Feb. 10, 1925. 1,525,798

H. C. BOEDICKER

PHOTOLITHO MACHINE

Filed July 1, 1922 5 Sheets-Sheet 1

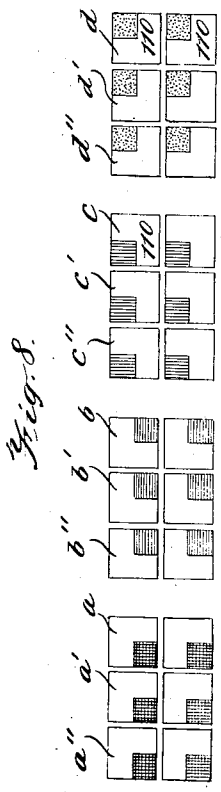


Fig. 8.

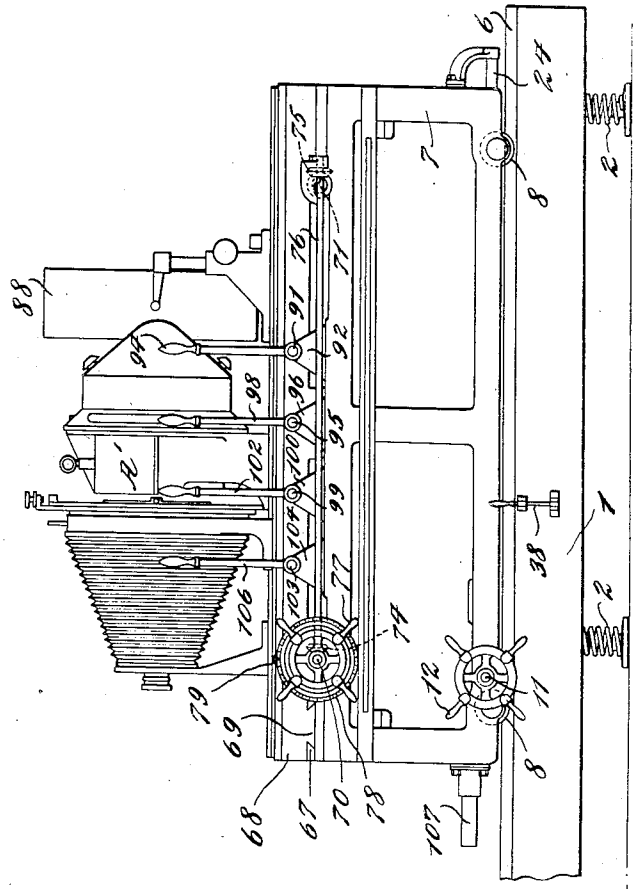


Fig. 1.

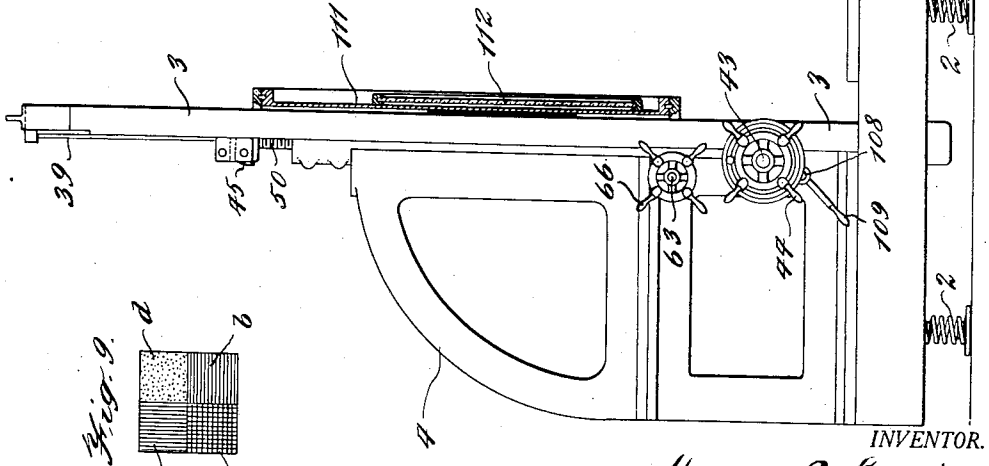


Fig. 9.

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Feb. 10, 1925.

