, which I shall term the "rotatable holder," consisting of a number of spokes *b*, extending out radially from a hub and terminating in a ring or flange B′, which I shall term the "frame-ring." This frame-ring is provided with a desired number of brackets *b*′, which I shall term "screen-brackets," extending out horizontally for a desired distance. These screen-brackets are intended to equal in number the number of screens or plates that it is desired that the rotatable holder of the machine shall hold or contain to be ruled. As I have the machine constructed and as it is illustrated in the drawings the rotatable holder is provided with twelve of these screen-brackets, because it is designed to contain or accommodate twelve plates or screens at the same time. If desired, however, any other number of screen-brackets may be employed, so that any desired number of plates or screens may be ruled at the same time. I do not of course intend to limit myself to any particular number of screens, brackets, or plates. These brackets are preferably cast and then securely fastened onto the frame-ring. Of course this may be done in various ways; but, as I have illustrated in the drawings, the screen-brackets are cast with segmental flanges b^2, which enable them to be attached to the frame-ring by means of screws, as shown in Fig. 1, although they may be fastened by thumb-screws, rivets, bolts, or in any other desired way. In casting these screen-brackets I also prefer to cast on them, parallel with the segmental flanges, laterally-

extended arms b^3, as shown in Fig. 2. These laterally-extending arms may be connected at their ends to the segmental flanges, as shown in Fig. 2.

By reference to Fig. 2 it will be seen that the screen-brackets when in place have their segmental flanges and their laterally-extending arms contiguous to each other at their ends, so as to make a practically continuous surface. The object of the laterally-extending arms is to form a surface or support for one edge of the screens or plates intended to be carried between the screen-brackets and to be supplied with color-lines. To provide the other support or surface for the edge of the screens or plates, I arrange along on the outer ends of the screen-brackets connecting-pieces b^4, which extend from one bracket to the other. These connecting-pieces are fastened to the ends of the screen-brackets by thumb-screws or in any other desired way, so as to hold them securely in place. The edges of the laterally-extending arms and of the connecting-pieces are suitably rabbeted or provided with flanges to receive and support the edges of the plates or screens. These various parts when combined together form what I shall term the "screen-holders." When the screens or plates are adjusted in place, they are held and secured in position by clamps b^5, which I shall term "screen-clamps," held in place by thumb-screws, as shown in Fig. 2, or in any other desired way. When the screens or plates are ruled, the thumb-screws may be loosened, the screen-clamps relieved, and the plates or screens removed, so that others may be inserted in their place. As the screens or plates which I rule on my machine are of glass, or, if of flexible material, intended to be backed by rigid material, the space for each plate or screen must therefore be in a flat plane instead of curved. In other words, taking the frame-ring as describing a true circle, the screens or plates describe chords of such circle, as shown clearly in Fig. 1, there being as many chords as there are screens or plates to be ruled.

The rotatable holder is supported on a shaft B^2, the ends of which are beveled, as shown in Fig. 2, so as to enable them to form cone-bearings, so that the frame may be rotated with the least amount of friction, vibration, or oscillation possible. Near the end of the shaft and opposite to the spokes of the frame is arranged a hub B^3, from which stay-rods B^4 extend across to the spokes of the frame, so as to render the frame more rigid and minimize oscillation or vibration. Other means for strengthening the rotatable holder can be employed, if desired; but I am describing the frame as built and used by me and as illustrated in the drawings. A bracket B^5, which I shall term the "bed-bracket," is arranged on the supporting-frame on the side opposite to the spokes of the rotatable holder and preferably near its top, so as to extend in under the screen-brackets and the screens or plates when they are in place. The office of this bracket is to support the ruling mechanism, by which the colors are applied to the screens or plates. I have shown it in the drawings as arranged near the top of the supporting-frame and so as to extend in within and under the screen-brackets, as above described. As a matter of fact, however, it does not need to be arranged in this particular position. It may be arranged either inside or outside of the screen-brackets, either below or above them, and anywhere in relation to the screens or plates so that the ruling mechanism may bear upon them. I have simply illustrated and described the bed-bracket for holding the ruling mechanism as I have not from necessity, but simply because I have it arranged in that way in the machine which I have built and have in use, and hence consider it a matter of convenience to so illustrate and describe it.

The rotatable holder may of course be rotated by various means, though to impart rotation to it I have shown a driving-pulley B^6, mounted on a shaft b^6, supported in suitable journals or bearings in the supporting-frame and provided with a friction-roll B^7, attached to bear against, preferably, the periphery of the frame-ring. A cord or belt may be applied to the driving-pulley, connecting it with any desired motive power—as, for instance, an electric engine—so as to cause it to rotate, and thus by means of the friction-roll impart rotation to the rotatable holder. As I have already said, however, any other desired means for rotating the holder carrying the screens or plates may be employed, if preferred.

Having now described the supporting-frame and the rotatable holder and the screen-holders, with the various parts and details which may be used with them, I will proceed to describe the mechanism by which the colors are to be ruled or placed on the screens or plates.

It will be understood that the lines are to be ruled on the plates or screens with such fineness as that from three hundred to five hundred lines may be laid to an inch. In fact, in some cases it may be desirable to place even a larger number of lines to the inch. These lines, furthermore, when intended for color photography are to be in alternating colors—those which have been found to be desirable in color photography—and to secure the desired results it is important, if not absolutely essential, that they lie side by side, so as to cover the entire surface of the screens or plates without being superposed upon or overlapping each other. It will be readily understood, therefore, that the mechanism by which these lines are applied must be of a delicate, fine, and accurate finish and that the mechanism for shifting the instrument, device, or tool which applies the lines or colors must be of a very fine, delicate, and accurate nature to move the ruling device the width of a line from time to time. I desire, how-

ever, to say that in referring to the colors appropriate for color photography I do not mean to limit the use of my mechanism to the placing of such colors alone, because the same mechanism is adapted to rule or place any kind of colors or to place a single color in fine lines side by side on the screens or plates to which it is applied.