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PHOTOLITHO MACHINE

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5 Sheets-Sheet 2

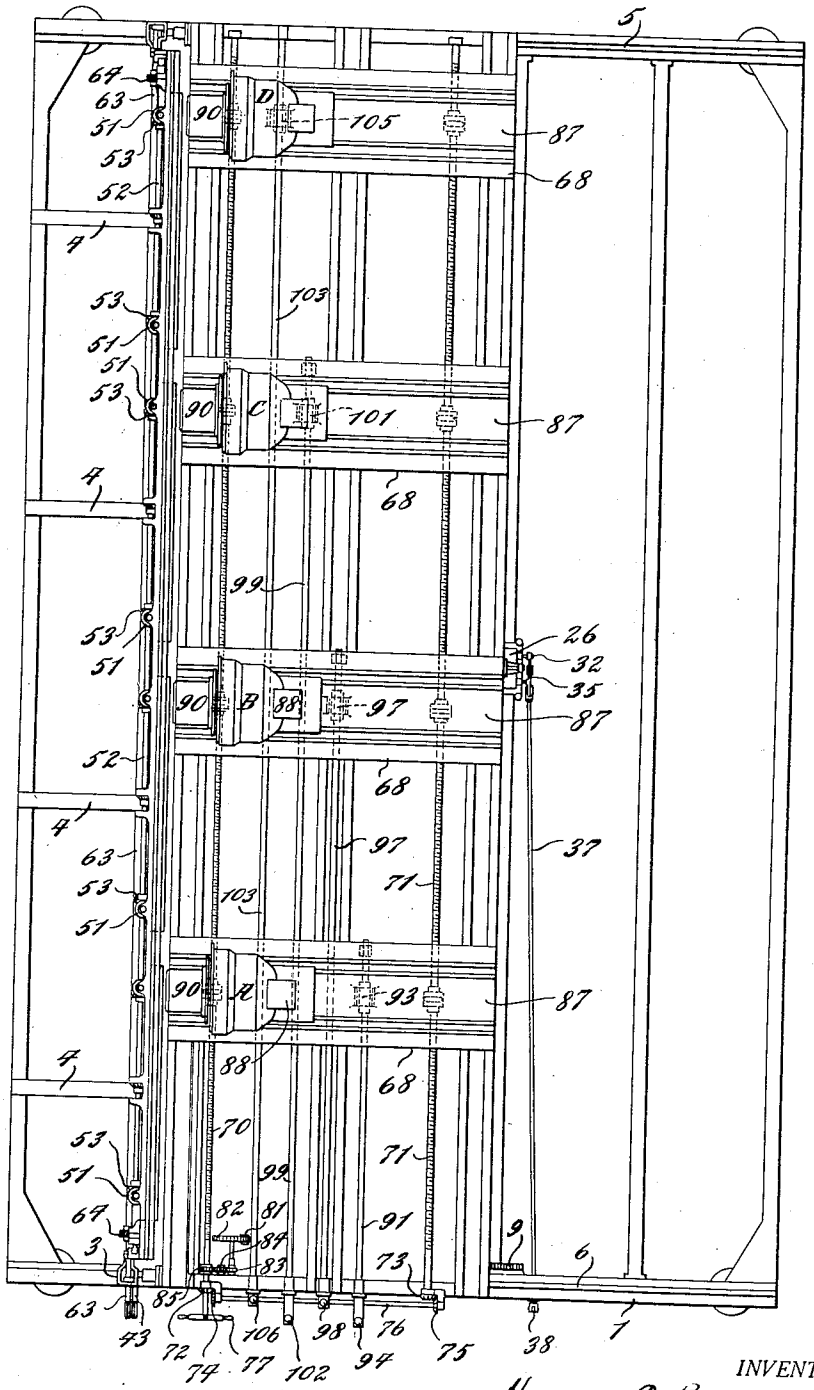


Fig. 2.

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PHOTOLITHO MACHINE

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5 Sheets-Sheet 3

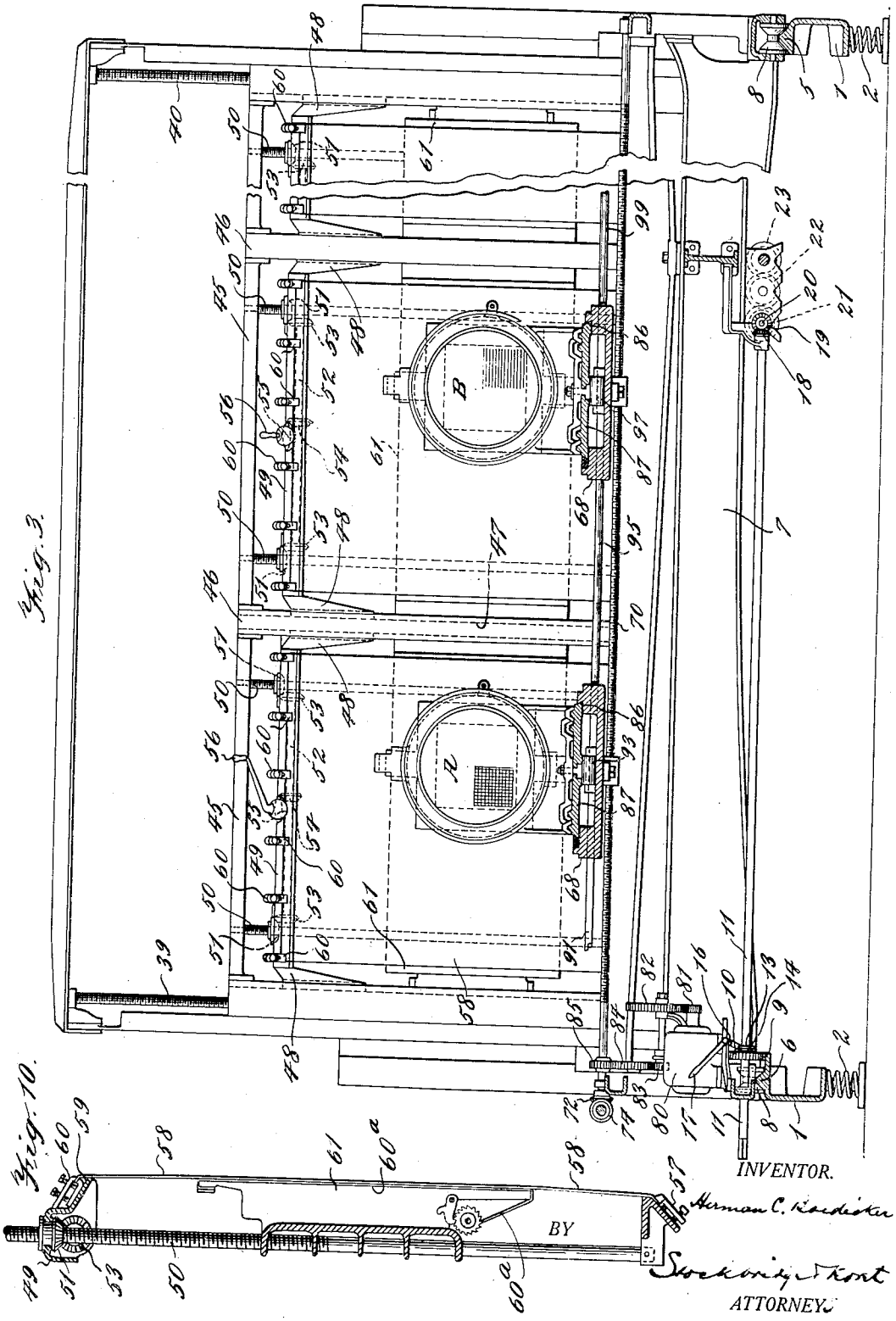


Fig. 3.

Fig. 10.

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Feb. 10, 1925.

1,525,798

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PHOTOLITHO MACHINE

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5 Sheets-Sheet 4

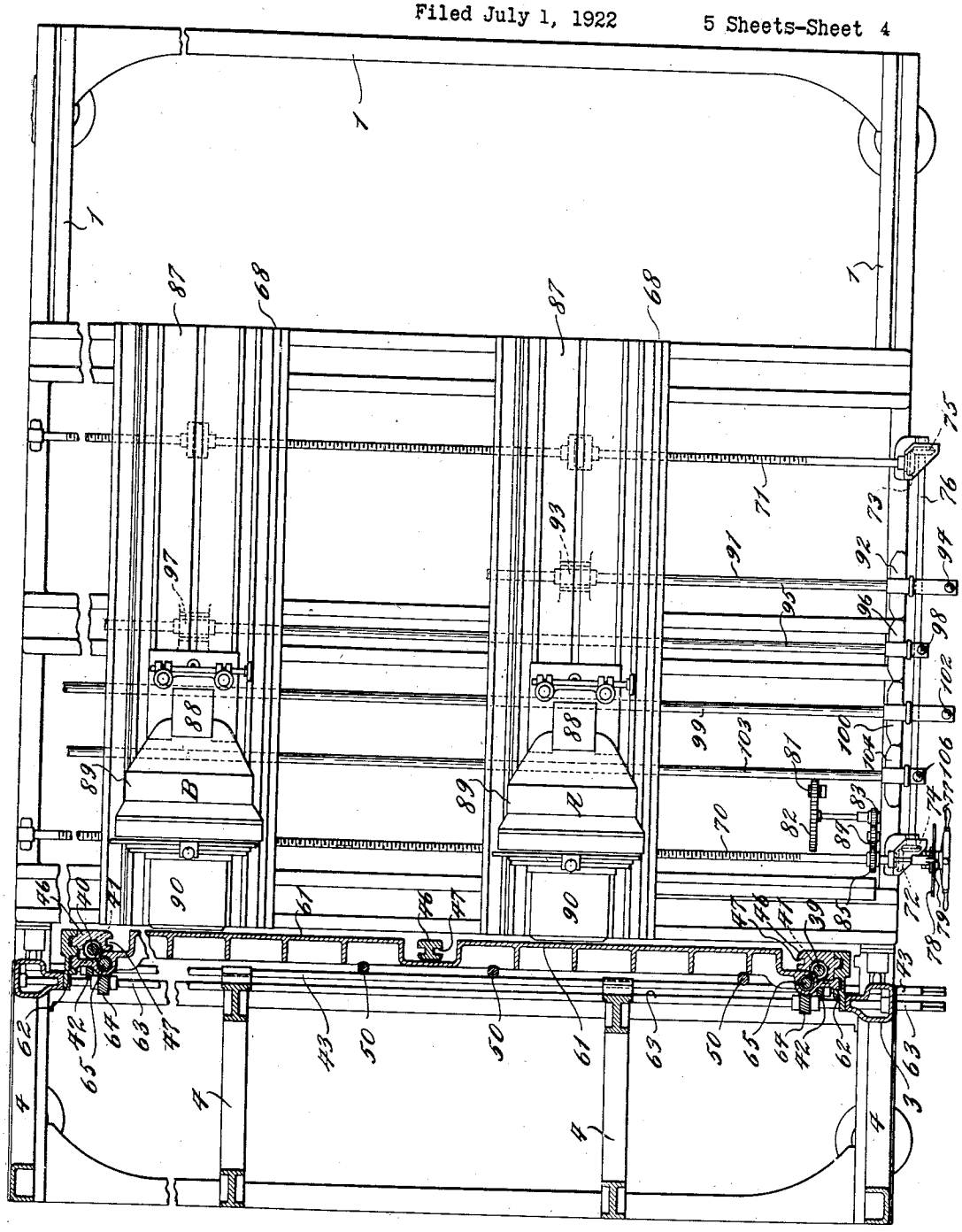


Fig. 4.