The ink of the color which it is desired to apply is contained in an ink-reservoir C. (Shown in Fig. 4.) From this ink-reservoir a flexible tube *c* carries the ink to a feed-reservoir C′, preferably smaller in size than the ink-reservoir and clearly shown in Fig. 6. This feed-reservoir, into which the ink is carried through the flexible tube, is filled to a desired extent with a sponge or other absorbent material adapted to absorb and retain the ink in it. The absorbent material preferably slightly protrudes above the top of the feed-reservoir, as shown in Fig. 6. The flexible tube connecting the reservoirs may be used simply as an ordinary tube to convey the ink from the one to the other, or it may also be filled with an absorbent material, as is the feed-reservoir. The ink-reservoir is supported in some suitable way on the machine, but preferably so as to be movable in a vertical direction, so that it can be raised or lowered to increase or decrease the flow of the ink into the feed-reservoir, as may be desired.

Arranged immediately above the mouth of the feed-reservoir is a wheel C^2, which I shall term the "inking-wheel." This inking-wheel is mounted on a small pin or shaft c^2, which has its ends supported in a yoke or frame C^3, which I shall term the "inking-frame." This inking-frame is pivoted at c^3, (shown in Fig. 4,) so that it can rock up or down within a desired limit, as may be necessary. To hold it in a desired up position, a spring c^4 is employed, as shown in Figs. 4 and 6. The inking-wheel, as will appear from Fig. 8, is provided with a circumferential groove, preferably somewhat beveled or V-shaped. The lower edge of the wheel, as shown in Fig. 6, presses into the sponge or other absorbent material protruding from the mouth of the feed-reservoir, so that it is constantly supplied with ink and its circumferential groove kept filled. Immediately above this inking-wheel is arranged a wheel C^4, which I shall term the "ruling-wheel." This ruling-wheel is provided with a beveled circumferential edge, as shown particularly in Fig. 8. The bevels around the edge, however, are not intended to give the ruling-wheel what may be termed a "sharp" or "knife" edge. It is preferable, I think, that the edge shall in reality present a narrow smooth flattened surface, as shown in Fig. 8. In some cases perhaps it may be well to bevel the wheel, so that it will present practically a knife-edge; but for ordinary purposes I prefer to make it as above described and as shown in Fig. 8. The reason that I prefer to provide the ruling-wheel with a smooth flat edge—even though very narrow or perhaps imperceptible to the naked eye—is that it will then apply the ink to the screen, plate, or surface to which it is applied as a thin flat band or ribbon slightly wider than the edge of the wheel. Its effect, as I have observed it when thus used, may be illustrated by the unrolling of a flat band of ribbon from a spool. In this way I am able to apply lines of ink as flat ribbons lying side by side without overlapping or being superposed upon each other. The ruling-wheel rests upon the inking-wheel, with its beveled edge extending down into the circumferential groove around the inking-wheel, as shown in Fig. 8.

The ruling-wheel is mounted upon a small pin or shaft c^5, which is provided with a beveled hole in each of its ends, in which is inserted a jewel, so as to make as smooth and frictionless bearings as possible. The pin or shaft is arranged between the arms of a frame C^5, as shown particularly in Fig. 5, which I shall term the "ruling-frame." Pins c^6 pass through the arms of the ruling-frame and have their inner hardened pointed ends resting in the jeweled bearings of the pin or shaft c^5. This will be readily understood by an inspection of Fig. 5, where the arrangement is shown. The ruling-frame carrying the wheel, as above explained, is pivoted at c^6 (shown particularly in Fig. 4) and is provided with a weighted end C^6, as particularly shown in Fig. 6. Immediately above the ruling-wheel, as illustrated in the drawings, is arranged the plates or screens C^7 to be ruled. This is well shown in Figs. 6 and 8. The plates or screens to be ruled are first prepared with a proper substratum or film c^7 of a desired material, as shown in Fig. 8. Mounted on the shaft of the ruling-wheel is arranged a soft disk C^8, of rubber or other suitable material, which bears against the plate or screen to be ruled, and as such plate or screen is carried around by the rotation of the holder in which it is arranged and which has already been described rotation is imparted to the ruling-wheel. Its contact with the inking-wheel causes the inking-wheel to also rotate, so as to consequently take up the desired or necessary supply of ink to keep the ruling-wheel likewise constantly supplied, so that as it rotates it can rule a line on the plate or screen, as desired. To hold the ruling and friction wheels against the screen or plate, I employ springs c^8, held at one end by screws c^9 or other similar means and the other ends freely arranged under pins or studs C^9 on the ruling-frame. By screwing in or out the screws the tension of the springs may be regulated and adjusted from time to time. If now the rotatable holder be constantly rotated, the ruling-wheel will lay a line or ribbon of ink across the film or surface of each screen or plate carried by the holder, but unless means be provided for shifting the ruling-wheel to one side it will constantly place or lay the line or ribbon of ink in the same

place or upon itself again and again. This brings us to the necessity of providing mechanism or means for shifting the ink-laying device, instrument, or tool laterally, so as to place the lines side by side.