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PHOTOLITHO MACHINE

Filed July 1, 1922

5 Sheets-Sheet 5

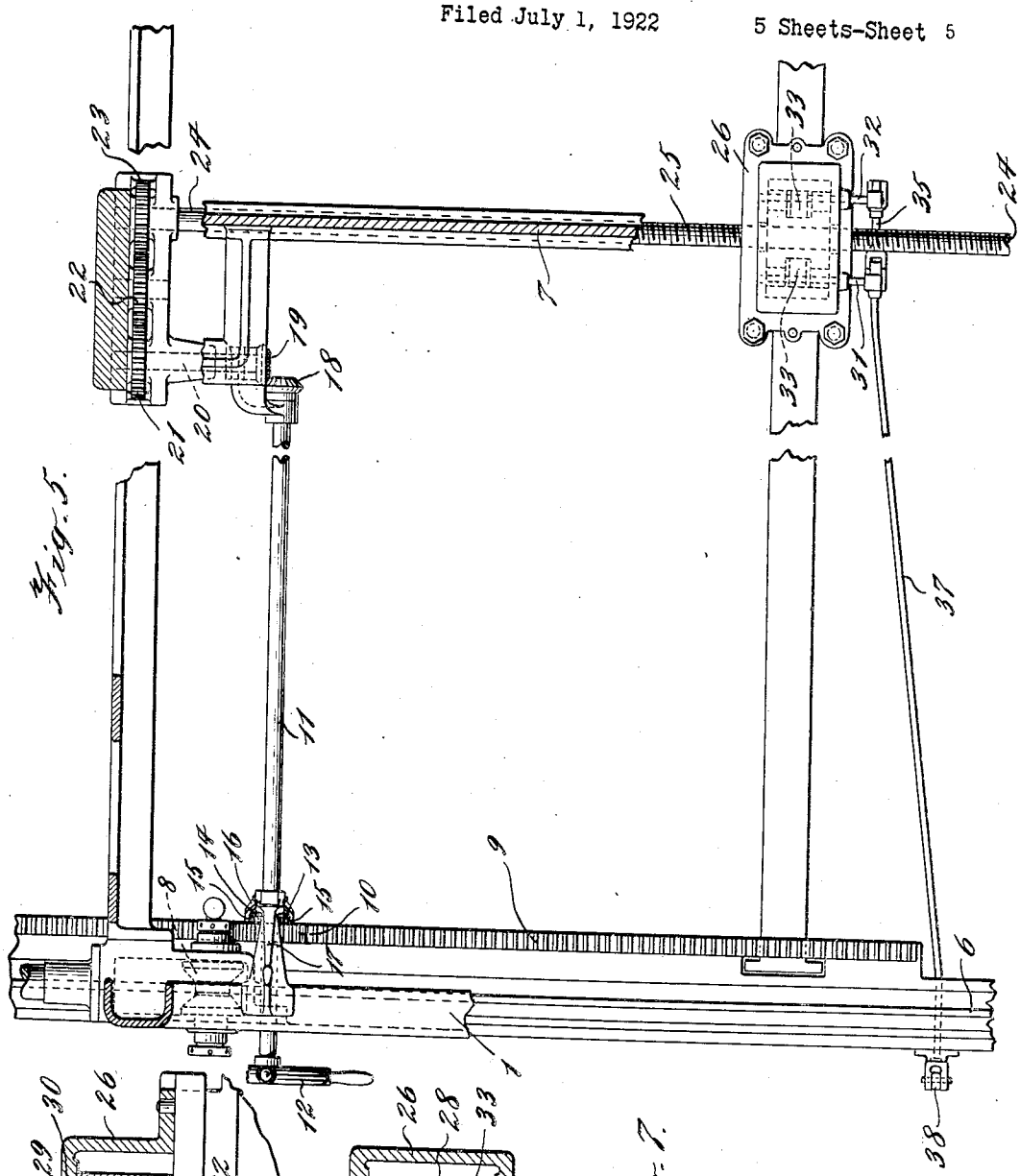


Fig. 5.

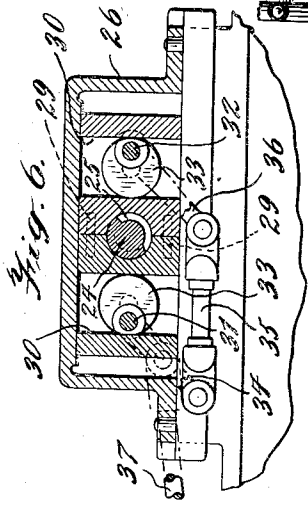


Fig. 6.

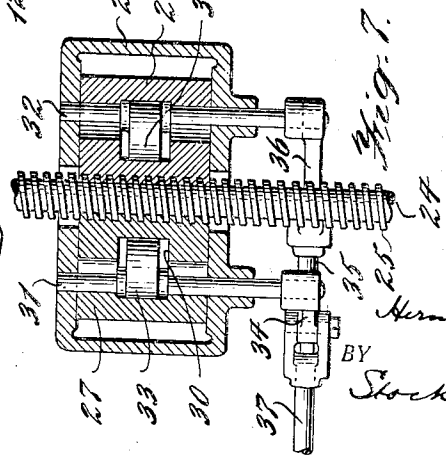


Fig. 7.

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Patented Feb. 10, 1925. 1,525,798

UNITED STATES PATENT OFFICE.

HERMAN C. BOEDICKER, OF NEW YORK, N. Y.

PHOTOLITHO MACHINE.

Application filed July 1, 1922. Serial No. 572,177.

To all whom it may concern:

Be it known that I, HERMAN C. BOEDICKER, a citizen of the United States, residing at New York city, in the county of New York and State of New York, have invented certain new and useful Improvements in Photolitho Machines, of which the following is a full, clear, and exact description.

This invention relates to methods and apparatus for producing multiple photographic plates for color, register work in the art of making photolithographic, typographical or rotogravure printing plates or cylinders. In the preparation of printing plates for color printing, a master color negative of the picture to be printed is prepared for each color to be printed, and these negatives are then photographed upon sensitized printing plates, which when developed are used for printing the colors successively upon a paper or article. Where a quantity of prints are to be made it has been a common practice to make a plurality of prints of each color negative upon each plate with the negatives spaced correspondingly upon all the plates so that when one is properly placed in the printing press for correct printing of one color, all of the other prints on the same plate will be in proper printing position. If the prints upon one color plate are not spaced exactly in accordance with the spacing in another color plate of the same set of prints, the plates must be discarded and remade, because the color prints made therefrom will never register. In making the multiple prints upon each color plate, errors of spacing are likely to occur, owing to the failure of the operator to read and set the indicators or scales correctly in the spacing of the cameras for each exposure.

An object of this invention is to provide an improved and simple method and apparatus for preparing plates for use in multiple print color register work, in accordance with which any variation in spacing of the prints upon the plates will be immaterial; with which absolute register of the prints in color work can always be obtained with certainty and with which any desired number of duplicates on one plate for each color may be obtained by the step and repeat method with absolute register of the color plates in printing. A further object is to provide an improved apparatus for these purposes which is efficient, durable, and inexpensive. Other objects and advantages will be apparent from the following description of an embodiment of the invention, and the novel features will be particularly pointed out in claims.

In the accompanying drawing:

Fig. 1 is a side elevation of a machine constructed in accordance with the invention and arranged for projection printing;

Fig. 2 is a plan of the same when arranged for contact printing;

Fig. 3 is a transverse sectional elevation through the same when arranged for contact printing;

Fig. 4 is a sectional plan of the same;

Fig. 5 is a fragmentary sectional plan of the mechanism for propelling the camera supporting carriage toward and from the plate supporting frame;

Fig. 6 is a transverse section through a portion of the same for showing the clutch coupling between the worm carried by the carriage and the frame;

Fig. 7 is a sectional plan through the same parts;

Fig. 8 is a diagram of the color plates showing the method of spacing the prints thereon;

Fig. 9 is a diagram illustrating the principle of color printing, and

Fig. 10 is a sectional elevation through one of the plate holders.

The main support or base for the apparatus comprises a horizontally disposed platform 1 which is preferably supported at numerous points by helical springs 2 which serve to absorb vibrations that might otherwise be transmitted to the platform, and thence to the other parts of the apparatus. At one end of the platform a vertically extending frame 3 is provided for supporting the printing plates or negative holder boxes. The frame 3 is braced in a suitable manner such as by arcuate braces 4 provided at suitable intervals along the width of the platform. The platform is provided upon its upper face, along each side thereof, with V-shaped rails 5 and 6 which support and guide the main carriage 7 for movement along the platform toward and from the end frame 3. The main carriage is provided with spool-like rollers 8 which ride upon the rails 5 and 6 and guide the carriage along the platform.

The platform 1, adjacent the rail 6, is provided with a rack 9 (Figs. 3 and 5) with which meshes a pinion 10 that is slidably but

non-rotatively carried by the shaft 11. The shaft 11 is rotatably carried by the main carriage 7 and extends transversely of the platform. The forwardly projecting end of the shaft 11 is provided with an operating hand wheel 12, by means of which the shaft may be rotated to rotate the pinion and thereby roll the carriage along the platform, through the reaction of the pinion 10 upon the rack 9. The pinion 10 is provided with a boss-like axial extension 13 upon its inner face, and the extension has in its periphery an annular groove 14 that is engaged by pins 15 upon the ends of a fork 16. The fork 16 is pivotally carried by the carriage, and is provided with an angular extension 17, forming a handle by means of which the fork may be oscillated about its pivot to shift the pinion axially along the shaft 11 into and out of engagement with the rack 9. The shaft 11 at its inner end is provided with a bevel gear 18 which meshes with a bevel gear 19, carried by a shaft 20. The shaft 20 is rotatably carried by the carriage 7 and extends transversely of the shaft 11. The shaft 20 is provided with a pinion 21 which meshes with an idler 22, rotatively carried by the carriage and in turn meshing with a pinion 23 carried by a shaft 24. The shaft 24 is rotatively carried by the carriage 7 so as to extend endwise thereof, that is, in the direction of travel of the carriage 7 upon the platform, and is provided with screw threads 25 by means of which the carriage may be shifted along the platform at a very slow rate in a manner to be described.

The platform is provided with an inverted casing 26 through the ends of which the shaft 24 freely passes. Within this casing 26, half nuts 27 and 28 are mounted for sliding movement toward and from the threaded portion 25 of the shaft 24, and are provided upon their abutting concave faces with threads which are adapted to engage with the threads 25 of the shaft and act together as a single nut. To maintain the sections 27 and 28 in proper meshing relation with respect to the threads, one of the sections is provided with dowel pins 29 which slidingly engage in recesses in the abutting face of the other section, and permit of a limited approach and separation of the sections with respect to one another. The sections are each provided with a recess 30 through which shafts 31 and 32 extend. These shafts 31 and 32 are rotatively carried by the casing in positions parallel with the shaft 24 and each is provided with an eccentric cam 33 which is disposed in a recess 30 and engages with opposite walls thereof so that when the shafts 31 and 32 are rotated, the eccentric cams will shift the sections 27 and 28 toward and from the shaft 24.

The shaft 31 is provided exteriorly of the casing 26 with a crank arm 34 which at its free end is connected through a link 35 with a second crank arm 36 provided upon the outer end of the shaft 32. This insures concomitant rotation together of the shafts 31 and 32. A link 37 is pivotally connected to the crank arm 34 and extends through a side face of the platform where it is pivotally connected to an operating lever 38. The operation of the lever 38 causes a concomitant operation of the shafts 31 and 32 and thereby concomitant operation of the eccentric cams 33 which shift the split nut sections 27 and 28 into and out of engagement with the threaded portion 25 of the shaft 24. If, when the lever 38 has been operated to couple the split nut sections 27 and 28 to the shaft 24, the shaft 24 is rotated through the hand wheel 12, shaft 11, gears 18 and 19, shaft 20, pinions 21, 22 and 23, the shaft 24 will, by its threaded engagement with the nut sections 27 and 28, be shifted endwise of the casing 26 and the platform 1 upon which it is carried. A very slow movement is thus imparted to the main carriage 7 for propelling it lengthwise of the platform. Owing to the reduction gearing effect provided by the threaded shaft 24 and the nut sections 27 and 28, a minimum of power applied to the hand wheel 12 will be effective in causing movement of the main carriage along the platform and great power would be necessary to move the carriage except by rotation of the shaft 24. During this movement by the shaft 24, it is, of course, understood that the pinion 10 is disconnected from the rack 9 of the platform. If now the nut sections are shifted out of engagement with the threaded shaft 24, by operation of the lever 38, the carriage is free and may be rolled along the platform manually, or the lever arm 17 may be shifted to operate the fork 16 and shift the pinion 10 into mesh with the teeth of the rack 9 upon the platform. If then the hand wheel 12 is operated the pinion 10 which is rotated thereby, will, by its engagement with the rack 9 propel the carriage at a comparatively rapid rate along the platform.

The end frame 3 is provided at each side with vertically extending threaded shafts 39 and 40 which are pivoted for rotation therein in a suitable manner. The shafts 39 and 40 are provided adjacent their lower ends with worm wheels 41 (Fig. 4) which mesh with worms 42 provided upon a horizontally and transversely extending shaft 43. The shaft 43 is provided at its outer end with a hand wheel 44 (Fig. 1) by means of which the shaft may be rotated. The shafts 39 and 40 have threaded engagement with the opposite ends of the contact or plate carrying frame 45 (Fig. 3) which is mounted for vertical sliding movement in the frame 3.

The frame 45 is provided at its ends and intermediate of its ends with spaced vertical guide posts 46 (Figs. 1 and 3) having upon their edges facing one another, grooves 47 which receive and guide the ends 48 of stretcher bars 49. The contact or plate carrying frame 45 is provided in the space between each pair of guides 46 with vertically disposed threaded shafts 50 (Figs. 3, 4 and 10) which are fixedly carried in the upper and lower portions of the contact frame. A beveled gear 51 is provided upon each shaft 50 and has threaded engagement therewith so that when the beveled gear is rotated it will be shifted axially along the threaded shaft 50. Each beveled gear 51 is rotatably carried by the adjacent stretcher bar 49 so that when the beveled gears are rotated the stretcher bar will be shifted vertically, being guided in its vertical movement by the enlarged ends 48 of the bar 49 which slide in the vertical guide grooves 47.

Each stretcher bar 49 is provided with a rotatable shaft 52 (Figs. 3 and 10) extending parallel therewith and provided upon its ends with beveled gears 53 which mesh with the beveled gears 51. The shaft 52 is provided at an intermediate point with a beveled gear 54 which meshes with a beveled gear 55 rotatably carried by the stretcher bar 49. A crank arm 56 is connected to the beveled gear 55 for rotating the same which, by its operation, rotates the shaft 52 and thereby rotates the bevel gears 51. This operation raises or lowers the stretcher bar controlled thereby.

For contact printing, the lower edge of the contact frame is provided with suitable clamps 57 (Fig. 10) for receiving and holding the lower edges of a plurality of sensitized plates 58 which when developed are to form the plates for printing the various colors upon the article or paper. Each stretcher bar 49 is provided upon a forwardly inclined face 59 with a plurality of clamps 60 which receive and hold the upper edges of the sensitized plates 58. If, after a plate has been clamped at its upper and lower edges, the crank arm 57, upon the stretcher bar 49 to which it is connected, is rotated, the stretcher bar will be shifted to stretch the plate and hold it taut during the printing operation.