The ruling mechanism above described, as has already been said, is mounted or supported on the bed-bracket B^5. This is done by means of a sliding carriage D. This sliding carriage is preferably dovetailed, so as to engage with a dovetailed ridge or projection D′ on the bed-bracket, as well illustrated in Figs. 4 and 7. This sliding carriage is provided with a guide-piece d, having a longitudinal groove d', as shown in Figs. 4 and 6. The block E, on which the ruling-frame carrying the ruling-wheel is mounted, is provided with a downwardly-projecting lug d^2, having an inwardly-directed flange d^3, engaging the longitudinal groove in the guide-plate, as will be understood particularly from Fig. 6. The block is also extended at its "rear" end, as I term it, e, so as to pass around and engage a rod E′, mounted longitudinally in suitable bearings e' on the carriage D. This permits the block to travel back and forth along the carriage and carry with it the frame and the ruling-wheel and other inking mechanism already described. I arrange a feed-screw F in suitable bearings f on the carriage D. This feed-screw is threaded with a desired number of threads to the inch. In the machine as I have constructed it and illustrated it in the drawings I have provided the feed-screw with ten threads to the inch. The screw passes through a hole in the nut e^2, arranged in the block E, which is also provided with ten threads to the inch. Every revolution, therefore, of the screw carries the block and the ruling-wheel in the one direction or the other one-tenth of an inch. On the end of the feed-screw next to the spokes of the rotatable holder is mounted a pinion F′, which contains a desired number of teeth. Next to this pinion is arranged an index-plate F^2, mounted on the feed-screw, as will be understood by reference particularly to Fig. 12. This index-plate is provided with ten notches f', as shown particularly in Fig. 10. These notches are equidistant apart and are intended to be cut or formed with care and accuracy. The teeth of the pinion mesh or engage with the teeth of an intermediate pinion F^3, mounted on a stud f^2, arranged, preferably, in a slot in the end plate D^2 of the bed-bracket, as shown in Fig. 11. The stud f^2 is preferably made as a screw, so that it can be loosened or tightened to permit adjustment of the intermediate pinion up or down in the slot. The teeth of the intermediate pinion engage with the teeth of a driving-pinion F^4, mounted on a stud f^3, secured in the end D^2 of the bed-bracket. On the same stud is mounted a star-wheel F^5, fast with the driving-pinion. If desired, they may both be made integral with each other, as shown in Fig. 12, or made separately and afterward attached and connected together. A headed screw or nut f^4 may be used to hold the parts together. This star-wheel is provided with a desired number of projections, preferably formed of pins f^5. In the machine as I have made it and have it in use and as illustrated in the drawings it is provided with ten of these projecting pins.

I may here say that while I have described the feed-screw as containing ten threads to the inch and the index-plate as containing ten notches and the star-wheel as containing ten projecting pins, I shall not limit myself to these numbers, as any other number may be adopted and used, depending upon the fineness or coarseness of ruling that may be desired and the arrangement of the train of driving-pinions.

Mounted on the end D^2 of the feed-bracket is a releasing-lever G. By means of a stud or screw g the releasing-lever is permitted to freely rock thereon. This releasing-lever is provided with a cam G′ and is also connected with an indexing-lever g'. The cam extends downwardly and for convenience is provided with a slot g^2 (shown in Figs. 3, 10, and 12) for the purpose of straddling one of the projecting pins on the star-wheel. The indexing-lever terminates in a tooth g^3, arranged to engage the notches f' in the index-plate. A spring G^2 (shown in Fig. 10) serves to hold the index-lever in its operative position, so that the tooth g^3 engages with one of the notches in the index-plate. It will be noticed that the cam is inclined or beveled, as shown in Fig. 10. A tripping-pin H, mounted on the rotatable holder, is so arranged that with every revolution of the holder it strikes or engages the cam and operates the releasing-lever, so as to disengage the indexing-lever from the index-plate. As the tripping-pin operates the releasing-lever, so as to free the parts, it strikes or engages with one of the projections on the star-wheel and causes it to be rotated the distance between two projections, which, as the machine is illustrated, would be one-tenth of a revolution. This, through the instrumentality of the mechanism above described, causes the feed-screw to be rotated one-tenth of a revolution. Thus the block, with the ruling mechanism, is carried laterally one one-hundredth of an inch from its previous position. As soon as the tripping-pin has passed, the spring G^2 causes the indexing-lever to engage the next succeeding notch in the index-plate, so as to stop the mechanism from further revolution and lock the parts at perfect rest and in the desired position during an entire revolution of the rotatable holder with the screens or plates to be ruled. This insures the laying of each ruled line precisely the distance from the preceding line desired. By having a projection on the star-wheel in a vertical position when the wheel is in a state of rest it may be operated by the tripping-pin going in either direction, and by having the cam beveled or cambered on each side, as shown in Fig. 10, the

tripping-pin may operate it from either direction, so that the rotatable holder may be rotated in either direction, and after the screens or plates have had any given line ruled on them by reversing the direction of the rotation of the frame and travel of the ruling mechanism the same line can be retraced to make it denser, if desired. It also follows that arranging the parts as above, so that the holder can be rotated in either direction, it permits a line of one color to be laid or placed on the screens or plates while the holder is rotated in one direction and the ruling mechanism working entirely across the screens or plates, and then a line of another color laid by the side of the one first laid while the holder is rotating in the other direction and the ruling mechanism traveling back to its initial point. This permits work to be done while the ruling mechanism is traveling in the one direction or in the other and avoids the loss of time which would otherwise be necessitated in returning such mechanism to its initial or starting point.