To receive and counteract the pressure upon the plate during the contact printing operation, a pressure beam 61 (Figs. 3, 4 and 10) is provided which extends the full width of the end frame and at its ends slides in grooves 62 (Fig. 4) in the end frame. A shaft 63 (Figs. 1 and 4) is rotatably carried by the end frame and extends transversely across the platform. Adjacent its ends, the shaft 63 is provided with worm gears 64 (Fig. 4) which mesh with corresponding worm gears (not shown) upon shafts 65, which are rotatably carried by the end frame and at their upper ends have threaded engagement with the end portions of the pressure beam 61. When the shaft 63 is rotated the threaded shafts 65 will be rotated, and the latter, by their threaded engagement with the pressure beam, will shift the pressure beam in one direction or the other vertically so as to position the beam at different heights. The shaft 63 at the end projecting from one of the side faces of the platform is provided with an operating hand wheel 66 (Fig. 1) to facilitate its rotation. The face of the pressure beam 61 against which the sensitized plates abut is preferably provided with a rubber or other suitable somewhat resilient material 60^a.

The main carriage is provided upon its upper face with a dovetailed guide groove 67 (Fig. 1) extending transversely of the platform 1 and along the edge of the carriage adjacent the end frame. A plurality of auxiliary or camera carriages 68 are provided, each with an undercut rib 69 upon its lower face and adjacent one end which fits in and slides in the dovetailed guide groove 67 so as to guide the auxiliary carriages transversely of the platform 1, that is, from side to side upon the main carriage 7. The auxiliary carriages at their other ends have each a simple sliding contact with the main carriage.

A shaft 70 is rotatably carried by the main carriage 7 so as to extend from side to side, adjacent to the dove-tailed guide groove 67 and adjacent the upper edge of the carriage. This shaft 70 has threaded engagement with each of the auxiliary carriages so that when the shaft is rotated the auxiliary carriages will be shifted from side to side upon the main carriage concomitantly and equally. A similar and parallel shaft 71 is rotatably carried by the main carriage adjacent to the other bearing surfaces between the carriages and likewise has threaded engagement with each of the auxiliary carriages.

The shafts 70 and 71 at corresponding ends are provided with beveled gears 72 and 73, respectively, which mesh with beveled gears 74 and 75, respectively, carried upon the opposite ends of a shaft 76 which is rotatably carried by the main carriage. The shafts 70 and 71, will, therefore, be geared for rotation together and operation of either of these shafts will cause a corresponding and equal operation of the other shaft so that the auxiliary carriages will be shifted equal amounts at each end concomitantly, which prevents binding in the dovetailed guide groove 67. One of the shafts, such as 70 is provided at an end with an operating hand wheel 77 by which the shifting of the auxiliary carriages may be accomplished.

Suitable indicating means may be provided for indicating the amount of movement of the auxiliary carriages. For example, a micrometer dial 78 may be provided upon the shaft 70 immediately to the rear of the operating hand wheel 77 for rotation with the shaft, and the scale thereon is adapted to cooperate with a stationary indicating pointer 79 carried by the main carriage. A suitable counter (not shown) may be carried by the main carriage 7 in position to be tripped by a lug upon the micrometer dial at each rotation thereof, for counting and indicating the number of rotations of the shaft 70 at each spacing movement of the auxiliary carriages.

An electric motor 80 may be mounted upon the main carriage 7 and geared through reduction gears 81, 82, 83, idler 84 to a pinion 85 carried upon the shaft 70. Operation of the motor, therefore, serves to rotate the shaft 70 and relieve the operator of the burden of manually rotating the shafts 70 and 71. The motor is preferably used for accomplishing the major portion of the shifting movements of the auxiliary carriages, the finishing portion of each of the movements being accomplished by manual operation of the hand wheel 74 to insure accuracy.

Suitable camera or other photographic printing mechanism is provided upon each auxiliary carriage. For this purpose each auxiliary carriage is provided in its upper face with an undercut guide groove 86 (Fig. 3) in which a plate 87 is slidingly disposed and confined. The guide grooves 86 extend from end to end of the auxiliary carriages and in a direction transversely of the guiding groove 67 of the main carriage so that the plates 87 will, in moving along the guide grooves 86, approach or recede from the end frame 3. Upon the upper face of each plate 87, I provide a lamp casing 88 (Figs. 1, 2 and 4) and a collecting hood 89 which opens into the lamp casing. Within the lamp casing, I provide a suitable and powerful source of illumination such as an arc lamp, for supplying the light necessary for the printing operation.

In contact printing a negative box 90 is supported by the hood 89 with provision for angular adjustment relatively thereto. The negative and negative glass are secured in the end of the negative box facing the end frame in a suitable manner such as is disclosed, for example, in my U. S. Patent #1,327,752, so that each negative and its negative box may be brought into direct contact with its corresponding sensitized plate 60 and held firmly in contact therewith during the printing operation.

The light from the lamp casing 88 passes through the collecting hood 89, through the negative box 90 and the negative, which serves to photograph each negative directly upon the sensitized plate with which it is in contact. The angular adjustment of the negative box enables angular adjustment of the negatives into corresponding positions upon their supports so that corresponding edges of the color negatives will be parallel when mounted in the negative boxes. The sources of illumination within the lamp casings 88 are controlled from a suitable position so that they may be rendered concomitantly effective for printing, for any desired duration of time. For convenience the contact printing cameras will be designated by the letters A, B, C and D for printing the colors yellow, red, blue and black.

A shaft 91 is rotatably mounted in a bearing 92 upon the main carriage 7 and extends in a direction transversely of the platform. The shaft 91 passes through and has a slidable and rotatable bearing in the auxiliary carriage 68 upon which the camera A is mounted. An eccentric cam 93 is keyed to the shaft 91 for rotation therewith and is slidable in an endwise direction thereon. The cam 93 is disposed in a recess in the under face of the plate 87 of the auxiliary carriage of the camera A, so that when the cam is rotated by the shaft 91, the plate 87 will be shifted lengthwise along the auxiliary carriage in one direction or another dependent upon the direction of rotation of the shaft. By this limited movement the camera A upon the plate 87 may be shifted to carry the negative box 90 into contact with the sensitized plate. The cam also serves to hold the camera A tightly against the sensitized plate. As the auxiliary carriage of the camera A is shifted toward the operating side of the platform, the auxiliary carriage will slide along the shaft 91 and the cam 93 will be shifted by the auxiliary carriage along the shaft 91. The shaft 91 is provided at its outer end with an operating handle 94 by means of which the shifting of the camera may be effected.

A shaft 95 similar to 91 is rotatably mounted in a bearing 96 carried by the main carriage 7, extends freely through the auxiliary carriage of the camera A, and slidably and rotatively through the carriage of the camera B. An eccentric cam 97 (Figs. 2 and 3) is keyed to and is slidable upon the shaft 95 and engages in a recess in the under face of the plate 87 of the camera B, so that when the shaft 95 is rotated by its handle 98 the camera B will be shifted toward and from the sensitized plate and locked in position in a manner similar to that described for the camera A.

A shaft 99 rotatably mounted in a bearing 100 of the main carriage, extends freely through the auxiliary carriages of the cameras A and B and has a slidable and rotatable bearing in the auxiliary carriage of

the camera C. An eccentric cam 101 is keyed to and is slidable upon the shaft 99 and engages in a recess in the under face of the plate 87 of the camera C so that when the shaft 99 is rotated by its handle 102, the eccentric cam 101 will shift the camera C toward and from the sensitized plate in a manner similar to that described for cameras A and B.

A shaft 103 rotatably mounted in a bearing 104 in the main carriage 7 extends freely through the auxiliary carriages for the cameras A, B and C and has slidable and rotatable bearing in the auxiliary carriage of the camera D. An eccentric cam 105 is keyed to and slidable upon the shaft 103 and engages in a recess in the under face of the plate 87 of the camera D so that when the shaft 103 is rotated by its operating handle 106, the camera D will be shifted toward and from the sensitized plate and held in shifted positions in a manner similar to that described in connection with cameras A, B and C.

The main carriage is provided upon its face towards the end frame 3 with a cylindrical tongue 107 (Fig. 1) which is adapted to enter a recess in the end frame 3 when the main carriage has been shifted towards the end frame for contact printing. The tongue 107 may be locked within its recess by an eccentric cam (not shown) which is carried by the shaft 108 of the end frame so as to project into the recess and rotated by a handle 109. The main carriage may in this manner be locked against displacement, the final movement of the negative boxes into contact with the sensitized plates being effected by the handles 94, 98, 102 and 106.

The operation of the device for contact printing will now be described. The cameras A, B, C and D, arranged for contact printing, are mounted upon the plates 87 of the auxiliary carriages in the manner illustrated in Figures 2, 3, and 4 with the plates 87 at their rearward limit of movement which can be effected by the operating handles 94, 98, 102 and 106. The corresponding color negatives are mounted upon the ends of the negative box in a manner well known in contact printing, with corresponding edges of the negatives arranged parallel through the angular adjustment of the negative boxes upon their supports.

A number of sensitized printing plates 58 are stretched between the lower edges of the contact frames 45 and the stretcher plates 49, one plate opposite each camera. The pressure beam 61 is shifted to the proper height for the first print by an operation of the handle 66. The cameras are then shifted to one limit of movement transversely of the platform by an operation of the handle 77, or by an operation of the motor 80, or both. With the lever 38 operated to disconnect the split nut sections 27 and 28 from the shaft 24, the main carriage may be rolled along the platform 1 either by pulling the same or by an operation of the operating handle 12.

This movement may be completed at a slow rate if desired, by operating the lever 38 to clutch the split nut sections 27 and 28 to the shaft 24. Then after the lever 17 has been operated to disconnect the pinion 10 from the rack 9, an operation of the hand wheel 12 will cause a rotation of the shaft 24 and cause a slow movement of the carriage along the platform. In this manner the carriage may be shifted at a slow rate into close proximity to the end frame 3, with the tongue 107 entering the recess in the end frame, after which the handle 109 may be operated to rotate the shaft 108 and carry its eccentric cam (not shown) into locking engagement with the tongue 107, which effectively locks the main carriage to the end frame.

The levers 94, 98, 102 and 106 are then shifted to carry the cameras A, B, C and D individually into tight contact with the sensitized plates. The sources of illumination within the lamp casings 88 are then rendered effective for the period of time necessary to cause a proper exposure of the negative to the sensitized plate, after which the sources of illumination are rendered ineffective. These exposures may be diagrammatically represented by the characters *a*, *b*, *c* and *d* in Figure 8. Handles 94, 98, 102 and 106 are then operated in a reverse direction to move the cameras A, B, C and D individually away from the sensitized plates, after which the hand wheel 77 is operated to shift all of the auxiliary carriages concomitantly and as a unit in a direction laterally of the sensitized plates.

During the lateral movement of the auxiliary carriages as a unit, the micrometer dial 78, the pointer 79 and the counter will indicate the extent of movement. After the auxiliary carriages have been shifted until the negatives are brought opposite unexposed portions of the sensitized plates, the movement is stopped and the handles 94, 98, 102 and 106 operated to again shift the cameras A, B, C and D into contact with the sensitized plates. The sources of illumination in the cameras are then again rendered effective for the period necessary to photograph the negatives again upon the sensitized plates. These second exposures may be represented diagrammatically by the letters *a'*, *b'*, *c'* and *d'* in Figure 8.

The handles 94, 98, 102 and 106 are then operated to shift the camera out of contact with the sensitized plate and the auxiliary carriages moved again into new printing positions, after which photographic prints *a''*, *b''*, *c''* and *d''* are effected in the same man-

ner. This method of printing is continued in a step by step manner until a number of prints have been made upon the sensitized plates. Then the plate carrying contact frame 45 is shifted by an operation of the hand wheel 44 to bring a fresh section of the sensitized plates opposite the negative boxes of the cameras, after which new rows of photographic prints are made thereon in a manner similar to that described above for the first row.

During the spacing of the cameras for new exposures, it is unnecessary to accurately measure the spacing between the printing positions because the prints from all of the color negatives will be correspondingly spaced, and therefore, when the plates are developed and placed in the printing machines, and one of the prints of a color negative is placed in proper register with the paper or object to be printed, the other prints of the same plate will automatically register because they were correspondingly spaced. Thus, in Figure 8, if the squares 110 represent the prints at each exposure, the shaded quarter sections thereof represent diagrammatically the portion of the square which is to be printed of that particular color, so that when a square 110 for each color is printed upon the same paper or article the component colors will be accurately superimposed as indicated diagrammatically in Figure 9.