From what has already been said it will be understood that in ruling a line of any particular color the line will be laid or placed on the plate or screen as the machine is illustrated and described at the number of one hundred to the inch. For the purpose of color photography, however, at least three colors must be laid side by side, and in order to get the lines at the number of three hundred to the inch, which number I merely use for the purpose of illustration, each line of color should be one three-hundredth of an inch in width. Having one laid, as above described, one three-hundredth of an inch in width, another color is now to be applied.

The ink-reservoir, the feed-reservoir, and the inking-wheel are removed and others containing the desired color arranged in place. The ruling-wheel is cleaned and the mechanism is now ready to rule a second line. To insure the exact placement or location of this line, however, requires that it shall be started at the proper distance from the line already laid. To do this with certainty and accuracy, I have arranged a graduated index I. (Shown in Figs. 1 and 3.) A wheel I is arranged on a shaft i, which passes through the end of the frame A and through a bearing i', arranged on the bed-bracket. The inner end of this shaft is screw-threaded and enters a screw-threaded hole in the end i^2 of the carriage D. Between the bearing i' and the end i^2 of the carriage is arranged a spring i^3 to take up any possible lost motion in the threads. While I desire to use this spring, I consider that it is a feature that is dispensable. Mounted on a shaft i is a finger I^2, which extends up to the graduated index. The graduated index, in the machine as described, is of a length that by moving the finger from one end to the other the carriage is moved one one-hundredth part of an inch. It is provided with marks so that the finger can be moved to any desired predetermined distance. By moving, for instance, one-third of the length of the index, the carriage and mechanism will be moved one three-hundredths part of an inch. In starting a new line, therefore, where three hundred lines are to be placed to the inch, all that is necessary is to move the finger one-third of the distance across the index. Of course it will be understood that I am describing the machine as I have built it and have it illustrated in the drawings.

Any number of marks can of course be placed on the graduated index, so that without departing from the principle above described the ruling mechanism can be moved in the one direction or the other any desired part of an inch, whether it be one three-hundredth or one six-hundredth part of an inch. By moving the finger the proper distance, therefore, the ruling mechanism can be certainly and accurately placed in the position to begin a new line, after which the natural and necessary operation of the machine will maintain the ruling-wheel at exactly the same distance from the line already ruled as it travels again and again over the screens or plates and fills them with lines from side to side during the revolution of the rotatable holder. I desire also to suggest, what I consider obvious, that instead of one ruling-wheel and its associated parts two or three or any desired number of ruling-wheels with their associated parts can be mounted on the sliding carriage. Where a train of ruling-wheels are used, they should of course follow each other at such distance apart as that the line ruled by one ruling-wheel will have time to set or dry by the time the next ruling-wheel approaches, so that the next line will be placed or laid exactly at its side without the lines overlapping or running together. In this way, by a mere duplication of parts, three colors—for instance, such as are used in color photography—can be laid or ruled on the screen or plate in one operation and practically simultaneously, so that one revolution of the holder B will lay or place three lines instead of one, or as many lines as there are ruling-wheels in the train employed.

Owing to the nicety and accuracy necessary to be observed in the placement of the lines side by side it becomes important, if not, indeed, necessary, to employ means by which the operator may verify the accuracy obtained by the mechanism above described for moving the ruling-wheel into the desired position at the commencement of each and every new line to be ruled. It may happen, for instance, that the edge of the ruling-wheel may be wider or narrower at different times, so that in order to secure perfectly accurate results the finger should be moved across the graduated scale a little less or a little more than the predetermined distance. Owing to the fineness of the lines, however, their exact position cannot be determined by the naked eye, nor is it practicable to examine them

under a microscope while the rotatable holder is rotating, as the plates and screens are then constantly moving. To enable the operator, therefore, to examine the lines to make such slight changes laterally in the position of the ruling-wheel as may be necessary by slightly advancing or retracting the finger across the face of the graduated scale, I have provided certain appliances and devices to be used in connection with the rotatable holder and ruling mechanism, which I will now describe.

I arrange at a desired point and preferably supported upon the bed-bracket a frame comprising, as shown in the drawings, two parallel rods J, connected by end pieces *j*, supported upon arms or brackets J', attached to the bed-bracket or to the frame, if preferred, which I shall term the "light-frame." I arrange on the parallel rods of the light-frame a cylinder K, preferably of metal, containing a longitudinal slot *k* along its top. An incandescent electric lamp is arranged in this cylinder having wires *k'*, making the proper connection with an electric current, so that the incandescent lamp may be lighted and the light shine up through the longitudinal slot at the top of the cylinder. This light casts a long straight beam, and it is desirable, if, indeed, not essential, that the cylinder shall be so adjusted as that the longitudinal slot will be parallel with the ruled lines instead of slanting across them. The cylinder is so mounted on the light-frame as that it may be slid back and forth crosswise of the screens or plates, as may be desired, to permit examination of any desired part of the screens or plates which are receiving the lines. The arrangement of the various parts of the light-frame and the cylinder will be readily understood from an inspection of Figs. 1, 4, and 5 of the drawings particularly.

I arrange above or outside of the rotatable holder a frame L', which I shall term the "projecting" frame, which may be pivotally mounted on a rod *l*, binding or connecting the upper ends of the supporting-frame together. A spring *l'* serves to hold the lower end of the projecting frame down against the outside of the segmental flanges. To permit the end of the projecting frame to ride along the segmental flanges, I provide it with a shoe L', which is beveled or upwardly inclined, as shown in Fig. 9, so that it can slide in either direction without interference or trouble. The projecting frame, as illustrated in the drawings, consists of two parallel bars, as shown in Fig. 2 and in section in Fig. 3. These bars are connected by transverse rods or bolts, as l^2, l^3, l^4, and l^5, which serve to impart strength and rigidity to the frame and diminish, as far as possible, its liability to spring, warp, or vibrate while in use. The rod l^2 performs another function as well. It is intended to carry the projecting mechanism shown in Figs. 4 and 9 particularly. This projecting mechanism comprises a mirror M, carried on a pin or rod *m*, arranged in a slotted frame M', rising from a sleeve or collar *m'*, surrounded and adapted to slide upon the rod l^2, which rod is also provided with a longitudinal guideway or slot, as shown in Figs. 4 and 9, in which the sleeve is keyed so that while it may slide along the rod from end to end it will only turn with the rod, so as to always preserve the same relative position with it. Projecting out from the sleeve is arranged an extension N, carrying the microscope-objective *n*. The shoe already described is also mounted upon the end of the rod l^2 and keyed to it. The rod l^2 is also arranged so that it can turn in the projecting frame, and thus conform to any position assumed by the shoe as it slides over the segmental brackets. This insures that the microscope-objective shall always maintain a position parallel to the surface of the plates or screens being ruled and preserve the same distance from them at all times.

To maintain the mirror in a constant and invariable position with reference to the microscope-objective through the various motions of the projecting frame, an arm M^2 extends back from the pin or shaft *m*, carrying the mirror. The end of this arm is bifurcated, as shown in Fig. 4, and embraces the rod m^2, which passes across from one arm of the projecting frame to the other. This will be understood from an inspection of Fig. 4, where the parts are particularly illustrated. The upper end of the projecting frame carries a ground-glass plate O, preferably arranged in a light-box O', so as to exclude most of the exterior light from the eye of the operator. When the operator desires to examine the position of the line being ruled, he looks at the ground-glass plate O. The ray of light passing from the incandescent-lamp passes through the lines of the plates or screens and through the microscope-objective to the mirror when it is reflected onto the ground-glass plate O. Without stopping or interrupting the operation of the machine the operator can at any time examine the position and condition of the lines being ruled, and if they are found to be too close together or too wide apart he can adjust the ruling-wheel slightly to one side or the other by moving the finger backward or forward on the graduated scale or plate, so that the position of the line being ruled can be certainly adjusted to the desired closeness to the preceding line without interfering with the movements and operations of the machine. This testing or verifying of the position of the lines and adjustment of the ruling mechanism to meet the requirements of the case will usually be at the commencement of the ruling of a new line, because, as before explained, when the ruling mechanism is started right it will remain in the right relative position from the commencement to the end of the operation. The means above described, however, make it practicable to examine the state and condition of the lines at any time while

a plate is being ruled from one side to the other.

From the foregoing detailed description it will be observed that my improved ruling-machine, considered as a whole, consists of a number of associated correlated mechanisms each reinforcing, assisting, and contributing to the other in the furtherance of a common object and the securing of a common result. There is the supporting-frame on which all of the parts are assembled, the rotatable holder or carrier receiving the screens or plates to be ruled and carrying the portion to be ruled past a point or place where the colors are to be applied to them, the inking and ruling mechanism arranged in such relation to the screens or plates as that they may contact with them and apply a line or band of color while the one is passing the other, the shifting mechanism by which the screens or plates and the inking and ruling mechanism are relatively shifted laterally with respect of the one to the other, so that the lines or bands of color will be placed side by side, and the testing or verifying mechanism by which the operator may examine the position and condition of the ruled lines from time to time without interrupting or interfering with the operation of the machine. I shall endeavor to claim the entire combination of mechanisms, as well as the several subcombinations which make up the respective parts above enumerated. Inasmuch, however, as various changes in form, structure, and detail can be made in many of the parts, I do not wish to be understood as desiring to limit myself to mere structural features, notwithstanding the detail and minuteness with which I have described the construction and operation of the machine and its various subordinate parts. I desire, in fact, to be understood as only limiting myself to particular features to the extent that the same may be called for in the claims. I shall, furthermore, for the sake of convenience and brevity in the claims, use a single word when I intend to designate all similar articles—as, for instance, I shall use the word "screens" to include plates, films, paper, and all surfaces on which the lines are to be ruled, without designating them severally.

What I regard as new, and desire to secure by Letters Patent, is—

1. In a machine for ruling photographic screens, the combination of means for holding a plurality of screens and carrying them around a central point, and means for ruling colors thereon, substantially as described.

2. In a machine for ruling photographic screens, the combination of means for holding screens in position to be ruled and carrying them around a central point, means located inside of the holder for ruling colors on the screens, and means for rotating one of such elements in such relation to the other as that lines may be ruled, substantially as described.

3. In a machine for ruling photographic screens, the combination of means for holding a plurality of screens and carrying them around a central point, means located inside of the holder for ruling colors on the screens, and means for rotating the holder, substantially as described.

4. In a machine for ruling photographic screens, the combination of means for holding screens and carrying them around a central point, means for ruling colors on the screens, and means for moving one of such elements laterally a predetermined distance, substantially as described.

5. In a machine for ruling photographic screens, the combination of ruling mechanism, a rotatable holder for carrying the screens to be ruled past the ruling mechanism to permit a line to be ruled thereon, and means for periodically and automatically changing the relative position of the ruling mechanism and the screens laterally a predetermined distance, substantially as described.

6. In a machine for ruling photographic screens, the combination of mechanism for ruling colors, a rotatable holder for carrying the screen to be ruled past the ruling mechanism to permit a line to be ruled thereon, and mechanism for examining and verifying the position and condition of the lines being ruled without interrupting the operation of the machine, substantially as described.