When the picture or representation to be printed is small, and it is desired to simultaneously print a large number of the same, considerable time may be saved by first preparing multiple negatives, in a manner now to be described. Upon the end frame 3 between the upper and lower edges of the contact frame, auxiliary negative holders 111 (Fig. 1) are supported, one for each camera. Each negative holder carries a photographic sensitized plate 112 with the sensitized surface facing the camera. The contact cameras which were used for contact printing are replaced by cameras A′, B′, C′ and D′ (A′ only being shown) which are used for projection printing. The details of these cameras are well known and a detailed description is unnecessary. It may be said, however, that the master color negatives are mounted in the projection cameras in a manner known in the art, and when the sources of light in the lamp casing are made effective, images of the color negatives will be projected upon the sensitized plates carried in the negative holders.

With this arrangement the master color negatives are projected upon the sensitized plates 112 in a step and repeat order, the cameras being shifted laterally by operation of the hand wheel 77 or by the motor, as described before in connection with contact printing. The images projected upon the sensitized plates will correspond in spacing to one another and after the desired number of exposures have been made upon the plates 112, the latter are developed and utilized as negatives in the contact cameras A, B, C and D for use in step and repeat contact printing, as hereinbefore described. The final sensitized printing plates thus provided contain a large number of prints which are correspondingly spaced in the different color printing plates so that when one print is aligned for each color plate, the other prints of the same plate are automatically aligned.

It will be understood that either the master or auxiliary color negatives may be protographed upon the sensitized metal plates by projection printing in the same order of concomitant lateral movements as described for contact printing, in order to obtain color printing plates with correspondingly spaced multiple prints thereon, at the same, enlarged or reduced sizes relatively to the color negatives projected.

Throughout the specification and claims, wherever I have referred to sensitized plates, it is to be understood that I mean any plate, film, or similar object having a sensitized photographic coating thereon, upon which photographs may be made. While I have illustrated and described apparatus for printing four colors, it is to be understood that the number of colors printed may be increased or decreased as desired. The apparatus herein described and illustrated is similar in parts to that disclosed in my copending application filed April 26, 1919, Serial No. 292,980.

It will be understood that various changes in the details and arrangement of parts herein described and illustrated for the purpose of explaining the nature of the invention may be made by those skilled in the art within the principle and scope of the invention.

I claim:

1. The method of producing multiple photographic plates for color, register work, which comprises providing a color negative and a sensitized plate for each color to be printed, producing stepped relative movement between the negatives as a group and the plates as a group, and photographing the negatives upon the sensitized plates at each step to provide a plurality of correspondingly spaced photographs upon each plate.

2. The method of producing multiple printing plates for color register work, which comprises producing a master color negative for each color to be printed, producing simultaneous and equal increments of movement between the master color negatives as a unit and a plurality of sensitized plates as a unit, one plate for each master negative, photographing the master color

negatives upon their corresponding plates at the ends of the increments of movements, for producing upon each plate when developed a plurality of pictures of its master color negative corresponding in spacing to the spacing of the pictures upon the other plates of their color negative, and then forming printing plates from the multiple picture plates as negatives.

3. The method of producing multiple printing plates for color register work, which comprises producing a master color negative for each color to be printed, producing simultaneous and equal increments of movement between the master color negatives as a unit and a plurality of sensitized plates as a unit, one plate for each master negative, photographing the master color negatives upon their corresponding plates at the ends of the increments of movements, for producing upon each plate when developed a plurality of pictures of its master color negative, corresponding in spacing to the spacing of the pictures upon the other plates of their color negative, then using the multiple picture plates as new color negatives and producing simultaneous and equal increments of movements between the new color negatives as a unit and a plurality of sensitized printing plates as a unit, one printing plate for each new color negative, photographing the new color negatives upon their corresponding sensitized printing plates at the ends of the increments of movement, for producing upon each printing plate when developed a plurality of pictures of its new color negative corresponding exactly in spacing to the spacing of the pictures upon the other printing plates for the other colors.

4. The method of producing multiple photographic plates for color register work, which comprises producing simultaneous and equal movements between the color negatives and the sensitized plates from one photographic position to another, and photographing the negatives upon the plates at each position to provide a plurality of photographs upon each plate which correspond exactly in spacing with those of each of the other plates.

5. Apparatus for the production of multiple photographic plates for color register work, which comprises means for supporting a plurality of sensitized plates, means for supporting a plurality of color negatives in positions for printing one on each of the plates, means for causing simultaneous and equal relative increments of movements between said two supporting means to place each negative in a new photographic position relative to its plate at the end of each increment of relative movement, whereby a printing exposure at each photographic position will result in the formation on each developed plate of a plurality of pictures of the negative which are spaced correspondingly with the pictures on all of the other color plates.

6. Apparatus for the production of multiple photographic plates for color register work, which comprises means for supporting a plurality of sensitized plates, means for supporting a plurality of color negatives in positions for printing one on each of the plates, means for imparting increments of movement to the negative supporting means as a unit in a direction transverse to a normal to the surfaces of the sensitized plates, whereby a printing exposure at the end of each increment of movement will result in the formation on each developed plate of a plurality of pictures of the negative which are spaced correspondingly with the pictures of all the other color plates.

7. Apparatus for the production of multiple photographic plates for color register work, comprising a support, means for mounting a plurality of sensitized plates in parallel planes on said support, a second support movable transversely to a normal to the surface of one of the plates, a plurality of different color negatives carried by said second support and spaced thereon for printing co-operation, one with each plate, and means for shifting the second support with its negatives as a unit through increments of movement into a succession of printing positions.

8. Apparatus for the production of multiple photographic plates for color register work, comprising a support, means for mounting a plurality of sensitized plates in parallel planes on said support, a second support movable transversely to a normal to the surface of one of the plates, a plurality of different color negatives carried by said second support and spaced thereon for printing co-operation, one with each plate, means for shifting the second support with its negatives as a unit through increments of movement into a succession of printing positions, and means for photographically exposing each negative to its corresponding plate in each printing position whereby each of the plates when developed will bear a series of pictures of a color negative which are spaced correspondingly to the pictures on the other plates formed from the other color negatives.

In witness whereof I hereunto subscribe my signature.

HERMAN C. BOEDICKER.