7. In a machine for ruling photographic screens, the combination of mechanism for ruling colors, mechanism for holding the screens and carrying the portion to be ruled past the ruling mechanism to permit a line to be ruled thereon, means for changing the relative position of the ruling mechanism and the screens laterally a desired distance, and mechanism for examining and verifying the position and condition of the lines being ruled without interrupting the operation of the machine, substantially as described.

8. In a machine for ruling photographic screens, the combination of mechanism for ruling colors, mechanism for holding the screens and carrying the portion to be ruled past the ruling mechanism to permit a line to be ruled thereon, means for periodically and automatically changing the relative position of the ruling mechanism and the screens laterally a predetermined distance and mechanism for examining and verifying the position and condition of the lines being ruled without interrupting the operation of the machine, substantially as described.

9. In a machine for ruling photographic screens, the combination of a rotatable holder for the screens carrying the portion to be ruled past ruling mechanism to permit a line to be ruled thereon, mechanism for ruling colors arranged in such relation to the holder as to permit it to rule a line on the screen as it is carried past, and means for rotating the holder, substantially as described.

10. In a machine for ruling photographic

screens, the combination of a rotatable holder for the screens carrying the portion to be ruled past ruling mechanism to permit a line to be ruled thereon, mechanism for ruling colors arranged in such relation to the holder as to permit it to rule a line on the screen as it is carried past, means for rotating the holder, and means for changing the relative position of the ruling mechanism and the screens laterally a desired distance, substantially as described.

11. In a machine for ruling photographic screens, the combination of a rotatable holder for the screens carrying the portion to be ruled past ruling mechanism to permit a line to be ruled thereon, mechanism for ruling colors arranged in such relation to the holder as to permit it to rule a line on the screen as it is carried past, means for rotating the holder, and means for periodically and automatically changing the relative position of the ruling mechanism and the screens laterally a predetermined distance, substantially as described.

12. In a machine for ruling photographic screens, the combination of a rotatable holder for the screens carrying the portion to be ruled past the ruling mechanism to permit a line to be ruled thereon, mechanism for ruling colors arranged in such relation to the holder as to permit it to rule a line on the screen as it is carried past, means for rotating the holder, and mechanism for examining and verifying the position and condition of the lines being ruled without interrupting the operation of the machine, substantially as described.

13. In a machine for ruling photographic screens, the combination of a rotatable holder for the screens carrying the portion to be ruled past ruling mechanism to permit a line to be ruled thereon, mechanism for ruling colors arranged in such relation to the holder as to permit it to rule a line on the screen as it is carried past, means for rotating the holder, means for changing the relative position of the ruling mechanism and the screens laterally a desired distance, and mechanism for examining and verifying the position and condition of the lines being ruled without interrupting the operation of the machine, substantially as described.

14. In a machine for ruling photographic screens, the combination of a rotatable holder for the screens carrying the portion to be ruled past ruling mechanism to permit a line to be ruled thereon, mechanism for ruling colors arranged in such relation to the rotatable holder as to permit it to rule a line on the screen as it is carried past, means for rotating the holder, means for periodically and automatically changing the relative position of the ruling mechanism and the screens laterally a predetermined distance, and mechanism for examining and verifying the position and condition of the lines being ruled without interrupting the operation of the machine, substantially as described.

15. In a machine for ruling photographic screens, the combination of a hollow rotatable holder for the screens open at one end, carrying the portion to be ruled past ruling mechanism to permit a line to be ruled thereon, mechanism for ruling colors arranged to extend into the holder through its open end and rule a line on the inner surface of the screen as it is carried past, and means for rotating the holder, substantially as described.

16. In a machine for ruling photographic screens, the combination of a hollow rotatable holder for the screens open at one end, carrying the portion to be ruled past ruling mechanism to permit a line to be ruled thereon, mechanism for ruling colors arranged to extend into the holder through its open end and to rule a line on the inner surface of the screen as it is carried past, means for rotating the holder, and means for changing the relative position of the ruling mechanism and the screens laterally a desired distance, substantially as described.

17. In a machine for ruling photographic screens, the combination of a hollow rotatable holder for the screens open at one end, carrying the portion to be ruled past ruling mechanism to permit a line to be ruled thereon, mechanism for ruling colors arranged to extend into the holder through its open end and to rule a line on the inner surface of the screen as it is carried past, means for rotating the holder, and means for periodically and automatically changing the relative position of the ruling mechanism and the screens laterally a predetermined distance, substantially as described.

18. In a machine for ruling photographic screens, the combination of a hollow holder for the screens, mechanism for ruling colors on the screens located and arranged inside of the holder, means for moving one of such elements past the other to permit of lines being ruled, and means for changing the relative position of the ruling mechanism and the screens laterally a desired distance, substantially as described.

19. In a machine for ruling photographic screens, the combination of a hollow holder for the screens, mechanism for ruling colors on the screens located and arranged inside of the holder, means for moving one of such elements past the other to permit lines to be ruled, and means for periodically and automatically changing the relative position of the ruling mechanism and the screens laterally a predetermined distance, substantially as described.

20. In a machine for ruling photographic screens, the combination of a rotatable holder for the screens containing a plurality of screen-holders comprising as parts thereof severally screen-brackets, lateral arms, connecting-pieces and screen-clamps, mechan-

ism for ruling colors arranged in such relation to the rotatable holder as to permit the ruling of lines on the screen as they are carried past, and means for rotating the rotatable holder, substantially as described.

21. In a machine for ruling photographic screens, the combination of a rotatable holder for the screens, containing a plurality of screen-holders comprising as parts thereof severally screen-brackets, lateral arms, connecting-pieces and screen-clamps, mechanism for ruling colors arranged in such relation to the rotatable holder as to permit the ruling of lines on the screens as they are carried past, means for rotating the rotatable holder, and means for changing the relative position of the ruling mechanism and the screens laterally a desired distance, substantially as described.

22. In a machine for ruling photographic screens, the combination of a rotatable holder for the screens containing a plurality of screen-holders comprising as parts thereof severally screen-brackets, lateral arms, connecting-pieces and screen-clamps, mechanism for ruling colors arranged in such relation to the rotatable holder as to permit the ruling of lines on the screens as they are carried past, means for rotating the rotatable holder, and means for periodically and automatically changing the relative position of the ruling mechanism and the screens laterally a predetermined distance, substantially as described.

23. In a machine for ruling photographic screens, mechanism for ruling colors comprising as parts thereof a ruling-wheel circumferentially beveled around its edge to form a narrow smooth flattened periphery, an inking-wheel provided with a circumferential groove around its periphery in which the beveled edge of the ruling-wheel rests, means for supplying ink to the circumferential groove of the inking-wheel and thereby to the ruling-wheel, and means for causing such wheels to rotate, substantially as described.

24. In a machine for ruling photographic screens, mechanism for ruling colors comprising as parts thereof a ruling-wheel, a pivoted ruling-frame in which the ruling-wheel is mounted, an inking-wheel, a pivoted inking-frame in which the inking-wheel is mounted, means for supplying ink to the inking-wheel, and means for causing such wheels to rotate, substantially as described.

25. In a machine for ruling photographic screens, mechanism for ruling colors comprising as parts thereof a threaded screw, a ruling-wheel having connection with the threaded screw, and means for periodically and automatically rotating the threaded screw a predetermined distance and thereby correspondingly moving the ruling-wheel laterally, substantially as described.

26. In a machine for ruling photographic screens, mechanism for ruling colors comprising as parts thereof a threaded screw, a ruling-wheel having connection with the threaded screw, means for supplying ink to the ruling-wheel, means for causing such wheel to rotate, and means for periodically and automatically rotating the threaded screw a predetermined distance and thereby correspondingly moving the ruling-wheel laterally, substantially as described.

27. In a machine for ruling photographic screens, mechanism for ruling colors comprising as parts thereof a sliding carriage, a threaded screw mounted therein, a ruling-wheel having connection with the threaded screw, and means for moving the sliding carriage and the parts mounted thereon a desired distance endwise at the will of the operator, substantially as described.

28. In a machine for ruling photographic screens, mechanism for ruling colors comprising as parts thereof a sliding carriage, a threaded screw mounted therein, a ruling-wheel having connection with the threaded screw, means for moving the sliding carriage and the parts mounted thereon a desired distance endwise at the will of the operator, and means for periodically and automatically rotating the threaded screw a predetermined distance and thereby correspondingly moving the ruling-wheel laterally, substantially as described.

29. In a machine for ruling photographic screens, mechanism for ruling colors comprising as parts thereof a bed-bracket, a sliding carriage, a threaded screw mounted therein, a block mounted on the threaded screw, a ruling-wheel mounted on the nut or block, means for supplying ink to the ruling-wheel, means for causing such wheel to rotate, and means for automatically and periodically rotating the threaded screw a predetermined distance and thereby correspondingly moving the ruling-wheel laterally, substantially as described.

30. In a machine for ruling photographic screens, mechanism for ruling colors comprising a bed-bracket, a sliding carriage, a threaded screw mounted therein, a nut or block mounted on the threaded screw, a ruling-wheel and an inking-wheel mounted on the block, means for supplying ink to the inking and ruling wheels, means for causing such wheels to rotate, and means for automatically and periodically rotating the threaded screw a predetermined distance and thereby correspondingly moving the ruling-wheel laterally, substantially as described.

31. In a machine for ruling photographic screens, the combination of a rotatable holder for the screens, means for rotating the holder, mechanism for ruling colors comprising as parts thereof a threaded screw, a ruling-wheel having connection with the threaded screw, and means for periodically and automatically rotating the threaded screw a predetermined distance and thereby correspondingly moving the ruling-wheel laterally, substantially as described.

32. In a machine for ruling photographic

screens, the combination of a rotatable holder for the screens, means for rotating the holder, mechanism for ruling colors comprising as parts thereof a threaded screw, a ruling-wheel having connection with the threaded screw, means for supplying ink to the ruling-wheel, means for causing such wheel to rotate, and means for periodically and automatically rotating the threaded screw a predetermined distance and thereby correspondingly moving the ruling-wheel laterally, substantially as described.

33. In a machine for ruling photographic screens, the combination of a rotatable holder for the screens, means for rotating the holder, mechanism for ruling colors comprising as parts thereof a sliding carriage, a threaded screw mounted therein, a ruling-wheel having connection with the threaded screw, and means for moving the sliding carriage and the parts mounted thereon a desired distance endwise at the will of the operator, substantially as described.

34. In a machine for ruling photographic screens, the combination of a rotatable holder for the screens, means for rotating the holder, mechanism for ruling colors comprising as parts thereof a sliding carriage, a threaded screw mounted therein, a ruling-wheel having connection with the threaded screw, means for moving the sliding carriage and the parts mounted thereon a desired distance endwise at the will of the operator, and means for periodically and automatically rotating the threaded screw a predetermined distance and thereby correspondingly moving the ruling-wheel laterally, substantially as described.

35. In a machine for ruling photographic screens, the combination of a rotatable holder for the screens, means for rotating the holder, mechanism for ruling colors comprising as parts thereof a threaded screw, a ruling-wheel having connection with the threaded screw, tripping mechanism arranged on the rotatable holder, and mechanism connected with the threaded screw and operated by the tripping mechanism to rotate the screw a predetermined distance and thereby correspondingly moving the ruling-wheel laterally, substantially as described.

36. In a machine for ruling photographic screens, the combination of a rotatable holder for the screens, means for rotating the holder, mechanism for ruling colors comprising as parts thereof a threaded screw, a ruling-wheel having connection with the threaded screw, means for supplying ink to the ruling-wheel, means for causing such wheel to rotate, tripping mechanism arranged on the rotatable holder, and mechanism connected with the threaded screw and operated by the tripping mechanism to rotate the screw a predetermined distance and thereby correspondingly moving the ruling-wheel laterally, substantially as described.

37. In a machine for ruling photographic screens, the combination of a rotatable holder for the screens, means for rotating the holder, mechanism for ruling colors comprising as parts thereof a sliding carriage, a threaded screw mounted therein, a ruling-wheel having connection with the threaded screw, trip mechanism arranged on the rotatable holder, and mechanism connected with the threaded screw and operated by the tripping mechanism to rotate the screw a predetermined distance and thereby correspondingly moving the ruling-wheel laterally, substantially as described.

38. In a machine for ruling photographic screens, the combination of a rotatable holder for the screens, means for rotating the holder, mechanism for ruling colors comprising as parts thereof a sliding carriage, a threaded screw mounted therein, a ruling-wheel having connection with the threaded screw, means for moving the sliding carriage and the parts mounted thereon a desired distance endwise at the will of the operator, tripping mechanism arranged on the rotatable holder, and mechanism connected with the threaded screw and operated by the tripping mechanism to rotate the screw a predetermined distance and thereby correspondingly moving the ruling-wheel laterally, substantially as described.

39. In a machine for ruling photographic screens, the combination of a rotatable holder for the screens, means for rotating the holder, mechanism for ruling colors comprising as parts thereof a bed-bracket, a sliding carriage, a threaded screw mounted therein, a nut or block mounted on the threaded screw, a ruling-wheel mounted on the nut or block, trip mechanism arranged on the rotatable holder, and mechanism connected with the threaded screw and operated by the tripping mechanism to rotate the screw a predetermined distance and thereby correspondingly moving the ruling-wheel laterally, substantially as described.

40. In a machine for ruling photographic screens, the combination of a rotatable holder for the screens, means for rotating the holder, mechanism for ruling colors comprising as parts thereof a threaded screw, a nut or lock mounted on the threaded screw, a ruling-wheel mounted on the nut or block, trip mechanism arranged on the rotatable holder, mechanism connected with the threaded screw and operated by the tripping mechanism to rotate the screw a predetermined distance and thereby correspondingly moving the ruling-wheel laterally, and means for locking such mechanism and holding its parts in a state of rest until again operated by the tripping mechanism, substantially as described.

41. In a machine for ruling photographic screens, mechanism for ruling colors comprising as parts thereof a bed-bracket, a sliding carriage, a threaded screw mounted therein, a nut or block mounted on the threaded screw, a ruling-wheel mounted on the nut or block, means for supplying ink to the ruling-wheel,

and means for moving the sliding carriage a desired distance endwise at the will of the operator, substantially as described.

42. In a machine for ruling photographic screens, mechanism for ruling colors comprising as parts thereof a bed-bracket, a sliding carriage, a threaded screw mounted therein, a nut or block mounted on the threaded screw, a ruling-wheel mounted on the nut or block, means for supplying ink to the ruling-wheel, a graduated scale, and means for moving the sliding carriage a predetermined distance endwise at the will of the operator, substantially as described.

43. In a machine for ruling photographic screens, mechanism for ruling colors comprising as parts thereof a bed-bracket, a sliding carriage, a threaded screw mounted therein, a nut or block mounted on the threaded screw, a ruling-wheel mounted on the nut or block, means for supplying ink to the ruling-wheel, means for moving the sliding carriage a desired distance endwise at the will of the operator, and mechanism for examining and verifying the position and condition of the lines to guide the operator in effecting adjustments of the sliding carriage, substantially as described.

44. In a machine for ruling photographic screens, mechanism for ruling colors, means for moving the ruling mechanism laterally a desired distance at the will of the operator, mechanism for examining and verifying the position and condition of the lines to guide the operator in effecting adjustments of the sliding carriage comprising as parts thereof means for throwing a long narrow beam of light through the screen being ruled, a microscope-objective on the other side of the screen, a mirror and a plate on which the lines are reflected, substantially as described.

45. In a machine for ruling photographic screens, mechanism for ruling colors, means for moving the ruling mechanism laterally a desired distance at the will of the operator, mechanism for examining and verifying the position and condition of the lines to guide the operator in effecting adjustments of the ruling mechanism comprising as parts thereof a laterally-movable cylinder provided with a long narrow slot opening toward the screen being ruled, an electric incandescent lamp arranged in the cylinder, a laterally-movable microscope-objective on the other side of the screen into which the light from the lamp shines, and means for reflecting the rays of light from the microscope-objective to a transparent plate on which the lines are reproduced to the eye, substantially as described.

46. In a machine for ruling photographic screens, mechanism for ruling colors, mechanism for examining and verifying the position and condition of the ruled lines comprising as parts thereof means for throwing a long narrow beam of light through the screen being ruled, a microscope-objective on the other side of the screen, means for reflecting the rays of light from the microscope-objective to a transparent plate on which the lines are reproduced to the eye, and means for maintaining the microscope-objective in a uniform and constant position relatively to the screen being ruled, substantially as described.

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